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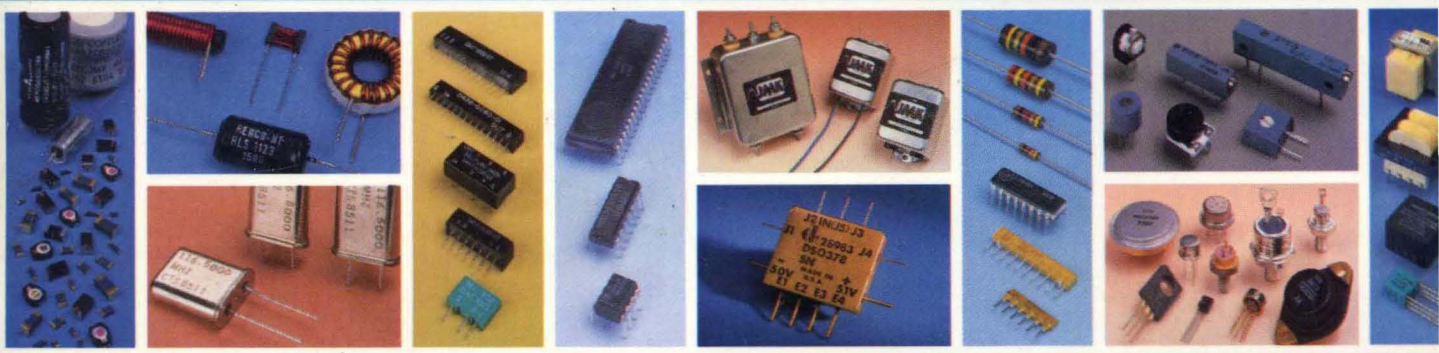
VOLUME A



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how to use eem

The 28th edition of EEM is arranged in four volumes, each composed of related Product Sections. For user convenience, each volume contains its own Product Index and Directory (green pages) and its own Manufacturers and Sales Offices Directory (yellow pages). Every Product Heading and every Manufacturer of electronic products is listed in each volume. Where, however, the Product Section is assigned to a volume other than that in use, a cross reference is made to the appropriate volume for further information.

To locate a specific product. Start by choosing the volume whose title describes the class of electronic product you are seeking. If you are not sure which volume is appropriate, pick up the first one at hand and find the product heading in the green pages. There you will find either a list of that product's manufacturers or you will be referred to the proper volume. All products are identified by their generic terms. Please read the detailed instructions on the first page of this section. Manufacturers with catalog data in this edition of EEM appear in bold face type and page numbers are shown. Manufacturers appearing in light face type have submitted verifying evidence that they supply the products shown. When you have located a product of interest, turn to the page(s) shown for further information. You will find these pages in each volume in the appropriate sections.

product selection guides

There are 34 Product Selection Guides included in this edition of EEM! They are located on the first pages of the Product Section to which they apply. Use these guides for basic selection parameters and then go to the EEM pages shown in the guide for more detailed information.

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Tustin, California 92680
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TWX: 910-595-1581

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Santa Clara, CA 95051
(408) 249-6800

*Product Selection Guide

advertisers' index

To find a specific manufacturer's data pages, an alphabetical index of EEM participants appears in EEM starting on page **A**•4 of Volume **A** and on pages **B**•4, **C**•4 and **D**•4 of the other volumes.

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trademark and logofinder directories

A comprehensive trademark directory is included at the end of the EEM green pages in Volume **B**. NEW in this edition, the EEM logofinder shows the symbols and graphics used by manufacturers as identifiers on their products. Use these pages to locate manufacturers of specific trademarks and logos.

manufacturers' index

In the EEM yellow pages you will find pertinent details on all manufacturers listed in EEM including local sales offices and/or distributors. Please refer to the detailed instructions on the first page of the EEM yellow pages for additional information.

to order a product found in eem

When you have located the product that suits your needs, call the manufacturer or the local sales rep or distributor as shown in the EEM yellow pages. Give the EEM data page number and specs from that page. You and the supplier will be talking on the same wave length which should simplify your ordering and buying.

to file manufacturers' catalogs and data

The EEM File System has been revised and updated. The new EEM File System contains a complete Product Index. This Index tells you where to file which catalog. It also contains a cross-reference so you'll know where catalogs are filed.

In order to use the new EEM File System all you need is a supply of standard letter size, third-cut, manila file folders which are available locally. You then use the pressure sensitive labels which are supplied with the File System to go into as much detail as you want (or need).

Each label fits the third-cut file folder exactly. There are over 300 of these labels in one System: 1 for the index, 1 each for the 62 EEM Product Sections, 24 for the alphabetical file of multiproduct catalogs, plus more than 200 additional labels for System expansion. The System also includes 62 Cross Reference Cards so you can quickly and easily find multiproduct catalogs. The EEM File System is complete and can save you countless hours of time and thousands of dollars. The price? Only $25.00. Send a check to: EEM File System, 645 Stewart Ave., Garden City, NY 11530 and we'll absorb postage and handling. Send a purchase order and add $2.00 for postage and handling. NY and CA residents, please add sales tax.

technical information: codes . . . miniglossaries . . . charts . . .

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Amphenol, An Allied Co., 43 Commerce Ct., Lisle, IL 60532 312-983-3500
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
Deutsch Co., Deutsch Fiber Optics Div., 7001 W. Imperial Hwy., Los Angeles, CA 90045 213-649-1400
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
† Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ..... 818-889-4030;805-497-4421
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Micro Mode Prods., 1870 John Towers Ave., El Cajon, CA 92020 619-449-3844
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reeve Electronics, Mellish E. Murray, 1720 W. Fulton St., Chicago, IL 60612 312-670-0150
Sivers IMA, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

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Antenna Feed Systems-3450

Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
American Electronic Labs., Box 552, Lansdale, PA 19446 215-822-2929
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
† Cablewave Sys., 60 Dodge Ave., North Haven, CT 06473 203-239-3311
Datron Systems, Inc., 200 West Los Angeles Ave., Simi Valley, CA 93065-1650 805-584-1717
† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ..... 207-655-4555;800-341-9678
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
† Electro-Magnetic Processes, Inc., 9616 Owensmouth Ave., Chatsworth, CA 91311 818-882-6333
Electrospace Sys., Inc., P. O. Box 831359, Richardson, TX 75083-1359 214-783-2004
§† E-Systems, Garland Div., Box 226118, Dallas, TX 75266 214-272-0515
† Gabriel Elctrns., Box 70, Scarborough Indl. Pk., Scarborough, ME 04074 207-883-5161
† Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
M/A-Com Cable/Home Communication Prodelin Satellite Antenna Systems, M/A-Com, Inc., P.O. Box 468, Newton, NC 28658 ..... 800-222-1195;704-464-4141
M/A-Com MDM, Inc., M/A-Com, 9000 Fullbright Ave., Chatsworth, CA 91311 818-700-8400
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microwave Applications Grp., 3030 Industrial Pkwy., Santa Maria, CA 93455 805-928-5711
† Milliflect, 7752 Enterprise Dr., Newark, CA 94560 415-791-5188
† Nurad, Inc., 2165 Druid Pk. Dr., Baltimore, MD 21211 301-462-1700
§ Pass & Seymour, Inc., P.O. Box 4822, Syracuse, NY 13221 315-468-6211
† Power Sys. Grp., Rantec Div., Emerson Elec., 9401 Oso Ave., Chatsworth, CA 91311 818-885-8223
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
§† Sealectro, 225 Hoyt St., Mamaroneck, NY 10543 914-698-5600
† G.T.E. Gov't Sys. Corp., Comm. Sys. Div., 77 A St., Needham Hgts., MA 02194 617-449-2000
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
Tasker Systems, 20131 Sunburst St., Chatsworth, CA 91311 213-341-3010
† Tecom Inds., 9324 Topanga Canyon Blvd., Chatsworth, CA 91311 818-341-4010
† Teledyne Micronetics, 7155 Mission Gorge Rd., San Diego, CA 92120 619-583-3525
Ten-Tec, Inc., Industrial Park, Sevierville, TN 37862 615-453-7172
† Transco Products, Inc., 4241 Glencoe Ave., Marina del Rey, CA 90295 213-822-0800

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Attenuators, Audio (T, L, LL Pads)-4750

Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•2006
§ VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... D•1056
§ Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022 212-605-2607
§† JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203 317-783-9875
Mallory Components Division, Emhart Elec./Elctrn. Grp., 3029 E. Washington St., Indianapolis, IN 46201 317-261-1361
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
§ Philmore Mfg., 40 Inip Dr., Inwood, NY 11696 516-239-6161
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
§ Soundlier, American Trading & Prod. Corp., 9380 Watson Ind'l. Pk., St. Louis, MO 63126 314-962-9870
Trimm, Inc., Div. of Newton Instr. Co., 400 W. Lake St., Box 489, Libertyville, IL 60048 312-362-3700

Attenuators, Coaxial-3450

† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 ..... A•1705
§ Compac, 279 Skidmore Rd., Deer Park, NY 11729, 516-667-3933 ..... A•1706
† Daico Inds., Inc., Box 5225, Compton, CA 90224, 213-631-1143 ..... A•1708
† Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33431, 305-994-1774 ..... A•1711
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735, 516-694-3600 ..... A•1712
§ ITT Pomona Electronics, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766, 714-623-3463 ..... C•1330
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235, 718-934-4500 ..... A•1719-1720,1768,1770,1771
† Alan Inds., P.O. Box 1203, Columbus, IN 47201 812-372-8869
Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
† Applied Research, Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
† Artech Corp., 2901 Telestar Ct., Falls Church, VA 22042 703-560-3292
§ Astrolab Inc., 4 Powder Horn Drive, Warren, NJ 07060 1-201-560-3800
§ Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
Continental Resources, Inc., 175 Middlesex Tpke., Bedford, MA 01730 617-275-0850
† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ..... 207-655-4555;800-341-9678
§ Eaton Corp., Elctrn. Instrmn. Div., 5340 Alla Rd., Los Angeles, CA 90066
Electro Impulse, Box 870, Red Bank, NJ 07701-0870 201-741-0404
§† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800

Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
§ JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203 317-783-9875
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
§† Kings Elctrns., 40 Marbledale Rd., Tuckahoe, NY 10707 914-793-5000
§ Macom Inds., 8230 Haskell Ave., Van Nuys, CA 91406
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
Matrix Sys. Corp., 5177 N. Douglas Fir Rd., Calabasas, CA 91302 818-992-6776
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 ..... 703-971-8606; 703-971-7082
Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Micro Mode Prods., 1870 John Towers Ave., El Cajon, CA 92020 619-449-3844
§† Micronetics, 36 Oak St., Norwood, NJ 07648 201-767-1320
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
Mu-Del Electronics, Inc., 2426 Linden Lane, Silver Spring, MD 20910-1288 301-587-6087
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Nurad, Inc., 2165 Druid Pk. Dr., Baltimore, MD 21211 301-462-1700
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RHG Electronics Lab., Inc., 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
§ RMS Electronics Inc., 50 Antin Pl., Bronx, NY 10462 212-892-6700
§ Sealectro, 225 Hoyt St., Mamaroneck, NY 10543 914-698-5600
§ Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
§ Test Probes, Inc., Box 2113, La Jolla, CA 92038 619-459-4197
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† Transco Products, Inc., 4241 Glencoe Ave., Marina del Rey, CA 90295 .. 213-822-0800
† Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, CA 91311 818-882-1020
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100
† Vectronics Microwave Corp., 276 Lincoln Blvd., Middlesex, NJ 08846 ... 201-356-2377
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332
† Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877 ..... 301-948-3434; 800-638-2048

Attenuators, Decade-3450

IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ..... D•1244
§ Shallco, Box 1089, Smithfield, NC 27577 919-934-3135

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Attenuators, Fixed-3450

† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 ..... A•1705
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•2006
Compac, 279 Skidmore Rd., Deer Park, NY 11729, 516-667-3933 ..... A•1706
CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 ..... A•1662,1667
CTS Electronics Corp., Halex Division, 1202 McGaw Ave., Irvine, CA 92714, 714-261-6381 ..... A•1662,1667
† Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33431, 305-994-1774 ..... A•1711
§ ITT Pomona Electronics, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766, 714-623-3463 ..... C•1330
Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235, 718-934-4500 ..... A•1719-1720,1770,1771
§ Shallco, Box 1089, Smithfield, NC 27577, 919-934-3135 ..... D•1036
† Tech Labs., Inc., Bergen & Edsall Blvds., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1701
VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... D•1056
† Alan Inds., P.O. Box 1203, Columbus, IN 47201 812-372-8869
Alco Elctrn. Prods., Inc., 1551 Osgood St., N. Andover, MA 01845 617-685-4371
Allen Avionics, 224 E. 2nd St., Mineola, NY 11501 516-248-8080
Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
† Applied Research, Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
§ Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
Continental Resources, Inc., 175 Middlesex Tpke., Bedford, MA 01730 .. 617-275-0850
Electro Impulse, Box 870, Red Bank, NJ 07701-0870 201-741-0404
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 .. 914-664-2333
§† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
General Resistance, Inc., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721
GRIM Corporation, Box 67, Medford, NJ 08055 609-267-7950
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hyletronics, Newtown Rd., Littleton, MA 01460 617-486-8911
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
§ JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203 317-783-9875
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
§† Kings Elctrns., 40 Marbledale Rd., Tuckahoe, NY 10707 914-793-5000
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ..... 315-437-3953; 800-448-1666
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
§ RMS Electronics Inc., 50 Antin Pl., Bronx, NY 10462 212-892-6700
Ross Engrg. Corp., 540 Westchester Dr., Campbell, CA 95008 408-377-4621
§ Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
Tektronix, Inc., P. O. Box 500, Y3-314, Beaverton, OR 97077 ..... 800-547-1512; Oregon only 800-452-1877
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
§ Test Probes, Inc., Box 2113, La Jolla, CA 92038 619-459-4197
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† Vectronics Microwave Corp., 276 Lincoln Blvd., Middlesex, NJ 08846 ... 201-356-2377
Vermont Precision Resistor, Codeco Corp. of Vermont, Box 1170, Stowe, VT 05672 802-253-8567
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332
† Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877 ..... 301-948-3434; 800-638-2048

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Attenuators, Impedance Matching-3450

Applied Research, Inc., 160 Dupont St., Plainview, NY 11803, 516-349-9200 ..... A•1703
† Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33431, 305-994-1774 ..... A•1711
§ Shallco, Box 1089, Smithfield, NC 27577, 919-934-3135 ..... D•1036
† Tech Labs., Inc., Bergen & Edsall Blvds., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1701
† Alan Inds., P.O. Box 1203, Columbus, IN 47201 812-372-8869
Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 617-935-8610
Allen Avionics, 224 E. 2nd St., Mineola, NY 11501 516-248-8080
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
Compac, 279 Skidmore Rd., Deer Park, NY 11729 516-667-3933
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 .. 914-664-2333
§ ITT Pomona Electronics, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766 714-623-3463
§ JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203 317-783-9875
Kay Elemetrics Corp., 12 Maple Ave., Pine Brook, NJ 07058-9797 201-227-2000
§† Kings Elctrns., 40 Marbledale Rd., Tuckahoe, NY 10707 914-793-5000
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Mu-Del Electronics, Inc., 2426 Linden Lane, Silver Spring, MD 20910-1288 301-587-6087
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60204 312-866-2200
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ONT, CANADA L9W2Y8 416-669-1244
§ Soundlier, American Trading & Prod. Corp., 9380 Watson Ind'l. Pk., St. Louis, MO 63126 314-962-9870
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332
Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877 ..... 301-948-3434; 800-638-2048
§ Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Attenuators, Logarithmic-3450

§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000

Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 516-694-3600
§ Laboratory Products, Inc., 57 Cornwall St., P. O. Box 1750, Jamaica Plain, MA 02130 617-522-7800
Shallco, Box 1089, Smithfield, NC 27577 919-934-3135
Waters Mfg., Longfellow Ctr., Wayland, MA 01778 617-358-2777

Attenuators, Microwave-3450

† Applied Research, Inc., 160 Dupont St., Plainview, NY 11803, 516-349-9200 ..... A•1703
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 ..... A•1705
Compac, 279 Skidmore Rd., Deer Park, NY 11729, 516-667-3933 ..... A•1706
† Daico Inds., Inc., Box 5225, Compton, CA 90224, 213-631-1143 ..... A•1708
† Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33431, 305-994-1774 ..... A•1711
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1867
† Electro Impulse, Box 870, Red Bank, NJ 07701-0870, 201-741-0404 ..... D•1211
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735, 516-694-3600 ..... A•1712
§ ITT Pomona Electronics, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766, 714-623-3463 ..... C•1330
Kay Elemetrics Corp., 12 Maple Ave., Pine Brook, NJ 07058-9797, 201-227-2000 ..... A•1713
Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235, 718-934-4500 ..... A•1719-1720,1768,1770,1771
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573, 914-939-8900 ..... A•1781
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
§ Astrolab Inc., 4 Powder Horn Drive, Warren, NJ 07060 1-201-560-3800
† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
§† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Hyletronics, Newtown Rd., Littleton, MA 01460 617-486-8911
§ JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203 317-783-9875
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
§† Kings Elctrns., 40 Marbledale Rd., Tuckahoe, NY 10707 914-793-5000
M/A-COM Microwave Circuits, Inc., South Ave., Burlington, MA 01803 .. 617-272-3000
M/A-Com Microwave Components, Inc., M/A-Com, South Avenue, Burlington, MA 01803 617-272-3000
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§† Micronetics, 36 Oak St., Norwood, NJ 07648 201-767-1320
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ..... 315-437-3953; 800-448-1666
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
Mu-Del Electronics, Inc., 2426 Linden Lane, Silver Spring, MD 20910-1288 301-587-6087
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
† Norsal Inds., 85 D Hoffman Lane So., Central Islip, NY 11722 516-234-1200
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
† Raytheon Co., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154 617-899-8400
† Reeve Electronics, Mellish E. Murray, 1720 W. Fulton St., Chicago, IL 60612 312-670-0150
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
Sivers IMA, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§ Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Technical Research & Mfg., Inc., R.F.D. #10, Manchester, NH 03103 ... 603-627-6000
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† Transco Products, Inc., 4241 Glencoe Ave., Marina del Rey, CA 90295 .. 213-822-0800
§ Tucker Elctrns., Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Vectronics Microwave Corp., 276 Lincoln Blvd., Middlesex, NJ 08846 ... 201-356-2377
Vermont Precision Resistor, Codeco Corp. of Vermont, Box 1170, Stowe, VT 05672 802-253-8567
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332
Wavetek Corporation, 9191 Towne Centre Drive, San Diego, CA 92122 619-450-9971
† Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877 ..... 301-948-3434; 800-638-2048
§ Wiltron, 805 E. Middlefield Rd., P.O. Box 7290, Mountain View, CA 94042-7290 415-969-6500

Attenuators, Programmable-3450

† Daico Inds., Inc., Box 5225, Compton, CA 90224, 213-631-1143 ..... A•1708
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735, 516-694-3600 ..... A•1712
Kay Elemetrics Corp., 12 Maple Ave., Pine Brook, NJ 07058-9797, 201-227-2000 ..... A•1713
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† Alan Inds., P.O. Box 1203, Columbus, IN 47201 812-372-8869
Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Applied Research, Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hyletronics, Newtown Rd., Littleton, MA 01460 617-486-8911
§ JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203 317-783-9875
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
M/A-COM Microwave Circuits, Inc., South Ave., Burlington, MA 01803 .. 617-272-3000
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
§ MARCONI INSTRUMENTS, 3 Pearl Court, Allendale, NJ 07401 201-934-9050
Matrix Sys. Corp., 5177 N. Douglas Fir Rd., Calabasas, CA 91302 818-992-6776
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235 .. 718-934-4500
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
† Racal-Dana Instrs. Inc., 4 Goodyear St., Irvine, CA 92715 714-859-8999
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
§ Tucker Elctrns., Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
† Vectronics Microwave Corp., 276 Lincoln Blvd., Middlesex, NJ 08846 ... 201-356-2377
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625 813-855-6611
Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332
Wavetek Corporation, 9191 Towne Centre Drive, San Diego, CA 92122 619-450-9971
† Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877 ..... 301-948-3434; 800-638-2048
§ Wiltron, 805 E. Middlefield Rd., P.O. Box 7290, Mountain View, CA 94042-7290 415-969-6500

Attenuators, RF-1900 — *See Vol. D*

Attenuators, Step-3450

IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ..... D•1244
† Alan Inds., P.O. Box 1203, Columbus, IN 47201 812-372-8869
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 516-694-3600
§ Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022 212-605-2607

Attenuators, Switch Operated-3450

† Alan Inds., P.O. Box 1203, Columbus, IN 47201 812-372-8869

Attenuators, Switchable-3450

† Alan Inds., P.O. Box 1203, Columbus, IN 47201 812-372-8869
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 516-694-3600
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832

Attenuators, Turret-3450

Kay Elemetrics Corp., 12 Maple Ave., Pine Brook, NJ 07058-9797, 201-227-2000 ..... A•1713
Tech Labs., Inc., Bergen & Edsall Blvds., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1701
† Alan Inds., P.O. Box 1203, Columbus, IN 47201 812-372-8869
§ JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203 317-783-9875
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Norsal Inds., 85 D Hoffman Lane So., Central Islip, NY 11722 516-234-1200
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
† Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332
† Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877 ..... 301-948-3434; 800-638-2048

Attenuators, Variable-3450

† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 ..... A•1705

Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•2006
Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33431, 305-994-1774 ..... A•1711
Electro Impulse, Box 870, Red Bank, NJ 07701-0870, 201-741-0404 ..... D•1211
Grayhill Inc., 569 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 .... B•1574
Kay Elemetrics Corp., 12 Maple Ave., Pine Brook, NJ 07058-9797, 201-227-2000 ..... A•1713
† Tech Labs., Inc., Bergen & Edsall Blvds., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1701
§ VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... D•1056
† Alan Inds., P.O. Box 1203, Columbus, IN 47201 812-372-8869
Allen Avionics, 224 E. 2nd St., Mineola, NY 11501 516-248-8080
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St, Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
† Artech Corp., 2901 Telestar Ct., Falls Church, VA 22042 703-560-3292
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
§ Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
Continental Resources, Inc., 175 Middlesex Tpke., Bedford, MA 01730 .. 617-275-0850
Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011 212-691-9050
§ Eaton Corp., Elctrn. Instrmn. Div., 5340 Alla Rd., Los Angeles, CA 90066
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 516-694-3600
† GRIM Corporation, Box 67, Medford, NJ 08055 609-267-7950
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hyletronics, Newtown Rd., Littleton, MA 01460 617-486-8911
§ JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203 317-783-9875
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
§ Leader instrs. Corp., 380 Oser Ave., Hauppauge, NY 11788-3694 516-231-6900
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
M/A-COM Microwave Circuits, Inc., South Ave., Burlington, MA 01803 .. 617-272-3000
M/A-Com Microwave Components, Inc., M/A-Com, South Avenue, Burlington, MA 01803 617-272-3000
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
§ MARCONI INSTRUMENTS, 3 Pearl Court, Allendale, NJ 07401 201-934-9050
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Merrimac Inds., 41 Fairfield Pl, West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§† Micronetics, 36 Oak St., Norwood, NJ 07648 201-767-1320
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ....315-437-3953; 800-448-1666
† Mini-Circuits Lab., 2625 E. 14th St, P.O. Box 166, Brooklyn, NY 11235 .. 718-934-4500
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
† Norsal Inds., 85 D Hoffman Lane So., Central Islip, NY 11722 516-234-1200
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RCI/Data, 1992 Lakewood Rd., Toms River, NJ 08753 201-341-8361
† RHG Electronics Lab., Inc., 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
§ RMS Electronics Inc., 50 Antin Pl., Bronx, NY 10462 212-892-6700
§ Shallco, Box 1089, Smithfield, NC 27577 919-934-3135
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ONT, CANADA L9W2Y8 416-669-1244
Sivers IMA, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
§ Tucker Elctrns., Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
† Vega Precision Labs., 800 Follin La., Vienna, VA 22180 703-938-6300
Vermont Precision Resistor, Codeco Corp. of Vermont, Box 1170, Stowe, VT 05672 802-253-8567
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
† Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332
† Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877 .....301-948-3434; 800-638-2048
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832

Attenuators, Voltage Controlled-3450

† Daico Inds., Inc., Box 5225, Compton, CA 90224, 213-631-1143 ..... A•1708
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735, 516-694-3600 ..... A•1712
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
† Amplifonix Inc., 220 Rte. 13, Bristol, PA 19007 215-788-2350
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
Atlantic Research, 5390 Cherokee Ave., Alexandria, VA 22312 703-642-4000
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
† Aydin Vector Div., Box 328, Newtown, PA 18940 215-968-4271
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
Hyletronics, Newtown Rd., Littleton, MA 01460 617-486-8911
§ JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203 317-783-9875
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
M/A-COM Microwave Circuits, Inc., South Ave., Burlington, MA 01803 .. 617-272-3000
† Vectronics Microwave Corp., 276 Lincoln Blvd., Middlesex, NJ 08846 ... 201-356-2377

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Batteries, Lead Dioxide-3900 — *See Vol. D*

Batteries, Lithium-3900 — *See Vol. D*

Batteries, Lithium Manganese Dioxide-3900 — *See Vol. D*

Batteries, Lithium Thionyl Chloride-3900 — *See Vol. D*

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Batteries, Mercury Oxide-3900 — *See Vol. D*

Batteries, Nickel Cadmium-3900 — *See Vol. D*

Batteries, Rechargeable-3900 — *See Vol. D*

Batteries, Silver Cadmium-3900 — *See Vol. D*

Batteries, Silver Oxide-3900 — *See Vol. D*

Batteries, Silver Zinc-3900 — *See Vol. D*

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Batteries, Thermal-3900 — *See Vol. D*

Batteries, Zinc Air-3900 — *See Vol. D*

Batteries, Zinc Carbon-3900 — *See Vol. D*

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Benches, Consoles, Tables (Work Stations, Lab & Shop)-Also See Enclosures, Equipment and Panel Mounting-1400 – *See Vol. C*

Bends & Twists, Microwave-3450

† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reeve Electronics, Mellish E. Murray, 1720 W. Fulton St., Chicago, IL 60612 312-670-0150
† Sivers IMA, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Bezels, Shielded & Unshielded-2400 – *See Vol. C*

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Board Computers & Subassemblies, PC Bus Compatible-2025 – *See Vol. D*

Board Computers & Subassemblies, Q Bus/Unibus Compatible-2025 – *See Vol. D*

Board Computers & Subassemblies, S100 Bus Compatible-2025 – *See Vol. D*

Board Computers & Subassemblies, STD Bus Compatible-2025 – *See Vol. D*

Board Computers & Subassemblies, VME Bus Compatible-2025 – *See Vol. D*

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Boards, Circuit, Unclad-1700 – *See Vol. C*

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Bridge Rectifiers, Silicon-Also See Rectifiers, Bridges & Assemblies-4800

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940 201-377-9566
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 213-699-0918
Diodes Inc., 9957 Canoga Ave., Chatsworth, CA 91311 ... 818-882-4920;800-821-1178
§† Elctrn. Devices, 21 Gray Oaks Ave., Yonkers, NY 10710 914-965-4400
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, JAPAN 03-986-6151
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400

Bridges, Admittance-2900 – *See Vol. D*

Bridges, Antenna – See Bridges, RF (Vol. D)

Bridges, Audio-2900 – *See Vol. D*

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Bridges, RF-2900 – *See Vol. D*

Bridges, Silicon Cell-4800

IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735, 516-753-0400 ..... A•2073
A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
§ Codi Semiconductor, Inc., 350 Hurst Ave., Linden, NJ 07036 201-862-8484

§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
§† Conditioning Semiconductor Devices, Box 2116, Wayne, NJ 07470 201-335-6723
§ General Instr., Discrete Semiconductor Div., 600 West John St., Hicksville, NY 11802 516-733-3333
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
NAE, 69 Bennett St., Lynn, MA 01905 617-598-4800
Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .....516-593-2025;Outside NY 800-645-5900
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Varo Semiconductor, Inc., 2800 W. Kingsley Dr., Garland, TX 75046 214-271-8511
§ Westinghouse Elec. Corp., Semiconductor Div., Armbrust Rd., Youngwood, PA 15697 412-925-7272

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Bridges, Wheatstone-2900 — ***See Vol. D***

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Cable, Communication-6000 — ***See Vol. C***

Cable, Computer-6000 — ***See Vol. C***

Cable, Data Transmission-6000 — ***See Vol. C***

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Cable, Flat-6000 — ***See Vol. C***

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Cable, High Voltage (1,000 Volts & Over)-6000 — ***See Vol. C***

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Cable, Power-6000 — ***See Vol. C***

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Cable, Shielded-6000 — ***See Vol. C***

Cable, Speaker-6000 — ***See Vol. C***

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Calibrators, Current-2900 — ***See Vol. D***

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Cans, Capacitor, Relay, Semiconductor, Transformer, etc-2500 — *See Vol. C*

Capacitance Comparators — See Bridges, Capacitance (Vol. D)

Capacitor Arrays-1500

† Nittany Piezo Ceramics, Box 756, Pine and Mill Streets, Bellefonte, PA 16823 ..... 814-355-1593;814-355-1594
SFE Technologies, 1501 1st St., San Fernando, CA 91340 213-365-9411
Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144 602-744-0400

Capacitor, Folded Flag Tabs-1500

Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229
† Stanley Elctrns., Inc., 592 Oak St., Copiague, NY 11726 516-842-8866

Capacitor Hardware-2800 — *See Vol. C*

Capacitor Leakage Indicators — See Testers, Capacitor (Vol. D)

Capacitor, Tap Rolls-1500

§ Liberty Intl. Corp., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452

Capacitor Wafers-1500

† Stanley Elctrns., Inc., 592 Oak St., Copiague, NY 11726 516-842-8866
Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144 602-744-0400

Capacitors, Energy Storage-1500

Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, 213-699-0918 ..... A•1064
CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069, 619-747-4000 ..... A•1070
§ Elpac Comps., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ..... A•1078
Marcon America Corp., 310 Era Drive, Northbrook, IL 60062, 312-564-2820 ..... A•1116
† Sohio Engineered Materials Co., Unit of Sohio, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ..... A•1172
† American Technical Ceramics Corporation, 1 Norden La., Huntington Sta., NY 11746 516-271-9600
† Condenser Prods., P.O. Box 997, Brooksville, FL 33512 904-796-3561
Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
§† Electron Products, 2084 Central Ave., Duarte, CA 91010 818-359-8281
† Elmag, 54 Clark St., Newark, NJ 07104 201-481-1600
§† Film Capacitors, 100 8th St., Passaic, NJ 07055 201-779-2240
High Energy, Lower Valley Rd., Parkesburg, PA 19365 215-593-2800
§ KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701 814-362-5536
Maxwell Labs., 8835 Balboa Ave., San Diego, CA 92123 619-279-5100
Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
† Stanley Elctrns., Inc., 592 Oak St., Copiague, NY 11726 516-842-8866
† Tobe Deutschmann Labs., Inc., 550 Turnpike St., Canton, MA 02021 617-828-3366
Tran-Spectra, Inc., Rte. 1-Box 27A, Greenfield, TN 38230 901-235-2218
Unilator Technical Ceramics Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5618
§ Westlake Capacitors, Inc., 5334 Sterling Center Dr., Westlake Village, CA 91361 818-889-4120

Capacitors, Chip (For Microcircuits)-1500

† American Technical Ceramics Corporation, 1 Norden La., Huntington Sta., NY 11746, 516-271-9600 ..... A•1007
§† AVX Corporation, Box 867, Myrtle Bch., SC 29577, 803-448-9411 ..... A•1010
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ..... A•1013
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, 213-699-0918 ..... A•1065
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830, 607-974-8725 ..... A•1068
† Johanson Dielectrics, 2220 Screenland Dr., Burbank, CA 91505, 818-848-4465 ..... A•1104
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981, 201-887-8100 ..... A•1881
§† Kemet, Union Carbide Corporation, Elctrns. Div., Components Dept., Box 5928, Greenville, SC 29606, 803-963-6348 ..... A•1107
§ Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ..... A•1110
§ Matsuo Electronics, 2134 Main Street, Suite 200, Huntington Beach, CA 92648, 714-969-2491 ..... A•1120
† Mepco//Electra, Inc., North American Philips Corp., 5900 Australian Ave., West Palm Beach, FL 33407, 305-842-3201 ..... A•1124-1121, B•1009
Mepco//Electra, Inc., North American Philips Corp., 6071 St. Andrews Rd., Columbia, SC 29210, 803-772-2500 ..... A•1124, B•1009
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•1135
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1136,1138
† Republic Elctrns. Corp., 176 E. 7th St., Paterson, NJ 07524, 201-279-0300 ..... A•1167
† SFE Technologies, 1501 1st St., San Fernando, CA 91340, 213-365-9411 ..... A•1170
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421, 615-892-0291 ..... A•1175
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076, 312-679-8200 ..... A•1176
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
§† Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000
† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
§ Centralab, Inc., A North American Philips Co., 4561 Colorado Blvd., Los Angeles, CA 90039 818-240-4880
§ Centre Engrg., 2820 E. College Ave., State College, PA 16801 814-237-0321
† Compex Corp., 35A East Main St., Marlton, NJ 08053 609-596-9388
Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
† Dielectric Labs., 69 Albany St., Cazenovia, NY 13035 315-655-8710
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
§ Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022 212-605-2607
§ IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 516-753-0400
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
§ KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
3M Co., Tech Ceramic Resources, 3M Center 225-4W, St. Paul, MN. 55101 617-736-0601
† Metuchen Capacitors, Inc., 420 Park Ave., Perth Amboy, NJ 08861 201-442-0500
† Microeap, Inc., 11120 Roselle St., San Diego, CA 92121 619-452-9812
† Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
National Micronetics, Route 28, West Hurley, NY 12136 914-338-0333
§ NEC Elctrns. USA Inc., NEC Electron Div., 252 Humboldt Ct., Sunnyvale, CA 94086 408-745-6520
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
PPD, Inc., Hwy. 70W, Resco Ct., P.O. Box 31347, Raleigh, NC 27612 919-781-3955
Presidio Components, Inc., 7185 Construction Ct., San Diego, CA 92121 619-578-9390
Radio Materials Corp., 4242 W. Bryn Mawr, Chicago, IL 60646 312-478-3600
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
SMD Technology Svc. Ctr., A North American Philips Co., 5855 N. Glen Pk. Rd., Milwaukee, WI 53209 800-431-4444
§ Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§† Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
Taiyo Yuden (USA) Inc., 714 Algonquin Rd., Arlington Heights, IL 60005 312-364-6104
§ Tansitor Elctrns., West Rd., Bennington, VT 05201 802-442-5473
Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
§† Union Carbide Corp., Elctrns. Div., Component Dept., Box 5928, Greenville, SC 29606 803-963-6348
Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540
† U S Microtek Components Corporation, 11144 Penrose St., Sun Valley, CA 91352 818-767-6770
§† Viclan, 7373A Engineers Rd., San Diego, CA 92138 619-292-1411
§† Vitramon N.A., P. O. Box 544, Bridgeport, CT 06601 203-268-6261
Wright Capacitors, 3000 So. Orange, Santa Ana, CA 92707 714-546-2490

Capacitors, Fixed, AC (Incl. Motor Start)-1500

Component Research Co. Inc., 1655-26 St., Santa Monica, CA 90404, 213-829-3615 ..... A•1014-1035,1051,1052,1054 - 1059,1062,1063
CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069, 619-747-4000 ..... A•1070
§ Elpac Comps., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ..... A•1078
§ Inter-Technical Grp., Box 23, Irvington, NY 10533, 914-591-8822 ..... A•1087
Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ..... A•1110
Mepco//Electra, Inc., North American Philips Corp., 6071 St. Andrews Rd., Columbia, SC 29210, 803-772-2500 ..... A•1125
§† American Capacitor, 2080 Central Ave, Duarte, CA 91010 818-357-8806
Baldor Electric Company, P.O. Box 2400, Fort Smith, AR 72901 501-646-4711
§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000

§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§† Electron Products, 2084 Central Ave., Duarte, CA 91010 818-359-8281
† Elmag, 54 Clark St., Newark, NJ 07104 201-481-1600
F-Dyne Elctrns., 449 Howard Ave., Bridgeport, CT 06605 203-367-6431
§ Film Capacitors, 100 8th St., Passaic, NJ 07055 201-779-2240
§ IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 516-753-0400
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
ITT Components Passive Grp., 1201 E. McFadden Ave., Santa Ana, CA 92705 714-836-0351
§ KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
§ Mallory Capacitor Co., Mallory Comps. Grp., 3029 E. Washington St., Indianapolis, IN 46201 317-636-5353
Nichicon (America) Corp., 927 E. State Pkwy., Schaumburg, IL 60195 ... 312-843-7500
Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229
PPD, Inc., Hwy. 70W, Resco Ct, P.O. Box 31347, Raleigh, NC 27612 919-781-3955
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
RTE Aerovox Inc., 740 Belleville Ave., New Bedford, MA 02745 617-994-9661
Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
§ Thomson-CSF Comps. Corp., Passive Comp. Div., 5850 Canoga Ave., Suite 300, Woodland Hills, CA 91367 818-887-1010
Tran-Spectra, Inc., Rte. 1-Box 27A, Greenfield, TN 38230 901-235-2218
Wesco Electrical Co., 201 Munson St., Greenfield, MA 01301 413-774-4358
§ Westlake Capacitors, Inc., 5334 Sterling Center Dr., Westlake Village, CA 91361 818-889-4120

Capacitors, Fixed, Air-1500

† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
High Energy, Lower Valley Rd., Parkesburg, PA 19365 215-593-2800
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 215-539-6050

Capacitors, Fixed, Aluminum Electrolytic-1500

Capacitor Technology, Inc., 5015 Speedway Dr., Ft. Wayne, IN 46825, 219-484-9054 ..... A•1012
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ..... A•1013
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, 213-699-0918 ..... A•1064
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011, 212-691-9050 ..... A•1071
§ Illinois Capacitor, Inc., 3757 W. Touhy Ave., Lincolnwood, IL 60645, 312-675-1760 ..... A•1084
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... A•1086
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ..... A•1094
§ ITT Components Passive Grp., 1201 E. McFadden Ave., Santa Ana, CA 92705, 714-836-0351 ..... A•1096,1099-1101
KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1108
Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ..... A•1112
§ Mallory Capacitor Co., Mallory Comps. Grp., 3029 E. Washington St., Indianapolis, IN 46201, 317-636-5353 ..... A•1115
§ Marcon America Corp., 310 Era Drive, Northbrook, IL 60062, 312-564-2820 ..... A•1116
Mepco/Electra, Inc., North American Philips Corp., 5900 Australian Ave., West Palm Beach, FL 33407, 305-842-3201 ..... B•1009
§† Mepco/Electra, Inc., North American Philips Corp., 6071 St. Andrews Rd., Columbia, SC 29210, 803-772-2500 ..... A•1125 B•1009
§ NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060;800-645-9333 ..... A•1140
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421, 615-892-0291 ..... A•1175
§ United Chemi-Con Inc., 9801 W. Higgins Rd., Rosemont, IL 60018, 312-696-2000 ..... A•1194
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 ..... 213-873-6400; 818-988-4400
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
§† Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000
Baldor Electric Company, P.O. Box 2400, Fort Smith, AR 72901 501-646-4711
§† Cornell-Dubilier Electronics, 150 Avenue "L", Newark, NJ 07105 201-589-7500
§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
Ei North America, 15 W. 53rd St. Suite 47E, New York, NY 10019 212-315-3099
§ Elna America, Inc., 153 E. Savarona Way, Carson, CA 90746 213-327-6090
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
Fuji-Svea, P.O. Box 3375, Torrance, CA 90510 213-533-1221
§ Goldwell Comps., 1815 W. 205th St. Ste. 201, Torrance, CA 90501 213-533-1228
§ IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 516-753-0400
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Kahgan Elctrns. Corp., 605 Peninsula Blvd., Hempstead, NY 11550 516-538-2300
Lawrence-Crow Elctrns. Inc., 2100 Stemmons, Dallas, TX 75207 214-749-5440
§ Liberty Intl. Corp., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
§ MG Electronics, 32 Ranick Rd., Hauppauge, NY 11788 516-582-3400
§ Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183
Nichicon (America) Corp., 927 E. State Pkwy., Schaumburg, IL 60195 ... 312-843-7500
§† Paccom, 3928 148th NE, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
§† Sangano Weston-Sangamo Components Div., Fairchild Semiconductor, Box 128, Pickens, SC 29671 803-878-6311
† Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
§ SPECO Div., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757 ..... 516-957-8700;800-645-5516
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§† Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
Tran-Spectra, Inc., Rte. 1-Box 27A, Greenfield, TN 38230 901-235-2218

Capacitors, Fixed, Ceramic, Disc & Tubular-1500

AVX Corporation, Box 867, Myrtle Bch., SC 29577, 803-448-9411 ..... A•1010
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ..... A•1013
Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011, 212-691-9050 ..... A•1071
§ IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735, 516-753-0400 ..... A•1080
§ Illinois Capacitor, Inc., 3757 W. Touhy Ave., Lincolnwood, IL 60645, 312-675-1760 ..... A•1085
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... A•1086
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ..... A•1095
§ Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ..... A•1109
† Metuchen Capacitors, Inc., 420 Park Ave., Perth Amboy, NJ 08861, 201-442-0500 ..... A•1128
§ Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•1135
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1136-1137,1139
§ NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060;800-645-9333 ..... A•1141
SFE Technologies, 1501 1st St., San Fernando, CA 91340, 213-365-9411 ..... A•1630
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421, 615-892-0291 ..... A•1175
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076, 312-679-8200 ..... A•1177
§† Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1187-1178,1189,1190,1193
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 ..... 213-873-6400; 818-988-4400
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
§† Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000
§ Centralab, Inc., A North American Philips Co., 7158 Merchant Ave., El Paso, TX 79915 915-779-3961
Centre Engrg., 2820 E. College Ave., State College, PA 16801 814-237-0321
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 213-699-0918
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
Corning Glass Works, Telecomm Prods Dept., BH-5, Corning, NY 14830 607-974-9000
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
Ei North America, 15 W. 53rd St. Suite 47E, New York, NY 10019 212-315-3099
Emcon Inc., Sub. of Kyocera Intl., 11620 Sorrento Valley Rd., San Diego, CA 92138 619-459-4355
§ Fuji-Svea, P.O. Box 3375, Torrance, CA 90510 213-533-1221
§ Goldwell Comps., 1815 W. 205th St. Ste. 201, Torrance, CA 90501 213-533-1228
High Energy, Lower Valley Rd., Parkesburg, PA 19365 215-593-2800
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089 413-781-1350
§ KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
KD Components, Inc., 3016 S. Orange Ave., Santa Ana, CA 92707 714-545-7108
§† Kemet, Union Carbide Corporation, Elctrns. Div., Components Dept., Box 5928, Greenville, SC 29606 803-963-6348
Lawrence-Crow Elctrns. Inc., 2100 Stemmons, Dallas, TX 75207 214-749-5440
§ Liberty Intl. Corp., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
§ Mallory Capacitor Co., Mallory Comps. Grp., 3029 E. Washington St., Indianapolis, IN 46201 317-636-5353
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
Nichicon (America) Corp., 927 E. State Pkwy., Schaumburg, IL 60195 ... 312-843-7500
§† Paccom, 3928 148th NE, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
Radio Materials Corp., 4242 W. Bryn Mawr, Chicago, IL 60646 312-478-3600
§† Republic Elctrns. Corp., 176 E. 7th St., Paterson, NJ 07524 201-279-0300
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
† Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700

§ Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
§† Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
Taiyo Yuden (USA) Inc., 714 Algonquin Rd., Arlington Heights, IL 60005 312-364-6104
§ Thomson-CSF Comps. Corp., Passive Comp. Div., 5850 Canoga Ave., Suite 300, Woodland Hills, CA 91367 818-887-1010
§ TRW Capacitor Div., 301 West "O" St., Ogallala, NE 69153 308-284-3611
Unilator Technical Ceramics Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5618
§† Union Carbide Corp., Elctrns. Div., Component Dept., Box 5928, Greenville, SC 29606 803-963-6348
§† Waldom Elctrns., 4301 W. 69th St., Dept. EEM, Chicago, IL 60629 312-585-1212

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† American Technical Ceramics Corporation, 1 Norden La., Huntington Sta., NY 11746, 516-271-9600 ..... A•1007
§† AVX Corporation, Box 867, Myrtle Bch., SC 29577, 803-448-9411 ..... A•1010
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ..... A•1013
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, 213-699-0918 ..... A•1065
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830, 607-974-8725 ..... A•1068
Johanson Dielectrics, 2220 Screenland Dr., Burbank, CA 91505, 818-848-4465 ..... A•1104
§† Kemet, Union Carbide Corporation, Elctrns. Div., Components Dept., Box 5928, Greenville, SC 29606, 803-963-6348 ..... A•1107
§ Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ..... A•1110
† Metuchen Capacitors, Inc., 420 Park Ave., Perth Amboy, NJ 08861, 201-442-0500 ..... A•1128
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•1135
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1136-1134,1139
§ NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060;800-645-9333 ..... A•1141
§† Republic Elctrns. Corp., 176 E. 7th St., Paterson, NJ 07524, 201-279-0300 ..... A•1167
SFE Technologies, 1501 1st St., San Fernando, CA 91340, 213-365-9411 ..... A•1169
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421, 615-892-0291 ..... A•1175
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076, 312-679-8200 ..... A•1176
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 ..... 213-873-6400; 818-988-4400
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
§† Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000
Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
§† Centralab, Inc., A North American Philips Co., 4561 Colorado Blvd., Los Angeles, CA 90039 818-240-4880
§ Centralab, Inc., A North American Philips Co., 7158 Merchant Ave., El Paso, TX 79915 915-779-3961
§ Centre Engrg., 2820 E. College Ave., State College, PA 16801 814-237-0321
Corning Glass Works, Telecomm Prods Dept., BH-5, Corning, NY 14830 607-974-9000
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
§ Emcon Inc., Sub. of Kyocera Intl., 11620 Sorrento Valley Rd., San Diego, CA 92138 619-459-4355
§ Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022 212-605-2607
§ IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 516-753-0400
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
ITT Components Passive Grp., 1201 E. McFadden Ave., Santa Ana, CA 92705 714-836-0351
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089 413-781-1350
§ KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
§ Liberty Intl. Corp., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
§ Mallory Capacitor Co., Mallory Comps. Grp., 3029 E. Washington St., Indianapolis, IN 46201 317-636-5353
† Microeap, Inc., 11120 Roselle St., San Diego, CA 92121 619-452-9812
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
Presidio Components, Inc., 7185 Construction Ct., San Diego, CA 92121 619-578-9390
Radio Materials Corp., 4242 W. Bryn Mawr, Chicago, IL 60646 312-478-3600
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
† Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
§† Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Tansitor Elctrns., West Rd., Bennington, VT 05201 802-442-5473
§ Thomson-CSF Comps. Corp., Passive Comp. Div., 5850 Canoga Ave., Suite 300, Woodland Hills, CA 91367 818-887-1010
Unilator Technical Ceramics Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5618
§† Union Carbide Corp., Elctrns. Div., Component Dept., Box 5928, Greenville, SC 29606 803-963-6348
† U S Microtek Components Corporation, 11144 Penrose St., Sun Valley, CA 91352 818-767-6770
§† Viclan, 7373A Engineers Rd., San Diego, CA 92138 619-292-1411
§† Vitramon N.A., P. O. Box 544, Bridgeport, CT 06601 203-268-6261
§ Waldom Elctrns., 4301 W. 69th St., Dept. EEM, Chicago, IL 60629 312-585-1212
Wright Capacitors, 3000 So. Orange, Santa Ana, CA 92707 714-546-2490

Capacitors, Fixed, Feedthru-1500

§ Elpac Comps., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ..... A•1078
§ IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735, 516-753-0400 ..... A•1080
§ ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ..... A•1095
† Metuchen Capacitors, Inc., 420 Park Ave., Perth Amboy, NJ 08861, 201-442-0500 ..... A•1131
† SFE Technologies, 1501 1st St., San Fernando, CA 91340, 213-365-9411 ..... A•1630
§† Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505, 814-455-0966 ..... A•1635
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421, 615-892-0291 ..... A•1175
§† Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1191
§ Acushnet Capacitor Co., Inc., 720 Belleville, New Bedford, MA 02741 617-999-3291
§† American Capacitor, 2080 Central Ave, Duarte, CA 91010 818-357-8806
† American Technical Ceramics Corporation, 1 Norden La., Huntington Sta., NY 11746 516-271-9600
§ Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000
§† AVX Corporation, Box 867, Myrtle Bch., SC 29577 803-448-9411
Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 513-667-8484
† Circle Electronics, A Division of F-Dyne Elctrns., 3501 Electronics Way, W. Palm Beach, FL 33407 305-844-1310
Compac, 279 Skidmore Rd., Deer Park, NY 11729 516-667-3933
§† Component Research Co. Inc., 1655-26 St., Santa Monica, CA 90404 213-829-3615
§ Cornell-Dubilier Electronics, 150 Avenue "L", Newark, NJ 07105 201-589-7500
§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
† Dynamic Air Engrg, Inc., EMC Filter Div., 620 E. Dyer Rd., Santa Ana, CA 92705 714-540-2081
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§† Electron Products, 2084 Central Ave., Duarte, CA 91010 818-359-8281
† Elmag, 54 Clark St., Newark, NJ 07104 201-481-1600
† Estes Engrg. Co., 930 Marine Dr., Port Angeles, WA 98362 206-457-0904
† F-Dyne Elctrns., 449 Howard Ave., Bridgeport, CT 06605 203-367-6431
† Filtron Co., Inc., Div. of Aeroflex Labs., Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804 516-752-1144
Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§ High Energy, Lower Valley Rd., Parkesburg, PA 19365 215-593-2800
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
§ ITT Pomona Electronics, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766 714-623-3463
† Jennings, 970 McLaughlin Ave., San Jose, CA 95122 408-292-4025
§ KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
§ Maida Development Co., 20 Libby St., Hampton, VA 23663 804-723-0785
† Microeap, Inc., 11120 Roselle St., San Diego, CA 92121 619-452-9812
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Presidio Components, Inc., 7185 Construction Ct., San Diego, CA 92121 619-578-9390
Radio Materials Corp., 4242 W. Bryn Mawr, Chicago, IL 60646 312-478-3600
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Rtron Corp., 7324 Lawndale, Skokie, IL 60076 312-679-7180
† S & El Mfg., Box 832, Northridge, CA 91324 818-349-4111
Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Southern Electronics, F-Dyne, 726 So. Flower St., Burbank, CA 91502 213-845-2458
§† Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§† Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
Standard Condenser Corp., 1065 W. Addison St., Chicago, IL 60613 312-327-5440
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
† Tobe Deutschmann Labs., Inc., 550 Turnpike St., Canton, MA 02021 617-828-3366
Unilator Technical Ceramics Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5618
† U S Microtek Components Corporation, 11144 Penrose St., Sun Valley, CA 91352 818-767-6770
§† Viclan, 7373A Engineers Rd., San Diego, CA 92138 619-292-1411
§ Waldom Elctrns., 4301 W. 69th St., Dept. EEM, Chicago, IL 60629 312-585-1212
Wesco Electrical Co., 201 Munson St., Greenfield, MA 01301 413-774-4358

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§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ..... A•1013
§† Component Research Co. Inc., 1655-26 St., Santa Monica, CA 90404, 213-829-3615 ..... A•1014,1058 - 1063
§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470, 201-256-2000 ..... A•1067

† CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069, 619-747-4000 ..... A•1070
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011, 212-691-9050 ..... A•1071
§† Electronic Concepts, Inc., Box 627 E, Eatontown, NJ 07724, 201-542-7880 ..... A•1072
§ Elpac Comps., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ..... A•1078
§ IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735, 516-753-0400 ..... A•1081
§ Illinois Capacitor, Inc., 3757 W. Touhy Ave., Lincolnwood, IL 60645, 312-675-1760 ..... A•1085
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... A•1086
§ Inter-Technical Grp., Box 23, Irvington, NY 10533, 914-591-8822 ..... A•1088
§ ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ..... A•1095
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981, 201-887-8100 ..... A•1881
§† Kemet, Union Carbide Corporation, Elctrns. Div., Components Dept., Box 5928, Greenville, SC 29606, 803-963-6348 ..... A•1107
§ KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1108
Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ..... A•1112
Marcon America Corp., 310 Era Drive, Northbrook, IL 60062, 312-564-2820 ..... A•1116
§ Matsuo Electronics, 2134 Main Street, Suite 200, Huntington Beach, CA 92648, 714-969-2491 ..... A•1123
Mepco//Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960, 201-539-2000 ..... A•1126
§ Mepco//Electra, Inc., North American Philips Corp., 6071 St. Andrews Rd., Columbia, SC 29210, 803-772-2500 ..... A•1126
§ NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060;800-645-9333 ..... A•1141
§† Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1142
PPD, Inc., Hwy. 70W, Resco Ct., P.O. Box 31347, Raleigh, NC 27612, 919-781-3955 ..... A•1157
§† SFE Technologies, 1501 1st St., San Fernando, CA 91340, 213-365-9411 ..... A•1168
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530, 914-681-0700 ..... D•1039
§† TRW Capacitor Div., 301 West "O" St., Ogallala, NE 69153, 308-284-3611 ..... A•1179
† Wesco Electrical Co., 201 Munson St., Greenfield, MA 01301, 413-774-4358 ..... A•1198
§† Acushnet Capacitor Co., Inc., 720 Belleville, New Bedford, MA 02741 617-999-3291
§† American Capacitor, 2080 Central Ave, Duarte, CA 91010 818-357-8806
§ Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000
AT&T, 1 Oak Way, Berkeley Heights, NJ 07922 1-800-372-2447
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§ Bishop Electronics Corp., 3729 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-695-0446;213-692-9391
† Capco, Box 1028, Grand Junction, CO 81502 303-243-8751
Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 513-667-8484
† Circle Electronics, A Division of F-Dyne Elctrns., 3501 Electronics Way, W. Palm Beach, FL 33407 305-844-1310
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 213-699-0918
† Condenser Prods., P.O. Box 997, Brooksville, FL 33512 904-796-3561
§† Cornell-Dubilier Electronics, 150 Avenue "L", Newark, NJ 07105 201-589-7500
§ Custom Elctrns., Browne St., Oneonta, NY 13820 607-432-3880
§† Datak Corp., 65 Seventy-First St., Guttenberg, NJ 07093 201-869-2200
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
Ei North America, 15 W. 53rd St. Suite 47E, New York, NY 10019 212-315-3099
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§† Electron Products, 2084 Central Ave., Duarte, CA 91010 818-359-8281
† Elmag, 54 Clark St., Newark, NJ 07104 201-481-1600
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
† F-Dyne Elctrns., 449 Howard Ave., Bridgeport, CT 06605 203-367-6431
§† Film Capacitors, 100 8th St., Passaic, NJ 07055 201-779-2240
† Filtron Co., Inc., Div. of Aeroflex Labs., Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804 516-752-1144
§ Fuji-Svea, P.O. Box 3375, Torrance, CA 90510 213-533-1221
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§ Goldwell Comps., 1815 W. 205th St. Ste. 201, Torrance, CA 90501 213-533-1228
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
Interelectronics Corp., Interelectronics Park, 550 U.S. Rte. 303, Congers, NY 10920 ..... 914-EL8-8000
§ ITT Components Passive Grp., 1201 E. McFadden Ave., Santa Ana, CA 92705 714-836-0351
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Kahgan Elctrns. Corp., 605 Peninsula Blvd., Hempstead, NY 11550 516-538-2300
§ KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
Lawrence-Crow Elctrns. Inc., 2100 Stemmons, Dallas, TX 75207 214-749-5440
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
§ Liberty Intl. Corp., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
§ Mallory Capacitor Co., Mallory Comps. Grp., 3029 E. Washington St., Indianapolis, IN 46201 317-636-5353
Maxwell Labs., 8835 Balboa Ave., San Diego, CA 92123 619-279-5100
Nichicon (America) Corp., 927 E. State Pkwy., Schaumburg, IL 60195 ... 312-843-7500
§† Paccom, 3928 148th NE, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
§† RTE Aerovox Inc., 740 Belleville Ave., New Bedford, MA 02745 617-994-9661
† S & EI Mfg., Box 832, Northridge, CA 91324 818-349-4111
Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
§ Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
† Southern Electronics, F-Dyne, 726 So. Flower St., Burbank, CA 91502 ... 213-845-2458
§† Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§† Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
Standard Condenser Corp., 1065 W. Addison St., Chicago, IL 60613 312-327-5440
§ Thomson-CSF Comps. Corp., Passive Comp. Div., 5850 Canoga Ave., Suite 300, Woodland Hills, CA 91367 818-887-1010
† Tobe Deutschmann Labs., Inc., 550 Turnpike St., Canton, MA 02021 617-828-3366
§† Union Carbide Corp., Elctrns. Div., Component Dept., Box 5928, Greenville, SC 29606 803-963-6348
§ Westlake Capacitors, Inc., 5334 Sterling Center Dr., Westlake Village, CA 91361 818-889-4120

Capacitors, Fixed, Foil-1500

§† Component Research Co. Inc., 1655-26 St., Santa Monica, CA 90404, 213-829-3615 ..... A•1056
§† American Capacitor, 2080 Central Ave, Duarte, CA 91010 818-357-8806
Baldor Electric Company, P.O. Box 2400, Fort Smith, AR 72901 501-646-4711
§ Bishop Electronics Corp., 3729 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-695-0446;213-692-9391
Capco, Box 1028, Grand Junction, CO 81502 303-243-8751
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 213-699-0918
Electronic Concepts, Inc., Box 627 E, Eatontown, NJ 07724 201-542-7880
§ IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 516-753-0400
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-822-9601
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
§† Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229
PPD, Inc., Hwy. 70W, Resco Ct., P.O. Box 31347, Raleigh, NC 27612 919-781-3955
SFE Technologies, 1501 1st St., San Fernando, CA 91340 213-365-9411

Capacitors, Fixed, Glass-1500

Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830, 607-974-8725 ..... A•1068
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 ..... 213-873-6400; 818-988-4400
† American Technical Ceramics Corporation, 1 Norden La., Huntington Sta., NY 11746 516-271-9600
§† Centre Engrg., 2820 E. College Ave., State College, PA 16801 814-237-0321
† Jennings, 970 McLaughlin Ave., San Jose, CA 95122 408-292-4025
Presidio Components, Inc., 7185 Construction Ct., San Diego, CA 92121 619-578-9390
§† Vitramon N.A., P. O. Box 544, Bridgeport, CT 06601 203-268-6261

Capacitors, Fixed, Laboratory Standard-1500

American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
† American Technical Ceramics Corporation, 1 Norden La., Huntington Sta., NY 11746 516-271-9600
Blanck, A. R., Co., Box 249, Rutherford, NJ 07070 201-933-2091
† Circle Electronics, A Division of F-Dyne Elctrns., 3501 Electronics Way, W. Palm Beach, FL 33407 305-844-1310
§† Component Research Co. Inc., 1655-26 St., Santa Monica, CA 90404 ... 213-829-3615
CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069 619-747-4000
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† F-Dyne Elctrns., 449 Howard Ave., Bridgeport, CT 06605 203-367-6431
§ Film Capacitors, 100 8th St., Passaic, NJ 07055 201-779-2240
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
Nichicon (America) Corp., 927 E. State Pkwy., Schaumburg, IL 60195 ... 312-843-7500
Rutherford Resch. Prods., Box 249, Rutherford, NJ 07070 201-933-2091
† Southern Electronics, F-Dyne, 726 So. Flower St., Burbank, CA 91502 ... 213-845-2458
Standard Condenser Corp., 1065 W. Addison St., Chicago, IL 60613 312-327-5440
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 215-539-6050
§ Tucker Elctrns., Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
§† Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144 602-744-0400
Wesco Electrical Co., 201 Munson St., Greenfield, MA 01301 413-774-4358

Capacitors, Fixed, Mica-1500

§† Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ..... A•1013
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1138
§ Acushnet Capacitor Co., Inc., 720 Belleville, New Bedford, MA 02741 617-999-3291
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 ..... 213-873-6400; 818-988-4400
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
§† Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900

§† Cornell-Dubilier Electronics, 150 Avenue "L", Newark, NJ 07105 201-589-7500
§† Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
§† Custom Elctrns., Browne St., Oneonta, NY 13820 607-432-3880
Ei North America, 15 W. 53rd St. Suite 47E, New York, NY 10019 212-315-3099
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§† Kahgan Elctrns. Corp., 605 Peninsula Blvd., Hempstead, NY 11550 516-538-2300
Lawrence-Crow Elctrns. Inc., 2100 Stemmons, Dallas, TX 75207 214-749-5440
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183
§† Sangano Weston-Sangamo Components Div., Fairchild Semiconductor, Box 128, Pickens, SC 29671 803-878-6311
§† SEMCO, Rte. 6, No. Windham, CT 06226 203-423-6316
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
§† Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§† Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
Spruce Pine Mica Co., Mtn. Laurel Dr., Spruce Pine, NC 28777 704-765-4241
Standex Elctrns., 4538 Camberwell Rd., Cincinnati, OH 45209 513-871-3777
† Stanley Elctrns., Inc., 592 Oak St., Copiague, NY 11726 516-842-8866
† Tobe Deutschmann Labs., Inc., 550 Turnpike St., Canton, MA 02021 617-828-3366

Capacitors, Fixed, Monolithic-1500

§† AVX Corporation, Box 867, Myrtle Bch., SC 29577, 803-448-9411 ..... A•1010
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ..... A•1013
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, 213-699-0918 ..... A•1065
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830, 607-974-8725 ..... A•1068
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ..... A•1095
§† Kemet, Union Carbide Corporation, Elctrns. Div., Components Dept., Box 5928, Greenville, SC 29606, 803-963-6348 ..... A•1107
† Metuchen Capacitors, Inc., 420 Park Ave., Perth Amboy, NJ 08861, 201-442-0500 ..... A•1133
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•1135
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1136,1138
§ NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060;800-645-9333 ..... A•1141
§† Republic Elctrns. Corp., 176 E. 7th St., Paterson, NJ 07524, 201-279-0300 ..... A•1167
SFE Technologies, 1501 1st St., San Fernando, CA 91340, 213-365-9411 ..... A•1169-1171,1630
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421, 615-892-0291 ..... A•1175
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076, 312-679-8200 ..... A•1176
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 ..... 213-873-6400; 818-988-4400
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
† American Technical Ceramics Corporation, 1 Norden La., Huntington Sta., NY 11746 516-271-9600
§ Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000
§† Centralab, Inc., A North American Philips Co., 4561 Colorado Blvd., Los Angeles, CA 90039 818-240-4880
§ Centralab, Inc., A North American Philips Co., 7158 Merchant Ave., El Paso, TX 79915 915-779-3961
§ Centre Engrg., 2820 E. College Ave., State College, PA 16801 814-237-0321
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
§ Emcon Inc., Sub. of Kyocera Intl., 11620 Sorrento Valley Rd., San Diego, CA 92138 619-459-4355
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
Johanson Dielectrics, 2220 Screenland Dr., Burbank, CA 91505 818-848-4465
§ KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
§† KD Components, Inc., 3016 S. Orange Ave., Santa Ana, CA 92707 714-545-7108
§ Maida Development Co., 20 Libby St., Hampton, VA 23663 804-723-0785
§ Mallory Capacitor Co., Mallory Comps. Grp., 3029 E. Washington St., Indianapolis, IN 46201 317-636-5353
§ Matsuo Electronics, 2134 Main Street, Suite 200, Huntington Beach, CA 92648 714-969-2491
† Microeap, Inc., 11120 Roselle St., San Diego, CA 92121 619-452-9812
Presidio Components, Inc., 7185 Construction Ct., San Diego, CA 92121 619-578-9390
Radio Materials Corp., 4242 W. Bryn Mawr, Chicago, IL 60646 312-478-3600
Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
§† Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
§† Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§† Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
§ Tansitor Elctrns., West Rd., Bennington, VT 05201 802-442-5473
Unilator Technical Ceramics Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5618
§† Union Carbide Corp., Elctrns. Div., Component Dept., Box 5928, Greenville, SC 29606 803-963-6348
§ Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540
† U S Microtek Components Corporation, 11144 Penrose St., Sun Valley, CA 91352 818-767-6770
§† Viclan, 7373A Engineers Rd., San Diego, CA 92138 619-292-1411
§† Vitramon N.A., P. O. Box 544, Bridgeport, CT 06601 203-268-6261
§ Waldom Elctrns., 4301 W. 69th St., Dept. EEM, Chicago, IL 60629 312-585-1212
Wright Capacitors, 3000 So. Orange, Santa Ana, CA 92707 714-546-2490

Capacitors, Fixed, Mylar — See Capacitors, Fixed, Film (Vol. A)

Capacitors, Fixed, Oil Filled-1500

† CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069, 619-747-4000 ..... A•1070
§ Elpac Comps., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ..... A•1078
§† Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1146,1154,1155
§† American Capacitor, 2080 Central Ave, Duarte, CA 91010 818-357-8806
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Baldor Electric Company, P.O. Box 2400, Fort Smith, AR 72901 501-646-4711
§† Component Research Co. Inc., 1655-26 St., Santa Monica, CA 90404 213-829-3615
† Condenser Prods., P.O. Box 997, Brooksville, FL 33512 904-796-3561
§ Cornell-Dubilier Electronics, 150 Avenue "L", Newark, NJ 07105 201-589-7500
§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
§† Electron Products, 2084 Central Ave., Duarte, CA 91010 818-359-8281
† Elmag, 54 Clark St., Newark, NJ 07104 201-481-1600
§† Film Capacitors, 100 8th St., Passaic, NJ 07055 201-779-2240
§ High Energy, Lower Valley Rd., Parkesburg, PA 19365 215-593-2800
Hipotronics, P.O. Drawer A, Brewster, NY 10509 914-279-8091
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
ITT Components Passive Grp., 1201 E. McFadden Ave., Santa Ana, CA 92705 714-836-0351
§ Mallory Capacitor Co., Mallory Comps. Grp., 3029 E. Washington St., Indianapolis, IN 46201 317-636-5353
Maxwell Labs., 8835 Balboa Ave., San Diego, CA 92123 619-279-5100
Nichicon (America) Corp., 927 E. State Pkwy., Schaumburg, IL 60195 312-843-7500
§† Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
§† RTE Aerovox Inc., 740 Belleville Ave., New Bedford, MA 02745 617-994-9661
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§† Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
† Stanley Elctrns., Inc., 592 Oak St., Copiague, NY 11726 516-842-8866

Capacitors, Fixed, Paper, Metallized & Nonmetallized-1500

† CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069, 619-747-4000 ..... A•1070
§ Elpac Comps., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ..... A•1078
§ Inter-Technical Grp., Box 23, Irvington, NY 10533, 914-591-8822 ..... A•1087,1091
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ..... A•1095
Marcon America Corp., 310 Era Drive, Northbrook, IL 60062, 312-564-2820 ..... A•1116
Mepco//Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960, 201-539-2000 ..... A•1126
Mepco//Electra, Inc., North American Philips Corp., 6071 St. Andrews Rd., Columbia, SC 29210, 803-772-2500 ..... A•1126
§† Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1146,1148,1150,1152,1153,1154,1155
§ Acushnet Capacitor Co., Inc., 720 Belleville, New Bedford, MA 02741 617-999-3291
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 ..... 213-873-6400; 818-988-4400
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
§† American Capacitor, 2080 Central Ave, Duarte, CA 91010 818-357-8806
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
§ Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§ Bishop Electronics Corp., 3729 San Gabriel River Pkwy., Pico Rivera, CA 90660 ..... 213-695-0446;213-692-9391
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735 516-454-6390
† Condenser Prods., P.O. Box 997, Brooksville, FL 33512 904-796-3561
§ Cornell-Dubilier Electronics, 150 Avenue "L", Newark, NJ 07105 201-589-7500
§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
§† Electron Products, 2084 Central Ave., Duarte, CA 91010 818-359-8281
† Elmag, 54 Clark St., Newark, NJ 07104 201-481-1600
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
† Fil-Coil Economy Intl., Inc., 800 Axinn Ave., Garden City, NY 11530 516-228-9445
§† Film Capacitors, 100 8th St., Passaic, NJ 07055 201-779-2240
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
High Energy, Lower Valley Rd., Parkesburg, PA 19365 215-593-2800

§IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 516-753-0400
§Illinois Capacitor, Inc., 3757 W. Touhy Ave., Lincolnwood, IL 60645 312-675-1760
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
ITT Components Passive Grp., 1201 E. McFadden Ave., Santa Ana, CA 92705 714-836-0351
§Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§Mallory Capacitor Co., Mallory Comps. Grp., 3029 E. Washington St., Indianapolis, IN 46201 317-636-5353
§Martin Sound Prods., 28 Alpha Park, Cleveland, OH 44143-2297 216-442-2286
§Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§†Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229
†RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
§†RTE Aerovox Inc., 740 Belleville Ave., New Bedford, MA 02745 617-994-9661
§†SFE Technologies, 1501 1st St., San Fernando, CA 91340 213-365-9411
§Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Southern Electronics, F-Dyne, 726 So. Flower St., Burbank, CA 91502 ... 213-845-2458
§SPECO Div., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757 ..... 516-957-8700;800-645-5516
§†Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§†Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
Standard Condenser Corp., 1065 W. Addison St., Chicago, IL 60613 312-327-5440
Wesco Electrical Co., 201 Munson St., Greenfield, MA 01301 413-774-4358

Capacitors, Fixed, Plastic — See Capacitors, Fixed, Film (Vol. A)

Capacitors, Fixed, Polycarbonate — See Capacitors, Fixed, Film (Vol. A)

Capacitors, Fixed, Polyester — See Capacitors, Fixed, Film (Vol. A)

Capacitors, Fixed, Polypropylene — See Capacitors, Fixed, Film (Vol. A)

Capacitors, Fixed, Polysulfone — See Capacitors, Fixed, Film (Vol. A)

Capacitors, Fixed, Polystyrene — See Capacitors, Fixed, Film (Vol. A)

Capacitors, Fixed, Porcelain-1500

†American Technical Ceramics Corporation, 1 Norden La., Huntington Sta., NY 11746, 516-271-9600 ..... A•1007
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
†Dielectric Labs., 69 Albany St., Cazenovia, NY 13035 315-655-8710
High Energy, Lower Valley Rd., Parkesburg, PA 19365 215-593-2800
†Johanson Dielectrics, 2220 Screenland Dr., Burbank, CA 91505 818-848-4465
§KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
§Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
Presidio Components, Inc., 7185 Construction Ct., San Diego, CA 92121 619-578-9390
†Republic Elctrns. Corp., 176 E. 7th St., Paterson, NJ 07524 201-279-0300
§Tansitor Elctrns., West Rd., Bennington, VT 05201 802-442-5473
§†Vitramon N.A., P. O. Box 544, Bridgeport, CT 06601 203-268-6261

Capacitors, Fixed, Tantalum Electrolytic-1500

§Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ..... A•1013
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830, 607-974-8725 ..... A•1068
§Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011, 212-691-9050 ..... A•1071
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... A•1086
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ..... A•1095
§ITT Components Passive Grp., 1201 E. McFadden Ave., Santa Ana, CA 92705, 714-836-0351 ..... A•1097
§†Kemet, Union Carbide Corporation, Elctrns. Div., Components Dept., Box 5928, Greenville, SC 29606, 803-963-6348 ..... A•1106
§†Mallory Capacitor Co., Mallory Comps. Grp., 3029 E. Washington St., Indianapolis, IN 46201, 317-636-5353 ..... A•1114
§Marcon America Corp., 310 Era Drive, Northbrook, IL 60062, 312-564-2820 ..... A•1116
§Matsuo Electronics, 2134 Main Street, Suite 200, Huntington Beach, CA 92648, 714-969-2491 ..... A•1118
§†Mepco/Electra, Inc., North American Philips Corp., 5900 Australian Ave., West Palm Beach, FL 33407, 305-842-3201 ..... A•1124, B•1009
§†Mepco/Electra, Inc., North American Philips Corp., 6071 St. Andrews Rd., Columbia, SC 29210, 803-772-2500 ..... A•1124, B•1009
§NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060;800-645-9333 ..... A•1140
§†Acushnet Capacitor Co., Inc., 720 Belleville, New Bedford, MA 02741 617-999-3291
Acushnet Elctrns. Co., Inc., 8700 E. Thomas Rd., Scottsdale, AZ 85252 .. 602-947-7474
§Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 ..... 213-873-6400; 818-988-4400
§Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
§†Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 213-699-0918
§†Cornell-Dubilier Electronics, 150 Avenue "L", Newark, NJ 07105 201-589-7500
§Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
Corning Glass Works, Telecomm Prods Dept., BH-5, Corning, NY 14830 607-974-9000
§Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
Ei North America, 15 W. 53rd St. Suite 47E, New York, NY 10019 212-315-3099
§Elna America, Inc., 153 E. Savarona Way, Carson, CA 90746 213-327-6090
Goldwell Comps., 1815 W. 205th St. Ste. 201, Torrance, CA 90501 213-533-1228
Hilton Industries, Inc., Div. of Core Industries, 1177 Cattlemen Road, Sarasota, FL 33582 813-371-2600
Hunter Stanley Elec., 1813 Church St., Nashville, TN 37203 615-321-0500
§Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Lawrence-Crow Elctrns. Inc., 2100 Stemmons, Dallas, TX 75207 214-749-5440
§Liberty Intl. Corp., 2539 237th St, Suite F, Torrance, CA 90505 213-539-6452
NEC Electronics, Inc., 401 Ellis Street, Mtn. View, CA 94039 415-960-6000
§NEC Elctrns. USA Inc., NEC Electron Div., 252 Humboldt Ct., Sunnyvale, CA 94086 408-745-6520
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
§Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§†Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
§†Tansitor Elctrns., West Rd., Bennington, VT 05201 802-442-5473
§†Thomson-CSF Comps. Corp., Passive Comp. Div., 5850 Canoga Ave., Suite 300, Woodland Hills, CA 91367 818-887-1010
§†Union Carbide Corp., Elctrns. Div., Component Dept., Box 5928, Greenville, SC 29606 803-963-6348
†Westlake Capacitors, Inc., 5334 Sterling Center Dr., Westlake Village, CA 91361 818-889-4120

Capacitors, Fixed, Vacuum-1500

†Jennings, 970 McLaughlin Ave., San Jose, CA 95122, 408-292-4025 ..... A•1102
†EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
§Inmark Corp., 147 West Cedar St., Norwalk, CT 06854 203-866-8474

Capacitors, Variable, Air-1500

§†Johanson Mfg. Corp., 400 Rockaway Valley Rd., Boonton, NJ 07005, 201-334-2676 ..... A•1105
§†Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ..... A•1173
§GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
Hopt, Karl, Co., 118 First Ave., Atlantic Highlands, NJ 07716 201-291-0633
§Johnson, E. F., Co., 299 Johnson Ave., Waseca, MN 56093 507-835-6222
§Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
Oxley, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 213-463-5120
§Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§†Tansitor Elctrns., West Rd., Bennington, VT 05201 802-442-5473
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 215-539-6050
§Trim-Tronics, Inc., 67 Albany St., Cazenovia, NY 13035 315-655-9528
†Voltronics, West St., P.O. Box 476, E. Hanover, NJ 07936 201-887-1517

Capacitors, Variable, Ceramic-1500

§Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134, 408-946-6000 ..... D•1057
§IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735, 516-753-0400 ..... A•1080
§†Johanson Mfg. Corp., 400 Rockaway Valley Rd., Boonton, NJ 07005, 201-334-2676 ..... A•1105
§Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ..... A•1173
§†Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421, 615-892-0291 ..... A•1175
§†Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1188
†Compex Corp., 35A East Main St., Marlton, NJ 08053 609-596-9388
§GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-822-9601
§Johnson, E. F., Co., 299 Johnson Ave., Waseca, MN 56093 507-835-6222
§†Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
§Maida Development Co., 20 Libby St., Hampton, VA 23663 804-723-0785
Mepco/Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960 201-539-2000
§Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
Oxley, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 213-463-5120
§Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000

§ Piher Int'l. Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ..... 312-640-8300; 800-323-6693
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303 415-856-6900
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
§ Tansitor Elctrns., West Rd., Bennington, VT 05201 802-442-5473
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
§ Trim-Tronics, Inc., 67 Albany St., Cazenovia, NY 13035 315-655-9528

Capacitors, Variable, Film-1500

§ Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ..... A•1173
† Circle Electronics, A Division of F-Dyne Elctrns., 3501 Electronics Way, W. Palm Beach, FL 33407 305-844-1310
† F-Dyne Elctrns., 449 Howard Ave., Bridgeport, CT 06605 203-367-6431
§ Johnson, E. F., Co., 299 Johnson Ave., Waseca, MN 56093 507-835-6222
Mepco//Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960 201-539-2000
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Southern Electronics, F-Dyne, 726 So. Flower St., Burbank, CA 91502 ... 213-845-2458
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Voltronics, West St., P.O. Box 476, E. Hanover, NJ 07936 201-887-1517

Capacitors, Variable, Gas Filled-1500

† Jennings, 970 McLaughlin Ave., San Jose, CA 95122, 408-292-4025 ..... A•1103
Continental Electronics Mfg. Co., P.O. Box 270879, Dallas, TX 75227 214-381-7161
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 215-539-6050

Capacitors, Variable, Glass-1500

§† Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ..... A•1173
† Jennings, 970 McLaughlin Ave., San Jose, CA 95122 408-292-4025
§† Johanson Mfg. Corp., 400 Rockaway Valley Rd., Boonton, NJ 07005 201-334-2676
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
§† Tansitor Elctrns., West Rd., Bennington, VT 05201 802-442-5473
† Voltronics, West St., P.O. Box 476, E. Hanover, NJ 07936 201-887-1517

Capacitors, Variable, HV (Lab Type)-Also See Decade Boxes, Capacitance-1500

† Jennings, 970 McLaughlin Ave., San Jose, CA 95122, 408-292-4025 ..... A•1102
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1138
§† Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ..... A•1173
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281, 215-539-6050 ..... D•1312
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
† Circle Electronics, A Division of F-Dyne Elctrns., 3501 Electronics Way, W. Palm Beach, FL 33407 305-844-1310
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† F-Dyne Elctrns., 449 Howard Ave., Bridgeport, CT 06605 203-367-6431
§† Johanson Mfg. Corp., 400 Rockaway Valley Rd., Boonton, NJ 07005 201-334-2676
† Southern Electronics, F-Dyne, 726 So. Flower St., Burbank, CA 91502 ... 213-845-2458

Capacitors, Variable, Mica-1500

§ Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ..... A•1173
§ Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000
Ei North America, 15 W. 53rd St. Suite 47E, New York, NY 10019 212-315-3099
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Standex Elctrns., 4538 Camberwell Rd., Cincinnati, OH 45209 513-871-3777

Capacitors, Variable, Padders & Trimmers-1500

§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134, 408-946-6000 ..... D•1057
§ IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735, 516-753-0400 ..... A•1080
§† Johanson Mfg. Corp., 400 Rockaway Valley Rd., Boonton, NJ 07005, 201-334-2676 ..... A•1105
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1138
§† Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ..... A•1173
§† Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1188
§ Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000
Ei North America, 15 W. 53rd St. Suite 47E, New York, NY 10019 212-315-3099
§ Johnson, E. F., Co., 299 Johnson Ave., Waseca, MN 56093 507-835-6222
§ Maida Development Co., 20 Libby St., Hampton, VA 23663 804-723-0785
Oxley, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 213-463-5120
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Tansitor Elctrns., West Rd., Bennington, VT 05201 802-442-5473
† Voltronics, West St., P.O. Box 476, E. Hanover, NJ 07936 201-887-1517

Capacitors, Variable, Vacuum-1500

† Jennings, 970 McLaughlin Ave., San Jose, CA 95122, 408-292-4025 ..... A•1102
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
§ Inmark Corp., 147 West Cedar St., Norwalk, CT 06854 203-866-8474

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Casters-1400 — *See Vol. C*

Cathode-Ray Readout Tubes — See Tubes, Readout (Vol. A)

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Cavities, Microwave-3450

§ Eaton Corp., Elctrn. Instrmn. Div., 5340 Alla Rd., Los Angeles, CA 90066
† EPSCO Microwave, 411 Providence Hwy., Westwood, MA 02090 617-329-1500
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† MCL, Inc., 10 North Beach Ave., La Grange, IL 60525-2092 312-354-4350
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44-(582) 60-14-41
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reeve Electronics, Mellish E. Murray, 1720 W. Fulton St., Chicago, IL 60612 312-670-0150
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E5, Tampa, FL 33614 813-884-1411
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
Zero Corp., 777 Front St., Burbank, CA 91503 213-846-4191

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Chambers, Radiation-2550 — *See Vol. D*

Chambers, RFI/EMI-2550 — *See Vol. D*

Chambers, Shock-2550 — *See Vol. D*

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Chokes, Filter-1800

Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2112-2113,2117

Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2120

§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ..... A•1210,1212,1214,1215

Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 .... A•1218

§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1231

Filter Concepts Inc., 2624 S. Rousselle, Santa Ana, CA 92707, 714-545-7003 ..... A•1606

§† Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 .. A•1240

Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ..... A•2157

Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 ..... A•2158

Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2164

† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... A•2211, D•1735

† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... D•1735

Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2213

Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1270

Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1622,2260,2263,2264

Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ..... A•1274

† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 ..... A•2272,2285

Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 .. A•2288

Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400 ..... A•2316

† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 ..... A•1280,2320,2321

Wilco Corp., 6451 Saguaro Court, Indianapolis, IN 46268, 317-293-9300 ..... A•1296

† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 818-841-3630

Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006

§ American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651

§ Amperex Electronic Corp., Ferroxcube Div., 5083 Kings Hwy., Saugerties, NY 12477 914-246-2811

Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100

Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311

Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541

† Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125

Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640

† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040

† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000

Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052 716-652-3600

Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ..... 415-785-5231;415-785-5235

Eastern Delta Corp., 29-09 S. Broadway, Fair Lawn, NJ 07410 201-797-4200

Electro Design Sys., 100 W. 35th St., Ste. S, National City, CA 92050 619-420-2351

§† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950

Goldwell Comps., 1815 W. 205th St. Ste. 201, Torrance, CA 90501 213-533-1228

§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710

§ Jeffers Elctrns., Grand Plaza, 945 Grand Ave., Nogales, AZ 85621 602-287-5851

Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700

Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700

Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 .....303-443-6250; 800-525-6478

† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054

§ Martin Sound Prods., 28 Alpha Park, Cleveland, OH 44143-2297 216-442-2286

Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050

North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700

OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600

† Oram Electronics, 12 Cranston Rd., Pittsford, NY 14534 716-381-4673

Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700

† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-6200

§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400

Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .....516-593-2025;Outside NY 800-645-5900

Schaffner EMC, Inc., 825 Lehigh Ave., Union, NJ 07083 201-851-0644

† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma

South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866

Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200

§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200

§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161

Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070

Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037 301-464-2100

† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880

§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500

§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500

† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443

§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

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Chokes, Swinging-1800

Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2112

§ EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2144

Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ... A•1240

Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 ..... A•2158

† **Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950** ..... **A•1622**
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ..... **A•1274**
† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 818-841-3630
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Eastern Delta Corp., 29-09 S. Broadway, Fair Lawn, NJ 07410 201-797-4200
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§ Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
§ E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 213-892-7279
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ..... 303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ..... 914-699-5514; 800-431-1064
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696 516-239-4510
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§ Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701 914-963-3400
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037 301-464-2100
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500

Chokes, Waveguide-3450

† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reeve Electronics, Mellish E. Murray, 1720 W. Fulton St., Chicago, IL 60612 312-670-0150
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
§ Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

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Circuits, Hybrid, Custom-3130

ACC Electronics, 1300 W. Oak, Independence, KS 67301, 316-331-1000 ..... **A•1659**
† **Aeroflex Labs., Microelctrns. Div., 35 S. Service Rd., Plainview, NY 11803, 516-694-6700** ..... **A•1660**
CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 ..... **A•1662**
† **CTS Electronics Corp., Halex Division, 1202 McGaw Ave., Irvine, CA 92714, 714-261-6381** ..... **A•1662**
† **HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776, 617-443-4631** ..... **A•1670,1872**
† **Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030, 408-395-2300** ..... **A•1671**
† **ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600** ..... **D•1150**
§† **Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050, 408-988-4930** ..... **A•1672**
§† **Integrated Circuits, Inc., 10301 Willows Road, Redmond, WA 98052, 206-882-3100** ..... **A•1673**
§† **International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111** ..... **A•1677**
† **Leach Corp., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770** ..... **A•1379,1678,1679, B•1428**
Modular Devices, 50 Orville Dr., Bohemia, NY 11716, 516-567-9620 ..... **D•1011**
† **Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501** ..... **A•1696**
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... **A•1957**
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200 ..... **A•1971**
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† Aeroflex Labs., Magnetic Prods. Div., 35 South Service Road, Plainview, NY 11803 516-694-6700
† Allied Corp. Aerospace Sector, Bendix Communications Div., East Joppa Rd., Towson, MD 21204 301-583-4000
† Alpha Inds., Inc.-Microelectronic Div., 2800 Crystal Drive, Hatfield, PA 19440 215-822-1311
American Elctrn. Labs., Inc., Hybrid/MIC Div., P.O. Box 552, Lansdale, PA 19446
American Microsignal, 8431 Monroe Ave., Stanton, CA 90680 714-761-1222
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
† Andrich Sys., Inc., 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
† Argo Transdata Corp., Box 554, Clinton, CT 06413 203-669-2233
Array Technology, 992 S. Saratoga-Sunnyvale Rd., San Jose, CA 95129 408-252-9900
Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
Astec USA, Ltd., A BSR Intl. Co., 2880 San Tomas Expwy., # 200, Santa Clara, CA 95051 408-748-1200
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
† Aydin Vector Div., Box 328, Newtown, PA 18940 215-968-4271
Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Beckman Instrs., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
† Boeing Microelectronics, PCB OPNS., M/S: 88-34, Box 24666, Seattle, WA 98124 206-773-1083
Bosch, Robert, Corp., 2800 S. 25th Ave., Broadview, IL 60153 312-865-5200
Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406 213-450-1761
Centralab, Inc., A North American Philips Co., 5855 N. Glen Park Rd., Milwaukee, WI 53209 414-228-7380
§ Cermetek Microelectronics Inc., 1308 Borregas Ave., Sunnyvale, CA 94088 408-752-5000
† Circuit Techn., 160 Smith St., Farmingdale, NY 11735 516-293-8686
Computer Avionics, 2 Southgate Dr., Mt. Carmel, IL 62863 618-263-4343
§ Dymec, 8 Lowell Ave., Winchester, MA 01890 617-729-7870
Eltec Instruments Inc., P.O. Box 9610, Daytona Bch., FL 32020 904-253-5328
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
§† Film Microelectronics, 17 A St., Burlington, MA 01803 617-272-5650
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
Fujitsu America, Inc., 918 Sherwood Dr., Lake Bluff, IL 60044 312-295-2610
† Gentex, Box 315, Carbondale, PA 18407 603-434-0311
HEI, Inc., 1495 Steiger Lake La., Victoria, MN 55386 612-443-2500
† Hi-G Company, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114 203-522-8600
† Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903 714-759-2411
† Hybrid Elctrns., 142 Adams St., Newton, MA 02158 617-527-2711
Hybrid Svcs. Inc., 38 Main St., North Reading, MA 01864 617-664-5500
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
Hybrilonics, Inc., P.O. Box 217, Lasalle Sta., Niagara Falls, NY 14304 716-731-9080
† Hy-Tec Industries, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786 516-744-5062
† Interconics, BMC Industries, Inc., 245 E. 6th St., 3rd Flr., St. Paul, MN 55101 612-228-6512
Isotronics, Industrial Park, New Bedford, MA 02745 617-998-2000
IXYS Corp., 142 Charcot Ave., San Jose, CA 95131 408-262-8800
† Kates Sci. Instrs., 142 Adam St., Newton, MA 02158 614-527-2711
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† M.S. Kennedy Corp., Sub of Hybrilonics, Inc., 8170 Thompson Rd., Clay, NY 13041 315-699-9201

§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
† Litton Applied Technology, 645 Almanor Ave., P.O. Box 3478, Sunnyvale, CA 94088-3478 408-773-0777
Macro Electronics Corp., 23 Royalston Lane, So. Setauket, NY 11720 ... 516-698-3357
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
MICRA Corp., 120 Ricefield Lane, Hauppauge, NY 11788 516-231-8600
Micronel U.S., 2142F Industrial Ct., Sycamore Research Center, Vista, CA 92083 619-727-7400
Micropac Inds., 905 E. Walnut St., Garland, TX 75040 214-272-3571
† Micropac Inds., Inc., General Sensors Div., 905 E. Walnut St., Garland, TX 75040 214-272-3571
Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ..... 714-979-8833; 714-634-1535
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
† Natel Engrg. Co., Inc., 4550 Runway St., Simi Valley, CA 93063 805-581-3950
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
† Northwest Microcircuits, Inc., 2115 N. College, Newberg, OR 97132 503-538-7081
Optical Electronics, Inc., Box 11140, Tucson, AZ 85734 602-624-8358
† Paine Instrs., 2401 S. Bayview St., Seattle, WA 98144 800-426-0366
† Parlex Corp., 145 Milk St., Methuen, MA 01844 ..... 617-685-4341, ext. 325
Radix Microelectronics Inc., 4182 Sandberg Dr., Colorado Springs, CO 80911 303-390-5168
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
RCA Solid State Div., Linear Integrated Circuits, Rte. 202, Somerville, NJ 08876 201-685-6000
Resistance Technology Inc., 1260 Red Fox Rd., St. Paul, MN 55112 612-636-9770
† Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
SFE Technologies, 1501 1st St., San Fernando, CA 91340 213-365-9411
Signatron, A Unit of Sundstrand Corp., 12 Hartwell Ave., Lexington, MA 02173 617-861-1500
Siltronics Ltd., P.O. Box 456, Dover, MA 02030 617-329-4068
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
Taiyo Yuden (USA) Inc., 714 Algonquin Rd., Arlington Heights, IL 60005 312-364-6104
§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
Thickfilm Int'l, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
Thomson-CSF Comps. Corp., Special Prods. Div., 301 Rte. 17 North, Rutherford, NJ 07070 201-438-2300
Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291 209-651-1402
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733
† Zenith Systems & Components Group, Zenith Electronics Corp., 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Circuits, Hybrid, Thick Film-3130

ACC Electronics, 1300 W. Oak, Independence, KS 67301, 316-331-1000 ..... A•1659
† Aeroflex Labs., Microelctrns. Div., 35 S. Service Rd., Plainview, NY 11803, 516-694-6700 ..... A•1660
Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406, 213-450-1761 ..... A•1829
† CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 ..... A•1662
† CTS Electronics Corp., Halex Division, 1202 McGaw Ave., Irvine, CA 92714, 714-261-6381 ..... A•1662
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... A•1845
† Datel, General Electric Co., 11 Cabot Blvd., Mansfield, MA 02048, 617-339-9341 ..... D•1147
† Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030, 408-395-2300 ..... A•1671
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ..... D•1150
§† Integrated Circuits, Inc., 10301 Willows Road, Redmond, WA 98052, 206-882-3100 ..... A•1673
§† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111 ..... A•1677
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981, 201-887-8100 ..... A•1881
† Leach Corp., Contro! Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ..... A•1379 ,1678,1679, B•1428
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761, 617-695-0203 ..... A•1906
Modular Devices, 50 Orville Dr., Bohemia, NY 11716, 516-567-9620 ..... D•1011
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1696
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... A•1957
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200 ..... A•1971
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† Aeroflex Labs., Magnetic Prods. Div., 35 South Service Road, Plainview, NY 11803 516-694-6700
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
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Allen-Bradley Co., Electronics Group, Div.of Rockwell Corp., Microelectronic Products Div., Highway 29 N. Bryan Pk. Exit, Greensboro, NC 27410 919-621-9010
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† Alpha Inds., Inc.-Microelectronic Div., 2800 Crystal Drive, Hatfield, PA 19440 215-822-1311
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
American Electronic Labs., Box 552, Lansdale, PA 19446 215-822-2929
American Elctrn. Labs., Inc., Hybrid/MIC Div., P.O. Box 552, Lansdale, PA 19446
§† American Microsignal, 8431 Monroe Ave., Stanton, CA 90680 714-761-1222
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
† Andrich Sys., Inc., 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
Aptek Microsystems, 700 N. W. 12th Ave., Deerfield Beach, FL 33441 ... 305-421-8450
† Argo Transdata Corp., Box 554, Clinton, CT 06413 203-669-2233
Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
† Aydin Vector Div., Box 328, Newtown, PA 18940 215-968-4271
§† Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
† Boeing Microelectronics, PCB OPNS., M/S: 88-34, Box 24666, Seattle, WA 98124 206-773-1083
Bosch, Robert, Corp., 2800 S. 25th Ave., Broadview, IL 60153 312-865-5200
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Centerflex Techn. Corp., 221 Seventh Ave., P.O. Box 21, Hawthorne, NJ 07507 201-423-0505
Centralab, Inc., A North American Philips Co., 5855 N. Glen Park Rd., Milwaukee, WI 53209 414-228-7380
Cermetek Microelectronics Inc., 1308 Borregas Ave., Sunnyvale, CA 94088 408-752-5000
† Circuit Techn., 160 Smith St., Farmingdale, NY 11735 516-293-8686
Computer Avionics, 2 Southgate Dr., Mt. Carmel, IL 62863 618-263-4343
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
† Dymec, 8 Lowell Ave., Winchester, MA 01890 617-729-7870
§† Elantec, Inc., 1996 Tarob Ct., Milpitas, CA 95035 ..... 408-945-1323;800-821-7429
Eltec Instruments Inc., P.O. Box 9610, Daytona Bch., FL 32020 904-253-5328
† Engelhard Corp., 70 Wood Ave. S., Iselin, NJ 08830 201-321-5900
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
Ferro, Thick Film Sys. Div., 27 Castilan Dr., Santa Barbara, CA 93117 ... 805-968-5000
§† Film Microelectronics, 17 A St., Burlington, MA 01803 617-272-5650
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
Fujitsu America, Inc., 918 Sherwood Dr., Lake Bluff, IL 60044 312-295-2610
General Instrument Corp., Microelectronics Div., 600 W. John St., Hicksville, NY 11802 516-733-3107
§ Gentron Corp., 6667 N. Sydney Pl., Milwaukee, WI 53209 414-351-1660
HEI, Inc., 1495 Steiger Lake La., Victoria, MN 55386 612-443-2500
† Hi-G Company, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114 203-522-8600
† Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903 714-759-2411
† Hybrid Elctrns., 142 Adams St., Newton, MA 02158 617-527-2711
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† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
Hybrilonics, Inc., P.O. Box 217, Lasalle Sta., Niagara Falls, NY 14304 716-731-9080
† Hy-Tec Industries, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786 516-744-5062
§† Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
† Interconics, BMC Industries, Inc., 245 E. 6th St., 3rd Flr., St. Paul, MN 55101 612-228-6512
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
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† M.S. Kennedy Corp., Sub of Hybrilonics, Inc., 8170 Thompson Rd., Clay, NY 13041 315-699-9201
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Lambda Electronics, Veeco Instr., Inc., 515 Broad Hollow Rd., Melville, NY 11747 516-694-4200
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Mepco//Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960 201-539-2000
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† Northwest Microcircuits, Inc., 2115 N. College, Newberg, OR 97132 503-538-7081
† Omnitek, Inc., P.O. Box 102, 820 Pennsylvania Blvd., Feasterville, PA 19047 215-355-4443
† Optical Electronics, Inc., Box 11140, Tucson, AZ 85734 602-624-8358
Opto Technology, Inc., 1674 S. Wolf Rd., Wheeling, IL 60090 312-537-4277
† Paine Instrs., 2401 S. Bayview St., Seattle, WA 98144 800-426-0366

Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Parlex Corp., 145 Milk St, Methuen, MA 01844 ..... 617-685-4341, ext. 325
PCK Technology Div., Kollmorgen Corp., 322 South Service Rd., Melville, NY 11747 516-454-4400
Plessey Ceramic Div., 8th & Harrison Sts., Frenchtown, NJ 08825 201-996-2121
Radix Microelectronics Inc., 4182 Sandberg Dr., Colorado Springs, CO 80911 303-390-5168
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
Resistance Technology Inc., 1260 Red Fox Rd., St. Paul, MN 55112 612-636-9770
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Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, JAPAN 03-986-6151
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SFE Technologies, 1501 1st St, San Fernando, CA 91340 213-365-9411
§† Silicon General, 11861 Western Ave., Garden Grove, CA 92641 714-898-8121
Siltronics Ltd., P.O. Box 456, Dover, MA 02030 617-329-4068
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Rd., Riviera Beach, FL 33404 305-848-4311
† Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
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§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
Thickfilm Int'l, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
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† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733
† Zenith Systems & Components Group, Zenith Electronics Corp., 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

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CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 ..... A•1662
† CTS Electronics Corp., Halex Division, 1202 McGaw Ave., Irvine, CA 92714, 714-261-6381 ..... A•1662
† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776, 617-443-4631 ..... A•1670,1872
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ..... D•1150
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1696
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200 ..... A•1971
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
Allen-Bradley Co., Electronics Group, Div.of Rockwell Corp., Microelectronic Products Div., Highway 29 N. Bryan Pk. Exit, Greensboro, NC 27410 919-621-9010
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Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
† Analog Devices, P.O. Box 280, Norwood, MA 02062 617-329-4700
† Andrich Sys., Inc., 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
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§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
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Beckman Instrs., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Bosch, Robert, Corp., 2800 S. 25th Ave., Broadview, IL 60153 312-865-5200
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
† Circuit Techn., 160 Smith St., Farmingdale, NY 11735 516-293-8686
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
† Datel, General Electric Co., 11 Cabot Blvd., Mansfield, MA 02048 617-339-9341
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§† Fairchild Camera & Instr. Corp., 464 Ellis St., 20-2271, Mountain View, CA 94042 415-962-5011
§† Film Microelectronics, 17 A St., Burlington, MA 01803 617-272-5650
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Fujitsu America, Inc., 918 Sherwood Dr., Lake Bluff, IL 60044 312-295-2610
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§† Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
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† Optical Electronics, Inc., Box 11140, Tucson, AZ 85734 602-624-8358
RHG Electronics Lab., Inc., 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
Rockwell Intl., Commercial Elctrns. Opers., 1200 N. Alma Rd., Richardson, TX 75081 214-996-5000
Sensor Techn., 21012 Lassen St., Chatsworth, CA 91311 213-882-4100
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§ Tau-Tron, Inc., A Unit of General Signal, 10 Lyberty Way, Westford, MA 01886 617-692-5100
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† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E5, Tampa, FL 33614 813-884-1411
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† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

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† Premier Microwave, 35 New Broad St., Port Chester, NY 10573, 914-939-8900 ..... A•1781
TRAK Microwave, Western Division, 735 Palomar Ave, Dept. E-5, Sunnyvale, CA 94086, 408-735-9660 ..... A•1782
AERCOM, 405 Tasman Dr., Sunnyvale, CA 94086 408-744-1320
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Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
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† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
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† Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44-(582) 60-14-41
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ONT, CANADA L9W2Y8 416-669-1244
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
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† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009

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Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2202
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Cortec, Inc., 15811 Chemical La., Huntington Bch., CA 92649 714-897-2529
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Coto Corporation, 55 DuPont Drive, Providence, RI 02907 401-943-2686
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Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electro Design Sys., 100 W. 35th St., Ste. S, National City, CA 92050 619-420-2351
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EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
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Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
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Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetic Systems, 1021 Pecten Ct., Milpitas, CA 95035 408-263-6680
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704 516-587-0510
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† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
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§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

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† Syntronic Instruments, Inc., 100 Industrial Rd., Addison, IL 60101 312-543-6444

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§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1236
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•1241,2195
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1243
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•1265
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1267,2235,2237,2239
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2257,2260,2263,2264
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ..... A•1274
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530, 914-681-0700 ..... D•1039
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076, 312-679-8200 ..... A•1278
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 ..... A•1287
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
De Coursey Engrg. Lab., 11828 W. Jefferson, Culver City, CA 90230 .... 213-EX7-9668
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ..... 415-785-5231;415-785-5235
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electro Design Sys., 100 W. 35th St., Ste. S, National City, CA 92050 619-420-2351
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§ Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Oram Electronics, 12 Cranston Rd., Pittsford, NY 14534 716-381-4673
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
† Roanwell, 180 Varick St., New York, NY 10014 212-989-1090
Signal Transformer, 500 Bayview Ave., Inwood, NY 11696 516-239-4510
Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
Won Tronics, Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
Xylog Corp., 150 Tillman St., Westwood, NJ 07675 201-664-7997

Coils, Antenna (Incl. Loading Type)-1800

Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 .... A•1218
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2202
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electro Design Sys., 100 W. 35th St., Ste. S, National City, CA 92050 619-420-2351
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
Sparkomatic, Rte. 6 & 209, Milford, PA 18337 717-296-6444
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 312-297-0070
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Coils, pi Winding-1800

Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2202
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566

Coils, Broadcast-1800

§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ..... A•1213,1216,1217
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 .... A•1218
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
§ Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
Permaluster, Inc., 1844 N. Keystone St., Burbank, CA 91504 213-849-4543
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .....914-699-5514; 800-431-1064
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 312-297-0070
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880

Coils, Chip-1800

§† Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1238
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1273
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421, 615-892-0291 ..... A•1175
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 201-432-0463
Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013 312-639-6400
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
§† Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
Jeffers Elctrns., Grand Plaza, 945 Grand Ave., Nogales, AZ 85621 602-287-5851
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .....914-699-5514; 800-431-1064
SFE Technologies, 1501 1st St., San Fernando, CA 91340 213-365-9411
Standex Elctrns., 4538 Camberwell Rd., Cincinnati, OH 45209 513-871-3777
† Thinco Div., Hull Corp., Davisville Rd., Hatboro, PA 19040 215-672-7800
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 312-297-0070
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100

Coils, Degaussing-1800

† Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880, 814-355-1521 ..... A•1266
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† E M S Development Corp., 200 Allen Blvd., Farmingdale, NY 11735 516-694-2886
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
LDJ Incorporated, 2200 Stephenson Hwy., P.O. Box 219, Troy, MI 48099-0219 313-528-2202
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
Magnetic Instrumentation, 8350 E. 48TH ST., Indianapolis, IN 46226 317-545-2102
§ Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566

Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Walker Scientific, Rockdale St., Worcester, MA 01606 617-852-3674

Coils, Field-1800

Advanced Kinetics, 1231 Victoria St., Costa Mesa, CA 92627 714-646-7165
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
† A.P.W. Co., Inc., 72 W. Main, Rockaway, NJ 07866 201-627-0643
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
LDJ Incorporated, 2200 Stephenson Hwy., P.O. Box 219, Troy, MI 48099-0219 313-528-2202
§ Magnos, Old School House Rd., Harvard, MA 01451 617-456-8880
Ogallala Elctrns., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153 308-284-4093
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§ Waldom Elctrns., 4301 W. 69th St., Dept. EEM, Chicago, IL 60629 312-585-1212
Walker Scientific, Rockdale St., Worcester, MA 01606 617-852-3674

Coils, Focusing-1800

† Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880, 814-355-1521 ..... A•1266
† THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006, 201-575-5586 ..... A•2342
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
† Ogallala Elctrns., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153 308-284-4093
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Syntronic Instruments, Inc., 100 Industrial Rd., Addison, IL 60101 312-543-6444
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Coils, Foil Wound-1800

† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069 619-747-4000
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§ Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
§ Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
§ ITT General Controls Div., Intl. Telephone & Telegraph Corp., 801 Allen Ave., Glendale, CA 91201 213-842-6131
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Ogallala Elctrns., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153 308-284-4093
OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Permaluster, Inc., 1844 N. Keystone St., Burbank, CA 91504 213-849-4543
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§ Tapecon, Inc., 10 Latta Rd., Rochester, NY 14612 716-621-8400
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
§ Waldom Elctrns., 4301 W. 69th St., Dept. EEM, Chicago, IL 60629 312-585-1212
Walker Scientific, Rockdale St., Worcester, MA 01606 617-852-3674
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674

Coils, High Q, Low Frequency-1800

Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ..... A•1214,1216,1217
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 .... A•1218
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1236
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2147
Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 .. A•1240
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ..... A•2157
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ..... A•2167
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•1241
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2202
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1243
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•1265
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1267
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ..... A•1935
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ..... 415-785-5231;415-785-5235
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electro Design Sys., 100 W. 35th St., Ste. S, National City, CA 92050 619-420-2351
§ Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§† Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
† Lenox-Fugle Elctrns., 100 Sylvania Pl., S. Plainfield, NJ 07080 201-756-1164
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
§† Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
§† Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532 803-393-5421
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
Oxley, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 213-463-5120
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
† Permaluster, Inc., 1844 N. Keystone St., Burbank, CA 91504 213-849-4543
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
† SFE Technologies, 1501 1st St., San Fernando, CA 91340 213-365-9411
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696 516-239-4510
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
Torelco, Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
§† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674

Won Tronics, Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Coils, Hum Eliminating — See Hum Eliminators (Vol. A)

Coils, Hybrid & Repeater-1800

§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•1241
§† ADC Prods., 4900 W. 78th St, Minneapolis, MN 55435 612-835-6800
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052 716-652-3600
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
† Oram Electronics, 12 Cranston Rd., Pittsford, NY 14534 716-381-4673
Pan-Magnetics Intl, Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .....914-699-5514; 800-431-1064
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
§† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674

Coils, IF-1800

Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 .... A•1218
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1236
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1279
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224 213-537-5200
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013 312-639-6400
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ..... 415-785-5231;415-785-5235
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electro Design Sys., 100 W. 35th St., Ste. S, National City, CA 92050 619-420-2351
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§ Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050
Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
§† PTS Electronics Inc., Box 272, Bloomington, IN 47401 812-824-9331
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
§† SFE Technologies, 1501 1st St., San Fernando, CA 91340 213-365-9411
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
§† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Won Tronics, Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Coils, Metallized Ceramic-1800

Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 615-892-0291

Coils, Metallized Glass-1800

Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
§† Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040 516-746-1385
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
† Thinco Div., Hull Corp., Davisville Rd.; Hatboro, PA 19040 215-672-7800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880

Coils, Molded-1800

Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2111
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 ..... A•1207
§† Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ..... A•1210-1211,1213,1214
CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069, 619-747-4000 ..... A•1070
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1231
§† Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1238
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ..... A•2152
§† Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 .. A•1240
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ..... A•2157
Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•1241
§† Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1248
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1273
SFE Technologies, 1501 1st St., San Fernando, CA 91340, 213-365-9411 ..... A•1277
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1279
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
† American Plasticraft Co., 814 N. Sacramento Blvd., Chicago, IL 60622 ... 312-722-7727
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
† Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
Cosmo Plastics Co., 3239 W. 14th St., Cleveland, OH 44109 216-861-5594
Coto Corporation, 55 DuPont Drive, Providence, RI 02907 401-943-2686
§† Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Electrical Plastics Corp., 500 Long Branch Ave., Long Branch, NJ 07740 201-870-9500
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§† Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
§ ITT General Controls Div., Intl. Telephone & Telegraph Corp., 801 Allen Ave., Glendale, CA 91201 213-842-6131
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
§† Jeffers Elctrns., Grand Plaza, 945 Grand Ave., Nogales, AZ 85621 602-287-5851
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
† Lenox-Fugle Elctrns., 100 Sylvania Pl., S. Plainfield, NJ 07080 201-756-1164
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§ Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951
§ Namco Controls, An Acme-Cleveland Co., 7567 Tyler Blvd., Mentor, OH 44060 216-946-9900
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .....914-699-5514; 800-431-1064
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
Standex Elctrns., 4538 Camberwell Rd., Cincinnati, OH 45209 513-871-3777
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200

† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
Trinetics Inc., 55807 Currant Rd., Mishawaka, IN 46545-4899 219-259-8535
§† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Wabash Electrical Components Group, A Kearney-National Co., 1375 Swan Street, Huntington, IN 46750 219-356-8300

Coils, RF-1800

† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 ..... A•1207
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ..... A•1210
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 .... A•1218
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1231
§† Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1238
§† Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 .. A•1240
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ..... A•2157
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2164
Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•1241
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2202
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1243
§† Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1248
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•1265,2213
Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880, 814-355-1521 ..... A•1266
Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1267
§† SFE Technologies, 1501 1st St., San Fernando, CA 91340, 213-365-9411 ..... A•1277
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421, 615-892-0291 ..... A•1175
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1279
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 ..... A•1281
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
§ Amperex Electronic Corp., Ferroxcube Div., 5083 Kings Hwy., Saugerties, NY 12477 914-246-2811
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
Blanck, A. R., Co., Box 249, Rutherford, NJ 07070 201-933-2091
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013 312-639-6400
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ..... 415-785-5231;415-785-5235
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Dyma Engrg., Box 1535, Los Lunas, NM 87031 505-865-6700
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electro Design Sys., 100 W. 35th St., Ste. S, National City, CA 92050 619-420-2351
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
† Fil-Coil Economy Intl., Inc., 800 Axinn Ave., Garden City, NY 11530 516-228-9445
Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
§† Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
International High Voltage Elctrns., Inc., 98 Mill Plain Rd., Danbury, CT 06811 203-792-7820
§† Jeffers Elctrns., Grand Plaza, 945 Grand Ave., Nogales, AZ 85621 602-287-5851
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
† Lenox-Fugle Elctrns., 100 Sylvania Pl., S. Plainfield, NJ 07080 201-756-1164
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
† Lepel, 59-21 Queens-Midtown Expwy., Maspeth, NY 11378 718-426-4580
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§ Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
Oxley, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 213-463-5120
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Raytheon Co., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154 617-899-8400
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
Rutherford Resch. Prods., Box 249, Rutherford, NJ 07070 201-933-2091
† Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696 516-239-4510
Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
Standex Elctrns., 4538 Camberwell Rd., Cincinnati, OH 45209 513-871-3777
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
Taiyo Yuden (USA) Inc., 714 Algonquin Rd., Arlington Heights, IL 60005 312-364-6104
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
† Thinco Div., Hull Corp., Davisville Rd., Hatboro, PA 19040 215-672-7800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
§† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Won Tronics, Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Coils, Relay-1800

American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
Antex Electronics Corp., 16100 S. Figueroa St., Gardena, CA 90248 213-532-3092
Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
† A.P.W. Co., Inc., 72 W. Main, Rockaway, NJ 07866 201-627-0643
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
§ ATR Elctrns., Inc., P.O. BOX 7008, St. Paul, MN 55107 ... 612-738-6520;414-297-7374
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803 914-738-1611
Coto Corporation, 55 DuPont Drive, Providence, RI 02907 401-943-2686
Custom Coil & Transformer, Box 2369, Zanesville, OH 43701 614-452-6973
Deltrol Controls, 2745 S. 19th St., Milwaukee, WI 53215 414-671-6800
† Dia-Netics, Inc., 18823 Napa St., Northridge, CA 91324 818-886-2616
§ Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electro Design Sys., 100 W. 35th St., Ste. S, National City, CA 92050 619-420-2351
§† Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 801-537-5237
INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 201-892-5881
§† Jaidinger Mfg., 1921 W. Hubbard St., Chicago, IL 60622 312-421-1090
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
Liberty Controls, 500 Brookforest Ave., Shorewood, IL 60435 815-725-2241
Line Elec. Prods., G. General Electro-Components, Inc., 122 Naubuc Ave., Glastonbury, CT 06033 203-659-3573
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704 516-587-0510
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 507-625-6521
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Regdon Corp., 3713 Grand Blvd., Brookfield, IL 60513 312-485-5152
Relay Service Co., 1310 N. Pulaski Rd., Chicago, IL 60651 ..... 312-AL2-2700
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
† SFE Technologies, 1501 1st St., San Fernando, CA 91340 213-365-9411
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Standex Elctrns., 4538 Camberwell Rd., Cincinnati, OH 45209 513-871-3777
Struthers-Dunn, Inc., Lamb's Rd., Pitman, NJ 08071 609-589-7500
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Trinetics Inc., 55807 Currant Rd., Mishawaka, IN 46545-4899 219-259-8535
Vanguard Relay Corp., 225 Cortland St., Lindenhurst, NY 11757 516-226-5000
Wabash Electrical Components Group, A Kearney-National Co., 1375 Swan Street, Huntington, IN 46750 219-356-8300
Won Tronics, Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500

Coils, Saturable Reactor-1800

Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 .. A•1240

Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ..... A•1275
§ Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
Cross Elctrns., 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§ Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
† Industrial Control Co., 3100 Pineda Ave., Rockledge, FL 32955 305-259-7105
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532 803-393-5421
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
Oram Elctrns., Rte. 22, Putnam Business Park, Brewster, NY 10509-9587 914-279-2966
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880 814-355-1521
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
Rtron Corp., 7324 Lawndale, Skokie, IL 60076 312-679-7180
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
Standex Elctrns., 4538 Camberwell Rd., Cincinnati, OH 45209 513-871-3777
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161
Torelco, Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Coils, Shielded-1800

§† Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ..... A•1211,1213
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 .... A•1218
§† Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1231
§† Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1238
§† Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 .. A•1240
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ..... A•2157
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1243
§† Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1244-1245,1249-1261
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ..... A•1274
SFE Technologies, 1501 1st St., San Fernando, CA 91340, 213-365-9411 ..... A•1277
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076, 312-679-8200 ..... A•1278
Wilco Corp., 6451 Saguaro Court, Indianapolis, IN 46268, 317-293-9300 ..... A•1296
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
Coto Corporation, 55 DuPont Drive, Providence, RI 02907 401-943-2686
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
§† Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
§† Jeffers Elctrns., Grand Plaza, 945 Grand Ave., Nogales, AZ 85621 602-287-5851
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
† Lenox-Fugle Elctrns., 100 Sylvania Pl., S. Plainfield, NJ 07080 201-756-1164
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .....914-699-5514; 800-431-1064
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
§† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100

Coils, Solenoid-1800

§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1236
Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 .. A•1240
Advanced Kinetics, 1231 Victoria St., Costa Mesa, CA 92627 714-646-7165
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
American Magnetics, P.O. Box 2509, Oak Ridge, TN 37831-2509 615-482-1056
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
† A.P.W. Co., Inc., 72 W. Main, Rockaway, NJ 07866 201-627-0643
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803 914-738-1611
Coto Corporation, 55 DuPont Drive, Providence, RI 02907 401-943-2686
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Cryomagnetics, Inc., 795 Oak Ridge Tpk., Oak Ridge, TN 37830 615-482-9551
Custom Coil & Transformer, Box 2369, Zanesville, OH 43701 614-452-6973
Deltrol Controls, 2745 S. 19th St., Milwaukee, WI 53215 414-671-6800
† Dia-Netics, Inc., 18823 Napa St., Northridge, CA 91324 818-886-2616
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§† Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electro Design Sys., 100 W. 35th St., Ste. S, National City, CA 92050 619-420-2351
Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
§† Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
§ ITT General Controls Div., Intl. Telephone & Telegraph Corp., 801 Allen Ave., Glendale, CA 91201 213-842-6131
§† Jaidinger Mfg., 1921 W. Hubbard St., Chicago, IL 60622 312-421-1090
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
LDJ Incorporated, 2200 Stephenson Hwy., P.O. Box 219, Troy, MI 48099-0219 313-528-2202
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Liberty Controls, 500 Brookforest Ave., Shorewood, IL 60435 815-725-2241
Line Elec. Prods., G. General Electro-Components, Inc., 122 Naubuc Ave., Glastonbury, CT 06033 203-659-3573
† Lisk, G. W., Co., 2 South St., Clifton Springs, NY 14432 315-462-2611

Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§ Magnos, Old School House Rd., Harvard, MA 01451 617-456-8880
§ Namco Controls, An Acme-Cleveland Co., 7567 Tyler Blvd., Mentor, OH 44060 216-946-9900
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
† Regdon Corp., 3713 Grand Blvd., Brookfield, IL 60513 312-485-5152
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
† SFE Technologies, 1501 1st St., San Fernando, CA 91340 213-365-9411
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† SR Engineering, Inc., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643 714-554-4200
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Trinetics Inc., 55807 Currant Rd., Mishawaka, IN 46545-4899 219-259-8535
Vanguard Relay Corp., 225 Cortland St., Lindenhurst, NY 11757 516-226-5000
Wabash Electrical Components Group, A Kearney-National Co., 1375 Swan Street, Huntington, IN 46750 219-356-8300
Walker Scientific, Rockdale St., Worcester, MA 01606 617-852-3674
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
Won Tronics, Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500

Coils, Telephone-1800

§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2126
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2192
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2213
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2222
§ Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
§† ADC Magnetic Controls Co., 4900 W. 78th St., Minneapolis, MN 55435 .. 612-835-6800
§† ADC Prods., 4900 W. 78th St., Minneapolis, MN 55435 612-835-6800
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
† A.P.W. Co., Inc., 72 W. Main, Rockaway, NJ 07866 201-627-0643
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
§† Daburn Elctrns. & Cable, 70 Oak St., Norwood, NJ 07648 201-768-5400
† Dia-Netics, Inc., 18823 Napa St., Northridge, CA 91324 818-886-2616
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 801-537-5237
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Oram Electronics, 12 Cranston Rd., Pittsford, NY 14534 716-381-4673
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .....914-699-5514; 800-431-1064
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Regdon Corp., 3713 Grand Blvd., Brookfield, IL 60513 312-485-5152
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
Won Tronics, Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500

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Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2110-2113,2117
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 ..... A•1207
§† Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ..... A•1210,1217
B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101, 612-228-6463 ..... A•2122
§† Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1232,2132
Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1238
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905, 607-797-1263 ..... A•1239
§† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2147
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ..... A•2152
§† Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 .. A•1240
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ..... A•2157
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2164
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ..... A•2167
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•1241
Nano Pulse Industries, 440 Nibus St., Brea, CA 92670, 714-529-2600 .... A•2207
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•1265,2213
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1622,2257,2260,2263,2264
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ..... A•1276
Ross Engrg. Corp., 540 Westchester Dr., Campbell, CA 95008, 408-377-4621 ..... B•1443
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 ..... A•1280,1284-1295
† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 818-841-3630
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 201-432-0463
† Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
Capco, Box 1028, Grand Junction, CO 81502 303-243-8751
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Corcom, Inc., 1600 Winchester Rd., Libertyville, IL 60048 312-680-7400
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Cross Elctrns., 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591
§ De Coursey Engrg. Lab., 11828 W. Jefferson, Culver City, CA 90230 ..... 213-EX7-9668
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ..... 415-785-5231;415-785-5235
† Diamond Magnetics, P.O. Box 4736, San Luis Obispo, CA 93403 805-544-4019
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Dynamic Air Engrg. Inc., EMC Filter Div., 620 E. Dyer Rd., Santa Ana, CA 92705 714-540-2081
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
† El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
Hurricane Electrns. Lab, P.O. Box 1280, Hurricane, UT 84737 801-635-2003
§ Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
§ Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951

Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ..... 914-699-5514; 800-431-1064
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
Rtron Corp., 7324 Lawndale, Skokie, IL 60076 312-679-7180
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† SFE Technologies, 1501 1st St., San Fernando, CA 91340 213-365-9411
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161
Torelco, Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037 301-464-2100
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261
§† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
Won Tronics, Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057 213-381-2500
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Coils, Transducer-1800

§ Ametek, 2 Station Square, Paoli, PA 19301 215-355-6900
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
Capco, Box 1028, Grand Junction, CO 81502 303-243-8751
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Dia-Netics, Inc., 18823 Napa St., Northridge, CA 91324 818-886-2616
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
§† Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§ Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
† Roanwell, 180 Varick St., New York, NY 10014 212-989-1090
§ Rye Inds., Inc., 125 Spencer Pl., P.O. Box M, Mamaroneck, NY 10543 ... 914-698-0080
Sensor Corp., Box 140, Scottdale, PA 15683 412-887-4080
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transducer Systems, Inc., 1510 Delp Dr., Kulpsville, PA 19443 215-256-4611
† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Wabash Electrical Components Group, A Kearney-National Co., 1375 Swan Street, Huntington, IN 46750 219-356-8300
§ Waldom Elctrns., 4301 W. 69th St., Dept. EEM, Chicago, IL 60629 312-585-1212
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674

Coils, Transformer-1800

Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2120
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 ..... A•1207
Avionic Instrs., 943 E. Hazelwood Ave., Rahway, NJ 07065, 201-388-3500 ..... D•1891
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2126-2127,2132
† Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 .. A•1240
Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•1241
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2202
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1243
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 818-841-3630
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
§ American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
† A.P.W. Co., Inc., 72 W. Main, Rockaway, NJ 07866 201-627-0643
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224 213-537-5200
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
Capco, Box 1028, Grand Junction, CO 81502 303-243-8751
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803 914-738-1611
Computer Power, 124E W. Main St., High Bridge, NJ 08829 201-735-8000
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Cross Elctrns., 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591
Custom Coil & Transformer, Box 2369, Zanesville, OH 43701 614-452-6973
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ..... 415-785-5231; 415-785-5235
† Diamond Magnetics, P.O. Box 4736, San Luis Obispo, CA 93403 805-544-4019
† Dia-Netics, Inc., 18823 Napa St., Northridge, CA 91324 818-886-2616
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§† Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
§† Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
Engineering Design & Sls., Rt. 2, Box 305, Danville, VA 24540 804-685-7073
§† E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 213-892-7279
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200; 800-526-4048
General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
Hurricane Electrns. Lab, P.O. Box 1280, Hurricane, UT 84737 801-635-2003
§ Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
International High Voltage Elctrns., Inc., 98 Mill Plain Rd., Danbury, CT 06811 203-792-7820
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704 516-587-0510
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300

Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
Oram Elctrns., Rte. 22, Putnam Business Park, Brewster, NY 10509-9587 914-279-2966
† Oram Electronics, 12 Cranston Rd., Pittsford, NY 14534 716-381-4673
† Osborne Transformer, 19636 Derby St, Detroit, MI 48203 313-368-4136
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
Permaluster, Inc., 1844 N. Keystone St., Burbank, CA 91504 213-849-4543
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ..... 914-699-5514; 800-431-1064
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
SFE Technologies, 1501 1st St., San Fernando, CA 91340 213-365-9411
† Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696 516-239-4510
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 312-297-0070
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
Wabash Electrical Components Group, A Kearney-National Co., 1375 Swan Street, Huntington, IN 46750 219-356-8300
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
Xylog Corp., 150 Tillman St., Westwood, NJ 07675 201-664-7997

Coils, TV (All Types)-1800

§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ..... A•1213
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1232
Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880, 814-355-1521 ..... A•1266
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1279
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ..... 415-785-5231;415-785-5235
International High Voltage Elctrns., Inc., 98 Mill Plain Rd., Danbury, CT 06811 203-792-7820
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
Standex Elctrns., 4538 Camberwell Rd., Cincinnati, OH 45209 513-871-3777
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 415-592-8832
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Coils, Variable-1800

Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2120
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 ..... A•1207
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ..... A•1213
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 ..... A•1218
§† Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1240
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ..... A•2157
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2164
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1243
§† Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1244,1262,1263
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1273
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1279
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
§ American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON, CANADA 416-661-2600
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013 312-639-6400
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
§† Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052 716-652-3600
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ..... 415-785-5231;415-785-5235
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electro Design Sys., 100 W. 35th St., Ste. S, National City, CA 92050 619-420-2351
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
§ Mechanical Techn., 968 Albany Shaker Rd., Latham, NY 12110 518-785-2353
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
Permaluster, Inc., 1844 N. Keystone St., Burbank, CA 91504 213-849-4543
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
§ SFE Technologies, 1501 1st St., San Fernando, CA 91340 213-365-9411
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
§† Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040 516-746-1385
Standex Elctrns., 4538 Camberwell Rd., Cincinnati, OH 45209 513-871-3777
§ Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100

Coils, Vidicon Alignment-1800

† Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880, 814-355-1521 ..... A•1266
† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123
Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566

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Cores, Ceramic-1850

† Centerflex Techn. Corp., 221 Seventh Ave., P.O. Box 21, Hawthorne, NJ 07507 201-423-0505
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Honeywell Inc., Aerospace & Defense Grp., Honeywell Plaza, Minneapolis, MN 55408 612-870-5186
Krystinel Corp., 126 Pennsylvania Ave., Paterson, NJ 07503 201-345-8900
3M Co., Tech Ceramic Resources, 3M Center 225-4W, St. Paul, MN. 55101 617-736-0601
National Beryllia Corp., Greenwood Ave., Haskell, NJ 07420 201-839-1600
† Norton, One New Bond St., Worcester, MA 01606 617-853-1000
Permag, 400 Karin La., Hicksville, NY 11801 516-822-3311
§ Plessey Ceramic Div., 8th & Harrison Sts., Frenchtown, NJ 08825 201-996-2121
† Quartzite Processing, Inc., 6 Holyoke St., Malden, MA 02148 617-322-1380
Radio Materials Corp., 4242 W. Bryn Mawr, Chicago, IL 60646 312-478-3600
Stackpole, Electronic Components Div., 201 Stackpole St., St. Marys, PA 15857 814-781-1234
Star Porcelain, 71 Muirhead Ave., Trenton, NJ 08638 609-392-3154
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200

Cores, Magnetic, Ferrite, L, E, etc.-1850

Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Magnetic Products Div., 5900 N. Harrison St., Shawnee, OK 74801, 405-275-2100 ..... A•1298
§† Krystinel Corp., 126 Pennsylvania Ave., Paterson, NJ 07503, 201-345-8900 ..... A•1304
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000

§ Amperex Electronic Corp., Ferroxcube Div., 5083 Kings Hwy., Saugerties, NY 12477 914-246-2811
† Ampex Corp., 401 Broadway, Redwood City, CA 94063 415-367-2011
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
Electrical Plastics Corp., 500 Long Branch Ave., Long Branch, NJ 07740 201-870-9500
§ Fair-Rite Prods., PO Box J, Wallkill, NY 12589 914-895-2055
Ferronics, 52 N. Main St., Fairport, NY 14450 716-223-1010
J. Tronics, Apollo Magnetics, 2720 W. Beverly Rd., Los Angeles, CA 90057 213-381-2500
† Magnetics, Box 391, Butler, PA 16003-0391 412-282-8282
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
Permag, 400 Karin La., Hicksville, NY 11801 516-822-3311
Radio Materials Corp., 4242 W. Bryn Mawr, Chicago, IL 60646 312-478-3600
§ Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
Stackpole, Electronic Components Div., 201 Stackpole St., St. Marys, PA 15857 814-781-1234
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
Thomson-CSF Comps. Corp., Passive Comp. Div., 5850 Canoga Ave., Suite 300, Woodland Hills, CA 91367 818-887-1010
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161

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Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Magnetic Products Div., 5900 N. Harrison St., Shawnee, OK 74801, 405-275-2100 ..... A•1298
Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1238
Krystinel Corp., 126 Pennsylvania Ave., Paterson, NJ 07503, 201-345-8900 ..... A•1304
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2165
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ..... A•1276
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
§ Amperex Electronic Corp., Ferroxcube Div., 5083 Kings Hwy., Saugerties, NY 12477 914-246-2811
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
§ Fair-Rite Prods., PO Box J, Wallkill, NY 12589 914-895-2055
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, NJ 08105 609-964-7842
† Magnetics, Box 391, Butler, PA 16003-0391 412-282-8282
Permag, 400 Karin La., Hicksville, NY 11801 516-822-3311
Radio Materials Corp., 4242 W. Bryn Mawr, Chicago, IL 60646 312-478-3600
§ Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
Stackpole, Electronic Components Div., 201 Stackpole St., St. Marys, PA 15857 814-781-1234
§ Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
Thomson-CSF Comps. Corp., Passive Comp. Div., 5850 Canoga Ave., Suite 300, Woodland Hills, CA 91367 818-887-1010
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161

Cores, Magnetic, Ferrite, Slug-1850

Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Magnetic Products Div., 5900 N. Harrison St., Shawnee, OK 74801, 405-275-2100 ..... A•1298
§† Krystinel Corp., 126 Pennsylvania Ave., Paterson, NJ 07503, 201-345-8900 ..... A•1304
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
§ Amperex Electronic Corp., Ferroxcube Div., 5083 Kings Hwy., Saugerties, NY 12477 914-246-2811
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
§ Fair-Rite Prods., PO Box J, Wallkill, NY 12589 914-895-2055
Ferronics, 52 N. Main St., Fairport, NY 14450 716-223-1010
† Magnetics, Box 391, Butler, PA 16003-0391 412-282-8282
Permag, 400 Karin La., Hicksville, NY 11801 516-822-3311
Radio Materials Corp., 4242 W. Bryn Mawr, Chicago, IL 60646 312-478-3600
Stackpole, Electronic Components Div., 201 Stackpole St., St. Marys, PA 15857 814-781-1234
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
Thomson-CSF Comps. Corp., Passive Comp. Div., 5850 Canoga Ave., Suite 300, Woodland Hills, CA 91367 818-887-1010
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161

Cores, Magnetic, Ferrite, Toroid-1850

Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Magnetic Products Div., 5900 N. Harrison St., Shawnee, OK 74801, 405-275-2100 ..... A•1298
§† Krystinel Corp., 126 Pennsylvania Ave., Paterson, NJ 07503, 201-345-8900 ..... A•1304
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
§ Amperex Electronic Corp., Ferroxcube Div., 5083 Kings Hwy., Saugerties, NY 12477 914-246-2811
† Ampex Corp., 401 Broadway, Redwood City, CA 94063 415-367-2011
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
† CTS Fabri-Tek, Inc., CTS Corporation, 6900 Shady Oak Rd., Eden Prairie, MN 55344 612-941-9100
† EMM/SESCO, 20630 Plummer St., Chatsworth, CA 91311 213-998-9090
§ Fair-Rite Prods., PO Box J, Wallkill, NY 12589 914-895-2055
Ferronics, 52 N. Main St., Fairport, NY 14450 716-223-1010
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, NJ 08105 609-964-7842
† Magnetics, Box 391, Butler, PA 16003-0391 412-282-8282
Permag, 400 Karin La., Hicksville, NY 11801 516-822-3311
Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
§ Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
Stackpole, Electronic Components Div., 201 Stackpole St., St. Marys, PA 15857 814-781-1234
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
Thomson-CSF Comps. Corp., Passive Comp. Div., 5850 Canoga Ave., Suite 300, Woodland Hills, CA 91367 818-887-1010
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161

Cores, Magnetic, Ferrite, Yoke Section-1850

Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Magnetic Products Div., 5900 N. Harrison St., Shawnee, OK 74801, 405-275-2100 ..... A•1298
Krystinel Corp., 126 Pennsylvania Ave., Paterson, NJ 07503, 201-345-8900 ..... A•1304
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
Ferronics, 52 N. Main St., Fairport, NY 14450 716-223-1010
Stackpole, Electronic Components Div., 201 Stackpole St., St. Marys, PA 15857 814-781-1234
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
Thomson-CSF Comps. Corp., Passive Comp. Div., 5850 Canoga Ave., Suite 300, Woodland Hills, CA 91367 818-887-1010
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161

Cores, Magnetic, Metal Alloy (Other Than Silicon & Nickel-Iron)-1850

† Arnold Engineering Company, Subsidiary Allegheny International, 300 West Street, Marengo, IL 60152 815-568-2000
Inter-Technical Grp., Box 23, Irvington, NY 10533 914-591-8822
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, NJ 08105 609-964-7842
† Magnetics, Box 391, Butler, PA 16003-0391 412-282-8282
Permag, 400 Karin La., Hicksville, NY 11801 516-822-3311
† Pyroferric Intl., Inc., 200 Madison St., Toledo, IL 62468 217-849-3300
SL Electronics, 300 Harvard Ave., Westville, NJ 08093 609-456-7300
Stackpole, Electronic Components Div., 201 Stackpole St., St. Marys, PA 15857 814-781-1234

Cores, Magnetic, Nickel-Iron, L, EE, F, & Ring Laminations-1850

Framar Metal Products Co., Inc., 345 Carnegie Avenue, Kenilworth, NJ 07033 201-241-0710
Inter-Technical Grp., Box 23, Irvington, NY 10533 914-591-8822
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, NJ 08105 609-964-7842
† Magnetics, Box 391, Butler, PA 16003-0391 412-282-8282
Permag, 400 Karin La., Hicksville, NY 11801 516-822-3311
SL Electronics, 300 Harvard Ave., Westville, NJ 08093 609-456-7300
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161

Cores, Magnetic, Nickel-Iron, Toroid-1850

Krystinel Corp., 126 Pennsylvania Ave., Paterson, NJ 07503, 201-345-8900 ..... A•1304
† Arnold Engineering Company, Subsidiary Allegheny International, 300 West Street, Marengo, IL 60152 815-568-2000
Infinetics Inc., Friskem Div., 201 Vandever Ave., Wilmington, DE 19802 302-658-2471
Inter-Technical Grp., Box 23, Irvington, NY 10533 914-591-8822
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, NJ 08105 609-964-7842
† Magnetics, Box 391, Butler, PA 16003-0391 412-282-8282
Permag, 400 Karin La., Hicksville, NY 11801 516-822-3311
SL Electronics, 300 Harvard Ave., Westville, NJ 08093 609-456-7300
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161

Cores, Magnetic, Powdered Iron, Pot/Cup-1850

Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1238
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ..... A•1276
† Arnold Engineering Company, Subsidiary Allegheny International, 300 West Street, Marengo, IL 60152 815-568-2000
Cortec, Inc., 15811 Chemical La., Huntington Bch., CA 92649 714-897-2529
Micrometals, 1190 N. Hawk, Anaheim, CA 92807 714-630-7420
† Pyroferric Intl., Inc., 200 Madison St., Toledo, IL 62468 217-849-3300
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161

Cores, Magnetic, Powdered Iron, Slug-1850

† Arnold Engineering Company, Subsidiary Allegheny International, 300 West Street, Marengo, IL 60152 815-568-2000
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
Cortec, Inc., 15811 Chemical La., Huntington Bch., CA 92649 714-897-2529
Micrometals, 1190 N. Hawk, Anaheim, CA 92807 714-630-7420
† Pyroferric Intl., Inc., 200 Madison St., Toledo, IL 62468 217-849-3300

§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Cores, Magnetic, Powdered Iron, Toroid-1850

† Arnold Engineering Company, Subsidiary Allegheny International, 300 West Street, Marengo, IL 60152 815-568-2000
Cortec, Inc., 15811 Chemical La., Huntington Bch., CA 92649 714-897-2529
Micrometals, 1190 N. Hawk, Anaheim, CA 92807 714-630-7420
† Pyroferric Intl., Inc., 200 Madison St., Toledo, IL 62468 217-849-3300
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161

Cores, Magnetic, Powdered Permalloy, Toroid-1850

† Arnold Engineering Company, Subsidiary Allegheny International, 300 West Street, Marengo, IL 60152 815-568-2000
† Magnetics, Box 391, Butler, PA 16003-0391 412-282-8282

Cores, Magnetic, Silicon C-1850

† Arnold Engineering Company, Subsidiary Allegheny International, 300 West Street, Marengo, IL 60152 815-568-2000
Framar Metal Products Co., Inc., 345 Carnegie Avenue, Kenilworth, NJ 07033 201-241-0710
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, NJ 08105 609-964-7842
SL Electronics, 300 Harvard Ave., Westville, NJ 08093 609-456-7300

Cores, Magnetic, Silicon EI, EE, & F Laminations-1850

Framar Metal Products Co., Inc., 345 Carnegie Avenue, Kenilworth, NJ 07033 201-241-0710
J. Tronics, Apollo Magnetics, 2720 W. Beverly Rd., Los Angeles, CA 90057 213-381-2500
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, NJ 08105 609-964-7842
SL Electronics, 300 Harvard Ave., Westville, NJ 08093 609-456-7300
Thomas & Skinner, Box 150 B, Indianapolis, IN 46206 317-923-2501

Cores, Magnetic, Silicon, Toroid-1850

† Arnold Engineering Company, Subsidiary Allegheny International, 300 West Street, Marengo, IL 60152 815-568-2000
Framar Metal Products Co., Inc., 345 Carnegie Avenue, Kenilworth, NJ 07033 201-241-0710
Inter-Technical Grp., Box 23, Irvington, NY 10533 914-591-8822
Magnetic Metals Co., Hayes Ave. at 21st St., Camden, NJ 08105 609-964-7842
† Magnetics, Box 391, Butler, PA 16003-0391 412-282-8282
SL Electronics, 300 Harvard Ave., Westville, NJ 08093 609-456-7300

Corners, Waveguide — See Bends & Twists, Microwave (Vol. A)

Coulometers — See Timers, Electrolytic Cell (Vol. D)

Countermeasures (CM) Sets (MIL), Airborne-3475 — *See Vol. D*

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CM Sets (MIL), Mobile-3475 — *See Vol. D*

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Counters, Coil Winding-2200 — *See Vol. D*

Counters, Decade-2200 — *See Vol. D*

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Counters, Electromagnetic-2200 — *See Vol. D*

Counters, Event-2200 — *See Vol. D*

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Couplers, Antenna-1900 — *See Vol. D*

Couplers, Communications, Acoustic, Telephone-1900 — *See Vol. D*

Couplers, Directional-3450

Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990, 215-723-8181 ..... D•1003
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 ..... A•1705
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235, 718-934-4500 ..... A•1719-1720,1744-1757
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573, 914-939-8900 ..... A•1781
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
Aiken Advanced Sys., Amstar Technical Products Company, Inc., 5901 Edsall Rd., Alexandria, VA 22304-4197 703-370-0900
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Amphenol, An Allied Co., 43 Commerce Ct., Lisle, IL 60532 312-983-3500
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
† Applied Research, Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
Automatic Connector, Inc., 400 Moreland Rd., Commack, NY 11725 516-543-5000
† Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
C-COR Elctrns., 60 Decibel Rd., State College, PA 16801 814-238-2461
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 216-267-2233
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Connecticut Microwave Corp., 106 Powder Mill Rd., Box 389, Canton, CT 06019 203-693-4247
§ Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ..... 207-655-4555;800-341-9678
Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33431 305-994-1774
† Electro Impulse, Box 870, Red Bank, NJ 07701-0870 201-741-0404
Electrospace Sys., Inc., P. O. Box 831359, Richardson, TX 75083-1359 214-783-2004
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hyletronics, Newtown Rd., Littleton, MA 01460 617-486-8911
† Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ..... 818-889-4030;805-497-4421
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ..... 315-437-3953; 800-448-1666
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Norsal Inds., 85 D Hoffman Lane So., Central Islip, NY 11722 516-234-1200
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Technical Research & Mfg., Inc., R.F.D. # 10, Manchester, NH 03103 ... 603-627-6000
† Transco Products, Inc., 4241 Glencoe Ave., Marina del Rey, CA 90295 .. 213-822-0800
§ Tucker Elctrns., Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
† Vectronics Microwave Corp., 276 Lincoln Blvd., Middlesex, NJ 08846 ... 201-356-2377
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
Wide Band Engrg. Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570
§ Wiltron, 805 E. Middlefield Rd., P.O. Box 7290, Mountain View, CA 94042-7290 415-969-6500

Couplers, Fiber Optic-2475 — *See Vol. B*

Couplers, Microwave-3450

† Applied Research, Inc., 160 Dupont St., Plainview, NY 11803, 516-349-9200 ..... A•1702
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 ..... A•1705
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235, 718-934-4500 ..... A•1719-1720,1729,1744-1755
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2210
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
American Electronic Labs., Box 552, Lansdale, PA 19446 215-822-2929
Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990 215-723-8181

Couplers, Microwave-3450 (Cont'd)

§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
§ Augat Fiberoptics, 710 Narragansett Park Dr., Pawtucket, RI 02861 401-724-4400
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 216-267-2233
† Connecticut Microwave Corp., 106 Powder Mill Rd., Box 389, Canton, CT 06019 203-693-4247
† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ..... 207-655-4555;800-341-9678
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33431 305-994-1774
† Electro Impulse, Box 870, Red Bank, NJ 07701-0870 201-741-0404
Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
Gabriel Elctrns., Box 70, Scarborough Indl. Pk., Scarborough, ME 04074 207-883-5161
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Hyletronics, Newtown Rd., Littleton, MA 01460 617-486-8911
† Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ..... 818-889-4030;805-497-4421
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
M/A-Com Microwave Components, Inc., M/A-Com, South Avenue, Burlington, MA 01803 617-272-3000
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ..... 315-437-3953; 800-448-1666
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Norsal Inds., 85 D Hoffman Lane So., Central Islip, NY 11722 516-234-1200
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Reeve Electronics, Mellish E. Murray, 1720 W. Fulton St., Chicago, IL 60612 312-670-0150
† RHG Electronics Lab., Inc., 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
Sivers IMA, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Technical Research & Mfg., Inc., R.F.D. #10, Manchester, NH 03103 603-627-6000
† Transco Products, Inc., 4241 Glencoe Ave., Marina del Rey, CA 90295 213-822-0800
§ Tucker Elctrns., Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Vectronics Microwave Corp., 276 Lincoln Blvd., Middlesex, NJ 08846 201-356-2377
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877 ..... 301-948-3434; 800-638-2048

Couplers, Multiset — See Couplers, Antenna (Vol. D)

Couplers, Optoelectronic — See Isolators, Optoelectronic (Vol. B)

Couplers, Rotary-3450

† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Concord Elctrns., 30 Great Jones St., Dept. JE, New York, NY 10012 212-777-6571
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
Electrospace Sys., Inc., P. O. Box 831359, Richardson, TX 75083-1359 214-783-2004
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§ Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951
Poly-Scientific, Litton Inds., 1213 N. Main St., Blacksburg, VA 24060 703-552-3014
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Couplers (MIL), Directional-2440 — *See Vol. B*

Couplings, Quick-disconnect, Liquid or Gas-2500 — *See Vol. C*

Couplings, Shaft, Rigid & Flexible-2400 — *See Vol. C*

Covers, Protective (Incl. Dustcovers)-3800 — *See Vol. C*

Crimping Services — See Services, Crimping (Vol. D)

Crossbars — See Scanners, Crossbar (Vol. D)

Crystal Blanks-2300

Croven Crystals, 500 Beech St., Whitby, ON, CANADA L1N 5S5, 416-668-3324 ..... A•1335
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... C•1621
SFE Technologies, 1501 1st St., San Fernando, CA 91340, 213-365-9411 ..... A•1434
§† Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648 .. 814-695-4428
§† Atomergic Chemetals Corp., 100 Fairchild Ave., Plainview, NY 11803 516-349-8800
† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506 814-838-3571
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 ..... 714-991-1580; 800-854-XTAL
CTS Electronics Corp., Knights Division, 400 Reimann Ave., Sandwich, IL 60548 815-786-8411
Harshaw Filtrol Partnership, 1945 E. 97th St., Cleveland, OH 44106 216-721-8300
† Hoffman, P. R., Co., Materials Processing Div., Amstar Tech. Prods. Co., Inc., 321 Cherry St., Carlisle, PA 17013 717-243-2011
International Crystal Mfg., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126 405-236-3741
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON, CANADA M3B 1M2 416-447-8531
§ Midland-Ross Corp., NEL Unit, 357 Beloit St., Burlington, WI 53105 414-763-3591
Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054 619-433-4510
† M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078 605-665-9321
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
† Savoy Elctrns., P.O. Box 5727, Ft. Lauderdale, FL 33310 .. 305-563-1333;800-327-1282
Toyo Comm. Equip. Co., Ltd., No. 8 Mori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, TOKYO, JAPAN 105 ..... 03-459-7320/03-459-7310
† Union Carbide Corporation, Elctrns. Div., Crystal Prods. Dept., 9320 Chesapeake Dr., Ste. 104, San Diego, CA 92123 619-279-4500
§† United States Crystal Corp., 3605 McCart St., Fort Worth, TX 76110 817-921-3014
Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831

Crystals, Frequency Control-2300

§† Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 ..... A•1313
† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ..... A•1316-1319,1321
† Colorado Crystal Corp., 2303 W. 8th St., Loveland, CO 80537, 303-667-9248 ..... A•1324
† Croven Crystals, 500 Beech St., Whitby, ON, CANADA L1N 5S5, 416-668-3324 ..... A•1335
† CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1336
§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ..... A•1363
Frequency and Time Systems, Inc., DATUM, INC., 34 Tozer Rd., Beverly, MA 01915, 617-927-8220 ..... A•1364
§ ITT Components Passive Grp., 1201 E. McFadden Ave., Santa Ana, CA 92705, 714-836-0351 ..... A•1377
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1380
§ Midland-Ross Corp., NEL Unit, 357 Beloit St., Burlington, WI 53105, 414-763-3591 ..... A•1387
† Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054, 619-433-4510 ..... A•1388
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, 312-451-1000 ..... A•1392
§† M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ..... A•1395
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1396
Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 ..... A•1413
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... A•1423
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ..... A•1428
§ Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-530-8777 ..... A•1433
SFE Technologies, 1501 1st St., San Fernando, CA 91340, 213-365-9411 ..... A•1434
Sokol Crystal Prods., Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 ..... A•1435
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ..... A•1441
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 ... 513-522-3300
§ Bomar Crystal, 201 Blackford Ave., Middlesex, NJ 08846 .. 201-356-7787;800-526-3935
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 ..... 714-991-1580; 800-854-XTAL
† Cirtech, EG & G, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
§† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
Deltronic Crystal Inds., 215 Rt. 10, Bldg. 3, Sec. 5, Randolph, NJ 07869 201-361-2222
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377 212-458-5811
Hoffman, P. R., Co., Materials Processing Div., Amstar Tech. Prods. Co., Inc., 321 Cherry St., Carlisle, PA 17013 717-243-2011

International Crystal Mfg., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126 405-236-3741
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON, CANADA M3B 1M2 416-447-8531
§ MG Electronics, 32 Ranick Rd., Hauppauge, NY 11788 516-582-3400
† Nittany Piezo Ceramics, Box 756, Pine and Mill Streets, Bellefonte, PA 16823 ..... 814-355-1593;814-355-1594
Pathcom, Inc., Pace Two-Way Radio Prods., 24105 S. Frampton Ave., Harbor City, CA 90710 213-325-1290
Philips Electronics, Ltd., Crystal Dept., 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
§† Pioner Components, 2352 E. 66th St., Brooklyn, NY 11234 718-444-3880
§ Q-Matic Corp., 3194-D Airport Loop Dr., Costa Mesa, CA 92626 714-545-8233
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064 213-820-4921
Racal-Dana Instrs. Inc., 4 Goodyear St., Irvine, CA 92715 714-859-8999
† Savoy Elctrns., P.O. Box 5727, Ft. Lauderdale, FL 33310 ..305-563-1333;800-327-1282
† Sentry Mfg., Crystal Park, Chickasha, OK 73018 ..... 405-224-6780;800-654-8850
Toyo Comm. Equip. Co., Ltd., No. 8 Mori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, TOKYO, JAPAN 105 ..... 03-459-7320/03-459-7310
§† United States Crystal Corp., 3605 McCart St., Fort Worth, TX 76110 817-921-3014
† Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 .. 216-232-8600
X-Tron Electronics, Inc., 1869 National Avenue, Hayward, CA 94545 415-783-2145

Crystals, Microprocessor-2300

Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ..... A•1319
CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1339
§ ITT Components Passive Grp., 1201 E. McFadden Ave., Santa Ana, CA 92705, 714-836-0351 ..... A•1377
§ Midland-Ross Corp., NEL Unit, 357 Beloit St., Burlington, WI 53105, 414-763-3591 ..... A•1387
Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054, 619-433-4510 ..... A•1388
§† M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ..... A•1395
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1396
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ..... A•1428
Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-530-8777 ..... A•1433
SFE Technologies, 1501 1st St., San Fernando, CA 91340, 213-365-9411 ..... A•1434
Sokol Crystal Prods., Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 ..... A•1435-1340,1437
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ..... A•1441
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 ... 513-522-3300
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 .....714-991-1580; 800-854-XTAL
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377 212-458-5811
§† Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
Kahgan Elctrns. Corp., 605 Peninsula Blvd., Hempstead, NY 11550 516-538-2300
NTK Technical Ceramics, NGK Spark Plugs (U.S.A.), Inc., 1701 N. Greenville Ave. #205, Richardson, TX 75081 214-235-8332
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
† Savoy Elctrns., P.O. Box 5727, Ft. Lauderdale, FL 33310 ..305-563-1333;800-327-1282
Toyo Comm. Equip. Co., Ltd., No. 8 Mori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, TOKYO, JAPAN 105 ..... 03-459-7320/03-459-7310
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
X-Tron Electronics, Inc., 1869 National Avenue, Hayward, CA 94545 415-783-2145

Crystals, Piezoelectric-2300

§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ..... A•1363
§ Midland-Ross Corp., NEL Unit, 357 Beloit St., Burlington, WI 53105, 414-763-3591 ..... A•1387
Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 ..... A•1413
Sokol Crystal Prods., Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 ..... A•1435
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ..... A•1441
§† Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648 .. 814-695-4428
§† Atomergic Chemetals Corp., 100 Fairchild Ave., Plainview, NY 11803 ... 516-349-8800
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 ... 513-522-3300
§ BEA electro-optics, Inc., 690 First Ave., Des Plaines, IL 60016 312-298-1420
§ Bomar Crystal, 201 Blackford Ave., Middlesex, NJ 08846 ..201-356-7787;800-526-3935
Burleigh Instrs., Burleigh Pk., Fishers, NY 14453 716-924-9355
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 .....714-991-1580; 800-854-XTAL
† Channel Inds., 839 Ward Dr., Santa Barbara, CA 93111 805-967-0171
† Colorado Crystal Corp., 2303 W. 8th St., Loveland, CO 80537 303-667-9248
† Croven Crystals, 500 Beech St., Whitby, ON, CANADA L1N 5S5 416-668-3324
§† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
§† CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548 815-786-8411
Deltronic Crystal Inds., 215 Rt. 10, Bldg. 3, Sec. 5, Randolph, NJ 07869 201-361-2222
† EDO Western Corp., EDO Corp., 2645 South 300 W., Salt Lake City, UT 84115 ..... 801-486-7481/3846
Gulton Inds., Inc., Piezo Prods. Div., Box 4300, Fullerton, CA 92634 714-871-2150
† Honeywell Inc., Aerospace & Defense Grp., Honeywell Plaza, Minneapolis, MN 55408 612-870-5186
International Crystal Mfg., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126 405-236-3741
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON, CANADA M3B 1M2 416-447-8531
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
† Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054 ... 619-433-4510
§† M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078 605-665-9321
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
† Nittany Piezo Ceramics, Box 756, Pine and Mill Streets, Bellefonte, PA 16823 ..... 814-355-1593;814-355-1594
NTK Technical Ceramics, NGK Spark Plugs (U.S.A.), Inc., 1701 N. Greenville Ave. #205, Richardson, TX 75081 214-235-8332
Philips Electronics, Ltd., Crystal Dept., 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
§† Pioner Components, 2352 E. 66th St., Brooklyn, NY 11234 718-444-3880
§ Q-Matic Corp., 3194-D Airport Loop Dr., Costa Mesa, CA 92626 714-545-8233
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064 213-820-4921
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303 415-856-6900
† Savoy Elctrns., P.O. Box 5727, Ft. Lauderdale, FL 33310 ..305-563-1333;800-327-1282
Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
† Sentry Mfg., Crystal Park, Chickasha, OK 73018 ..... 405-224-6780;800-654-8850
Star Micronics, Inc., Components Div., 70-D Ethel Rd. W., Piscataway, NJ 08854 201-572-9512
Toyo Comm. Equip. Co., Ltd., No. 8 Mori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, TOKYO, JAPAN 105 ..... 03-459-7320/03-459-7310
§† United States Crystal Corp., 3605 McCart St., Fort Worth, TX 76110 817-921-3014
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
† Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 .. 216-232-8600

Crystals, Quartz-2300

§† Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 ..... A•1313
† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ..... A•1316-1319,1321
† Colorado Crystal Corp., 2303 W. 8th St., Loveland, CO 80537, 303-667-9248 ..... A•1324
† Croven Crystals, 500 Beech St., Whitby, ON, CANADA L1N 5S5, 416-668-3324 ..... A•1335
§† CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1336
§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ..... A•1363
Frequency and Time Systems, Inc., DATUM, INC., 34 Tozer Rd., Beverly, MA 01915, 617-927-8220 ..... A•1364
§ ITT Components Passive Grp., 1201 E. McFadden Ave., Santa Ana, CA 92705, 714-836-0351 ..... A•1377
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1380
§ Midland-Ross Corp., NEL Unit, 357 Beloit St., Burlington, WI 53105, 414-763-3591 ..... A•1387
† Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054, 619-433-4510 ..... A•1388
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, 312-451-1000 ..... A•1392
§† M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ..... A•1395
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1396
Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 ..... A•1413
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... A•1423
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ..... A•1428
§ Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-530-8777 ..... A•1433
SFE Technologies, 1501 1st St., San Fernando, CA 91340, 213-365-9411 ..... A•1434
Sokol Crystal Prods., Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 ..... A•1435
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ..... A•1441
Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
§† Atomergic Chemetals Corp., 100 Fairchild Ave., Plainview, NY 11803 ... 516-349-8800
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 ... 513-522-3300
§ Bomar Crystal, 201 Blackford Ave., Middlesex, NJ 08846 ..201-356-7787;800-526-3935
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 .....714-991-1580; 800-854-XTAL
† Cirtech, EG & G, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
§† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
§† CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700

Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377 212-458-5811
† Hoffman, P. R., Co., Materials Processing Div., Amstar Tech. Prods. Co., Inc., 321 Cherry St., Carlisle, PA 17013 717-243-2011
§† Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
§ Inficon Leybold-Heraeus, Inc., 6500 Fly Rd, E. Syracuse, NY 13057 315-437-0377
International Crystal Mfg., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126 405-236-3741
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
KLC/Karl Lambrecht Corp., 4204 N. Lincoln Ave., Chicago, IL 60618 312-472-5442
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON, CANADA M3B 1M2 416-447-8531
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§ Optics International, Box 101, Tenafly, NJ 07670 201-567-4799
§ Paccom, 3928 148th NE, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
Philips Electronics, Ltd., Crystal Dept., 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
§ Q-Matic Corp., 3194-D Airport Loop Dr., Costa Mesa, CA 92626 714-545-8233
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064 213-820-4921
† Savoy Elctrns., P.O. Box 5727, Ft. Lauderdale, FL 33310 ..305-563-1333;800-327-1282
† Sentry Mfg., Crystal Park, Chickasha, OK 73018 ..... 405-224-6780;800-654-8850
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
§ Sloan Technology, 602 E. Montecito St., Santa Barbara, CA 93103 805-963-4431
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Rd., Riviera Beach, FL 33404 305-848-4311
Thermal Amer. Fused Quartz, Change Bridge Rd., Montville, NJ 07045 .. 201-334-7770
Toyo Comm. Equip. Co., Ltd., No. 8 Mori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, TOKYO, JAPAN 105 ..... 03-459-7320/03-459-7310
§† United States Crystal Corp., 3605 McCart St., Fort Worth, TX 76110 817-921-3014
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
X-Tron Electronics, Inc., 1869 National Avenue, Hayward, CA 94545 415-783-2145

Crystals, Quartz, for Watches-2300

§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ..... A•1363
§ Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-530-8777 ..... A•1433
Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ..... A•1441
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 ... 513-522-3300
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 .....714-991-1580; 800-854-XTAL
Hoffman, P. R., Co., Materials Processing Div., Amstar Tech. Prods. Co., Inc., 321 Cherry St., Carlisle, PA 17013 717-243-2011
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
§ Q-Matic Corp., 3194-D Airport Loop Dr., Costa Mesa, CA 92626 714-545-8233
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303 415-856-6900
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831

Crystals, Semiconductor(Ingots & Wafers)-2300

§† Atomergic Chemetals Corp., 100 Fairchild Ave., Plainview, NY 11803 ... 516-349-8800
Capintec Instrs., 6 Arrow Rd., Ramsey, NJ 07446 201-825-9500
Dow Corning Corp., Box 0994, Midland, MI 48686-0994 517-496-4000
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
Laser Diode Labs, 1130 Somerset St., New Brunswick, NJ 08901 201-249-7000
M/A-COM Laser Diode, Inc., M/A-COM, Inc., 1130 Somerset St., New Brunswick, NJ 08901 201-249-7000
Materials Resch., Route 303, Orangeburg, NY 10962 914-359-4200
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
† Saphikon, 51 Powers St., Milford, NH 03055 603-673-5831
† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Rd., Riviera Beach, FL 33404 305-848-4311
§ Tennelec, 601 Turnpike, Oak Ridge, TN 37830 615-483-8405
Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
Thomson-CSF Comps. Corp., Metals & Chemicals Div., 6660 Variel Ave., Canoga Pk., CA 91303 213-887-1010
† Union Carbide Corporation, Elctrns. Div., Crystal Prods. Dept., 9320 Chesapeake Dr., Ste. 104, San Diego, CA 92123 619-279-4500

Crystals, YIG-2300

† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
§† Atomergic Chemetals Corp., 100 Fairchild Ave., Plainview, NY 11803 ... 516-349-8800
Deltronic Crystal Inds., 215 Rt. 10, Bldg. 3, Sec. 5, Randolph, NJ 07869 201-361-2222
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161

Crystals (MIL)-2440 — *See Vol. B*

Cups, Encapsulation-1600 — *See Vol. C*

Current Limiters (MIL)-2440 — *See Vol. B*

Current Sensors-Also See Transducers, Volt, etc.-2200 — *See Vol. D*

Current Sources-4000 — *See Vol. D*

Custom Molding Services, Plastics — See Services, Custom Molding, Plastics (Vol. D)

Cutters, Diagonal — See Cutters, Manual (Vol. C)

Cutters, Wire, Automatic — See Machines, Wire Measuring & Cutting (Vol. D)

Cutters, Wire, Manual-5400 — *See Vol. C*

Dampers, Servo-4900 — *See Vol. D*

Dampers, Structural, Chassis, Panel, etc. — See Mounts, Shock & Vibration (Vol. C)

Data Collection Equipment, Hand Held-2000 — *See Vol. D*

Data Collection Equipment, Modular-2000 — *See Vol. D*

Data Collection Equipment, Portable-2000 — *See Vol. D*

Data Acquisition & Reduction Systems-Also See Modules, Data Acquisition-2325 — *See Vol. D*

Data Compressors, Digital-2000 — *See Vol. D*

Data Display Indicators — See Displays Indicator Lights (Vol. B)

Data Display Systems — See Displays, CRT (Vol. A), Terminals, Data Display (Vol. D)

Data Links, Fiber Optic-2475 — *See Vol. B*

Data Links, Optical-2000 — *See Vol. D*

Data Loggers-2325 — *See Vol. D*

Data Security Devices: Encryptors, Decryptors — See Security Systems, Data

Data Switches — See Switches, Data (Vol. D)

Data Systems (MIL), Naval Tactical-3475 — *See Vol. D*

Data Translators — See Translators, Data

DCXO — See Oscillators, Digitally Compensated Crystal

Decade Boxes, Capacitance-2900 — *See Vol. D*

Decade Boxes, Inductance-2900 — *See Vol. D*

Decade Boxes, Resistance-2900 — *See Vol. D*

Decade Boxes, Transformer-2900 — *See Vol. D*

Decalcomania-Also See Labels, Pressure Sensitive-2400 — *See Vol. C*

Decapsulation Services — See Services, Decapsulation (Vol. D)

Decoders, Binary To Decimal — See Converters, Binary To Decimal (Vol. D)

Decoders, Digital To Analog — See Converters, Digital To Analog (Vol. D)

Decoders, Pulse-1900 — *See Vol. D*

Decoders, Readout — See Drivers & Decoders For Readouts (Vol. B)

Decoders, Telemetry — See Decoders, Tone (Vol. D)

Decoders, Tone-1900 — *See Vol. D*

Decoders, Video-1900 — *See Vol. D*

Decontaminants — See Cleaners & Solvents (Vol. C)

Decoys (MIL), Buoy-3475 — *See Vol. D*

Decryptors — See Security Systems, Data

Degaussers — See Demagnetizers (Vol. C), Coils, Degaussing (Vol. A)

Degreasers & Cleaners, Machine — See Machines, Cleaning & Degreasing (Vol. D)

Degreasing Chemicals — See Cleaners & Solvents (Vol. C)

Dehumidifiers (For Equipment)-2600 — *See Vol. C*

Dehydrators-4100 — *See Vol. D*

Delay Lines, Active-2350

Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 ..... A•1464
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... A•1486
§ Datamax Electronics, Inc., P. O. Box 2839, Blue Jay, CA 92631, 714-336-3561;714-951-5646 ..... A•1502
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1508,1510,1514,1515,1521
Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030, 408-395-2300 ..... A•1522
JBM Electronics, Inc., 531 Front St., Manchester, NH 03102, 603-623-0222 ..... A•1528
§† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065, 201-541-1600 ..... A•1540
§ Nano Pulse Industries, 440 Nibus St., Brea, CA 92670, 714-529-2600 .... A•1546
§† Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1554
PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ..... A•1556
† Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595, 714-898-0960 ..... A•1568
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
§ CCD Imaging, Fairchild Camera & Instr. Corp., 450 National Ave., Mountain View, CA 94043 415-493-8001
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ..... 415-785-5231;415-785-5235
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761

Delay Lines, Cable-2350

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501 516-248-8080
Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
† Astrolab Inc., 4 Powder Horn Drive, Warren, NJ 07060 1-201-560-3800
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 201-432-0463
† Cablewave Sys., 60 Dodge Ave., North Haven, CT 06473 203-239-3311
† Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735 516-694-0125
Fischer-America, Inc., Div. of Technographics, Inc., 13756 Glenoaks Blvd., Sylmar, CA 91342 818-362-9396
Flexco Microwave, Inc., P.O. Box 174, Karrville Rd., Port Murray, NJ 07865 201-689-3020
W. L. Gore & Assocs., 555 Paper Mill Rd., Newark, DE 19714 302-738-4880
§† Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
Micro Mode Prods., 1870 John Towers Ave., El Cajon, CA 92020 619-449-3844
Precision Tube, Church Rd. & Wissahickon, N. Wales, PA 19454 215-699-5801
† Times Fiber Communications, Inc., 358 Hall Ave., P.O. Box 384, Wallingford, CT 06492-0384 203-265-8500
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100

Delay Lines, Digital-2350

† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 ..... A•1464
§ Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... A•1468-1477,1479,1481-1486
Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725, 516-543-4220 ..... A•1487
Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011, 201-772-1106 ..... A•1489-1493,1495-1501
§ Datamax Electronics, Inc., P. O. Box 2839, Blue Jay, CA 92631, 714-336-3561;714-951-5646 ..... A•1503,1505,1506
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1508-1510,1512-1521
† Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030, 408-395-2300 ..... A•1522,1524,1525,1527
JBM Electronics, Inc., 531 Front St., Manchester, NH 03102, 603-623-0222 ..... A•1528
§† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065, 201-541-1600 ..... A•1530
§ Nano Pulse Industries, 440 Nibus St., Brea, CA 92670, 714-529-2600 .... A•1546
§ Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1550
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ..... A•1556
† Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595, 714-898-0960 ..... A•1568
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ..... A•1574-1579, B•1010
§ AKG Acoustics, Inc., 77 Selleck St., Stamford, CT 06902 203-348-2121
AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
Eventide, Inc., One Alsan Way, Little Ferry, NJ 07643 201-641-1200
LeCroy Resch. Sys. Corp., 700 S. Main St., Spring Vly., NY 10977 914-425-2000
M/A-COM Microwave Circuits, Inc., South Ave., Burlington, MA 01803 .. 617-272-3000
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261

Delay Lines, Dispersive (Frequency Variable)-2350

† Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 ..... A•1432
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 201-432-0463

Delay Lines, Distributed, Constant (Fixed)-2350

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ..... A•1460
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 ..... A•1465
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735, 516-694-0125 ..... A•1488
† Daico Inds., Inc., Box 5225, Compton, CA 90224, 213-631-1143 ..... A•1708
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011, 201-772-1106 ..... A•1490-1491,1495-1501
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1508-1516,1518
Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030, 408-395-2300 ..... A•1522
JBM Electronics, Inc., 531 Front St., Manchester, NH 03102, 603-623-0222 ..... A•1528
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065, 201-541-1600 ..... A•1530
§ Nano Pulse Industries, 440 Nibus St., Brea, CA 92670, 714-529-2600 .... A•1546
§† Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1550
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ..... A•1556-1562,1564,1565,1566
Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595, 714-898-0960 ..... A•1571
Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ..... A•1574-1575,1577,1578,1579, B•1010
AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 201-432-0463
† Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
§ Television Equip. Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100

Delay Lines, Distributed, Constant (Variable)-2350

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ..... A•1462
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735, 516-694-0125 ..... A•1488
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011, 201-772-1106 ..... A•1495,1500
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1508-1510,1514,1515
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065, 201-541-1600 ..... A•1540-1541,1545
§† Nano Pulse Industries, 440 Nibus St., Brea, CA 92670, 714-529-2600 .... A•1546
AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 201-432-0463
† Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220
§ Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
§ Television Equip. Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100

Delay Lines, Glass & Quartz-2350

† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1591
Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1360
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1386
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
† Anders, Inc., 77 Wolcott Rd., Simsbury, CT 06070 203-658-7666
Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735 516-694-0125

Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
Corning Glass Works, Memory Prods Dept., 3900 Electronic Dr., Raleigh, NC 27604 919-876-1100
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666

Delay Lines, Liquid-2350

Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444

Delay Lines, Lumped Constant (Electrically Variable)-2350

† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725, 516-543-4220 ..... A•1487
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735, 516-694-0125 ..... A•1488
† Daico Inds., Inc., Box 5225, Compton, CA 90224, 213-631-1143 ..... A•1708
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011, 201-772-1106 ..... A•1490
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1508-1510,1514,1515
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065, 201-541-1600 ..... A•1540-1541,1545
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2202
† Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595, 714-898-0960 ..... A•1571
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ..... A•1576-1573, B•1010
Allen Avionics, 224 E. 2nd St., Mineola, NY 11501 516-248-8080
AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 201-432-0463
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
† Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261

Delay Lines, Lumped Constant (Fixed)-2350

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ... A•1461,1463
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... A•1478
† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725, 516-543-4220 ..... A•1487
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735, 516-694-0125 ..... A•1488
† Daico Inds., Inc., Box 5225, Compton, CA 90224, 213-631-1143 ..... A•1708
§ Datamax Electronics, Inc., P. O. Box 2839, Blue Jay, CA 92631, 714-336-3561;714-951-5646 ..... A•1502
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1508-1510,1514,1515
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ..... A•2157
† Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030, 408-395-2300 ..... A•1522
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065, 201-541-1600 ..... A•1540
§† Nano Pulse Industries, 440 Nibus St., Brea, CA 92670, 714-529-2600 .... A•1546
§ Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1552
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ..... A•1556-1559,1564,1565,1566
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ..... A•1576, B•1010
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1581
AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
† Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 201-772-1106
† El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
† Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
† Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595 .. 714-898-0960
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
§ Television Equip. Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
Transducer Systems, Inc., 1510 Delp Dr., Kulpsville, PA 19443 215-256-4611
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261

Delay Lines, Lumped Constant (Mechanically Variable)-2350

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ..... A•1463
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735, 516-694-0125 ..... A•1488
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1509
AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 201-432-0463
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
† Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 201-772-1106
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
† Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595 .. 714-898-0960
§ Television Equip. Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100

Delay Lines, Magnetostrictive-2350

† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735, 516-694-0125 ..... A•1488
JBM Electronics, Inc., 531 Front St., Manchester, NH 03102, 603-623-0222 ..... A•1528
Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595, 714-898-0960 ..... A•1571
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
† Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220
ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400

Delay Lines, Programmable-2350

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ..... A•1462
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... A•1475-1477,1480
Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011, 201-772-1106 ..... A•1489,1492,1493
§ Datamax Electronics, Inc., P. O. Box 2839, Blue Jay, CA 92631, 714-336-3561;714-951-5646 ..... A•1503
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1509,1519,1520,1521
Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030, 408-395-2300 ..... A•1523
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065, 201-541-1600 ..... A•1540
§ Nano Pulse Industries, 440 Nibus St., Brea, CA 92670, 714-529-2600 .... A•1546
† Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595, 714-898-0960 ..... A•1568,1570
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ..... A•1578-1579, B•1010
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
§ CCD Imaging, Fairchild Camera & Instr. Corp., 450 National Ave., Mountain View, CA 94043 415-493-8001
Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
Eventide, Inc., One Alsan Way, Little Ferry, NJ 07643 201-641-1200
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261

Delay Lines, SAW — See Surface Acoustic Wave Devices

Delay Lines, Strip-2350

† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735, 516-694-0125 ..... A•1488
JBM Electronics, Inc., 531 Front St., Manchester, NH 03102, 603-623-0222 ..... A•1528
Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1554
PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ..... A•1556
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 201-432-0463
† Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
§† Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
§ Television Equip. Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893

Delay Lines, Trimmer-2350

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ..... A•1462
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1508,1510,1514,1515
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065, 201-541-1600 ..... A•1540-1541,1545
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Anders, Inc., 77 Wolcott Rd., Simsbury, CT 06070 203-658-7666
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 201-432-0463
† Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735 516-694-0125
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 201-772-1106
† Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
§ Lenco Elctrns., Inc., 300 N. Maryland St., Jackson, MO 63755 314-243-3147
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
§ Television Equip. Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100

Delay Lines, Ultrasonic-2350

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ..... A•1462
§ Datamax Electronics, Inc., P. O. Box 2839, Blue Jay, CA 92631, 714-336-3561;714-951-5646 ..... A•1502
ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1509
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1386
† Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 ..... A•1432
† Anders, Inc., 77 Wolcott Rd., Simsbury, CT 06070 203-658-7666
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
† Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735 516-694-0125
Corning Glass Works, Memory Prods Dept., 3900 Electronic Dr., Raleigh, NC 27604 919-876-1100
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333

Delay Lines, Video — See Delay Lines, Ultrasonic (Vol. A)

Delay Lines, Waveguide-2350

Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 201-432-0463
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Union Carbide Corporation, Elctrns. Div., Crystal Prods. Dept., 9320 Chesapeake Dr., Ste. 104, San Diego, CA 92123 619-279-4500
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100

Delay Lines (MIL)-2440 — *See Vol. B*

Demagnetizers-4525 — *See Vol. C*

Demodulators-1900 — *See Vol. D*

Demodulators, Magnetic-2200 — *See Vol. D*

Densitometers-2900 — *See Vol. D*

Deposition Equipment, Vacuum & Accessories-Also See Evaporation Equipment, Electron Beam-4100 — *See Vol. D*

Desiccators — See Dehumidifiers (Vol. C)

Desks, Data Terminal — See Benches, Consoles, Tables (Vol. C)

Desoldering Tools & Equipment — See Soldering Accessories (Vol. C), Soldering Equip. (Vol. C), Soldering Guns (Vol. C), etc.

Detection & Ranging Systems (MIL)-3475 — *See Vol. D*

Detection Sets (MIL), IR-3475 — *See Vol. D*

Detection Systems, Laser-3700 — *See Vol. B*

Detection Systems (MIL), Passive-3475 — *See Vol. D*

Detection Systems (MIL), Submarine-3475 — *See Vol. D*

Detector Arrays, Infrared-3700 — *See Vol. B*

Detectors, Air Flow-2900 — *See Vol. D*

Detectors, AM/FM-2900 — *See Vol. D*

Detectors, Bar Code — See Readers, Bar Code (Vol. D)

Detectors, Coaxial-2900 — *See Vol. D*

Detectors, Corona — See Testers, Corona (Vol. D)

Detectors, Crystal-2300

Advanced Devices, 1618 Camino Uva, Los Alamos, NM 87544 505-662-7729
Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 617-935-8610
American Electronic Labs., Box 552, Lansdale, PA 19446 215-822-2929
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 516-694-3600
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
§† JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203 317-783-9875
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
M/A-Com Microwave Components, Inc., M/A-Com, South Avenue, Burlington, MA 01803 617-272-3000
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† 3M Co., Static Control Sys. Div., P. O. Box 2963, Austin, TX 78769-2963 800-328-1368
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§† Micronetics, 36 Oak St., Norwood, NJ 07648 201-767-1320
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44-(582) 60-14-41
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
§ Wiltron, 805 E. Middlefield Rd., P.O. Box 7290, Mountain View, CA 94042-7290 415-969-6500

Detectors, Fiber Optic-Also See Diodes, PIN-2475 — *See Vol. B*

Detectors, Flaw & Defect-2900 — *See Vol. D*

Detectors, GaAs-3450

Ortel Corp., 2015 W. Chestnut St., Alhambra, CA 91803 818-281-3636
§ Siemens Comps., Inc., Optoelectronics Div., 19000 Homestead Rd., Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400

Detectors, Ground Fault-4300 — *See Vol. D*

Detectors, Impedance — See Meters, Impedance (Vol. D)

Detectors, Infrared-3700 — *See Vol. B*

Detectors, Light Intensity — See Meters, Light, Nonphotographic (Vol. D)

Detectors, Magnetic — See Meters, Gauss (Vol. D)

Detectors, Microwave-3400 — *See Vol. D*

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Detectors, Photovoltaic — See Cells, Photovoltaic (Vol. B)

Detectors, RF-2900 — *See Vol. D*

Detectors, Radiation-2900 — *See Vol. D*

Detectors, Resistance Temperature (RTDs) — See Thermometers, Resistance (Vol. D)

Detectors, Standing Wave-2900 — *See Vol. D*

Detectors, Synchronous-2900 — *See Vol. D*

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Detectors, Video-2900 — *See Vol. D*

Detectors, Voltage-2900 — *See Vol. D*

Detectors (MIL), IR-3475 — *See Vol. D*

Detectors (MIL), Radar-3475 — *See Vol. D*

DIACs-4800

Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ..... A•2083
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2091
§ Teccor Elctrns., 1801 Hurd Dr., Irving, TX 75062, 214-252-7651 ..... A•2092
Triac Electronic Systems, Inc., 87-27 Myrtle Ave., Glendale, NY 11385, 718-441-4759 ..... D•1132
American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940 201-377-9566
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089

Dials, Instrument, Metal, Plastic, etc.-2400 — *See Vol. C*

Dials, Turns Counting-2400 — *See Vol. C*

Dielectric Heating Equipment-4100 — *See Vol. D*

Dielectrics — See Films (Vol. C), Insulation Materials (Vol. C)

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Digitizers, Audio (Sonic)-2000 — *See Vol. D*

Digitizers, Video-2000 — *See Vol. D*

Digitizers, Pencil Follower (Incl. Coordinate & Graphic)-2000 — *See Vol. D*

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Dimmers, Light — See Controls, Lamp Dimming, Flashing (Vol. D)

Diode Arrays (Incl. Photo)-3700 — *See Vol. B*

Diodes, Avalanche-4800

§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ..... A•2084
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
† Applied Solar Energy Corp., Photosensor Div., 15251 E. Don Julian Rd., City of Industry, CA 91749 818-968-6581
§† Codi Semiconductor, Inc., 350 Hurst Ave., Linden, NJ 07036 201-862-8484
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 213-699-0918
§ Conditioning Semiconductor Devices, Box 2116, Wayne, NJ 07470 201-335-6723
§† Fairchild Camera & Instr. Corp., 464 Ellis St., 20-2271, Mountain View, CA 94042 415-962-5011
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 .....714-557-9394; 800-854-7651
§† ITT Electro-Optical Prods., 7635 Plantation Rd., Roanoke, VA 24019 703-563-0371
Koep Precision Standards, Inc., P. O. Box 191, So. Plainfield, NJ 07080 201-549-9280
† MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998 213-828-7496
§† Micro Semiconductor, 2830 S. Fairview St., Santa Ana, CA 92704 714-979-8220
† Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44-(582) 60-14-41
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§† Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§ Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, JAPAN 03-986-6151
§ Semicon, 10 North Ave., Burlington, MA 01803 617-272-9015
§ Semikron, Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 .....603-883-8102; 1-800-258-1308
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§† St-Semicon, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402 812-332-1435
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
† THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006 201-575-5586
§ Varo Semiconductor, Inc., 2800 W. Kingsley Dr., Garland, TX 75046 214-271-8511
Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291 209-651-1402

Diodes, Backward-4800

American Power Devices, 7 Andover St., Andover, MA 01810 617-475-4074
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 .....714-557-9394; 800-854-7651
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880

Diodes, Breakdown — See Diodes, Avalanche (Vol. A)

Diodes, Chip, Unpackaged-4800

Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
American Power Devices, 7 Andover St., Andover, MA 01810 617-475-4074
† Applied Solar Energy Corp., Photosensor Div., 15251 E. Don Julian Rd., City of Industry, CA 91749 818-968-6581
§ BEA electro-optics, Inc., 690 First Ave., Des Plaines, IL 60016 312-298-1420
Centronic Inc., 1101 Bristol Rd., Mountainside, NJ 07092 201-233-7200
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 213-699-0918
Diodes Inc., 9957 Canoga Ave., Chatsworth, CA 91311 ... 818-882-4920;800-821-1178
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
† Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
Elctrn. Devices, 21 Gray Oaks Ave., Yonkers, NY 10710 914-965-4400
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
General Semiconductor Ind., Inc., Square D Company, 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
§† ITT Electro-Optical Prods., 7635 Plantation Rd., Roanoke, VA 24019 703-563-0371
† Micro Semiconductor, 2830 S. Fairview St., Santa Ana, CA 92704 714-979-8220
† Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44-(582) 60-14-41
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
MSI Electronics, Inc., 34-32 57th St., Woodside, NY 11377 212-672-6500
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 415-968-9211
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
Semicon, 10 North Ave., Burlington, MA 01803 617-272-9015
Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
§ Varo Semiconductor, Inc., 2800 W. Kingsley Dr., Garland, TX 75046 214-271-8511

Diodes, Electroluminescent (Radiating)-4800

§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
§ Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
† Laser Diode Labs, 1130 Somerset St., New Brunswick, NJ 08901 201-249-7000
§† Leecraft Mfg., 21-02 44th Rd., Long Island City, NY 11101 718-392-8800
† MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998 213-828-7496
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
Sensor Techn., 21012 Lassen St., Chatsworth, CA 91311 213-882-4100
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700

Diodes, Frequency Multiplier-4800

§ A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 201-722-9800
§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 .....714-557-9394; 800-854-7651
† Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44-(582) 60-14-41
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
§† Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
Thomson-CSF Comps. Corp., Special Prods. Div., 301 Rte. 17 North, Rutherford, NJ 07070 201-438-2300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880

Diodes, Germanium-4800

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... A•2070
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 213-699-0918
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500

International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..... 714-557-9394; 800-854-7651
§ International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
ITT Semiconductors, 500 Broadway, Lawrence, MA 01841 617-688-1881
McGuirk Electronics Co. Inc., 212 So. Main St, P. O. Box 853, Middleton, MA 01949 617-933-3500
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Diode Corp., Washington St-Box 250, W. Stewartstown, NH 03597 ..... 603-246-3362/3363
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
Optoelectronics, Inc., 1309 Dynamic St, Petaluma, CA 94952 707-763-4181
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33497 305-283-4500
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880

Diodes, Gunn-4800

§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Central Microwave Co., Alpha Inds., Inc., 12180 Prichard Farm Rd., Maryland Heights, MO 63043 314-291-5270
MARCONI INSTRUMENTS, 3 Pearl Court, Allendale, NJ 07401 201-934-9050
† Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44-(582) 60-14-41
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
§† Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
Thomson-CSF Comps. Corp., Special Prods. Div., 301 Rte. 17 North, Rutherford, NJ 07070 201-438-2300
† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141

Diodes, High Voltage (1,000 Volts & Over)-4800

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... A•2070
§ IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735, 516-753-0400 ..... A•2072
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... A•2074
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089, 413-781-1350 ..... A•1879
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2090
† Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291, 209-651-1402 ..... A•2097
§ A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 201-722-9800
§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
§† Codi Semiconductor, Inc., 350 Hurst Ave., Linden, NJ 07036 201-862-8484
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
§ Conditioning Semiconductor Devices, Box 2116, Wayne, NJ 07470 201-335-6723
Diodes Inc., 9957 Canoga Ave., Chatsworth, CA 91311 ... 818-882-4920;800-821-1178
§ Elctrn. Devices, 21 Gray Oaks Ave., Yonkers, NY 10710 914-965-4400
§† General Instr., Discrete Semiconductor Div., 600 West John St., Hicksville, NY 11802 516-733-3333
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..... 714-557-9394; 800-854-7651
International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St, El Segundo, CA 90245 213-772-2000
§† Micro Semiconductor, 2830 S. Fairview St, Santa Ana, CA 92704 714-979-8220
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
§ New-Tone Electronics, Inc., 44 Farrand St, Bloomfield, NJ 07003 201-748-5089
Oram Elctrns., Rte. 22, Putnam Business Park, Brewster, NY 10509-9587 914-279-2966
§† Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§ RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§ Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, JAPAN 03-986-6151
Sanken Elec. U.S.A. Corp., 3848 Carson St, Ste. 105, Torrance, CA 90503 213-540-2209
§ Semicon, 10 North Ave., Burlington, MA 01803 617-272-9015
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33497 305-283-4500
§ Semikron, Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 ..... 603-883-8102; 1-800-258-1308
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
Silicon Power Cube Corp., 2725 Seaboard Lane, Long Beach, CA 90805 213-634-9390
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
§† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Rd., Riviera Beach, FL 33404 305-848-4311
§† St-Semicon, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402 812-332-1435
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§ Varo Semiconductor, Inc., 2800 W. Kingsley Dr., Garland, TX 75046 214-271-8511
Westcode Semiconductors, Inc., 0-02 Fair Lawn Ave., Fair Lawn, NJ 07410 201-791-3020
§ Westinghouse Elec. Corp., Semiconductor Div., Armbrust Rd., Youngwood, PA 15697 412-925-7272
Zenith Systems & Components Group, Zenith Electronics Corp., 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Diodes, Hot Carrier-4800

§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
§† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St, El Segundo, CA 90245 213-772-2000
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
§ Varo Semiconductor, Inc., 2800 W. Kingsley Dr., Garland, TX 75046 214-271-8511

Diodes, Impatt-4800

† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
† Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44-(582) 60-14-41
Thomson-CSF Comps. Corp., Special Prods. Div., 301 Rte. 17 North, Rutherford, NJ 07070 201-438-2300
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Diodes, Infrared-4800

Texas Instruments Optoelectronics, P.O. Box 225012 MS12, Dallas, TX 75265, 214-995-3821 ..... B•1219
† Gilway Technical Lamp, 165 New Boston Street, Woburn, MA 01801 ... 617-935-4442
Ledtronics, Inc., 4009 Pacific Coast Hwy., Torrance, CA 90505 213-534-1505
† MERET, Inc., 1815 24th St, Santa Monica, CA 90404-4998 213-828-7496
Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
Ortel Corp., 2015 W. Chestnut St, Alhambra, CA 91803 818-281-3636
Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
Wamco, Inc., 11555-A Coley River Cir., Fountain Valley, CA 92708 714-545-5560
Zexco, 7661 Densmore, # 8, Van Nuys, CA 91406 818-997-7895

Diodes, Laser-4800

A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 201-722-9800
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
Codenoll Technology Corp., 1086 N. Bwy., Yonkers, NY 10701 914-965-6300
† General Optronics, 3005 Hadley Rd., So. Plainfield, NJ 07080 201-549-9000
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
† Laser Diode Labs, 1130 Somerset St, New Brunswick, NJ 08901 201-249-7000
§† M/A-COM Laser Diode, Inc., M/A-COM, Inc., 1130 Somerset St., New Brunswick, NJ 08901 201-249-7000
Mitsubishi Elctrns. America, Inc., Semiconductor Div., 1050 East Arques Ave., Sunnyvale, CA 94086 408-730-5900
NEC Electronics, Inc., 401 Ellis Street, Mtn. View, CA 94039 415-960-6000
Ortel Corp., 2015 W. Chestnut St, Alhambra, CA 91803 818-281-3636
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
Thomson-CSF Comps. Corp., Special Prods. Div., 301 Rte. 17 North, Rutherford, NJ 07070 201-438-2300
† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300

Diodes, Light Emitting (LEDs)-3700 — *See Vol. B*

Diodes, Limiting-4800

§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Eastern Delta Corp., 29-09 S. Broadway, Fair Lawn, NJ 07410 201-797-4200
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..... 714-557-9394; 800-854-7651
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44-(582) 60-14-41
§ Microwave Diode Corp., Washington St-Box 250, W. Stewartstown, NH 03597 ..... 603-246-3362/3363
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
§† Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
§ Schauer Mfg., 4500 Alpine Ave., Cincinnati, OH 45242 513-791-3030
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St, Stuart, FL 33497 305-283-4500
§† Teledyne-Crystalonics, 147 Sherman St, Cambridge, MA 02140 617-491-1670
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880

Diodes, Liquid Crystal (LCDs)-3700 — *See Vol. B*

Diodes, Matched Pairs-4800

§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
§† Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940 201-377-9566
American Power Devices, 7 Andover St, Andover, MA 01810 617-475-4074
§ Codi Semiconductor, Inc., 350 Hurst Ave., Linden, NJ 07036 201-862-8484
§ Conditioning Semiconductor Devices, Box 2116, Wayne, NJ 07470 201-335-6723
Datacopy Corp., 1215 Terra Bella Ave., Mountain View, CA 94043 415-965-7900
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
† Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
§† Fairchild Camera & Instr. Corp., 464 Ellis St., 20-2271, Mountain View, CA 94042 415-962-5011
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
§† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
§† Honeywell Optoelectronics, 830 E. Arapaho Dr., Richardson, TX 75080 214-234-4271
§ International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
McGuirk Electronics Co. Inc., 212 So. Main St, P. O. Box 853, Middleton, MA 01949 617-933-3500
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§† Micro Semiconductor, 2830 S. Fairview St, Santa Ana, CA 92704 714-979-8220
† Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44-(582) 60-14-41
§ Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-469-3311
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
MSI Electronics, Inc., 34-32 57th St, Woodside, NY 11377 212-672-6500
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Poulin Associates, Inc., 302 North Rd., Sudbury, MA 01776 617-443-7333
§ Semicoa, 333 McCormick Ave., Costa Mesa, CA 92626 714-979-1900
§ Semicon, 10 North Ave., Burlington, MA 01803 617-272-9015
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St, Stuart, FL 33497 305-283-4500
† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Rd., Riviera Beach, FL 33404 305-848-4311
§ St-Semicon, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402 812-332-1435
Summit Engineering Corp., Box 938, Bozeman, MT 59715 406-587-4511
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291 209-651-1402
§ Westinghouse Elec. Corp., Semiconductor Div., Armbrust Rd., Youngwood, PA 15697 412-925-7272

Diodes, Matched Quads-4800

§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
American Power Devices, 7 Andover St., Andover, MA 01810 617-475-4074
Codi Semiconductor, Inc., 350 Hurst Ave., Linden, NJ 07036 201-862-8484
§ Conditioning Semiconductor Devices, Box 2116, Wayne, NJ 07470 201-335-6723
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
§† Fairchild Camera & Instr. Corp., 464 Ellis St., 20-2271, Mountain View, CA 94042 415-962-5011
§† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
§ International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-469-3311
MSI Electronics, Inc., 34-32 57th St., Woodside, NY 11377 212-672-6500
Poulin Associates, Inc., 302 North Rd., Sudbury, MA 01776 617-443-7333
§ Semicon, 10 North Ave., Burlington, MA 01803 617-272-9015
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33497 305-283-4500
† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Rd., Riviera Beach, FL 33404 305-848-4311
Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
St-Semicon, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402 812-332-1435
Summit Engineering Corp., Box 938, Bozeman, MT 59715 406-587-4511
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
§ Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291 209-651-1402

Diodes, Microwave Detector-4800

§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
§† Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33431 305-994-1774
§† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44-(582) 60-14-41
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
§† Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880

Diodes, Microwave Mixer-4800

§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
§† Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
§† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44-(582) 60-14-41
Microwave Diode Corp., Washington St-Box 250, W. Stewartstown, NH 03597 ..... 603-246-3362/3363
§ Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-469-3311
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
§† Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880

Diodes, Noise-4800

† Koep Precision Standards, Inc., P. O. Box 191, So. Plainfield, NJ 07080, 201-549-9280 ..... D•1257
† MDF Products Inc., 7 Johnson Dr., Danbury, CT 06811, 203-743-3579 ... D•1265
§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
§ Frequency Sources, KSW Semiconductor Div., 16 Maple Rd., Chelmsford, MA 01824 617-256-8101
§ Micronetics, 36 Oak St., Norwood, NJ 07648 201-767-1320
Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
Solitron Devices, 8808 Balboa Ave., San Diego, CA 92123 619-278-8780
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300

Diodes, Photoelectric-3700 — *See Vol. B*

Diodes, PIN-4800

§ EG & G Vactec, 10900 Page Blvd., St. Louis, MO 63132, 314-423-4900 ... B•1210
Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235, 718-934-4500 ..... A•1769
† Silonex Inc., 331 Cornelia St., Plattsburgh, NY 12901, 518-561-3160 ..... B•1215
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2090
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Applied Solar Energy Corp., Photosensor Div., 15251 E. Don Julian Rd., City of Industry, CA 91749 818-968-6581
§ BEA electro-optics, Inc., 690 First Ave., Des Plaines, IL 60016 312-298-1420
† Centronic Inc., 1101 Bristol Rd., Mountainside, NJ 07092 201-233-7200
Crosspoint, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022 201-941-4455
† Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
EG & G Rotron, Custom Div., Hasbrouck La., Woodstock, NY 12498 914-679-5201
§ Frequency Sources, KSW Semiconductor Div., 16 Maple Rd., Chelmsford, MA 01824 617-256-8101
§† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Infrared Inds., Inc., P.O. Box 14200, Orlando, FL 32857 305-282-7700
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..... 714-557-9394; 800-854-7651
§† ITT Electro-Optical Prods., 7635 Plantation Rd., Roanoke, VA 24019 703-563-0371
† LVC Inds., Inc., CO-ORD Switch Div., 23 Hanse Ave., Freeport, NY 11520 516-868-1900
† MERET, Inc., 1815 24th St, Santa Monica, CA 90404-4998 213-828-7496
† Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44-(582) 60-14-41
§ Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-469-3311
Mitsubishi Elctrns. America, Inc., Semiconductor Div., 1050 East Arques Ave., Sunnyvale, CA 94086 408-730-5900
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
MSI Electronics, Inc., 34-32 57th St., Woodside, NY 11377 212-672-6500
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
Ortel Corp., 2015 W. Chestnut St., Alhambra, CA 91803 818-281-3636
Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107

Poulin Associates, Inc., 302 North Rd., Sudbury, MA 01776 617-443-7333
Sensor Techn., 21012 Lassen St., Chatsworth, CA 91311 213-882-4100
Silicon Detector Corp., 855 Lawrence Dr., Newbury Park, CA 91320 805-498-6737
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
United Detector Tech., 12525 Chadron Ave., Hawthorne, CA 90250 213-978-0516
§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540

Diodes, Schottky-4800

§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
§ BEA electro-optics, Inc., 690 First Ave., Des Plaines, IL 60016 312-298-1420
† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
Diodes Inc., 9957 Canoga Ave., Chatsworth, CA 91311 ... 818-882-4920;800-821-1178
Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33431 305-994-1774
§† Fairchild Camera & Instr. Corp., 464 Ellis St., 20-2271, Mountain View, CA 94042 415-962-5011
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 .....714-557-9394; 800-854-7651
§† International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
§ ITT Semiconductors, 500 Broadway, Lawrence, MA 01841 617-688-1881
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-469-3311
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
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§ EG & G Vactec, 10900 Page Blvd., St. Louis, MO 63132, 314-423-4900 ... B•1210
§ IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735, 516-753-0400 ..... A•2072
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† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... D•1735
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§† NAE, 69 Bennett St., Lynn, MA 01905 617-598-4800
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§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§ Schauer Mfg., 4500 Alpine Ave., Cincinnati, OH 45242 513-791-3030
§ Semicon, 10 North Ave., Burlington, MA 01803 617-272-9015
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33497 305-283-4500
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
Solitron Devices, 8808 Balboa Ave., San Diego, CA 92123 619-278-8780
§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
§† St-Semicon, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402 812-332-1435
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Diodes (MIL)-2440 — *See Vol. B*

Diplexers, Antenna-1900 — *See Vol. D*

Direction Finders (MIL), High Frequency-3475 — *See Vol. D*

Direction Finders (MIL), Radio-3475 — *See Vol. D*

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Display Modules-2450 — *See Vol. B*

Display Power Supplies — See Converters, DC to DC (Vol. D), Power Supplies, AC Output (Vol. D)

Displays, CRT-5700

† Infodex, Inc., 395 W. Main St., Waterbury, CT 06702, 203-757-9291 ..... B•1080-1081, D•1410
ADAC Corp., 70 Tower Office Pk, Woburn, MA 01801 617-935-6668
§ Andromeda Sys., 9000 Eton Ave., Canoga Park, CA 91304 818-709-7600
§ Ann Arbor Terminals, 6175 Jackson Rd., Ann Arbor, MI 48103 313-663-8000
Applied Sys., 26401 Harper Ave., St. Clair Shores, MI 48081 313-779-8700
Aspect Elctrns., 725 San Aleso, Sunnyvale, CA 94086 408-737-2290
Astec USA, Ltd., A BSR Intl. Co., 2880 San Tomas Expwy., # 200, Santa Clara, CA 95051 408-748-1200
† Astronautics Corporation of America, P.O. Box 523, Milwaukee, WI 53201-0523 414-447-8200
ATV Research, Inc., 1301 Broadway, Dakota City, NE 68731 402-987-3771
† Audiotronics Corp., 7428 Bellaire Ave., N. Hollywood, CA 91605 818-765-2645
Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
§† Aydin Controls, 414 Commerce Dr., Ft. Washington, PA 19034 215-542-7800
† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018 215-622-1000
† Collins Avionics Divisions, Rockwell Intl., 400 Collins Rd. NE, Cedar Rapids, IA 52498 319-395-1000
Colorgraphic Communications Corp., 2379 John Glenn Dr. Ste. 105, P.O. Box 80448, Atlanta, GA 30366 404-455-3921
The Computer Place, D & D Financial Entprs. Inc., 4595 Van Epps Rd., Brooklyn Hts., OH 44131 216-351-7444
§ Computerware, Inc., 8480-I Tyco Rd., Vienna, VA 22180 703-821-8200
† Conrac Corp., System Comps. Div., 1700 S. Mountain Ave., Duarte, CA 91010 213-359-9141
§ Conrac Div., Conrac Corp., 600 N. Rimsdale Ave., Covina, CA 91722 213-966-3511
Control Systems, 2855 Anthony Lane, Minneapolis, MN 55418 612-789-2421
CPS Inc., 110 Wolfe Rd., Sunnyvale, CA 94086 408-738-0530
† Custom Prods. Grp., Sys. Dev. Corp.-A Burroughs Co., P.O. Box 517, Paoli, PA 19301 215-648-7660
Data Ray Corp., 452 Burbank Street, Broomfield, CO 80020 303-469-5173
§ Data Rentals/Sls., Inc, P. O. Box 3257, Culver City, CA 90230 213-559-3822
Daytronic Corp., 2589 Corporate Pl., Miamisburg, OH 45342 513-866-3300
Delta Data Systems Corp., 2595 Metropolitan Dr., Trevose, PA 19047 ... 215-322-5400
Digital Equip., One Iron Way, Marlborough, MA 01752
§ Dotronix, 160 First St. SE, New Brighton, MN 55112 612-633-1742
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
Enterprise Sys. Corp., P.O. Box 698, Dover, NH 03820 603-742-7363
Facit, Inc., 9 Executive Park Dr., Merrimack, NH 03054 603-424-8000
§ Fan-S Corp., 7158 Industrial Pk. Blvd., Mentor, OH 44060 216-951-3300
Genstar Rental Elctrns., 2445 Faber Pl., Palo Alto, CA 94303 415-856-7600
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 801-537-5237
† Hartman Systems, Figgie Intl., 360 Wolf Hill Rd., Huntington Sta., NY 11746 516-427-7500
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
† Kaiser Elctrns., Kaiser Aerospace & Elctrns., 2701 Orchard Pkwy., San Jose, CA 95134 408-946-3000
Kikusui Intl. Corp., 17819 S. Figueroa St., Gardena, CA 90248 .....213-515-6432; 800-421-5334
§ Leader Instrs. Corp., 380 Oser Ave., Hauppauge, NY 11788-3694 516-231-6900
Lee Data Corporation, 7075 Flying Cloud Drive, Minneapolis, MN 55344 612-828-0300
Lundy Elctrns. & Systems, Inc., 1 Robert La., Glen Head, NY 11545 516-671-9000
Matrix Corp., 1639 Green St., Raleigh, NC 27603 919-833-2837
Matrox Elctrn. Sys., 1055 St. Regis Blvd., Dorval, QU, CANADA H9P 2T4 514-685-2630
Metra Instrs., 2056 Bering Dr., San Jose, CA 95131 408-297-8530

Microsystems Dev. Corp. Inc., 1560 Teaneck Rd., Teaneck, NJ 07666 ... 201-837-0051
§ Mitsubishi Elctrns., Industrial Electronics Div., 991 Knox Street, Torrance, CA 90502 ... 213-515-3993
Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 ... 617-890-6107
§ Ramtek, 2211 Lawson Lane, Santa Clara, CA 95050 ... 408-988-2211
RCA Solid State Div., Route 202, Somerville, NJ 08876 ... 201-685-6000
SEKAI Elctrns. of Amer., Inc., 14700 E. Firestone Blvd., Suite 122, La Mirada, CA 90638 ... 714-670-1854
§ Spatial Data Systems, A DBA Systems Co., 508 S. Fairview, Goleta, CA 93117 ... 805-967-2383
§ Sumitronics, Inc., Sumitomo Corporation, 1270 Oakmead Pkwy. Ste. 201, Sunnyvale, CA 94086 ... 408-737-7683
§ Summit CAD Corp., 5222 FM 1960 W100, Houston, TX 77069 ... 713-440-1468
† Systems Resch. Labs., Inc., 2800 Indian Ripple Rd., Dayton, OH 45440 .. 513-426-6000
TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703 ... 602-792-2230
Teletype, 5555 Touhy Ave., Skokie, IL 60076 ... 312-982-2000
§† TeleVideo Sys., Inc., 1170 Morse Ave., Sunnyvale, CA 94086 ... 408-745-7760
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 ... 317-545-4196
§ Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 ... 201-486-3300
† THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006 ... 201-575-5586
Vu-Data, 7122 Convoy Ct., San Diego, CA 92111 ... 619-279-6572
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 ... 317-787-3332
† Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 ... 607-796-3211
XKD Corporation, 101 Cooper Court, Los Gatos, CA 95030 ... 408-395-3700
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 ... 312-391-7733
Zenith Systems & Components Group, Zenith Electronics Corp., 1000 Milwaukee Ave., Glenview, IL 60025 ... 312-391-7733

Displays, Dot Matrix-2450 — *See Vol. B*

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Dividers, Analog-3130

Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235, 718-934-4500 ... A•1729
Action Instrs., 8601 Aero Dr., San Diego, CA 92123 ... 619-279-5726
§ American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 ... 301-826-8651
† Analog Devices, P.O. Box 280, Norwood, MA 02062 ... 617-329-4700
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 ... 201-887-5700
§† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 ... 201-743-2700
Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 ... 617-667-8700
§ Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050 ... 408-988-4930
Intronics, Inc., 57 Chapel St., Newton, MA 02158 ... 617-964-4000
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 ... 201-887-8100
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 ... 603-669-0054
Rochester Instr. Sys., 255 N. Union St., Rochester, NY 14605 ... 716-263-7700
Teledyne Philbrick, Allied Dr. Rte 128, Dedham, MA 02026 ... 617-329-1600
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 ... 516-293-3100

Dividers, Frequency-3450

† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ... A•1366
Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235, 718-934-4500 ... A•1729
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ... A•2210
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 ... 671-273-3333
American Electronic Labs., Box 552, Lansdale, PA 19446 ... 215-822-2929
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 ... 602-746-1111
Electro Scientific Inds., 13900 N.W. Science Pk. Dr., Portland, OR 97229 ... 503-641-4141
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 ... 201-887-5700
§† Luff Research, Box 449, Jackson Hgts., NY 11372 ... 718-429-5900
M/A-Com Microwave Components, Inc., M/A-Com, South Avenue, Burlington, MA 01803 ... 617-272-3000
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 ... 617-272-3000
§ Martin Sound Prods., 28 Alpha Park, Cleveland, OH 44143-2297 ... 216-442-2286
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 ... 203-866-8000
§† Plessey Semiconductors, 1641 Kaiser Ave., Irvine, CA 92714 ... 714-540-9979
RCA Solid State Div., Linear Integrated Circuits, Rte. 202, Somerville, NJ 08876 ... 201-685-6000
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 ... 617-653-0844
Sensor Corp., Box 140, Scottdale, PA 15683 ... 412-887-4080
§ Signetics, U.S. Philips Corp., 811 E. Arques Ave, P.O. Box 3409, Sunnyvale, CA 94088-3409 ... 408-739-7700
Spectracom, 101 Despatch Drive, East Rochester, NY 14445 ... 716-381-4827
Tempo Instrument, Inc., 87 Modular Ave., Commack, NY 11725 ... 516-864-3700

Dividers, Power (LF, HF, VHF, UHF)-3450

† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235, 718-934-4500 ... A•1719-1720,1729,1744-1755
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ... A•1780,2210
† Aiken Advanced Sys., Amstar Technical Products Company, Inc., 5901 Edsall Rd., Alexandria, VA 22304-4197 ... 703-370-0900
† Alan Inds., P.O. Box 1203, Columbus, IN 47201 ... 812-372-8869
Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 ... 617-935-8610
American Electronic Labs., Box 552, Lansdale, PA 19446 ... 215-822-2929
Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990 ... 215-723-8181
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 ... 315-432-8909
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 ... 516-231-8400
Automatic Connector, Inc., 400 Moreland Rd., Commack, NY 11725 ... 516-543-5000
† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 ... 408-496-6710
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 ... 216-267-2233
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 ... 914-337-4775
† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ... 207-655-4555;800-341-9678
Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33431 ... 305-994-1774
Electro Scientific Inds., 13900 N.W. Science Pk. Dr., Portland, OR 97229 ... 503-641-4141
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 ... 201-887-5700
JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203 ... 317-783-9875
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 ... 201-887-8100
§ KLM Electronics, 16890 Church St., P.O. Box 816, Morgan Hill, CA 95037 ... 408-779-7363
† Locus, Box 740, State College, PA 16804 ... 814-466-6275
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 ... 201-569-8282
§ Macom Inds., 8230 Haskell Ave., Van Nuys, CA 91406
M/A-Com Cable/Home Communication Prodelin Satellite Antenna Systems, M/A-Com, Inc., P.O. Box 468, Newton, NC 28658 ... 800-222-1195;704-464-4141
M/A-Com Microwave Components, Inc., M/A-Com, South Avenue, Burlington, MA 01803 ... 617-272-3000
† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 ... 603-424-4111
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 ... 201-575-1300
Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 ... 215-489-3700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 ... 203-866-8000
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 ... 802-864-0064
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 ... 516-231-1700
† Norsal Inds., 85 D Hoffman Lane So., Central Islip, NY 11722 ... 516-234-1200
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 ... 914-241-1334
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 ... 617-653-0844
Summit Engineering Corp., Box 938, Bozeman, MT 59715 ... 406-587-4511
† Technical Research & Mfg., Inc., R.F.D. # 10, Manchester, NH 03103 ... 603-627-6000
† Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, CA 91311 ... 818-882-1020
† Vega Precision Labs., 800 Follin La., Vienna, VA 22180 ... 703-938-6300

Vitek Elctrns., 4 Gladys Ct., Edison, NJ 08817 201-287-3200
Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
Wide Band Engrg. Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570

Dividers, Power, Microwave-3450

† **Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 ..... A•1705**
† **Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235, 718-934-4500 ..... A•1719-1720,1729,1744-1755**
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1780,2210
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
American Electronic Labs., Box 552, Lansdale, PA 19446 215-822-2929
Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990 215-723-8181
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33431 305-994-1774
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† Locus, Box 740, State College, PA 16804 814-466-6275
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§ Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ..... 315-437-3953; 800-448-1666
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reeve Electronics, Mellish E. Murray, 1720 W. Fulton St., Chicago, IL 60612 312-670-0150
RHG Electronics Lab., Inc., 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Technical Research & Mfg., Inc., R.F.D. # 10, Manchester, NH 03103 ... 603-627-6000
† Transco Products, Inc., 4241 Glencoe Ave., Marina del Rey, CA 90295 .. 213-822-0800
† Vectronics Microwave Corp., 276 Lincoln Blvd., Middlesex, NJ 08846 ... 201-356-2377
† Vega Precision Labs., 800 Follin La., Vienna, VA 22180 703-938-6300
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
§ Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877 ..... 301-948-3434; 800-638-2048

Dividers, Voltage-Also See Networks, Resistance; Transformers, Voltage Dividing-2900 — *See Vol. D*

Doublers, Frequency — See Multipliers, Frequency (Vol. A)

Doublers, Voltage-Also See Rectifiers, Bridges & Assemblies-4800

† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Megatran Electronic Power, Rising Sun Rd., Bordentown, NJ 08505 609-298-7300
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
§ Semikron, Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 ..... 603-883-8102; 1-800-258-1308
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
§ Staco Energy Prods. Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191

Down Converters-3400 — *See Vol. D*

Drafting Machines-4200 — *See Vol. C*

Drafting Symbols, Dry Transfer, Pressure Sensitive, etc. (Incl. Lettering)-4200 — *See Vol. C*

Drawers, Sliding-1400 — *See Vol. C*

Drills & Accessories, Manual & Power-5400 — *See Vol. C*

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Drivers, Chopper-1100 — *See Vol. D*

Drivers, Nut-5400 — *See Vol. C*

Drivers, Solenoid-4550 — *See Vol. B*

Drivers, Speaker-1300 — *See Vol. D*

Drivers, Switch-3450

American Electronic Labs., Box 552, Lansdale, PA 19446 215-822-2929
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Circuit Techn., 160 Smith St., Farmingdale, NY 11735 516-293-8686
Plessey Semiconductors, 1641 Kaiser Ave., Irvine, CA 92714 714-540-9979
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
† Technical Research & Mfg., Inc., R.F.D. # 10, Manchester, NH 03103 ... 603-627-6000

Drivers, Tube — See Drivers & Decoders for Readouts (Vol. B)

Drives & Drive Mechanisms (Dial)-2400 — *See Vol. C*

Drives/Subsystems, Core Disk Emulator-2000 — *See Vol. D*

Drives/Subsystems, Disk, 3½″ Diskette-2000 — *See Vol. D*

Drives/Subsystems, Disk, 5¼″ Diskette-2000 — *See Vol. D*

Drives/Subsystems, Disk, 5¼″ Winchester-2000 — *See Vol. D*

Drives, Subsystems, Disk, 8″ Diskette-2000 — *See Vol. D*

Drives/Subsystems, Disk, 8″ Winchester-2000 — *See Vol. D*

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Electromagnets-1850

Magnet Sales & Mfg. Co. Inc., 11250 Playa Court, Culver City, CA 90230-6127, 213-391-7213;800-421-6692 ..... A•1307

A.P.W. Co., Inc., 72 W. Main, Rockaway, NJ 07866 201-627-0643

Electronic Counter Countermeasures (ECCM) Fixes (MIL)-3475 – *See Vol. D*

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Emitters/Detectors, Infrared-3700

Texas Instruments Optoelectronics, P.O. Box 225012 MS12, Dallas, TX 75265, 214-995-3821 ..... B•1218

† Analog Modules, Inc., 126 Baywood Avenue, Longwood, FL 32750 ..... 305-339-4356/4355

§ Banner Engrg. Corp., 9714 - 10th Ave. N., Minneapolis, MN 55441 612-544-3164

Centronic Inc., 1101 Bristol Rd., Mountainside, NJ 07092 201-233-7200

Ledtronics, Inc., 4009 Pacific Coast Hwy., Torrance, CA 90505 213-534-1505

MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998 213-828-7496

Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900

NEC Electronics, Inc., 401 Ellis Street, Mtn. View, CA 94039 415-960-6000

Ortel Corp., 2015 W. Chestnut St., Alhambra, CA 91803 818-281-3636

§ Siemens Comps., Inc., Optoelectronics Div., 19000 Homestead Rd., Cupertino, CA 95014 408-257-7910

Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400

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Erasing Equipment, EPROM-3130

Ango Electronics Corp., Post Office Box 112, Harrison, NJ 07029 ..... 212-685-6336; 201-484-1115

Bytek Computer Systems Corp., 1021 S. Rogers Circle, Boca Raton, FL 33431 305-994-3520

Digelec, Inc., Affil. Wavetek Corp., 586 Weddell Drive, Suite 1, Sunnyvale, CA 94089 408-745-0722

GTEK, Inc., 307 Coleman Ave., Waveland, MS 39576 601-467-8048

International Instrumentation, 31131-602 Via Colinas, Westlake Vlg., CA 91362 213-991-9614

International Microsystems, 11554 C Ave., Auburn, CA 95603 800-325-6028

Oliver Advanced Engrg., 676 W. Wilson Ave., Glendale, CA 91203 818-240-0080

Signetics, U.S. Philips Corp., 811 E. Arques Ave, P.O. Box 3409, Sunnyvale, CA 94088-3409 408-739-7700
Southern Computer Corp., 3720 N. Stratford Rd. N.E., Atlanta, GA 30342 404-231-5363
§† Spectronics Corp., 956 Brush Hollow Rd., Westbury, NY 11590 516-333-4840
§ Turner Designs, 2247 Old Middlefield Way, Mountain View, CA 94043-2489 415-965-9800
UVP, Inc., 5100 Walnut Grove Ave., P.O. Box 1501, San Gabriel, CA 91778 818-285-3123

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Ferrite Material & Parts-1850

§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ..... A•1784
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Magnetic Products Div., 5900 N. Harrison St., Shawnee, OK 74801, 405-275-2100 ..... A•1298
§† Krystinel Corp., 126 Pennsylvania Ave., Paterson, NJ 07503, 201-345-8900 ..... A•1304
Premier Microwave, 35 New Broad St., Port Chester, NY 10573, 914-939-8900 ..... A•1781
§ Amperex Electronic Corp., Ferroxcube Div., 5083 Kings Hwy., Saugerties, NY 12477 914-246-2811
§† Atomergic Chemetals Corp., 100 Fairchild Ave., Plainview, NY 11803 ... 516-349-8800
† Centerflex Techn. Corp., 221 Seventh Ave., P.O. Box 21, Hawthorne, NJ 07507 201-423-0505
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
§† Countis Inds., 2670 Lockheed Way, Carson City, NV 89701 702-882-6123
§ Fair-Rite Prods., PO Box J, Wallkill, NY 12589 914-895-2055
Ferro Corp., Ottawa Chem. Div., 700 N. Wheeling St., Toledo, OH 43605 419-691-3507
Ferronics, 52 N. Main St., Fairport, NY 14450 716-223-1010
The Hoosier Magnetics Group, Hoosier of Ohio, Inc., 700 North Wheeling Street, Toledo, OH 43607 419-698-8087
Hoosier Magnetics, Inc., 520 E. Van Trees St., P.O. Box 753, Washington, IN 47501 812-254-1901
Hoosier of New York, Inc., Lower Denny Street, P.O. Box 372, Ogdensburg, NY 13669 315-393-2293
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Jobmaster Corp., 9008 Liberty Rd., Randallstown, MD 21133 301-655-1400
J. Tronics, Apollo Magnetics, 2720 W. Beverly Rd., Los Angeles, CA 90057 213-381-2500
† Magnetics, Box 391, Butler, PA 16003-0391 412-282-8282
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
National Micronetics, Route 28, West Hurley, NY 12136 914-338-0333
Permag, 400 Karin La., Hicksville, NY 11801 516-822-3311
† Quartzite Processing, Inc., 6 Holyoke St., Malden, MA 02148 617-322-1380
† Raytheon Co., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154 617-899-8400
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
Stackpole, Electronic Components Div., 201 Stackpole St., St. Marys, PA 15857 814-781-1234
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
† Thomson-CSF Comps. Corp., Special Prods. Div., 301 Rte. 17 North, Rutherford, NJ 07070 201-438-2300
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E5, Tampa, FL 33614 813-884-1411
Trans-Tech, 12 Meem Ave., Gaithersburg, MD 20760 301-948-3800
Trans-Tech, Inc., Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150

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Films, Resistance-4700

Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ... A•1923
† Acheson Colloids, P.O. Box 288, Port Huron, MI 48060 313-984-5581
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
§† Datak Corp., 65 Seventy-First St., Guttenberg, NJ 07093 201-869-2200
Electrostatic Consltg. Assocs., 556 Lowell Rd., Groton, MA 01450 617-448-5485
† Engelhard Corp., 70 Wood Ave. S., Iselin, NJ 08830 201-321-5900
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776 617-443-4631
Lehighton Elctrns., Inc., Box 328, Dept M, Lehighton, PA 18235 ..... 717-386-4156; 215-377-5990
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
Metavac, Inc., 45-68 162nd St., Flushing, NY 11358 ..... 212-HI5-0400

Filters, AF-2700

A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028, 212-737-1348 ..... A•1592
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ..... A•1327
† Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1603
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1604
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 ..... A•1609, D•1231
Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903, 714-759-2411 ..... A•1370
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322, 617-580-1660 ..... D•1259
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1381
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ..... A•1401
Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1618
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ..... A•1626
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1643
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1644
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
Alpha-Tek, 7286 Murdy Circle, Huntington Beach, CA 92647 714-847-7515
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591

Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
† Cirtech, EG & G, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 201-772-1106
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electronic Specialists, 171 South Main St., Natick, MA 01760 ..... 617-655-1532; 800-225-4876
Fogg Sys., 15592 E. Batavia Dr., Aurora, CO 80011 303-344-1883
§ Frazier, 1930 Valley View La., Dallas, TX 75234 214-241-3441
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 213-361-8691
§ Inmac, 2465 Augustine Dr., Santa Clara, CA 95054 408-727-1970
ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 607-272-7640
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Modular Audio Prods., Modular Devices Inc., 50 Orville Dr., Bohemia, NY 11716 516-567-9620
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
§ Pall Ultrafine Filtration Corp., 2200 Northern Blvd., East Hills, NY 11548 516-484-5400
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Rockwell Filter Prods., 2990 Airway Ave., Costa Mesa, CA 92626 714-641-5311
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60204 312-866-2200
Silicon Systems Inc., 14351 Myford Rd., Tustin, CA 92680 714-979-0941
Solar Elctrns. Co., 901 N. Highland, Hollywood, CA 90038 213-462-0806
Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625 813-855-6611
† Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900

Filters, Air — See Air Cleaners & Filters (Vol. C)

Filters, Antialias-2700

† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
Precision Filters, 240 Cherry St., Ithaca, NY 14850 607-277-3550

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Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 ..... A•1413
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Applied Research, Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224 213-537-5200
† Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 513-667-8484
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
† Cincinnati Elctrns., 2630 Glendale Milford Rd., Cincinnati, OH 45241 513-733-6100
† Cirtech, EG & G, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 216-267-2233
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700
Continental Electronics Mfg. Co., P.O. Box 270879, Dallas, TX 75227 214-381-7161
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
† Electro-Magnetic Processes, Inc., 9616 Owensmouth Ave., Chatsworth, CA 91311 818-882-6333
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
§ Electronic Specialists, 171 South Main St., Natick, MA 01760 ..... 617-655-1532; 800-225-4876
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§ Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ..... 315-437-3953; 800-448-1666
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RACOM Corp., 1028 W. Maude Ave. Ste. 401, Sunnyvale, CA 94086 408-737-2460
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
† Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ONT, CANADA L9W2Y8 416-669-1244
Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Transco Products, Inc., 4241 Glencoe Ave., Marina del Rey, CA 90295 213-822-0800
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010

Filters, Band Elimination-2700

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ..... A•1589
A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028, 212-737-1348 ..... A•1592
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 ..... A•1705
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407, 201-797-9655 ..... A•1593
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ..... A•1327,1595
CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 ..... A•1667
CTS Electronics Corp., Halex Division, 1202 McGaw Ave., Irvine, CA 92714, 714-261-6381 ..... A•1667
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1360
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1603
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1604
§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ..... A•1363
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ..... A•2151
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 ..... A•1609, D•1231
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1367
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ..... A•1369
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903, 714-759-2411 ..... A•1370
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 ..... A•1613
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322, 617-580-1660 ..... D•1259
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 ..... A•1386
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ..... A•1401
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1618
Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 ..... A•1413-1414,1417
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1621
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ..... A•1624
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... A•1425
† Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 ..... A•1432
Sokol Crystal Prods., Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 ..... A•1435
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1648,1650,1651,1655
Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Applied Research, Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
† Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 513-667-8484
† Cirtech, EG & G, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188

† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 .. 602-967-7874
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
Datel, General Electric Co., 11 Cabot Blvd., Mansfield, MA 02048 617-339-9341
§ De Coursey Engrg. Lab., 11828 W. Jefferson, Culver City, CA 90230 .... 213-EX7-9668
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Dynamics, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311 818-998-8281
Ealing Optics Co., Ealing Corp., 22 Pleasant St., S. Natick, MA 01760 617-655-7000
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
Eaton Corp., Microwave Products Division, 955 Benicia Avenue, Sunnyvale, CA 94086 408-730-6300
§† Eaton Corp, Yig-Tek Prods., 785 Palomar Ave., Sunnyvale, CA 94086 ... 408-737-7300
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electro-Mechanics Co., Box 1546, Austin, TX 78767 512-835-4684
§ Electro-Metrics, Penril Corp., 100 Church St, Amsterdam, NY 12010 518-843-2600
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
† Ferretec Inc., 1701A Fortune Dr., San Jose, CA 95131 408-263-1216
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 516-694-3600
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§† Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 607-272-7640
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501
Liberty Mirror, Libbey-Owens-Ford Co., 851 Third Ave., Brackenridge, PA 15014 412-224-1800
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
M/A-Com Microwave Components, Inc., M/A-Com, South Avenue, Burlington, MA 01803 617-272-3000
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
MARCONI INSTRUMENTS, 3 Pearl Court, Allendale, NJ 07401 201-934-9050
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 .....703-971-8606; 703-971-7082
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
† North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RACOM Corp., 1028 W. Maude Ave. Ste. 401, Sunnyvale, CA 94086 408-737-2460
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
Sentry Mfg., Crystal Park, Chickasha, OK 73018 ..... 405-224-6780;800-654-8850
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ONT, CANADA L9W2Y8 416-669-1244
§ Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
§ Spectra Sonics, 3750 Airport Rd., Ogden, UT 84403 801-392-7531
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Television Equip. Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 .. 216-232-8600
† Vibration Instrs. Co., 1614 Orangethorpe Way, Anaheim, CA 92801 714-879-6085
Vitek Elctrns., 4 Gladys Ct., Edison, NJ 08817 201-287-3200
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332
† Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832

Filters, Bandpass-2700

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ..... A•1585,1587,1589
Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1591
A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028, 212-737-1348 ..... A•1592
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 ..... A•1705
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407, 201-797-9655 ..... A•1593
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ..... A•1327,1595
CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1356
CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 ..... A•1667
CTS Electronics Corp., Halex Division, 1202 McGaw Ave., Irvine, CA 92714, 714-261-6381 ..... A•1667
Curtis Inds., 8000 West Tower Ave., Milwaukee, WI 53223, 414-354-1500 ..... A•1599
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1360
† Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1603
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1604
† Filtron Co., Inc., Div. of Aeroflex Labs., Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804, 516-752-1144 ..... A•1608
§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ..... A•1363
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ..... A•2151
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 ..... A•1609-1605, D•1231
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1367
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ..... A•1369
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903, 714-759-2411 ..... A•1370
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 .... A•1613
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322, 617-580-1660 ..... D•1259
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1381
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1386
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1397
† North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1780
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ..... A•1401
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1618
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 ..... A•1413,1417
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1620-1622,2263,2264
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ..... A•1624
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... A•1425
† Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 ..... A•1432
Sokol Crystal Prods., Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 ..... A•1435
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1644-1646,1648,1650,1651,1652
Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1656
† Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478, 216-232-8600 ..... A•1455
† Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
† Aeroflex Labs., Microelctrns. Div., 35 S. Service Rd., Plainview, NY 11803 516-694-6700
† Aiken Advanced Sys., Amstar Technical Products Company, Inc., 5901 Edsall Rd., Alexandria, VA 22304-4197 703-370-0900
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
§ American Microsignal, 8431 Monroe Ave., Stanton, CA 90680 714-761-1222
† Applied Research, Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
Aptek Microsystems, 700 N. W. 12th Ave., Deerfield Beach, FL 33441 ... 305-421-8450
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
† Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
† Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 608-752-8701
Bruel & Kjaer Instrs. Inc., 185 Forest St., Marlboro, MA 01752 617-481-7000
† Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310

Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 513-667-8484
† Cirtech, EG & G, 15237 Cherry St, Stanley, KS 66223 913-681-2801
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 216-267-2233
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Continental Electronics Mfg. Co., P.O. Box 270879, Dallas, TX 75227 214-381-7161
Continental Resources, Inc., 175 Middlesex Tpke., Bedford, MA 01730 .. 617-275-0850
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 .. 602-967-7874
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
§† Data-Control Sys., Commerce Dr., Box 860, Danbury, CT 06810 203-743-9241
Datel, General Electric Co., 11 Cabot Blvd., Mansfield, MA 02048 617-339-9341
§ De Coursey Engrg. Lab., 11828 W. Jefferson, Culver City, CA 90230 .... 213-EX7-9668
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Dyma Engrg., Box 1535, Los Lunas, NM 87031 505-865-6700
§ Dynamics, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311 818-998-8281
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
Eaton Corp., Microwave Products Division, 955 Benicia Avenue, Sunnyvale, CA 94086 408-730-6300
§† Eaton Corp, Yig-Tek Prods., 785 Palomar Ave., Sunnyvale, CA 94086 408-737-7300
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
Fogg Sys., 15592 E. Batavia Dr., Aurora, CO 80011 303-344-1883
§ Furman Sound, Inc., 30 Rich St., Greenbrae, CA 94904 415-927-1225
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§† Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Infrared Inds., Inc., P.O. Box 14200, Orlando, FL 32857 305-282-7700
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 607-272-7640
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON, CANADA M3B 1M2 416-447-8531
Liberty Mirror, Libbey-Owens-Ford Co., 851 Third Ave., Brackenridge, PA 15014 412-224-1800
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
M/A-Com Land Mobile Communications, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-3400
M/A-Com Microwave Components, Inc., M/A-Com, South Avenue, Burlington, MA 01803 617-272-3000
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 .....703-971-8606; 703-971-7082
§† Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ....315-437-3953; 800-448-1666
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054 ... 619-433-4510
Mu-Del Electronics, Inc., 2426 Linden Lane, Silver Spring, MD 20910-1288 301-587-6087
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RACOM Corp., 1028 W. Maude Ave. Ste. 401, Sunnyvale, CA 94086 408-737-2460
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
Resdel Engrg., 300 E. Live Oak Ave., Arcadia, CA 91006 213-684-2600
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Rockwell Filter Prods., 2990 Airway Ave., Costa Mesa, CA 92626 714-641-5311
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
† Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
§ Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505 213-530-8777
Sentry Mfg., Crystal Park, Chickasha, OK 73018 ..... 405-224-6780;800-654-8850
SFE Technologies, 1501 1st St., San Fernando, CA 91340 213-365-9411
Signatron, A Unit of Sundstrand Corp., 12 Hartwell Ave., Lexington, MA 02173 617-861-1500
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ONT, CANADA L9W2Y8 416-669-1244
Solar Elctrns. Co., 901 N. Highland, Hollywood, CA 90038 213-462-0806
§ Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
§ Spectra Sonics, 3750 Airport Rd., Ogden, UT 84403 801-392-7531
§† Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
Tektronix, Inc., P. O. Box 500, Y3-314, Beaverton, OR 97077 ..... 800-547-1512;Oregon only 800-452-1877
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
§ Television Equip. Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
§ Tucker Elctrns., Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Vibration Instrs. Co., 1614 Orangethorpe Way, Anaheim, CA 92801 714-879-6085
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625 813-855-6611
Vitek Elctrns., 4 Gladys Ct., Edison, NJ 08817 201-287-3200
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
† Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332
† Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832
Wide Band Engrg. Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570

Filters, Bandpass, SAW (Surface Acoustic Wave)-2700

† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1591
† Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 ..... A•1432
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
† Dontech Inc., 601-606 Airport Indl. Blvd., Doylestown, PA 18901 215-348-5010
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
RF Monolithics, Inc., 4441 Sigma Rd., Dallas, TX 75234 214-233-2903
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
Toyo Comm. Equip. Co., Ltd., No. 8 Mori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, TOKYO, JAPAN 105 ..... 03-459-7320/03-459-7310
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Filters, Band Reject, Band Stop — See Filters, Band Elimination (Vol. A)

Filters, Ceramic-2700

Curtis Inds., 8000 West Tower Ave., Milwaukee, WI 53223, 414-354-1500 ..... A•1599
Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011, 212-691-9050 ..... A•1071
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1397 ,1582
NTK Technical Ceramics, NGK Spark Plugs (U.S.A.), Inc., 1701 N. Greenville Ave. # 205, Richardson, TX 75081, 214-235-8332 ..... A•1399
§† SFE Technologies, 1501 1st St., San Fernando, CA 91340, 213-365-9411 ..... A•1630
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1643

† **Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1656**
A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
AMP Incorporated, Box 3608, Harrisburg, PA 17105 717-564-0100
Assembly Specialists, 914 Main St, Box 965, Acton, MA 01720 617-263-9100
§† AVX Corporation, Box 867, Myrtle Bch., SC 29577 803-448-9411
Centre Engrg., 2820 E. College Ave., State College, PA 16801 814-237-0321
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§† Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN ... 489-5333
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
† Norton, One New Bond St., Worcester, MA 01606 617-853-1000
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
§† Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
Star Porcelain, 71 Muirhead Ave., Trenton, NJ 08638 609-392-3154
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
† U S Microtek Components Corporation, 11144 Penrose St., Sun Valley, CA 91352 818-767-6770
† Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 .. 216-232-8600
Viclan, 7373A Engineers Rd., San Diego, CA 92138 619-292-1411

Filters, Coaxial-2700

† **Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 ..... A•1705**
† **North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1780**
Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1618
SFE Technologies, 1501 1st St., San Fernando, CA 91340, 213-365-9411 ..... A•1630
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1648-1657,1650,1651
Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1656
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Automatic Connector, Inc., 400 Moreland Rd., Commack, NY 11725 516-543-5000
Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 216-267-2233
Cornell-Dubilier Electronics, 150 Avenue "L", Newark, NJ 07105 201-589-7500
† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
§ Macom Inds., 8230 Haskell Ave., Van Nuys, CA 91406
M/A-Com Microwave Components, Inc., M/A-Com, South Avenue, Burlington, MA 01803 617-272-3000
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ... 315-437-3953; 800-448-1666
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RACOM Corp., 1028 W. Maude Ave. Ste. 401, Sunnyvale, CA 94086 408-737-2460
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
§ Sealectro, 225 Hoyt St, Mamaroneck, NY 10543 914-698-5600
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ONT, CANADA L9W2Y8 416-669-1244
Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
Telco Products Co., 44 Sea Cliff, Glen Cove, NY 11542 516-759-0300
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† Transco Products, Inc., 4241 Glencoe Ave., Marina del Rey, CA 90295 .. 213-822-0800
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
Veeco Instruments Inc., Terminal Dr., Plainview, NY 11803 516-349-8300
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
† Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332

Filters, Color, Panel Light - Also see Lenses, Readout & Display; Lenses, Filters, Windows, Infrared-2450 — *See Vol. B*

Filters, Comb-2700

† **Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1386**
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ..... A•1626
Sokol Crystal Prods., Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 ..... A•1435
Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
† Applied Research, Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
† Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 608-752-8701
† Cirtech, EG & G, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 .. 602-967-7874
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 .. 914-664-2333
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903 714-759-2411
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054 ... 619-433-4510
North Hills Elctrns., 1 Alexander Pl, Glen Cove, NY 11542 516-671-5700
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
† Piezo Crystal, 100 "K" St, Box 619, Carlisle, PA 17013 717-249-2151
RACOM Corp., 1028 W. Maude Ave. Ste. 401, Sunnyvale, CA 94086 408-737-2460
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Rockwell Filter Prods., 2990 Airway Ave., Costa Mesa, CA 92626 714-641-5311
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ONT, CANADA L9W2Y8 416-669-1244
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224

Filters, Continuously Variable-2700

A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028, 212-737-1348 ..... A•1592
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322, 617-580-1660 ..... D•1259
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ..... A•1626
§ AMF Inc., AMF Cuno/General Filter Products Division, 400 Research Pkwy., Meriden, CT 06450 203-237-5541
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 216-267-2233
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700

† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
† Deltronic Crystal Inds., 215 Rt. 10, Bldg. 3, Sec. 5, Randolph, NJ 07869 201-361-2222
§ Dynamics, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311 818-998-8281
Eaton Corp., Microwave Products Division, 955 Benicia Avenue, Sunnyvale, CA 94086 408-730-6300
§† Eaton Corp, Yig-Tek Prods., 785 Palomar Ave., Sunnyvale, CA 94086 ... 408-737-7300
ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
Fogg Sys., 15592 E. Batavia Dr., Aurora, CO 80011 303-344-1883
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 516-694-3600
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ...315-437-3953; 800-448-1666
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
Palomar Engrs., Box 455, Escondido, CA 92025 619-747-3343
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RACOM Corp., 1028 W. Maude Ave. Ste. 401, Sunnyvale, CA 94086 408-737-2460
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† TRAK Microwave, Western Division, 735 Palomar Ave, Dept. E-5, Sunnyvale, CA 94086 408-735-9660
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100
† Vibration Instrs. Co., 1614 Orangethorpe Way, Anaheim, CA 92801 714-879-6085
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625 813-855-6611
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332
† Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900

Filters, Crystal (Incl. Monolithic Devices)-2300

† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ..... A•1327,1595
† CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1356
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1360
§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ..... A•1363
Frequency and Time Systems, Inc., DATUM, INC., 34 Tozer Rd., Beverly, MA 01915, 617-927-8220 ..... A•1364
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1367
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ..... A•1369
Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ..... A•1610
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903, 714-759-2411 ..... A•1370
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1381
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1386
† Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054, 619-433-4510 ..... A•1391
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1396
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ..... A•1401
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 ..... A•1413-1415,1417
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... A•1425
Sokol Crystal Prods., Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 ..... A•1435
† Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
† Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 608-752-8701
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 ..... 714-991-1580; 800-854-XTAL
† Cirtech, EG & G, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 .. 602-967-7874
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§† Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON, CANADA M3B 1M2 416-447-8531
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
§ Q-Matic Corp., 3194-D Airport Loop Dr., Costa Mesa, CA 92626 714-545-8233
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Savoy Elctrns., P.O. Box 5727, Ft. Lauderdale, FL 33310 .. 305-563-1333;800-327-1282
Sentry Mfg., Crystal Park, Chickasha, OK 73018 ..... 405-224-6780;800-654-8850
Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111

Filters, Delay-2700

Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900

Filters, Digital-2700

Curtis Inds., 8000 West Tower Ave., Milwaukee, WI 53223, 414-354-1500 ..... A•1599
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 ..... D•1231
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1643
† Aeroflex Labs., Microelctrns. Div., 35 S. Service Rd., Plainview, NY 11803 516-694-6700
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028 212-737-1348
Bruel & Kjaer Instrs. Inc., 185 Forest St., Marlboro, MA 01752 617-481-7000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Mathematical Systems Design, Inc., 2850 Ocean Park Blvd., Ste. 300, Santa Monica, CA 90405 213-450-9851
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
Precision Filters, 240 Cherry St., Ithaca, NY 14850 607-277-3550
RCI/Data, 1992 Lakewood Rd., Toms River, NJ 08753 201-341-8361
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
Signatron, A Unit of Sundstrand Corp., 12 Hartwell Ave., Lexington, MA 02173 617-861-1500
Television Equip. Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900

Filters, Display-2450 — *See Vol. B*

Filters, EMI/RFI-2700

Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2112-2113,2117
AMP Incorporated, Box 3608, Harrisburg, PA 17105, 717-564-0100 ..... A•1590
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ..... A•1215
§ Compac, 279 Skidmore Rd., Deer Park, NY 11729, 516-667-3933 ..... A•1594
Control Concepts Corp., P.O. Box 1380, Binghamton, NY 13902-1380, 607-724-2484 ..... B•1233
§ Corcom, Inc., 1600 Winchester Rd., Libertyville, IL 60048, 312-680-7400 ..... A•1596
§† Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470, 201-256-2000 ..... A•1597
§ Curtis Inds., 8000 West Tower Ave., Milwaukee, WI 53223, 414-354-1500 ..... A•1599
§ Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545, 415-785-5231;415-785-5235 ..... A•1600
Filter Concepts Inc., 2624 S. Rousselle, Santa Ana, CA 92707, 714-545-7003 ..... A•1606
† Filtron Co., Inc., Div. of Aeroflex Labs., Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804, 516-752-1144 ..... A•1608
§† JMK, Inc., 15 Caldwell Dr., Amherst, NH 03060, 603-886-4100 ..... A•1611
† Lindgren RF Enclosures, Inc., 1228 Capitol Drive, Addison, IL 60101, 312-628-9100 ..... C•1726
† Metuchen Capacitors, Inc., 420 Park Ave., Perth Amboy, NJ 08861, 201-442-0500 ..... A•1133 ,1614,1615
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1582,1616,1617
NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... D•1735
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... D•1735
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2213
Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1270
Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1622
Potter Co., P.O. Box 337, North Hwy. 51, Wesson, MS 39191, 601-643-2215 ..... A•1623

Power Dynamics, 59 Lakeside Ave., West Orange, NJ 07052, 201-762-6886 ..... A•1628
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ..... A•1274
† **RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706, 516-231-6400 ..... A•1629**
SFE Technologies, 1501 1st St., San Fernando, CA 91340, 213-365-9411 ..... A•1630
Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 ..... A•1632
§† **Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505, 814-455-0966 .. A•1635**
§ **Standex Elctrns., 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... A•1638**
§ **TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076, 312-679-8200 ..... A•1278,1640,1641**
Amphenol, An Allied Co., 43 Commerce Ct., Lisle, IL 60532 312-983-3500
† Ark Elctrns. Corp., 1325 Industrial Hwy., Southampton, PA 18966 215-322-6510
† Astronautics Corporation of America, P.O. Box 523, Milwaukee, WI 53201-0523 414-447-8200
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† Brady Co., 574A Somerset St., N. Plainfield, NJ 07060 201-753-7988
Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 513-667-8484
† Centre Engrg., 2820 E. College Ave., State College, PA 16801 814-237-0321
† Chomerics, Inc., 77 Dragon Ct., Woburn, MA 01888 617-935-4850
† Circle Electronics, A Division of F-Dyne Elctrns., 3501 Electronics Way, W. Palm Beach, FL 33407 305-844-1310
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700
§ Cornell-Dubilier Electronics, 150 Avenue "L", Newark, NJ 07105 201-589-7500
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
§ Current Technology, Inc., 1400 S. Sherman, # 202, Richardson, TX 75081 214-238-5300
De Coursey Engrg. Lab., 11828 W. Jefferson, Culver City, CA 90230 ..... 213-EX7-9668
§ Displex, Inc., Alexander Place, Glen Cove, NY 11542 516-671-4400
Dontech Inc., 601-606 Airport Indl. Blvd., Doylestown, PA 18901 215-348-5010
† Dynamic Air Engrg, Inc., EMC Filter Div., 620 E. Dyer Rd., Santa Ana, CA 92705 714-540-2081
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§ Electronic Specialists, 171 South Main St., Natick, MA 01760 ..... 617-655-1532; 800-225-4876
† Elmag, 54 Clark St., Newark, NJ 07104 201-481-1600
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
§ Ericson Mfg. Co., 4215 Hamann Pkwy., Willoughby, OH 44094 216-951-8000
ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† Estes Engrg. Co., 930 Marine Dr., Port Angeles, WA 98362 206-457-0904
† Evaporated Coatings, P.O. Box 160, Huntingdon Valley, PA 19006 215-947-1465
§† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
§ Fan-S Corp., 7158 Industrial Pk. Blvd., Mentor, OH 44060 216-951-3300
† F-Dyne Elctrns., 449 Howard Ave., Bridgeport, CT 06605 203-367-6431
† Fil-Coil Economy Intl, Inc., 800 Axinn Ave., Garden City, NY 11530 516-228-9445
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§† Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 213-361-8691
§† Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
Inter-Technical Grp., Box 23, Irvington, NY 10533 914-591-8822
ITC Systems, Inc., 3739 Meru Lane, Santa Barbara, CA 93105 805-682-8122
§† ITT Cannon, 666 E. Dyer Road, Santa Ana, CA 92705-5684 714-557-4700
Kaiglo Elctrns. Co., Inc., 6584 Ruch Rd., E. Allen Twp., Bethlehem, PA 18017 215-837-0700
Keene Ray Proof, Keene Corp., 50 Keeler Ave., Norwalk, CT 06878 203-838-4555
Kessler-Ellis Prods., 120 1st Ave., Atlantic Highlands, NJ 07716 ..... 201-291-0500; 800-631-2165
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
Lambda Electronics, Veeco Instr., Inc., 515 Broad Hollow Rd., Melville, NY 11747 516-694-4200
§ Lea Dynatech, Inc., 12516 Lakeland Rd., Santa Fe Springs, CA 90670-9990 213-944-0916
Lectro Magnetics, Inc., 6056 W. Jefferson Blvd., Los Angeles, CA 90016 ..... 800-325-9814;213-870-9383
Liberty Mirror, Libbey-Owens-Ford Co., 851 Third Ave., Brackenridge, PA 15014 412-224-1800
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
† Metavac, Inc., 45-68 162nd St., Flushing, NY 11358 ..... 212-HI5-0400
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
† Optical & Conductive Coatings, Meridian Inds., Inc., 428 N. Buchanan Cir., # 8, Pacheco, CA 94553 415-798-6066
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Panel Components Corp., P.O. Box 6626M, Santa Rosa, CA 95406 707-523-0600
† Power Integrity Corp., 1840 Pembroke Rd., P.O. Box 9682, Greensboro, NC 27408 919-379-9773
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
† Research Prods., 1015 E Washington Ave., Madison, WI 53701 608-257-8801
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
RTE Aerovox Inc., 740 Belleville Ave., New Bedford, MA 02745 617-994-9661
† Rtron Corp., 7324 Lawndale, Skokie, IL 60076 312-679-7180
§ SAFT America, Inc., Elctrns. Sys. Div., 2414 W. 14th St., Tempe, AZ 85281 602-894-6864
† Sanders Assocs., Inc., Electromagnetic, EMC Dept., 95 Canal St., Nashua, NH 03061 603-885-3602
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
Schaffner EMC, Inc., 825 Lehigh Ave., Union, NJ 07083 201-851-0644
§ Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
SL Homalite, Div. of SL Inds., 11 Brookside Dr., Wilmington, DE 19804 .. 302-652-3686
SL Waber, 300 Harvard Ave., Westville, NJ 08093 ..... 609-456-5400;800-257-8384
Solar Elctrns. Co., 901 N. Highland, Hollywood, CA 90038 213-462-0806
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
† Southern Electronics, F-Dyne, 726 So. Flower St., Burbank, CA 91502 ... 213-845-2458
§ SPECO Div., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757 ..... 516-957-8700;800-645-5516
§† Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§† Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
§ Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§ Sun-Flex Co., Inc., 20 Pimentel Ct., Novato, CA 94947 415-883-1221
§† Surgeonics Ltd., 344 Main St., Mt. Kisco, NY 10549 914-241-3203
† Tobe Deutschmann Labs., Inc., 550 Turnpike St., Canton, MA 02021 617-828-3366
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161
† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144 602-744-0400
TWP, Inc., 2133 4th St., Berkeley, CA 94710 415-548-4434
Universal Electronics Inc., 3475 A. Victor St., Santa Clara, CA 95050 408-970-0455
† Universal Shielding Corp., 20 W. Jefryn Blvd., Deer Park, NY 11729 516-667-7900
† U S Microtek Components Corporation, 11144 Penrose St., Sun Valley, CA 91352 818-767-6770
Viclan, 7373A Engineers Rd., San Diego, CA 92138 619-292-1411
§ Vidaire Electronics Mfg. Corp., P. O. Box 788, Freeport, NY 11520 516-623-6696
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141

Filters, Equalizer-2700

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ..... A•1586
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1603
† **Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ..... A•1369**
† **KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 .... A•1613**
† **Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... A•1425**
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028 212-737-1348
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
§ Cermetek Microelectronics Inc., 1308 Borregas Ave., Sunnyvale, CA 94088 408-752-5000
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
† Cirtech, EG & G, 15237 Cherry St., Stanley, KS 66223 913-681-2801
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700
Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 .. 602-967-7874
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
§ Frazier, 1930 Valley View La., Dallas, TX 75234 214-241-3441
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Precision Filters, 240 Cherry St., Ithaca, NY 14850 607-277-3550
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Rockwell Filter Prods., 2990 Airway Ave., Costa Mesa, CA 92626 714-641-5311
† Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
§ Spectra Sonics, 3750 Airport Rd., Ogden, UT 84403 801-392-7531
Television Equip. Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010

Filters, Harmonic-2700

Curtis Inds., 8000 West Tower Ave., Milwaukee, WI 53223, 414-354-1500 ..... A•1599
Filtron Co., Inc., Div. of Aeroflex Labs., Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804, 516-752-1144 ..... A•1608

§ Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ..... A•1363
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1621
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ..... A•1626
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1648,1650,1651
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028 212-737-1348
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
† Cirtech, EG & G, 15237 Cherry St, Stanley, KS 66223 913-681-2801
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 216-267-2233
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700
Continental Electronics Mfg. Co., P.O. Box 270879, Dallas, TX 75227 214-381-7161
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ..... 315-437-3953; 800-448-1666
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ONT, CANADA L9W2Y8 416-669-1244
Telco Products Co., 44 Sea Cliff, Glen Cove, NY 11542 516-759-0300
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Vibration Instrs. Co., 1614 Orangethorpe Way, Anaheim, CA 92801 714-879-6085
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
† Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900

Filters, High Pass-2700

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ..... A•1584,1586,1589
A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028, 212-737-1348 ..... A•1592
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407, 201-797-9655 ..... A•1593
Curtis Inds., 8000 West Tower Ave., Milwaukee, WI 53223, 414-354-1500 ..... A•1599
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1360
† Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1603
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1604
Filtron Co., Inc., Div. of Aeroflex Labs., Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804, 516-752-1144 ..... A•1608
§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ..... A•1363
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ..... A•2151
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 ..... D•1231
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 ..... A•1613
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322, 617-580-1660 ..... D•1259
† North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1780
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ..... A•1401
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1618
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1620-1622,2263,2264
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ..... A•1624
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... A•1425
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1648-1651,1653,1654
Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Applied Research, Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† Balzers Optical Grp., 170 Locke Dr., Marlboro, MA 01752 617-481-9860
Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224 213-537-5200
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
Bruel & Kjaer Instrs. Inc., 185 Forest St., Marlboro, MA 01752 617-481-7000
† Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 513-667-8484
† Cirtech, EG & G, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 216-267-2233
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700
Continental Resources, Inc., 175 Middlesex Tpke., Bedford, MA 01730 617-275-0850
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 602-967-7874
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
§† Data-Control Sys., Commerce Dr., Box 860, Danbury, CT 06810 203-743-9241
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 201-772-1106
Datel, General Electric Co., 11 Cabot Blvd., Mansfield, MA 02048 617-339-9341
De Coursey Engrg. Lab., 11828 W. Jefferson, Culver City, CA 90230 ..... 213-EX7-9668
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Dyma Engrg., Box 1535, Los Lunas, NM 87031 505-865-6700
§ Dynamics, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311 818-998-8281
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§ Electronic Specialists, 171 South Main St., Natick, MA 01760 ..... 617-655-1532; 800-225-4876
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elmag, 54 Clark St., Newark, NJ 07104 201-481-1600
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
§† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
Fogg Sys., 15592 E. Batavia Dr., Aurora, CO 80011 303-344-1883
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§† Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ..... Call Local Sls. Off.
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 213-361-8691
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903 714-759-2411
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
Infrared Inds., Inc., P.O. Box 14200, Orlando, FL 32857 305-282-7700
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 607-272-7640
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501
Lectro Magnetics, Inc., 6056 W. Jefferson Blvd., Los Angeles, CA 90016 ..... 800-325-9814;213-870-9383
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
M/A-Com Microwave Components, Inc., M/A-Com, South Avenue, Burlington, MA 01803 617-272-3000

† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 ..... 703-971-8606; 703-971-7082
§† Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188 617-337-4200
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 .... 315-437-3953; 800-448-1666
† Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054 ... 619-433-4510
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
Optics International, Box 101, Tenafly, NJ 07670 201-567-4799
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
† Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
Sentry Mfg., Crystal Park, Chickasha, OK 73018 ..... 405-224-6780;800-654-8850
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60204 312-866-2200
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ONT, CANADA L9W2Y8 416-669-1244
Solar Elctrns. Co., 901 N. Highland, Hollywood, CA 90038 213-462-0806
Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
§ Spectra Sonics, 3750 Airport Rd., Ogden, UT 84403 801-392-7531
§ Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
§ Tucker Elctrns., Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
† U S Microtek Components Corporation, 11144 Penrose St., Sun Valley, CA 91352 818-767-6770
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625 813-855-6611
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
† Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332
† Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832
Wide Band Engrg. Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Filters, Hybrid-2700

A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028, 212-737-1348 ..... A•1592
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ..... A•1327,1595
CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1356
Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ..... A•1369
† Aydin Vector Div., Box 328, Newtown, PA 18940 215-968-4271
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776 617-443-4631
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
Modular Devices, 50 Orville Dr., Bohemia, NY 11716 516-567-9620
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Filters, IF-2700

† **Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ..... A•1327,1595**
† **CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1356**
† **Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1360**
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1603
† **ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1604**
Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ..... A•1363
† **KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 .... A•1613**
† **McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1381**
§ **Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1396**
† **OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ..... A•1401**
Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 ..... A•1413-1414,1418
† **Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 ..... A•1432**
Sokol Crystal Prods., Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 ..... A•1435
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1644-1645,1647,1649
† Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
† Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 608-752-8701
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
† Cirtech, EG & G, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
§ Cornell-Dubilier Electronics, 150 Avenue "L", Newark, NJ 07105 201-589-7500
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 .. 602-967-7874
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903 714-759-2411
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501
† LNR Communications, Inc., 180 Marcus Blvd., Hauppauge, NY 11788 ... 516-273-7111
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188 617-337-4200
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054 ... 619-433-4510
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
Oxley, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 213-463-5120
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Rockwell Filter Prods., 2990 Airway Ave., Costa Mesa, CA 92626 714-641-5311
Sentry Mfg., Crystal Park, Chickasha, OK 73018 ..... 405-224-6780;800-654-8850
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
Toyo Comm. Equip. Co., Ltd., No. 8 Mori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, TOKYO, JAPAN 105 ..... 03-459-7320/03-459-7310
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 .. 216-232-8600
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
† Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332

Filters, Ladder-2700

Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 608-752-8701
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 .. 216-232-8600

Filters, LC-2700

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ..... A•1462,1584-1589

Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407, 201-797-9655 ..... **A•1593**
† **Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700** ..... **A•1327,1595**
† **Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333** ..... **A•1603**
† **ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400** ..... **A•1604**
† **Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500** ..... **A•1369**
† **KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900** ..... **A•1613**
† **Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200** ..... **A•1386**
† **OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600** ..... **A•1401**
† **Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501** ..... **A•1618**
Sokol Crystal Prods., Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 ..... **A•1435**
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... **A•1643**
† Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
† Applied Research, Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224 213-537-5200
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 608-752-8701
† Cirtech, EG & G, 15237 Cherry St., Stanley, KS 66223 913-681-2801
† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 602-967-7874
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
† Dynamic Air Engrg, Inc., EMC Filter Div., 620 E. Dyer Rd., Santa Ana, CA 92705 714-540-2081
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elmag, 54 Clark St., Newark, NJ 07104 201-481-1600
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§ Hartley Prods., 620 Island Rd., Ramsey, NJ 07446 201-327-4443
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 213-361-8691
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501
Lectro Magnetics, Inc., 6056 W. Jefferson Blvd., Los Angeles, CA 90016 ..... 800-325-9814;213-870-9383
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 617-329-1508
† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 ..... 703-971-8606; 703-971-7082
Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054 619-433-4510
Mu-Del Electronics, Inc., 2426 Linden Lane, Silver Spring, MD 20910-1288 301-587-6087
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
† Performance Controls Inc., 333-E Byberry Rd., Hatboro, PA 19040 215-675-6500
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† Power Integrity Corp., 1840 Pembroke Rd., P.O. Box 9682, Greensboro, NC 27408 919-379-9773
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
Rtron Corp., 7324 Lawndale, Skokie, IL 60076 312-679-7180
† Sanders Assocs., Inc., Electromagnetic, EMC Dept., 95 Canal St., Nashua, NH 03061 603-885-3602
SFE Technologies, 1501 1st St., San Fernando, CA 91340 213-365-9411
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
† Thinco Div., Hull Corp., Davisville Rd., Hatboro, PA 19040 215-672-7800
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224
† Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144 602-744-0400
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100
† U S Microtek Components Corporation, 11144 Penrose St., Sun Valley, CA 91352 818-767-6770
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

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Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ..... **A•1588**
Curtis Inds., 8000 West Tower Ave., Milwaukee, WI 53223, 414-354-1500 ..... **A•1599**
† **ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400** ..... **A•1604**
† **Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500** ..... **A•1369**
† **KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900** ..... **A•1613**
† **Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200** ..... **A•1386**
† **OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600** ..... **A•1401**
† **Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501** ..... **A•1618**
† **Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000** ..... **A•1413 ,1415,1417**
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ..... **A•1624,1626**
† **Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860** ..... **A•1432**
Sokol Crystal Prods., Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 ..... **A•1435**
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... **A•1647,1649**
† Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028 212-737-1348
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
† Cirtech, EG & G, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700
Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 602-967-7874
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
§† Data-Control Sys., Commerce Dr., Box 860, Danbury, CT 06810 203-743-9241
Datel, General Electric Co., 11 Cabot Blvd., Mansfield, MA 02048 617-339-9341
§ De Coursey Engrg. Lab., 11828 W. Jefferson, Culver City, CA 90230 ..... 213-EX7-9668
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Dynamics, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311 818-998-8281
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903 714-759-2411
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ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 607-272-7640
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† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322 617-580-1660
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON, CANADA M3B 1M2 416-447-8531
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 617-329-1508
† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 ..... 703-971-8606; 703-971-7082
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Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100

† North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Rockwell Filter Prods., 2990 Airway Ave., Costa Mesa, CA 92626 714-641-5311
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 312-297-0070
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332
† Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900

Filters, Low Pass-2700

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A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028, 212-737-1348 ..... A•1592
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407, 201-797-9655 ..... A•1593
§ Compac, 279 Skidmore Rd., Deer Park, NY 11729, 516-667-3933 ..... A•1594
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ..... A•1327,1595
CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 ..... A•1667
CTS Electronics Corp., Halex Division, 1202 McGaw Ave., Irvine, CA 92714, 714-261-6381 ..... A•1667
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1360
† Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1603
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1604
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ..... A•2151
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 ..... A•1609, D•1231
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ..... A•1369
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 ..... A•1613
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322, 617-580-1660 ..... D•1259
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ..... A•1401
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1618
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1620-1622,2263,2264
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ..... A•1624
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... A•1425
† SFE Technologies, 1501 1st St., San Fernando, CA 91340, 213-365-9411 ..... A•1630
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1647-1648,1650,1651,1653,1654
Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
† Aeroflex Labs., Microelctrns. Div., 35 S. Service Rd., Plainview, NY 11803 516-694-6700
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
AMP Incorporated, Box 3608, Harrisburg, PA 17105 717-564-0100
§ Analogic Corp., 8 Centennial Dr., Peabody, MA 01961 .....617-532-5660;617-777-4500; 617-246-0300;800-451-1
† Applied Research, Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
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† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
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† Balzers Optical Grp., 170 Locke Dr., Marlboro, MA 01752 617-481-9860
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† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
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Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 216-267-2233
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Continental Resources, Inc., 175 Middlesex Tpke., Bedford, MA 01730 .. 617-275-0850
† Control Concepts Corp., P.O. Box 1380, Binghamton, NY 13902-1380 ... 607-724-2484
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† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ..... 207-655-4555;800-341-9678
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§ Dyma Engrg., Box 1535, Los Lunas, NM 87031 505-865-6700
† Dynamic Air Engrg, Inc., EMC Filter Div., 620 E. Dyer Rd., Santa Ana, CA 92705 714-540-2081
§ Dynamics, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311 818-998-8281
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electronic Specialists, 171 South Main St., Natick, MA 01760 .....617-655-1532; 800-225-4876
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elmag, 54 Clark St., Newark, NJ 07104 201-481-1600
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EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
† Fil-Coil Economy Intl., Inc., 800 Axinn Ave., Garden City, NY 11530 516-228-9445
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† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
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† Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 213-361-8691
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903 714-759-2411
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† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
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Lectro Magnetics, Inc., 6056 W. Jefferson Blvd., Los Angeles, CA 90016 ..... 800-325-9814;213-870-9383
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M/A-Com Land Mobile Communications, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-3400
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
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Marel Instr. Co., 907 South East 13th Pl., Cape Coral, FL 33904 813-574-8788
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
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§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ....315-437-3953; 800-448-1666
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§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
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† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
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Rtron Corp., 7324 Lawndale, Skokie, IL 60076 312-679-7180
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
† Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
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§† Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
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§ Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 312-297-0070
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
§ Tucker Elctrns., Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
† U S Microtek Components Corporation, 11144 Penrose St, Sun Valley, CA 91352 818-767-6770
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 .. 216-232-8600
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625 813-855-6611
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
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† Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832
Wide Band Engrg. Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570

Filters, Mechanical-2700

Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1643
A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
§ AMF Inc., AMF Cuno/General Filter Products Division, 400 Research Pkwy., Meriden, CT 06450 203-237-5541
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† Fil-Coil Economy Intl, Inc., 800 Axinn Ave., Garden City, NY 11530 516-228-9445
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Pall Ultrafine Filtration Corp., 2200 Northern Blvd., East Hills, NY 11548 516-484-5400
† Penfield, Inc., West & W. Main Sts., Plantsville, CT 06479 203-621-9141
RACOM Corp., 1028 W. Maude Ave. Ste. 401, Sunnyvale, CA 94086 408-737-2460
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Rockwell Filter Prods., 2990 Airway Ave., Costa Mesa, CA 92626 714-641-5311
§† Rockwell Int'l., 4311 Jamboree Rd., Newport Beach, CA 92660 800-854-8099
Rockwell Intl., Commercial Elctrns. Opers., 1200 N. Alma Rd., Richardson, TX 75081 214-996-5000
§ Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505 213-530-8777
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161
TWP, Inc., 2133 4th St., Berkeley, CA 94710 415-548-4434
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332

Filters, Microwave-3450

† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 ..... A•1705
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ..... A•1327,1595
ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1604
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1780
Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1618
Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 ..... A•1413,1417
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† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
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† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
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† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
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† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
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Eaton Corp., Microwave Products Division, 955 Benicia Avenue, Sunnyvale, CA 94086 408-730-6300
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† Epsilon-Lambda Elctrns. Corp., 427 Stevens St., Geneva, IL 60134 312-232-9611
† Ferretec Inc., 1701A Fortune Dr., San Jose, CA 95131 408-263-1216
Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 516-694-3600
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
§ Integra, Inc., 2368 Walsh Ave., Santa Clara, CA 95051 408-727-9601
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
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† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
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† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 ..... 703-971-8606; 703-971-7082
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† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ....315-437-3953; 800-448-1666
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
Mu-Del Electronics, Inc., 2426 Linden Lane, Silver Spring, MD 20910-1288 301-587-6087
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
RACOM Corp., 1028 W. Maude Ave. Ste. 401, Sunnyvale, CA 94086 408-737-2460
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
† TRAK Microwave, Western Division, 735 Palomar Ave, Dept. E-5, Sunnyvale, CA 94086 408-735-9660
† Transco Products, Inc., 4241 Glencoe Ave., Marina del Rey, CA 90295 .. 213-822-0800
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
§ Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332
† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95054 408-727-6001

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ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1604
Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ..... A•1363
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1780
NTK Technical Ceramics, NGK Spark Plugs (U.S.A.), Inc., 1701 N. Greenville Ave. # 205, Richardson, TX 75081, 214-235-8332 ..... A•1399
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1618
† Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 ..... A•1432
SFE Technologies, 1501 1st St., San Fernando, CA 91340, 213-365-9411 ..... A•1630
Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1656
† Aluminum Filter, P.O. Box 1311, Santa Barbara, CA 93102 805-684-7651
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
† Lenox Laser, 504 Pittsfield Rd., Lenox, MA 01240 413-637-0444

† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 ..... 703-971-8606; 703-971-7082
† Rockwell Filter Prods., 2990 Airway Ave., Costa Mesa, CA 92626 714-641-5311
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
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Filters, Optical-2700

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† Balzers Optical Grp., 170 Locke Dr., Marlboro, MA 01752 617-481-9860
Burleigh Instrs., Burleigh Pk., Fishers, NY 14453 716-924-9355
† Dontech Inc., 601-606 Airport Indl. Blvd., Doylestown, PA 18901 215-348-5010
Ealing Optics Co., Ealing Corp., 22 Pleasant St., S. Natick, MA 01760 617-655-7000
† Evaporated Coatings, P.O. Box 160, Huntingdon Valley, PA 19006 215-947-1465
† Hartman Systems, Figgie Intl., 360 Wolf Hill Rd., Huntington Sta., NY 11746 516-427-7500
† Hoffman Engineering Corp., P.O. Box 300, Old Greenwich, CT 06870 203-325-8933
Infrared Inds., Inc., P.O. Box 14200, Orlando, FL 32857 305-282-7700
Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 212-361-0800
† JMJ Technical Prods., 50 Wheeler Point Rd., Newark, NJ 07105 201-589-4257
§† Lenox Laser, 504 Pittsfield Rd., Lenox, MA 01240 413-637-0444
Liberty Mirror, Libbey-Owens-Ford Co., 851 Third Ave., Brackenridge, PA 15014 412-224-1800
3M Co., Carbonless/Related Prods Div Ind'l Optics, 3M Center, Bldg. 225-3S, St. Paul, MN. 55144 612-733-4403
† Melles Griot, 1770 Kettering St., Irvine, CA 92714 714-261-5600
† Optical & Conductive Coatings, Meridian Inds., Inc., 428 N. Buchanan Cir., # 8, Pacheco, CA 94553 415-798-6066
§ Optics for Research, Inc., P.O. Box 82, Caldwell, NJ 07006 201-228-4480
† Plumer Precision Optics, 601 Montgomery Ave., Pennsburg, PA 18073 215-679-6272
† Pomfret Research Optics, 817 Long Ridge Rd., Stamford, CT 06902 203-322-6386
Schott Glass Technologies, Inc., 400 York Ave., Duryea, PA 18642 717-457-7485
Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
SL Homalite, Div. of SL Inds., 11 Brookside Dr., Wilmington, DE 19804 302-652-3686
§ Sun-Flex Co., Inc., 20 Pimentel Ct., Novato, CA 94947 415-883-1221

Filters, Programmable — See Filters, Variable (Vol. A)

Filters, RF-2700

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Applied Research, Inc., 160 Dupont St., Plainview, NY 11803, 516-349-9200 ..... A•1702
§ **Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ..... A•1214**
Compac, 279 Skidmore Rd., Deer Park, NY 11729, 516-667-3933 ..... A•1594
† **Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ..... A•1327,1595**
CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1356
Curtis Inds., 8000 West Tower Ave., Milwaukee, WI 53223, 414-354-1500 ..... A•1599
† **Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1360**
† **ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1604**
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† **Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1367**
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§† **Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1396**
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OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ..... A•1401
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Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1621
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Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1643
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1644-1645,1647,1648,1649,1650,1651
Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
Air Maze Corp., 25000 Miles Rd., Cleveland, OH 44128 216-292-6800
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† Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
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† Chomerics, Inc., 77 Dragon Ct., Woburn, MA 01888 617-935-4850
† Cirtech, EG & G, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 216-267-2233
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§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
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† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
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† Dynamic Air Engrg, Inc., EMC Filter Div., 620 E. Dyer Rd., Santa Ana, CA 92705 714-540-2081
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
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§ Electro-Metrics, Penril Corp., 100 Church St., Amsterdam, NY 12010 518-843-2600
† Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
† Elmag, 54 Clark St., Newark, NJ 07104 201-481-1600
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
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§† Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
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† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 ..... 703-971-8606; 703-971-7082
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Mu-Del Electronics, Inc., 2426 Linden Lane, Silver Spring, MD 20910-1288 301-587-6087
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
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Peca, Inc., 592 Winks Lane, Bensalem, PA 19020 215-245-1550
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† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
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† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
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† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
Resdel Engrg., 300 E. Live Oak Ave., Arcadia, CA 91006 213-684-2600
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† Rtron Corp., 7324 Lawndale, Skokie, IL 60076 312-679-7180
§ Sealectro, 225 Hoyt St, Mamaroneck, NY 10543 914-698-5600
Sentry Mfg., Crystal Park, Chickasha, OK 73018 ..... 405-224-6780;800-654-8850
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
§† Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
§† Sprague Elec. Co., 481 Marshall St, No. Adams, MA 01247 413-664-4411
§† Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
§† Systron-Donner Microwave Div., 14844 Oxnard St, Van Nuys, CA 91409 818-786-1760
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
Toyo Comm. Equip. Co., Ltd., No. 8 Mori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, TOKYO, JAPAN 105 ..... 03-459-7320/03-459-7310
† Transco Products, Inc., 4241 Glencoe Ave., Marina del Rey, CA 90295 213-822-0800
§ Tucker Elctrns., Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 216-232-8600
Vitek Elctrns., 4 Gladys Ct., Edison, NJ 08817 201-287-3200
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
† Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332
Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900
Wide Band Engrg. Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Filters, Single Sideband-2700

† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ..... A•1327,1595
CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1356
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1367
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377, 718-424-7500 ..... A•1369
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... A•1425
Sokol Crystal Prods., Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 ..... A•1435
Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† Blackhawk Networks Corp., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545 608-752-8701
† Cirtech, EG & G, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 602-967-7874
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk, NJ 07650 201-947-0400
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903 714-759-2411
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON, CANADA M3B 1M2 416-447-8531
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St, P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054 619-433-4510
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
§ Q-Matic Corp., 3194-D Airport Loop Dr., Costa Mesa, CA 92626 714-545-8233
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Rockwell Filter Prods., 2990 Airway Ave., Costa Mesa, CA 92626 714-641-5311
§† Rockwell Int'l., 4311 Jamboree Rd., Newport Beach, CA 92660 800-854-8099
† Savoy Elctrns., P.O. Box 5727, Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-327-1282
Sentry Mfg., Crystal Park, Chickasha, OK 73018 ..... 405-224-6780;800-654-8850
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224

Filters, Synchronous Tracking-2700

Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ..... A•1626, D•1017
Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
† Cirtech, EG & G, 15237 Cherry St, Stanley, KS 66223 913-681-2801
† Electrac, Inc., 1614 Orangethrope Way, Anaheim, CA 92801 714-879-6021
§ Endevco, 30700 Rancho Viejo Rd., San Juan Capistrano, CA 92675 714-493-8181
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† Ferretec Inc., 1701A Fortune Dr., San Jose, CA 95131 408-263-1216
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322 617-580-1660
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
† TRAK Microwave, Western Division, 735 Palomar Ave, Dept. E-5, Sunnyvale, CA 94086 408-735-9660
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224
Unholtz-Dickie Corp., 6 Brookside Dr., Wallingford, CT 06492 203-265-3929
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
† Vibration Instrs. Co., 1614 Orangethorpe Way, Anaheim, CA 92801 714-879-6085

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Filters, Tone, Telegraph-2700

Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1603
† Filtron Co., Inc., Div. of Aeroflex Labs., Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804, 516-752-1144 ..... A•1608
A. P. Circuit Corp., 513 East 86th St, P.O. Box 1350, New York, NY 10028 212-737-1348
Aptek Microsystems, 700 N. W. 12th Ave., Deerfield Beach, FL 33441 305-421-8450
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
† Cirtech, EG & G, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
Data Signal Corp., 149 California St., Newton, MA 02158 617-926-5080
§ De Coursey Engrg. Lab., 11828 W. Jefferson, Culver City, CA 90230 ..... 213-EX7-9668
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk, NJ 07650 201-947-0400
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St, P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Rockwell Filter Prods., 2990 Airway Ave., Costa Mesa, CA 92626 714-641-5311
Silicon Systems Inc., 14351 Myford Rd., Tustin, CA 92680 714-979-0941
Solar Elctrns. Co., 901 N. Highland, Hollywood, CA 90038 213-462-0806
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 216-232-8600

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Filters, Tuning Fork-2300

† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111

Filters, UHF & VHF-2700

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ..... A•1584,1586,1587
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ..... A•1327,1595
Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1360
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1604
§ Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ..... A•1363
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1367
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1780
OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ..... A•1401
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1618
Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 ..... A•1413,1417,1418
† Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 ..... A•1432
Sokol Crystal Prods., Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 ..... A•1435,1437
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1644-1645,1647,1649
† Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1656
Advanced Filter Devices, Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028 212-737-1348
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
† Cirtech, EG & G, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 216-267-2233
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ..... 207-655-4555;800-341-9678
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
† Electro-Magnetic Processes, Inc., 9616 Owensmouth Ave., Chatsworth, CA 91311 818-882-6333
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903 714-759-2411
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501
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Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ..... 315-437-3953; 800-448-1666
Mu-Del Electronics, Inc., 2426 Linden Lane, Silver Spring, MD 20910-1288 301-587-6087
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
Oxley, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 213-463-5120
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
Sentry Mfg., Crystal Park, Chickasha, OK 73018 ..... 405-224-6780;800-654-8850
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ONT, CANADA L9W2Y8 416-669-1244
§ Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, JAPAN ..... (03) 775-2111
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† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
Toyo Comm. Equip. Co., Ltd., No. 8 Mori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, TOKYO, JAPAN 105 ..... 03-459-7320/03-459-7310
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† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Vitek Elctrns., 4 Gladys Ct., Edison, NJ 08817 201-287-3200
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332
Wide Band Engrg. Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570
† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95054 408-727-6001

Filters, Variable-2700

A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028, 212-737-1348 ..... A•1592
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 ..... A•1609, D•1231
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322, 617-580-1660 ..... D•1259
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ..... A•1624
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† Balzers Optical Grp., 170 Locke Dr., Marlboro, MA 01752 617-481-9860
Bently Nevada Corp., P.O. Box 157, Minden, NV 89423 702-782-3611
† Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 216-267-2233
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700
Continental Resources, Inc., 175 Middlesex Tpke., Bedford, MA 01730 617-275-0850
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
† Deltronic Crystal Inds., 215 Rt. 10, Bldg. 3, Sec. 5, Randolph, NJ 07869 201-361-2222
§ Dynamics, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311 818-998-8281
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
Eaton Corp., Microwave Products Division, 955 Benicia Avenue, Sunnyvale, CA 94086 408-730-6300
§† Eaton Corp, Yig-Tek Prods., 785 Palomar Ave., Sunnyvale, CA 94086 408-737-7300
† Electrac, Inc., 1614 Orangethrope Way, Anaheim, CA 92801 714-879-6021
† Ferretec Inc., 1701A Fortune Dr., San Jose, CA 95131 408-263-1216
Fogg Sys., 15592 E. Batavia Dr., Aurora, CO 80011 303-344-1883
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 516-694-3600
Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 213-361-8691
§ Integra, Inc., 2368 Walsh Ave., Santa Clara, CA 95051 408-727-9601
ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 607-272-7640
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
Marel Instr. Co., 907 South East 13th Pl., Cape Coral, FL 33904 813-574-8788
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 617-329-1508
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ..... 315-437-3953; 800-448-1666
§ Optics International, Box 101, Tenafly, NJ 07670 201-567-4799
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RACOM Corp., 1028 W. Maude Ave. Ste. 401, Sunnyvale, CA 94086 408-737-2460
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
Sivers IMA, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Transco Products, Inc., 4241 Glencoe Ave., Marina del Rey, CA 90295 213-822-0800
§ Tucker Elctrns., Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625 813-855-6611
Voltex, 3460 Great Neck Rd., Amityville, NY 11701 516-842-2772
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332
† Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900
† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95054 408-727-6001

Filters, Vestigial Sideband-2700

† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ..... A•1327,1595
Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1618
† Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 ..... A•1432

Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
† Cirtech, EG & G, 15237 Cherry St., Stanley, KS 66223 913-681-2801
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224

Filters, Video-2700

Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1643
Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
† Filtron Co., Inc., Div. of Aeroflex Labs., Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804 516-752-1144
† Hartman Systems, Figgie Intl., 360 Wolf Hill Rd., Huntington Sta., NY 11746 516-427-7500
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501

Filters, Waveguide-3450

† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 ..... 703-971-8606; 703-971-7082
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ..... 315-437-3953; 800-448-1666
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
§ Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Filters, YIG-2700

† Ferretec Inc., 1701A Fortune Dr., San Jose, CA 95131 408-263-1216
† TRAK Microwave, Western Division, 735 Palomar Ave, Dept. E-5, Sunnyvale, CA 94086 408-735-9660

Filters (MIL), Electrical & Networks-2440 — *See Vol. B*

Flanges, Waveguide-3450

† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Gabriel Elctrns., Box 70, Scarborough Indl. Pk., Scarborough, ME 04074 207-883-5161
† M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
§ Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

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Foil, Magnetic-1850

† Ad-Vance Magnetics, Inc., 625 Monroe St., Rochester, IN 46975, 219-223-3158 ..... C•1720
† Amuneal Mfg., 4737 Darrah St., Philadelphia, PA 19124, 215-535-3000 ..... C•1721
† Eagle Magnetic Company, Inc., P.O. Box 24283, Indianapolis, IN 46224, 317-297-1030 ..... C•1723
† Magnetic Shield Div., Perfection Mica Co., 750 North Thomas Dr., Bensenville, IL 60106, 312-766-7800 ..... C•1727
† Arnold Engineering Company, Subsidiary Allegheny International, 300 West Street, Marengo, IL 60152 815-568-2000
Framar Metal Products Co., Inc., 345 Carnegie Avenue, Kenilworth, NJ 07033 201-241-0710
§† Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 212-361-0800
§ Magnetic Metals Co., Hayes Ave. at 21st St., Camden, NJ 08105 609-964-7842
† Magnetics, Box 391, Butler, PA 16003-0391 412-282-8282
Permaluster, Inc., 1844 N. Keystone St., Burbank, CA 91504 213-849-4543
§ Russell Inds., 3000 Lawson Blvd., Oceanside, NY 11572 516-536-5000
SL Electronics, 300 Harvard Ave., Westville, NJ 08093 609-456-7300
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161
† Zippertubing Co., P.O. Box 61129, Los Angeles, CA 90061 213-321-3901

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§ Advanced Micro Devices, P.O. Box 3453, 901 Thompson Pl., Sunnyvale, CA 94088 408-732-2400
Ballantine Labs., 90 Fanny Rd., Boonton, NJ 07005 201-335-0900
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
Cybernetic Micro Sys., P.O. Box 3000, 3000 Hwy. 84, San Gregorio, CA 94074 415-726-3000
Energetec Systems, Inc., 130 E. St. Charles Rd., Carol Stream, IL 60188 312-653-1920
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
§ Hameg, Inc., 88-90 Harbor Rd., Port Washington, NY 11050 516-883-3837
§† Harris Circuits Mfg., 2706 Colley Ave., Norfolk, VA. 23517 804-467-1116
ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600
† Interface Engrg., 386 Lindelof Ave., Stoughton, MA 02072 617-344-7383
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
Velonex, 560 Robert Ave., Santa Clara, CA 95050 408-727-7370
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Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625 813-855-6611
§ VIZ Test Equipment, Div. VIZ Mfg., 335 E. Price St., Philadelphia, PA 19144 215-844-2626
Wavetek Corporation, 9191 Towne Centre Drive, San Diego, CA 92122 619-450-9971

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Holders, Crystal-2300

§ Atlee Inc., One Gill St., Woburn, MA 01801, 617-933-3510 ..... B•1229
Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ..... A•1320
† M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ..... A•1395
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... C•1621
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ..... A•1428
Accurate Elctrns., 169 S. Abbe Rd., P.O. Box 1287, Elyria, OH 44036 216-365-1211
Augat Inc., 33 Perry Ave., Box 779, Attleboro, MA 02703 617-222-2202
Connector Corp., 6025 N. Keystone Ave., Chicago, IL 60646 312-539-3108
CTS Electronics Corp., Knights Division, 400 Reimann Ave., Sandwich, IL 60548 815-786-8411
Elctrn. Molding Corp., 96 Mill St., Woonsocket, RI 02895 401-769-3800
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377 212-458-5811
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
International Crystal Mfg., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126 405-236-3741
† Jettron Prods., P.O. Box 337, E. Hanover, NJ 07936 201-887-0571
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
§ Schott Elctrns., Hershey Dr., Ansonia, CT 06401 203-736-2677
Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

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Asmann Components, Div. of ebm Industries, Inc., 525 New Britain Ave., Unionville, CT 06085, 203-674-1515 ..... C•1160
§ Bivar, Inc., 4 Thomas, Irvine, CA 92718, 714-951-8808 ..... C•1025
§ Wells Elctrns., 1701 S. Main St., South Bend, IN 46613, 219-287-5941 ... C•1580
§† Accessories for Elctrns., Inc., 800 Merrick Rd., Baldwin, NY 11510-3593 516-546-1751
Accurate Elctrns., 169 S. Abbe Rd., P.O. Box 1287, Elyria, OH 44036 216-365-1211
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, NJ 07657 201-943-7650
§ Amphenol, An Allied Co., 43 Commerce Ct., Lisle, IL 60532 312-983-3500
§ Augat Inc., 33 Perry Ave., Box 779, Attleboro, MA 02703 617-222-2202
Burndy Corporation, Richards Ave., Norwalk, CT 06852 203-838-4444
† Detoronics Corporation, 10660 E. Rush St., S. El Monte, CA 91733 818-579-7130
Elctrn. Molding Corp., 96 Mill St., Woonsocket, RI 02895 401-769-3800
Garry Mfg. Co., Div. of Brand-Rex Co., 9 Queen Anne Ct., Laghorne, PA 19047 215-949-2300
Gibson/Egan, 2666 E. Huntington Dr., Duarte, CA 91010 818-358-0191
† Gordon, L., Packaging, 1050 S. Paca St., Baltimore, MD 21230 301-539-6537
† Jettron Prods., P.O. Box 337, E. Hanover, NJ 07936 201-887-0571
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† Milton Ross Co., 511 Second St. Pike, Southampton, PA 18966 215-355-0200
§ Robinson-Nugent, Inc., 800 East 8th St., New Albany, IN 47150 812-945-0211
Sealectro, 225 Hoyt St., Mamaroneck, NY 10543 914-698-5600
§ Simco Co., 2257 North Penn Rd., Hatfield, PA 19440 215-822-2171
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700

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Hum Eliminators-2700

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ..... A•2109

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Integrated Circuits, Custom/Semicustom-3130

Exar Corp., P. O. Box 62229, 750 Palomar Ave., Sunnyvale, CA 94086, 408-732-7970 ..... **A•1668**

Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050, 408-988-4930 ..... **A•1672**

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Gould-AMI, Sub. Gould Inc., 3800 Homestead Rd., Santa Clara, CA 95051 408-554-2150

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Sunol Systems, 1187 Quarry Lane, Pleasanton, CA 94586 415-484-3322

Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070

VLSI Technology, Inc., 1101 McKay Dr., San Jose, CA 95131 408-942-1810

ZyMOS Corp., 477 N. Mathilda Ave., Sunnyvale, CA 94086 ..... 408-730-8800; 408-730-5400

Integrated Circuits, Digital-3130

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... **A•1661**

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§† Advanced Micro Devices, P.O. Box 3453, 901 Thompson Pl., Sunnyvale, CA 94088 408-732-2400
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§ Data General, 4400 Computer Dr., Westboro, MA 01581 617-366-8911
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Fairchild Camera & Instr. Corp., Memory & High Speed Logic Div., P. O. Box 5000, Puyallup, WA 98373 206-841-6000
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Micropac Inds., 905 E. Walnut St., Garland, TX 75040 214-272-3571
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Silicon Systems Inc., 14351 Myford Rd., Tustin, CA 92680 714-979-0941
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SMD Technology Svc. Ctr., A North American Philips Co., 5855 N. Glen Pk. Rd., Milwaukee, WI 53209 800-431-4444
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§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
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§† Supertex, Inc., 1225 Bordeaux Dr., P.O. Box 3607, Sunnyvale, CA 94088 408-744-0100
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Texas Instrs., Data Sys. Group, P. O. Box 809063, Dallas, TX 75380-9063 1-800-527-3500
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§† TRW LSI Products, PO Box 2472, La Jolla, CA 92038 619-457-1000
VLSI Technology, Inc., 1101 McKay Dr., San Jose, CA 95131 408-942-1810
§ Western Digital Corp., 2445 McCabe Way, Irvine, CA 92714 714-557-3550

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Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Cybernetic Micro Sys., P.O. Box 3000, 3000 Hwy. 84, San Gregorio, CA 94074 415-726-3000
Datel, General Electric Co., 11 Cabot Blvd., Mansfield, MA 02048 617-339-9341
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
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Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 312-297-0070

Integrated Circuits, Memory-3130

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... **A•1661**
International Microelectronic Prods., 2830 North First Street, San Jose, CA 95134, 408-262-9100 ..... **A•1674**
§ **Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900** ..... **A•1682**
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... **A•2090**
Advanced Electronic Packaging, 2159 Bay St., Los Angeles, CA 90021 .. 213-622-9042
§† Advanced Microcomputers, 3340 Scott Blvd., Santa Clara, CA 95051 ... 408-732-2400
§† Advanced Micro Devices, P.O. Box 3453, 901 Thompson Pl., Sunnyvale, CA 94088 408-732-2400
† Andrich Sys., Inc., 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
AT&T, 1 Oak Way, Berkeley Heights, NJ 07922 1-800-372-2447
§ Data General, 4400 Computer Dr., Westboro, MA 01581 617-366-8911
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
§† Fairchild Camera & Instr. Corp., 464 Ellis St., 20-2271, Mountain View, CA 94042 415-962-5011
Fairchild Camera & Instr. Corp., Memory & High Speed Logic Div., P. O. Box 5000, Puyallup, WA 98373 206-841-6000
§ General Instrument Corp., Microelectronics Div., 600 W. John St., Hicksville, NY 11802 516-733-3107
GTE Microcircuits, 2000 W. 14th. St., Tempe, AZ 85281 602-968-4431
§† Harris Semiconductor, Box 883, Melbourne, FL 32901 305-724-7400
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903 714-759-2411
§† Inmos Corp., P.O. Box 16000, Colorado Springs, CO 80935 ... 303-630-4000 Ext. 4454
§† Integrated Device Technlg., Inc., 3236 Scott Blvd., Santa Clara, CA 95054-3090 408-727-6116
§† Intersil, 10710 N. Tantau Ave., Cupertino, CA 95014 408-996-5000
† Isotronics, Industrial Park, New Bedford, MA 02745 617-998-2000
ITT Semiconductors, 500 Broadway, Lawrence, MA 01841 617-688-1881
Micrel, Inc., 1235 Midas Way, Sunnyvale, CA 94086 408-245-2500
§† Mitel Semiconductor, P.O. Box 13089, Kanata, ON, CANADA K2K 1X3 .. 613-592-5280
§ Mitsubishi Elctrns. America, Inc., Semiconductor Div., 1050 East Arques Ave., Sunnyvale, CA 94086 408-730-5900
§† NCR Microelectronics Div., NCR Corp., 8181 Byers Rd., Miamisburg, OH 45342 ..... 800-543-5618;513-866-7471
NEC Electronics, Inc., 401 Ellis Street, Mtn. View, CA 94039 415-960-6000
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
† Nitron, 10420 Bubb Rd., Cupertino, CA 95014 408-255-7550
§ Paccom, 3928 148th NE, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 415-968-9211
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§† RCA Solid State Div., Micro Processors/Memories/Peripherals, Route 202, Somerville, NJ 08876 201-685-6000
§† Rockwell Int'l, 4311 Jamboree Rd., Newport Beach, CA 92660 800-854-8099
§† SEEQ Technlg., 1849 Fortune Dr., San Jose, CA 95131 408-942-1990
SGS-ATES Semiconductor Corp., 240 Bear Hill Rd, Waltham, MA 02154 617-890-6688
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
§† Signetics, U.S. Philips Corp., 811 E. Arques Ave, P.O. Box 3409, Sunnyvale, CA 94088-3409 408-739-7700
§† Solid State Scientific, 3900 Welsh Rd., Willow Grove, PA 19090 215-657-8400
§† Standard Microsystems, 35 Marcus Blvd., Hauppauge, NY 11788 516-273-3100
§† Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
Texas Instrs., Data Sys. Group, P. O. Box 809063, Dallas, TX 75380-9063 1-800-527-3500
† Third Domain, P.O. Box 35400, Tucson, AZ 85740-5400 602-293-6310
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk, CA 91304 213-887-1010
§ Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
VLSI Technology, Inc., 1101 McKay Dr., San Jose, CA 95131 408-942-1810

Integrated Circuits, Microprocessor-3130

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... **A•1661**
International Microelectronic Prods., 2830 North First Street, San Jose, CA 95134, 408-262-9100 ..... **A•1674**
§ **Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900** ..... **A•1686**
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... **A•2090**
§† Advanced Microcomputers, 3340 Scott Blvd., Santa Clara, CA 95051 ... 408-732-2400
§† Advanced Micro Devices, P.O. Box 3453, 901 Thompson Pl., Sunnyvale, CA 94088 408-732-2400
AT&T, 1 Oak Way, Berkeley Heights, NJ 07922 1-800-372-2447
§ Data General, 4400 Computer Dr., Westboro, MA 01581 617-366-8911
§† Fairchild Camera & Instr. Corp., 464 Ellis St., 20-2271, Mountain View, CA 94042 415-962-5011
§† Fairchild Microcontroller Div., Fairchild Camera & Instr. Corp., 450 National Ave., Mountain View, CA 94042 415-962-3838
General Instrument Corp., Microelectronics Div., 600 W. John St., Hicksville, NY 11802 516-733-3107

Gould-AMI, Sub. Gould Inc., 3800 Homestead Rd., Santa Clara, CA 95051 408-554-2150
GTE Microcircuits, 2000 W. 14th St., Tempe, AZ 85281 602-968-4431
§† Harris Semiconductor, Box 883, Melbourne, FL 32901 305-724-7400
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
§† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903 714-759-2411
§† Inmos Corp., P.O. Box 16000, Colorado Springs, CO 80935 ... 303-630-4000 Ext. 4454
§† Intersil, 10710 N. Tantau Ave., Cupertino, CA 95014 408-996-5000
† Isotronics, Industrial Park, New Bedford, MA 02745 617-998-2000
§ LSI Computer Sys., 1235 Walt Whitman Rd., Melville, NY 11747 516-271-0400
§† Mitel Semiconductor, P.O. Box 13089, Kanata, ON, CANADA K2K 1X3 .. 613-592-5280
§ Mitsubishi Elctrns. America, Inc., Semiconductor Div., 1050 East Arques Ave., Sunnyvale, CA 94086 408-730-5900
NEC Electronics, Inc., 401 Ellis Street, Mtn. View, CA 94039 415-960-6000
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§ Paccom, 3928 148th NE, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
Photobell, 26 Just Rd., Fairfield, NJ 07006 201-227-3613
§ Pro-Log, 2411 Garden Rd., Monterey, CA 93940 408-372-4593
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 415-968-9211
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§† RCA Solid State Div., Micro Processors/Memories/Peripherals, Route 202, Somerville, NJ 08876 201-685-6000
§† Rockwell Int'l., 4311 Jamboree Rd., Newport Beach, CA 92660 800-854-8099
SGS-ATES Semiconductor Corp., 240 Bear Hill Rd, Waltham, MA 02154 617-890-6688
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
§ Signetics, U.S. Philips Corp., 811 E. Arques Ave, P.O. Box 3409, Sunnyvale, CA 94088-3409 408-739-7700
Silicon Systems Inc., 14351 Myford Rd., Tustin, CA 92680 714-979-0941
§† Standard Microsystems, 35 Marcus Blvd., Hauppauge, NY 11788 516-273-3100
§† Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
Texas Instrs., Data Sys. Group, P. O. Box 809063, Dallas, TX 75380-9063 1-800-527-3500
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§ Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§ Western Digital Corp., 2445 McCabe Way, Irvine, CA 92714 714-557-3550

Integrated Circuits, Silicon Monolithic, Unpackaged Chips-3130

International Microelectronic Prods., 2830 North First Street, San Jose, CA 95134, 408-262-9100 ..... A•1674
Array Technology, 992 S. Saratoga-Sunnyvale Rd., San Jose, CA 95129 408-252-9900
Astec USA, Ltd., A BSR Intl. Co., 2880 San Tomas Expwy., # 200, Santa Clara, CA 95051 408-748-1200
† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
Gould-AMI, Sub. Gould Inc., 3800 Homestead Rd., Santa Clara, CA 95051 408-554-2150
GTE Microcircuits, 2000 W. 14th St., Tempe, AZ 85281 602-968-4431
† Holt Inc., 9351 Jeronimo Rd., Irvine, CA 92718 714-859-8800
§† Linear Technology Corp., 1630 McCarthy Blvd., Milpitas, CA 95035 408-942-0810
Linear Technlg., P.O. Box 489, Sta. "A", Burlington, ON, CANADA L7R 3Y3 416-632-2996
§ LSI Computer Sys., 1235 Walt Whitman Rd., Melville, NY 11747 516-271-0400
MCE Semiconductor, Inc., 1111 Fairfield Dr., West Palm Beach, FL 33407 305-845-2837
Micrel, Inc., 1235 Midas Way, Sunnyvale, CA 94086 408-245-2500
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
Polycore Elctrns., 1107 Tourmaline Dr., Newbury Pk., CA 91320 805-499-6777
§† Precision Monolithics, Inc., 1500 Space Dr., Santa Clara, CA 95054 408-727-9222
§† RCA Solid State Div., CMOS IC Mktg., Rte. 202, Somerville, NJ 08876 ... 201-685-6000
RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
Silicon General, 11861 Western Ave., Garden Grove, CA 92641 714-898-8121
§† Siliconix, Inc., 2201 Laurelwood Rd., Santa Clara, CA 95054 408-988-8000
§† Solid State Scientific, 3900 Welsh Rd., Willow Grove, PA 19090 215-657-8400
§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Sprague Elec. Co., Integrated Circuit Div., 115 Northeast Cutoff, Worcester, MA 01606 617-853-5000

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Intensifiers, Image-5700

A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
Aiphone, 1700 130th St. NE, Bellevue, WA 98005 206-455-0510
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
† Colorado Video, Inc., Box 928, Boulder, CO 80306 303-444-3972
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
ElectroPhysics Corp., 48 Spruce St., Nutley, NJ 07110 201-667-2262
Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Interelectronics Corp., Interelectronics Park, 550 U.S. Rte. 303, Congers, NY 10920 ..... 914-EL8-8000
Microscience, Inc., 182 Forbes Rd., Braintree, MA 02184 617-849-1952
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§ Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Varo, Inc., Electron Devices Div., 2203 W. Walnut St., Garland, TX 75040 214-272-3561
Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3211

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Interrupters, Power-4300 — *See Vol. B*

Interrupters, Vacuum-4300 — *See Vol. B*

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Isolators, Antenna-1900 — *See Vol. D*

Isolators, Ferrite-3450

AERCOM, 405 Tasman Dr., Sunnyvale, CA 94086 408-744-1320
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
† Emerson & Cuming, W. R. Grace & Co., 59 Walpole St., Canton, MA 02021 617-828-3300
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ..... 818-889-4030;805-497-4421
M/A-Com Microwave Components, Inc., M/A-Com, South Avenue, Burlington, MA 01803 617-272-3000
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microwave Applications Grp., 3030 Industrial Pkwy., Santa Maria, CA 93455 805-928-5711
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ONT, CANADA L9W2Y8 416-669-1244
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E5, Tampa, FL 33614 813-884-1411
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

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Isolators, Microwave (All Types)-3450

† Premier Microwave, 35 New Broad St., Port Chester, NY 10573, 914-939-8900 ..... A•1781
TRAK Microwave, Western Division, 735 Palomar Ave, Dept. E-5, Sunnyvale, CA 94086, 408-735-9660 ..... A•1782
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
† Emerson & Cuming, W. R. Grace & Co., 59 Walpole St., Canton, MA 02021 617-828-3300
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ..... 818-889-4030;805-497-4421

M/A-Com Microwave Components, Inc., M/A-Com, South Avenue, Burlington, MA 01803 617-272-3000
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Microwave Applications Grp., 3030 Industrial Pkwy., Santa Maria, CA 93455 805-928-5711
† Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44-(582) 60-14-41
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Norsal Inds., 85 D Hoffman Lane So., Central Islip, NY 11722 516-234-1200
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E5, Tampa, FL 33614 813-884-1411
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

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Jack Covers-2100 — ***See Vol. C***

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Jacks (All Types)-2100 — ***See Vol. C***

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Jammers (MIL), Communications (Commjam)-3475 — ***See Vol. D***

Jammers (MIL), Commjam, Truck Mounted-3475 — ***See Vol. D***

Jammers (MIL), Drone Borne-3475 — ***See Vol. D***

Jammers (MIL), Expendable-3475 — ***See Vol. D***

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Jammers (MIL), J-band-3475 — ***See Vol. D***

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Joints, Rotary, Microwave-3450

† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
Graphite Metallizing Corp., 1036 Nepperhan Ave., P.O. Box 110, Yonkers, NY 10702 914-968-8400
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
† Sivers IMA, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

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Jumpers, Circuit Board-2100 — ***See Vol. C***

Jumpers, Wire, Terminated — See Cords, Patch (Vol. C)

Junctions, Hybrid, Microwave-3450

† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 617-935-8610
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
§ CES Elctrns., 2968 Avenue Z, Brooklyn, NY 11235
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
† Electro-Magnetic Processes, Inc., 9616 Owensmouth Ave., Chatsworth, CA 91311 818-882-6333
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 516-694-3600
Hades Mfg. Corp., 151-A Verdi St., Farmingdale, NY 11735 516-249-4244
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ..... 818-889-4030;805-497-4421
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reeve Electronics, Mellish E. Murray, 1720 W. Fulton St., Chicago, IL 60612 312-670-0150
Sivers IMA, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Technical Research & Mfg., Inc., R.F.D. # 10, Manchester, NH 03103 603-627-6000
† Transco Products, Inc., 4241 Glencoe Ave., Marina del Rey, CA 90295 213-822-0800
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Keyboard Legends and Symbols-5150 — ***See Vol. B***

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Keyboards, Capacitive-5150 — ***See Vol. B***

Keyboards, Ferrite Core-5150 — ***See Vol. B***

Keyboards, Full Travel-5150 — ***See Vol. B***

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Keyboards, Modular-5150 — ***See Vol. B***

Keyboards, Pad-5150 — ***See Vol. B***

Keyboards, Photo-optical-5150 — ***See Vol. B***

Keyboards, Reed-5150 — ***See Vol. B***

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Kits, Enclosure Prototyping-1400 — ***See Vol. C***

Kits, Fiber Optic-2475 — ***See Vol. B***

Kits, Marking (Dial, Instrument, Equipment, etc.)-2400 — ***See Vol. C***

Kits, Potentiometer, Rheostat-4750

Allen-Bradley Co., Industrial Control Div., 1201 S. Second St., Milwaukee, WI 53201 414-671-2000

Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050

E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 219-356-4300

Kits, Printed Circuit-1700 — ***See Vol. C***

Kits, Programming Board-4200 — ***See Vol. C***

Kits, Shielding-4525 — ***See Vol. C***

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Knobs - Also see Dials, Instrument-2400 — ***See Vol. C***

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Knobs, Locking, Control Shaft-2400 — ***See Vol. C***

Knobs, Slip Clutch-2400 — ***See Vol. C***

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Lamps, Ultraviolet-2450 — ***See Vol. B***

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Limit Stops, Mechanical-2500 — ***See Vol. C***

Limiters, Current-4300 — ***See Vol. B***

Limiters, Microwave-3450

† **Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235, 718-934-4500** ..... **A•1719-1720,1759**

† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500

Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520

Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150

American Electronic Labs., Box 552, Lansdale, PA 19446 215-822-2929

† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
EFI Corporation, 350 West 2700 South, Salt Lake City, UT 84115 801-486-5871
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 516-694-3600
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
M/A-Com Microwave Components, Inc., M/A-Com, South Avenue, Burlington, MA 01803 617-272-3000
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44-(582) 60-14-41
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141

Limiters, Surge — See Suppressors, Transient Voltage

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Line Controlled Switches — See Switches, Data (Vol. D)

Line Stretchers, Microwave-3450

Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 617-935-8610
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Astrolab Inc., 4 Powder Horn Drive, Warren, NJ 07060 1-201-560-3800
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
§ Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Liners, Tube Shield — See Shields, Tube (Vol. C)

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Locators, Open Short-2900 — *See Vol. D*

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Machines, Coil Winding-4100 — *See Vol. D*

Machines, Component Handling, Feeding, Insertion & Sorting-4100 — *See Vol. D*

Machines, Hermetic Sealing-4100 — *See Vol. D*

Machines, Induction Heating (Electronic)-4100 — *See Vol. D*

Machines, Lead Cutting & Forming-4100 — *See Vol. D*

Machines, Magnet Wire Twisting-4100 — *See Vol. D*

Machines, Marking & Numbering-4100 — *See Vol. D*

Machines, Mask Alignment & Exposure-4100 — *See Vol. D*

Machines, Metallizing, Vacuum — See Deposition Equipment, Vacuum & Accessories (Vol. D)

Machines, Plastic Molding-4100 — *See Vol. D*

Machines, Plating-4100 — *See Vol. D*

Machines, Printed Circuit Drilling, Etching & Punching-4100 — *See Vol. D*

Machines, Terminal Installing-4100 — *See Vol. D*

Machines, Ultrasonic Bonding-4100 — *See Vol. D*

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Magnetometers-2900 — *See Vol. D*

Magnetoresistors, Hall-4800

Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, OH 43212, 614-486-9561 ..... B•1819
† American Aerospace Controls, 570 Smith St., Farmingdale, NY 11735 .. 516-694-5100
§ Magnetic Instrumentation, 8350 E. 48TH ST., Indianapolis, IN 46226 317-545-2102
Magnet Sales & Mfg. Co. Inc., 11250 Playa Court, Culver City, CA 90230-6127 ..... 213-391-7213;800-421-6692
§ Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400

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Magnets (Lab. Type)-1850

Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Magnetic Products Div., 5900 N. Harrison St., Shawnee, OK 74801, 405-275-2100 ..... A•1300
Jobmaster Corp., 9008 Liberty Rd., Randallstown, MD 21133, 301-655-1400 ..... A•1303
† Magnet Sales & Mfg. Co. Inc., 11250 Playa Court, Culver City, CA 90230-6127, 213-391-7213;800-421-6692 ..... A•1307
Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
§ General Hardware Mfg., 80 White St., New York, NY 10013 212-431-6100
High Voltage Engrg. Corp., S. Bedford St., Burlington, MA 01803 617-272-1313
LDJ Incorporated, 2200 Stephenson Hwy., P.O. Box 219, Troy, MI 48099-0219 313-528-2202
Magnetic Instrumentation, 8350 E. 48TH ST., Indianapolis, IN 46226 317-545-2102
§ Magnos, Old School House Rd., Harvard, MA 01451 617-456-8880
Sensitive Research Instrs., 25 Dock St., Mt. Vernon, NY 10550 914-699-9717
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
§ Techni-Tool, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462 215-825-4990
Varian Assocs., Instr. Grp., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
Walker Scientific, Rockdale St., Worcester, MA 01606 617-852-3674

Magnets, Permanent-1850

Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Magnetic Products Div., 5900 N. Harrison St., Shawnee, OK 74801, 405-275-2100 ..... A•1300
§† Jobmaster Corp., 9008 Liberty Rd., Randallstown, MD 21133, 301-655-1400 ..... A•1303
† Magnet Sales & Mfg. Co. Inc., 11250 Playa Court, Culver City, CA 90230-6127, 213-391-7213;800-421-6692 ..... A•1307
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, 815-235-6600 ..... B•1628

§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St, Milwaukee, WI 53204 414-671-2000
Alpha-Tek, 7286 Murdy Circle, Huntington Beach, CA 92647 714-847-7515
† Arnold Engineering Company, Subsidiary Allegheny International, 300 West Street, Marengo, IL 60152 815-568-2000
Bunting Magnetics, 500 So. Spencer Rd., Newton, KS 67114 316-284-2020
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
† Engelhard Corp., 70 Wood Ave. S., Iselin, NJ 08830 201-321-5900
Ferronics, 52 N. Main St., Fairport, NY 14450 716-223-1010
§ General Hardware Mfg., 80 White St., New York, NY 10013 212-431-6100
Hamlin, Lake & Grove Sts., Lake Mills, WI 53551 414-648-2361
§ Indiana General/Div. Emm Corp., Magnet Prods., 405 Elm St., Valparaiso, IN 46383 219-462-3131
§† Magnetic Systems, 770 Linden Avenue, Rochester, NY 14625 716-385-9010
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183
† Ogallala Elctrns., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153 308-284-4093
† Permanent Magnet, 4437 Bragdon St., Indianapolis, IN 46226 317-547-1336
† Raytheon Co., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154 617-899-8400
R-Columbia Prods. Co., Inc., 2008 St. Johns Ave., Highland Park, IL 60035 312-432-7915
§ Reed Switch Dev. Co. Inc., PO Box 1464, Kerrville, TX 78028 512-896-4444
§ Risk, George, Inds., GRI Plaza, Kimball, NE 69145 308-235-4645
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Stackpole, Magnet Div., 700 Elk Ave., Kane, PA 16735 814-837-7000
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
† Thomas & Skinner, Box 150 B, Indianapolis, IN 46206 317-923-2501
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161
Varian Assocs., Instr. Grp., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Magnets, Superconducting-1850
Jobmaster Corp., 9008 Liberty Rd., Randallstown, MD 21133, 301-655-1400 ..... A•1303
Advanced Kinetics, 1231 Victoria St., Costa Mesa, CA 92627 714-646-7165
American Magnetics, P.O. Box 2509, Oak Ridge, TN 37831-2509 615-482-1056
Cryomagnetics, Inc., 795 Oak Ridge Tpk., Oak Ridge, TN 37830 615-482-9551
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
Varian Assocs., Instr. Grp., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

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Mask Alignment & Exposure Systems — See Machines, Mask Alignment & Exposure (Vol. D)

Material, Permanent Magnet-1850
Magnet Sales & Mfg. Co. Inc., 11250 Playa Court, Culver City, CA 90230-6127, 213-391-7213;800-421-6692 ..... A•1307

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Meters, EMC — See Meters, RFI (Vol. D)

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Meters, Field Strength-2900 — ***See Vol. D***

Meters, Fluid Flow-2200 — ***See Vol. D***

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Meters, Hand Held-2900 — ***See Vol. D***
Meters, Humidity-2900 — ***See Vol. D***
Meters, Illuminated Scale-2950 — ***See Vol. D***
Meters, Impedance-2900 — ***See Vol. D***
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Meters, Laser Energy — See Monitors, Laser Energy (Vol. D)
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Meters, Microampere — See Meters, Ampere (Vol. D)
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Meters, Modulation-2900 — ***See Vol. D***
Meters, Moving Coil-2950 — ***See Vol. D***
Meters, Moving Iron-2950 — ***See Vol. D***
Meters, Moving Scale-2950 — ***See Vol. D***
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Meters, Multifunction (Digital)-2900 — ***See Vol. D***
Meters, Noise & Sound Level-2900 — ***See Vol. D***
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Meters, Ohm-2900 — ***See Vol. D***
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Meters, Vibration-2900 — ***See Vol. D***
Meters, Volt, AC-2900 — ***See Vol. D***
Meters, Volt/Ampere — See Meters, Watt
Meters, Volt, DC-2900 — ***See Vol. D***
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Meters, Volt, True RMS-2900 — ***See Vol. D***
Meters, VU-2900 — ***See Vol. D***
Meters, Watt-2900 — ***See Vol. D***
Meters, Watt Hour-2900 — ***See Vol. D***
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Microcircuit Production Equip.-4100 — ***See Vol. D***
Microcircuits — See Integrated Circuits (Specific Types) (Vol. A)
Microcircuits, Thick Film — See Circuits, Hybrid, Thick Film (Vol. A)
Microcircuits (MIL)-2440 — ***See Vol. B***
Microcircuits (MIL), Linear-2440 — ***See Vol. B***
Microcircuits (MIL), Low Power Schottky-2440 — ***See Vol. B***
Microcircuits (MIL), Memories, CMOS, Hybrids-2440 — ***See Vol. B***
Microcircuits (MIL), TTL, Schottky, Microprocessor-2440 — ***See Vol. B***

Microcomputer Boards-3130

G W Three Incorporated, 7623 Fullerton Rd., 2nd Floor, Springfield, VA 22153, 703-451-2043 ..... **D•1088**
† Acromag, 30765 Wixom Rd., Wixom, MI 48096 313-624-1541
Applied Micro Technlg., A Burr Brown Co., 3669 E. 44th Street, Tucson, AZ 85713 602-622-8605
§ Colex, Incorporated, 15028 Beltway Dr., Dallas, TX 75234 214-458-2779
Control Systems, 2855 Anthony Lane, Minneapolis, MN 55418 612-789-2421
Distributed Computer Sys., 223 Crescent St, Waltham, MA 02154 617-899-6619
§† Fairchild Microcontroller Div., Fairchild Camera & Instr. Corp., 450 National Ave., Mountain View, CA 94042 415-962-3838
§ General Robotics Corp., 57 N. Main St., Hartford, WI 53027 414-673-6800
§ Industrial Computer Designs, Inc., 31264 La Baya Drive, Westlake Village, CA 91362 818-889-3179
JF Microsystems, 3641 Frontier Road, Pasco, WA 99301 ..... 509-297-4294; 800-JF-CARDS
Kinetic Sys., 11 Maryknoll Dr., Lockport, IL 60441 815-838-0005
Microbar Systems, Inc., 785 Lucerne Drive, Sunnyvale, CA 94086 408-720-9300
Pacific Microcomputers, Inc., 160 Chesterfield Dr., Cardiff, CA 92007 619-436-8649
§ Quam Corporation, 900 W. 128th St. Ste 208, Burnsville, MN 55337 612-894-2360
§ Quartic Systems, Inc., 3575 South West Temple #7, Salt Lake City, UT 84115 801-268-9264
Stock Drive Prods., Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040 ..... 516-328-0200;328-3300
Zendex Corp., 6700 Sierra La., Dublin, CA 94566 415-828-3000
Ziatech, 3433 Roberto Ct., San Luis Obispo, CA 93401 805-541-0488

Microfilm, Computer Output (COM) Equipment-2000 — ***See Vol. D***
Micrometers — See Testers, Thickness (All Types) (Vol. D)
Microphone Accessories (Incl. Stands, Holders, Booms)-1300 — ***See Vol. D***
Microphones, Bone Conduction-1300 — ***See Vol. D***
Microphones, Carbon-1300 — ***See Vol. D***
Microphones, Cardioid-1300 — ***See Vol. D***
Microphones, Ceramic-1300 — ***See Vol. D***
Microphones, Condenser (Incl. Electret)-1300 — ***See Vol. D***

Microphones, Crystal-1300 — *See Vol. D*

Microphones, Dynamic-1300 — *See Vol. D*

Microphones, Lavalier-1300 — *See Vol. D*

Microphones, Magnetic-1300 — *See Vol. D*

Microphones, Omnidirectional-1300 — *See Vol. D*

Microphones, Subminiature-1300 — *See Vol. D*

Microphones, Velocity-1300 — *See Vol. D*

Microphones, Wireless-1300 — *See Vol. D*

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Microprocessor — See Integrated Circuits, Microprocessor (Vol. A)

Microprocessor Development Systems-3130

American Automation, 14731 Franklin Avenue, Tustin, CA 92680, 714-731-1661 ..... D•1179
Elctrn. Molding Corp., 96 Mill St., Woonsocket, RI 02895, 401-769-3800 .. C•1708
§ Gould Inc., Design & Test Sys. Div., 4650 Old Ironsides Dr., Santa Clara, CA 95054-1279, 408-988-6800 ..... D•1237
Heurikon Corporation, 3201 Latham Dr., Madison, WI 53713, 800-356-9602;608-271-8700 ..... D•1091
Magnum Opus Custom Elctrn. Engrg., 284 Kennedy St., Iselin, NJ 08830, 201-283-4925 ..... D•1093
Wintek Corp., 1801 South St., Lafayette, IN 47904-2993, 317-742-8428 ... D•1105
§ Advanced Microcomputers, 3340 Scott Blvd., Santa Clara, CA 95051 ... 408-732-2400
† Applied Data Communications, 14272 Chambers Rd., Tustin, CA 92680 714-731-9000
Applied Micro Technlg., A Burr Brown Co., 3669 E. 44th Street, Tucson, AZ 85713 602-622-8605
Applied Sys., 26401 Harper Ave., St. Clair Shores, MI 48081 313-779-8700
† Astronautics Corporation of America, P.O. Box 523, Milwaukee, WI 53201-0523 414-447-8200
§ Boston Systems Office, 469 Moody St., Waltham, MA 02254-9164 617-894-7800
Bridge Computer Co., Sea Data Corp., 1 Bridge St., Newton, MA 02158 .. 617-244-8190
§ Computer System Assocs., 7564 Trade St., San Diego, CA 92121 619-566-3911
Digital Equip., One Iron Way, Marlborough, MA 01752
Dolch Logic Instrs., 2029 O'Toole Avenue, San Jose, CA 95131 408-945-1881
Electro Rent Corp., 4209 Van Owen Place, Burbank, CA 91505 818-843-1221
Emulogic, 3 Technology Way, Norwood, MA 02062 617-329-1031
Fairchild Microcontroller Div., Fairchild Camera & Instr. Corp., 450 National Ave., Mountain View, CA 94042 415-962-3838
Genstar Rental Elctrns., 2445 Faber Pl., Palo Alto, CA 94303 415-856-7600
§ GMR Co., 8801 Sepulveda Blvd., Los Angeles, CA 90045 213-216-9516
Hilevel Tech., Inc., 18902 Bardeen Way, Irvine, CA 92715 714-752-5215
† Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Information Control, Dept. EM7 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
§ Innotronics, Brooks Rd., Lincoln, MA 01773 617-678-8720
Innovatek Microsystems, Inc., Smithfield Rd., R1 Box 104, Millerton, NY 12546-9720 914-373-9003
§ Intech, Instruments Div., 282 Brokaw Rd., Santa Clara, CA 95050 408-727-0500
§ Integrated Computer Systems, 6305 Arizona Pl., P.O. Box 45405, Los Angeles, CA 90045 213-417-8888
Kinetic Sys., 11 Maryknoll Dr., Lockport, IL 60441 815-838-0005
Kontron Elctrns., 1230 Charleston Rd., Mountain View, CA 94039-7230 415-965-7020
Matrix Corp., 1639 Green St., Raleigh, NC 27603 919-833-2837
Matrox Elctrn. Sys., 1055 St. Regis Blvd., Dorval, QU, CANADA H9P 2T4 514-685-2630
Micro/sys, 1011 Grand Central Ave., Glendale, CA 91201-3010 818-244-4600
Monolithic Sys., 84 Inverness Circle E., Englewood, CO 80112 303-790-7400
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
Mupac, 10 Mupac Dr., Brockton, MA 02401 617-588-6110
Omnibyte Corp., 245 W. Roosevelt Rd., Bldg. 1-5, W. Chicago, IL 60185 312-231-6880
Pacific Microcomputers, Inc., 160 Chesterfield Dr., Cardiff, CA 92007 619-436-8649
Photobell, 26 Just Rd., Fairfield, NJ 07006 201-227-3613
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
RCA Solid State Div., Micro Processors/Memories/Peripherals, Route 202, Somerville, NJ 08876 201-685-6000
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
Signum Systems, 726 Santa Monica Blvd., Santa Monica, CA 90401 213-451-5382
§ Software Dynamics, 2111 W. Crescent Ave-G, Anaheim, CA 92801 714-635-4760
Standard Engrg., 44800 Industrial Dr., Fremont, CA 94538 415-657-7555
Step Engineering, P.O. Box 61166, Sunnyvale, CA 94088 408-733-7837
Tektronix, Inc., P. O. Box 500, Y3-314, Beaverton, OR 97077 ..... 800-547-1512;Oregon only 800-452-1877
§ Zax Corp., 2572 White Rd., Irvine, CA 92714 ..... 714-474-1170;800-421-0982

Microscopes-3700 — *See Vol. B*

Microscopes, Measuring-2900 — *See Vol. D*

Microwave Comb Generator — See Generators, Microwave (Vol. D)

Microwave Integrated Circuits (MICs)-3450

† Daico Inds., Inc., Box 5225, Compton, CA 90224, 213-631-1143 ..... A•1708
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735, 516-694-3600 ..... A•1712
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
† Alpha Inds., Inc.-Microelectronic Div., 2800 Crystal Drive, Hatfield, PA 19440 215-822-1311
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
American Electronic Labs., Box 552, Lansdale, PA 19446 215-822-2929
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
† Central Microwave Co., Alpha Inds., Inc., 12180 Prichard Farm Rd., Maryland Heights, MO 63043 314-291-5270
Compact Software, Inc., Comsat Corp., 1131 San Antonia Rd., Palo Alto, CA 94303 415-966-8440
Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
Electro Rent Corp., 4209 Van Owen Place, Burbank, CA 91505 818-843-1221
Epsilon-Lambda Elctrns. Corp., 427 Stevens St., Geneva, IL 60134 312-232-9611
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
Harris Microwave Semiconductor, 1530 McCarthy Blvd., Milpitas, CA 95035 408-262-2222
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
† Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Hyletronics, Newtown Rd., Littleton, MA 01460 617-486-8911
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† Litton Systems, Inc., Electron Dvcs. Div., 960 Industrial Rd., San Carlos, CA 94070 415-591-8411
M/A-COM Microwave Circuits, Inc., South Ave., Burlington, MA 01803 .. 617-272-3000
M/A-Com Microwave Components, Inc., M/A-Com, South Avenue, Burlington, MA 01803 617-272-3000
§† Magnum Microwave Corp., 365 Ravendale Dr., Mountain View, CA 94043 415-968-9281
§† 3M-Electronic Products Division, Bldg. 502, P.O. Box 2963, Austin, TX 78769-2963 512-834-6682
† Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44-(582) 60-14-41
Mitsubishi Elctrns. America, Inc., Semiconductor Div., 1050 East Arques Ave., Sunnyvale, CA 94086 408-730-5900
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
§† Plessey Semiconductors, 1641 Kaiser Ave., Irvine, CA 92714 714-540-9979
RHG Electronics Lab., Inc., 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
§ Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E5, Tampa, FL 33614 813-884-1411
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Vectronics Microwave Corp., 276 Lincoln Blvd., Middlesex, NJ 08846 ... 201-356-2377

Microwave Receivers — See Receivers, Microwave

Mirrors, Cold-3700 — *See Vol. B*

Mirrors, Front Surface-3700 — *See Vol. B*

Mirrors, Hot-3700 — *See Vol. B*

Mixers, Audio-1300 — *See Vol. D*

Mixers, Microwave-3450

† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235, 718-934-4500 ..... A• 1716-1779
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1780
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
† Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
§ Eaton Corp., Elctrn. Instrmn. Div., 5340 Alla Rd., Los Angeles, CA 90066
Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33431 305-994-1774
† Epsilon-Lambda Elctrns. Corp., 427 Stevens St., Geneva, IL 60134 312-232-9611

§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† LNR Communications, Inc., 180 Marcus Blvd., Hauppauge, NY 11788 ... 516-273-7111
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
M/A-COM Microwave Circuits, Inc., South Ave., Burlington, MA 01803 .. 617-272-3000
M/A-Com Microwave Components, Inc., M/A-Com, South Avenue, Burlington, MA 01803 617-272-3000
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
§† Magnum Microwave Corp., 365 Ravendale Dr., Mountain View, CA 94043 415-968-9281
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§ Micro-Now Instr. Co., Inc., 8260 N. Elmwood St., P.O. Box 856, Skokie, IL 60077 312-677-4700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44-(582) 60-14-41
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
§† MITEQ Inc., 125 Ricefield Lane, Hauppauge, NY 11788 516-543-8873
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Norsal Inds., 85 D Hoffman Lane So., Central Islip, NY 11722 516-234-1200
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RHG Electronics Lab., Inc., 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Technical Research & Mfg., Inc., R.F.D. #10, Manchester, NH 03103 ... 603-627-6000
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Vectronics Microwave Corp., 276 Lincoln Blvd., Middlesex, NJ 08846 ... 201-356-2377
§ Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Mixers, RF-3450

† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235, 718-934-4500 ..... A•1719-1743
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
† Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
§ Eaton Corp., Elctrn. Instrmn. Div., 5340 Alla Rd., Los Angeles, CA 90066
Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33431 305-994-1774
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
§ Macom Inds., 8230 Haskell Ave., Van Nuys, CA 91406
M/A-COM Microwave Circuits, Inc., South Ave., Burlington, MA 01803 .. 617-272-3000
§† Magnum Microwave Corp., 365 Ravendale Dr., Mountain View, CA 94043 415-968-9281
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ....315-437-3953; 800-448-1666
Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
§† MITEQ Inc., 125 Ricefield Lane, Hauppauge, NY 11788 516-543-8873
§† Plessey Semiconductors, 1641 Kaiser Ave., Irvine, CA 92714 714-540-9979
REPCO, 2421 N. Orange Blossom Trail, Box 7065, Orlando, FL 32854 .. 305-843-8484
RHG Electronics Lab., Inc., 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
Summit Engineering Corp., Box 938, Bozeman, MT 59715 406-587-4511
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877 .....301-948-3434; 800-638-2048

Modems — See Modulator/Demodulators, Data (Vol. D)

Modems, Broadband RF-1900 — *See Vol. D*

Modems, Communications, Eliminator/Line Driver-1900 — *See Vol. D*

Modems, Communications, Line Receivers-1900 — *See Vol. D*

Modems, Communications, Long Haul-1900 — *See Vol. D*

Modems, Communications, Short Haul (Limited Distance)-1900 — *See Vol. D*

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Modulation Transfer Analyzers — See Analyzers, Transfer Function (Vol. D)

Modulator/Demodulators, Data-2000 — *See Vol. D*

Modulator/Demodulators, Laser-3700 — *See Vol. B*

Modulators, AM-1900 — *See Vol. D*

Modulators, FM-1900 — *See Vol. D*

Modulators, Light-3700 — *See Vol. B*

Modulators, Magnetic-2200 — *See Vol. D*

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Modulators, Pulse-3400 — *See Vol. D*

Modulators, RF-1900 — *See Vol. D*

Modulators, Video-2200 — *See Vol. D*

Modules, Amplifier-Also See Amplifiers, Specific Types-3130

† Analog Modules, Inc., 126 Baywood Avenue, Longwood, FL 32750, 305-339-4356/4355 ..... D•1004
§† Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050, 408-988-4930 ..... A•1672
Modular Devices, 50 Orville Dr., Bohemia, NY 11716, 516-567-9620 ..... D•1011
Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ..... A•1688
Validyne Engrg. Corp., 8626 Wilbur Ave., Northridge, CA 91324, 818-886-2057 ..... D•1164
† Alpha Inds., Inc.-Microelectronic Div., 2800 Crystal Drive, Hatfield, PA 19440 215-822-1311
Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990 215-723-8181
† Analog Devices, P.O. Box 280, Norwood, MA 02062 617-329-4700
Analogic Corp., Data Conversion Prods. Grp., Audubon Rd., Wakefield, MA 01880 617-246-0300
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Canberra Ind., One State St., Meriden, CT 06450 203-238-2351
† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123
Control Prods., Devar, Inc., P.O. Box 589, Bridgeport, CT 06601 203-368-6751
† Datel, General Electric Co., 11 Cabot Blvd., Mansfield, MA 02048 617-339-9341
EH Electronics, Inc., Sub. EH Intl., Inc., 48507 Milmont Drive, Fremont, CA 94538 415-651-2340
Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
Infodex, Inc., 395 W. Main St., Waterbury, CT 06702 203-757-9291
Information Control Corp., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
† Inland Motor, Kollmorgen Corp., 501 First St., Radford, VA 24141 703-639-9045
Instruments for Industry, Inc., 151 Toledo St., Farmingdale, NY 11735 516-694-1414
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
Macro Electronics Corp., 23 Royalston Lane, So. Setauket, NY 11720 ... 516-698-3357
MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998 213-828-7496
Modular Audio Prods., Modular Devices Inc., 50 Orville Dr., Bohemia, NY 11716 516-567-9620
§ MVP Elctrns., 1161 N. Tustin, Orange, CA 92667 714-639-9246
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
Pulse Instrs. Co., 1234 Francisco, Torrance, CA 90502 213-515-5330
Skan-A-Matic, Box S, Elbridge, NY 13060 315-689-3961
§ Tennelec, 601 Turnpike, Oak Ridge, TN 37830 615-483-8405
Texmate, Inc., 348 S. Cedros Ave., P.O. Box 2000, Solana Beach, CA 92075 619-481-7177
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E5, Tampa, FL 33614 813-884-1411
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
TRW, RF Devices Div., 14520 Aviation Blvd., Lawndale, CA 90260 213-536-0888
Tustin Elctrns. Co., 1431 E. Saint Andrews Pl., Santa Ana, CA 92705 714-549-0391

Modules, Analog Multiplier-3130

† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735, 516-293-3100 ..... D•1162
† Acromag, 30765 Wixom Rd., Wixom, MI 48096 313-624-1541
† Analog Devices, P.O. Box 280, Norwood, MA 02062 617-329-4700

Analogic Corp., Data Conversion Prods. Grp., Audubon Rd., Wakefield, MA 01880 617-246-0300
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
§ Control Prods., Devar, Inc., P.O. Box 589, Bridgeport, CT 06601 203-368-6751
§† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
§ Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
† Natel Engrg. Co., Inc., 4550 Runway St., Simi Valley, CA 93063 805-581-3950
Phoenix Data, Inc., 3384 W. Osborn Rd., Phoenix, AZ 85017 602-278-8528

Modules, Analog-to-Digital Conversion-3130

ADAC Corp., 70 Tower Office Pk., Woburn, MA 01801, 617-935-6668 .... D•1135
Analogic Corp., Data Conversion Prods. Grp., Audubon Rd., Wakefield, MA 01880, 617-246-0300 ..... D•1138
† Datel, General Electric Co., 11 Cabot Blvd., Mansfield, MA 02048, 617-339-9341 ..... D•1083
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ..... D•1151
Preston Scientific, 805 E. Cerritos Ave., Anaheim, CA 92805, 714-776-6400 ..... D•1161
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735, 516-293-3100 ..... D•1162
† Acromag, 30765 Wixom Rd., Wixom, MI 48096 313-624-1541
† Analog Devices, P.O. Box 280, Norwood, MA 02062 617-329-4700
Applied Micro Technlg., A Burr Brown Co., 3669 E. 44th Street, Tucson, AZ 85713 602-622-8605
† Astronautics Corporation of America, P.O. Box 523, Milwaukee, WI 53201-0523 414-447-8200
† Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Canberra Ind., One State St., Meriden, CT 06450 203-238-2351
§ CmC Instr. Div., Connecticut microComputer Inc., 568 Danbury Road, New Milford, CT 06776 203-354-9395
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
Cybersystems, Inc., 7540 South Memorial Pkwy., Huntsville, AL 35802 .. 205-883-4410
§ Data Translation, 100 Locke Dr., Marlboro, MA 01752 617-481-3700
Datawest, 7333 E. Helm Dr., Scottsdale, AZ 85260 602-948-3280
Digital Equip., One Iron Way, Marlborough, MA 01752
§† Dymec, 8 Lowell Ave., Winchester, MA 01890 617-729-7870
§ Giddings & Lewis Elctrns., A Unit of AMCA Intl., 666 S. Military Rd., P.O. Box 1658, Fond du Lac, WI 54935 414-921-7100
† Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
§ Industrial Computer Designs, Inc., 31264 La Baya Drive, Westlake Village, CA 91362 818-889-3179
Information Control Corp., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
§† Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
† Interface Engrg., 386 Lindelof Ave., Stoughton, MA 02072 617-344-7383
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
Kinetic Sys., 11 Maryknoll Dr., Lockport, IL 60441 815-838-0005
LeCroy Resch. Sys. Corp., 700 S. Main St., Spring Vly., NY 10977 914-425-2000
LeCroy Resch. Sys. Corp. (Cal.), 1806 Embarcadero Rd., Palo Alto, CA 94303 415-856-1800
Macro Electronics Corp., 23 Royalston Lane, So. Setauket, NY 11720 ... 516-698-3357
MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998 213-828-7496
† Micro Networks, 324 Clark St., Worcester, MA 01606 617-852-5400
† Natel Engrg. Co., Inc., 4550 Runway St., Simi Valley, CA 93063 805-581-3950
§ NES, Inc. (Nationwide Electronic Systems), 3003 Wakefield, Carpentersville, IL 60110 312-426-5900
Northern Precision Labs., 11 Madison Rd., Fairfield, NJ 07006 201-227-4800
§ Opto 22, 15461 Springdale St., Huntington Bch., CA 92649 714-891-5861
§† Phoenix Data, Inc., 3384 W. Osborn Rd., Phoenix, AZ 85017 602-278-8528
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
§ RCA Solid State Div., Micro Processors/Memories/Peripherals, Route 202, Somerville, NJ 08876 201-685-6000
† Rolm Mil-Spec Computers, Rolm Corp., 1 River Oaks Pl., San Jose, CA 95134 408-942-8000
Serial Lab Prods., Inc., 162 Cook Lane, P.O. Box 766, Marlboro, MA 01752 617-481-1684
Standard Engrg., 44800 Industrial Dr., Fremont, CA 94538 415-657-7555
Strawberry Tree Computers, 949 Cascade Dr., Sunnyvale, CA 94087 ... 408-736-3083
SYMBICON, 89 Route 101A, Amherst, NH 03031 603-673-8898
Taurus Computer Products, Inc., 1755 Woodward Dr., Ottawa, ON, CANADA K2COPQ 613-226-5361
Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§ Tennelec, 601 Turnpike, Oak Ridge, TN 37830 615-483-8405
Texmate, Inc., 348 S. Cedros Ave., P.O. Box 2000, Solana Beach, CA 92075 619-481-7177
Tustin Elctrns. Co., 1431 E. Saint Andrews Pl., Santa Ana, CA 92705 714-549-0391
§ Veeder-Root, 70 Sargeant St., Hartford, CT 06102 203-527-7201
Xycom, 750 N. Maple Rd., Saline, MI 48176 313-429-4971

Modules, Arithmetic (Binary)-3130

Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050, 408-988-4930 ..... A•1672

Modules, Control & Switching-2200 — *See Vol. D*

Modules, Data Acquisition-2325 — *See Vol. D*

Modules, Data Retention-2325 — *See Vol. D*

Modules Delay Line-2350

Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
† Anders, Inc., 77 Wolcott Rd., Simsbury, CT 06070 203-658-7666

Modules, Digital-to-Analog Conversion-3130

Analogic Corp., Data Conversion Prods. Grp., Audubon Rd., Wakefield, MA 01880, 617-246-0300 ..... D•1139
† Datel, General Electric Co., 11 Cabot Blvd., Mansfield, MA 02048, 617-339-9341 ..... D•1083
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ..... D•1151
† Interface Engrg., 386 Lindelof Ave., Stoughton, MA 02072, 617-344-7383 ..... D•1156
Preston Scientific, 805 E. Cerritos Ave., Anaheim, CA 92805, 714-776-6400 ..... D•1161
† Acromag, 30765 Wixom Rd., Wixom, MI 48096 313-624-1541
† Analog Devices, P.O. Box 280, Norwood, MA 02062 617-329-4700
Applied Micro Technlg., A Burr Brown Co., 3669 E. 44th Street, Tucson, AZ 85713 602-622-8605
† Astronautics Corporation of America, P.O. Box 523, Milwaukee, WI 53201-0523 414-447-8200
† Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
§ CmC Instr. Div., Connecticut microComputer Inc., 568 Danbury Road, New Milford, CT 06776 203-354-9395
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
Cybersystems, Inc., 7540 South Memorial Pkwy., Huntsville, AL 35802 .. 205-883-4410
§ Data Translation, 100 Locke Dr., Marlboro, MA 01752 617-481-3700
Datawest, 7333 E. Helm Dr., Scottsdale, AZ 85260 602-948-3280
Digital Equip., One Iron Way, Marlborough, MA 01752
§† Dymec, 8 Lowell Ave., Winchester, MA 01890 617-729-7870
† Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
§ Industrial Computer Designs, Inc., 31264 La Baya Drive, Westlake Village, CA 91362 818-889-3179
Information Control Corp., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
§† Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
Kinetic Sys., 11 Maryknoll Dr., Lockport, IL 60441 815-838-0005
LeCroy Resch. Sys. Corp. (Cal.), 1806 Embarcadero Rd., Palo Alto, CA 94303 415-856-1800
Macro Electronics Corp., 23 Royalston Lane, So. Setauket, NY 11720 ... 516-698-3357
MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998 213-828-7496
† Micro Networks, 324 Clark St., Worcester, MA 01606 617-852-5400
† Natel Engrg. Co., Inc., 4550 Runway St., Simi Valley, CA 93063 805-581-3950
Northern Precision Labs., 11 Madison Rd., Fairfield, NJ 07006 201-227-4800
§ Opto 22, 15461 Springdale St., Huntington Bch., CA 92649 714-891-5861
§† Phoenix Data, Inc., 3384 W. Osborn Rd., Phoenix, AZ 85017 602-278-8528
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
§ PrimeLine-Soltec Distbn., Soltec Corp., P.O. Box 818, Sun Valley, CA 91353-0818 ..... 800-525-5554;818-764-5400
§ RCA Solid State Div., Micro Processors/Memories/Peripherals, Route 202, Somerville, NJ 08876 201-685-6000
† R. C. Elctrns. Inc., 5386 Hollister Ave., Santa Barbara, CA 93111 805-964-6708
† Rolm Mil-Spec Computers, Rolm Corp., 1 River Oaks Pl., San Jose, CA 95134 408-942-8000
Serial Lab Prods., Inc., 162 Cook Lane, P.O. Box 766, Marlboro, MA 01752 617-481-1684
Standard Engrg., 44800 Industrial Dr., Fremont, CA 94538 415-657-7555
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
Tustin Elctrns. Co., 1431 E. Saint Andrews Pl., Santa Ana, CA 92705 714-549-0391
Xycom, 750 N. Maple Rd., Saline, MI 48176 313-429-4971

Modules, Display — See Display Modules

Modules, Encoding/Decoding-3130

† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731, 516-261-3300 ..... D•1140
† Control Sciences, Inc., 9509 Vassar Ave., Chatsworth, CA 91311, 818-709-5510 ..... D•1142
† Interface Engrg., 386 Lindelof Ave., Stoughton, MA 02072, 617-344-7383 ..... D•1156
Xico, Inc., 120 Ocean Way, Santa Monica, CA 90402, 213-454-0302 ..... D•1082
Analog Devices, P.O. Box 280, Norwood, MA 02062 617-329-4700
† Anders, Inc., 77 Wolcott Rd., Simsbury, CT 06070 203-658-7666
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Datel, General Electric Co., 11 Cabot Blvd., Mansfield, MA 02048 617-339-9341
Dio-Rey, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022 201-941-4455
§ Giddings & Lewis Elctrns., A Unit of AMCA Intl., 666 S. Military Rd., P.O. Box 1658, Fond du Lac, WI 54935 414-921-7100
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600
Information Control Corp., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
§ Interswitch, 770 Airport Blvd., Burlingame, CA 94010 415-347-8217
§ NES, Inc. (Nationwide Electronic Systems), 3003 Wakefield, Carpentersville, IL 60110 312-426-5900

† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100

Modules, Filter-3130

† Acromag, 30765 Wixom Rd., Wixom, MI 48096 313-624-1541
† Anders, Inc., 77 Wolcott Rd., Simsbury, CT 06070 203-658-7666
Aptek Microsystems, 700 N. W. 12th Ave., Deerfield Beach, FL 33441 ... 305-421-8450
† Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Cambridge Filter Corp., P.O. Box 4906, Syracuse, NY 13221-4906 315-457-1000
† Circuit Techn., 160 Smith St., Farmingdale, NY 11735 516-293-8686
§† Data-Control Sys., Commerce Dr., Box 860, Danbury, CT 06810 203-743-9241
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 213-361-8691
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
Schaffner EMC, Inc., 825 Lehigh Ave., Union, NJ 07083 201-851-0644
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070

Modules, I/O Relay-3130

§ Elec-Trol, Inc., 26477 N. Golden Valley Rd., Saugus, CA 91350, 805-252-8330 ..... B•1342
§ Gordos Arkansas, Gordos International Corp., 1000 N. Second St., Rogers, AR 72756, 501-636-5000 ..... B•1382
ITT Components Electromechanical Grp., 1201 E. McFadden Ave., Santa Ana, CA 92705, 714-836-0351 ..... B•1422
§ Opto 22, 15461 Springdale St., Huntington Bch., CA 92649, 714-891-5861 ..... B•1440
Applied Micro Technlg., A Burr Brown Co., 3669 E. 44th Street, Tucson, AZ 85713 602-622-8605
§ Electric Switches, Inc., 2478 Fletcher Dr., Los Angeles, CA 90039 213-660-1310
Electronic Prods. Corp., Interstate Indl. Plaza, R. D. # 5, York, PA 17402 717-767-6517
§ GIC Systems, 2324 A Ridgepoint Dr., Austin, TX 78754 512-926-8840
§ Gordos Corporation, Gordos International Corp., 250 Glenwood Ave., Bloomfield, NJ 07003 201-743-6800
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
§ Standard Grigsby, Inc., Gordos International Corp., 920 Rathbone Ave., Aurora, IL 60507 312-844-4300

Modules, Logic-Also See Cards; Circuits; Networks-3130

Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ..... D•1098
§ Anaheim Automation, 910 E. Orangefair La., Anaheim, CA 92801 714-992-6990
† Antona Corp., 2100 S. Sawtelle Blvd., Suite 205, Los Angeles, CA 90025 213-473-8995
Applied Micro Technlg., A Burr Brown Co., 3669 E. 44th Street, Tucson, AZ 85713 602-622-8605
Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
† Astronautics Corporation of America, P.O. Box 523, Milwaukee, WI 53201-0523 414-447-8200
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Automatic Test Systems, 23 Poplar St., Malden, MA 02148 617-322-1107
§ Circuit Assembly Corp., 18 Thomas St., Irvine, CA 92718-2703 714-855-7887
Datel, General Electric Co., 11 Cabot Blvd., Mansfield, MA 02048 617-339-9341
Digital Equip., One Iron Way, Marlborough, MA 01752
Douglas Elctrns., 718 Marina Blvd., San Leandro, CA 94577 415-483-8770
§ Dymec, 8 Lowell Ave., Winchester, MA 01890 617-729-7870
Dynage/Controls, Inc., 2 Willowbrook Rd., Cromwell, CT 06416 203-635-6257
EH Electronics, Inc., Sub. EH Intl., Inc., 48507 Milmont Drive, Fremont, CA 94538 415-651-2340
Elgenco, Inc., Box 460, Hurricane, UT 84737 801-635-4954
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
Enterprise Sys. Corp., P.O. Box 698, Dover, NH 03820 603-742-7363
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600
Information Control, Dept. EM7 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
Information Control Corp., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
§ Interswitch, 770 Airport Blvd., Burlingame, CA 94010 415-347-8217
LeCroy Resch. Sys. Corp., 700 S. Main St., Spring Vly., NY 10977 914-425-2000
LeCroy Resch. Sys. Corp. (Cal.), 1806 Embarcadero Rd., Palo Alto, CA 94303 415-856-1800
Matrix Sys. Corp., 5177 N. Douglas Fir Rd., Calabasas, CA 91302 818-992-6776
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
† Micro/sys, 1011 Grand Central Ave., Glendale, CA 91201-3010 818-244-4600
Monolithic Sys., 84 Inverness Circle E., Englewood, CO 80112 303-790-7400
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183
§ Namco Controls, An Acme-Cleveland Co., 7567 Tyler Blvd., Mentor, OH 44060 216-946-9900
§ NES, Inc. (Nationwide Electronic Systems), 3003 Wakefield, Carpentersville, IL 60110 312-426-5900
Penn Airborne Prods., Industrial Hwy., Southampton, PA 18966 215-355-3400
Precicontact, Inc., 835 Wheeler Way, Langhorne, PA 19047 215-757-1202
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
RCI/Data, 1992 Lakewood Rd., Toms River, NJ 08753 201-341-8361
Rockwell Int'l., 4311 Jamboree Rd., Newport Beach, CA 92660 800-854-8099
Skan-A-Matic, Box S, Elbridge, NY 13060 315-689-3961
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Standard Engrg., 44800 Industrial Dr., Fremont, CA 94538 415-657-7555
§ Struthers-Dunn, Inc., Lamb's Rd., Pitman, NJ 08071 609-589-7500
§† Superior Elec. Co., 383 Middle St., Bristol, CT 06010 203-582-9561
Sylvania Electronic, Box 360, Muncy, PA 17756 717-546-3191
† Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
Tri-Tronics Co. Inc., 13420 Wright Cir., Tampa, FL 33624 813-855-4453
Xycom, 750 N. Maple Rd., Saline, MI 48176 313-429-4971

Modules, Oscillator-2300

California Instruments, A Div. of Amstar Tech. Prods. Co., Inc., 5150-Convoy St., San Diego, CA 92111, 619-279-8620;800-356-2244;800-821-1634 ..... D•1907
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, 602-967-7874 ..... A•1358
§ Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, 312-451-1000 ..... A•1393
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746 ..... A•1446
Alpha Inds., Inc.-Microelectronic Div., 2800 Crystal Drive, Hatfield, PA 19440 215-822-1311
† Austron, Inc., P.O. Box 14766, Exit 248 N. IH 35, Austin, TX 78761 512-251-2341
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
Behlman Div., California Instrs., Div. of Norlin Inds., 5150 Convoy St., San Diego, CA 92111 619-279-8620
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185 312-231-5270
Elin Div., California Instrs. Co., Div. of Norlin Ind., 5150 Convoy St., San Diego, CA 92111 619-279-8620
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
† Gorman-Redlich Mfg. Co., 6 Curtis St., Athens, OH 45701 614-593-3150
Information Control Corp., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
§ ITT Components Passive Grp., 1201 E. McFadden Ave., Santa Ana, CA 92705 714-836-0351
Modular Audio Prods., Modular Devices Inc., 50 Orville Dr., Bohemia, NY 11716 516-567-9620
Modular Devices, 50 Orville Dr., Bohemia, NY 11716 516-567-9620
Racal-Dana Instrs. Inc., 4 Goodyear St., Irvine, CA 92715 714-859-8999
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E5, Tampa, FL 33614 813-884-1411
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625 813-855-6611

Modules, RMS-to-DC Conversion-3130

Abbott Transistor Labs., Industrial Products Div., 8203 Vineland Ave., Sun Valley, CA 91352 818-504-0644
† Acromag, 30765 Wixom Rd., Wixom, MI 48096 313-624-1541
† Analog Devices, P.O. Box 280, Norwood, MA 02062 617-329-4700
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
§ Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
§ Semikron, Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 ..... 603-883-8102; 1-800-258-1308

Modules, Sample & Hold-3130

Analogic Corp., Data Conversion Prods. Grp., Audubon Rd., Wakefield, MA 01880, 617-246-0300 ..... D•1139
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ..... D•1151
† Acromag, 30765 Wixom Rd., Wixom, MI 48096 313-624-1541
† Analog Devices, P.O. Box 280, Norwood, MA 02062 617-329-4700
Applied Micro Technlg., A Burr Brown Co., 3669 E. 44th Street, Tucson, AZ 85713 602-622-8605
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
§ Dymec, 8 Lowell Ave., Winchester, MA 01890 617-729-7870
Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
Information Control Corp., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
§ Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
LeCroy Resch. Sys. Corp., 700 S. Main St., Spring Vly., NY 10977 914-425-2000
Standard Engrg., 44800 Industrial Dr., Fremont, CA 94538 415-657-7555

Modules, Switching-5100 — *See Vol. B*

Modules (MIL), Electronic-2440 — *See Vol. B*

Modules (MIL), Standard Electronic-2440 — *See Vol. B*

Molding Services — See Services, Molding (Vol. D)

Monitors, Current-2200 — *See Vol. D*

Monitors, Data Link-1900 — *See Vol. D*

Monitors, Error Rate-1900 — *See Vol. D*

Monitors, Frequency-2900 — *See Vol. D*

Monitors, Laser Energy-2200 — *See Vol. D*

Monitors, Line & Program-1900 — *See Vol. D*

Monitors, Modulation-2900 — *See Vol. D*

Monitors, Phase & Phase Angle-2900 — *See Vol. D*

Monitors, Phase Sequence & Loss-2200 — *See Vol. D*

Monitors, Power, AC & DC-2200 — *See Vol. D*

Monitors, Power, AF-1300 — *See Vol. D*

Monitors, Power Failure-2200 — *See Vol. D*

Monitors, Power, Microwave-2900 — *See Vol. D*

Monitors, Power, RF-2900 — *See Vol. D*

Monitors, Response Time-2900 — *See Vol. D*

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Monitors, Touch — See Touch Monitors

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Monitors, Waveform — See Oscilloscopes (Vol. D)

Monitors (MIL), Data-3475 — *See Vol. D*

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Motor Assemblies with Integral Tachometer/Encoder-3500 — *See Vol. B*

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Motor Speed Drives — See Controls, Motor Speed (Vol. D)

Motors, Brush, DC-3500 — *See Vol. B*

Motors, Brushless, DC-3500 — *See Vol. B*

Motors, Clock & Timing-3500 — *See Vol. B*

Motors, Control-3500 — *See Vol. B*

Motors, DC Timing-3500 — *See Vol. B*

Motors, Drag Cup-3500 — *See Vol. B*

Motors, Fractional Horsepower-3500 — *See Vol. B*

Motors, Gearhead-3500 — *See Vol. B*

Motors, Gyro-3500 — *See Vol. B*

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Mounts, CRT & Accessories-2500 — *See Vol. C*

Mounts, Crystal-2300

Accurate Elctrns., 169 S. Abbe Rd., P.O. Box 1287, Elyria, OH 44036 216-365-1211
§ Atlee Inc., One Gill St., Woburn, MA 01801 617-933-3510
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
§ Methode Electronics, Inc., Interconnect Prods Div, 1700 Hicks Rd, Rolling Meadows, IL 60008 312-392-3500
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Milton Ross Co., 511 Second St. Pike, Southampton, PA 18966 215-355-0200
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
§ Schott Elctrns., Hershey Dr., Ansonia, CT 06401 203-736-2677
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Mounts, Integrated Circuit — See Sockets, Integrated Circuit (Vol. C), Boards, Plug-In (Vol. C)

Mounts, Microwave-3450

§ CGTI, 2 Windward Ave., White Plains, NY 10605 914-949-3719
Gabriel Elctrns., Box 70, Scarborough Indl. Pk., Scarborough, ME 04074 207-883-5161
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
Microflect, 3575 25th S.E., Salem, OR 97302-0985 503-363-9267
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Micro-Mounting Devices, 4092 Keith Dr., Campbell, CA 95008 408-866-4626
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

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Multipliers, Crystal-1900 — *See Vol. D*

Multipliers, Diode-1900 — *See Vol. D*

Multipliers, Frequency-3450

† Applied Research, Inc., 160 Dupont St., Plainview, NY 11803, 516-349-9200 .... A•1702

† **Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235, 718-934-4500 ..... A•1719-1720,1772,1773**
† **Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746 ..... A•1447**
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
† Ajax Magnethermic Corp., 1745 Overland Ave., N.E., Warren, OH 44482 216-372-8511
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700
DigiMax Instrs. Corp., 5625 Kearny Villa Rd., San Diego, CA 92123 619-569-6582
Eaton Corp., Microwave Products Division, 955 Benicia Avenue, Sunnyvale, CA 94086 408-730-6300
† Electrac, Inc., 1614 Orangethrope Way, Anaheim, CA 92801 714-879-6021
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§ Micro-Now Instr. Co., Inc., 8260 N. Elmwood St., P.O. Box 856, Skokie, IL 60077 312-677-4700
† Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44-(582) 60-14-41
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
§† MITEQ Inc., 125 Ricefield Lane, Hauppauge, NY 11788 516-543-8873
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
Racal-Dana Instrs. Inc., 4 Goodyear St., Irvine, CA 92715 714-859-8999
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§† RCA Solid State Div., CMOS IC Mktg., Rte. 202, Somerville, NJ 08876 ... 201-685-6000
Reliance Comm/Tec, Reliance Electric, P. O. Box 99502, Cleveland, OH 44199 ..... 800-245-4501;in OH 800-245-4497
Resdel Engrg., 300 E. Live Oak Ave., Arcadia, CA 91006 213-684-2600
RFL Inds., A Dowty Grp. Co./Comms. Div., Powerville Rd., Boonton, NJ 07005 201-334-3100
Rockwell Intl., Commercial Elctrns. Opers., 1200 N. Alma Rd., Richardson, TX 75081 214-996-5000
† Technical Research & Mfg., Inc., R.F.D. # 10, Manchester, NH 03103 ... 603-627-6000
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E5, Tampa, FL 33614 813-884-1411
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
§ Tucker Elctrns., Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Vibration Instrs. Co., 1614 Orangethorpe Way, Anaheim, CA 92801 714-879-6085
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95054 408-727-6001

Multipliers, Hall-4800

§ **Bell, F. W., Inc., 6120 Hanging Moss Rd., Orlando, FL 32807, 305-678-6900 ..... D•1113**
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, OH 43212 ... 614-486-9561

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Networks, Hybrid Substrates-3130

§ **Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ..... A•1796**
HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776, 617-443-4631 ..... A•1872
Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1696
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... A•1957
ACC Electronics, 1300 W. Oak, Independence, KS 67301 316-331-1000
Allen-Bradley Co., Electronics Group, Div.of Rockwell Corp., Microelectronic Products Div., Highway 29 N. Bryan Pk. Exit, Greensboro, NC 27410 919-621-9010
Corning Glass Works, Materials Business, Main Plant, MP 21-3, Corning, NY 14831 607-974-4102
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886 401-738-9150
† Hy-Tec Industries, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786 516-744-5062
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 .....714-979-8833; 714-634-1535
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
† Natel Engrg. Co., Inc., 4550 Runway St., Simi Valley, CA 93063 805-581-3950
Northwest Microcircuits, Inc., 2115 N. College, Newberg, OR 97132 503-538-7081
§† Res-Net, 110 Route 10, Whippany, NJ 07981 ..... 201-887-2260;out of state 800-526-0704
Techno-Components Corp., 7803 Lemona, Van Nuys, CA 91405 818-781-1642
§ Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104 216-795-8200
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Networks, Ladder-4700

§ **Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ..... A•1797**
Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406, 213-450-1761 ..... A•1829
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830, 607-974-8725 ..... A•1835
§† **Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... A•1845-1847,1849**
† **Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1866**
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981, 201-887-8100 ..... A•1881
§ **KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1884**
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1899
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ... A•1923
† **TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... A•1956**
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ..... A•1959
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•1978
Allen-Bradley Co., Electronics Group, Div.of Rockwell Corp., Microelectronic Products Div., Highway 29 N. Bryan Pk. Exit, Greensboro, NC 27410 919-621-9010
† Andrich Sys., Inc., 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
† Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
§† Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
Burr-Brown Corp., P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 714-788-1700
† Circuit Techn., 160 Smith St., Farmingdale, NY 11735 516-293-8686
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 .. 914-664-2333
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
General Resistance, Inc., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hybrid Svcs. Inc., 38 Main St., North Reading, MA 01864 617-664-5500
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411 818-782-6662
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ... 603-668-3210;800-257-3300
Meissner Inds., 551 Rte. 10, Dover, NJ 07801 201-366-1700
Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 .....714-979-8833; 714-634-1535
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
† Res-Net, 110 Route 10, Whippany, NJ 07981 ..... 201-887-2260;out of state 800-526-0704
Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
Shallco, Box 1089, Smithfield, NC 27577 919-934-3135
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
† Tech Labs., Inc., Bergen & Edsall Blvds., Palisades Pk., NJ 07650 201-944-2221
Tel Labs, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 ... 603-625-8994
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 ...216-232-8600
Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722

† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Networks, LC-2700

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ..... A•1586
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... A•1853
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2147
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1899
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ..... A•1401
Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1618
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
† Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
† Artronic Instr. Co., Iric., 9 Division St., Sidney, NY 13838 607-563-8444
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
Design Automation, Inc., 809 Massachusetts Ave., Lexington, MA 02173-3992 617-862-8998
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 .. 914-664-2333
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Maxwell Labs., 8835 Balboa Ave., San Diego, CA 92123 619-279-5100
Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
Rtron Corp., 7324 Lawndale, Skokie, IL 60076 312-679-7180
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
† Thinco Div., Hull Corp., Davisville Rd., Hatboro, PA 19040 215-672-7800
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect., IL 60056 312-297-0070
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832

Networks, Line Impedance Stabilization-1900 — *See Vol. D*

Networks, Matching-1900 — *See Vol. D*

Networks, Phase-2700

Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33431, 305-994-1774 ..... A•1711
Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div.of Rockwell Corp., Microelectronic Products Div., Highway 29 N. Bryan Pk. Exit, Greensboro, NC 27410 919-621-9010
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
† Applied Electro Technlg., Int., STI Company, 2220 So. Anne St., Santa Ana, CA 92704 714-556-6570
† Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 .. 914-664-2333
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
M/A-Com Microwave Components, Inc., M/A-Com, South Avenue, Burlington, MA 01803 617-272-3000
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microwave Applications Grp., 3030 Industrial Pkwy., Santa Maria, CA 93455 805-928-5711
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
Sprague Elec. Co., 481 Marshall St., No. Adams, MA,01247 413-664-4411
Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100
Velonex, 560 Robert Ave., Santa Clara, CA 95050 408-727-7370
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300

Networks, Pulse Forming-2700

§† Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... A•1853
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1621
Triac Electronic Systems, Inc., 87-27 Myrtle Ave., Glendale, NY 11385, 718-441-4759 ..... D•1132
Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div.of Rockwell Corp., Microelectronic Products Div., Highway 29 N. Bryan Pk. Exit, Greensboro, NC 27410 919-621-9010
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 .. 914-664-2333
† El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
Hipotronics, P.O. Drawer A, Brewster, NY 10509 914-279-8091
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
Kappa Scientific Corp., Box 30585, Santa Barbara, CA 93105 805-687-9648
Maxwell Labs., 8835 Balboa Ave., San Diego, CA 92123 619-279-5100
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
† Stanley Elctrns., Inc., 592 Oak St., Copiague, NY 11726 516-842-8866
§ Television Microtime, Inc., 1280 Blue Hills Ave., Bloomfield, CT 06002 ... 203-242-4242
† Tobe Deutschmann Labs., Inc., 550 Turnpike St., Canton, MA 02021 617-828-3366
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300

Networks, Rejection — See Filters (Vol. A)

Networks, RC-2000 — *See Vol. D*

Networks, Resistance-4700

§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ..... A•1784-1789,1797
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134, 408-946-6000 ..... D•1057
§ Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•1800
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1804-1805,1809,1815,1820-1825
Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406, 213-450-1761 ..... A•1829,1831
§ Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830, 607-974-8725 ..... A•1068,1835
§ CTS Corporation, Berne Division, 406 Parr Rd., Berne, IN 46711, 219-589-3111 ..... A•1836
† CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 ..... A•1662
† CTS Electronics Corp., Halex Division, 1202 McGaw Ave., Irvine, CA 92714, 714-261-6381 ..... A•1662
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... A•1845-1847,1849
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1866
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1868
General Resistance, Inc., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ..... A•1870
HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776, 617-443-4631 ..... A•1872
§ IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735, 516-753-0400 ..... A•1875
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... A•1876
† Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... A•1878
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089, 413-781-1350 ..... A•1879
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981, 201-887-8100 ..... A•1881
§ KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1884
§† Mepco//Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960, 201-539-2000 ..... A•1891
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310;213-686-0535 ..... A•1897
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1899

† **Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761, 617-695-0203** ..... **A•1906**
§ **Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777** ..... **A•1907**
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ... **A•1923**
§† **RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054** ..... **A•1935**
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... **A•1941**
Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577, 919-934-5181 ..... **A•1941**
§† **Res-Net, 110 Route 10, Whippany, NJ 07981, 201-887-2260;out of state 800-526-0704** ..... **A•1943**
Sangano Weston-Sangamo Components Div., Fairchild Semiconductor, Box 128, Pickens, SC 29671, 803-878-6311 ..... **A•2056**
State of the Art, Inc., 2470 Fox Hill Rd., State College, PA 16801, 814-355-8004 ..... **A•1951**
§† **TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230** ..... **A•1955**
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ..... **A•1959-1957,1963**
§ **Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200** ..... **A•1969**
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... **A•1976,1978**
ACC Electronics, 1300 W. Oak, Independence, KS 67301 316-331-1000
Alco Elctrn. Prods., Inc., 1551 Osgood St., N. Andover, MA 01845 617-685-4371
Allen-Bradley Co., Electronics Group, Div.of Rockwell Corp., Microelectronic Products Div., Highway 29 N. Bryan Pk. Exit, Greensboro, NC 27410 919-621-9010
§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806 714-630-0081
† Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
§ Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Beckman Instrs., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735 516-454-6390
§ Centralab, Inc., A North American Philips Co., 2566 Northwestern Ave., McClure Pk., West Lafayette, IN 47906 317-463-2536
† Circuit Techn., 160 Smith St., Farmingdale, NY 11735 516-293-8686
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 213-699-0918
Corning Glass Works, Telecomm Prods Dept., BH-5, Corning, NY 14830 607-974-9000
§ CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Hybrid Svcs. Inc., 38 Main St., North Reading, MA 01864 617-664-5500
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
Hy-Cal Engrg., 9650 Telstar Ave., El Monte, CA 91731 213-444-4000
† Hy-Tec Industries, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786 516-744-5062
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-822-9601
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411 818-782-6662
Keystone Carbon, Thermistor Div., St. Marys, PA 15857 814-781-1591
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ... 603-668-3210;800-257-3300
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
Meissner Inds., 551 Rte. 10, Dover, NJ 07801 201-366-1700
Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ..... 714-979-8833; 714-634-1535
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
§ NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735 ..... 516-694-0060; 800-645-9333
† Northwest Microcircuits, Inc., 2115 N. College, Newberg, OR 97132 503-538-7081
RFL Inds., A Dowty Grp. Co./Comms. Div., Powerville Rd., Boonton, NJ 07005 201-334-3100
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
§† Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
† Tech Labs., Inc., Bergen & Edsall Blvds., Palisades Pk., NJ 07650 201-944-2221
§† Techno-Components Corp., 7803 Lemona, Van Nuys, CA 91405 818-781-1642
Tel Labs, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 ... 603-625-8994
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722
§† Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403 717-876-1500
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Networks, Resistance, Trimmer-4700

§ **Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000** ..... **A•1798**
Allen-Bradley Co., Electronics Group, Div.of Rockwell Corp., Microelectronic Products Div., Highway 29 N. Bryan Pk. Exit, Greensboro, NC 27410 919-621-9010
Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022 212-605-2607

Networks, Resistance, Voltage Divider-4700

Bertan Assocs., 121 New South Rd., Hicksville, NY 11801, 516-433-3110 ..... **D•1523**
§ **Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700** ..... **A•1809**
Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div.of Rockwell Corp., Microelectronic Products Div., Highway 29 N. Bryan Pk. Exit, Greensboro, NC 27410 919-621-9010
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926 915-592-3253
Glassman High Voltage Inc., P.O. Box 551, Salem Indl. Pk., Whitehouse Sta., NJ 08889 201-534-9007
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411 818-782-6662
Northwest Microcircuits, Inc., 2115 N. College, Newberg, OR 97132 503-538-7081
Res-Net, 110 Route 10, Whippany, NJ 07981 ..... 201-887-2260;out of state 800-526-0704

Networks, Video-2700

§ Vicon Industries, Inc., 525 Broad Hollow Rd., Melville, NY 11747 516-293-2200

Networks, (MIL), Resistance-2440 — *See Vol. B*

Null Detectors — See Indicators, Null (Vol. D)

Nuts, Metal-2825 — *See Vol. C*

Nuts, Plastic — See Fasteners, Nonmetallic (Vol. C)

Oils — See Lubricants (Vol. C)

Optical Breadboards-4200 — *See Vol. C*

Optical Component Mounts & Accessories-3700 — *See Vol. B*

Optical-Coupler Isolators — See Isolators, Opto (Vol. B)

Optical Design Service — See Services, Optical Design

Optical Radiation Measuring-2900 — *See Vol. D*

Optical Signal Sources — See Generators, Light Pulse (Vol. D)

Oscillators, Audio (Module)-2300

Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903, 714-759-2411 ..... **A•1370**
† **McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411** ..... **A•1382**
§ **Opamp Labs, Inc., 1033 N. Sycamore Ave., Los Angeles, CA 90038, 213-934-3566** ..... **D•1014**
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... **A•1409**
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 718-857-2400
† Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185 312-231-5270
Continental Resources, Inc., 175 Middlesex Tpke., Bedford, MA 01730 .. 617-275-0850
Cybernetic Micro Sys., P.O. Box 3000, 3000 Hwy. 84, San Gregorio, CA 94074 415-726-3000
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 312-932-9380
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† FSI/Fork Standards Inc., 666 Western Ave., Lombard, IL 60148 ..... 312-231-3511; 312-932-9380
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
Genstar Rental Elctrns., 2445 Faber Pl., Palo Alto, CA 94303 415-856-7600
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Industrial Test Equip., 21 Yennicock Ave., Port Washington, NY 11050 .. 516-883-1700
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Modular Audio Prods., Modular Devices Inc., 50 Orville Dr., Bohemia, NY 11716 516-567-9620
Modular Devices, 50 Orville Dr., Bohemia, NY 11716 516-567-9620
Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054 ... 619-433-4510
Oscillatek Corp., 620 North Lindenwood Dr., Olathe, KS 66062 913-829-1777
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064 213-820-4921
Racal-Dana Instrs. Inc., 4 Goodyear St., Irvine, CA 92715 714-859-8999
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 ... 818-993-8257
† Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116 805-964-7791
Star Micronics, Inc., Components Div., 70-D Ethel Rd. W., Piscataway, NJ 08854 201-572-9512
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752 617-481-7827
Telesis Laboratory, Box 1972, Chillocothe, OH 45601 614-642-5000
† T-F Elctrns., 9415 Neils Thompson Dr., Austin, TX 78759 512-836-7323
† Vectron Labs., 166 Glover Ave., Norwalk, CT 06850 203-853-4433
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625 813-855-6611
§ Wilson, H. M., Co., 11501 Chimney Rock Rd., Houston, TX 77035 713-729-1183

Oscillators, Audio (Test) — See Generators, Audio (Vol. D)

Oscillators, Beat Frequency (BFO)-2300

Bruel & Kjaer Instrs. Inc., 185 Forest St., Marlboro, MA 01752 617-481-7000

† Connor-Winfield Corp., 109 Turner Ct, POB L, W. Chicago, IL 60185 312-231-5270
† Electronic Research Co., 7618 Wedd St, Overland Park, KS 66204 913-631-6700
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
Racal-Dana Instrs. Inc., 4 Goodyear St., Irvine, CA 92715 714-859-8999
RFL Inds., A Dowty Grp. Co./Comms. Div., Powerville Rd., Boonton, NJ 07005 201-334-3100

Oscillators, Bias-2300

§ Opamp Labs, Inc., 1033 N. Sycamore Ave., Los Angeles, CA 90038, 213-934-3566 .... D•1014
† Connor-Winfield Corp., 109 Turner Ct, POB L, W. Chicago, IL 60185 312-231-5270
† Electronic Research Co., 7618 Wedd St, Overland Park, KS 66204 913-631-6700
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257

Oscillators, Cavity-2300

Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Communication Techniques Inc., 36 Route 10, East Hanover, NJ 07936 201-884-2580
† EPSCO Microwave, 411 Providence Hwy., Westwood, MA 02090 617-329-1500
† Frequency West, Inc., 3140 Alfred St., Santa Clara, CA 95054 408-727-8500
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† MCL, Inc., 10 North Beach Ave., La Grange, IL 60525-2092 312-354-4350
† Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England .... 44-(582) 60-14-41
§† MITEQ Inc., 125 Ricefield Lane, Hauppauge, NY 11788 516-543-8873
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† RFD, Inc., 5024 Nassau St., Tampa, FL 33607 813-872-1502
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070 .. 717-774-2746
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95054 408-727-6001

Oscillators, Clock-2300

† Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 .... A•1313
† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 .... A•1322
Comclok, Inc., 1142 N. Gilbert St., Anaheim, CA 92801, 714-991-1580;800-854-XTAL .... A•1325
† Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 .... A•1331
CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 .... A•1341-1342,1344,1345,1346,1347
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, 602-967-7874 .... A•1358
§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 .... A•1363
Frequency and Time Systems, Inc., DATUM, INC., 34 Tozer Rd., Beverly, MA 01915, 617-927-8220 .... A•1364
Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903, 714-759-2411 .... A•1370
§ ITT Components Passive Grp., 1201 E. McFadden Ave., Santa Ana, CA 92705, 714-836-0351 .... A•1377
† Leach Corp., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 .... A•1378-1678
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 .... A•1382
§† MF Elctrns. Corp., 10 Renewal Pl., New Rochelle, NY 10801, 914-576-6570 .... A•1384
Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1386
§ Midland-Ross Corp., NEL Unit, 357 Beloit St., Burlington, WI 53105, 414-763-3591 .... A•1387
Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054, 619-433-4510 .... A•1388
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, 312-451-1000 .... A•1393
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 .... A•1396
Oscillatek Corp., 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 .... A•1402
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064, 213-820-4921 .... A•1420
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 .... A•1426
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 .... A•1430
Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-530-8777 .... A•1433
Sokol Crystal Prods., Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 .... A•1435
Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116, 805-964-7791 .... A•1438
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 .... A•1441
† Vectron Labs., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 .... A•1450-1452
† Xsis Electronics, Inc., 12620 W. 63rd St., Shawnee, KS 66216, 913-631-0448 .... A•1457
† Austron, Inc., P.O. Box 14766, Exit 248 N. IH 35, Austin, TX 78761 512-251-2341
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 513-522-3300
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 .... 714-991-1580; 800-854-XTAL
Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 201-772-1106
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377 212-458-5811
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Kahgan Elctrns. Corp., 605 Peninsula Blvd., Hempstead, NY 11550 516-538-2300
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
Pulse Instrs. Co., 1234 Francisco, Torrance, CA 90502 213-515-5330
† Savoy Elctrns., P.O. Box 5727, Ft. Lauderdale, FL 33310 .. 305-563-1333;800-327-1282
Toyo Comm. Equip. Co., Ltd., No. 8 Mori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, TOKYO, JAPAN 105 .... 03-459-7320/03-459-7310
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831

Oscillators, Crystal Controlled (Module)-2300

§† Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 .... A•1313
Austron, Inc., P.O. Box 14766, Exit 248 N. IH 35, Austin, TX 78761, 512-251-2341 .... A•1314
† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 .... A•1322
Comclok, Inc., 1142 N. Gilbert St., Anaheim, CA 92801, 714-991-1580;800-854-XTAL .... A•1325
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 .... A•1328
† Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 .... A•1331
† CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 .... A•1349-1353,1355
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, 602-967-7874 .... A•1358
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 .... A•1360
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204, 913-631-6700 .... A•1362
Elgar Corp, An Onan McGraw Edison Co., 9250 Brown Deer Rd., San Diego, CA 92121, 619-450-0085 .... D•1922
§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 .... A•1363
† Frequency and Time Systems, Inc., DATUM, INC., 34 Tozer Rd., Beverly, MA 01915, 617-927-8220 .... A•1364-1365, D•1148
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 .... A•1367
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903, 714-759-2411 .... A•1370
† Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901, 804-295-3101 .... A•1374
§ ITT Components Passive Grp., 1201 E. McFadden Ave., Santa Ana, CA 92705, 714-836-0351 .... A•1377
† Leach Corp., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 .... A•1378,1678
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 .... A•1382
§† MF Elctrns. Corp., 10 Renewal Pl., New Rochelle, NY 10801, 914-576-6570 .... A•1384
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1386
§ Midland-Ross Corp., NEL Unit, 357 Beloit St., Burlington, WI 53105, 414-763-3591 .... A•1387
† Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054, 619-433-4510 .... A•1388
§ Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, 312-451-1000 .... A•1392
§ M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 .... A•1395
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 .... A•1396
Oscillatek Corp., 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 .... A•1402
† Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 .... A•1408
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 .... A•1413,1416,1417
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064, 213-820-4921 .... A•1420
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 .... A•1426
† Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 .... A•1432
Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-530-8777 .... A•1433
SFE Technologies, 1501 1st St., San Fernando, CA 91340, 213-365-9411 .... A•1434
Sokol Crystal Prods., Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 .... A•1435
† Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116, 805-964-7791 .... A•1438
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 .... A•1441-1442,1444,1445
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746 .... A•1446
† Vectron Labs., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 .... A•1451,1453,1454
† Xsis Electronics, Inc., 12620 W. 63rd St., Shawnee, KS 66216, 913-631-0448 .... A•1457

† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 ... 513-522-3300
Behlman Div., California Instrs., Div. of Norlin Inds., 5150 Convoy St, San Diego, CA 92111 619-279-8620
Berkeley Nucleonics Corp., 1198 Tenth St., Berkeley, CA 94710 415-527-1121
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 .....714-991-1580; 800-854-XTAL
† California Instruments, A Div. of Amstar Tech. Prods. Co., Inc., 5150-Convoy St, San Diego, CA 92111 ..... 619-279-8620;800-356-2244;800-821-1634
Chronomite Labs, 21011 S. Figueroa St., Carson, CA 90745 213-320-9452
Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
Datum Inc., Timing/Aacom Divisions, 1363 S. State College Blvd., Anaheim, CA 92806 714-533-6333
Elin Div., California Instrs. Co., Div. of Norlin Ind., 5150 Convoy St., San Diego, CA 92111 619-279-8620
† Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 312-932-9380
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377 212-458-5811
† FSI/Fork Standards Inc., 666 Western Ave., Lombard, IL 60148 .....312-231-3511; 312-932-9380
§† Gorman-Redlich Mfg. Co., 6 Curtis St., Athens, OH 45701 614-593-3150
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
International Crystal Mfg., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126 405-236-3741
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON, CANADA M3B 1M2 416-447-8531
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
§† MITEQ Inc., 125 Ricefield Lane, Hauppauge, NY 11788 516-543-8873
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
§ Q-Matic Corp., 3194-D Airport Loop Dr., Costa Mesa, CA 92626 714-545-8233
† Racal-Dana Instrs. Inc., 4 Goodyear St., Irvine, CA 92715 714-859-8999
† RFD, Inc., 5024 Nassau St., Tampa, FL 33607 813-872-1502
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303 415-856-6900
† Savoy Elctrns., P.O. Box 5727, Ft. Lauderdale, FL 33310 ..305-563-1333;800-327-1282
Sensor Corp., Box 140, Scottdale, PA 15683 412-887-4080
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 ... 818-993-8257
Standard Logic, 2215 S. Standard Ave., Santa Ana, CA 92707 714-979-4770
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752 617-481-7827
† T-F Elctrns., 9415 Neils Thompson Dr., Austin, TX 78759 512-836-7323
Toyo Comm. Equip. Co., Ltd., No. 8 Mori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, TOKYO, JAPAN 105 ..... 03-459-7320/03-459-7310
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E5, Tampa, FL 33614 813-884-1411
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95054 408-727-6001

Oscillators, Digitally Compensated Crystal (DCXO)-2300

CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1355
† Vectron Labs., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 ..... A•1450

Oscillators, Decade (Test)-2900 — *See Vol. D*

Oscillators, LC-2300

Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1410
Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185 312-231-5270
Continental Resources, Inc., 175 Middlesex Tpke., Bedford, MA 01730 .. 617-275-0850
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901 804-295-3101
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
§† MITEQ Inc., 125 Ricefield Lane, Hauppauge, NY 11788 516-543-8873
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116 805-964-7791
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070 .. 717-774-2746
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 312-297-0070

Oscillators, Low Frequency (Module)-2300

Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 ..... A•1313
† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ..... A•1322
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217, 718-857-2400 ..... D•1908
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ..... A•1328
† Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 ..... A•1331
CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1341-1342,1344,1345,1346,1347,1349,1350,1351
Elgar Corp, An Onan McGraw Edison Co., 9250 Brown Deer Rd., San Diego, CA 92121, 619-450-0085 ..... D•1922
† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ..... A•1363
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1367
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903, 714-759-2411 ..... A•1370
† Leach Corp., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ..... A•1378
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1382
M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ..... A•1395
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1396
Oscillatek Corp., 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 ..... A•1402
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1408
Pacific Power Source Corp., 15122 Bolsa Chica St., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 ..... D•1953
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ..... A•1441-1442,1444,1445
Behlman Div., California Instrs., Div. of Norlin Inds., 5150 Convoy St., San Diego, CA 92111 619-279-8620
Behlman Engineering, 1142 Mark Ave., Carpinteria, CA 93013 805-684-8311
† California Instruments, A Div. of Amstar Tech. Prods. Co., Inc., 5150-Convoy St., San Diego, CA 92111 ..... 619-279-8620;800-356-2244;800-821-1634
Cybernetic Micro Sys., P.O. Box 3000, 3000 Hwy. 84, San Gregorio, CA 94074 415-726-3000
Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011 212-691-9050
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
Elin Div., California Instrs. Co., Div. of Norlin Ind., 5150 Convoy St., San Diego, CA 92111 619-279-8620
† Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 312-932-9380
Frequency Control Prods., Inc., American Time Prods.-Div., 61-20 Woodside Ave., Woodside, NY 11377 212-458-5811
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† FSI/Fork Standards Inc., 666 Western Ave., Lombard, IL 60148 .....312-231-3511; 312-932-9380
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Industrial Test Equip., 21 Yennicock Ave., Port Washington, NY 11050 .. 516-883-1700
† Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901 804-295-3101
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
§† MF Elctrns. Corp., 10 Renewal Pl., New Rochelle, NY 10801 914-576-6570
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
† Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054 ... 619-433-4510
§ Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131 312-451-1000
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064 213-820-4921
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
§ Richard-Lee Co., Box 724, New Providence, NJ 07974 201-276-0710
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303 415-856-6900
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 ... 818-993-8257
† Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116 805-964-7791
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752 617-481-7827
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† T-F Elctrns., 9415 Neils Thompson Dr., Austin, TX 78759 512-836-7323
Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
† Vectron Labs., 166 Glover Ave., Norwalk, CT 06850 203-853-4433
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625 813-855-6611

Oscillators, Microwave-3450

Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ..... A•1328-1329, D•1204
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1367
Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064, 213-820-4921 ..... A•1420
† Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 ..... A•1432
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746 ..... A•1446
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
† Central Microwave Co., Alpha Inds., Inc., 12180 Prichard Farm Rd., Maryland Heights, MO 63043 314-291-5270
† Communication Techniques Inc., 36 Route 10, East Hanover, NJ 07936 201-884-2580
Continental Resources, Inc., 175 Middlesex Tpke., Bedford, MA 01730 .. 617-275-0850
† Deltronic Crystal Inds., 215 Rt. 10, Bldg. 3, Sec. 5, Randolph, NJ 07869 201-361-2222
Eaton Corp., Microwave Products Division, 955 Benicia Avenue, Sunnyvale, CA 94086 408-730-6300
§ Eaton Corp., Elctrn. Instrmn. Div., 5340 Alla Rd., Los Angeles, CA 90066
§† Eaton Corp, Yig-Tek Prods., 785 Palomar Ave., Sunnyvale, CA 94086 ... 408-737-7300
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
† EPSCO Microwave, 411 Providence Hwy., Westwood, MA 02090 617-329-1500
† Epsilon-Lambda Elctrns. Corp., 427 Stevens St., Geneva, IL 60134 312-232-9611
† Frequency West, Inc., 3140 Alfred St., Santa Clara, CA 95054 408-727-8500
Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
† HDS Inc., 12310 Pinecrest Rd., Reston, VA 22091 703-620-6200
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.

Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† Litton Systems, Inc., Electron Dvcs. Div., 960 Industrial Rd., San Carlos, CA 94070 415-591-8411
† M/A-COM OSW, Inc., 2626 S. Hardy Dr., Tempe, AZ 85282 602-966-1471
§† Magnum Microwave Corp., 365 Ravendale Dr., Mountain View, CA 94043 415-968-9281
MARCONI INSTRUMENTS, 3 Pearl Court, Allendale, NJ 07401 201-934-9050
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† MCL, Inc., 10 North Beach Ave., La Grange, IL 60525-2092 312-354-4350
MF Elctrns. Corp., 10 Renewal Pl., New Rochelle, NY 10801 914-576-6570
† Micropac Inds., 905 E. Walnut St., Garland, TX 75040 214-272-3571
† Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, ENGLAND LU5 4SX, England ..... 44-(582) 60-14-41
† Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-469-3311
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
§† MITEQ Inc., 125 Ricefield Lane, Hauppauge, NY 11788 516-543-8873
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
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Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901 804-977-8050
† Racal-Dana Instrs. Inc., 4 Goodyear St., Irvine, CA 92715 714-859-8999
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
† Reeve Electronics, Mellish E. Murray, 1720 W. Fulton St., Chicago, IL 60612 312-670-0150
§ REI Sls., 19525 Business Centre Dr., Northridge, CA 91324 617-938-0900
† RFD, Inc., 5024 Nassau St., Tampa, FL 33607 813-872-1502
† Rodale Elctrns. Corp., 603 Chestnut St., Garden City, NY 11530 516-222-0050
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
Sivers IMA, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752 617-481-7827
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E5, Tampa, FL 33614 813-884-1411
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
§ Tucker Elctrns., Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95054 408-727-6001

Oscillators, Oven-2300

Austron, Inc., P.O. Box 14766, Exit 248 N. IH 35, Austin, TX 78761, 512-251-2341 ..... A•1314
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ..... A•1328
Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 ..... A•1334
CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1352
Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204, 913-631-6700 ..... A•1362
† Frequency and Time Systems, Inc., DATUM, INC., 34 Tozer Rd., Beverly, MA 01915, 617-927-8220 ..... A•1364
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1382
Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 ..... A•1386
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1396
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1408
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 ..... A•1413-1416,1417
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... A•1426
† Vectron Labs., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 ..... A•1453
† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506 814-838-3571
Datum Inc., Timing/Aacom Divisions, 1363 S. State College Blvd., Anaheim, CA 92806 714-533-6333
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377 212-458-5811
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070 .. 717-774-2746

Oscillators, Power (Module)-2300

CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217, 718-857-2400 ..... D•1908
Elgar Corp, An Onan McGraw Edison Co., 9250 Brown Deer Rd., San Diego, CA 92121, 619-450-0085 ..... D•1922
Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... D•1256
Pacific Power Source Corp., 15122 Bolsa Chica St., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 ..... D•1953
Behlman Div., California Instrs., Div. of Norlin Inds., 5150 Convoy St., San Diego, CA 92111 619-279-8620
Behlman Engineering, 1142 Mark Ave., Carpinteria, CA 93013 805-684-8311
† California Instruments, A Div. of Amstar Tech. Prods. Co., Inc., 5150-Convoy St., San Diego, CA 92111 ..... 619-279-8620;800-356-2244;800-821-1634
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
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† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Industrial Test Equip., 21 Yennicock Ave., Port Washington, NY 11050 .. 516-883-1700
Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901 804-295-3101
† MCL, Inc., 10 North Beach Ave., La Grange, IL 60525-2092 312-354-4350
§† MITEQ Inc., 125 Ricefield Lane, Hauppauge, NY 11788 516-543-8873
Modular Devices, 50 Orville Dr., Bohemia, NY 11716 516-567-9620
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
§† Omni Spectra, Inc., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282 602-966-1471
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064 213-820-4921
§ REI Sls., 19525 Business Centre Dr., Northridge, CA 91324 617-938-0900
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303 415-856-6900
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
Vectron Labs., 166 Glover Ave., Norwalk, CT 06850 203-853-4433
§ Wilson, H. M., Co., 11501 Chimney Rock Rd., Houston, TX 77035 713-729-1183

Oscillators, Programmable-2300

IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ..... D•1245
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625 813-855-6611

Oscillators, Pulse (Module)-2300

Austron, Inc., P.O. Box 14766, Exit 248 N. IH 35, Austin, TX 78761, 512-251-2341 ..... A•1314
Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 ..... A•1331
CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1341-1342,1344,1345,1346,1347,1349,1350,1351
Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1360
Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ..... A•1363
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903, 714-759-2411 ..... A•1370
Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901, 804-295-3101 ..... A•1374
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1382
MF Elctrns. Corp., 10 Renewal Pl., New Rochelle, NY 10801, 914-576-6570 ..... A•1384
Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 ..... A•1386
§ Midland-Ross Corp., NEL Unit, 357 Beloit St., Burlington, WI 53105, 414-763-3591 ..... A•1387
Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054, 619-433-4510 ..... A•1388
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, 312-451-1000 ..... A•1393
Oscillatek Corp., 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 ..... A•1402
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1408
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064, 213-820-4921 ..... A•1420
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... A•1427
Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595, 714-898-0960 ..... A•1569
Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-530-8777 ..... A•1433
Sokol Crystal Prods., Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 ..... A•1435
Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116, 805-964-7791 ..... A•1438
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ..... A•1441-1442,1444,1445
Vectron Labs., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 .. A•1452,1454
§ Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648 .. 814-695-4428
Berkeley Nucleonics Corp., 1198 Tenth St., Berkeley, CA 94710 415-527-1121
† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
EPSCO Microwave, 411 Providence Hwy., Westwood, MA 02090 617-329-1500
† Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 312-932-9380
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377 212-458-5811
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
§ ITT Components Passive Grp., 1201 E. McFadden Ave., Santa Ana, CA 92705 714-836-0351
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944

† MCL, Inc., 10 North Beach Ave., La Grange, IL 60525-2092 312-354-4350
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§† Omni Spectra, Inc., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282 602-966-1471
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
Power Functions Engrg., 3831 Cavalier Dr., Garland, TX 75042 214-278-0996
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
§ Richard-Lee Co., Box 724, New Providence, NJ 07974 201-276-0710
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303 415-856-6900
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 ... 818-993-8257
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752 617-481-7827
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E5, Tampa, FL 33614 813-884-1411
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

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Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 ..... A•1334
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322, 617-580-1660 ..... D•1258
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1410
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Elgar Corp, An Onan McGraw Edison Co., 9250 Brown Deer Rd., San Diego, CA 92121 619-450-0085
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901 804-295-3101
Modular Devices, 50 Orville Dr., Bohemia, NY 11716 516-567-9620
§† Omni Spectra, Inc., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282 602-966-1471
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 ... 818-993-8257
Tektronix, Inc., P. O. Box 500, Y3-314, Beaverton, OR 97077 ..... 800-547-1512;Oregon only 800-452-1877
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625 813-855-6611

Oscillators, Reed-2300

Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150

Oscillators, RF (Module)-2300

Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 ..... A•1313
Austron, Inc., P.O. Box 14766, Exit 248 N. IH 35, Austin, TX 78761, 512-251-2341 ..... A•1314
† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ..... A•1322
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ..... A•1328
† Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 ..... A•1331
CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1349
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, 602-967-7874 ..... A•1358
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1360
Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204, 913-631-6700 ..... A•1362
§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ..... A•1363
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1367
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903, 714-759-2411 ..... A•1370
† Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901, 804-295-3101 ..... A•1374
† Leach Corp., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ..... A•1378
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1382
MF Elctrns. Corp., 10 Renewal Pl., New Rochelle, NY 10801, 914-576-6570 ..... A•1384
Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 ..... A•1386
§ M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ..... A•1395
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1396
Oscillatek Corp., 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 ..... A•1402
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1408
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 ..... A•1413-1417
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064, 213-820-4921 ..... A•1420

Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... A•1426
Sokol Crystal Prods., Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 ..... A•1435
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746 ..... A•1446
† Vectron Labs., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 ..... A•1451
† Alpha Inds., Inc.-Microelectronic Div., 2800 Crystal Drive, Hatfield, PA 19440 215-822-1311
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
† Applied Research, Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
† Communication Techniques Inc., 36 Route 10, East Hanover, NJ 07936 201-884-2580
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
Eaton Corp., Microwave Products Division, 955 Benicia Avenue, Sunnyvale, CA 94086 408-730-6300
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 312-932-9380
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377 212-458-5811
† Frequency West, Inc., 3140 Alfred St., Santa Clara, CA 95054 408-727-8500
§† Gorman-Redlich Mfg. Co., 6 Curtis St., Athens, OH 45701 614-593-3150
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
International Crystal Mfg., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126 405-236-3741
§ ITT Components Passive Grp., 1201 E. McFadden Ave., Santa Ana, CA 92705 714-836-0351
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† M/A-COM OSW, Inc., 2626 S. Hardy Dr., Tempe, AZ 85282 602-966-1471
† MCL, Inc., 10 North Beach Ave., La Grange, IL 60525-2092 312-354-4350
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
§† MITEQ Inc., 125 Ricefield Lane, Hauppauge, NY 11788 516-543-8873
† Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054 ... 619-433-4510
§ Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131 312-451-1000
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† NSD, 10936 Portal Dr., Los Alamitos, CA 90720 714-527-4896
§† Omni Spectra, Inc., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282 602-966-1471
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
† Racal-Dana Instrs/Inc., 4 Goodyear St., Irvine, CA 92715 714-859-8999
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303 415-856-6900
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 ... 818-993-8257
Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116 805-964-7791
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752 617-481-7827
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E5, Tampa, FL 33614 813-884-1411
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

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Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 ..... A•1313
† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ..... A•1322
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ..... A•1329
† Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 ..... A•1331
CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1349
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1360
Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204, 913-631-6700 ..... A•1362
Elgar Corp, An Onan McGraw Edison Co., 9250 Brown Deer Rd., San Diego, CA 92121, 619-450-0085 ..... D•1922
Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903, 714-759-2411 ..... A•1370
Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901, 804-295-3101 ..... A•1374
† Leach Corp., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ..... A•1378

† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1382
Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1386
† Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054, 619-433-4510 ..... A•1389
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, 312-451-1000 ..... A•1392
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1396
Oscillatek Corp., 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 ..... A•1402
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1408
Pacific Power Source Corp., 15122 Bolsa Chica St., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 ..... D•1953
† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ..... A•1441-1442,1444,1445
Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746 ..... A•1446
† Vectron Labs., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 ..... A•1451
Xsis Electronics, Inc., 12620 W. 63rd St., Shawnee, KS 66216, 913-631-0448 ..... A•1457
Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
Behlman Div., California Instrs., Div. of Norlin Inds., 5150 Convoy St., San Diego, CA 92111 619-279-8620
Behlman Engineering, 1142 Mark Ave., Carpinteria, CA 93013 805-684-8311
California Instruments, A Div. of Amstar Tech. Prods. Co., Inc., 5150-Convoy St., San Diego, CA 92111 ..... 619-279-8620;800-356-2244;800-821-1634
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
Cybernetic Micro Sys., P.O. Box 3000, 3000 Hwy. 84, San Gregorio, CA 94074 415-726-3000
Elin Div., California Instrs. Co., Div. of Norlin Ind., 5150 Convoy St., San Diego, CA 92111 619-279-8620
† Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 312-932-9380
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377 212-458-5811
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
† FSI/Fork Standards Inc., 666 Western Ave., Lombard, IL 60148 ..... 312-231-3511; 312-932-9380
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
§† Gorman-Redlich Mfg. Co., 6 Curtis St., Athens, OH 45701 614-593-3150
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Industrial Test Equip., 21 Yennicock Ave., Port Washington, NY 11050 .. 516-883-1700
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON, CANADA M3B 1M2 416-447-8531
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
MF Elctrns. Corp., 10 Renewal Pl., New Rochelle, NY 10801 914-576-6570
Modular Audio Prods., Modular Devices Inc., 50 Orville Dr., Bohemia, NY 11716 516-567-9620
Modular Devices, 50 Orville Dr., Bohemia, NY 11716 516-567-9620
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064 213-820-4921
Real Time Sys., 152 S. MacQuesten Pkwy., Mt. Vernon, NY 10550 914-667-0425
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303 415-856-6900
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 ... 818-993-8257
Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116 805-964-7791
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752 617-481-7827
Telesis Laboratory, Box 1972, Chillocothe, OH 45601 614-642-5000
† T-F Elctrns., 9415 Neils Thompson Dr., Austin, TX 78759 512-836-7323
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625 813-855-6611

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Oscillators, Square Wave (Module)-2300

Austron, Inc., P.O. Box 14766, Exit 248 N. IH 35, Austin, TX 78761, 512-251-2341 ..... A•1314
† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ..... A•1322
Comclok, Inc., 1142 N. Gilbert St., Anaheim, CA 92801, 714-991-1580;800-854-XTAL ..... A•1325
† Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 ..... A•1331
§ CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1348
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, 602-967-7874 ..... A•1358
† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ..... A•1363
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903, 714-759-2411 ..... A•1370
Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901, 804-295-3101 ..... A•1374
† Leach Corp., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ..... A•1378
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1382
§† MF Elctrns. Corp., 10 Renewal Pl., New Rochelle, NY 10801, 914-576-6570 ..... A•1384
Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1386
§ Midland-Ross Corp., NEL Unit, 357 Beloit St., Burlington, WI 53105, 414-763-3591 ..... A•1387
† Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054, 619-433-4510 ..... A•1388
§† Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, 312-451-1000 ..... A•1393
§ M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ..... A•1395
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1396
Oscillatek Corp., 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 ..... A•1402
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1408
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064, 213-820-4921 ..... A•1420
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... A•1427
Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-530-8777 ..... A•1433
† Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116, 805-964-7791 ..... A•1438
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ..... A•1441-1442,1444,1445
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
† Vectron Labs., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 .. A•1452,1454
† Xsis Electronics, Inc., 12620 W. 63rd St., Shawnee, KS 66216, 913-631-0448 ..... A•1457
§ Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648 .. 814-695-4428
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Behlman Div., California Instrs., Div. of Norlin Inds., 5150 Convoy St., San Diego, CA 92111 619-279-8620
Berkeley Nucleonics Corp., 1198 Tenth St., Berkeley, CA 94710 415-527-1121
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 ..... 714-991-1580; 800-854-XTAL
† California Instruments, A Div. of Amstar Tech. Prods. Co., Inc., 5150-Convoy St., San Diego, CA 92111 ..... 619-279-8620;800-356-2244;800-821-1634
† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
ECO Instrs. Div., Sea Data Corp., 1 Bridge St., Newton, MA 02158 617-964-8360
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
Elin Div., California Instrs. Co., Div. of Norlin Ind., 5150 Convoy St., San Diego, CA 92111 619-279-8620
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 312-932-9380
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377 212-458-5811
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
† FSI/Fork Standards Inc., 666 Western Ave., Lombard, IL 60148 ..... 312-231-3511; 312-932-9380
Genstar Rental Elctrns., 2445 Faber Pl., Palo Alto, CA 94303 415-856-7600
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Industrial Test Equip., 21 Yennicock Ave., Port Washington, NY 11050 .. 516-883-1700
§ ITT Components Passive Grp., 1201 E. McFadden Ave., Santa Ana, CA 92705 714-836-0351
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON, CANADA M3B 1M2 416-447-8531
§† Omni Spectra, Inc., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282 602-966-1471
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
§ Richard-Lee Co., Box 724, New Providence, NJ 07974 201-276-0710
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303 415-856-6900
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 ... 818-993-8257
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752 617-481-7827
† T-F Elctrns., 9415 Neils Thompson Dr., Austin, TX 78759 512-836-7323
Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877 ..... 301-948-3434; 800-638-2048

Oscillators, Square Wave (Test) — See Generators, Function (Vol. D)

Oscillators, Sweep — See Generators, Sweep (Vol. D)

Oscillators, Telemetry-1900 — *See Vol. D*

Oscillators, Temperature Compensated-2300

† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ..... A•1323
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ..... A•1328
Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 ..... A•1333
† CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1348-1351,1354,1355
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, 602-967-7874 ..... A•1359
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1367

† **Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903, 714-759-2411** ..... A•1371
† **Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901, 804-295-3101** ..... A•1374
† **McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411** ..... A•1382
† **Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200** ..... A•1386
† **Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054, 619-433-4510** ..... A•1388
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, 312-451-1000 ..... A•1392
§† **Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777** ..... A•1396
Oscillatek Corp., 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 ..... A•1402
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1408
† **Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000** ..... A•1413-1417
† **Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929** ..... A•1426
† **Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860** ..... A•1432
† **Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116, 805-964-7791** ..... A•1439
† **Vectron Labs., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433** ..... A•1452
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-329-2460
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Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377 212-458-5811
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† Gorman-Redlich Mfg. Co., 6 Curtis St., Athens, OH 45701 614-593-3150
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
HDS Inc., 12310 Pinecrest Rd., Reston, VA 22091 703-620-6200
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
International Crystal Mfg., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126 405-236-3741
§ ITT Components Passive Grp., 1201 E. McFadden Ave., Santa Ana, CA 92705 714-836-0351
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Leach Corp., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620 714-739-0770
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON, CANADA M3B 1M2 416-447-8531
† M/A-COM OSW, Inc., 2626 S. Hardy Dr., Tempe, AZ 85282 602-966-1471
§† Magnum Microwave Corp., 365 Ravendale Dr., Mountain View, CA 94043 415-968-9281
§† Omni Spectra, Inc., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282 602-966-1471
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064 213-820-4921
Racal-Dana Instrs. Inc., 4 Goodyear St., Irvine, CA 92715 714-859-8999
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 ... 818-993-8257
† T-F Elctrns., 9415 Neils Thompson Dr., Austin, TX 78759 512-836-7323
Toyo Comm. Equip. Co., Ltd., No. 8 Mori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, TOKYO, JAPAN 105 ..... 03-459-7320/03-459-7310
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E5, Tampa, FL 33614 813-884-1411
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95054 408-727-6001

Oscillators, Test Equipment — See Generators (Specific Types) (Vol. D)

Oscillators, Tuning Fork Controlled - Also see Resonators-2300

§† **Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810** ..... A•1441-1442,1444,1445
† Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 312-932-9380
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377 212-458-5811
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
† Philamon, Inc., 33 Dubon Ct., Farmingdale, NY 11735 516-249-2700
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064 213-820-4921
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303 415-856-6900
† Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116 805-964-7791
† T-F Elctrns., 9415 Neils Thompson Dr., Austin, TX 78759 512-836-7323

Oscillators, UHF/VHF (Module)-2300

Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1591
Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 ..... A•1313
Austron, Inc., P.O. Box 14766, Exit 248 N. IH 35, Austin, TX 78761, 512-251-2341 ..... A•1314
† **Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571** ..... A•1322
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ..... A•1328
Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 ..... A•1331

CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1341-1342,1344,1345,1346,1347,1348,1353
† **Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460** ..... A•1360
† **Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212** ..... A•1363
† **Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500** ..... A•1367
Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903, 714-759-2411 ..... A•1370
Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901, 804-295-3101 ..... A•1374
† **Leach Corp., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770** ..... A•1378
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1382
MF Elctrns. Corp., 10 Renewal Pl., New Rochelle, NY 10801, 914-576-6570 ..... A•1384
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, 312-451-1000 ..... A•1393
§† **Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777** ..... A•1396
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... A•1408
† **Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000** ..... A•1413-1417
† **Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064, 213-820-4921** ..... A•1420
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... A•1426
Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-530-8777 ..... A•1433
Sokol Crystal Prods., Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 ..... A•1435
Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116, 805-964-7791 ..... A•1438
† **Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746** ..... A•1446
† **Vectron Labs., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433** ..... A•1451
Alpha Inds., Inc.-Microelectronic Div., 2800 Crystal Drive, Hatfield, PA 19440 215-822-1311
† Applied Research, Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
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† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377 212-458-5811
† Frequency West, Inc., 3140 Alfred St., Santa Clara, CA 95054 408-727-8500
† Gorman-Redlich Mfg. Co., 6 Curtis St., Athens, OH 45701 614-593-3150
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
International Crystal Mfg., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126 405-236-3741
§ ITT Components Passive Grp., 1201 E. McFadden Ave., Santa Ana, CA 92705 714-836-0351
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Microsonics Inc., 60 Winter St., Weymouth, MA 02188 617-337-4200
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054 ... 619-433-4510
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
Racal-Dana Instrs. Inc., 4 Goodyear St., Irvine, CA 92715 714-859-8999
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752 617-481-7827
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E5, Tampa, FL 33614 813-884-1411
Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95054 408-727-6001

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Oscillators, Ultrasonic (Module)-2300

M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ..... A•1395
† Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 312-932-9380
Matec Instruments, Inc., 60 Metebello Rd., Warwick, RI 02886 401-739-9030
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 ... 818-993-8257
Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
† Vectron Labs., 166 Glover Ave., Norwalk, CT 06850 203-853-4433

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Oscillators, Voltage Controlled Crystal (VCXO)-2300

† **Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571** ..... A•1323
† **Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700** ..... A•1328
Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 ..... A•1332
† **CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411** ..... A•1348-1351,1355

† **Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460** ..... **A•1360**
† **Frequency and Time Systems, Inc., DATUM, INC., 34 Tozer Rd., Beverly, MA 01915, 617-927-8220** ..... **A•1364**
† **Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500** ..... **A•1367**
† **Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903, 714-759-2411** ..... **A•1370**
§ **Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777** ..... **A•1396**
Oscillatek Corp., 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 ..... **A•1402**
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ..... **A•1410**
† **Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000** ..... **A•1413,1416**
† **Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064, 213-820-4921** ..... **A•1420**
† **Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929** ..... **A•1426**
† **Vectron Labs., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433** ..... **A•1454**
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† Applied Research, Inc., 160 Dupont St, Plainview, NY 11803 516-349-9200
Behlman Div., California Instrs., Div. of Norlin Inds., 5150 Convoy St, San Diego, CA 92111 619-279-8620
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St, Brooklyn, NY 11217 718-857-2400
† Communication Techniques Inc., 36 Route 10, East Hanover, NJ 07936 201-884-2580
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
§† Data-Control Sys., Commerce Dr., Box 860, Danbury, CT 06810 203-743-9241
§† EFRATOM, a division of Ball Corp., 18851 Bardeen Ave, Irvine, CA 92715 714-752-2891
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
Elin Div., California Instrs. Co., Div. of Norlin Ind., 5150 Convoy St., San Diego, CA 92111 619-279-8620
§ EMR Data Systems, Div. Sangamo- Weston, Box 3041, Sarasota, FL 33578 813-371-0811
Erbtec Engineering, Inc., 5680 Valmont Rd., Boulder, CO 80301 303-447-8750
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Industrial Test Equip., 21 Yennicock Ave., Port Washington, NY 11050 .. 516-883-1700
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§† Luff Research, Box 449, Jackson Hgts., NY 11372 718-429-5900
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† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St, P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
† Micropac Inds., 905 E. Walnut St., Garland, TX 75040 214-272-3571
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188 617-337-4200
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
§† MITEQ Inc., 125 Ricefield Lane, Hauppauge, NY 11788 516-543-8873
† Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054 ... 619-433-4510
§† Omni Spectra, Inc., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282 602-966-1471
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 ... 818-993-8257
† Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116 805-964-7791
Struthers-Dunn, Inc., Lamb's Rd., Pitman, NJ 08071 609-589-7500
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070 .. 717-774-2746
Teledyne/Geotech, 3401 Shiloh Rd., Garland, TX 75041 214-271-2561
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
T-F Elctrns., 9415 Neils Thompson Dr., Austin, TX 78759 512-836-7323
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625 813-855-6611
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Ovens, Aging, Burn-in, Life Test-2550 — *See Vol. D*

Ovens, Drying (for Electronic Instruments)-4100 — *See Vol. D*

Ovens, Crystal & Component-2300

† **CTS Electronics Corp.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411** ..... **A•1348**
† **Monitor Prods. Co., Inc., Post Office Box 1966, Oceanside, CA 92054, 619-433-4510** ..... **A•1391**
† **Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, 804-977-8050** ..... **A•1411**
Acme Elec. Heating Corp., 4685 E. 11th, Hialeah, FL 33013 305-685-8326
† Blue M, A Unit of General Signal, 138th & Chatham Sts., Blue Island, IL 60406 312-385-9000
§† Casso-Solar, P.O. Box 163, U.S. Route 202, Pomona, NY 10970 914-354-2500
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
DigiMax Instrs. Corp., 5625 Kearny Villa Rd., San Diego, CA 92123 619-569-6582
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
International Instrumentation, 31131-602 Via Colinas, Westlake Vlg., CA 91362 213-991-9614
† Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901 804-295-3101
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
† Oven Inds., 191 Hempt Rd., P.O. Box 290, Mechanicsburg, PA 17055 ... 717-766-0721
Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116 805-964-7791
Texas Instrs., Matls. & Controls Grp., 34 Forrest St., Attleboro, MA 02703 617-699-3800
† Trent, Inc., 201 Leverington Ave., Philadelphia, PA 19127 215-482-5000

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Packages, Integrated Circuit-3130

† **Mini-Systems; Inc., Electronic Package Div., 168 E. Bacon St., P.O. Box 1597, Plainville, MA 02762, 617-695-2000** ..... **A•1681**
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... **C•1619**
§ Accessories for Elctrns., Inc., 800 Merrick Rd., Baldwin, NY 11510-3593 516-546-1751
Airpax Corp., Woods Rd., Cambridge, MD 21613 301-228-4600
Aromat Corp., 250 Sheffield St., Mountainside, NJ 07092 201-232-4260
§ Aura Mfg., 50 McDermott Rd., North Haven, CT 06473 203-777-2541
† Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§ Bivar, Inc., 4 Thomas, Irvine, CA 92718 714-951-8808
Centerflex Techn. Corp., 221 Seventh Ave., P.O. Box 21, Hawthorne, NJ 07507 201-423-0505
† Detoronics Corporation, 10660 E. Rush St., S. El Monte, CA 91733 818-579-7130
Douglas Elctrns., 718 Marina Blvd., San Leandro, CA 94577 415-483-8770
Elctrn. Molding Corp., 96 Mill St., Woonsocket, RI 02895 401-769-3800
§† Garry Mfg. Co., Div. of Brand-Rex Co., 9 Queen Anne Ct., Laghorne, PA 19047 215-949-2300
Glasseal Products Inc., HCC Industries, 16311 Ventura Blvd., Encino, CA 91436 201-370-9100
† Hermetic Seal, 4232 Temple City Blvd., Rosemead, CA 91770 818-283-0411
Hudson Tool & Die Co., Inc., 18 Malvern St., Newark, NJ 07105 201-589-1800
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Industrial Elctrn. Engrs., Inc., 7740 Lemona Ave., Van Nuys, CA 91405 ... 818-787-0311
Interconics, BMC Industries, Inc., 245 E. 6th St., 3rd Flr., St. Paul, MN 55101 612-228-6512

International Instrumentation, 31131-602 Via Colinas, Westlake Vlg., CA 91362 213-991-9614
† Isotronics, Industrial Park, New Bedford, MA 02745 617-998-2000
§† Kyocera Intl, Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
Linear Technlg., P.O. Box 489, Sta. "A", Burlington, ON, CANADA L7R 3Y3 416-632-2996
3M-Electronic Products Division, Bldg. 502, P.O. Box 2963, Austin, TX 78769-2963 512-834-6682
† Milton Ross Co., 511 Second St. Pike, Southampton, PA 18966 215-355-0200
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
† National Beryllia Corp., Greenwood Ave., Haskell, NJ 07420 201-839-1600
NTK Technical Ceramics, NGK Spark Plugs (U.S.A.), Inc., 1701 N. Greenville Ave. #205, Richardson, TX 75081 214-235-8332
Plessey Ceramic Div., 8th & Harrison Sts., Frenchtown, NJ 08825 201-996-2121
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
Sinclair & Rush, 6900 S. Broadway, St. Louis, MO 63111 314-481-2450
† Stevens Products, Inc., 128 N. Park St., E. Orange, NJ 07019 201-672-2140
† Thomson-CSF Comps. Corp., Special Prods. Div., 301 Rte. 17 North, Rutherford, NJ 07070 201-438-2300

Packaging Materials, Antistatic-3800 — *See Vol. C*

Packaging Materials, Foam & Plastic-3800 — *See Vol. C*

Packaging Panels, Integrated Circuits — See Boards, Plug-in (Vol. C)

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Panels, Jack-2100 — *See Vol. C*

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Panels, Meter — See Enclosures, Circuit Board, Module, & Relay Mounting (Vol. C)

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Paper Tape Equipment, Reader-2000 — *See Vol. D*

Paper Tape Equipment, Reader/Punch-2000 — *See Vol. D*

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Paper, Thermal-2000 — *See Vol. D*

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Photometers — See Meters, Light (Vol. D)

Photomultiplier Tube Housings-5700

§ THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006, 201-575-5586 ..... A•2343
Bunting Magnetics, 500 So. Spencer Rd., Newton, KS 67114 316-284-2020
Corning Glass Works, Materials Business, Main Plant, MP 21-3, Corning, NY 14831 607-974-4102
Gamma Scientific Inc., 3777 Ruffin Rd., San Diego, CA 92123 619-279-8034
Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Pacific Instrs. Inc., 215 Mason Circle, Concord, CA 94518 415-827-9010
Products for Resch., 88 Holten St., Danvers, MA 01923 617-774-3250
§ Stanton Magnetics, Inc., Terminal Dr., Plainview, NY 11803 ..... 718-445-0063; 516-349-0235

Photoresistors-3700 — *See Vol. B*

Pickups, Magnetic, Proximity, Torque, Vibration, etc. — See Transducers, Specific Type (Vol. B)

Pickups, Telephone (For Recording)-1300 — *See Vol. D*

Piezoelectric Ceramics-2300

LZR Electronics, Inc., 8174 Beechcraft Ave., Gaithersburg, MD 20879, 301-921-9440 ..... D•1716
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1396
Piezo Elec. Prods., Inc., 212 Durham Ave., CN-15, Metuchen, NJ 08840, 201-548-2800 ..... B•1768
Star Micronics, Inc., Components Div., 70-D Ethel Rd. W., Piscataway, NJ 08854, 201-572-9512 ..... D•1043
† Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478, 216-232-8600 ..... A•1455
§ Amperex Electronic Corp., Ferroxcube Div., 5083 Kings Hwy., Saugerties, NY 12477 914-246-2811
§ Atomergic Chemetals Corp., 100 Fairchild Ave., Plainview, NY 11803 516-349-8800
Burleigh Instrs., Burleigh Pk., Fishers, NY 14453 716-924-9355
† Channel Inds., 839 Ward Dr., Santa Barbara, CA 93111 805-967-0171
† EDO Western Corp., EDO Corp., 2645 South 300 W., Salt Lake City, UT 84115 ..... 801-486-7481/3846
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
§ Martin Sound Prods., 28 Alpha Park, Cleveland, OH 44143-2297 216-442-2286
Norton, One New Bond St., Worcester, MA 01606 617-853-1000
NTK Technical Ceramics, NGK Spark Plugs (U.S.A.), Inc., 1701 N. Greenville Ave. #205, Richardson, TX 75081 214-235-8332
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 615-892-0291
Unilator Technical Ceramics Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5618

Pilot Lights — See Lights, Indicator (Vol. B)

Pin Grid Arrays — See Sockets, Pin Grid Array

Pin Straighteners, Tube-5700

§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§ Techni-Tool, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462 215-825-4990

Pins, Cotter, Dowel, Taper, etc.-2825 — *See Vol. C*

Pins, Electrically Conductive-2100 — *See Vol. C*

Pins, Mechanical-2825 — *See Vol. C*

Plastic Raw Materials, Liquids, Pellets, Powders, Resins-1600 — *See Vol. C*

Plastics, Encapsulating — See Compounds, Encapsulating, Molding, Potting (Vol. C)

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Plastics, Heat Shrinkable – See Caps, Forms & Tapes, Heat Shrinkable (Vol. C), Tubing, Heat Shrinkable (Vol. C)

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Plotters/Hard-Copy Devices-2000 – *See Vol. D*

Plotters, X-Y, & Accessories-3000 – *See Vol. D*

Plug & Jack Sets-2100 – *See Vol. C*

Plug Adapters-2100 – *See Vol. C*

Plug Buttons-2825 – *See Vol. C*

Plug Caps & Shells-2100 – *See Vol. C*

Plugboard Programming Systems – See Boards, Programming (Vol. C)

Plugs, Electrical (All Types)-2100 – *See Vol. C*

Plugs, Fused-2100 – *See Vol. C*

Plugs, Power, International-2100 – *See Vol. C*

Plugs (MIL)-2440 – *See Vol. B*

Pointers, Dial-2400 – *See Vol. C*

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Positioning Systems, Multiple Axis, Computer Guided-4100 – *See Vol. D*

Posts, Binding-2100 – *See Vol. C*

Posts, Harness Board-6000 – *See Vol. C*

Potentiometer Elements-4750

† **Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626, 714-545-8261** ..... **A•2013**
† **JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, 805-499-7779** ..... **A•2021**
† **Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100** ..... **A•2048**
Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
† Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161
Carter Mfg. Corp., Sugar Rd., Bolton, MA 01740 617-779-5501
† Electronic Controls, Inc., 561 Tamarack Ave., Brea, CA 92621 714-990-0850
Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022 212-605-2607
§ Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 212-361-0800
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629 312-581-4555
† New England Instr., Robertshaw Controls, 14 Kendal Lane, Natick, MA 01760 617-875-9711
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
Waters Mfg., Longfellow Ctr., Wayland, MA 01778 617-358-2777

Potentiometers, Air Operated-4750

Pres-Air-Trol Corp., 1009 Boston Post Rd., Mamaroneck, NY 10543, 914-698-2026-800-431-2625 (outside NY) ..... **B•1690**
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733

Potentiometers, Carbon Ceramic-4750

Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022, 212-605-2607 ..... **A•2019**
§ **IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735, 516-753-0400** ..... **A•2020**
† **Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100** ..... **A•2048**
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
§† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
Centralab, Inc., A North American Philips Co., Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011 212-691-9050
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 ... 516-822-9601
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Ste. 565 Arlington Center, Golf Rd., Arlington Heights, IL 60005 312-310-8641

Potentiometers, Carbon Film-4750

§ **Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134, 408-946-6000** ..... **D•1057**
§ **Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022, 212-605-2607** ..... **A•2019**
§ **IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735, 516-753-0400** ..... **A•2020**
IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ..... **D•1244**
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... **A•2037**
† **Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100** ..... **A•2048**
§ Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
Carter Mfg. Corp., Sugar Rd., Bolton, MA 01740 617-779-5501
Centralab, Inc., A North American Philips Co., Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300
Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011 212-691-9050
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 ... 516-822-9601
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
New England Instr., Robertshaw Controls, 14 Kendal Lane, Natick, MA 01760 617-875-9711
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Ste. 565 Arlington Center, Golf Rd., Arlington Heights, IL 60005 312-310-8641
Wilbrecht Elctrns., 240 Plato Blvd., St. Paul, MN 55107 612-222-2791

Potentiometers, Ceramic Metal (CERMET)-4750

§ **Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000** ..... **A•1784**
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935, 915-592-4888 ..... **A•1993**
§ **Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134, 408-946-6000** ..... **D•1057**
§† **Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050** ..... **A•2001,2004,2005**
CTS Corporation, Berne Division, 406 Parr Rd., Berne, IN 46711, 219-589-3111 ..... **A•2011**
CTS Electronics Corp., Paso Robles Div., Electromechanical Gp., 500 Linne Rd., Paso Robles, CA 93446, 805-238-0350 ..... **B•1546**
§ **Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022, 212-605-2607** ..... **A•2018**
§ **IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735, 516-753-0400** ..... **A•2020**
Mepco/Electra, Inc., North American Philips Corp., 11468 Sorrento Valley Rd., San Diego, CA 92121, 619-453-0332 ..... **A•2029, B•1008**
§ **Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777** ..... **A•1990,2030**
Sangano Weston-Sangamo Components Div., Fairchild Semiconductor, Box 128, Pickens, SC 29671, 803-878-6311 ..... **A•2058,2062,2063**
§† **Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749, 818-964-6565** ..... **A•2040-2041,2044**
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ..... **A•1965**
Beckman Instrs., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Centralab, Inc., A North American Philips Co., Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300
§ Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
§† CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906 317-463-2565
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011 212-691-9050
§ ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054 619-757-7770
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 ... 516-822-9601
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038

Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Precision Elctrn. Comps. Ltd., 1919 Hafis Rd., Toronto, ON, CANADA M6M 2V6 416-249-7103
Preh Electronics Industries, Inc., 5665 Howard Street, Niles, IL 60648 ... 312-647-8338
§† RCD Components, Inc., 330 Bedford St, Manchester, NH 03101 603-669-0054
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
§† Techno-Components Corp., 7803 Lemona, Van Nuys, CA 91405 818-781-1642
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Ste. 565 Arlington Center, Golf Rd., Arlington Heights, IL 60005 312-310-8641
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108 215-923-8230
§† VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743 813-347-2181
§† Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403 717-876-1500

Potentiometers, Composition, Carbon-4750

Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935, 915-592-4888 ..... A•1993
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134, 408-946-6000 ..... D•1057
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590, 516-935-3640 ..... A•2009
CTS Corporation, Berne Division, 406 Parr Rd., Berne, IN 46711, 219-589-3111 ..... A•2011
§ Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022, 212-605-2607 ..... A•2019
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1990, 2030
§† Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ... A•2033
† Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... A•2037
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530, 914-681-0700 ..... D•1039
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2048
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
§† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
Centralab, Inc., A North American Philips Co., Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300
§ Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
§ CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ CTS Corporation, Asheville Division, P.O. Box 100, Skyland, NC 28776 .. 704-684-6451
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-822-9601
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
§ Paccom, 3928 148th NE, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ Philmore Mfg., 40 Inip Dr., Inwood, NY 11696 516-239-6161
§ Piher Int'l. Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ..... 312-640-8300; 800-323-6693
Preh Electronics Industries, Inc., 5665 Howard Street, Niles, IL 60648 ... 312-647-8338
§† RCD Components, Inc., 330 Bedford St, Manchester, NH 03101 603-669-0054
§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749 818-964-6565
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Ste. 565 Arlington Center, Golf Rd., Arlington Heights, IL 60005 312-310-8641
Wilbrecht Elctrns., 240 Plato Blvd., St. Paul, MN 55107 612-222-2791
† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Potentiometers, Conductive Plastic-4750

§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ..... A•1784
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935, 915-592-4888 ..... A•1994
§† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•2004
† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626, 714-545-8261 ..... A•2012
§ ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... A•2017 B•1150
† JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, 805-499-7779 ..... A•2021
§† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555 .. A•2023
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1990, 2030
Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418, 203-735-7405 ..... A•2035
§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749, 818-964-6565 ..... A•2041,2044
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2048-2049, B•1011
† Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161
† Carter Mfg. Corp., Sugar Rd., Bolton, MA 01740 617-779-5501
Centralab, Inc., A North American Philips Co., Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300
§† Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
Electronic Controls, Inc., 561 Tamarack Ave., Brea, CA 92621 714-990-0850
Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 212-361-0800
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
† New England Instr., Robertshaw Controls, 14 Kendal Lane, Natick, MA 01760 617-875-9711
PIC Design, P.O. Box 1004, Middlebury, CT 06762 203-758-8272
Resistance Technology Inc., 1260 Red Fox Rd., St. Paul, MN 55112 612-636-9770
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743 813-347-2181
Waters Mfg., Longfellow Ctr., Wayland, MA 01778 617-358-2777
Wilbrecht Elctrns., 240 Plato Blvd., St. Paul, MN 55107 612-222-2791

Potentiometers, Hot Molded-4750

§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ..... A•1784
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935, 915-592-4888 ..... A•1994
§† Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ... A•2033
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2048
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Precision Elctrn. Comps. Ltd., 1919 Hafis Rd., Toronto, ON, CANADA M6M 2V6 416-249-7103
§† RCD Components, Inc., 330 Bedford St, Manchester, NH 03101 603-669-0054

Potentiometers, Hybrid-4750

§† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626, 714-545-8261 ..... A•2012
ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... A•2016 B•1150
Beckman Instrs., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Dymec, 8 Lowell Ave., Winchester, MA 01890 617-729-7870
Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038

Potentiometers, Lab Type-4750

IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ..... D•1243
Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... D•1254
Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418, 203-735-7405 ..... A•2035
†Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2048
Biddle Instruments, A Thorn EMI Co., 510 Township Line Rd., Blue Bell, PA 19422 215-646-9200
§ Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
Bristol Babcock Inc., 40 Bristol St., Waterbury, CT 06708 203-575-3000
† Carter Mfg. Corp., Sugar Rd., Bolton, MA 01740 617-779-5501
Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
Electro Scientific Inds., 13900 N.W. Science Pk. Dr., Portland, OR 97229 503-641-4141
ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054 619-757-7770
§ Guildline Instrs., 4403 Vineland Rd, Suite B-10, Orlando, FL 32811-9998 305-423-8215
Leeds & Northrup Instrs., A Unit of General Signal Corp., Sumneytown Pike, North Wales, PA 19454 215-643-2000
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
Penn Airborne Prods., Industrial Hwy., Southampton, PA 18966 215-355-3400
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749 818-964-6565
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 215-539-6050
§† VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743 813-347-2181
§ West Division, Gulton Industries, Inc., 3860 N. River Rd., Schiller Park, IL 60176 312-678-6400
Yokogawa Corp. of America, 2 Dart Rd., Shenandoah, GA 30265 404-253-7000

Potentiometers, Linear-4750

Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•2003-2005
§† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626, 714-545-8261 ..... A•2013
§ ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... A•2017, B•1150
§ Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022, 212-605-2607 ..... A•2018
IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ..... D•1244
Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101, 212-361-0800 ..... C•1593
† JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, 805-499-7779 ..... A•2021
§† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555 .. A•2023
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•2030
§† Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ... A•2033
Sangano Weston-Sangamo Components Div., Fairchild Semiconductor, Box 128, Pickens, SC 29671, 803-878-6311 ..... A•2058
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... A•2037
§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749, 818-964-6565 ..... A•2040-2045,2047
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2048-2049, B•1011,1196
§† VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... A•2055
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888

§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Barber-Colman Co., Indl. Instrs. Div., P.O. Box 2940, 1354 Clifford Ave., Loves Park, IL 61132 815-877-0241
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
† Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161
† Carter Mfg. Corp., Sugar Rd., Bolton, MA 01740 617-779-5501
§ Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
§† CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906 317-463-2565
§ Fuji-Svea, P.O. Box 3375, Torrance, CA 90510 213-533-1221
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§ Goldwell Comps., 1815 W. 205th St. Ste. 201, Torrance, CA 90501 213-533-1228
† Humphrey, Inc., 9212 Balboa Ave., San Diego, CA 92123 619-565-6631
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
Mepco//Electra, Inc., North American Philips Corp., 11468 Sorrento Valley Rd., San Diego, CA 92121 619-453-0332
† New England Instr., Robertshaw Controls, 14 Kendal Lane, Natick, MA 01760 617-875-9711
§† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
† Orbit Instrument Corp., 80 Cabot Ct., Hauppauge, NY 11788 516-435-8300
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 .. 203-762-4786
Precision Elctrn. Comps. Ltd., 1919 Hafis Rd., Toronto, ON, CANADA M6M 2V6 416-249-7103
Preh Electronics Industries, Inc., 5665 Howard Street, Niles, IL 60648 ... 312-647-8338
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
Singer Co., Kearfott Div., 1150 McBride Ave., Little Falls, NJ 07424 201-785-6000
§ Temposonics, MTS Sys. Corp., 111 East Ames Ct., Plainview, NY 11803 516-349-1950
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Ste. 565 Arlington Center, Golf Rd., Arlington Heights, IL 60005 312-310-8641
§ Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
§ Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722
Waters Mfg., Longfellow Ctr., Wayland, MA 01778 617-358-2777
§† Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403 717-876-1500

Potentiometers, Metal Film-4750

Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1804
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054 619-757-7770
§ Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022 212-605-2607
IET Labs, Inc., 534 Main St., Westbury, NY 11590 516-334-5959
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
§† Mepco//Electra, Inc., North American Philips Corp., 11468 Sorrento Valley Rd., San Diego, CA 92121 619-453-0332
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
† Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108 215-923-8230
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
§† VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743 813-347-2181
§† Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403 717-876-1500

Potentiometers, Metal, Glazed — See Potentiometers, Ceramic Metal (Vol. A)

Potentiometers, Motorized-4750

§ ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... B•1150-1152, D•1120
† Industrial Control Co., 3100 Pineda Ave., Rockledge, FL 32955, 305-259-7105 ..... D•1988
† JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, 805-499-7779 ..... A•2021
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2049
Carter Mfg. Corp., Sugar Rd., Bolton, MA 01740 617-779-5501
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629 312-581-4555

Potentiometers, Multiturn-4750

§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ..... A•1784
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935, 915-592-4888 ... A•1993,1995
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134, 408-946-6000 ..... D•1057
§† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•1996-1999,2003,2004
§† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626, 714-545-8261 ..... A•2012
§ ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... A•2016, B•1150
§ Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022, 212-605-2607 ..... A•2018
IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ..... D•1244
§ Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101, 212-361-0800 ..... C•1593
† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555 .. A•2027
Mepco//Electra, Inc., North American Philips Corp., 11468 Sorrento Valley Rd., San Diego, CA 92121, 619-453-0332 ..... A•2029 B•1008
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1990,2031
Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418, 203-735-7405 ..... A•2035
Sangano Weston-Sangamo Components Div., Fairchild Semiconductor, Box 128, Pickens, SC 29671, 803-878-6311 ..... A•2058
§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749, 818-964-6565 ..... A•2040-2041,2045
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2048
§ VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... A•2055
§† Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Beckman Instrs., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
† Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161
§ Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
§ CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ CTS Corporation, Asheville Division, P.O. Box 100, Skyland, NC 28776 .. 704-684-6451
CTS Corporation, Berne Division, 406 Parr Rd., Berne, IN 46711 219-589-3111
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 .. 203-762-4786
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Techno-Components Corp., 7803 Lemona, Van Nuys, CA 91405 818-781-1642
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Ste. 565 Arlington Center, Golf Rd., Arlington Heights, IL 60005 312-310-8641
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502 303-242-0810
§† Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403 717-876-1500

Potentiometers, Nonlinear-4750

IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ..... D•1244
§ Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101, 212-361-0800 ..... C•1593
† JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, 805-499-7779 ..... A•2021
Mallory Components Division, Emhart Elec./Elctrn. Grp., 3029 E. Washington St., Indianapolis, IN 46201, 317-261-1361 ..... A•2022
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... A•2037
§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749, 818-964-6565 ..... A•2040
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2048-2049, B•1011
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
§† Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
† Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161
† Carter Mfg. Corp., Sugar Rd., Bolton, MA 01740 617-779-5501
Centralab, Inc., A North American Philips Co., Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300
Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
† Electronic Controls, Inc., 561 Tamarack Ave., Brea, CA 92621 714-990-0850
ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054 619-757-7770
§ Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022 212-605-2607
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629 312-581-4555
† New England Instr., Robertshaw Controls, 14 Kendal Lane, Natick, MA 01760 617-875-9711
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 .. 203-762-4786
Preh Electronics Industries, Inc., 5665 Howard Street, Niles, IL 60648 ... 312-647-8338
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722
§ VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743 813-347-2181
Waters Mfg., Longfellow Ctr., Wayland, MA 01778 617-358-2777

Potentiometers, Power — See Rheostats

Potentiometers, Rectilinear-4750

CTS Corporation, Berne Division, 406 Parr Rd., Berne, IN 46711, 219-589-3111 ..... A•2011
† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626, 714-545-8261 ..... A•2013
Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022, 212-605-2607 ..... A•2018
§ IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735, 516-753-0400 ..... A•2020
IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ..... D•1244
† JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, 805-499-7779 ..... A•2021
Sangano Weston-Sangamo Components Div., Fairchild Semiconductor, Box 128, Pickens, SC 29671, 803-878-6311 ..... A•2058
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2048
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
§ Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§ Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
§ Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
§ Bourns Instrs., Inc., Industrial Div., 1960 Chicago Ave., Unit F, Riverside, CA 92503 714-781-5147
† Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161
† Carter Mfg. Corp., Sugar Rd., Bolton, MA 01740 617-779-5501
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Electronic Controls, Inc., 561 Tamarack Ave., Brea, CA 92621 714-990-0850
§ ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054 619-757-7770
† Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
† Humphrey, Inc., 9212 Balboa Ave., San Diego, CA 92123 619-565-6631
§ Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 212-361-0800
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
† New England Instr., Robertshaw Controls, 14 Kendal Lane, Natick, MA 01760 617-875-9711
† Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749 818-964-6565
§ Temposonics, MTS Sys. Corp., 111 East Ames Ct., Plainview, NY 11803 516-349-1950
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Ste. 565 Arlington Center, Golf Rd., Arlington Heights, IL 60005 312-310-8641
§ Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
§ VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743 813-347-2181
§† Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403 717-876-1500

Potentiometers, Servo Mount-4750

† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•2004
§ ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... B•1150
† JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, 805-499-7779 ..... A•2021
§† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555 ..... A•2023-2027
† Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418, 203-735-7405 ..... A•2035
§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749, 818-964-6565 ..... A•2042
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2048
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
§† Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Beckman Instrs., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
† Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161
† Carter Mfg. Corp., Sugar Rd., Bolton, MA 01740 617-779-5501
Computer Optical Prods., Inc., Sub. of Hathaway Corp., 9353 Eton Ave., Chatsworth, CA 91311-5866 818-882-0424
† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
† Electronic Controls, Inc., 561 Tamarack Ave., Brea, CA 92621 714-990-0850
Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 212-361-0800
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
† New England Instr., Robertshaw Controls, 14 Kendal Lane, Natick, MA 01760 617-875-9711
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743 813-347-2181
Waters Mfg., Longfellow Ctr., Wayland, MA 01778 617-358-2777
§† Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403 717-876-1500

Potentiometers, Sliding-4750

Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626, 714-545-8261 ..... A•2013
§ Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022, 212-605-2607 ..... A•2018
Preh Electronics Industries, Inc., 5665 Howard Street, Niles, IL 60648, 312-647-8338 ..... A•2034
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Ste. 565 Arlington Center, Golf Rd., Arlington Heights, IL 60005 312-310-8641

Potentiometers, Trimmer-4750

§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ..... A•1784
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935, 915-592-4888 ..... A•1993-1995
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134, 408-946-6000 ..... D•1057
§† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•1996
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590, 516-935-3640 ..... A•2009
§ CTS Corporation, Berne Division, 406 Parr Rd., Berne, IN 46711, 219-589-3111 ..... A•2011
§ CTS Electronics Corp., Paso Robles Div., Electromechanical Gp., 500 Linne Rd., Paso Robles, CA 93446, 805-238-0350 ..... B•1546
§ Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022, 212-605-2607 ..... A•2018
§ IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735, 516-753-0400 ..... A•2020
IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ..... D•1244
§† Mepco//Electra, Inc., North American Philips Corp., 11468 Sorrento Valley Rd., San Diego, CA 92121, 619-453-0332 ..... A•2029 B•1008
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•2030
Preh Electronics Industries, Inc., 5665 Howard Street, Niles, IL 60648, 312-647-8338 ..... A•2034
Sangano Weston-Sangamo Components Div., Fairchild Semiconductor, Box 128, Pickens, SC 29671, 803-878-6311 ..... A•2056
† Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... A•2037
§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749, 818-964-6565 ..... A•2039
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ..... A•1965
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•2051
§ VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... A•2054
§† Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Beckman Instrs., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§ Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
§ CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ CTS Corporation, Asheville Division, P.O. Box 100, Skyland, NC 28776 ... 704-684-6451
CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906 317-463-2565
CTS Electronics Corp., Halex Division, 1202 McGaw Ave., Irvine, CA 92714 714-261-6381
† EMCA, Sub. Rohm and Haas Advanced Matls. Co., 605 Center Ave., Mamaroneck, NY 10543 914-698-8434
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-822-9601
§† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629 312-581-4555
Mel-Rain Controls, 42974 M-43 Hwy., Paw Paw, MI 49079 616-657-2527
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
§† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Precision Elctrn. Comps. Ltd., 1919 Hafis Rd., Toronto, ON, CANADA M6M 2V6 416-249-7103
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Resistance Technology Inc., 1260 Red Fox Rd., St. Paul, MN 55112 612-636-9770
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
§† Techno-Components Corp., 7803 Lemona, Van Nuys, CA 91405 818-781-1642
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Ste. 565 Arlington Center, Golf Rd., Arlington Heights, IL 60005 312-310-8641
§† Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403 717-876-1500
Wilbrecht Elctrns., 240 Plato Blvd., St. Paul, MN 55107 612-222-2791

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Potentiometers, Wirewound-4750

§† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•1996,1998,2000,2003,2004
§† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626, 714-545-8261 ..... A•2012
§† ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... A•2017, B•1150
§ Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022, 212-605-2607 ..... A•2019
§ Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101, 212-361-0800 ..... C•1593
Mallory Components Division, Emhart Elec./Elctrn. Grp., 3029 E. Washington St., Indianapolis, IN 46201, 317-261-1361 ..... A•2022
§† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555 ..... A•2023-2025,2027
§† Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ... A•2032
† Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418, 203-735-7405 ..... A•2035
Sangano Weston-Sangamo Components Div., Fairchild Semiconductor, Box 128, Pickens, SC 29671, 803-878-6311 ..... A•2059
§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749, 818-964-6565 ..... A•2041
Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2048
§† VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... A•2055
§ Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Beckman Instrs., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
† Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161
† Carter Mfg. Corp., Sugar Rd., Bolton, MA 01740 617-779-5501
§† Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ CTS Corporation, Asheville Division, P.O. Box 100, Skyland, NC 28776 .. 704-684-6451
† Electronic Controls, Inc., 561 Tamarack Ave., Brea, CA 92621 714-990-0850
E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 219-356-4300
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
† Humphrey, Inc., 9212 Balboa Ave., San Diego, CA 92123 619-565-6631
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
† Mel-Rain Controls, 42974 M-43 Hwy., Paw Paw, MI 49079 616-657-2527
† New England Instr., Robertshaw Controls, 14 Kendal Lane, Natick, MA 01760 617-875-9711
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 .. 203-762-4786
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Tech Labs., Inc., Bergen & Edsall Blvds., Palisades Pk., NJ 07650 201-944-2221
§† Techno-Components Corp., 7803 Lemona, Van Nuys, CA 91405 818-781-1642
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Ste. 565 Arlington Center, Golf Rd., Arlington Heights, IL 60005 312-310-8641
† Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
† Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722
Waters Mfg., Longfellow Ctr., Wayland, MA 01778 617-358-2777
§† Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403 717-876-1500
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

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Power Entry Module — See Adaptors, US to European Power

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Preselector-Mixers-3450

North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1780
Eaton Corp., Microwave Products Division, 955 Benicia Avenue, Sunnyvale, CA 94086 408-730-6300
§† Eaton Corp, Yig-Tek Prods., 785 Palomar Ave., Sunnyvale, CA 94086 ... 408-737-7300
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
FG Engrg., Box 476, Fredonia, AZ 86022 602-643-7375
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057-0486 ....315-437-3953; 800-448-1666
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RHG Electronics Lab., Inc., 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

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Probes, Hall-4800

§ Bell, F. W., Inc., 6120 Hanging Moss Rd., Orlando, FL 32807, 305-678-6900 ..... D•1113, 1194
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, 815-235-6600 ..... B•1476
North American Soar Corp., 11126 Cornell Ave., Cherry Hill, NJ 08002, 609-488-1060 ..... D•1273
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, OH 43212, 614-486-9561 ..... B•1819
Active Control Instrmn., P.O. Box 243-Wildwood Circle, Key Largo, FL 33037 305-451-1000
§ Fluke, John, Mfg. Co., Box C9090, MS 250C, Everett, WA 98206 206-356-5400
LDJ Incorporated, 2200 Stephenson Hwy., P.O. Box 219, Troy, MI 48099-0219 313-528-2202
Magnetic Instrumentation, 8350 E. 48TH ST., Indianapolis, IN 46226 317-545-2102
§ Magnos, Old School House Rd., Harvard, MA 01451 617-456-8880
RFL Inds., A Dowty Grp. Co./Instr. Div., Powerville Rd., Boonton, NJ 07005 201-334-3100
§ Sunshine Sci. Instr., 1810 Grant Ave., Philadelphia, PA 19115 215-673-5600
Walker Scientific, Rockdale St., Worcester, MA 01606 617-852-3674

Probes, High Voltage (1,000 Volts & Over)-2900 — ***See Vol. D***

Probes, IC-2900 — ***See Vol. D***

Probes, Logic Test-2900 — ***See Vol. D***

Probes, Microwave-3450

Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 617-935-8610
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 516-694-3600
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
Probe-Rite, Inc., 2725 Lafayette St., Santa Clara, CA 95050 408-727-0100

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Programmers, PROM & Logic Array-3130

Allied Systems Corp., Box 18077, Greensboro, NC 27419 919-299-2294
Ango Electronics Corp., Post Office Box 112, Harrison, NJ 07029 .....212-685-6336; 201-484-1115
Applied Micro Technlg., A Burr Brown Co., 3669 E. 44th Street, Tucson, AZ 85713 602-622-8605
Barber-Colman Co., Indl. Instrs. Div., P.O. Box 2940, 1354 Clifford Ave., Loves Park, IL 61132 815-877-0241
Bytek Computer Systems Corp., 1021 S. Rogers Circle, Boca Raton, FL 33431 305-994-3520
Citel, Inc., 3060 Raymond St., Santa Clara, CA 95050 408-727-6562
§ Curtis Electro Devices, Inc., Box 4090, Mountain View, CA 94040 415-964-3846
Cybernetic Micro Sys., P.O. Box 3000, 3000 Hwy. 84, San Gregorio, CA 94074 415-726-3000
Data I/O Corp., 10525 Willows Rd. N.E., Redmond, WA 98073-9746 206-881-6444
† Datron Instrs., Inc., 3401 SW 42nd Ave., Stuart, FL 33497 305-283-0935
Digelec, Inc., Affil. Wavetek Corp., 586 Weddell Drive, Suite 1, Sunnyvale, CA 94089 408-745-0722
Digital Equip., One Iron Way, Marlborough, MA 01752
Digital Media, 3178 Gibraltar Ave., Costa Mesa, CA 92626 714-751-1373
Dynatec International, 3594 West 1820 South, Salt Lake City, UT 84104 ..... 801-973-9500;800-722-7425
Eventide, Inc., One Alsan Way, Little Ferry, NJ 07643 201-641-1200
GMR Co., 8801 Sepulveda Blvd., Los Angeles, CA 90045 213-216-9516
GTEK, Inc., 307 Coleman Ave., Waveland, MS 39576 601-467-8048
Harrel, Inc., 16 Fitch St., E. Norwalk, CT 06855 203-866-2573
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Innovatek Microsystems, Inc., Smithfield Rd., R1 Box 104, Millerton, NY 12546-9720 914-373-9003
† International Microsystems, 11554 C Ave., Auburn, CA 95603 800-325-6028
§ Klockner Moeller, 4 Strathmore Rd., Natick, MA 01760 617-655-1910
§ Kontron Elctrns., 1230 Charleston Rd., Mountain View, CA 94039-7230 415-965-7020
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
Oliver Advanced Engrg., 676 W. Wilson Ave., Glendale, CA 91203 818-240-0080
Onset Computer Corp., 199 Main St., PO Box 1030, N. Falmouth, MA 02556 617-563-2267
PCM-PAC Cyber-Metric, 6800 Sierra Ct., Dublin, CA 94568 415-829-8700
PPM, Inc., 4521 Emery Ind. Pkwy., Cleveland, OH 44128 216-292-6006
Pro-Log, 2411 Garden Rd., Monterey, CA 93940 408-372-4593
§† Rockwell Int'l., 4311 Jamboree Rd., Newport Beach, CA 92660 800-854-8099

Southern Computer Corp., 3720 N. Stratford Rd. N.E., Atlanta, GA 30342 404-231-5363
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§ Structured Design, Inc., 1700 Wyatt Dr. #7, Santa Clara, CA 95054 408-988-0725
Sunrise Electronics, Inc., 524 S. Vermont Ave., Glendora, CA 91740 818-914-1926
Walmor Data Systems, Inc., 300 E. Irving Park Rd., Wood Dale, IL 60190 312-350-0625
Xycom, 750 N. Maple Rd., Saline, MI 48176 313-429-4971

Programmers, Punched Card-2000 — ***See Vol. D***

Programmers, Tape-2000 — ***See Vol. D***

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Radar Intercept (MIL)-3475 — ***See Vol. D***

Radar Systems (MIL), Elint-3475 — ***See Vol. D***

Radar System Components-3450

† Interface Engrg., 386 Lindelof Ave., Stoughton, MA 02072, 617-344-7383 ..... D•1156
† North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1780
American Electronic Labs., Box 552, Lansdale, PA 19446 215-822-2929
† Applied Research, Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
† Astronautics Corporation of America, P.O. Box 523, Milwaukee, WI 53201-0523 414-447-8200
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
† Cardion Elctrns., Div. of Gen. Sig. Conts., Inc. Unit of Gen. Sig. Corp., Long Island Expwy., Woodbury, NY 11797 516-921-7300
† Cincinnati Elctrns., 2630 Glendale Milford Rd., Cincinnati, OH 45241 513-733-6100
Cober Elctrns., 102 Hamilton Ave., Stamford, CT 06902 203-327-0003
Continental Electronics Mfg. Co., P.O. Box 270879, Dallas, TX 75227 214-381-7161
† Datron Systems, Inc., 200 West Los Angeles Ave., Simi Valley, CA 93065-1650 805-584-1717
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
† Electro-Magnetic Processes, Inc., 9616 Owensmouth Ave., Chatsworth, CA 91311 818-882-6333
Epsilon-Lambda Elctrns. Corp., 427 Stevens St., Geneva, IL 60134 312-232-9611
† Honeywell Inc., Aerospace & Defense Grp., Honeywell Plaza, Minneapolis, MN 55408 612-870-5186
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509-2999 213-517-6000
† ITT Gilfillan, 7821 Orion Ave., Van Nuys, CA 91409 818-988-2600
Mathematical Systems Design, Inc., 2850 Ocean Park Blvd., Ste. 300, Santa Monica, CA 90405 213-450-9851
† Metric Sys., 645 Anchors St., Ft. Walton Beach, FL 32548 904-244-9600
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
† Milliflect, 7752 Enterprise Dr., Newark, CA 94560 415-791-5188
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
RHG Electronics Lab., Inc., 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
† Signatron, A Unit of Sundstrand Corp., 12 Hartwell Ave., Lexington, MA 02173 617-861-1500
Singer Co., Kearfott Div., 1150 McBride Ave., Little Falls, NJ 07424 201-785-6000
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Tasker Systems, 20131 Sunburst St., Chatsworth, CA 91311 213-341-3010
† Teledyne Micronetics, 7155 Mission Gorge Rd., San Diego, CA 92120 619-583-3525
Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E5, Tampa, FL 33614 813-884-1411
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† Vega Precision Labs., 800 Follin La., Vienna, VA 22180 703-938-6300
† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
† Whittaker Corp., 10880 Wilshire Blvd., Los Angeles, CA 90024 213-475-9411

Radio Communications Systems — See Communications Systems (Vol. D)

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Radomes & Windows, Microwave-3450

Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
Corning Glass Works, Telecomm Prods Dept., BH-5, Corning, NY 14830 607-974-9000
Electronic Space Sys. Corp., Old Powder Mill Rd., Concord, MA 01742 617-369-7200
† Gabriel Elctrns., Box 70, Scarborough Indl. Pk., Scarborough, ME 04074 207-883-5161
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
† Milliflect, 7752 Enterprise Dr., Newark, CA 94560 415-791-5188
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Nurad, Inc., 2165 Druid Pk. Dr., Baltimore, MD 21211 301-462-1700
† Rogers Corp., One Technology Dr., Rogers, CT 06263 203-774-9605
† Teledyne Micronetics, 7155 Mission Gorge Rd., San Diego, CA 92120 619-583-3525
† Transco Products, Inc., 4241 Glencoe Ave., Marina del Rey, CA 90295 213-822-0800

Reactors, Charging-5600

Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Hipotronics, P.O. Drawer A, Brewster, NY 10509 914-279-8091
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torelco, Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Reactors, Epitaxial — See Machines & Accessories, Semiconductor Manufacturing (Vol. D)

Reactors, Filter-5600

Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 ..... A•2158

† **NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300** ..... **A•2211, D•1735**
† **NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300** ..... **D•1735**
† **Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•1270**
† **Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950** ..... **A•2260**
† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105** .... **B•1010**
Wilco Corp., 6451 Saguaro Court, Indianapolis, IN 46268, 317-293-9300 ..... **A•1296**
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
§ Alltech Assocs. Inc., Applied Science Labs., 2051 Waukegan Rd., Deerfield, IL 60015 312-948-8600
§ American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Oram Electronics, 12 Cranston Rd., Pittsford, NY 14534 716-381-4673
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
† Raytheon Co., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154 617-899-8400
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701 914-963-3400
Torelco, Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Reactors, Loading-5600

† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Reactors, Saturable-1800

Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 .... **A•1218**
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 ..... **A•2158**
† **NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300** ..... **A•2211**
† **Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950** ..... **A•1622, 2263, 2264**
† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105** .... **B•1010**
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
† Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Cross Elctrns., 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hipotronics, P.O. Drawer A, Brewster, NY 10509 914-279-8091
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Industrial Control Co., 3100 Pineda Ave., Rockledge, FL 32955 305-259-7105
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
§ Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oram Elctrns., Rte. 22, Putnam Business Park, Brewster, NY 10509-9587 914-279-2966
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
Sigma Instrs., 170 Pearl St., Braintree, MA 02184 617-843-5000
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torelco, Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

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Readers, Bar Code-2000 — ***See Vol. D***

Readers, Character-2000 — ***See Vol. D***

Readers, Magnetic Card-2000 — ***See Vol. D***

Readers, Magnetic Stripe Card-2000 — ***See Vol. D***

Readers, Punched Card-2000 — ***See Vol. D***

Readers, Punched Tape-2000 — ***See Vol. D***

Readers, Static Card-2000 — ***See Vol. D***

Readers, Time Code-2000 — ***See Vol. D***

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Receivers (MIL), IR Warning-3475 — *See Vol. D*

Receivers (MIL), Missile Launch Warning-3475 — *See Vol. D*

Receivers (MIL), Radar Warning-3475 — *See Vol. D*

Receivers (MIL), Radio-3475 — *See Vol. D*

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Receivers (MIL), Search-3475 — *See Vol. D*

Receivers (MIL), Shipboard-3475 — *See Vol. D*

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Recording Systems (MIL)-3475 — *See Vol. D*

Rectifiers, Bridges & Assemblies-4800

Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ..... **A•1784**

Allen-Bradley Co., Electronics Group, Div.of Rockwell Corp., Microelectronic Products Div., Highway 29 N. Bryan Pk. Exit, Greensboro, NC 27410, 919-621-9010 ..... **A•2069**

§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ..... **A•1013**

§ IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735, 516-753-0400 ..... **A•2072**

International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... **A•2074**

ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ..... **A•2075**

§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ..... **A•2077- 2085**

NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... **D•1735**

† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... **D•1735**

Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... **A•2090**

TRW Optoelectronics Div., 1207 Tappan Circle, Carrollton, TX 75006, 214-323-2200 ..... **A•2094**

§ Varo Semiconductor, Inc., 2800 W. Kingsley Dr., Garland, TX 75046, 214-271-8511 ..... **A•2095**

† Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291, 209-651-1402 ..... **A•2097**

A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 201-722-9800

§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940 201-377-9566

§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200

† Basic Electronics, Inc., 11762 Western Ave. "O", Stanton, CA 90680 714-530-2400

§ Codi Semiconductor, Inc., 350 Hurst Ave., Linden, NJ 07036 201-862-8484

§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589

Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 213-699-0918

§† Conditioning Semiconductor Devices, Box 2116, Wayne, NJ 07470 201-335-6723

Diodes Inc., 9957 Canoga Ave., Chatsworth, CA 91311 ... 818-882-4920;800-821-1178

Eastern Delta Corp., 29-09 S. Broadway, Fair Lawn, NJ 07410 201-797-4200

§† Elctrn. Devices, 21 Gray Oaks Ave., Yonkers, NY 10710 914-965-4400

§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321

§ Gentron Corp., 6667 N. Sydney Pl., Milwaukee, WI 53209 414-351-1660

Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404

Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525

§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000

Lambda Electronics, Veeco Instr., Inc., 515 Broad Hollow Rd., Melville, NY 11747 516-694-4200

Lambda Semiconductors, Veeco Instr., 121 International Dr., Corpus Christi, TX 78410 ..... 512-289-0403;800-255-9606

Lark Electronics, Inc., Box 390, New York, NY 10040 212-569-0430

† Megatran Electronic Power, Rising Sun Rd., Bordentown, NJ 08505 609-298-7300

§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777

NAE, 69 Bennett St., Lynn, MA 01905 617-598-4800

§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089

Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107

Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .....516-593-2025;Outside NY 800-645-5900

Sanken Elec. U.S.A. Corp., 3848 Carson St., Ste. 105, Torrance, CA 90503 213-540-2209

§ Semikron, Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 .....603-883-8102; 1-800-258-1308

§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392

§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700

§† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660

Solitron Devices, 8808 Balboa Ave., San Diego, CA 92123 619-278-8780

§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Rd., Riviera Beach, FL 33404 305-848-4311

§† St-Semicon, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402 812-332-1435

§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010

§ Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300

§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540

§ Westinghouse Elec. Corp., Semiconductor Div., Armbrust Rd., Youngwood, PA 15697 412-925-7272

Rectifiers, Copper Oxide-4800

Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107

Rectifiers, Copper Sulfide-4800

Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107

Rectifiers, Electron Tube — See Tubes, Rectifying (Vol. A)

Rectifiers, Germanium-4800

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... **A•2070**

§† Germanium Power Devices, Box 3065, Shawsheen Village Sta., Andover, MA 01810 617-475-5982

International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500

International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518

§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089

Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107

§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636

§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700

§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700

§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107

§ Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300

§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Rectifiers, Selenium-4800

A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 201-722-9800

Eastern Delta Corp., 29-09 S. Broadway, Fair Lawn, NJ 07410 201-797-4200

International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500

Lark Electronics, Inc., Box 390, New York, NY 10040 212-569-0430

§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089

Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107

Power Conversion Prods., 42 East St., Box 380, Crystal Lake, IL 60014 815-459-9100

§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636

Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .....516-593-2025;Outside NY 800-645-5900
§ Semikron, Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 .....603-883-8102; 1-800-258-1308
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ St-Semicon, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402 812-332-1435
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§ Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300

Rectifiers, Silicon-4800

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... A•2070
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ..... A•1013
§ IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735, 516-753-0400 ..... A•2072
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... A•2074
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ..... A•2075
§† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ..... A•2077
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•2089
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2090
TRW Optoelectronics Div., 1207 Tappan Circle, Carrollton, TX 75006, 214-323-2200 ..... A•2094
§ Varo Semiconductor, Inc., 2800 W. Kingsley Dr., Garland, TX 75046, 214-271-8511 ..... A•2095
† Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291, 209-651-1402 ..... A•2097
§ A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 201-722-9800
Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div.of Rockwell Corp., Microelectronic Products Div., Highway 29 N. Bryan Pk. Exit, Greensboro, NC 27410 919-621-9010
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
Christie Elec. Corp., 20665 Manhattan Pl., Torrance, CA 90501 213-320-0808
§ Codi Semiconductor, Inc., 350 Hurst Ave., Linden, NJ 07036 201-862-8484
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 213-699-0918
§ Conditioning Semiconductor Devices, Box 2116, Wayne, NJ 07470 201-335-6723
Diodes Inc., 9957 Canoga Ave., Chatsworth, CA 91311 ... 818-882-4920;800-821-1178
§ Elctrn. Devices, 21 Gray Oaks Ave., Yonkers, NY 10710 914-965-4400
§ Electronic Transistors, 112-15 Northern Blvd., Flushing, NY 11368 212-651-7200
§ Fairchild Camera & Instr. Corp., 464 Ellis St., 20-2271, Mountain View, CA 94042 415-962-5011
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§† General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
§† General Instr., Discrete Semiconductor Div., 600 West John St., Hicksville, NY 11802 516-733-3333
§ Gentron Corp., 6667 N. Sydney Pl., Milwaukee, WI 53209 414-351-1660
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 .....714-557-9394; 800-854-7651
International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
Lark Electronics, Inc., Box 390, New York, NY 10040 212-569-0430
§† NAE, 69 Bennett St., Lynn, MA 01905 617-598-4800
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§ RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 ..... 800-245-4501;800-245-4497 In Ohio
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .....516-593-2025;Outside NY 800-645-5900
Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, JAPAN 03-986-6151
Sanken Elec. U.S.A. Corp., 3848 Carson St., Ste. 105, Torrance, CA 90503 213-540-2209
§ Semicon, 10 North Ave., Burlington, MA 01803 617-272-9015
§ Semikron, Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 .....603-883-8102; 1-800-258-1308
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
Silicon Power Cube Corp., 2725 Seaboard Lane, Long Beach, CA 90805 213-634-9390
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
§† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Rd., Riviera Beach, FL 33404 305-848-4311
§† St-Semicon, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402 812-332-1435
§ Teccor Elctrns., 1801 Hurd Dr., Irving, TX 75062 214-252-7651
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§ Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540
† Westcode Semiconductors, Inc., 0-02 Fair Lawn Ave., Fair Lawn, NJ 07410 201-791-3020
§† Westinghouse Elec. Corp., Semiconductor Div., Armbrust Rd., Youngwood, PA 15697 412-925-7272
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Rectifiers, Silicon Controlled — See Thyristors (Vol. A)

Rectifiers, Ultrafast-4800

Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div.of Rockwell Corp., Microelectronic Products Div., Highway 29 N. Bryan Pk. Exit, Greensboro, NC 27410 919-621-9010
Diodes Inc., 9957 Canoga Ave., Chatsworth, CA 91311 ... 818-882-4920;800-821-1178
§ Elctrn. Devices, 21 Gray Oaks Ave., Yonkers, NY 10710 914-965-4400
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
§ RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, JAPAN 03-986-6151
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291 209-651-1402

Rectifiers (MIL), Semiconductor-2440 — *See Vol. B*

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Reels, Tape — See Tape Recording Accessories (Vol. D)

Reference Books — See Technical Books (Vol. D)

References, DC Voltage-2900 — *See Vol. D*

Refrigerants, Spray-1600 — *See Vol. C*

Refrigerated Cooling Equipment — See Air Conditioners (Vol. C)

Refrigerators, Environmental Test-2550 — *See Vol. D*

Regulators, Current-4000 — *See Vol. D*

Regulators, Frequency-4050 — *See Vol. D*

Regulators & References, Silicon-Also See Diodes, Zener & Stabistors-4800

Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... D•1254
† Koep Precision Standards, Inc., P. O. Box 191, So. Plainfield, NJ 07080, 201-549-9280 ..... D•1257
Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ..... A•1691-1692,2077
§† ACD-Elcor Products, P.O. Box 244, Bethel, CT 06801 203-743-3510
§† Advanced Micro Devices, P.O. Box 3453, 901 Thompson Pl., Sunnyvale, CA 94088 408-732-2400
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
§† Codi Semiconductor, Inc., 350 Hurst Ave., Linden, NJ 07036 201-862-8484
§ Fairchild Camera & Instr. Corp., 464 Ellis St., 20-2271, Mountain View, CA 94042 415-962-5011
§† General Semiconductor Ind., Inc., Square D Company, 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
§† Linear Technology Corp., 1630 McCarthy Blvd., Milpitas, CA 95035 408-942-0810
MICRA Corp., 120 Ricefield Lane, Hauppauge, NY 11788 516-231-8600
§† Micro Semiconductor, 2830 S. Fairview St., Santa Ana, CA 92704 714-979-8220
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
† Northwest Microcircuits, Inc., 2115 N. College, Newberg, OR 97132 503-538-7081
Power Designs, Inc., 1700 Shames Dr., Westbury, NY 11590 516-333-6200
§ Semicon, 10 North Ave., Burlington, MA 01803 617-272-9015
Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Silicon General, 11861 Western Ave., Garden Grove, CA 92641 714-898-8121
§ St-Semicon, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402 812-332-1435
§ Sunshine Sci. Instr., 1810 Grant Ave., Philadelphia, PA 19115 215-673-5600
§† Teledyne Semiconductor, 1300 Terra Bella Ave., PO Box 7267, Mountain View, CA 94039-7267 415-968-9241
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
† Trio Labs., 80 Dupont St., Plainview, NY 11803 516-349-0400

Regulators & Stabilizers, Voltage-Also See Transformers, Voltage Regulating-4000 — *See Vol. D*

Relays, Antenna – See Relays, RF (Incl. Antenna & Coaxial) (Vol. B)

Relays, Audio Operated – See Relays, Frequency Selective (Vol. B)

Relays, Coaxial – See Relays, RF (Vol. B)

Relays, Contact – See Relays, Power (Vol. B)

Relays, Cradle-4500 – *See Vol. B*

Relays, Crystal Can, 1/2 Crystal Can-4500 – *See Vol. B*

Relays, Current Sensing-4500 – *See Vol. B*

Relays, Differential-4500 – *See Vol. B*

Relays, Frequency Selective-4500 – *See Vol. B*

Relays, General Purpose-4500 – *See Vol. B*

Relays, High Voltage (500 Volts & Over)-4500 – *See Vol. B*

Relays, Hybrid-4500 – *See Vol. B*

Relays, Impulse – See Relays, Stepping (Vol. B)

Relays, I/O Modules – See Modules, I/O Relays (Vol. A)

Relays, Latching-4500 – *See Vol. B*

Relays, Mercury-Wetted Contacts-4500 – *See Vol. B*

Relays, Meter-4500 – *See Vol. B*

Relays, Motor Start-4500 – *See Vol. B*

Relays, Phase Sensing-4500 – *See Vol. B*

Relays, Plug-in-4500 – *See Vol. B*

Relays, Power-4500 – *See Vol. B*

Relays, Printed Circuit Mounting (Incl. Transistor & DIP Case Types)-4500 – *See Vol. B*

Relays, Programmable-4500 – *See Vol. B*

Relays, RF (Incl. Antenna & Coaxial)-4500 – *See Vol. B*

Relays, Reed-4500 – *See Vol. B*

Relays, Sealed-4500 – *See Vol. B*

Relay, Solid State-4500 – *See Vol. B*

Relays, Stepping-4500 – *See Vol. B*

Relays, Telephone-4500 – *See Vol. B*

Relays, Thermal-4500 – *See Vol. B*

Relays, Time Delay-4500 – *See Vol. B*

Relays, Transistor & DIP Case Types – See Relays, Printed Circuit Mounting (Vol. B)

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Relays, Voltage Sensitive-4500 – *See Vol. B*

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Resistor Hardware-2800 – *See Vol. C*

Resistors, Adjustable-Also See Potentiometers; Rheostats-4700

§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134, 408-946-6000 ..... D•1057

† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•1996

§ CTS Corporation, Berne Division, 406 Parr Rd., Berne, IN 46711, 219-589-3111 ..... A•2011

§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 ..... A•1869

Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022, 212-605-2607 ..... A•2019

Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750, 219-356-0778 ..... A•1871

IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ..... D•1243

Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101, 212-361-0800 ..... C•1593

Mepco//Electra, Inc., North American Philips Corp., 11468 Sorrento Valley Rd., San Diego, CA 92121, 619-453-0332 ..... A•2029 B•1008

† Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ..... A•1900

§† Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1918

† Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650, 312-652-7555 ..... A•1942

Sangano Weston-Sangamo Components Div., Fairchild Semiconductor, Box 128, Pickens, SC 29671, 803-878-6311 ..... A•2056

Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... A•2037

§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749, 818-964-6565 ..... A•2040

TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... A•1957

Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ..... A•1965

§ Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•2051

§† VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ..... A•2054

§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000

Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888

§† Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848

Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161

Capco, Box 1028, Grand Junction, CO 81502 303-243-8751

Carter Mfg. Corp., Sugar Rd., Bolton, MA 01740 617-779-5501

Centralab, Inc., A North American Philips Co., Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300

§ Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120

Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900

Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640

§† CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511

§ CTS Corporation, Asheville Division, P.O. Box 100, Skyland, NC 28776 704-684-6451

Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261

Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900

§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500

International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700

§ Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480

† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733

§ Martin Sound Prods., 28 Alpha Park, Cleveland, OH 44143-2297 216-442-2286

† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629 312-581-4555

Mel-Rain Controls, 42974 M-43 Hwy., Paw Paw, MI 49079 616-657-2527

† New England Instr., Robertshaw Controls, 14 Kendal Lane, Natick, MA 01760 617-875-9711

† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038

§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000

Precision Elctrn. Comps. Ltd., 1919 Hafis Rd., Toronto, ON, CANADA M6M 2V6 416-249-7103

§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054

Resistance Technology Inc., 1260 Red Fox Rd., St. Paul, MN 55112 612-636-9770

† Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405

§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700

§† Techno-Components Corp., 7803 Lemona, Van Nuys, CA 91405 818-781-1642

Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Ste. 565 Arlington Center, Golf Rd., Arlington Heights, IL 60005 312-310-8641

United Foam Plastics, 172 E. Main St., Georgetown, MA 01833 617-352-2200

† Vernitech, 300 Marcus Blvd., Deer Pk, NY 11729 516-586-5100

Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722

§† Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550 914-664-1000

§† Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403 717-876-1500

Wilbrecht Elctrns., 240 Plato Blvd., St. Paul, MN 55107 612-222-2791

Resistors, Ballast (Incl. Tube & Solid State Devices)-4700

Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, 213-699-0918 ..... A•1833

Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1899

§† Amperite Co., Inc., 600 Palisade Ave., Union City, NJ 07087 201-864-9503

Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500

§ Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131

Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300

§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 219-356-4300

EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048

Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204 414-271-9900

§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054

TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108 215-923-8230

Resistors, Beryllia Core — See Resistors, Integral Heat Dissipator (Vol. A)

Resistors, Bulk Ceramic-4700

Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, 213-699-0918 ..... A•1833
† Sohio Engineered Materials Co., Unit of Sohio, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ..... A•1944
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ..... 714-979-8833; 714-634-1535
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
Stackpole, Carbon Div., 201 Stackpole St., St. Marys, PA 15857 814-781-1234

Resistors, Carbon Film-4700

Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, 213-699-0918 ..... A•1833
Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... A•1860
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... A•1876
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ..... A•1877- 2075
§ KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1884
§ Mepco/Electra, Inc., Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... A•1890
§ NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060;800-645-9333 ..... A•1910
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ... A•1919
§ TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... A•1955
§ Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200 ..... A•1968
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735 516-454-6390
Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011 212-691-9050
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
Ei North America, 15 W. 53rd St. Suite 47E, New York, NY 10019 212-315-3099
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
Fuji-Svea, P.O. Box 3375, Torrance, CA 90510 213-533-1221
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§ Goldwell Comps., 1815 W. 205th St. Ste. 201, Torrance, CA 90501 213-533-1228
§ IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 516-753-0400
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§ Kahgan Elctrns. Corp., 605 Peninsula Blvd., Hempstead, NY 11550 516-538-2300
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
§ Liberty Intl. Corp., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
§† Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731 ..... 818-442-3310; 213-686-0535
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
§† Paccom, 3928 148th NE, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ Piher Int'l. Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ..... 312-640-8300; 800-323-6693
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
§ Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 615-892-0291
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Ceramic Core-4700

Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, 213-699-0918 ..... A•1833
Electro Comp., Inc., 2415 Main St., Stratford, CT 06497, 203-375-5811 ... A•1865
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750, 219-356-0778 ..... A•1871
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411, 818-782-6662 ..... A•1882
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1899
† Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ..... A•1900
NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060;800-645-9333 ..... A•1910
§† Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1911
§† Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1912-1914,1917,1918,1920
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ... A•1924
§ TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... A•1954
† Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•1979
§† Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550, 914-664-1000 ..... A•1986
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 714-788-1700
§† Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406 213-450-1761
§ Carbone Lorraine Inds., 400 Myrtle Ave., Boonton, NJ 07005 ..... 201-DE4-0700
Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Detoronics Corporation, 10660 E. Rush St., S. El Monte, CA 91733 818-579-7130
† Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 .. 914-664-2333
EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 219-356-4300
§ Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Meissner Inds., 551 Rte. 10, Dover, NJ 07801 201-366-1700
§ Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731 ..... 818-442-3310; 213-686-0535
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
† Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 33543 813-541-5771
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
§† RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102 603-627-3831
§† Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577 919-934-5181
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
Stackpole, Carbon Div., 201 Stackpole St., St. Marys, PA 15857 814-781-1234
Tel Labs, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 ... 603-625-8994
§† Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502 303-242-0810
† Vermont Precision Resistor, Codeco Corp. of Vermont, Box 1170, Stowe, VT 05672 802-253-8567
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Ceramic Metal (Cermet)-4700

Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406, 213-450-1761 ..... A•1829
§ CTS Corporation, Berne Division, 406 Parr Rd., Berne, IN 46711, 219-589-3111 ..... A•1836
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ... A•1923
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ..... A•1935
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
§ Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
§† CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ CTS Electronics Corp., Paso Robles Div., Electromechanical Gp., 500 Linne Rd., Paso Robles, CA 93446 805-238-0350
† CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906 317-463-2565
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Ferro, Thick Film Sys. Div., 27 Castilan Dr., Santa Barbara, CA 93117 ... 805-968-5000
Hybrid Svcs. Inc., 38 Main St., North Reading, MA 01864 617-664-5500
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089 413-781-1350
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731 ..... 818-442-3310; 213-686-0535
Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ..... 714-979-8833; 714-634-1535
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108 215-923-8230
Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403 717-876-1500

Resistors, Chip (For Microcircuits)-4700

Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ... A•1796-1799
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134, 408-946-6000 ... D•1057
§ Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406, 213-450-1761 ... A•1829
Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ... A•1850
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ... A•1866
† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776, 617-443-4631 ... A•1873
§ KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ... A•1886
† Mepco/Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960, 201-539-2000 ... A•1890
§ Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310;213-686-0535 ... A•1896
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761, 617-695-0203 ... A•1906
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ... A•1923
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ... A•1935
State of the Art, Inc., 2470 Fox Hill Rd., State College, PA 16801, 814-355-8004 ... A•1949
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ... A•1954
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ... A•1975
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 ... 915-592-4888
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ... 818-765-8300;800-423-3186
Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 ... 617-263-9100
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 ... 714-781-5050
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 ... 714-788-1700
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 ... 813-855-6655
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 ... 607-974-8725
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 ... 219-293-7511
† CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906 ... 317-463-2565
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 ... 402-371-0080
Eltec Instruments Inc., P.O. Box 9610, Daytona Bch., FL 32020 ... 904-253-5328
† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 ... 609-429-7800
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 ... 714-557-7800
§† Film Microelectronics, 17 A St., Burlington, MA 01803 ... 617-272-5650
§ Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022 ... 212-605-2607
Hybrid Svcs. Inc., 38 Main St., North Reading, MA 01864 ... 617-664-5500
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 ... 617-667-8700
Hy-Tec Industries, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786 ... 516-744-5062
§ IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ... 516-753-0400
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 ... 516-293-1500
† International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 ... 401-683-9700
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 ... 305-771-7000
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 ... 201-887-8100
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 ... 619-454-1800
§ Liberty Intl. Corp., 2539 237th St., Suite F, Torrance, CA 90505 ... 213-539-6452
† Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ... 714-979-8833; 714-634-1535
§ Morris Entprs., 16799 Schoenborn St, Sepulveda, CA 91343 ... 818-894-9103
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN ... 075-951-9111
National Micronetics, Route 28, West Hurley, NY 12136 ... 914-338-0333
§ NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735 ... 516-694-0060; 800-645-9333
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 ... 617-649-7501
§† Res-Net, 110 Route 10, Whippany, NJ 07981 ... 201-887-2260;out of state 800-526-0704
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 ... 704-872-8101
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 ... 714-855-2131
SMD Technology Svc. Ctr., A North American Philips Co., 5855 N. Glen Pk. Rd., Milwaukee, WI 53209 ... 800-431-4444
Solitron/Microwave, Box 278, Port Salerno, FL 33492 ... 305-287-5000
§ Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 ... 413-664-4481
§ Techno-Components Corp., 7803 Lemona, Van Nuys, CA 91405 ... 818-781-1642
Thickfilm Int'l, Rt. 1-Box 85-0, Indian Head, MD 20640 ... 301-375-8666

Resistors, Composition, Carbon-4700

§† Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ... A•1919-1921
§ TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ... A•1955
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 ... 414-671-2000
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 ... 915-592-4888
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ... 818-765-8300;800-423-3186
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660 ... 213-699-0918
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 ... 219-293-7511
Ei North America, 15 W. 53rd St. Suite 47E, New York, NY 10019 ... 212-315-3099
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 ... 305-556-4000
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 ... 815-968-9661
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 ... 516-293-1500
§ KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701 ... 814-362-5536
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 ... 201-348-7000
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 ... 603-669-0054
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 ... 914-681-0700
Stackpole, Carbon Div., 201 Stackpole St., St. Marys, PA 15857 ... 814-781-1234
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 ... 516-586-5100
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 ... 813-371-4242

Resistors, Decade-4700

General Resistance, Inc., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ... D•1233
Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ... D•1255
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ... A•1899
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ... A•1920
Tech Labs., Inc., Bergen & Edsall Blvds., Palisades Pk., NJ 07650, 201-944-2221 ... B•1701
§ AEMC, 99 Chauncy, Boston, MA 02111 ... 617-451-0227;800-343-1391
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 ... 414-671-2000
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 ... 915-592-4888
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 ... 305-973-8620
† Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 ... 603-669-0940
§ Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 ... 714-871-4848
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 ... 714-788-1700
CDS - Colorado Data Sys., 3301 W. Hampden, Unit C, Englewood, CO 80110 ... 303-762-1640
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ... 914-YO3-5900
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 ... 402-371-0080
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 ... 914-664-2333
Electro Scientific Inds., 13900 N.W. Science Pk. Dr., Portland, OR 97229 ... 503-641-4141
§ Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 ... 609-461-1900
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 ... 401-683-9700
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 ... 305-771-7000
Meissner Inds., 551 Rte. 10, Dover, NJ 07801 ... 201-366-1700
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731 ... 818-442-3310; 213-686-0535
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304 ... 716-283-4025
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 ... 603-669-0054
Shalltronix Corp., Preston St., P.O. Box 235, Selma, NC 27576 ... 919-965-6346
† Sohio Engineered Materials Co., Unit of Sohio, P. O. Box 156, Niagara Falls, NY 14302 ... 716-278-2000
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 ... 215-539-6050
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502 ... 303-242-0810
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 ... 215-644-1300

Resistors, Deposited Carbon-4700

Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310;213-686-0535 ... A•1895
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ... 818-765-8300;800-423-3186
Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 ... 402-371-0080
§ KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701 ... 814-362-5536

Resistors, Disk, Rod & Tube-4700

E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 ... A•1869
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089, 413-781-1350 ... A•1879
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981, 201-887-8100 ... A•1881
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ... A•1899
† Sohio Engineered Materials Co., Unit of Sohio, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ... A•1944
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ... A•1957
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 ... 813-855-6655
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 ... 402-371-0080
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 ... 609-461-1900
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 ... 219-356-0778
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204 ... 414-271-9900
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 ... 603-669-0054

§† Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
Stackpole, Carbon Div., 201 Stackpole St, St. Marys, PA 15857 814-781-1234
Thickfilm Int'l, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
§ Ward Leonard Elec., 31 South St, Mt. Vernon, NY 10550 914-664-1000

Resistors, Film, Metallized & Nonmetallized-4700

Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ..... A•1784-1798
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1804-1807,1810 -1814,1816-1819,1826,1827
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ..... A•1013
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, 213-699-0918 ..... A•1833
§† Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830, 607-974-8725 ..... A•1068
Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011, 212-691-9050 ..... A•1071
Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... A•1850,1852,1853,1860,1861,1862,1863
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1866
† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776, 617-443-4631 ..... A•1872
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... A•1876
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ..... A•1877
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981, 201-887-8100 ..... A•1881
§† KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1884,1886
§† Mepco//Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960, 201-539-2000 ..... A•1890
§† Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310;213-686-0535 ..... A•1893,1896
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1909
§ NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060;800-645-9333 ..... A•1910
§† Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ... A•1919
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ... A•1923
§ Precision Resistive Prods., Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 ..... A•1929
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ..... A•1935
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•1941
Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577, 919-934-5181 ..... A•1941
§† Res-Net, 110 Route 10, Whippany, NJ 07981, 201-887-2260;out of state 800-526-0704 ..... A•1943
State of the Art, Inc., 2470 Fox Hill Rd., State College, PA 16801, 814-355-8004 ..... A•1949
Tel Labs, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053, 603-625-8994 ..... A•1952
§† TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... A•1954- 1957
§† Vamistor Corp., 115 Industrial Pk., Sevierville, TN 37862, 615-453-0001 .. A•1967
§ Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200 ..... A•1968,1970
§† Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•1984
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Eltec Instruments Inc., P.O. Box 9610, Daytona Bch., FL 32020 904-253-5328
EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
† Engelhard Corp., 70 Wood Ave. S., Iselin, NJ 08830 201-321-5900
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
Ferro, Thick Film Sys. Div., 27 Castilan Dr., Santa Barbara, CA 93117 ... 805-968-5000
Goldwell Comps., 1815 W. 205th St. Ste. 201, Torrance, CA 90501 213-533-1228
§ Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022 212-605-2607
Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§ Kahgan Elctrns. Corp., 605 Peninsula Blvd., Hempstead, NY 11550 516-538-2300
§ Liberty Intl. Corp., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
§† Mepco//Electra, Inc., Airport Road, P.O. Box 760, Mineral Wells, TX 76067 817-325-7871
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
§ Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 615-892-0291
Thickfilm Int'l, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
§† Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502 303-242-0810
† Vermont Precision Resistor, Codeco Corp. of Vermont, Box 1170, Stowe, VT 05672 802-253-8567
§† Vishay Angstrohm, 1 Precision Pl, Hagerstown, MD 21740 301-739-8722

Resistors, Flame Retardant-4700

Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, 213-699-0918 ..... A•1833
Electro Comp., Inc., 2415 Main St., Stratford, CT 06497, 203-375-5811 ... A•1865
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... A•1876
§ Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310;213-686-0535 ..... A•1895
§ Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1899
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1908
NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060;800-645-9333 ..... A•1910
Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1913,1920,1921
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ..... A•1935
§† TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... A•1954
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•1979
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 714-788-1700
Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
§ Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Elect. Prec. Comp. Oorp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 .. 914-664-2333
§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 219-356-4300
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
General Resistance, Inc., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
§ IEI-ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 516-753-0400
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§ Kahgan Elctrns. Corp., 605 Peninsula Blvd., Hempstead, NY 11550 516-538-2300
§ KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701 814-362-5536
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ... 603-668-3210;800-257-3300
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
§ Liberty Intl. Corp., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
§† Mepco//Electra, Inc., Airport Road, P.O. Box 760, Mineral Wells, TX 76067 817-325-7871
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
Tel Labs, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 ... 603-625-8994
Thickfilm Int'l, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502 303-242-0810
Vamistor Corp., 115 Industrial Pk., Sevierville, TN 37862 615-453-0001
§ Ward Leonard Elec., 31 South St, Mt. Vernon, NY 10550 914-664-1000

Resistors, Flux Sensitive-4700

Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500

Resistors, Foil, Ultraprecision-4700

§† Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ..... A•1958
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 714-788-1700
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
Vishay Angstrohm, 1 Precision Pl, Hagerstown, MD 21740 301-739-8722

Resistors, Four Terminal-4700

Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 33543, 813-541-5771 ..... A•1931
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... A•1955

Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411 818-782-6662

Resistors, Fuse-4300 — *See Vol. B*

Resistors, Glass-4700

Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
Eltec Instruments Inc., P.O. Box 9610, Daytona Bch., FL 32020 904-253-5328
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104 216-795-8200
§† Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
§† Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Heat Sink Encased — See Resistors, Integral Heat Dissipator (Vol. A)

Resistors, High Frequency-4700

Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1899
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 714-788-1700
§ Carbone Lorraine Inds., 400 Myrtle Ave., Boonton, NJ 07005 ..... 201-DE4-0700
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 219-356-4300
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776 617-443-4631
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ... 603-668-3210;800-257-3300
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102 603-627-3831
Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577 919-934-5181
Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650 312-652-7555
Res-Net, 110 Route 10, Whippany, NJ 07981 ..... 201-887-2260;out of state 800-526-0704
† Sohio Engineered Materials Co., Unit of Sohio, P. O. Box 156, Niagara Falls, NY 14302 716-278-2000
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
Tel Labs, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 ... 603-625-8994
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108 215-923-8230
§† Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502 303-242-0810
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104 216-795-8200
§† Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722

Resistors, High Megohm (Over 22 Megohms)-4700

§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ..... A•1787
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1805-1807,1810,1811,1812,1814,1816,1817
Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... A•1860
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089, 413-781-1350 ..... A•1879
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981, 201-887-8100 ..... A•1881
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761, 617-695-0203 ..... A•1906
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1909
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ... A•1923
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ..... A•1935
§† TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... A•1954
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ..... A•1962
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200 ..... A•1969
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
§ Carbone Lorraine Inds., 400 Myrtle Ave., Boonton, NJ 07005 ..... 201-DE4-0700
Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Eltec Instruments Inc., P.O. Box 9610, Daytona Bch., FL 32020 904-253-5328
Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
Hybrilonics, Inc., P.O. Box 217, Lasalle Sta., Niagara Falls, NY 14304 716-731-9080
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411 818-782-6662
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ... 603-668-3210;800-257-3300
Mepco//Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960 201-539-2000
§† Mepco//Electra, Inc., Airport Road, P.O. Box 760, Mineral Wells, TX 76067 817-325-7871
† Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ..... 714-979-8833; 714-634-1535
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Penn Airborne Prods., Industrial Hwy., Southampton, PA 18966 215-355-3400
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102 603-627-3831
Stackpole, Carbon Div., 201 Stackpole St., St. Marys, PA 15857 814-781-1234
Tel Labs, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 ... 603-625-8994
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
Vamistor Corp., 115 Industrial Pk., Sevierville, TN 37862 615-453-0001
† Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300

Resistors, High Temperature (Over 125°C)-4700

§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ..... A•1787
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1804-1807,1810,1811,1812,1816,1817,1818,1819
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, 213-699-0918 ..... A•1833
Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... A•1852,1857,1858,1859
Electro Comp., Inc., 2415 Main St., Stratford, CT 06497, 203-375-5811 ... A•1865
KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1884
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310;213-686-0535 ..... A•1893
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1899
† Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ..... A•1900
Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1911
§† Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1915-1920
† Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 818-345-7811 ..... A•1926
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ..... A•1935
§† RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•1936
§† Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577, 919-934-5181 ..... A•1936
† Sohio Engineered Materials Co., Unit of Sohio, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ..... A•1944
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... A•1957
§† Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ..... A•1958
§† Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•1979
Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550, 914-664-1000 ..... A•1986
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
Capco, Box 1028, Grand Junction, CO 81502 303-243-8751
Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
§† Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 .. 914-664-2333
Eltec Instruments Inc., P.O. Box 9610, Daytona Bch., FL 32020 904-253-5328
§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 219-356-4300
§† Fenwal Elctrns., 63 Fountain St., Framingham, MA 01701 617-872-8841
Ferro, Thick Film Sys. Div., 27 Castilan Dr., Santa Barbara, CA 93117 ... 805-968-5000
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900

Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776 617-443-4631
§ INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 201-892-5881
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ... 603-668-3210;800-257-3300
§ Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
Meissner Inds., 551 Rte. 10, Dover, NJ 07801 201-366-1700
§† Mepco//Electra, Inc., Airport Road, P.O. Box 760, Mineral Wells, TX 76067 817-325-7871
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
New England Instr., Robertshaw Controls, 14 Kendal Lane, Natick, MA 01760 617-875-9711
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 33543 813-541-5771
Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650 312-652-7555
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
Stackpole, Carbon Div., 201 Stackpole St., St. Marys, PA 15857 814-781-1234
Tel Labs, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 ... 603-625-8994
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
United Foam Plastics, 172 E. Main St., Georgetown, MA 01833 617-352-2200
§† Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722

Resistors, High Voltage (1,000 Volts & Over)-4700

Alden Products Co., P.O. Box 860, 117 N. Main St., Brockton, MA 02403, 617-583-0160 ..... C•1121
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1804-1808,1810,1811,1812,1814
Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... A•1878
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089, 413-781-1350 ..... A•1879
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981, 201-887-8100 ..... A•1881
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411, 818-782-6662 ..... A•1883
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310;213-686-0535 ..... A•1892,1894
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1899
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1909
† Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 818-345-7811 ..... A•1926
† Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 33543, 813-541-5771 ..... A•1930
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ..... A•1935
† Sohio Engineered Materials Co., Unit of Sohio, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ..... A•1944
Tel Labs, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053, 603-625-8994 ..... A•1952
† TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... A•1957
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200 ..... A•1969
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•1979
Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069 619-747-4000
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ CTS Corporation, Asheville Division, P.O. Box 100, Skyland, NC 28776 .. 704-684-6451
† CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906 317-463-2565
§† Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926 915-592-3253
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
† Electro Impulse, Box 870, Red Bank, NJ 07701-0870 201-741-0404
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Hybrid Svcs. Inc., 38 Main St., North Reading, MA 01864 617-664-5500
Hybrilonics, Inc., P.O. Box 217, Lasalle Sta., Niagara Falls, NY 14304 716-731-9080
KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ... 603-668-3210;800-257-3300
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102 603-627-3831
§† Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577 919-934-5181
Sensitive Research Instrs., 25 Dock St., Mt. Vernon, NY 10550 914-699-9717
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
§ Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550 914-664-1000
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Hot Molded-4700

§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ..... A•1784,1787
§† Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1915,1921
† Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 818-345-7811 ..... A•1926
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 219-356-4300
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ... 603-668-3210;800-257-3300
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102 603-627-3831
Res-Net, 110 Route 10, Whippany, NJ 07981 ..... 201-887-2260;out of state 800-526-0704
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Tel Labs, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 ... 603-625-8994
§† TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108 215-923-8230
§† Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
§† Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722

Resistors, Integral Heat Dissipator-4700

Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1826
Electro Comp., Inc., 2415 Main St., Stratford, CT 06497, 203-375-5811 ... A•1865
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1868
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411, 818-782-6662 ..... A•1883
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310;213-686-0535 ..... A•1892
Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1911
Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 818-345-7811 ..... A•1926
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ..... A•1935
§† RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•1937
§† Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577, 919-934-5181 ..... A•1937
§ Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ..... A•1962
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•1977
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
§† Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406 213-450-1761
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 216-267-2233
Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069 619-747-4000
§† Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926 915-592-3253
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204 414-271-9900
Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Res-Net, 110 Route 10, Whippany, NJ 07981 ..... 201-887-2260;out of state 800-526-0704
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
Tel Labs, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 ... 603-625-8994

Resistors, Low Temperature Coefficient-4700

§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1804-1808,1810,1811,1812,1814,1816,1817,1818,1819,1826
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ..... A•1013
Colber Corp., 26E Buffington St., Irvington, NJ 07111, 201-371-9500 .... A•1832
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, 213-699-0918 ..... A•1833
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1867
† Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1868

General Resistance, Inc., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ... A•1870
Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ... A•1878
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089, 413-781-1350 ... A•1879
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411, 818-782-6662 ... A•1882
§† KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ... A•1884,1886
Meissner Inds., 551 Rte. 10, Dover, NJ 07801, 201-366-1700 ... A•1889
Mepco//Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960, 201-539-2000 ... A•1890
§† Mepco//Electra, Inc., Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ... A•1890
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310;213-686-0535 ... A•1892
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ... A•1899
NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060;800-645-9333 ... A•1910
Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532, 803-393-5421 ... A•1911
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ... A•1913-1915,1920
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ... A•1923
† Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 818-345-7811 ... A•1926
§ Precision Resistive Prods., Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 ... A•1929
† Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 33543, 813-541-5771 ... A•1930
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102, 603-627-3831 ... A•1936
Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577, 919-934-5181 ... A•1936
† Res-Net, 110 Route 10, Whippany, NJ 07981, 201-887-2260;out of state 800-526-0704 ... A•1943
† Sohio Engineered Materials Co., Unit of Sohio, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ... A•1944
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ... A•1954,1957
§† Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ... A•1958
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200 ... A•1968
§† Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ... A•1972-1975,1977-1985
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 ... 414-671-2000
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 ... 915-592-4888
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ... 818-765-8300;800-423-3186
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 ... 305-973-8620
† Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 ... 603-669-0940
§ Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 ... 714-871-4848
Capco, Box 1028, Grand Junction, CO 81502 ... 303-243-8751
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ... 914-YO3-5900
§† Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 ... 607-974-8725
§† CTS Corporation, 905 North West Blvd., Elkart, IN 46514 ... 219-293-7511
§† Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 ... 402-564-3131
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926 ... 915-592-3253
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 ... 402-371-0080
Eltec Instruments Inc., P.O. Box 9610, Daytona Bch., FL 32020 ... 904-253-5328
† EMCA, Sub. Rohm and Haas Advanced Matls. Co., 605 Center Ave., Mamaroneck, NY 10543 ... 914-698-8434
§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 ... 219-356-4300
§† Fenwal Elctrns., 63 Fountain St., Framingham, MA 01701 ... 617-872-8841
Ferro, Thick Film Sys. Div., 27 Castilan Dr., Santa Barbara, CA 93117 ... 805-968-5000
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 ... 609-461-1900
§ Guildline Instrs., 4403 Vineland Rd, Suite B-10, Orlando, FL 32811-9998 ... 305-423-8215
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 ... 219-356-0778
Hybrilonics, Inc., P.O. Box 217, Lasalle Sta., Niagara Falls, NY 14304 ... 716-731-9080
† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776 ... 617-443-4631
§ INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 ... 201-892-5881
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 ... 516-822-9601
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 ... 305-771-7000
§† KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 ... 201-887-8100
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ... 603-668-3210;800-257-3300
§ Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 ... 303-243-8480
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 ... 617-695-0203
New England Instr., Robertshaw Controls, 14 Kendal Lane, Natick, MA 01760 ... 617-875-9711
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 ... 617-649-7501
Piher Int'l. Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ... 312-640-8300; 800-323-6693
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 ... 603-669-0054
† Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650 ... 312-652-7555
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 ... 714-855-2131
Solitron/Microwave, Box 278, Port Salerno, FL 33492 ... 305-287-5000
Tel Labs, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 ... 603-625-8994
§ Tepro of Florida, 2608 Enterprise Rd., Clearwater, FL 33575 ... 813-796-1044
Thickfilm Int'l, Rt. 1-Box 85-0, Indian Head, MD 20640 ... 301-375-8666
§† Vamistor Corp., 115 Industrial Pk., Sevierville, TN 37862 ... 615-453-0001
† Vermont Precision Resistor, Codeco Corp. of Vermont, Box 1170, Stowe, VT 05672 ... 802-253-8567
Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 ... 301-739-8722
§ Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550 ... 914-664-1000
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 ... 813-371-4242

Resistors, Metal Glazed-4700

§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ... A•1013
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, 213-699-0918 ... A•1833
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310;213-686-0535 ... A•1893
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ... A•1935
§† TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ... A•1954
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ... 818-765-8300;800-423-3186
Colber Corp., 26E Buffington St., Irvington, NJ 07111 ... 201-371-9500
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 ... 402-371-0080
† EMCA, Sub. Rohm and Haas Advanced Matls. Co., 605 Center Ave., Mamaroneck, NY 10543 ... 914-698-8434
Ferro, Thick Film Sys. Div., 27 Castilan Dr., Santa Barbara, CA 93117 ... 805-968-5000
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 ... 305-771-7000
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 ... 617-695-0203
Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076 ... 312-675-2600
§† Paccom, 3928 148th NE, Redmond, WA 98052 ... 206-883-9200;800-426-6254
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 ... 201-348-7000
† Res-Net, 110 Route 10, Whippany, NJ 07981 ... 201-887-2260;out of state 800-526-0704
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 ... 914-681-0700
Thickfilm Int'l, Rt. 1-Box 85-0, Indian Head, MD 20640 ... 301-375-8666
§ Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104 ... 216-795-8200

Resistors, Metal Oxide-4700

Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, 213-699-0918 ... A•1833
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830, 607-974-8725 ... A•1068
Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ... A•1860
Colber Corp., 26E Buffington St., Irvington, NJ 07111 ... 201-371-9500
§ Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022 ... 212-605-2607
§ KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701 ... 814-362-5536
§ Liberty Intl. Corp., 2539 237th St., Suite F, Torrance, CA 90505 ... 213-539-6452
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ... 201-748-5089
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 ... 704-872-8101

Resistors, Microwave-4700

§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ... A•1935
Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 ... 216-248-1200
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 ... 714-788-1700
Colber Corp., 26E Buffington St., Irvington, NJ 07111 ... 201-371-9500
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 ... 813-855-6655
† Electro Impulse, Box 870, Red Bank, NJ 07701-0870 ... 201-741-0404
EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 ... 609-429-7800
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 ... 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 ... 714-752-3800
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 ... 401-683-9700
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 ... 201-887-8100
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 ... 617-695-0203
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 ... 802-864-0064
§ Precision Resistive Prods., Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637 ... 319-394-9131
† Sohio Engineered Materials Co., Unit of Sohio, P. O. Box 156, Niagara Falls, NY 14302 ... 716-278-2000
Solitron/Microwave, Box 278, Port Salerno, FL 33492 ... 305-287-5000
Thickfilm Int'l, Rt. 1-Box 85-0, Indian Head, MD 20640 ... 301-375-8666
§† Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502 ... 303-242-0810
§† Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 ... 215-644-1300

Resistors, Negative Temperature Coefficient-4700

Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, 213-699-0918 ... A•1833
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, 402-371-0080 ... B•1748

Fenwal Elctrns., 63 Fountain St., Framingham, MA 01701, 617-872-8841 ..... B•1751
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... A•1876
§ **Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 ..... B•1752-1753,1755**
§ **Midwest Comps., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602 ..... B•1758-1759,1765**
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1899
Piezo Elec. Prods., Inc., 212 Durham Ave., CN-15, Metuchen, NJ 08840, 201-548-2800 ..... B•1768
§† **RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ..... A•1935**
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•1941
Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577, 919-934-5181 ..... A•1941
† **Sohio Engineered Materials Co., Unit of Sohio, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ..... B•1772**
§† **TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... A•1957**
§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806 714-630-0081
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
§ Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 714-788-1700
§† Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406 213-450-1761
§ Carbone Lorraine Inds., 400 Myrtle Ave., Boonton, NJ 07005 ..... 201-DE4-0700
Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886 401-738-9150
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 .. 914-664-2333
Eltec Instruments Inc., P.O. Box 9610, Daytona Bch., FL 32020 904-253-5328
E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 219-356-4300
Ferro, Thick Film Sys. Div., 27 Castilan Dr., Santa Barbara, CA 93117 ... 805-968-5000
§ Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
§ Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022 212-605-2607
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776 617-443-4631
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-822-9601
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Julie Resch. Labs., 211 West 61st St., New York, NY 10023 212-245-2727
§† KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Mepco//Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960 201-539-2000
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ Precision Resistive Prods., Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637 319-394-9131
† Res-Net, 110 Route 10, Whippany, NJ 07981 ..... 201-887-2260;out of state 800-526-0704
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
Tel Labs, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 ... 603-625-8994
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
† Vermont Precision Resistor, Codeco Corp. of Vermont, Box 1170, Stowe, VT 05672 802-253-8567
§ Victory Engrg. Corp., Victory Rd., Springfield, NJ 07081 201-379-5900
§† Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Noninductive-4700

§ **Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1804-1807,1810,1811,1812,1813,1816,1817,1818,1819**
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, 213-699-0918 ..... A•1833
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830, 607-974-8725 ..... A•1068
† **Kelvin, 5919 Noble Ave., Van Nuys, CA 91411, 818-782-6662 ..... A•1882**
Meissner Inds., 551 Rte. 10, Dover, NJ 07801, 201-366-1700 ..... A•1889
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310;213-686-0535 ..... A•1892,1894
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1899
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ..... A•1900
NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060;800-645-9333 ..... A•1910
§† **Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1911**
§† **Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1912,1920,1921**
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ... A•1923
† **Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 818-345-7811 ..... A•1926**
§ **Precision Resistive Prods., Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 ..... A•1929**
† **Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 33543, 813-541-5771 ..... A•1930**
§† **RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ..... A•1935**
§ **RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•1941**
§ **Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577, 919-934-5181 ..... A•1941**
† **Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650, 312-652-7555 ..... A•1942**
† **Res-Net, 110 Route 10, Whippany, NJ 07981, 201-887-2260;out of state 800-526-0704 ..... A•1943**
† **Sohio Engineered Materials Co., Unit of Sohio, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ..... A•1944**
§† **TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... A•1954,1957**
§† **Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ..... A•1961**
† **Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•1984**
§ **Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550, 914-664-1000 ..... A•1986**
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
§ Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§† Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406 213-450-1761
Capco, Box 1028, Grand Junction, CO 81502 303-243-8751
§ Carbone Lorraine Inds., 400 Myrtle Ave., Boonton, NJ 07005 ..... 201-DE4-0700
Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
§† Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
† Electro Impulse, Box 870, Red Bank, NJ 07701-0870 201-741-0404
† Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 .. 914-664-2333
Electro Scientific Inds., 13900 N.W. Science Pk. Dr., Portland, OR 97229 503-641-4141
§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 219-356-4300
§† Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
§ INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 201-892-5881
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Julie Resch. Labs., 211 West 61st St., New York, NY 10023 212-245-2727
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089 413-781-1350
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ... 603-668-3210;800-257-3300
§ Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
Mepco//Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960 201-539-2000
Mepco//Electra, Inc., Airport Road, P.O. Box 760, Mineral Wells, TX 76067 817-325-7871
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Tel Labs, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 603-625-8994
§† Tepro of Florida, 2608 Enterprise Rd., Clearwater, FL 33575 813-796-1044
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
† Vermont Precision Resistor, Codeco Corp. of Vermont, Box 1170, Stowe, VT 05672 802-253-8567
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104 216-795-8200
Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Oil Filled-4700

† **Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... A•1878**
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1899
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
† Electro Impulse, Box 870, Red Bank, NJ 07701-0870 201-741-0404
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 .. 914-664-2333
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411 818-782-6662
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ... 603-668-3210;800-257-3300
Meissner Inds., 551 Rte. 10, Dover, NJ 07801 201-366-1700
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502 303-242-0810
§ Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300

Resistors, Plug-in-4700

§ **ITT Pomona Electronics, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766, 714-623-3463 ..... C•1296**
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411, 818-782-6662 ..... A•1882

Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... **A•1899**
§† **RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054** ..... **A•1935**
† **TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230** ..... **A•1954**
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... **A•1982**
† Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 714-788-1700
Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
§ CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 .. 914-664-2333
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Julie Resch. Labs., 211 West 61st St., New York, NY 10023 212-245-2727
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089 413-781-1350
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ... 603-668-3210;800-257-3300
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
Tel Labs, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 ... 603-625-8994
Thickfilm Int'l, Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722

Resistors, Positive Temperature Coefficient-4700

§ **Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700** ..... **A•1826**
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, 213-699-0918 ..... **A•1833**
Electro Comp., Inc., 2415 Main St., Stratford, CT 06497, 203-375-5811 ... **A•1865**
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411, 818-782-6662 ..... **A•1882**
§ **Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591** .. **B•1754**
Meissner Inds., 551 Rte. 10, Dover, NJ 07801, 201-366-1700 ..... **A•1889**
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310;213-686-0535 ..... **A•1893**
§ **Midwest Comps., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602** ..... **B•1759,1763**
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... **A•1899**
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... **A•1908**
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ... **A•1923**
† **Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 33543, 813-541-5771** ..... **B•1770**
§† **TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230** ..... **A•1954-1955,1957**
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ..... **A•1963**
§† **Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300** ..... **A•1979**
Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806 714-630-0081
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
§ Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
† Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406 213-450-1761
Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
§ Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926 915-592-3253
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886 401-738-9150
§ Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 .. 914-664-2333
§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 219-356-4300
Ferro, Thick Film Sys. Div., 27 Castilan Dr., Santa Barbara, CA 93117 ... 805-968-5000
§ Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776 617-443-4631
§ INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 201-892-5881
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Julie Resch. Labs., 211 West 61st St., New York, NY 10023 212-245-2727
§ Jumbo Process Control, Inc., 410 Garibaldi Ave., Lodi, NJ 07644 201-779-7744
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089 413-781-1350
§† KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ... 603-668-3210;800-257-3300
Mepco//Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960 201-539-2000
Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ..... 714-979-8833; 714-634-1535
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ Precision Resistive Prods., Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637 319-394-9131
Raychem Corp., Elctrns. Grp., 300 Constitution Dr., Menlo Park, CA 94025 415-361-3860
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
§ RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102 603-627-3831
† Res-Net, 110 Route 10, Whippany, NJ 07981 ..... 201-887-2260;out of state 800-526-0704
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 615-892-0291
Sylvania GTE Control Devices, Rte. 35, Standish, ME 04084 207-642-4535
Tel Labs, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 ... 603-625-8994
† Vermont Precision Resistor, Codeco Corp. of Vermont, Box 1170, Stowe, VT 05672 802-253-8567
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Power-4700

Alden Products Co., P.O. Box 860, 117 N. Main St., Brockton, MA 02403, 617-583-0160 ..... **C•1121**
Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ..... **A•1787**
§ **Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700** ..... **A•1804-1807,1810,1811,1812,1813,1826**
§† **Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406, 213-450-1761** ..... **A•1830**
Colber Corp., 26E Buffington St., Irvington, NJ 07111, 201-371-9500 .... **A•1832**
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, 213-699-0918 ..... **A•1833**
Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... **A•1854**
Electro Comp., Inc., 2415 Main St., Stratford, CT 06497, 203-375-5811 ... **A•1865**
§† **Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333** ..... **A•1868**
§† **E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300** ..... **A•1869**
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ..... **A•1877**
Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... **A•1878**
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089, 413-781-1350 ..... **A•1879**
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411, 818-782-6662 ..... **A•1882**
Meissner Inds., 551 Rte. 10, Dover, NJ 07801, 201-366-1700 ..... **A•1889**
§† **Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310;213-686-0535** ..... **A•1892,1894,1895**
§ **Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454** ..... **A•1899**
† **Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900** ..... **A•1900**
§ **Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777** ..... **A•1909**
§† **Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532, 803-393-5421** ..... **A•1911**
§† **Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600** ..... **A•1912-1916,1918,1919,1920,1921**
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ... **A•1923**
† **Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 818-345-7811** ..... **A•1926**
† **Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 33543, 813-541-5771** ..... **A•1932**
§† **RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054** ..... **A•1935**
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... **A•1936**
§† **Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577, 919-934-5181** ..... **A•1936**
† **Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650, 312-652-7555** ..... **A•1942**
Res-Net, 110 Route 10, Whippany, NJ 07981, 201-887-2260;out of state 800-526-0704 ..... **A•1943**
† **Sohio Engineered Materials Co., Unit of Sohio, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000** ..... **A•1944**
† **Tel Labs, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053, 603-625-8994** ..... **A•1953**
§† **TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230** ..... **A•1955**
§† **Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810** ..... **A•1961-1962,1964**
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200 ..... **A•1969**
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... **A•1977,1979,1980,1981,1982,1983**
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186

§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
Capco, Box 1028, Grand Junction, CO 81502 303-243-8751
§ Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
§ Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069 619-747-4000
§† Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
† Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
§ INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 201-892-5881
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§ KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
§ KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701 814-362-5536
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ... 603-668-3210;800-257-3300
§ Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
§ Liberty Intl. Corp., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
Stackpole, Carbon Div., 201 Stackpole St., St. Marys, PA 15857 814-781-1234
Standard Condenser Corp., 1065 W. Addison St., Chicago, IL 60613 312-327-5440
§† Tepro of Florida, 2608 Enterprise Rd., Clearwater, FL 33575 813-796-1044
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
§† Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550 914-664-1000
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Precision-4700

§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ..... A•1788,1798,1799
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1804-1808,1810,1811,1812,1814,1816,1817,1818,1819,1825,1826
§† Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406, 213-450-1761 ..... A•1830
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ..... A•1013
§† Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830, 607-974-8725 ..... A•1068
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... A•1849-1850,1852,1853,1860,1861,1862,1863
Electro Comp., Inc., 2415 Main St., Stratford, CT 06497, 203-375-5811 ... A•1865
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1867
† Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1868
§ General Resistance, Inc., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ..... A•1870
† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776, 617-443-4631 ..... A•1872
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... A•1876
Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... A•1878
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089, 413-781-1350 ..... A•1879
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981, 201-887-8100 ..... A•1881
† Kelvin, 5919 Noble Ave., Van Nuys, CA 91411, 818-782-6662 ..... A•1882
§† KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1884,1886
Meissner Inds., 551 Rte. 10, Dover, NJ 07801, 201-366-1700 ..... A•1889
Mepco//Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960, 201-539-2000 ..... A•1890
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310;213-686-0535 ..... A•1892-1894,1897
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1899
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761, 617-695-0203 ..... A•1906
NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060;800-645-9333 ..... A•1910
Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1911
§† Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1914,1920
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ... A•1923
† Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 818-345-7811 ..... A•1926
§ Precision Resistive Prods., Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 ..... A•1929
† Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 33543, 813-541-5771 ..... A•1930
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ..... A•1935
§† RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•1939
§† Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577, 919-934-5181 ..... A•1939
Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650, 312-652-7555 ..... A•1942
† Res-Net, 110 Route 10, Whippany, NJ 07981, 201-887-2260;out of state 800-526-0704 ..... A•1943
Tel Labs, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053, 603-625-8994 ..... A•1952
† TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... A•1954
§† Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ..... A•1958
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200 ..... A•1968
§† Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•1972-1975,1977,1978,1984,1985
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
§ Beckman Industrial Corp., Electronic Technologies Div., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Beckman Instrs., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161
Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
† CTS Electronics Corp., Halex Division, 1202 McGaw Ave., Irvine, CA 92714 714-261-6381
§† Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
Hybrilonics, Inc., P.O. Box 217, Lasalle Sta., Niagara Falls, NY 14304 716-731-9080
§ INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 201-892-5881
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-822-9601
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ... 603-668-3210;800-257-3300
§ Liberty Intl. Corp., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
§ Mepco//Electra, Inc., Airport Road, P.O. Box 760, Mineral Wells, TX 76067 817-325-7871
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
† Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
§† Tepro of Florida, 2608 Enterprise Rd., Clearwater, FL 33575 813-796-1044
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 215-539-6050
§† Varistor Corp., 115 Industrial Pk., Sevierville, TN 37862 615-453-0001
§† Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722
Waters Mfg., Longfellow Ctr., Wayland, MA 01778 617-358-2777

Resistors, Pressure Sensitive-4700

† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776 617-443-4631
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300

Resistors, Rectilinear-4700

§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
§ Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
§ Bourns Instrs., Inc., Industrial Div., 1960 Chicago Ave., Unit F, Riverside, CA 92503 714-781-5147
§ Carbone Lorraine Inds., 400 Myrtle Ave., Boonton, NJ 07005 ..... 201-DE4-0700
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ... 603-668-3210;800-257-3300
New England Instr., Robertshaw Controls, 14 Kendal Lane, Natick, MA 01760 617-875-9711
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Res-Net, 110 Route 10, Whippany, NJ 07981 ..... 201-887-2260;out of state 800-526-0704
† Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300

Resistors, Standards — See Standards, Resistance (Vol. D)

Resistors, Strip-4700

TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... A•1957
† Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
§ CTS Corporation, Asheville Division, P.O. Box 100, Skyland, NC 28776 .. 704-684-6451
§ Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Tel Labs, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 ... 603-625-8994
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
§ Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550 914-664-1000

Resistors, Suppressor-4700

Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1899
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... A•1957
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•1977
Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 .. 914-664-2333
† Estes Engrg. Co., 930 Marine Dr., Port Angeles, WA 98362 206-457-0904
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
† Sohio Engineered Materials Co., Unit of Sohio, P. O. Box 156, Niagara Falls, NY 14302 716-278-2000
Stackpole, Carbon Div., 201 Stackpole St., St. Marys, PA 15857 814-781-1234
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Surge-4700

Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, 213-699-0918 ..... A•1833
§ Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 .. B•1752
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ... A•1920
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ..... A•1935
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... A•1957
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•1977
Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806 714-630-0081
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 714-788-1700
Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
§ Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069 619-747-4000
§ Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Electrostatic Consltg. Assocs., 556 Lowell Rd., Groton, MA 01450 617-448-5485
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731 .....818-442-3310; 213-686-0535
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204 414-271-9900
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Sohio Engineered Materials Co., Unit of Sohio, P. O. Box 156, Niagara Falls, NY 14302 716-278-2000
§ Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550 914-664-1000

Resistors, Tapped-4700

§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 ..... A•1869
† Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ..... A•1900
† Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650, 312-652-7555 ..... A•1942
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... A•1957
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
§ Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
§† Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 .. 914-664-2333
§† Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
Hybrilonics, Inc., P.O. Box 217, Lasalle Sta., Niagara Falls, NY 14304 716-731-9080
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089 413-781-1350
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411 818-782-6662
§ Liberty Intl. Corp., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
† Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731 .....818-442-3310; 213-686-0535
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Quality Thermistor, 2147 Centurion Pl., Boise, ID 83705 208-377-3373
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577 919-934-5181
† Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Tel Labs, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 ... 603-625-8994
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
§ Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550 914-664-1000

Resistors, Temperature Sensitive — See Thermistors (Vol. B)

Resistors, Tin Oxide-4700

§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ..... A•1935
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735 516-454-6390
§† Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
§ KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701 814-362-5536
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731 .....818-442-3310; 213-686-0535

Resistors, Variable — See Potentiometers (Vol. A), Rheostats (Vol. A), Resistors, Adjustable (Vol. A)

Resistors, Voltage Sensitive-4700

§ Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ..... A•1109,1113
§ Marcon America Corp., 310 Era Drive, Northbrook, IL 60062, 312-564-2820 ..... A•1116,1887
Mepco/Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960, 201-539-2000 ..... A•1891
§ Midwest Comps., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602 ..... B•1764
Sohio Engineered Materials Co., Unit of Sohio, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ..... A•1946
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2090
§ Carbone Lorraine Inds., 400 Myrtle Ave., Boonton, NJ 07005 ..... 201-DE4-0700
Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Diodes Inc., 9957 Canoga Ave., Chatsworth, CA 91311 ... 818-882-4920;800-821-1178
Electrostatic Consltg. Assocs., 556 Lowell Rd., Groton, MA 01450 617-448-5485
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 801-537-5237
GTE Switching & Telephone Products, 400 N. Wolf Rd., Northlake, IL 60164 312-681-7100
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245, ... 213-772-2000
KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411 818-782-6662
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
§ Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, JAPAN 03-986-6151
§ Schauer Mfg., 4500 Alpine Ave., Cincinnati, OH 45242 513-791-3030
Taiyo Yuden (USA) Inc., 714 Algonquin Rd., Arlington Heights, IL 60005 312-364-6104
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
§ Thomson-CSF Comps. Corp., Passive Comp. Div., 5850 Canoga Ave., Suite 300, Woodland Hills, CA 91367 818-887-1010

§ Victory Engrg. Corp., Victory Rd., Springfield, NJ 07081 201-379-5900
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Wirewound-4700

§† Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406, 213-450-1761 ..... A•1830
Colber Corp., 26E Buffington St., Irvington, NJ 07111, 201-371-9500 .... A•1832
Concept Industries, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, 213-699-0918 ..... A•1833
Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... A•1854
Electro Comp., Inc., 2415 Main St., Stratford, CT 06497, 203-375-5811 ... A•1865
§† Elect. Prec. Comp. Corp., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1868
§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 ..... A•1869
§ General Resistance, Inc., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ..... A•1870
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750, 219-356-0778 ..... A•1871
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ..... A•1877
Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... A•1878
† Kelvin, 5919 Noble Ave., Van Nuys, CA 91411, 818-782-6662 ..... A•1882
† Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310;213-686-0535 ..... A•1892
§ Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720, 213-598-2454 ..... A•1899
† Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ..... A•1900
§† Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ... A•1912
† Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 818-345-7811 ..... A•1926
† Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 33543, 813-541-5771 ..... A•1930
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ..... A•1935
§† RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•1936
§† Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577, 919-934-5181 ..... A•1936
† Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650, 312-652-7555 ..... A•1942
† Tel Labs, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053, 603-625-8994 ..... A•1952
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... A•1955,1957
§† Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ..... A•1960-1962,1964
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•1979
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161
Capco, Box 1028, Grand Junction, CO 81502 303-243-8751
§ Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ..... 914-YO3-5900
CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069 619-747-4000
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ CTS Corporation, Asheville Division, P.O. Box 100, Skyland, NC 28776 .. 704-684-6451
§† Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
† Engelhard Corp., 70 Wood Ave. S., Iselin, NJ 08830 201-321-5900
§† Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
§ INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 201-892-5881
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ... 603-668-3210;800-257-3300
§ Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
§ Liberty Intl. Corp., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
Meissner Inds., 551 Rte. 10, Dover, NJ 07801 201-366-1700
† Mel-Rain Controls, 42974 M-43 Hwy., Paw Paw, MI 49079 616-657-2527
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
§† Nytronics Components Grp., Inc., Orange St., Darlington, SC 29532 803-393-5421
§† Paccom, 3928 148th NE, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
Standard Condenser Corp., 1065 W. Addison St., Chicago, IL 60613 312-327-5440
§† Tepro of Florida, 2608 Enterprise Rd., Clearwater, FL 33575 813-796-1044
§† Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550 914-664-1000
Waters Mfg., Longfellow Ctr., Wayland, MA 01778 617-358-2777
Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403 717-876-1500
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

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Kelvin, 5919 Noble Ave., Van Nuys, CA 91411, 818-782-6662 ..... A•1882
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-923-8230 ..... A•1954
Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
§ KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701 814-362-5536
§ Liberty Intl. Corp., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101

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Resonators, Ceramic-2700

§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ..... A•1363
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•1396
NTK Technical Ceramics, NGK Spark Plugs (U.S.A.), Inc., 1701 N. Greenville Ave. # 205, Richardson, TX 75081, 214-235-8332 ..... A•1398
Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 ..... A•1418
† Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478, 216-232-8600 ..... A•1455
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
Radio Materials Corp., 4242 W. Bryn Mawr, Chicago, IL 60646 312-478-3600
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 312-297-0070

Resonators, SAW-2300

† Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 ..... A•1432
RF Monolithics, Inc., 4441 Sigma Rd., Dallas, TX 75234 214-233-2903
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 312-297-0070

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§† IERC, 135 W. Magnolia Blvd., Burbank, CA 91502 ..... 818-849-2481;818-786-1182
Intl. Elctrn. Resch., 135 W. Magnolia Blvd., Burbank, CA 91502 213-849-2481

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§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 ..... A•2015
§† Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ... A•2032
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... A•2037
§† Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•2052
§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935 915-592-4888
Biddle Instruments, A Thorn EMI Co., 510 Township Line Rd., Blue Bell, PA 19422 215-646-9200
Carter Mfg. Corp., Sugar Rd., Bolton, MA 01740 617-779-5501
Centralab, Inc., A North American Philips Co., Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300
§ Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
CTS Corporation, 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
Mallory Components Division, Emhart Elec./Elctrn. Grp., 3029 E. Washington St., Indianapolis, IN 46201 317-261-1361
† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629 312-581-4555
Mel-Rain Controls, 42974 M-43 Hwy., Paw Paw, MI 49079 616-657-2527
New England Instr., Robertshaw Controls, 14 Kendal Lane, Natick, MA 01760 617-875-9711
† Noble U.S.A., Inc., 151 Stanley St., Elk Grove Village, IL 60007 312-364-6038
Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 ..... 800-245-4501;800-245-4497 In Ohio
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722
Wilbrecht Elctrns., 240 Plato Blvd., St. Paul, MN 55107 612-222-2791

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†Bacon Inds., 192 Pleasant St., Watertown, MA 02172-2399 617-926-2550
†Chomerics, Inc., 77 Dragon Ct., Woburn, MA 01888 617-935-4850
Detoronics Corporation, 10660 E. Rush St., S. El Monte, CA 91733 818-579-7130
M/A-Com Microwave Components, Inc., M/A-Com, South Avenue, Burlington, MA 01803 617-272-3000
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
Microflect, 3575 25th S.E., Salem, OR 97302-0985 503-363-9267
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§Parker Seal Grp., P.O. Box 11751, Lexington, KY 40512 606-269-2351
§†Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
†Tecknit (Eastern Facility), 129 Dermody St., Cranford, NJ 07016 201-272-5500
Vernay Laboratories, Inc., S. College St., Yellow Springs, OH 45387 513-767-7261
§†Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

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Magnet Sales & Mfg. Co. Inc., 11250 Playa Court, Culver City, CA 90230-6127, 213-391-7213;800-421-6692 ..... A•1307

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† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 ..... A•1705
† Daico Inds., Inc., Box 5225, Compton, CA 90224, 213-631-1143 ..... A•1708
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1780, D•1734
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573, 914-939-8900 ..... A•1781
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 617-935-8610
Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Amphenol, An Allied Co., 43 Commerce Ct., Lisle, IL 60532 312-983-3500
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 516-694-3600
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Microwave Applications Grp., 3030 Industrial Pkwy., Santa Maria, CA 93455 805-928-5711
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Norsal Inds., 85 D Hoffman Lane So., Central Islip, NY 11722 516-234-1200
Reeve Electronics, Mellish E. Murray, 1720 W. Fulton St., Chicago, IL 60612 312-670-0150
Sivers IMA, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Technical Research & Mfg., Inc., R.F.D. # 10, Manchester, NH 03103 ... 603-627-6000
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Shifters, Phase, RF-3450

† Daico Inds., Inc., Box 5225, Compton, CA 90224, 213-631-1143 ..... A•1708
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•1780
Ryan Intl. Corp., 4800 Evanswood Dr., Columbus, OH 43229, 614-885-3303 ..... D•1303
Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 617-935-8610
Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
† Amphenol, An Allied Co., 43 Commerce Ct., Lisle, IL 60532 312-983-3500
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 516-694-3600
Locus, Box 740, State College, PA 16804 814-466-6275
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
M/A-Com Microwave Components, Inc., M/A-Com, South Avenue, Burlington, MA 01803 617-272-3000
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

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Shunts, Meter-2900 — *See Vol. D*

Shutters, Microwave-3450

† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

SIDACs-4800

Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ..... A•2083
Triac Electronic Systems, Inc., 87-27 Myrtle Ave., Glendale, NY 11385, 718-441-4759 ..... D•1132
§ Teccor Elctrns., 1801 Hurd Dr., Irving, TX 75062 214-252-7651

Signal Averagers-2900 — *See Vol. D*

Signal Conditioners & Equipment-1100 — *See Vol. D*

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Slip Rings & Assemblies-3500 — *See Vol. B*

Slotted Lines, Microwave-3450

† Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 617-935-8610
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
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Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Sivers IMA, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§ Tucker Elctrns., Box 461966, Garland, TX 75046 ..... 214-348-8800;800-527-4642

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Speakers, Replacement (Incl. Aircraft, Automotive & TV)-1300 — *See Vol. D*

Speakers, Submergence Proof-1300 — *See Vol. D*

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Standards, Current-2900 — ***See Vol. D***

Standards, Delay Line-2350

† Anders, Inc., 77 Wolcott Rd., Simsbury, CT 06070 203-658-7666
† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220

Standards, Frequency-2900 — ***See Vol. D***

Standards, Inductance-2900 — ***See Vol. D***

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Storage Equipment, Punched Card-3800 — ***See Vol. C***

Storage Equipment, Reel-to-Reel Tape-3800 — ***See Vol. C***

Strain Reliefs, Cable & Wire-2800 — ***See Vol. C***

Strip-Line Components, Microwave-3450

Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† American Etching & Mfg., 13730 Desmond St., Pacoima,, CA 91331 213-896-1187
Amphenol, An Allied Co., 43 Commerce Ct., Lisle, IL 60532 312-983-3500
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
Centerflex Techn. Corp., 221 Seventh Ave., P.O. Box 21, Hawthorne, NJ 07507 201-423-0505
† Central Microwave Co., Alpha Inds., Inc., 12180 Prichard Farm Rd., Maryland Heights, MO 63043 314-291-5270
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 216-267-2233
† Electro-Magnetic Processes, Inc., 9616 Owensmouth Ave., Chatsworth, CA 91311 818-882-6333
† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 516-694-3600
HDS Inc., 12310 Pinecrest Rd., Reston, VA 22091 703-620-6200
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ..... 818-889-4030;805-497-4421
§ 3M-Electronic Products Division, Bldg. 502, P.O. Box 2963, Austin, TX 78769-2963 512-834-6682
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Norsal Inds., 85 D Hoffman Lane So., Central Islip, NY 11722 516-234-1200
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
Rogers Corp., One Technology Dr., Rogers, CT 06263 203-774-9605
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
§† Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Technical Research & Mfg., Inc., R.F.D. # 10, Manchester, NH 03103 ... 603-627-6000
Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
† Transco Products, Inc., 4241 Glencoe Ave., Marina del Rey, CA 90295 .. 213-822-0800
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332

Strips, Ground-1900 — ***See Vol. D***

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Substrates, Metallic-2800 — ***See Vol. C***

Substrates, Sapphire-2800 — ***See Vol. C***

Surface Acoustic Wave, Delay Line-2350

† Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 ..... **A•1432**

† Hoffman, P. R., Co., Materials Processing Div., Amstar Tech. Prods. Co., Inc., 321 Cherry St., Carlisle, PA 17013 717-243-2011
† Union Carbide Corporation, Elctrns. Div., Crystal Prods. Dept., 9320 Chesapeake Dr., Ste. 104, San Diego, CA 92123 619-279-4500

Surface Acoustic Wave, Filter-2700

† Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 ..... A•1432
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070

Suppressors, Arc — See Protectors, Surge (Vol. B)

Suppressors, Noise-2700

Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2120
† Control Concepts Corp., P.O. Box 1380, Binghamton, NY 13902-1380, 607-724-2484 ..... B•1233
† Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083, 1-800-521-4792 ..... D•1912
§ Displex, Inc., Alexander Place, Glen Cove, NY 11542, 516-671-4400 ..... D•1917
Hipotronics, P.O. Drawer A, Brewster, NY 10509, 914-279-8091 ..... D•1934
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2165
MCG Elctrns., 12 Burt Dr., Deer Park, NY 11729, 516-586-5125 ..... B•1248
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2213
Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1270
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706, 516-231-6400 ..... A•1629
Xentek, Inc., 279 S. Pacific St., San Marcos, CA 92069, 619-744-3346 .... D•1872
§ Amperex Electronic Corp., Ferroxcube Div., 5083 Kings Hwy., Saugerties, NY 12477 914-246-2811
Basic Measuring Insts., 402 Lincoln Centre Dr., Foster City, CA 94404 ... 415-570-5355
§ Brooks Mfg. Co., 2016/24 Amber St., Philadelphia, PA 19125 ..... 215-425-3395; 800-523-0130
Brooks Mktg. Corp., 3569 Bristol Pike Bldg. 2 Ste 102, Bensalem, PA 19020 ..... 215-244-0264;1-800-523-1551
† Chomerics, Inc., 77 Dragon Ct., Woburn, MA 01888 617-935-4850
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645 312-262-7700
§ Corcom, Inc., 1600 Winchester Rd., Libertyville, IL 60048 312-680-7400
† Dynamic Air Engrg, Inc., EMC Filter Div., 620 E. Dyer Rd., Santa Ana, CA 92705 714-540-2081
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St, Milwaukee, WI 53216 414-449-7487
EFI Corporation, 350 West 2700 South, Salt Lake City, UT 84115 801-486-5871
Elite Electronics, Inc., 1408 Summit - Suite #5, Plano, TX 75074 214-881-0026
Engineered Comps. Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† Estes Engrg. Co., 930 Marine Dr., Port Angeles, WA 98362 206-457-0904
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
General Semiconductor Ind., Inc., Square D Company, 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 213-361-8691
Kalglo Elctrns. Co., Inc., 6584 Ruch Rd., E. Allen Twp., Bethlehem, PA 18017 215-837-0700
Marway Prods. Inc., 311 N. Clara St., Santa Ana, CA 92703 714-973-1800
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
Potter Co., P.O. Box 337, North Hwy. 51, Wesson, MS 39191 601-643-2215
§† Power Integrity Corp., 1840 Pembroke Rd., P.O. Box 9682, Greensboro, NC 27408 919-379-9773
§ Production Industries, Inc., 12880-E Pierce Street, Pacoima, CA 91331 ..... 818-896-0555;800-423-5618
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§ Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
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† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1591
Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-329-2460 ..... A•1360
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§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
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† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 ..... A•1705
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† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
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† Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
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American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... **A•2071**

§† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ..... **A•2077,2083**

Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... **A•2090**

§ Teccor Elctrns., 1801 Hurd Dr., Irving, TX 75062, 214-252-7651 ..... **A•2092**

Triac Electronic Systems, Inc., 87-27 Myrtle Ave., Glendale, NY 11385, 718-441-4759 ..... **D•1132**

§ A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 201-722-9800

Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800

Conditioning Semiconductor Devices, Box 2116, Wayne, NJ 07470 201-335-6723

Ei North America, 15 W. 53rd St. Suite 47E, New York, NY 10019 212-315-3099

§† General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321

§ Gentron Corp., 6667 N. Sydney Pl., Milwaukee, WI 53209 414-351-1660

Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404

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Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800

Hutson Inds., 1000 Hutson Cir., Frisco, TX 75034 214-377-3557

International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 .....714-557-9394; 800-854-7651

§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000

ITT Semiconductors, 500 Broadway, Lawrence, MA 01841 617-688-1881

NAE, 69 Bennett St., Lynn, MA 01905 617-598-4800

§ NEC Elctrns. USA Inc., NEC Electron Div., 252 Humboldt Ct., Sunnyvale, CA 94086 408-745-6520

† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300

§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000

Raytheon/TAG Semiconductors Ltd., 43 Third Ave., Burlington, MA. 01803 ..... 617-272-3704 (3705)

§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636

§ RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000

§ RCA Solid State Div., Thyristors & Rectifiers, Rte. 202, Somerville, NJ 08876 201-685-6000

§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000

§ Research, Inc., Box 24064, Minneapolis, MN 55424 612-941-3300

Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, JAPAN 03-986-6151

Sanken Elec. U.S.A. Corp., 3848 Carson St., Ste. 105, Torrance, CA 90503 213-540-2209

§ Semikron, Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 .....603-883-8102; 1-800-258-1308

Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400

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§† St-Semicon, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402 812-332-1435

§ Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611

§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010

§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540

† Westcode Semiconductors, Inc., 0-02 Fair Lawn Ave., Fair Lawn, NJ 07410 201-791-3020

§ Westinghouse Elec. Corp., Semiconductor Div., Armbrust Rd., Youngwood, PA 15697 412-925-7272

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Timing Systems, Oscillators-2300

Datum Inc., Timing/Aacom Divisions, 1363 S. State College Blvd., Anaheim, CA 92806, 714-533-6333 ..... **D•1148**

† Frequency and Time Systems, Inc., DATUM, INC., 34 Tozer Rd., Beverly, MA 01915, 617-927-8220 ..... **A•1365, D•1148**

† Austron, Inc., P.O. Box 14766, Exit 248 N. IH 35, Austin, TX 78761 512-251-2341

† Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185 312-231-5270

C-Tek Inc., 4 Railroad Ave., Wakefield, MA 01880 617-246-1720

CTS Electronics Corp., Knights Division, 400 Reimann Ave., Sandwich, IL 60548 815-786-8411

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§ Master Elctrn. Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
Northwest Microcircuits, Inc., 2115 N. College, Newberg, OR 97132 503-538-7081
Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901 804-977-8050
Stanford Telecommunications, Inc., 2421 Mission College Blvd., Santa Clara, CA 95054 408-748-1010
† TRAK Systems, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E-5, Tampa, FL 33614 813-884-1411

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Tools & Assembly, Permanent Magnet-1850
Magnet Sales & Mfg. Co. Inc., 11250 Playa Court, Culver City, CA 90230-6127, 213-391-7213;800-421-6692 ..... A•1307

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Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2120
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† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ..... A•2150
§ Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 .. A•1240
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ..... A•2157
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MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 414-358-5300;800-558-4332 ..... A•2199
§ Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2203
§ Opamp Labs, Inc., 1033 N. Sycamore Ave., Los Angeles, CA 90038, 213-934-3566 ..... D•1014
† Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2214-2216,2220
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2223
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2233
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1622 ,2257,2262,2263,2264
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Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 .. A•2288
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† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... A•2318
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Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ... A•2334
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§† ADC Prods., 4900 W. 78th St., Minneapolis, MN 55435 612-835-6800
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† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
§ Atlas Sound Div., 10 Pomeroy Rd., Parsippany, NJ 07054 201-887-7800
§† Audiosone, Inc., 617 Fan Hill Rd., Monroe, CT 06468 ..... 203-268-4372;203-268-6703
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† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101 612-228-6463
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
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Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
§ C-COR Elctrns., 60 Decibel Rd., State College, PA 16801 814-238-2461
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CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 718-857-2400
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† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Coiltronics Inc., 984 SW 13th Court, Pompana Beach, FL 33069 305-781-8900
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
Custom Coil & Transformer, Box 2369, Zanesville, OH 43701 614-452-6973
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011 212-691-9050
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
§† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
§ Frazier, 1930 Valley View La., Dallas, TX 75234 214-241-3441
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
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§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 507-625-6521
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Oram Electronics, 12 Cranston Rd., Pittsford, NY 14534 716-381-4673
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 816-221-2000
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704 516-491-3300
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 .. 203-762-4786
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
§† Primo, 25-1, 6-Chome, Mure, Mitakashi, Tokyo, JAPAN 0422-43-3121
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ Quam-Nichols Co., 234 E. Marquette Rd., Chicago, IL 60637 312-488-5800
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
RFL Inds., A Dowty Grp. Co./Comms. Div., Powerville Rd., Boonton, NJ 07005 201-334-3100
§ Rye Inds., Inc., 125 Spencer Pl., P.O. Box M, Mamaroneck, NY 10543 ... 914-698-0080
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60204 312-866-2200
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
Kulka Smith, Inc., 1913 Atlantic Ave., Manasquan, NJ 08736 201-223-9400
§ Soundlier, American Trading & Prod. Corp., 9380 Watson Ind'l. Pk., St. Louis, MO 63126 314-962-9870
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
§ SPECO Div., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757 ..... 516-957-8700;800-645-5516
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
Xentek, Inc., 279 S. Pacific St., San Marcos, CA 92069 619-744-3346
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Autotransformer-5600

† Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083, 1-800-521-4792 ..... D•1910
§† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2134
§ EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2144
§† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ..... A•2153
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2160
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2164
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2197
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2229
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 ..... A•2272,2285
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 .. A•2288
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211, 718-782-4200 ..... A•2299
Superior Elec. Co., 383 Middle St., Bristol, CT 06010, 203-582-9561 ..... A•2304
§† Technipower, A Penril Co., P.O. Box 222, Commerce Pk., Danbury, CT 06810, 203-748-7001 ..... A•2306
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
§ Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400 ..... A•2317
Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ... A•2333
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503, 201-278-7674 ..... A•2341

Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 818-841-3630
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
§ AC Transformer, 89 Madison St., Newark, NJ 07105 201-589-8574
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
§ Altec Lansing, Altec Corp., 1250 N. Red Gum St., Anaheim, CA 92806 ... 714-632-7117
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
Carson Mfg. Co., Inc., 5453 N. Rural St., P.O. Box 20464, Indianapolis, IN 46220 317-257-3191
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 718-857-2400
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
Custom Coil & Transformer, Box 2369, Zanesville, OH 43701 614-452-6973
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Diamond Magnetics, P.O. Box 4736, San Luis Obispo, CA 93403 805-544-4019
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Displex, Inc., Alexander Place, Glen Cove, NY 11542 516-671-4400
§ Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Elctrns., 1730 21st St, Santa Monica, CA 90404 213-828-9541
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263

Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
Field Electronics, 1416 Commerce St., Chatham, NJ 07928 201-635-6566
§ Frazier, 1930 Valley View La., Dallas, TX 75234 214-241-3441
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hipotronics, P.O. Drawer A, Brewster, NY 10509 914-279-8091
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
§ Hughey & Phillips, Inc., 3050 N. California St., Burbank, CA 91504 818-849-1104
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
§ Jefferson Elec., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021 312-691-2400
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 .... 303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704 516-587-0510
§ Micron Inds., 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 507-625-6521
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 816-221-2000
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 203-762-4786
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .... 914-699-5514; 800-431-1064
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
§ Relay Specialties, 1300 Plaza Rd., Fair Lawn, NJ 07410 .... 201-797-3313; 800-526-5376
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .... 516-593-2025; Outside NY 800-645-5900
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 .... 213-32-Sigma
§ Soundlier, American Trading & Prod. Corp., 9380 Watson Ind'l. Pk., St. Louis, MO 63126 314-962-9870
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§† Staco Energy Prods. Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037 301-464-2100
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404 415-574-1100
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
Xentek, Inc., 279 S. Pacific St., San Marcos, CA 92069 619-744-3346
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Bias – See Transformers, Power (Vol. A)

Transformers, Bridging – See Transformers, Matching (Vol. A)

Transformers, Chip-5600

Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735 516-293-0475
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .... 914-699-5514; 800-431-1064
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
SFE Technologies, 1501 1st St, San Fernando, CA 91340 213-365-9411

Transformers, Chopper-5600

Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 .... A•1240
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 .... A•2197
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 .... A•2318
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
§† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 .... 201-245-3200; 800-526-4048
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .... 914-699-5514; 800-431-1064
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Torelco, Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100

Transformers, Constant Voltage-5600

† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 .... A•2153
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 .... A•2164
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 414-358-5300; 800-558-4332 .... A•2199
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 .... A•2226
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 .... A•2272
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503, 201-278-7674 .... A•2340
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
§ Altec Lansing, Altec Corp., 1250 N. Red Gum St., Anaheim, CA 92806 714-632-7117
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
† American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 915-592-9985
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 718-857-2400
§ Computer Power, 124E W. Main St., High Bridge, NJ 08829 201-735-8000
Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083 1-800-521-4792
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., 2 Willowbrook Road, Cromwell, CT 06416 203-635-3510
§† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855

§ Electronic Specialists, 171 South Main St., Natick, MA 01760 ..... 617-655-1532; 800-225-4876
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Elgar Corp, An Onan McGraw Edison Co., 9250 Brown Deer Rd., San Diego, CA 92121 619-450-0085
Elgin Electronics, Combustion Engineering, 5533 New Perry Hwy., Erie, PA 16509-3570 814-864-4921
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
§† E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 213-892-7279
§† Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
§ Jefferson Elec., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021 312-691-2400
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ..... 303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
§ Micron Inds., 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788
§ Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
§ Oaktron Inds., 1000 30th St., Monroe, WI 53566 608-328-5560
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Oram Electronics, 12 Cranston Rd., Pittsford, NY 14534 716-381-4673
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 816-221-2000
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
Ratelco, 1260 Mercer, Dept. EEM, Seattle, WA 98109 206-624-7770
Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 ..... 800-245-4501;800-245-4497 In Ohio
Ronor Systems, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492 203-265-2110
Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148 312-620-8394
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
§ Sola, A Unit of General Sign., 1717 Busse Rd., Elk Grove Village, IL 60007 312-439-2800
§ Soundlier, American Trading & Prod. Corp., 9380 Watson Ind'l. Pk., St. Louis, MO 63126 314-962-9870
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§ Sun Research, Inc., Box 210, Old Bay Rd., New Durham, NH 03855 603-859-7110
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Transistor Devices, 274 S. Salem St., Randolph, NJ 07869 201-361-6622
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404 415-574-1100
§ University Sound, Altec Corp., 1250 N. Red Gum St., Anaheim, CA 92806 714-632-7117
Xentek, Inc., 279 S. Pacific St., San Marcos, CA 92069 619-744-3346
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

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Transformers, Converter, DC To DC-5600

Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 .... A•1218
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2125,2132
§† Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 .. A•1240
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ..... A•2157
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2165
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2190
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2213
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2233,2252,2253
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2257-2258,2263,2264
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... A•2318
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
§ Alpha Comps., 115 Eucalyptus Dr., El Segundo, CA 90245 213-322-7780
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
† Applied Electro Technlg., Int., STI Company, 2220 So. Anne St., Santa Ana, CA 92704 714-556-6570
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101 612-228-6463
† Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
Bikor, 1504 W. 228th St., Torrance, CA 92718 213-539-6320
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coiltronics Inc., 984 SW 13th Court, Pompana Beach, FL 33069 305-781-8900
Computer Power, 124E W. Main St., High Bridge, NJ 08829 201-735-8000
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Datamax Electronics, Inc., P. O. Box 2839, Blue Jay, CA 92631 ..... 714-336-3561; 714-951-5646
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Diamond Magnetics, P.O. Box 4736, San Luis Obispo, CA 93403 805-544-4019
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., 2 Willowbrook Road, Cromwell, CT 06416 203-635-3510
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
† Endicott Resch. Grp., Inc., 2601 Wayne St., P.O. Box 269, Endicott, NY 13760 607-754-9187
§† E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 213-892-7279
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
§† Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
Hurricane Electrns. Lab, P.O. Box 1280, Hurricane, UT 84737 801-635-2003
International High Voltage Elctrns., Inc., 98 Mill Plain Rd., Danbury, CT 06811 203-792-7820
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ..... 303-443-6250; 800-525-6478
§ Love Controls, 1475 S. Wheeling Rd., Wheeling, IL 60090 312-541-3232
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183

Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Novatronics, Box 878, Pompano Beach, FL 33061 305-942-5200
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Pacific Electro Dynamics, Inc., 11465 Willows Rd. N.E., Redmond, WA 98052 206-881-1700
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
Ronor Systems, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492 203-265-2110
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
Torelco, Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Transistor Devices, 274 S. Salem St., Randolph, NJ 07869 201-361-6622
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Xylog Corp., 150 Tillman St., Westwood, NJ 07675 201-664-7997
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

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Transformers, Decade-5600

† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro Scientific Inds., 13900 N.W. Science Pk. Dr., Portland, OR 97229 503-641-4141
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 .. 203-762-4786
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .....914-699-5514; 800-431-1064
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880

Transformers, Differential-5600

Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 .... A•1218
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731, 516-261-3300 ..... D•1141
ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ..... D•1150
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
Transducers and Systems Inc., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ..... B•1828
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
§ Ametek, 2 Station Square, Paoli, PA 19301 215-355-6900
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
Automatic Timing & Controls Co., 201 So. Gulph Rd., King of Prussia, PA 19406 ..... 215-337-5500;800-441-8245
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
† Columbia Resch. Labs., Macdade Blvd. & Bullens La., Woodlyn, PA 19094 215-532-9464
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 507-625-6521
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Oram Electronics, 12 Cranston Rd., Pittsford, NY 14534 716-381-4673
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .....914-699-5514; 800-431-1064
§† Robinson-Halpern, One Apollo Rd., P.O. Box 248, Plymouth Meeting, PA 19462-0248 215-825-9200
† Schaevitz Engrg., U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transducer Systems, Inc., 1510 Delp Dr., Kulpsville, PA 19443 215-256-4611
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
Trans-Tek, P.O. Box 338, Rte. 83, Ellington, CT 06029 203-872-8351
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674

Transformers, Discriminator-5600

§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ..... A•1213
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1622
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Datamax Electronics, Inc., P. O. Box 2839, Blue Jay, CA 92631 .....714-336-3561; 714-951-5646
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .....914-699-5514; 800-431-1064
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100

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Transformers, Driver-5600

§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2197
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2214
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2224

Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880, 814-355-1521 ..... **A•2231**

† **Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950** ..... **A•1622,2263,2264**

Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ..... **A•2268**

† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105** .... **B•1010**

† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314** ..... **A•2320**

† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 818-841-3630

§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568

Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006

American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838

Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100

† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900

Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341

Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541

† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195

Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188

† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015

§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301

† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911

Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520

§† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950

† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222

† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541

El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300

† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048

† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300

Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430

§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710

† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012

Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525

§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080

Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700

Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700

† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511

KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786

Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900

Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625

Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ..... 303-443-6250; 800-525-6478

Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820

† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700

† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752

† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166

Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202

† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300

† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300

Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440

† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600

† Oram Electronics, 12 Cranston Rd., Pittsford, NY 14534 716-381-4673

† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 203-762-4786

† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ..... 914-699-5514; 800-431-1064

Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700

† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200

† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777

§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700

† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700

† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma

South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866

Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191

§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244

† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200

Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121

Torelco, Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641

† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050

† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800

† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880

§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500

§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500

† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674

Transformers, Ferroresonant-5600

Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ..... **A•2153**

Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 ..... **A•2158**

Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201, 201-353-5700 ..... **D•1679**

MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 414-358-5300;800-558-4332 ..... **A•2199**

† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105** ..... **A•2307, B•1010**

§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568

Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006

Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100

Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541

§ C-COR Elctrns., 60 Decibel Rd., State College, PA 16801 814-238-2461

Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083 1-800-521-4792

† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000

Dynage/Power & Magnetics, Division Of Oakleaf, Inc., 2 Willowbrook Road, Cromwell, CT 06416 203-635-3510

§† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950

Elgin Electronics, Combustion Engineering, 5533 New Perry Hwy., Erie, PA 16509-3570 814-864-4921

† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541

Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263

§† E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 213-892-7279

Framar Metal Products Co., Inc., 345 Carnegie Avenue, Kenilworth, NJ 07033 201-241-0710

§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710

Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700

† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511

Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625

Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ..... 303-443-6250; 800-525-6478

† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700

Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054

§ Micron Inds., 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788

Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050

† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300

Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411

Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334

† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300

† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600

Oram Electronics, 12 Cranston Rd., Pittsford, NY 14534 716-381-4673

Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880 814-355-1521

Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334

S & H Inds., 119 Glen Cove Dr., Glen Head, NY 11545 516-671-5600

§ Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148 312-620-8394

† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700

Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191

§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244

Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998

Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581

Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050

† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500

Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404 415-574-1100

§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Filament-5600

† **Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630** ..... **A•2102**

Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... **A•2121**

§† **Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300** ..... **A•2150,2153**

Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 ..... **A•2158**

JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... **A•2160**

Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... **A•2165**

§† **Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050** ..... **A•2197**

Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... **A•2214**

Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... **A•2221-2222,2224,2225**

PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... **A•2226**

† **Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•2254**

Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... **A•1622**

† **Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510** ..... **A•2273-2275,2277**

§ **Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244** ..... **A•2289**

† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105** .... **B•1010**

§ **Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400** ..... **A•2314**

§ **Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500** ... **A•2330**

† **Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503, 201-278-7674** ..... **A•2340**

Abbott Transistor Labs., Industrial Products Div., 8203 Vineland Ave., Sun Valley, CA 91352 818-504-0644
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 718-857-2400
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coiltronics Inc., 984 SW 13th Court, Pompana Beach, FL 33069 305-781-8900
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
Computer Power, 124E W. Main St., High Bridge, NJ 08829 201-735-8000
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
§ Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
Field Electronics, 1416 Commerce St., Chatham, NJ 07928 201-635-6566
§† Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704 516-587-0510
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
Oram Elctrns., Rte. 22, Putnam Business Park, Brewster, NY 10509-9587 914-279-2966
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 816-221-2000
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Transistor Devices, 274 S. Salem St., Randolph, NJ 07869 201-361-6622
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Flyback-5600

Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2202
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... A•2205
Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880, 814-355-1521 ..... A•2231
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863, 618-262-5121 ..... A•2310
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101 612-228-6463
† Coiltronics Inc., 984 SW 13th Court, Pompana Beach, FL 33069 305-781-8900
Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., 2 Willowbrook Road, Cromwell, CT 06416 203-635-3510
§† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
International High Voltage Elctrns., Inc., 98 Mill Plain Rd., Danbury, CT 06811 203-792-7820
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ..... 303-443-6250; 800-525-6478
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
Ronor Systems, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492 203-265-2110
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Foil Wound — See Coils, Foil Wound (Vol. A)

Transformers, 400 Hz-5600

† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2102
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ..... A•2150
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ..... A•2157
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2160
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2165
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ..... A•2167
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2190
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... A•2211
Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2233,2255
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 ..... A•2272,2280,2281,2287
' Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211, 718-782-4200 ..... A•2300
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ..... A•2307, B•1010
Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400 ..... A•2314
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... A•2318
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 ..... A•2323
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701, 201-364-1800 ..... A•2328

Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ... A•2337
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503, 201-278-7674 ... A•2340
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 ... 201-526-6010
Abbott Transistor Labs., Industrial Products Div., 8203 Vineland Ave., Sun Valley, CA 91352 ... 818-504-0644
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 ... 714-891-3568
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 ... 206-771-4006
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 ... 612-788-9161
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 ... 516-328-1600
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 ... 617-445-7100
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 ... 718-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 ... 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 ... 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 ... 607-722-2376
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 ... 915-592-9985
Crompton Instrs., Hawker Siddley, 2763 Old Higgins Rd., Elk Grove Village, IL 60007 ... 312-593-1107
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 ... 605-665-9301
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 ... 914-699-2000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 ... 203-599-2075
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 ... 312-498-6520
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 ... 818-573-3300
§† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 ... 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 ... 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 ... 805-964-0751
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 ... 213-828-9541
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 ... 716-968-2400
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ... 201-245-3200;800-526-4048
Field Electronics, 1416 Commerce St., Chatham, NJ 07928 ... 201-635-6566
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 ... 201-743-2700
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 ... 716-894-5710
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 ... 201-782-5525
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 ... 312-342-0080
§† Jefferson Elec., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021 ... 312-691-2400
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 ... 201-353-5700
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 ... 201-353-5700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 ... 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 ... 818-798-0786
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 ... 512-546-1625
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 ... 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 ... 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 ... 408-757-8752
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 ... 619-279-7054
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 ... 713-785-4202
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704 ... 516-587-0510
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 ... 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 ... 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 ... 312-395-5710
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 ... 603-332-3334
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 ... 609-298-7300
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 ... 201-454-2600
† Oram Electronics, 12 Cranston Rd., Pittsford, NY 14534 ... 716-381-4673
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 ... 313-368-4136
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 ... 213-532-1790
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 ... 818-892-0761
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704 ... 516-491-3300
† Performance Controls Inc., 333-E Byberry Rd., Hatboro, PA 19040 ... 215-675-6500
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 ... 203-762-4786
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 ... 603-332-3334
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 ... 815-385-2700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 ... 609-298-8200
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 ... 213-450-0777
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 ... 914-681-0700
Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 ... 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ... 213-32-Sigma
§† Staco Energy Prods. Co., 301 Gaddis Blvd., Dayton, OH 45403 ... 513-253-1191
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 ... 513-253-1191
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 ... 219-722-2244
§† Technipower, A Penril Co., P.O. Box 222, Commerce Pk., Danbury, CT 06810 ... 203-748-7001
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 ... 603-524-1998
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 ... 214-424-1581
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 ... 201-835-6195
Torelco, Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 ... 201-374-8641
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 ... 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 ... 212-255-3500
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404 ... 415-574-1100
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 ... 213-323-4100
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 ... 516-887-9443
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 ... 415-968-9176

Transformers, High Voltage (1,000 Volts & Over)-5600

† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, 914-699-2000 ... A•2133
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ... A•2150
† Hipotronics, P.O. Drawer A, Brewster, NY 10509, 914-279-8091 ... A•2154
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 ... A•2158
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ... A•2197
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 414-358-5300;800-558-4332 ... A•2199
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ... A•2205
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ... A•2211
Pearson Elctrns., 1860 Embarcadero Rd., Palo Alto, CA 94303, 415-494-6444 ... A•2230
Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880, 814-355-1521 ... A•2231
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ... A•1622
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863, 618-262-5121 ... A•2310
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503, 201-278-7674 ... A•2340
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 ... 714-891-3568
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 ... 301-826-8651
American Magnetics, P.O. Box 8, Carterville, IL 62918 ... 618-985-4838
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 ... 516-333-8100
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 ... 305-979-7920
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 ... 617-445-7100
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 ... 718-291-3900
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 ... 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 ... 607-722-2376
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 ... 915-592-9985
Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083 ... 1-800-521-4792
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 ... 414-377-7040
§† Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 ... 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 ... 203-599-2075
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 ... 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 ... 805-964-0751
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 ... 415-494-7303
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 ... 213-828-9541
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 ... 716-968-2400
ENI Power Sys., 3000 Winton Rd. S., Rochester, NY 14623 ... 716-473-7330
Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 ... 212-691-3610
Field Electronics, 1416 Commerce St., Chatham, NJ 07928 ... 201-635-6566
Glassman High Voltage Inc., P.O. Box 551, Salem Indl. Pk., Whitehouse Sta., NJ 08889 ... 201-534-9007
§† Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 ... 305-894-3351
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 ... 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 ... 913-782-0012
International High Voltage Elctrns., Inc., 98 Mill Plain Rd., Danbury, CT 06811 ... 203-792-7820
§ Jefferson Elec., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021 ... 312-691-2400
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 ... 201-353-5700
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 ... 201-353-5700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 ... 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 ... 818-798-0786
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 ... 815-344-2900
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ... 303-443-6250; 800-525-6478
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 ... 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 ... 516-654-1166
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704 ... 516-587-0510
§ Micron Inds., 1830 N. 32nd Ave., Stone Park, IL 60165 ... 312-345-0788
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 ... 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 ... 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 ... 312-395-5710
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 ... 603-332-3334
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 ... 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 ... 503-238-2440
Oram Elctrns., Rte. 22, Putnam Business Park, Brewster, NY 10509-9587 ... 914-279-2966
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 ... 313-368-4136
† Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 ... 816-221-2000
Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 ... 312-489-2229
Power Designs, Inc., 1700 Shames Dr., Westbury, NY 11590 ... 516-333-6200
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 ... 603-332-3334
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 ... 413-568-2301

† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 ..... 800-245-4501;800-245-4497 In Ohio
Ronor Systems, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492 203-265-2110
Ross Engrg. Corp., 540 Westchester Dr., Campbell, CA 95008 408-377-4621
Rutherford Resch. Prods., Box 249, Rutherford, NJ 07070 201-933-2091
S & H Inds., 119 Glen Cove Dr., Glen Head, NY 11545 516-671-5600
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
Simco Co., 2257 North Penn Rd., Hatfield, PA 19440 215-822-2171
Spellman High Voltage Elctrns. Corp., 7 Fairchild Ave., Plainview, NY 11803 516-349-8686
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
Torelco, Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Horizontal Sweep-5600

MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2177,2180,2182,2183
Penn-Tran Corp., Box 1321, Rte. 744N, Wingate, PA 16880, 814-355-1521 ..... A•2231
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863, 618-262-5121 ..... A•2309
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404 415-574-1100

Transformers, Hybrid-5600

Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2192
† North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2210
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
† Coiltronics Inc., 984 SW 13th Court, Pompana Beach, FL 33069 305-781-8900
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ..... 415-785-5231;415-785-5235
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 507-625-6521
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† Oram Electronics, 12 Cranston Rd., Pittsford, NY 14534 716-381-4673
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ..... 914-699-5514; 800-431-1064
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 415-592-8832

Transformers, IF-5600

† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 ..... A•1207
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ..... A•1213
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 ..... A•1218
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2202
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† Alpha Inds., Inc.-Microelectronic Div., 2800 Crystal Drive, Hatfield, PA 19440 215-822-1311
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ..... 415-785-5231;415-785-5235
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
§ Fuji-Svea, P.O. Box 3375, Torrance, CA 90510 213-533-1221
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§ Goldwell Comps., 1815 W. 205th St. Ste. 201, Torrance, CA 90501 213-533-1228
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235 718-934-4500
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704 516-491-3300
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ..... 914-699-5514; 800-431-1064
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transformers, Input-5600

Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2165
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2191-2194,2196
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2214
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2224
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2229
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2233-2249,2254
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1622
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ..... B•1010
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 ..... A•2320
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
§ Altec Lansing, Altec Corp., 1250 N. Red Gum St., Anaheim, CA 92806 714-632-7117
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 915-592-9985
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Coiltronics Inc., 984 SW 13th Court, Pompana Beach, FL 33069 305-781-8900
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
Custom Coil & Transformer, Box 2369, Zanesville, OH 43701 614-452-6973
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., 2 Willowbrook Road, Cromwell, CT 06416 203-635-3510
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
§† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080

Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ..... 303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 507-625-6521
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Oram Electronics, 12 Cranston Rd., Pittsford, NY 14534 716-381-4673
† Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 816-221-2000
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 .. 203-762-4786
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
Kulka Smith, Inc., 1913 Atlantic Ave., Manasquan, NJ 08736 201-223-9400
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500

Transformers, Instrument-5600

§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2132
† Del Elctrns, Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, 914-699-2000 ..... A•2133
Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 .. A•1240
Ion Physics Co., 323 Andover St., Wilmington, MA 01887, 617-658-6030 ..... D•1123
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ..... A•2167
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2184
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 414-358-5300;800-558-4332 ..... A•2199
Nano Pulse Industries, 440 Nibus St., Brea, CA 92670, 714-529-2600 .... A•2206
NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... A•2211
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2214
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2224
Pearson Elctrns., 1860 Embarcadero Rd., Palo Alto, CA 94303, 415-494-6444 ..... A•2230
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1622,2263,2264
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 .. A•2288
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244 ..... A•2292
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281, 215-539-6050 ..... D•1312
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... A•2318
† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 818-841-3630
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Bell, F. W., Inc., 6120 Hanging Moss Rd., Orlando, FL 32807 305-678-6900
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803 914-738-1611
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Crompton Instrs., 2763 Higgins Road, Elk Grove Village, IL 60007 714-841-2901
Crompton Instrs., Hawker Siddley, 2763 Old Higgins Rd., Elk Grove Village, IL 60007 312-593-1107
Custom Coil & Transformer, Box 2369, Zanesville, OH 43701 614-452-6973
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Electrical Instr. Svc., 25 Dock St., Mt. Vernon, NY 10550 914-699-9717
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
§ Electromatic Controls Corp., 2495 Pembroke Road, Hoffman Estates, IL 60195-2010 312-882-5757
§ Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
Epoch Enterprises, Ltd., 3541 N. Olive Rd., Tucson, AZ 85719 ..... 602-887-1970; 888-5167
Esterline Angus Instr. Corp., Box 24000, Indianapolis, IN 46224 317-244-7611
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
† Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
Flex-Core Div., Morlan & Assocs., Inc., 6625 McVey Blvd., Worthington, OH 43085 614-889-6152
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
JAMB Inds., Box 281, Rockaway Valley Rd., Boonton, NJ 07005 201-263-9295
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
§ Larson Instr., Greenbush Rd., Orangeburg, NY 10962 914-359-3800
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704 516-587-0510
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, OH 43212 ... 614-486-9561
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704 516-491-3300
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 .. 203-762-4786
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ..... 914-699-5514; 800-431-1064
Power Designs, Inc., 1700 Shames Dr., Westbury, NY 11590 516-333-6200
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
Ronor Systems, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492 203-265-2110
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Sensitive Research Instrs., 25 Dock St., Mt. Vernon, NY 10550 914-699-9717
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
§ Simpson Elec. Co., 853 Dundee Ave., Elgin, IL 60120 312-697-2260
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
† Sunshine Sci. Instr., 1810 Grant Ave., Philadelphia, PA 19115 215-673-5600
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200

Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701 914-963-3400
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404 415-574-1100
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
§ Western Electro. Mech. Co. Inc., 300 Broadway, Oakland, CA 94607 415-452-1936
§ Yokogawa Corp. of America, 2 Dart Rd., Shenandoah, GA 30265 404-253-7000
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Interstage-5600

§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2191,2196
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2214
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2229
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1622,2263,2264
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ..... A•2268
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 ..... A•2320
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Custom Coil & Transformer, Box 2369, Zanesville, OH 43701 614-452-6973
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
§† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Oram Electronics, 12 Cranston Rd., Pittsford, NY 14534 716-381-4673
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ..... 914-699-5514; 800-431-1064
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500

Transformers, Inverter-5600

Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2117
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 .... A•1218
Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 .. A•1240
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2197
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2214
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2224
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ..... A•2268
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... A•2318
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
Alpha Comps., 115 Eucalyptus Dr., El Segundo, CA 90245 213-322-7780
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101 612-228-6463
† Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
† Coiltronics Inc., 984 SW 13th Court, Pompana Beach, FL 33069 305-781-8900
§ Computer Power, 124E W. Main St., High Bridge, NJ 08829 201-735-8000
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Datamax Electronics, Inc., P. O. Box 2839, Blue Jay, CA 92631 ..... 714-336-3561; 714-951-5646
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., 2 Willowbrook Road, Cromwell, CT 06416 203-635-3510
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elgar Corp, An Onan McGraw Edison Co., 9250 Brown Deer Rd., San Diego, CA 92121 619-450-0085
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
† Endicott Resch. Grp., Inc., 2601 Wayne St., P.O. Box 269, Endicott, NY 13760 607-754-9187
Energy, Ltd., 4714 Upshur Street, Bladensburg, MD 20710 301-699-1144
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
International High Voltage Elctrns., Inc., 98 Mill Plain Rd., Danbury, CT 06811 203-792-7820
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ..... 303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Pacific Electro Dynamics, Inc., 11465 Willows Rd. N.E., Redmond, WA 98052 206-881-1700
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 ... 203-762-4786
Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ..... 914-699-5514; 800-431-1064

§† Powermark, 3855 Ruffin Rd., San Diego, CA 92123 619-565-8363
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
§ Sun Research, Inc., Box 210, Old Bay Rd., New Durham, NH 03855 603-859-7110
§† Terado, 1068 Raymond Ave., St. Paul, MN 55108 612-646-2868
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
Torelco, Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transducer Systems, Inc., 1510 Delp Dr., Kulpsville, PA 19443 215-256-4611
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Isolation-5600

Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2121
§ B & K Precision, Industrial Electronics Product Group, Dynascan Corporation, 6460 W. Cortland, Chicago, IL 60635, 312-889-9087 ..... D•1521
Control Concepts Corp., P.O. Box 1380, Binghamton, NY 13902-1380, 607-724-2484 ..... B•1233
Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083, 1-800-521-4792 ..... D•1876,1912
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2128
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, 914-699-2000 ..... A•2133
§† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2134
§ EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2144,2148
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ..... A•2153
† Hipotronics, P.O. Drawer A, Brewster, NY 10509, 914-279-8091 ..... A•2155, D•1659
§ Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 ..... A•2158
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2160
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2165
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2191,2196
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 414-358-5300;800-558-4332 ..... A•2199
† North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2208
§ Opamp Labs, Inc., 1033 N. Sycamore Ave., Los Angeles, CA 90038, 213-934-3566 ..... D•1014
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2214
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2224
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2229
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1622
† RTE Deltec Corp., 2727 Kurtz St., San Diego, CA 92110, 619-291-4211;800-854-2658 ..... D•1959
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 ..... A•2272-2275,2277,2287
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 .. A•2288
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244 ..... A•2294
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211, 718-782-4200 ..... A•2299
§† Superior Elec. Co., 383 Middle St., Bristol, CT 06010, 203-582-9561 ..... D•1968
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ..... A•2307, B•1010
§ Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400 ..... A•2316
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... A•2318
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 ..... A•2320
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ... A•2335
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503, 201-278-7674 ..... A•2340
§ Xentek, Inc., 279 S. Pacific St., San Marcos, CA 92069, 619-744-3346 .... D•1872
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 818-841-3630
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
§ ACD-Elcor Products, P.O. Box 244, Bethel, CT 06801 203-743-3510
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
§ Avel-Lindberg, Inc., Peacock Alley 116, 1 Padanaram Rd., Danbury, CT 06811 203-797-8698
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101 612-228-6463
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Carson Mfg. Co., Inc., 5453 N. Rural St., P.O. Box 20464, Indianapolis, IN 46220 317-257-3191
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coiltronics Inc., 984 SW 13th Court, Pompana Beach, FL 33069 305-781-8900
§ Computer Power, 124E W. Main St., High Bridge, NJ 08829 201-735-8000
Custom Coil & Transformer, Box 2369, Zanesville, OH 43701 614-452-6973
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
† Diamond Magnetics, P.O. Box 4736, San Luis Obispo, CA 93403 805-544-4019
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., 2 Willowbrook Road, Cromwell, CT 06416 203-635-3510
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
Electronic Navigation Inds, Emerson Electric Co., 100 Highpower Road, Rochester, NY 14623 716-427-8300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elgar Corp, An Onan McGraw Edison Co., 9250 Brown Deer Rd., San Diego, CA 92121 619-450-0085
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Emergency Power Engineering Inc., 3580 Cadillac Ave., Costa Mesa, CA 92606 714-557-1636
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
§† Ericson Mfg. Co., 4215 Hamann Pkwy., Willoughby, OH 44094 216-951-8000
† Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
Field Electronics, 1416 Commerce St., Chatham, NJ 07928 201-635-6566
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
§ Hughey & Phillips, Inc., 3050 N. California St., Burbank, CA 91504 818-849-1104
International High Voltage Elctrns., Inc., 98 Mill Plain Rd., Danbury, CT 06811 203-792-7820
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
§ Jefferson Elec., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021 312-691-2400
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ..... 303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704 516-587-0510
§ Micron Inds., 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 507-625-6521
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235 .. 718-934-4500
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710

Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
Oram Elctrns., Rte. 22, Putnam Business Park, Brewster, NY 10509-9587 914-279-2966
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 816-221-2000
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 .. 203-762-4786
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .....914-699-5514; 800-431-1064
Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229
Power Conversion Prods., 42 East St., Box 380, Crystal Lake, IL 60014 815-459-9100
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
Rutherford Resch. Prods., Box 249, Rutherford, NJ 07070 201-933-2091
Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .....516-593-2025;Outside NY 800-645-5900
Schauer Mfg., 4500 Alpine Ave., Cincinnati, OH 45242 513-791-3030
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Sencore, 3200 Sencore Dr., Sioux Falls, SD 57107 605-339-0100
Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148 312-620-8394
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§† Staco Energy Prods. Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
§ Sun Research, Inc., Box 210, Old Bay Rd., New Durham, NH 03855 603-859-7110
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§† Topaz Electronics, 9192 Topaz Way, San Diego, CA 92123-1164 619-279-0831
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404 415-574-1100
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
§ VIZ Test Equipment, Div. VIZ Mfg., 335 E. Price St., Philadelphia, PA 19144 215-844-2626
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Line-5600

Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... **A•2118**
Avionic Instrs., 943 E. Hazelwood Ave., Rahway, NJ 07065, 201-388-3500 ..... **D•1891**
† Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083, 1-800-521-4792 ..... **D•1876,1910,1912**
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... **A•2130**
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, 914-699-2000 ..... **A•2133**
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... **A•2197**
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 414-358-5300;800-558-4332 ..... **A•2199**
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... **A•2209**
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... **A•1622**
Quam-Nichols Co., 234 E. Marquette Rd., Chicago, IL 60637, 312-488-5800 ..... **D•1033**
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... **A•2270**
Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 ..... **A•2273-2275,2277**
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 .. **A•2288**
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211, 718-782-4200 ..... **A•2302**
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... **B•1010**
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... **A•2318**
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ... **A•2335**
† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 818-841-3630
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
§ Altec Lansing, Altec Corp., 1250 N. Red Gum St., Anaheim, CA 92806 ... 714-632-7117
§ American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
§ Avel-Lindberg, Inc., Peacock Alley 116, 1 Padanaram Rd., Danbury, CT 06811 203-797-8698
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
† Coiltronics Inc., 984 SW 13th Court, Pompana Beach, FL 33069 305-781-8900
§ Computer Power, 124E W. Main St., High Bridge, NJ 08829 201-735-8000
Custom Coil & Transformer, Box 2369, Zanesville, OH 43701 614-452-6973
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Elgar Corp, An Onan McGraw Edison Co., 9250 Brown Deer Rd., San Diego, CA 92121 619-450-0085
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
ERA Transpac Div., Sub. Elctrn. Research Assocs., 50 Graphic Place, Moonachie, NJ 07074 201-641-3650
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
† Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-822-9601
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
JM Transformer Co., inc., 112 Florida St., Farmingdale, NY 11735 516-293-0475
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 .....303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
§ Martin Sound Prods., 28 Alpha Park, Cleveland, OH 44143-2297 216-442-2286
§ Micron Inds., 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .....914-699-5514; 800-431-1064
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148 312-620-8394
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60204 312-866-2200
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
§ SPECO Div., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757 ..... 516-957-8700;800-645-5516
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§ Staco Energy Prods. Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§ Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701 914-963-3400
§† Topaz Electronics, 9192 Topaz Way, San Diego, CA 92123-1164 619-279-0831
Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transformers, Linear Variable-Differential — See Transformers, Differential (Vol. A)

Transformers, Magnetic Amplifier-5600

Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 .. A•1240
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
Cross Elctrns., 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Field Electronics, 1416 Commerce St., Chatham, NJ 07928 201-635-6566
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ..... 303-443-6250; 800-525-6478
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetic Specs., 10 Albemarle Ave., Trenton, NJ 08638 609-883-3150
† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
Pan-Magnetics Intl, Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
Torelco, Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404 415-574-1100
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674

Transformers, Matching-5600

† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 ..... A•1207
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 .... A•1218
† Electro Impulse, Box 870, Red Bank, NJ 07701-0870, 201-741-0404 ..... D•1211
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ..... A•2157
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2165
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2191,2196
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2203
† North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2208
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2214
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2223
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2233
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1622
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... A•2270
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
§ Altec Lansing, Altec Corp., 1250 N. Red Gum St., Anaheim, CA 92806 ... 714-632-7117
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990 215-723-8181
Applied Research, Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Coiltronics Inc., 984 SW 13th Court, Pompana Beach, FL 33069 305-781-8900
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33431 305-994-1774
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
§ Electronic Navigation Inds, Emerson Electric Co., 100 Highpower Road, Rochester, NY 14623 716-427-8300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
ENI Power Sys., 3000 Winton Rd. S., Rochester, NY 14623 716-473-7330
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk, NJ 07650 201-947-0400
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-822-9601
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§ MG Electronics, 32 Ranick Rd., Hauppauge, NY 11788 516-582-3400
Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 507-625-6521
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
§ Oaktron Inds., 1000 30th St, Monroe, WI 53566 608-328-5560
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Oram Electronics, 12 Cranston Rd., Pittsford, NY 14534 716-381-4673
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
§ Palomar Engrs., Box 455, Escondido, CA 92025 619-747-3343
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704 516-491-3300
§ Philmore Mfg., 40 Inip Dr., Inwood, NY 11696 516-239-6161
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
RFL Inds., A Dowty Grp. Co./Comms. Div., Powerville Rd., Boonton, NJ 07005 201-334-3100
§ RMS Electronics Inc., 50 Antin Pl., Bronx, NY 10462 212-892-6700
† Sabre Comms. Corp., 117 Main St., Soiux City, IA 51102 712-258-6690
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60204 312-866-2200
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
§ Sitco Antennas, 10330 N.E. Marx St., Portland, OR 97220 503-253-2000
§ Soundlier, American Trading & Prod. Corp., 9380 Watson Ind'l. Pk., St. Louis, MO 63126 314-962-9870
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
§ SPECO Div., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757 ..... 516-957-8700;800-645-5516

Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
† Technical Research & Mfg., Inc., R.F.D. # 10, Manchester, NH 03103 ... 603-627-6000
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
Wide Band Engrg. Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

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Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2121
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ..... A•1213
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2125
§† Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 .. A•1240
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2191,2195,2196
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2208
† Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2214
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2233
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211, 718-782-4200 ..... A•2303
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 ..... A•2320
Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ... A•2335
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052 716-652-3600
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., 2 Willowbrook Road, Cromwell, CT 06416 203-635-3510
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235 .. 718-934-4500
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
† Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595 .. 714-898-0960
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
SFE Technologies, 1501 1st St., San Fernando, CA 91340 213-365-9411
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696 516-239-4510
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100

Transformers, Microphone-5600

Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2121
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2191
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2214
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2224
Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2233
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211, 718-782-4200 ..... A•2302
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
§ Altec Lansing, Altec Corp., 1250 N. Red Gum St., Anaheim, CA 92806 ... 714-632-7117
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011 212-691-9050
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
§ Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
§ Paso Sound Prods., 14 First St, Pelham, NY 10803 914-738-4800
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60204 312-866-2200
Kulka Smith, Inc., 1913 Atlantic Ave., Manasquan, NJ 08736 201-223-9400
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500

Transformers, Mixing-5600

§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2197
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2214
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2224
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1622
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235 .. 718-934-4500

North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .....914-699-5514; 800-431-1064
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 312-297-0070
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100

Transformers, Modulation-5600

Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 ..... A•2158
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1622
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
§† Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .....914-699-5514; 800-431-1064
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Output-5600

Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2121
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2130
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2165
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2191,2196
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 414-358-5300;800-558-4332 ..... A•2199
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2214-2215,2217
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2224
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2229
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1622 ,2263,2264
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... A•2318
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 ..... A•2320
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503, 201-278-7674 ..... A•2340
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
§ Altec Lansing, Altec Corp., 1250 N. Red Gum St., Anaheim, CA 92806 ... 714-632-7117
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 718-857-2400
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Coiltronics Inc., 984 SW 13th Court, Pompana Beach, FL 33069 305-781-8900
Custom Coil & Transformer, Box 2369, Zanesville, OH 43701 614-452-6973
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735 516-293-0475
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 .....303-443-6250, 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 507-625-6521
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 816-221-2000
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 .. 203-762-4786
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .....914-699-5514; 800-431-1064
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
Ronor Systems, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492 203-265-2110
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500

Transformers, Plate-5600

Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2224
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211, 718-782-4200 ..... A•2302
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503, 201-278-7674 ..... A•2341

Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 818-841-3630
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 718-857-2400
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Computer Power, 124E W. Main St., High Bridge, NJ 08829 201-735-8000
Custom Coil & Transformer, Box 2369, Zanesville, OH 43701 614-452-6973
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
§† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
† Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
Field Electronics, 1416 Commerce St., Chatham, NJ 07928 201-635-6566
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ..... 303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ..... 914-699-5514; 800-431-1064
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Plug-in-5600

MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 414-358-5300;800-558-4332 ..... A•2199
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2214
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... A•2270
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Coiltronics Inc., 984 SW 13th Court, Pompana Beach, FL 33069 305-781-8900
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
ISL Products int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 516-822-9601
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735 516-293-0475
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ..... 914-699-5514; 800-431-1064
Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700

Transformers, Power-5600

† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2102
Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2114
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2118-2121
Avionic Instrs., 943 E. Hazelwood Ave., Rahway, NJ 07065, 201-388-3500 ..... D•1891
Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083, 1-800-521-4792 ..... D•1876,1910-1916
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2128
§† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2134
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905, 607-797-1263 ..... A•2135
§† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2136-2148
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ..... A•2150,2153
§ Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1240
Hipotronics, P.O. Drawer A, Brewster, NY 10509, 914-279-8091 ..... A•2154
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ..... A•2157
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 ..... A•2158
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ..... A•2159
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201, 201-353-5700 ..... D•1679
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2160
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2164
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ..... A•2167
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2173-2183
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2098, 2185-2190
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 414-358-5300;800-558-4332 ..... A•2199
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2202
NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... A•2211, D•1735
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... D•1735
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2213-2215,2217,2218,2219,2220
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2221
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2226
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2233-2255
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2263
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2265
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... A•2270
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 ..... A•2272
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 ..... A•2288
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244 ..... A•2289-2291,2297
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211, 718-782-4200 ..... A•2299
Superior Elec. Co., 383 Middle St., Bristol, CT 06010, 203-582-9561 ..... A•2304
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ..... A•2307, B•1010
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863, 618-262-5121 ..... A•2311
§ Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400 ..... A•2314
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... A•2318
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 ..... A•2320-2325
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701, 201-364-1800 ..... A•2328
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2330
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404, 415-574-1100 ..... A•2338
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503, 201-278-7674 ..... A•2340
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
Abbott Transistor Labs., Industrial Products Div., 8203 Vineland Ave., Sun Valley, CA 91352 818-504-0644
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
Advanced Components Inds., Inc., 114 Center St., El Segundo, CA 90245 213-322-4249
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
§ ATR Elctrns., Inc., P.O. BOX 7008, St. Paul, MN 55107 ..... 612-738-6520;414-297-7374

§ Ault, Incorporated, 1600 Freeway Blvd., Minneapolis, MN 55430 612-560-9300
§ Avel-Lindberg, Inc., Peacock Alley 116, 1 Padanaram Rd., Danbury, CT 06811 203-797-8698
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101 612-228-6463
† Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Brown Boveri Elec., Norristown Rd., Spring House, PA 19477 215-628-7400
Westinghouse Elec. Corp., Bryant Circuit Devices Div., 500 Sylvan Ave., Bridgeport, CT 06606 203-334-5561
Carson Mfg. Co., Inc., 5453 N. Rural St., P.O. Box 20464, Indianapolis, IN 46220 317-257-3191
§ C-COR Elctrns., 60 Decibel Rd., State College, PA 16801 814-238-2461
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 718-857-2400
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coiltronics Inc., 984 SW 13th Court, Pompana Beach, FL 33069 305-781-8900
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
§ Computer Power, 124E W. Main St., High Bridge, NJ 08829 201-735-8000
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Custom Coil & Transformer, Box 2369, Zanesville, OH 43701 614-452-6973
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Diamond Magnetics, P.O. Box 4736, San Luis Obispo, CA 93403 805-544-4019
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
† Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§ Edwards Co., Signaling Prods. Div., P.O. Box 1188, Farmington, CT 06034 203-678-0410
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elgar Corp, An Onan McGraw Edison Co., 9250 Brown Deer Rd., San Diego, CA 92121 619-450-0085
Elgin Electronics, Combustion Engineering, 5533 New Perry Hwy., Erie, PA 16509-3570 814-864-4921
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
Engineering Design & Sls., Rt. 2, Box 305, Danville, VA 24540 804-685-7073
§† E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 213-892-7279
Federal Pacific, Reliance Electric, P. O. Box 99502, Cleveland, OH 44199 ..... 800-245-4501;in OH 800-245-4497
† Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
Field Electronics, 1416 Commerce St., Chatham, NJ 07928 201-635-6566
§† Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
ISOREG Corp., 410 Great Rd., P.O. Box 486, Littleton, MA 01460 617-486-9483
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
§ Jefferson Elec., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021 312-691-2400
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 .....303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
§ Micron Inds., 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 816-221-2000
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 .. 203-762-4786
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .....516-593-2025;Outside NY 800-645-5900
Schauer Mfg., 4500 Alpine Ave., Cincinnati, OH 45242 513-791-3030
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148 312-620-8394
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
† Staco Energy Prods. Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161
§† Topaz Electronics, 9192 Topaz Way, San Diego, CA 92123-1164 619-279-0831
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
Torelco, Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Transistor Devices, 274 S. Salem St., Randolph, NJ 07869 201-361-6622
Tran-Trol Co., 2525 N. Alvernon Way, C-6, Tucson, AZ 85712 602-795-8008
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Power Distribution-5600

Control Concepts Corp., P.O. Box 1380, Binghamton, NY 13902-1380, 607-724-2484 ..... B•1233
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 ..... A•2158
OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ..... A•2212
Advanced Components Inds., Inc., 114 Center St., El Segundo, CA 90245 213-322-4249
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083 1-800-521-4792
Golden Pacific Elctrns., Inc., 1020 N. Batavia St., Ste. Q, Orange, CA 92667 ..... 714-538-9752/9753
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
ISOREG Corp., 410 Great Rd., P.O. Box 486, Littleton, MA 01460 617-486-9483
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 .....303-443-6250; 800-525-6478
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Topaz Electronics, 9192 Topaz Way, San Diego, CA 92123-1164 619-279-0831
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
Xebex Data Systems, 6610 Buckley Dr., Cambria, CA 93428 805-927-5008

Transformers, Printed Circuit Mounting-5600

Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2120
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ..... A•1213
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2125,2128,2129,2130,2131,2132
§† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032, 201-997-0950 ..... A•2134
§ EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2136,2146
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ..... A•2150
§† Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 .. A•1240
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201, 201-353-5700 ..... D•1679
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2160

Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2164
† **Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ..... A•2167**
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2170
§† **Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2184**
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 414-358-5300;800-558-4332 ..... A•2199
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2202
† **North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2208**
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2213-2216,2218,2219
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2221
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2226
† **Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856, 203-762-4786 ..... A•2232**
† **Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2233**
† **Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2263**
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ..... A•2265
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ..... A•2268
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... A•2270
† **Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 ..... A•2272 ,2274,2276,2277,2278,2279,2280,2281**
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 .. A•2288
§ **Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244 ..... A•2292-2293,2297**
† **Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211, 718-782-4200 ..... A•2302**
† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ..... A•2307 B•1010**
§ **Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863, 618-262-5121 ..... A•2311**
† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 ..... A•1280 ,2320,2321,2322,2323,2324,2325**
† **Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701, 201-364-1800 ..... A•2328**
Transformation Elctrns. Corp., 170 Wilbur Pl., Bohemia, NY 11716, 516-563-1117 ..... D•1857
§ **Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ... A•2334**
† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 818-841-3630
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
Advanced Components Inds., Inc., 114 Center St., El Segundo, CA 90245 213-322-4249
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
§ Avel-Lindberg, Inc., Peacock Alley 116, 1 Padanaram Rd., Danbury, CT 06811 203-797-8698
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† BG Elctrns., 30 South St., Mt. Vernon, NY 10550 914-664-5591
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101 612-228-6463
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803 914-738-1611
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Custom Coil & Transformer, Box 2369, Zanesville, OH 43701 614-452-6973
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§† Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., 2 Willowbrook Road, Cromwell, CT 06416 203-635-3510
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
Engineering Design & Sls., Rt. 2, Box 305, Danville, VA 24540 804-685-7073
† Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
Golden Pacific Elctrns., Inc., 1020 N. Batavia St., Ste. Q, Orange, CA 92667 ..... 714-538-9752/9753
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 507-625-6521
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235 .. 718-934-4500
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Oram Electronics, 12 Cranston Rd., Pittsford, NY 14534 716-381-4673
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880 814-355-1521
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
† Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595 .. 714-898-0960
Ronor Systems, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492 203-265-2110
Schaffner EMC, Inc., 825 Lehigh Ave., Union, NJ 07083 201-851-0644
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Transistor Devices, 274 S. Salem St., Randolph, NJ 07869 201-361-6622
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404 415-574-1100
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
Xylog Corp., 150 Tillman St., Westwood, NJ 07675 201-664-7997
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Programmable Ratio-5600

Astrosystems, 6 Nevada Dr., Lake Success, NY 11042, 516-328-1600 ... D•1183
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ..... 914-699-5514; 800-431-1064

Transformers, Pulse-5600

Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2121
B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101, 612-228-6463 ..... A•2123
† **EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2147**
§† **Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ..... A•2150**
† **Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ..... A•2157**
§† **Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2197**
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2202

Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2213
Pearson Elctrns., 1860 Embarcadero Rd., Palo Alto, CA 94303, 415-494-6444 ..... A•2230
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2233,2250,2251
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2257,2261,2263,2264
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ..... A•2307, B•1010
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070 ..... A•1581
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990 215-723-8181
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 915-592-9985
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coiltronics Inc., 984 SW 13th Court, Pompana Beach, FL 33069 305-781-8900
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Datamax Electronics, Inc., P. O. Box 2839, Blue Jay, CA 92631 ..... 714-336-3561; 714-951-5646
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052 716-652-3600
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ..... 415-785-5231;415-785-5235
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
EG&G, Inc., Electro-Optics Div., 35 Congress St., Salem, MA 01970 617-745-3200
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electronic Navigation Inds, Emerson Electric Co., 100 Highpower Road, Rochester, NY 14623 716-427-8300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
† El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
§† Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
† Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ..... 303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Maxwell Labs., 8835 Balboa Ave., San Diego, CA 92123 619-279-5100
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704 516-587-0510
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 507-625-6521
† North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 312-543-6400
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
† Raytheon Co., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154 617-899-8400
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
† Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595 714-898-0960
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
§ Semikron, Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 ..... 603-883-8102; 1-800-258-1308
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Simmonds Precision, P.O. Box 310, Norwich, NY 13815 607-335-5000
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
§† Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§ TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Tobe Deutschmann Labs., Inc., 550 Turnpike St., Canton, MA 02021 617-828-3366
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
U.S. Scientific Instrs., 61 North Beacon St., Boston, MA 02134 617-787-2411
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Ratio-5600

Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2214
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ..... 914-699-5514; 800-431-1064
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566

Transformers, RF-5600

† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 ..... A•1207
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ..... A•2157
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235, 718-934-4500 ..... A•1719-1720,1729,1760,1761
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2202
† North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2208,2210
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ..... B•1010
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Alpha Inds., Inc.-Microelectronic Div., 2800 Crystal Drive, Hatfield, PA 19440 215-822-1311
Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990 215-723-8181
Antennacraft, Box 1005, Burlington, IA 52601 319-754-7575
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224 213-537-5200
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640

Datamax Electronics, Inc., P. O. Box 2839, Blue Jay, CA 92631 ..... 714-336-3561; 714-951-5646
Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052 716-652-3600
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33431 305-994-1774
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
† Electro Impulse, Box 870, Red Bank, NJ 07701-0870 201-741-0404
§ Electronic Navigation Inds, Emerson Electric Co., 100 Highpower Road, Rochester, NY 14623 716-427-8300
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
International High Voltage Elctrns., Inc., 98 Mill Plain Rd., Danbury, CT 06811 203-792-7820
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
§ KLM Electronics, 16890 Church St., P.O. Box 816, Morgan Hill, CA 95037 408-779-7363
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
§ Macom Inds., 8230 Haskell Ave., Van Nuys, CA 91406
M/A-Com Microwave Components, Inc., M/A-Com, South Avenue, Burlington, MA 01803 617-272-3000
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ..... 914-699-5514; 800-431-1064
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
† Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595 714-898-0960
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ONT, CANADA L9W2Y8 416-669-1244
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Summit Engineering Corp., Box 938, Bozeman, MT 59715 406-587-4511
Technical Research & Mfg., Inc., R.F.D. # 10, Manchester, NH 03103 603-627-6000
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 312-297-0070
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Reactor – See Reactors, Filter (Vol. A)

Transformers, Rectifier-5600

† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2105
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2128
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 ..... A•2158
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2160
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2197
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 414-358-5300;800-558-4332 ..... A•2199
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2214-2215,2218,2219
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2224
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2257,2259,2263,2264
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 ..... A•2272-2275,2277,2278,2280,2281,2282,2283,2284
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 .. A•2288
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244 ..... A•2289
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400 ..... A•2314
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... A•2318
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2332 ,2334
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
Abbott Transistor Labs., Industrial Products Div., 8203 Vineland Ave., Sun Valley, CA 91352 818-504-0644
§ ACD-Elcor Products, P.O. Box 244, Bethel, CT 06801 203-743-3510
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
Alpha Comps., 115 Eucalyptus Dr., El Segundo, CA 90245 213-322-7780
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
§† Bendix Corp., Electric Power Div., Hwy. 35, Eatontown, NJ 07724 201-542-2000
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 718-857-2400
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coiltronics Inc., 984 SW 13th Court, Pompana Beach, FL 33069 305-781-8900
§ Computer Power, 124E W. Main St., High Bridge, NJ 08829 201-735-8000
Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083 1-800-521-4792
Custom Coil & Transformer, Box 2369, Zanesville, OH 43701 614-452-6973
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., 2 Willowbrook Road, Cromwell, CT 06416 203-635-3510
Eastern Delta Corp., 29-09 S. Broadway, Fair Lawn, NJ 07410 201-797-4200
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elgar Corp, An Onan McGraw Edison Co., 9250 Brown Deer Rd., San Diego, CA 92121 619-450-0085
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
§† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
Field Electronics, 1416 Commerce St., Chatham, NJ 07928 201-635-6566
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hipotronics, P.O. Drawer A, Brewster, NY 10509 914-279-8091
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
§ Liberty Intl. Corp., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704 516-587-0510
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 816-221-2000
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704 516-491-3300
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ..... 914-699-5514; 800-431-1064
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 312-543-6400
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
Ronor Systems, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492 203-265-2110
S & H Inds., 119 Glen Cove Dr., Glen Head, NY 11545 516-671-5600
Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 ..... 516-593-2025;Outside NY 800-645-5900
Schauer Mfg., 4500 Alpine Ave., Cincinnati, OH 45242 513-791-3030
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800

† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404 415-574-1100
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
Xylog Corp., 150 Tillman St., Westwood, NJ 07675 201-664-7997
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Reference-5600

§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2197
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856, 203-762-4786 ..... A•2232
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ... A•2333
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Kenyon Magnetics, 1040 Grand St. Hoboken, NJ 07030 201-798-6511
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
North Atlantic Inds., Instrument Div., 60 Plant Ave., Hauppauge, NY 11788 516-582-6500
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .....914-699-5514; 800-431-1064
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Rotary-5600

† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ..... A•2167
Transducers and Systems Inc., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ..... B•1828
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Schaevitz Engrg., U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880

Transformers, Scott T-5600

† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ..... A•2167
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856, 203-762-4786 ..... A•2232
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ..... A•2307, B•1010
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
§ Jefferson Elec., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021 312-691-2400
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .....914-699-5514; 800-431-1064
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Servo-5600

† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ..... A•2167
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2197
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856, 203-762-4786 ..... A•2232
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735, 516-293-3100 ..... D•1162
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
† Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .....914-699-5514; 800-431-1064
Ronor Systems, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492 203-265-2110
Singer Co., Kearfott Div., 1150 McBride Ave., Little Falls, NJ 07424 201-785-6000
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
Xylog Corp., 150 Tillman St., Westwood, NJ 07675 201-664-7997
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Split Bobbin-5600

Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2118,2121
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2130
§ EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2138 ,2144,2145,2146,2148
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ..... A•2159
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ..... A•2160
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2165
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2170 ,2173,2174,2175
Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2184,2186
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... A•2202
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2213-2215,2219
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2226,2228
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 ..... A•2272-2275,2277,2279,2282,2283,2286
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 .. A•2288
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244 ..... A•2292
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ... A•2336
Advanced Components Inds., Inc., 114 Center St., El Segundo, CA 90245 213-322-4249
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
§ Avel-Lindberg, Inc., Peacock Alley 116, 1 Padanaram Rd., Danbury, CT 06811 203-797-8698
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101 612-228-6463
† Coiltronics Inc., 984 SW 13th Court, Pompana Beach, FL 33069 305-781-8900
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., 2 Willowbrook Road, Cromwell, CT 06416 203-635-3510
§† Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
Electronetics, Inc., Paine Field Bldg 335, Everett, WA 98204 206-355-1855
Electronic Coil Corp., Farmington Industrial Park, Farmington, CT 06032 203-677-6731

El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
Engineering Design & Sls., Rt. 2, Box 305, Danville, VA 24540 804-685-7073
Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Golden Pacific Elctrns., Inc., 1020 N. Batavia St., Ste. Q, Orange, CA 92667 ..... 714-538-9752/9753
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ..... 303-443-6250; 800-525-6478
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
Schauer Mfg., 4500 Alpine Ave., Cincinnati, OH 45242 513-791-3030
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Step Down, Step Up — See Transformers, Power (Vol. A)

Transformers, Synchro Control-5600

Astrosystems, 6 Nevada Dr., Lake Success, NY 11042, 516-328-1600 ... D•1183
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731, 516-261-3300 ..... D•1141
Control Sciences, Inc., 9509 Vassar Ave., Chatsworth, CA 91311, 818-709-5510 ..... D•1144
Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ..... A•2157
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ..... D•1150
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ..... A•2167
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856, 203-762-4786 ..... A•2232
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735, 516-293-3100 ..... D•1162
† Vernitron Corp., Control Comps. Div., 1601 Precision Park La., San Diego, CA 92073, 619-428-5581 ..... B•1202
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018 215-622-1000
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
§† Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Muirhead, 1101 Briston Rd., Mountainside, NJ 07092 201-233-6010
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ..... 914-699-5514; 800-431-1064
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
† Singer Co., Kearfott Div., 1150 McBride Ave., Little Falls, NJ 07424 201-785-6000
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300

Transformers, Telephone Coupling-5600

Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2120
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2126
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ..... A•2159
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2191
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2213
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2222
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2229
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244 ..... A•2294
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ... A•2335
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Coiltronics Inc., 984 SW 13th Court, Pompana Beach, FL 33069 305-781-8900
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Datamax Electronics, Inc., P. O. Box 2839, Blue Jay, CA 92631 ..... 714-336-3561; 714-951-5646
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ..... 415-785-5231;415-785-5235
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 507-625-6521
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Oram Electronics, 12 Cranston Rd., Pittsford, NY 14534 716-381-4673
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ..... 914-699-5514; 800-431-1064
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 312-543-6400
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500

Transformers, Toroidal-5600

† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2107
Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2112,2114,2115,2116
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 ..... A•1207
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905, 607-797-1263 ..... A•1239
§† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2143,2147
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ..... A•2152
§† Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 .. A•1240
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ..... A•2157
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..... A•2164
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ..... A•2167
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2190,2192,2193,2194
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 414-358-5300;800-558-4332 ..... A•2199
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856, 203-762-4786 ..... A•2232
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1622,2263,2264
Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 ..... A•2272,2276
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010

Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ..... A•2318
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 ..... A•1280
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701, 201-364-1800 ..... A•2328
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ... A•2336
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404, 415-574-1100 ..... A•2338
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Airpax Corp., Ft. Lauderdale Div., 6801 W. Sunrise Blvd., Ft. Lauderdale, FL 33313 305-587-1100
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
§ Avel-Lindberg, Inc., Peacock Alley 116, 1 Padanaram Rd., Danbury, CT 06811 203-797-8698
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224 213-537-5200
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101 612-228-6463
† Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Coiltronics Inc., 984 SW 13th Court, Pompana Beach, FL 33069 305-781-8900
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
Cross Elctrns., 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Datamax Electronics, Inc., P. O. Box 2839, Blue Jay, CA 92631 .....714-336-3561; 714-951-5646
De Coursey Engrg. Lab., 11828 W. Jefferson, Culver City, CA 90230 .... 213-EX7-9668
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ..... 415-785-5231;415-785-5235
† Diamond Magnetics, P.O. Box 4736, San Luis Obispo, CA 93403 805-544-4019
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§ Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
† El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
§† E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 213-892-7279
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§† Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hurricane Electrns. Lab, P.O. Box 1280, Hurricane, UT 84737 801-635-2003
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Devices Inc., 5575 Kearny Villa Rd., San Diego, CA 92123 619-279-7054
Magnetic Specs., 10 Albemarle Ave., Trenton, NJ 08638 609-883-3150
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235 .. 718-934-4500
MPC Sys., Div. of Consulting Systems, RFD Box 441, Fremont, NH 03044 603-642-5913
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Novatronics, Box 878, Pompano Beach, FL 33061 305-942-5200
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .....914-699-5514; 800-431-1064
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 .. 312-543-6400
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148 312-620-8394
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§† Staco Energy Prods. Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
Torelco, Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Transistor-5600

Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ..... A•2121
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2130
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ..... A•2150
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2191,2195,2196
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 414-358-5300;800-558-4332 ..... A•2199
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2214
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 818-281-0222 ..... A•2224
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1622
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211, 718-782-4200 ..... A•2302
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ... A•2333
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224 213-537-5200
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
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B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101 612-228-6463
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Custom Coil & Transformer, Box 2369, Zanesville, OH 43701 614-452-6973
Datamax Electronics, Inc., P. O. Box 2839, Blue Jay, CA 92631 .....714-336-3561; 714-951-5646
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ..... 415-785-5231;415-785-5235
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electromech, Inc., 528 Elm Street, Kearny, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752

† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .....914-699-5514; 800-431-1064
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torelco, Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Trigger — See Transformers, Pulse (Vol. A)

Transformers, Variable-5600

Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 .. A•1240
† Hipotronics, P.O. Drawer A, Brewster, NY 10509, 914-279-8091 ..... A•2154
§† Superior Elec. Co., 383 Middle St., Bristol, CT 06010, 203-582-9561 ..... A•2304
§† Technipower, A Penril Co., P.O. Box 222, Commerce Pk., Danbury, CT 06810, 203-748-7001 ..... A•2306
Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... A•2307
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33061 305-979-7920
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
† Columbia Resch. Labs., Macdade Blvd. & Bullens La., Woodlyn, PA 19094 215-532-9464
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Diamond Magnetics, P.O. Box 4736, San Luis Obispo, CA 93403 805-544-4019
§† Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 .....303-443-6250; 800-525-6478
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 .. 203-762-4786
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879 617-649-7501
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696 516-239-4510
§† Staco Energy Prods. Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701 914-963-3400
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100

Transformers, Voltage Dividing-5600

† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281, 215-539-6050 ..... D•1312
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 818-841-3630
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Crompton Instrs., Hawker Siddley, 2763 Old Higgins Rd., Elk Grove Village, IL 60007 312-593-1107
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro Scientific Inds., 13900 N.W. Science Pk. Dr., Portland, OR 97229 503-641-4141
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 .....303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
Oram Elctrns., Rte. 22, Putnam Business Park, Brewster, NY 10509-9587 914-279-2966
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 .. 203-762-4786
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .....914-699-5514; 800-431-1064
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
† Rayco Elctrn. Mfg., 1625 12th St., Santa Monica, CA 90404 213-450-0777
Ronor Systems, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492 203-265-2110
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696 516-239-4510
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
§ Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Venable Industries, Inc., 3555 Lomita Blvd., Torrance, CA 90505 213-539-2522
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Voltage Regulating-Also See Regulators & Stabilizers, Voltage-5600

Ault, Incorporated, 1600 Freeway Blvd., Minneapolis, MN 55430, 612-560-9300 ..... D•1518
§ Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 ..... A•2158
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 414-358-5300;800-558-4332 ..... A•2199
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 ..... A•2272
§† Technipower, A Penril Co., P.O. Box 222, Commerce Pk., Danbury, CT 06810, 203-748-7001 ..... A•2306
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ..... A•2307, B•1010
Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400 ..... A•2317
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503, 201-278-7674 ..... A•2340
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
§† Able Power and Engineering Inc., 335 S. New Ave., # H, Monterey Park, CA 91754 714-891-3568
Adtech Power Inc., 1620 S. Sunkist St., Anaheim, CA 92806 714-634-9211
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
† Applied Electro Technlg., Int., STI Company, 2220 So. Anne St., Santa Ana, CA 92704 714-556-6570
Behlman Div., California Instrs., Div. of Norlin Inds., 5150 Convoy St., San Diego, CA 92111 619-279-8620
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 718-857-2400
§ Computer Power, 124E W. Main St., High Bridge, NJ 08829 201-735-8000
† Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083 1-800-521-4792
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
§ Displex, Inc., Alexander Place, Glen Cove, NY 11542 516-671-4400
Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000

Dynage/Power & Magnetics, Division Of Oakleaf, Inc., 2 Willowbrook Road, Cromwell, CT 06416 203-635-3510
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elgar Corp, An Onan McGraw Edison Co., 9250 Brown Deer Rd., San Diego, CA 92121 619-450-0085
Elin Div., California Instrs. Co., Div. of Norlin Ind., 5150 Convoy St., San Diego, CA 92111 619-279-8620
ERA Transpac Div., Sub. Elctrn. Research Assocs., 50 Graphic Place, Moonachie, NJ 07074 201-641-3650
§† E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 213-892-7279
§ Franek, John, Co., Inc., P.O. Box 11752, Santa Ana, CA 92711-1752 .....714-832-0290; 800-854-9420
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
§ HDR Power Sys., Inc., 600 Oakland Park Ave., Columbus, OH 43214 614-262-6832
† Hipotronics, P.O. Drawer A, Brewster, NY 10509 914-279-8091
§ ISOREG Corp., 410 Great Rd., P.O. Box 486, Littleton, MA 01460 617-486-9483
§ Jefferson Elec., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021 312-691-2400
Jerome Industries Corp., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 .....303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
§ Micron Inds., 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788
§ Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580 516-561-6050
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Parker McCrory Mfg. Co., 2000 Forest Ave., Kansas City, MO 64108 816-221-2000
Power Conversion Prods., 42 East St., Box 380, Crystal Lake, IL 60014 815-459-9100
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
† RTE Deltec Corp., 2727 Kurtz St., San Diego, CA 92110 ..619-291-4211;800-854-2658
S & H Inds., 119 Glen Cove Dr., Glen Head, NY 11545 516-671-5600
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
§ Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148 312-620-8394
§ Sola, A Unit of General Sign., 1717 Busse Rd., Elk Grove Village, IL 60007 312-439-2800
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
§ Sunshine Sci. Instr., 1810 Grant Ave., Philadelphia, PA 19115 215-673-5600
§† Superior Elec. Co., 383 Middle St., Bristol, CT 06010 203-582-9561
§ Techni-Tool, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462 215-825-4990
Teco Corp., Bay Rd., P. O. Box A, Winnisquam, NH 03289 603-524-1998
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§† Topaz Electronics, 9192 Topaz Way, San Diego, CA 92123-1164 619-279-0831
Torad Coil Co., Inc., 283 Linden Rd., Wayne, NJ 07470 201-835-6195
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404 415-574-1100
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
Xebex Data Systems, 6610 Buckley Dr., Cambria, CA 93428 805-927-5008
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers, Wall Plug-in — See Power Supplies, Plug-in (Vol. D)

Transformers, Wideband-5600

Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 .... A•1218
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ..... A•2157
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11580, 516-561-6050 ..... A•2191
† Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235, 718-934-4500 ..... A•1719-1720,1760,1761
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 414-358-5300;800-558-4332 ..... A•2199
† North Hills Elctrns., 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2208
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ..... A•2215
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•1622,2257,2262
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... B•1010
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
† Axel Elctrns., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418 718-291-3900
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
§ C-COR Elctrns., 60 Decibel Rd., State College, PA 16801 814-238-2461
† Chloride Power Electronics, 10931 Pellicano Drive, El Paso, TX 79935 .. 915-592-9985
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 718-857-2400
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
Datamax Electronics, Inc., P. O. Box 2839, Blue Jay, CA 92631 .....714-336-3561; 714-951-5646
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electro Assemblies, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062 312-498-6520
§ Electronic Navigation Inds, Emerson Electric Co., 100 Highpower Road, Rochester, NY 14623 716-427-8300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
El-Rad Mfg., 2800 W. Cullom Ave., Chicago, IL 60618 312-478-7300
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Kappa Networks, Inc., 1443 Pinewood St., Rahway, NJ 07065 201-541-1600
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .....914-699-5514; 800-431-1064
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ONT, CANADA L9W2Y8 416-669-1244
South American Dev. Corp., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538 914-229-8866
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 400-988-0700
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Summit Engineering Corp., Box 938, Bozeman, MT 59715 406-587-4511
Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Torotron Corp., 519 South Fifth Ave., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transformer & Coil Products, TRW Electronic Assemblies Division, 150 Varick St., New York, NY 10013 212-255-3500
Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064 213-478-8224
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832
Wide Band Engrg. Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

Transformers (MIL), Audio, Power, RF-2440 — *See Vol. B*

Transformers (MIL), Pulse & Variable-2440 — *See Vol. B*

Transistor Arrays-4800

Exar Corp., P. O. Box 62229, 750 Palomar Ave., Sunnyvale, CA 94086, 408-732-7970 ..... A•1669
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
† Andrich Sys., Inc., 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
§ Fairchild Camera & Instr. Corp., 464 Ellis St., 20-2271, Mountain View, CA 94042 415-962-5011
§ Fairchild Camera & Instr. Corp., Linear Div., 313 Fairchild Dr., Mountain View, CA 94139 415-962-4011
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 ... 213-673-8422

Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
† International Sensor Systems, Inc., Aurora Industrial Pk, Box 345, Aurora, NE 68818 402-694-6111
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
RCA Solid State Div., Linear Integrated Circuits, Rte. 202, Somerville, NJ 08876 201-685-6000
Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, JAPAN 03-986-6151
Sanken Elec. U.S.A. Corp., 3848 Carson St, Ste. 105, Torrance, CA 90503 213-540-2209
§ Semicoa, 333 McCormick Ave., Costa Mesa, CA 92626 714-979-1900
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
§† Silicon General, 11861 Western Ave., Garden Grove, CA 92641 714-898-8121
§† Siliconix, Inc., 2201 Laurelwood Rd., Santa Clara, CA 95054 408-988-8000
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Rd., Riviera Beach, FL 33404 305-848-4311
§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
§† Sprague Elec. Co., Integrated Circuit Div., 115 Northeast Cutoff, Worcester, MA 01606 617-853-5000
§† Supertex, Inc., 1225 Bordeaux Dr., P.O. Box 3607, Sunnyvale, CA 94088 408-744-0100
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§ Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§ Western Digital Corp., 2445 McCabe Way, Irvine, CA 92714 714-557-3550

Transistor, Diode, Thyristor Heat Dissipators — See Heat Sinks, Transistor (Vol. C)

Transistors, Bipolar-Also See Transistors, Silicon-4800

§† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ..... A•2077-2080,2082
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2090
American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940 201-377-9566
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
§ Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 .....714-557-9394; 800-854-7651
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Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
§ PPC Prods., 7516 Central Industrial Dr., Riviera Beach, FL 33404 305-848-9606
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 415-968-9211
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, JAPAN 03-986-6151
Sanken Elec. U.S.A. Corp., 3848 Carson St, Ste. 105, Torrance, CA 90503 213-540-2209
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
§ Texet Semiconductors, 301 Texet Dr., Allen, TX 75002 214-727-1111
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk, CA 91304 213-887-1010
§† TRW, RF Devices Div., 14520 Aviation Blvd., Lawndale, CA 90260 213-536-0888

Transistors, Chip, Unpackaged-4800

EG & G Vactec, 10900 Page Blvd., St. Louis, MO 63132, 314-423-4900 ... B•1210
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ..... A•2080
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
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† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
Cherry Semiconductor Corp, 2000 S. County Trail, East Greenwich, RI 02818 401-885-3600
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† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
EG & G Rotron, Custom Div., Hasbrouck La., Woodstock, NY 12498 914-679-5201
§ Fairchild Camera & Instr. Corp., 464 Ellis St., 20-2271, Mountain View, CA 94042 415-962-5011
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§† General Semiconductor Ind., Inc., Square D Company, 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 ... 213-673-8422
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Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
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IXYS Corp., 142 Charcot Ave., San Jose, CA 95131 408-262-8800
Lambda Semiconductors, Veeco Instr., 121 International Dr., Corpus Christi, TX 78410 ..... 512-289-0403;800-255-9606
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§ Solitron Devices, 8808 Balboa Ave., San Diego, CA 92123 619-278-8780
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Rd., Riviera Beach, FL 33404 305-848-4311
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§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
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Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540

Transistors, Darlington-4800

§ Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ..... A•1784
Allen-Bradley Co., Electronics Group, Div.of Rockwell Corp., Microelectronic Products Div., Highway 29 N. Bryan Pk. Exit, Greensboro, NC 27410, 919-621-9010 ..... A•2068
EG & G Vactec, 10900 Page Blvd., St. Louis, MO 63132, 314-423-4900 ... B•1210
§† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ..... A•2077
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2090
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§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
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Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§ Fuji-Svea, P.O. Box 3375, Torrance, CA 90510 213-533-1221
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 ... 213-673-8422
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International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 .....714-557-9394; 800-854-7651
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§ NEC Elctrns. USA Inc., NEC Electron Div., 252 Humboldt Ct., Sunnyvale, CA 94086 408-745-6520
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§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
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§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
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Sanken Elec. U.S.A. Corp., 3848 Carson St, Ste. 105, Torrance, CA 90503 213-540-2209
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§ Semikron, Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 .....603-883-8102; 1-800-258-1308
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SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100

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§† Silicon Transistor Corp., Katrina Rd., Chelmsford, MA 01824 617-256-3321
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§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Rd., Riviera Beach, FL 33404 305-848-4311
§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
§ Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
§ Texet Semiconductors, 301 Texet Dr., Allen, TX 75002 214-727-1111
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
† TRW Optoelectronics Div., 1207 Tappan Circle, Carrollton, TX 75006 ... 214-323-2200
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§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transistors, Dual-4800

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† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
§ Fairchild Camera & Instr. Corp., 464 Ellis St., 20-2271, Mountain View, CA 94042 415-962-5011
§ Fuji-Svea, P.O. Box 3375, Torrance, CA 90510 213-533-1221
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 ... 213-673-8422
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 .....714-557-9394; 800-854-7651
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§† Micro Power Sys. Inc., 3100 Alfred St., Santa Clara, CA 95050 408-727-5350
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§† Plessey Semiconductors, 1641 Kaiser Ave., Irvine, CA 92714 714-540-9979
§† Precision Monolithics, Inc., 1500 Space Dr., Santa Clara, CA 95054 408-727-9222
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§† Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33497 305-283-4500
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† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§ Solitron Devices, 8808 Balboa Ave., San Diego, CA 92123 619-278-8780
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Rd., Riviera Beach, FL 33404 305-848-4311
§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
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§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540

Transistors, Field Effect-4800

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Telpar, Inc., 4137 Billy Mitchell Rd., P.O. Box 796, Addison, TX 75001, 214-233-6631 ..... D•1075
§ AND, 770 Airport Blvd., Burlingame, CA 94010 415-347-9916
† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
§ Fuji-Svea, P.O. Box 3375, Torrance, CA 90510 213-533-1221
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 ... 213-673-8422
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Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
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§† Intersil, 10710 N. Tantau Ave., Cupertino, CA 95014 408-996-5000
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§† Micro Power Sys. Inc., 3100 Alfred St., Santa Clara, CA 95050 408-727-5350
† Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-469-3311
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
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§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 415-968-9211
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§† RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
† RCA Solid State Div., Linear Integrated Circuits, Rte. 202, Somerville, NJ 08876 201-685-6000
§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33497 305-283-4500
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§ Solitron Devices, 8808 Balboa Ave., San Diego, CA 92123 619-278-8780
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Rd., Riviera Beach, FL 33404 305-848-4311
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§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
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Transistors, Germanium-4800

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Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2090
Ei North America, 15 W. 53rd St. Suite 47E, New York, NY 10019 212-315-3099
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
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§† Germanium Power Devices, Box 3065, Shawsheen Village Sta., Andover, MA 01810 617-475-5982
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Transistors, Low Noise, GaAs, FETs - Also See Transistors, Microwave-4800

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Transistors, Microwave-4800

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† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
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Transistors, Photo (Incl. Arrays)-3700 — *See Vol. B*

Transistors, Power-4800

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Allen-Bradley Co., Electronics Group, Rockwell Corporation, 1201 S. Second St, Milwaukee, WI 53204 414-671-2000
Allen-Bradley Co., Electronics Group, Div.of Rockwell Corp., Microelectronic Products Div., Highway 29 N. Bryan Pk. Exit, Greensboro, NC 27410 919-621-9010
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
Ei North America, 15 W. 53rd St. Suite 47E, New York, NY 10019 212-315-3099
§ Electronic Transistors, 112-15 Northern Blvd., Flushing, NY 11368 212-651-7200
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
§ Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§ Fuji-Svea, P.O. Box 3375, Torrance, CA 90510 213-533-1221
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St, Auburn, NY 13021 315-253-7321
§† General Semiconductor Ind., Inc., Square D Company, 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 ... 213-673-8422
§† Germanium Power Devices, Box 3065, Shawsheen Village Sta., Andover, MA 01810 617-475-5982
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 .....714-557-9394; 800-854-7651
§ International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
§† International Rectifier Corp., Semiconductor Div., 233 Kansas St, El Segundo, CA 90245 213-772-2000
IXYS Corp., 142 Charcot Ave., San Jose, CA 95131 408-262-8800
M/A-Com PHI, Inc., M/A-Com, 1742 Crenshaw Blvd., Torrance, CA 90501 213-320-6160
† Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-469-3311
§ NEC Elctrns. USA Inc., NEC Electron Div., 252 Humboldt Ct., Sunnyvale, CA 94086 408-745-6520
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
† Powertech, Inc., 0-02 Fairlawn Ave., Fairlawn, NJ 07410 201-791-5050
§ PPC Prods., 7516 Central Industrial Dr., Riviera Beach, FL 33404 305-848-9606
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§† RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
§ Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, JAPAN 03-986-6151
Sanken Elec. U.S.A. Corp., 3848 Carson St, Ste. 105, Torrance, CA 90503 213-540-2209
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§ Semicoa, 333 McCormick Ave., Costa Mesa, CA 92626 714-979-1900
§† Semiconductor Technlg., Inc., 3131 S.E. Jay St, Stuart, FL 33497 305-283-4500
§ SGS-ATES Semiconductor Corp., 240 Bear Hill Rd, Waltham, MA 02154 617-890-6688
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Siliconix, Inc., 2201 Laurelwood Rd., Santa Clara, CA 95054 408-988-8000
§† Silicon Transistor Corp., Katrina Rd., Chelmsford, MA 01824 617-256-3321
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Rd., Riviera Beach, FL 33404 305-848-4311
§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
§ Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk, CA 91304 213-887-1010
† TRW Optoelectronics Div., 1207 Tappan Circle, Carrollton, TX 75006 ... 214-323-2200
§† TRW, RF Devices Div., 14520 Aviation Blvd., Lawndale, CA 90260 213-536-0888
§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540
§† Westinghouse Elec. Corp., Semiconductor Div., Armbrust Rd., Youngwood, PA 15697 412-925-7272
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transistors, Power, Bipolar-4800

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940 201-377-9566
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St, Auburn, NY 13021 315-253-7321
† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 .....714-557-9394; 800-854-7651
† Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-469-3311
§† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
§ PPC Prods., 7516 Central Industrial Dr., Riviera Beach, FL 33404 305-848-9606
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, JAPAN 03-986-6151
Sanken Elec. U.S.A. Corp., 3848 Carson St, Ste. 105, Torrance, CA 90503 213-540-2209
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St, Stuart, FL 33497 305-283-4500
§ Semikron, Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 .....603-883-8102; 1-800-258-1308
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
§† Silicon Transistor Corp., Katrina Rd., Chelmsford, MA 01824 617-256-3321
§ Texet Semiconductors, 301 Texet Dr., Allen, TX 75002 214-727-1111
TRW Optoelectronics Div., 1207 Tappan Circle, Carrollton, TX 75006 ... 214-323-2200
§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540
† Westcode Semiconductors, Inc., 0-02 Fair Lawn Ave., Fair Lawn, NJ 07410 201-791-3020

Transistors, Power, FET-4800

§† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ..... A•2078-2079,2082
American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940 201-377-9566
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
† Dexcel, Div. of Gould, 2285C Martin Ave., Santa Clara, CA 95050 408-727-9833
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
§† International Rectifier Corp., Semiconductor Div., 233 Kansas St, El Segundo, CA 90245 213-772-2000
§† Intersil, 10710 N. Tantau Ave., Cupertino, CA 95014 408-996-5000
IXYS Corp., 142 Charcot Ave., San Jose, CA 95131 408-262-8800
M/A-Com PHI, Inc., M/A-Com, 1742 Crenshaw Blvd., Torrance, CA 90501 213-320-6160
† Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-469-3311
Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St, Stuart, FL 33497 305-283-4500
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
§† Siliconix, Inc., 2201 Laurelwood Rd., Santa Clara, CA 95054 408-988-8000
Silicon Transistor Corp., Katrina Rd., Chelmsford, MA 01824 617-256-3321
§† Supertex, Inc., 1225 Bordeaux Dr., P.O. Box 3607, Sunnyvale, CA 94088 408-744-0100
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§ Texet Semiconductors, 301 Texet Dr., Allen, TX 75002 214-727-1111
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, JAPAN ..... Tokyo 03-402-6161
§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540

Transistors, Pressure Sensitive-4800

Stow Labs., Inc., Kane Ind'l. Dr., Hudson, MA 01749 617-562-9347

Transistors, RF-4800

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... A•2071
§† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ..... A•2077,2080,2081,2082

§ **Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107** ..... **A•2090**
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
§ Electronic Transistors, 112-15 Northern Blvd., Flushing, NY 11368 212-651-7200
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 ... 213-673-8422
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 .....714-557-9394; 800-854-7651
† Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-469-3311
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
§† Plessey Semiconductors, 1641 Kaiser Ave., Irvine, CA 92714 714-540-9979
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§† RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§ Semicoa, 333 McCormick Ave., Costa Mesa, CA 92626 714-979-1900
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33497 305-283-4500
§ SGS-ATES Semiconductor Corp., 240 Bear Hill Rd, Waltham, MA 02154 617-890-6688
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
§ Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§ TRW, RF Devices Div., 14520 Aviation Blvd., Lawndale, CA 90260 213-536-0888
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transistors, Silicon-4800

American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ..... **A•2071**
§† **Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900** ..... **A•2077**
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... **A•2090**
A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 201-722-9800
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-496-6710
† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
Ei North America, 15 W. 53rd St. Suite 47E, New York, NY 10019 212-315-3099
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§ Fuji-Svea, P.O. Box 3375, Torrance, CA 90510 213-533-1221
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
§† General Semiconductor Ind., Inc., Square D Company, 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 ... 213-673-8422
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 .....714-557-9394; 800-854-7651
ITT Semiconductors, 500 Broadway, Lawrence, MA 01841 617-688-1881
† Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-469-3311
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
† Powertech, Inc., 0-02 Fairlawn Ave., Fairlawn, NJ 07410 201-791-5050
§ PPC Prods., 7516 Central Industrial Dr., Riviera Beach, FL 33404 305-848-9606
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§† RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, JAPAN 03-986-6151
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33497 305-283-4500
SGS-ATES Semiconductor Corp., 240 Bear Hill Rd, Waltham, MA 02154 617-890-6688
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Silicon Transistor Corp., Katrina Rd., Chelmsford, MA 01824 617-256-3321
SMD Technology Svc. Ctr., A North American Philips Co., 5855 N. Glen Pk. Rd., Milwaukee, WI 53209 800-431-4444
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§ Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Rd., Riviera Beach, FL 33404 305-848-4311
§ Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
§† TRW, RF Devices Div., 14520 Aviation Blvd., Lawndale, CA 90260 213-536-0888
§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540
§† Westinghouse Elec. Corp., Semiconductor Div., Armbrust Rd., Youngwood, PA 15697 412-925-7272
† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transistors, Switching-4800

§† **Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900** ..... **A•2077-2080,2080,2081**
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940 201-377-9566
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
Cherry Semiconductor Corp, 2000 S. County Trail, East Greenwich, RI 02818 401-885-3600
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ..... 415-785-5231;415-785-5235
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
§ Electronic Transistors, 112-15 Northern Blvd., Flushing, NY 11368 212-651-7200
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§ Fuji-Svea, P.O. Box 3375, Torrance, CA 90510 213-533-1221
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
§† General Semiconductor Ind., Inc., Square D Company, 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 ... 213-673-8422
§† Germanium Power Devices, Box 3065, Shawsheen Village Sta., Andover, MA 01810 617-475-5982
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 .....714-557-9394; 800-854-7651
§ International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
§† International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
§† Intersil, 10710 N. Tantau Ave., Cupertino, CA 95014 408-996-5000
ITT Semiconductors, 500 Broadway, Lawrence, MA 01841 617-688-1881
IXYS Corp., 142 Charcot Ave., San Jose, CA 95131 408-262-8800
Lambda Electronics, Veeco Instr., Inc., 515 Broad Hollow Rd., Melville, NY 11747 516-694-4200
Lambda Semiconductors, Veeco Instr., 121 International Dr., Corpus Christi, TX 78410 ..... 512-289-0403;800-255-9606
§ NEC Elctrns. USA Inc., NEC Electron Div., 252 Humboldt Ct., Sunnyvale, CA 94086 408-745-6520
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
† Powertech, Inc., 0-02 Fairlawn Ave., Fairlawn, NJ 07410 201-791-5050
§ PPC Prods., 7516 Central Industrial Dr., Riviera Beach, FL 33404 305-848-9606
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 415-968-9211
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§† RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, JAPAN 03-986-6151
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§ Semicoa, 333 McCormick Ave., Costa Mesa, CA 92626 714-979-1900
§† Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33497 305-283-4500
§ SGS-ATES Semiconductor Corp., 240 Bear Hill Rd, Waltham, MA 02154 617-890-6688
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Silicon Transistor Corp., Katrina Rd., Chelmsford, MA 01824 617-256-3321
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§ Solitron Devices, 8808 Balboa Ave., San Diego, CA 92123 619-278-8780
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Rd., Riviera Beach, FL 33404 305-848-4311
§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
§† Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
† TRW Optoelectronics Div., 1207 Tappan Circle, Carrollton, TX 75006 ... 214-323-2200

§† Westinghouse Elec. Corp., Semiconductor Div., Armbrust Rd., Youngwood, PA 15697 412-925-7272
† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transistors, Unijunction-4800

§† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ..... A•2083
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2091
American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940 201-377-9566
§ Fuji-Svea, P.O. Box 3375, Torrance, CA 90510 213-533-1221
§† General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 ... 213-673-8422
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 .....714-557-9394; 800-854-7651
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
§ Sprague Electric Company, Distribution Division, 481 Marshall St., No. Adams, MA 01247 413-664-4481
Triac Electronic Systems, Inc., 87-27 Myrtle Ave., Glendale, NY 11385 .. 718-441-4759
§ Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transistors (MIL)-2440 — *See Vol. B*

Translators, Data-2325 — *See Vol. D*

Translators, Frequency Band-2700

Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832

Translators, Time Code-2000 — *See Vol. D*

Transmission Line, Wire & Cable — See Cable, Transmission Line (Vol. C)

Transmission Systems, Data-2000 — *See Vol. D*

Transmitters, Fiber Optic-3700 — *See Vol. B*

Transmitters, Fixed Frequency-1900 — *See Vol. D*

Transmitters, Laser-3700 — *See Vol. B*

Transmitters, Position-1900 — *See Vol. D*

Transmitters, Process Control (Temperature, Pressure, Flow, etc.)-5500 — *See Vol. B*

Transmitters, Radar — See Radar System Components (Vol. A)

Transmitters, Telemetry-1900 — *See Vol. D*

Transmitters, Tone-1900 — *See Vol. D*

Transmitters (MIL), ECM-3475 — *See Vol. D*

Transmitters (MIL), Shipboard Jamming-3475 — *See Vol. D*

Transmitters (MIL), TWTs-3475 — *See Vol. D*

Transponders-1900 — *See Vol. D*

Transports, Tape (all kinds)-2000 — *See Vol. D*

TRIACs-4800

† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ..... A•2083
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2090
§ Teccor Elctrns., 1801 Hurd Dr., Irving, TX 75062, 214-252-7651 ..... A•2092
Triac Electronic Systems, Inc., 87-27 Myrtle Ave., Glendale, NY 11385, 718-441-4759 ..... D•1132
§ AEMC, 99 Chauncy, Boston, MA 02111 ..... 617-451-0227;800-343-1391
American Microsemiconductor, Inc., 133 Kings Rd., Madison, NJ 07940 201-377-9566
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
Gentron Corp., 6667 N. Sydney Pl., Milwaukee, WI 53209 414-351-1660
Hutson Inds., 1000 Hutson Cir., Frisco, TX 75034 214-377-3557
§ RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
Silicon Power Cube Corp., 2725 Seaboard Lane, Long Beach, CA 90805 213-634-9390

Triggers, SCR — See Controls, SCR (Vol. D)

Tube Heat Dissipators-5700

† IERC, 135 W. Magnolia Blvd., Burbank, CA 91502 ..... 818-849-2481;818-786-1182
Intl. Elctrn. Resch., 135 W. Magnolia Blvd., Burbank, CA 91502 213-849-2481
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Tubes, Backward Wave-5700

† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
§† Raytheon Co., 465 Centre St., Quincy, MA 02169 617-479-5300
† Raytheon Co., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154 617-899-8400
§ Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141

Tubes, Ballast — See Resistors, Ballast (Vol. A)

Tubes, Cathode Ray, General Purpose-5700

† THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006, 201-575-5586 ..... A•2342
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
† Astronautics Corporation of America, P.O. Box 523, Milwaukee, WI 53201-0523 414-447-8200
Ball Electronic, Systems Div., 9300 W. 108th Circle, Broomfield, CO 80020 303-460-5256
Corning Glass Works, Telecomm Prods Dept., BH-5, Corning, NY 14830 607-974-9000
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
§ Mitsubishi Elctrns., Industrial Electronics Div., 991 Knox Street, Torrance, CA 90502 213-515-3993
Rauland-Zenith Electronics Corp., 2407 W. North Ave., Melrose Pk., IL 60160 312-345-4700
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
Thomas Elctrns., 100 Riverview Dr., Wayne, NJ 07470 201-696-5200
§ Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3211
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Tubes, Cathode Ray, Special Purpose-5700

† THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006, 201-575-5586 ..... A•2342
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
† Astronautics Corporation of America, P.O. Box 523, Milwaukee, WI 53201-0523 414-447-8200
Ball Electronic, Systems Div., 9300 W. 108th Circle, Broomfield, CO 80020 303-460-5256
Corning Glass Works, Telecomm Prods Dept., BH-5, Corning, NY 14830 607-974-9000
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Hughes Aircraft Co., 6155 El Camino Real, Carlsbad, CA 92008 619-931-3000
Hughes Aircraft Co., Indl. Prods. Div. FACT Sys., 6155 El Camino Real, Carlsbad, CA 92008 619-931-3000
† Litton Systems, Inc., Electron Dvcs. Div., 960 Industrial Rd., San Carlos, CA 94070 415-591-8411
§ Mitsubishi Elctrns., Industrial Electronics Div., 991 Knox Street, Torrance, CA 90502 213-515-3993
Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
Rauland-Zenith Electronics Corp., 2407 W. North Ave., Melrose Pk., IL 60160 312-345-4700
† Raytheon Co., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154 617-899-8400
Thomas Elctrns., 100 Riverview Dr., Wayne, NJ 07470 201-696-5200
§ Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
† Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3211
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Tubes, Counting-5700

§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
§ THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006 201-575-5586

Tubes, Electron Multiplier-5700

§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
§ Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
§ THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006 201-575-5586

Tubes, Flash-5700

† Amglo, 5265 Michigan Ave., Rosemont, IL 60018 312-671-4321
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
EG&G, Inc., Electro-Optics Div., 35 Congress St., Salem, MA 01970 617-745-3200
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
U.S. Scientific Instrs., 61 North Beacon St., Boston, MA 02134 617-787-2411
§ Xenon Corp., 66 Industrial Way, Wilmington, MA 01887 617-658-8940

Tubes, Gas-5700

§† Alltech Assocs. Inc., Applied Science Labs., 2051 Waukegan Rd., Deerfield, IL 60015 312-948-8600
§† Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
§† ITT Electron Tube, ITT Corp., Box 100, Easton, PA 18042 215-252-7331
Lightning Protection Corp., Box 6086, Santa Barbara, CA 93160 .. 805-967-5089/4577
§† Raytheon Co., 465 Centre St., Quincy, MA 02169 617-479-5300
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§ UVP, Inc., 5100 Walnut Grove Ave., P.O. Box 1501, San Gabriel, CA 91778 818-285-3123
§ Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3211

Tubes, Ignitron-5700

† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
§ Raytheon Co., 465 Centre St., Quincy, MA 02169 617-479-5300
§ Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3211

Tubes, Image Converter-5700

§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
ElectroPhysics Corp., 48 Spruce St., Nutley, NJ 07110 201-667-2262
Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Hughes Aircraft Co., 6155 El Camino Real, Carlsbad, CA 92008 619-931-3000
Industrial Elctrn. Engrs., Inc., 7740 Lemona Ave., Van Nuys, CA 91405 ... 818-787-0311
§ Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Varo, Inc., Electron Devices Div., 2203 W. Walnut St., Garland, TX 75040 214-272-3561
Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3211

Tubes, Indicator — See Tubes, Readout (Vol. A)

Tubes, Magnetron — See Tubes, Microwave (Vol. A)

Tubes, Microwave-5700

§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
§† Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
Amperex Electronic Inds., Smithfield Div., George Washington Hwy., Smithfield, RI 02917 401-232-0500
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
† Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509-2999 213-517-6000
§† ITT Electron Tube, ITT Corp., Box 100, Easton, PA 18042 215-252-7331
† Litton Systems, Inc., Electron Dvcs. Div., 960 Industrial Rd., San Carlos, CA 94070 415-591-8411
Mictron Inc., 6050 Porter Way, Sarasota, FL 33582 813-371-6659
Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
§† Raytheon Co., 465 Centre St., Quincy, MA 02169 617-479-5300
† Raytheon Co., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154 617-899-8400
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§ Siemens Components, Inc., 186 Wood Ave., S., Iselin, NJ 08830 201-321-3400
§ Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
§ Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† VTM Microwaves, Inc., 4975 W. 80 Ave., Westminster, CO 80030 303-426-6866
Wall, A. T., Co., 55 Service Ave., Warwick, RI 02886 401-739-0740
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141

Tubes, Noise Source-5700

† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141

Tubes, Photomultiplier-5700

§† **THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006, 201-575-5586** ..... **A•2343**
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
Centronic Inc., 1101 Bristol Rd., Mountainside, NJ 07092 201-233-7200
EG&G Gamma Scientific, Div. of EG&G Inc., 3777 Ruffin Rd., San Diego, CA 92123 619-279-8034
Gamma Scientific Inc., 3777 Ruffin Rd., San Diego, CA 92123 619-279-8034
Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Microscience, Inc., 182 Forbes Rd., Braintree, MA 02184 617-849-1952
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Thomson-CSF Comps. Corp., DuMont Div., 750 Bloomfield Ave., Clifton, NJ 07015 201-773-2000
§ Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3211

Tubes, Readout (CRT, Cold-Cathode, Vacuum Fluorescent, Incandescent, etc.)-5700

Infodex, Inc., 395 W. Main St., Waterbury, CT 06702, 203-757-9291 ..... B•1080
† **THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006, 201-575-5586** ..... **A•2342**
ACI Data Products, 17921 Sampson Ln., Huntington Beach, CA 92647 .. 714-842-2945
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
Ball Electronic, Systems Div., 9300 W. 108th Circle, Broomfield, CO 80020 303-460-5256
§ Clinton Elctrns., 6701 Clinton Rd., Rockford, IL 61111 815-633-1444
Displays, Inc., Mifflin Countey Indl. Pk., Rte. 4, Box 6AAA, Lewistown, PA 17044 717-242-2541
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
§† Industrial Elctrn. Engrs., Inc., 7740 Lemona Ave., Van Nuys, CA 91405 ... 818-787-0311
§ Mitsubishi Elctrns., Industrial Electronics Div., 991 Knox Street, Torrance, CA 90502 213-515-3993
§ NEC Elctrns. USA Inc., NEC Electron Div., 252 Humboldt Ct., Sunnyvale, CA 94086 408-745-6520
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
† Plasmarc Technologies, Inc., 180 Passaic Avenue, Fairfield, NJ 07006 .. 201-575-0870
Rauland-Zenith Electronics Corp., 2407 W. North Ave., Melrose Pk., IL 60160 312-345-4700
† Refac Elctrns. Corp., P.O. Box 809, Winsted, CT 06098 203-379-2731
Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680 714-669-9850
† Thomson-CSF Comps. Corp., DuMont Div., 750 Bloomfield Ave., Clifton, NJ 07015 201-773-2000
§ Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3211

Tubes, Receiving-5700

§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
§ Fuji-Svea, P.O. Box 3375, Torrance, CA 90510 213-533-1221
§ Goldwell Comps., 1815 W. 205th St. Ste. 201, Torrance, CA 90501 213-533-1228
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141

Tubes, Rectifying-5700

§† Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
§ Conditioning Semiconductor Devices, Box 2116, Wayne, NJ 07470 201-335-6723
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
§† Elctrn. Devices, 21 Gray Oaks Ave., Yonkers, NY 10710 914-965-4400
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
Philips ECG, Inc., 100 First Ave., Waltham, MA 02254 617-890-6107
§† Raytheon Co., 465 Centre St., Quincy, MA 02169 617-479-5300
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§ Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3211

Tubes, Strobe — See Lamps, Stroboscopic Source (Vol. B)

Tubes, Switching-5700

§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
† EG&G, Inc., Electro-Optics Div., 35 Congress St., Salem, MA 01970 617-745-3200
§ Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

§ Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3211

Tubes, TV Camera Pickup-5700

Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
ATV Research, Inc., 1301 Broadway, Dakota City, NE 68731 402-987-3771
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§ Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
§ THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006 201-575-5586
Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3211

Tubes, Transmitting-5700

§† Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
§† ITT Electron Tube, ITT Corp., Box 100, Easton, PA 18042 215-252-7331
§† Raytheon Co., 465 Centre St., Quincy, MA 02169 617-479-5300
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§ Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
§ Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3211

Tubes, Voltage Reference or Regulating-5700

§† Raytheon Co., 465 Centre St., Quincy, MA 02169 617-479-5300
§ Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
§ Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3211

Tubes, X-ray-5700

§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 .. 201-722-9800
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Spectro Equipment, Inc., 13821 Progress Pkwy., N. Royalton, OH 44133 216-237-8910
§ Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Tubes (MIL), Indicator & Pickup-2440 — *See Vol. B*

Tubes (MIL), Microwave-2440 — *See Vol. B*

Tubes (MIL), Power & Gas, Planar-2440 — *See Vol. B*

Tubes (MIL), Receiving, & Tube Shields-2440 — *See Vol. B*

Tubing, Ceramic-2500 — *See Vol. C*

Tubing, Fiberglass-2800 — *See Vol. C*

Tubing, Glass-2500 — *See Vol. C*

Tubing, Heat Shrinkable-Also See Caps, Forms & Tapes, Heat Shrinkable-2800 — *See Vol. C*

Tubing, Metal-2500 — *See Vol. C*

Tubing, Paper-2800 — *See Vol. C*

Tubing, Plastic-Also See Tubing, Spaghetti-2800 — *See Vol. C*

Tubing, Spaghetti-2800 — *See Vol. C*

Tubing, Spiral Wrap-2800 — *See Vol. C*

Tubing, Waveguide-3450

Markel Corp., P.O. Box 752, Norristown, PA 19404, 215-272-8960 ..... C•1689
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Gabriel Elctrns., Box 70, Scarborough Indl. Pk., Scarborough, ME 04074 207-883-5161
General Electric Co., Lamp Comps. & Technical Prods. Div. Sls. Oper., 21800 Tungsten Rd., Cleveland, OH 44117 216-266-2451
† Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
Thielex Plastics Corp., 201 11th St., Piscataway, NJ 08854 201-968-5300
Wall, A. T., Co., 55 Service Ave., Warwick, RI 02886 401-739-0740
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Tubing, Zipper-6000 — *See Vol. C*

Tuners, AM/FM-1300 — *See Vol. D*

Tuners, Microwave-3450

§† Johanson Mfg. Corp., 400 Rockaway Valley Rd., Boonton, NJ 07005, 201-334-2676 ..... A•1105
Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 617-935-8610
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
† Ferretec Inc., 1701A Fortune Dr., San Jose, CA 95131 408-263-1216
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
HDS Inc., 12310 Pinecrest Rd., Reston, VA 22091 703-620-6200
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
Mallory Components Division, Emhart Elec./Elctrn. Grp., 3029 E. Washington St., Indianapolis, IN 46201 317-261-1361
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
Rockwell Intl., Commercial Elctrns. Opers., 1200 N. Alma Rd., Richardson, TX 75081 214-996-5000
Sivers IMA, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Tuning Forks-2300

§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ..... A•1363
ITT Components Passive Grp., 1201 E. McFadden Ave., Santa Ana, CA 92705, 714-836-0351 ..... A•1377
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377 212-458-5811
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
† Philamon, Inc., 33 Dubon Ct., Farmingdale, NY 11735 516-249-2700
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303 415-856-6900
T-F Elctrns., 9415 Neils Thompson Dr., Austin, TX 78759 512-836-7323

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Washers, Plain-2825 — ***See Vol. C***

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Waveguide-Coax Adapters-3450

† Adams-Russell, Antenna & Microwave Div., Haverhill Rd., Amesbury, MA 01913 617-388-5210
† Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 617-935-8610
Amphenol, An Allied Co., 43 Commerce Ct., Lisle, IL 60532 312-983-3500
Andrew Corp., 10500 W. 153rd St., Orland Pk., IL 60462 312-349-3300
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
§† Astrolab Inc., 4 Powder Horn Drive, Warren, NJ 07060 1-201-560-3800
† Cablewave Sys., 60 Dodge Ave., North Haven, CT 06473 203-239-3311
§† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ..... 207-655-4555;800-341-9678
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .. Call Local Sls. Off.
† Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ..... 818-889-4030;805-497-4421
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Micro Mode Prods., 1870 John Towers Ave., El Cajon, CA 92020 619-449-3844
† Microwave Applications Grp., 3030 Industrial Pkwy., Santa Maria, CA 93455 805-928-5711
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
Nurad, Inc., 2165 Druid Pk. Dr., Baltimore, MD 21211 301-462-1700
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
Reeve Electronics, Mellish E. Murray, 1720 W. Fulton St., Chicago, IL 60612 312-670-0150
Sivers IMA, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Waveguides-3450

Airtron, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Amphenol, An Allied Co., 43 Commerce Ct., Lisle, IL 60532 312-983-3500
Andrew Corp., 10500 W. 153rd St., Orland Pk., IL 60462 312-349-3300
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Astrolab Inc., 4 Powder Horn Drive, Warren, NJ 07060 1-201-560-3800
† Cablewave Sys., 60 Dodge Ave., North Haven, CT 06473 203-239-3311
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ..... 207-655-4555;800-341-9678
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
† Electro Impulse, Box 870, Red Bank, NJ 07701-0870 201-741-0404
† Gabriel Elctrns., Box 70, Scarborough Indl. Pk., Scarborough, ME 04074 207-883-5161
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Lectro Magnetics, Inc., 6056 W. Jefferson Blvd., Los Angeles, CA 90016 ..... 800-325-9814;213-870-9383
M/A-Com Microwave Components, Inc., M/A-Com, South Avenue, Burlington, MA 01803 617-272-3000
M/A-Com Millimeter Products, M/A-Com, Inc., Second Avenue, Burlington, MA 01803 617-272-3000
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
Reeve Electronics, Mellish E. Murray, 1720 W. Fulton St., Chicago, IL 60612 312-670-0150
† Servometer Corp., 501 Little Falls Rd., Cedar Grove, NJ 07009 201-785-4630
† Sivers IMA, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
† G.T.E. Gov't Sys. Corp., Comm. Sys. Div., 77 A St., Needham Hgts., MA 02194 617-449-2000
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

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Yokes, Deflection, Oscilloscope-1800

† **Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880, 814-355-1521** ..... **A•1266**
§ **Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863, 618-262-5121** ..... **A•2308**
† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123
† Syntronic Instruments, Inc., 100 Industrial Rd., Addison, IL 60101 312-543-6444

Yokes, Deflection, Radar PPI-1800

† **Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880, 814-355-1521** ..... **A•1266**
§ **Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863, 618-262-5121** ..... **A•2308**
† **THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006, 201-575-5586** ..... **A•2342**
† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123
Muirhead, 1101 Briston Rd., Mountainside, NJ 07092 201-233-6010
† Syntronic Instruments, Inc., 100 Industrial Rd., Addison, IL 60101 312-543-6444

Yokes, Deflection, CRT-1800

Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... **A•2202**
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Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Astronautics Corporation of America, P.O. Box 523, Milwaukee, WI 53201-0523 414-447-8200
† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123
Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
§ Murata Mfg. Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan, JAPAN 075-951-9111
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
† Syntronic Instruments, Inc., 100 Industrial Rd., Addison, IL 60101 312-543-6444
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Yokes, Deflection, TV Camera-1800

† **Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880, 814-355-1521** ..... **A•1266**
ATV Research, Inc., 1301 Broadway, Dakota City, NE 68731 402-987-3771
† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Syntronic Instruments, Inc., 100 Industrial Rd., Addison, IL 60101 312-543-6444
Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

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MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

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Filters, Product Selection Guide ..... **A**•1583
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Instruments, Panel Meters, Product Selection Guide ..... **D**•1329
Instruments, Test & Measuring Product Selection Guide ..... **D**•1175
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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A

AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire gauge

B

BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C

CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D

D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E

EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F

FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G

GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H

HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I

IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J

JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K

kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L

LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M

MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microforad
MHz megahertz
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOSIGT metal-oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N

NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM nuclear instrumentation module
NOR not OR
NTC negative temperature coefficient

O

OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P

PC printed circuit
PCB printed circuit board
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLL phased lock loop
PPI plan position indicator
PROM programmable read only memory
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q

QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R

RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S

SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T

TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U

UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V

VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W

WPS word processing software

Y

YIG yttrium iron garnet

Z

ZIF zero insertion force

85
86 Manufacturers and Sales Offices Directory

Each manufacturer is listed alphabetically with complete address and telephone number of main offices. The names of those with data pages in this edition of EEM are shown in boldface.

Many manufacturers also show TWX and Telex numbers, FSC (Federal Supply Code), other pertinent company data, their sales and/or local distributor offices and phones. The page numbers of their data pages in this edition are shown in all volumes.

AABA COMPONENTS CORP., P.O. Box 171, Baldwin Place, NY 10505, Tel: 914-628-6952; Empl.: 15; *Sls. Mgr.:* D. McVey; *Dist. Mgr.:* D. McVey

AAK CORP, 747 River St., Haverhill, MA 01830, Tel: 617-373-3769; FSC No.: 04 26 3109-1; Empl.: 10; *Sls. Mgr.:* S. Musumeci

A & B TECHNICAL SERVICES, 11300 Hartland St., N. Hollywood, CA 91605, Tel: 213-769-6772, Telex: 66-2497, TWX: 910-499-2675; Empl.: 40; *Sls. Mgr.:* V. A. Littlefield; *Dist. Mgr.:* C. Cloud

A & D ELEC. INSTRS., 73-07 88th St., Glendale, NY 11385, Tel: 718-275-6516; Empl.: 7

A&M INSTRUMENT, INC., 5 Nassau St., Rockville Centre, NY 11571, Tel: 516-678-6960

AAVID ENGRG., One Kool Path, Laconia, NH 03246, Tel: 603-524-4443, TWX: 510-298-1127; FSC No.: 30161; Empl.: 300; *Sls. Mgr.:* Philip Johnson; *Dist. Mgr.:* Philip Johnson

abacus controls inc.

ABACUS CONTROLS INC., 89 Readington Rd., Somerville, NJ 08876, Tel: 201-526-6010, Telex: 888186 ABACUS CONT UD; FSC No.: 54241; Empl.: 45; *Sls. Mgr.:* L. Albrecht ..... **D•1880-1882**

Local Sales Offices & Reps

AL	Huntsville, Scientific Dvcs.	205-536-1969
CA	Los Angeles, Power Partners	800-468-5400
CA	San Diego, Power Partners	800-468-5400
CT	New London, Elctrn. Sls. of New England	203-443-2646
FL	Ft. Walton Beach, Scientific Dvcs.	904-651-4407
FL	Orlando, Scientific Dvcs.	305-841-8180
GA	Atlanta, Scientific Dvcs.	205-536-1969
GA	Savannah, Scientific Dvcs.	904-651-4407
MA	Wareham, Elctrn. Sls. of New England	617-295-7634
NC	Raleigh, Scientific Dvcs.	919-846-7319
NC	Winston-Salem, Scientific Dvcs.	919-765-5776
TX	Dallas, True Techn.	214-691-7870

ABA ELECTROMECHANICAL SYS. INC., Box 500, Pinellas Pk., FL 34290-0500, Tel: 813-541-6681, TWX: 810-866-0433; FSC No.: 26795; Empl.: 485; *Sls. Mgr.:* Bruce W. Harting

ABALON PRECISION MFG., 1040 Home Street, Bronx, NY 10459, Tel: 212-589-5682; Empl.: 25; *Sls. Mgr.:* Norman C. Orent

abbott

WHEN RELIABILITY IS IMPERATIVE

ABBOTT TRANSISTOR LABS., Industrial Products Div., 8203 Vineland Ave., Sun Valley, CA 91352, Tel: 818-504-0644, Telex: 91-6101; Empl.: 30; *Sls. Mgr.:* Peter Batte ..... **D•1449, 1884-1885**

Local Sales Offices & Reps

CT	Stamford, Dynamic Sls.	203-693-6567
MA	Burlington, Dynamic Sls. of New England	617-272-5676
NJ	Fort Lee, Abbott Transistor Labs.	201-461-4411
TX	Richardson, Abbott Transistor Labs.	214-437-0697
VT	S. Burlington, Dynamic Sls.	802-863-3928
Can	North Vancouver, BC, Jerome & Francis Co.	604-986-1286

ABBOTT TRANSISTOR LABS., Power Supply Div., 5200 W. Jefferson Blvd., Los Angeles, CA 90016, Tel: 213-936-8185, Telex: 69-1398; FSC No.: 15755; Empl.: 500 ..... **D•1449-1461**

Local Sales Offices & Reps

FL	Altamonte Springs, Gugel-Tuttle Assocs. Inc.	305-788-0845
NJ	Ft. Lee, Abbott Transistor Labs.	201-461-4411
TX	Richardson, Abbott Transistor Labs.	214-437-0697

ABBOTT TRANSISTOR LABS., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506, Tel: 818-841-3630, Telex: 69-6282; FSC No.: 58910; Empl.: 50; *Sls. Mgr.:* P. Ferrari ..... **A•2102-2108**

Local Sales Offices & Reps

AL	Huntsville, The Novus Grp.	205-881-2207
CT	Stamford, Dynamic Sls.	203-693-6567
FL	Altamonte Springs, Gugel-Tuttle Assocs. Inc.	305-788-0845
GA	Norcross, The Novus Grp.	404-939-1135
IL	Hinsdale, Palatine Engrg. & Sls. (CKC)	312-655-0668
IA	Cedar Rapids, Palatine Engrg. & Sls., Inc.	319-365-8071
KS	Mission, Palatine Engrg. & Sls., Inc.	913-831-0555
MA	Burlington, Dynamic Sls.	617-272-5676
MN	Spring Lake Park, Holmgren Assocs., Inc.	612-786-7641
MO	Hazelwood, Palatine Engrg. & Sls., Inc.	314-839-0800
NJ	Ft. Lee, Abbott Transistor Labs.	201-461-4411
TX	Richardson, Abbott Transistor Labs.	214-437-0697
VT	S. Burlington, Dynamic Sls.	802-863-3928
Can	Rexdale, Ontario, Source Elctrns., Ltd.	416-675-6235

ABLE POWER AND ENGINEERING INC., 335 S. New Ave., #H, Monterey Park, CA 91754, Tel: 714-891-3568; *Sls. Mgr.:* Joe Chou; *Dist. Mgr.:* Bob Barrio

ABLESTIK LABORATORIES, 833 W. 182nd St., Gardena, CA 90248, Tel: 213-532-9341, TWX: 910-346-7606; FSC No.: 21109; Empl.: 100; *Sls. Mgr.:* D. W. Lefever

ABRAMS INSTR. CORP., P.O. Box 26007, Lansing, MI 48909, Tel: 517-332-6405, TWX: 810-251-0785; FSC No.: 00048; *Sls. Mgr.:* Merlyn Gates

ACCARDI LABORATORIES, 66-45 69th St., Middle Village, NY 11379, Tel: 212-326-0570; *Sls. Mgr.:* Leonard Carney

ACC ELECTRONICS, 1300 W. Oak, Independence, KS 67301, Tel: 316-331-1000, Telex: 436483; FSC No.: 316-331-0660; Empl.: 1000; *Sls. Mgr.:* Leon Allen ..... **A•1659**

Local Sales Offices & Reps

MI	Troy, C. B. Jensen & Assoc.	313-643-0506

ACCESSORIES FOR ELCTRNS., INC., 800 Merrick Rd., Baldwin, NY 11510-3593, Tel: 516-546-1751; FSC No.: 54355; Empl.: 20; *Sls. Mgr.:* Angela Calabro

ACCUDYNE CORP., P.O. Box 1429, Janesville, WI 53547, Tel: 608-752-9081; FSC No.: 18356; Empl.: 276; *Sls. Mgr.:* R. E. Mowris; *Dist. Mgr.:* R. E. Mowris

ACCUGRAPH CORP., 50 Gervais Drive, Suite 204, Don Mills, ONT, Canada M3C 1Z3, Tel: 416-441-2211, TWX: 06 986 766 TOR; Empl.: 23; *Sls. Mgr.:* Mr. David V. McDonald

ACCUMET ENGRG., 518 Main St, Hudson, MA 01749, Tel: 617-568-8311; *Sls. Mgr.:* J. B. Snook

Local Sales Offices & Reps

CA Los Altos, Stout Inds. 415-949-0440
CA Malibu, R. L. Comps. 213-456-9021
MD Pasadena, Spectro-Lambda 301-437-7633
NJ East Windsor, Micro-Lambda 609-443-3113
NY Chappaqua, Micrel 914-238-4961

ACCUPROBE, INC., 1 Harrison Ave, Box 1044, Salem, MA 01970, Tel: 617-745-7878, Telex: 882194 Accuprobe UD; Empl.: 26; *Sls. Mgr.:* Dana B. Lee; *Dist. Mgr.:* T. H. Murphy

ACCURASSEMBLY, 9525 Cozycroft Ave., Chatsworth, CA 91311, Tel: 818-700-0708

ACCURATE ELCTRNS., 169 S. Abbe Rd., P.O. Box 1287, Elyria, OH 44036, Tel: 216-365-1211, Telex: 469705; FSC No.: 11375;13625; Empl.: 35

ACCURIDE, 12311 S. Shoemaker, Santa Fe Springs, CA 90670, Tel: 213-944-0921; *Sls. Mgr.:* Mike Hart; *Dist. Mgr.:* Bill Kniegge

ACCUSONIC SYSTEMS CORP., 12 Kulick Rd., Fairfield, NJ 07006, Tel: 201-575-1570; FSC No.: 5965;12606; Empl.: 45; *Sls. Mgr.:* Dennis Goodman

ACCUTEST, 25 Industrial Ave., Chelmsford, MA 01824, Tel: 617-256-8124, TWX: 710-347-0620; Empl.: 300; *Sls. Mgr.:* Tom Emery

ACCUTRONICS/CONNOR-WINFIELD, See Connor-Winfield

ACDC ELECTRONICS, 401 Jones Rd., Oceanside, CA 92054, Tel: 619-757-1880, TWX: 910-322-1470; Empl.: 750; *Sls. Mgr.:* Larry Slagal; *Dist. Mgr.:* Ray Brown

ACD-ELCOR PRODUCTS, P.O. Box 244, Bethel, CT 06801, Tel: 203-743-3510; Empl.: 3

ACHESON COLLOIDS, P.O. Box 288, Port Huron, MI 48060, Tel: 313-984-5581, TWX: 810-231-5265; Empl.: 150; *Sls. Mgr.:* Richard Doehring

ACI DATA PRODUCTS, 17921 Sampson Ln., Huntington Beach, CA 92647, Tel: 714-842-2945, Telex: 655328; Empl.: 10; *Sls. Mgr.:* J. Rogers

A.C. INTERFACE, 17911 Sampson, Huntington Beach, CA 92647, Tel: 714-841-6090, Telex: 655-328; Empl.: 23; *Sls. Mgr.:* R. D. Henwood; *Dist. Mgr.:* Wayne Neal

ACL INC., 1960 E. Devon Ave., Elk Grove, IL 60007, Tel: 312-981-9212; Empl.: 8

ACME CHEMICALS & INSULATION CO., Div. of Allied Products Corp., 166 Chapel St, New Haven, CT 06513, Tel: 203-562-2171, Telex: 295503 Acme UR; Empl.: 75; *Sls. Mgr.:* Marvin Leonard

ACME ELEC. HEATING CORP., 4685 E. 11th, Hialeah, FL 33013, Tel: 305-685-8326; Empl.: 12

ACME MODEL ENGRG. CO., 654 Bergen Blvd., Ridgefield, NJ 07657, Tel: 201-943-7650; Empl.: 29

ACOPIAN, Box 638, Easton, PA 18044, Tel: 215-258-5441, TWX: 510-651-4919; FSC No.: 14749; *Sls. Mgr.:* T. Skopal ..... **D•1463-1497**

Local Sales Offices & Reps

FL Melbourne, Acopian 305-727-1172
MD Ellicott City, Doss Elctrns. 301-465-1336

ACOUSTIC POWER SYS., 2151 Las Palmas Dr., Ste. G, Carlsbad, CA 92008, Tel: 619-438-4848, Telex: 67-8401; Empl.: 5

ACQUIS COMMUNICATIONS, 17192 Gillette Ave., Irvine, CA 92714, Tel: 714-250-4964; *Sls. Mgr.:* Patrice Garner

ACRODYNE CONTROLS, See Accudyne Corp.

ACROMAG, 30765 Wixom Rd., Wixom, MI 48096, Tel: 313-624-1541, Telex: 247354; Empl.: 110; *Sls. Mgr.:* Bill Carey

Local Sales Offices & Reps

AZ Tempe, Aldrich Indl. Controls, Ltd. 602-945-8598
CA Costa Mesa, FLW, Inc. 714-751-7512
CA Walnut Creek, Sharman, Inc. 415-947-5757
CO Lakewood, Technical Mktg. Mfg. 303-232-1516
FL Ruskin, Leroy E. Rogers 813-645-1453
GA Atlanta, R. Freeman Assocs. 404-938-1227
IL Hoffman Estates, Carvel Engrg. & Sls. Co. 312-885-8800
IN Indianapolis, Process Controls Corp. .. 317-259-1316
IA Cedar Rapids, Dy-Tronix 319-377-8275
KS Shawnee Mission, D. Allert Co. 913-831-4244
LA Baton Rouge, Devitt Pancoast Controls Co. 504-291-0074
MD Cockeysville, Koch/Assoc. 301-666-7400
MA Norwell, Bordewieck Engrg. & Sls. Co. 617-659-4915
MI Negaunee, The Shertron Co. 906-475-5234
MI Troy, George R. Peters & Assocs. 313-362-1200
MN Cedar, Bican Co. 612-434-7733
MO Bridgeton, Dy-Tronix 314-291-4777
NJ Blackwood, J. Koch/Assocs. 609-227-5000
NY Buffalo, Chippewa Instrs., Inc. 716-838-5050
NY E. Syracuse, Analog Instrs., Inc. 315-437-8413
NY New York, Flowmaster Controls Co. .. 212-741-9675
NC Matthews, W.K. Hile Co. 704-847-9125
OH Cincinnati, George Drysdale & Assocs. 513-528-2200
OH Cleveland, Jay Indl. Sls. Co. 216-831-9393
OK Tulsa, Dave Allert Co. 918-743-7705
OR Portland, McLaren, Inc. 503-297-2248
PA Bridgeville, Instr. Svcs. 412-221-3601
PA Erie, Instrument Svcs. 814-455-1969
TN Knoxville, Hile Controls of Tenn. 615-584-0208
TN Memphis, Mel Watson Co. 901-345-0890
TX Corpus Christi, Collier Equip. Co. 512-289-6181
TX Irving, DACO/Dave Allert Co. 214-986-1506
TX Sugar Land, Pan-Tech Engrg. Co. 713-240-1220
UT West Jordan, Specialty Sls. Co. 801-561-0222
VA Chester, Hile Controls of Virginia 804-796-3001
WA Bellevue, McLaren, Inc. 206-454-3400
WV Charleston, Instr. Svcs. 304-345-0348
WI New Berlin, Carvel Engrg. & Sls. Co. .. 414-784-7007

ACROMARK, 60 Locust/Dept. 397, Berkeley Hgts., NJ 07922, Tel: 201-464-6474; Empl.: 50

ACTION INSTRS., 8601 Aero Dr., San Diego, CA 92123, Tel: 619-279-5726, TWX: 910-335-2030; Empl.: 230; *Sls. Mgr.:* Frank Williams

ACTIVAIR, Duracell, Inc., 2777 Eagandale Blvd., Eagan, MN 55121, Tel: 612-681-4200, Telex: 297-486; Empl.: 100; *Sls. Mgr.:* H. T. Ross; *Dist. Mgr.:* H. T. Ross

ACTIVE CONTROL INSTRMN., P.O. Box 243-Wildwood Circle, Key Largo, FL 33037, Tel: 305-451-1000; FSC No.: 55116; Empl.: 6 ..... **D•1109**

AC TRANSFORMER, 89 Madison St., Newark, NJ 07105, Tel: 201-589-8574; Empl.: 13; *Sls. Mgr.:* George Giangrande

ACUREX-AUTODATA, 555 Clyde, Mountain View, CA 94039, Tel: 415-964-3200, Telex: 34-6391, TWX: 910-379-6593; Empl.: 1000; *Sls. Mgr.:* Don Willett

ACUSHNET CAPACITOR CO., INC., 720 Belleville, New Bedford, MA 02741, Tel: 617-999-3291, TWX: 710-344-6451; FSC No.: 61152; Empl.: 300

ACUSHNET ELCTRNS. CO., INC., 8700 E. Thomas Rd., Scottsdale, AZ 85252, Tel: 602-947-7474, TWX: 910-950-1320

ADAC CORP., 70 Tower Office Pk., Woburn, MA 01801, Tel: 617-935-6668, Telex: 951802; Empl.: 80; *Sls. Mgr.:* Les Silvern ..... **D•1135**

Local Sales Offices & Reps

AZ Phoenix, RML Assocs. 602-246-0321
CA Los Angeles, ADAC Corp. 213-476-6535
CA Redwood City, ADAC Corp. 415-366-4300
CO Denver, RML Assocs. 303-757-6654
FL Orlando, E. G. Holmes & Assocs. 305-894-8901
FL Palm Bay, E. G. Holmes & Assocs. 305-723-7339
GA Chamblee, E. G. Holmes & Assocs. 404-451-6161
IL Bloomingdale, ADAC Corp. 312-980-3191
IL Hoffman Estates, Carvel Engrg. & Sls. Co. 312-885-8800
KS Overland Park, Ramsey Assocs. 913-649-6996
MI Madison Hgts., WKM Assocs. 313-588-2300
MN Edina, Carvel Engrg. & Sls. Co. 612-835-7929
MO St. Louis, Ramsey Assocs. 314-878-5042
NJ Pennsauken, Sci-Reps 609-662-5222
NM Rio Ranch, RML Assocs. 505-892-2385
NY DeWitt, DB Assocs. 315-446-0220
NY White Plains, Cane Tech Sls. 914-694-9240
NC Carey, E. G. Holmes & Assocs. 919-469-8850
OH Dayton, WKM Assocs. 513-434-7500
OH Independence, WKM Assocs. 216-524-5930
OR Portland, Brett-Ross 503-256-9727
PA Pittsburgh, WKM Assocs. 412-892-2953
TX Houston, ADAC Corp. 713-771-9347
UT Salt Lake City, RML Assocs. 801-942-4468
VA Fairfax, Sci-Reps 703-385-0600
WA Redmond, Brett-Ross 206-882-4822
WI New Berlin, Carvel Engrg. & Sls. Co. .. 414-784-7007

ADALET-PLM DIV, Div. Scott & Fetzer Co., 4801 W. 150th St., Cleveland, OH 44135, Tel: 216-267-9000, Telex: 98-5349; FSC No.: 73389; Empl.: 177; *Sls. Mgr.:* J. L. Smelko

ADAMS-MAXWELL DIVISION, Coast Magnetics, 1207 North La Brea Ave., Inglewood, CA 90302, Tel: 213-673-3245, Telex: 686103; FSC No.: 22558; Empl.: 55; *Sls. Mgr.:* H. Adams

ADAMS RITE PRODS., INC., 540 W. Chevy Chase Dr., Glendale, CA 91204, Tel: 818-241-5121, TWX: 910-497-2276; Empl.: 130

ADAMS-RUSSELL, Antenna & Microwave Div., Haverhill Rd., Amesbury, MA 01913, Tel: 617-388-5210, TWX: 710-347-6360; FSC No.: 11556; Empl.: 350; *Sls. Mgr.:* David W. Ryan

ADAMS-RUSSELL, Anzac Div., 80 Cambridge St, Burlington, MA 01803, Tel: 671-273-3333, Telex: 200155, TWX: 710-332-0258; FSC No.: 21912; Empl.: 300; *Sls. Mgr.:* Julian D. Parker

ADAMS RUSSELL, Modpak Div., 80 Cambridge St., Burlington, MA 01803, Tel: 617-273-3333, TWX: 710-332-0258; FSC No.: 21912; Empl.: 1; *Sls. Mgr.:* Pat Corrigan

ADAMS-RUSSELL, Parisi Div., 280 Bear Hill Rd., Waltham, MA 02154, Tel: 617-890-0055, TWX: 710-324-6450; FSC No.: 27965; Empl.: 8; *Sls. Mgr.:* J. M. Caputo

ADAPTER/CHARGER PRDTS., Box 3218, Peoria, IL 61614, Tel: 309-691-0810; Empl.: 50

ADAPTIVE INTELLIGENCE, 1401 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-262-7222; *Sls. Mgr.:* Jim Breen

ADAPTIVE SCIENCE, 4700 San Pablo Ave., Emeryville, CA 94608, Tel: 415-652-1805; FSC No.: 7379; Empl.: 26; *Sls. Mgr.:* Jesse Huffman

ADATEK, INC., P.O. Box 1339, Sandpoint, ID 83864, Tel: 208-263-1471, 800-323-3343; Empl.: 13; *Sls. Mgr.:* Kim Jones or Ray Pelland; *Dist. Mgr.:* Janis Chilton

ADC MAGNETIC CONTROLS CO., 4900 W. 78th St., Minneapolis, MN 55435, Tel: 612-835-6800, Telex: 290321; Empl.: 2000; *Sls. Mgr.:* Jack Brandmueller

ADCOTECH, 1980 Tarob Ct., Milpitas, CA 95035, Tel: 408-943-9430, TWX: 910-338-2333; Empl.: 125; *Sls. Mgr.:* Bill Sendell

ADC PRODS., 4900 W. 78th St., Minneapolis, MN 55435, Tel: 612-835-6800, TWX: 910-576-2832; Empl.: 1,435

ADDACON, INC., 3702-C Alliance Dr., Greensboro, NC 27407, Tel: 919-852-6200, TWX: 510-922-7361; *Sls. Mgr.:* Lynn Cummings

A.D. DATA SYS., Techtran Industries, 200 Commerce Dr., Rochester, NY 14623, Tel: 716-334-9649, TWX: 510-253-3246; Empl.: 35; *Sls. Mgr.:* Jack Petz

ADDELCO CORP., Advanced Dev. Elctrns. Div., 20 Freeman Pl, Needham, MA 02192, Tel: 617-444-4754, TWX: 710-325-0370; Empl.: 23; *Sls. Mgr.:* Alan LeMay; *Dist. Mgr.:* M. B. Polayes

ADDINGTON LABS. INC., SOLID STATE PRODS DIV., See Eaton Corp. Comm. Prods. Div.

ADDITIVE PRODUCTS DIV., Kollmorgen Corp., P.O. Box 700, West La., Aquebogue, NY 11931, Tel: 516-722-4100, TWX: 510-220-0022; Empl.: 450

ADDMASTER CORP., 416 Junipero Serra Dr., San Gabriel, CA 91776, Tel: 818-285-1121, Telex: 67-4770; Empl.: 200; *Sls. Mgr.:* Larry Wirtz

ADE, INC., 1560 E. 98th St., Chicago, IL 60628, Tel: 312-221-3400; FSC No.: 62049

ADELIE CORPORATION, 288 Walnut Street, Newtonville, MA 02160, Tel: 617-965-8480; Empl.: 35; *Sls. Mgr.:* Albert R. Vandam

ADI ELECTRONICS, INC., 160 Wilbur Place, Bohemia, NY 11716, Tel: 516-567-3555

ADHESIVE PRODS., 1660 Boone Ave., Bronx, NY 10460, Tel: 212-542-4600; *Sls. Mgr.:* M. S. Peters

ADIRONDACK WIRE & CABLE CO., INC., 1451 New Britain Ave., Farmington, CT 06032, Tel: 1-203-677-2657; Empl.: 150; *Sls. Mgr.:* Kenneth Stowell; *Dist. Mgr.:* Mary Anne Violette

ADRET/COMSTRON, See Comstron/Adret

ADTECH POWER INC., 1620 S. Sunkist St., Anaheim, CA 92806, Tel: 714-634-9211, Telex: 68-1498; FSC No.: 56410; Empl.: 70; *Sls. Mgr.:* C. C. O'Reilly; *Dist. Mgr.:* C. C. O'Reilly ..... **D•1499**

Local Sales Offices & Reps

CA	Anaheim, Galaie Sls. Intl.	714-937-5622
CA	Brea, Synertech	714-691-6123
CA	Campbell, Sedillo Co.	408-374-5220
FL	Melbourne, Reynolds & Assocs.	305-259-7000
MA	Stoughton, Elctrn. Meas. Labs	617-341-0781
NY	New York, Elctrn. Meas. Labs	212-706-4059
TX	Garland, Carey, McMahill & Zerbe Co.	214-681-1414
TX	Houston, Carey, McMahill & Zerbe Co.	713-771-1500
TX	Round Rock, Carey McMahill & Zerbe Co.	512-255-1663
WA	Bellevue, Al Smith Co.	206-746-6770
WA	Vancouver, Al Smith Co.	206-892-9912

ADVANCE CONVERSION DEVICES CO., 274 S. Salem St., Randolph, NJ 07869, Tel: 201-989-0095; FSC No.: 52298; Empl.: 24; *Sls. Mgr.:* D. J. Fedderly ..... **D•1886-1887**

ADVANCED AUTOMATION CONCEPTS, INC., 3760 Lower Roswell Rd., Marietta, GA 30067, Tel: 404-973-0027, Telex: 703452; Empl.: 12; *Sls. Mgr.:* Bob Pap

ADVANCED CIRCUITRY, Litton Inds., 4811 W. Kearney, Springfield, MO 65803, Tel: 417-862-0751, TWX: 910-775-4705; Empl.: 1000; *Sls. Mgr.:* Steve Fadler

ADVANCED CIRCUIT TECHNLG., 118 N. Eastern Blvd., Nashua, NH 03062, Tel: 603-880-6000, TWX: 710-228-8961; FSC No.: 57034; Empl.: 125

Local Sales Offices & Reps

CA	Mission Viejo, Advanced Circuit Technlg.	714-770-2637
FL	Crystal River, Advanced Circuit Technlg.	904-795-3200

ADVANCED COATINGS & CHEM., Philip A. Hunt Chemical Corp., 4343 Temple City Blvd., Temple City, CA 91780, Tel: 818-579-6270, Telex: 675594; *Sls. Mgr.:* Tim Hughes

ADVANCED COLOR TECHNLG., 21 Alpha Rd., Chelmsford, MA 01824, Tel: 617-256-1222, Telex: 951-419; *Sls. Mgr.:* Jack Flynn

ADVANCED COMPONENTS INDS., INC., 114 Center St., El Segundo, CA 90245, Tel: 213-322-4249; *Sls. Mgr.:* Irma Spreitzer

ADVANCED CONTROL SYS., 24 Teed Dr., Randolph, MA 02368, Tel: 617-963-4543; Empl.: 6; *Sls. Mgr.:* Kenneth Egan

ADVANCED DETECTOR CORP., Applied Solar Energy Corp., 15251 E. Don Julian Rd., Industry, CA 91746, Tel: 818-369-6886, TWX: 910-584-4890; *Sls. Mgr.:* T. Scott Thorpe ..... **B•1203**

Local Sales Offices & Reps

AZ	Tempe, Piper Sls.	602-949-0048
CA	City of Industry, Advanced Detector Corp.	818-369-6886
CA	Mountain View, Weseloh/Swanson Assocs.	415-961-0565
CO	Longmont, Piper Sls.	303-651-2378
GA	Norcross, Hollingsworth & Still, Inc.	404-447-1700
IL	Buffalo Grove, Hill Sls. Corp.	312-541-0661
MA	Sudbury, Poulin Assocs., Inc.	617-443-7333
MI	Brooklyn, Engineered Comps., Inc.	517-592-3236
MN	Minneapolis, Furber Sls.	612-881-3620
NJ	Montclair, Controlyne, Inc.	201-746-8900
NC	Fayetteville, Zim-Tek	919-488-4101
OR	Portland, Component Technlg.	503-292-1518
PA	Pittsburgh, Covert & Newman	412-531-2002
TX	Richardson, Moore Assocs.	214-690-4929
UT	Salt Lake City, Piper Sls.	801-466-9336
VA	Fairfax, Beacon North, Inc.	703-591-1300

Local Distributors

AZ	Tempe, Piper Sls.	602-949-0048
CA	City of Industry, Advanced Detector Corp.	818-369-6886
CA	Mountain View, Weseloh/Swanson Assocs.	415-961-0565
CO	Longmont, Piper Sls.	303-651-2378
GA	Norcross, Hollingsworth & Still, Inc.	404-447-1700
IL	Buffalo Grove, Hill Sls. Corp.	312-541-0661
MA	Sudbury, Poulin Assocs., Inc.	617-443-7333
MI	Brooklyn, Engineered Comps., Inc.	517-592-3236
MN	Minneapolis, Furber Sls.	612-881-3620
NJ	Montclair, Controlyne, Inc.	201-746-8900
NC	Fayetteville, Zim-Tek	919-488-4101
OR	Portland, Component Technlg.	503-292-1518
PA	Pittsburgh, Covert & Newman	412-531-2002
TX	Richardson, Moore Assocs.	214-690-4929
UT	Salt Lake City, Piper Sls.	801-466-9336
VA	Fairfax, Beacon North, Inc.	703-591-1300

ADVANCED DEVICES, 1618 Camino Uva, Los Alamos, NM 87544, Tel: 505-662-7729

ADVANCED DIGITAL TECH, 13400 Northrup Wy Ste 27, Bellevue, WA 98005, Tel: 206-643-2382, TWX: 296 352 ADT UR; Empl.: 14; *Sls. Mgr.:* Brian T. Best; *Dist. Mgr.:* Matt Astengo

ADVANCED ELCTRNS. DESIGN, INC., 440 Potrero Ave., Sunnyvale, CA 94086, Tel: 408-733-3555, 800-538-1730 (outside CA), Telex: 357-498; *Sls. Mgr.:* Leon Drozdowski

ADVANCED ELECTRONIC PACKAGING, 2159 Bay St., Los Angeles, CA 90021, Tel: 213-622-9042; *Sls. Mgr.:* Douglas A. Hill

ADVANCED FILTER DEVICES, INC., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008, Tel: 619-438-2074; FSC No.: 56620; Empl.: 45; *Sls. Mgr.:* Herbert Johnson

ADVANCED HIGH VOLTAGE CO., INC., P.O. Box 2136, Lancaster, CA 93539-2136, Tel: 213-997-7222; *Sls. Mgr.:* J. Richardson

ADVANCED INPUT DEVICES, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814, Tel: 208-765-8000, TWX: 510-776-0584; FSC No.: 95666; Empl.: 550; *Sls. Mgr.:* Larry May

ADVANCED INTERCONNECTIONS CORP., 5 Division St., Warwick, RI 02818, Tel: 401-885-0485, TWX: 710-382-0400; FSC No.: 05-0394638; *Sls. Mgr.:* Max E. Rice

ADVANCED KINETICS, 1231 Victoria St., Costa Mesa, CA 92627, Tel: 714-646-7165, Telex: 18-2714; Empl.: 32; *Sls. Mgr.:* R. L. Gradishar

ADVANCED MATERIALS SYSTEMS, See Handy & Harman Electronic Materials Corp.

ADVANCED MICROCOMPUTERS, 3340 Scott Blvd., Santa Clara, CA 95051, Tel: 408-732-2400, Telex: 34-6306, TWX: 910-339-9280; *Sls. Mgr.:* Steve Zelencik; *Dist. Mgr.:* Rick Marz

ADVANCED MICRO DEVICES, P.O. Box 3453, 901 Thompson Pl., Sunnyvale, CA 94088, Tel: 408-732-2400, Telex: 34-6306, TWX: 910-339-9280; Empl.: 11000; *Sls. Mgr.:* Steve Zelencik; *Dist. Mgr.:* Michael Furman

ADVANCED SYS. CONCEPTS, 435 N. Lake Ave., Pasadena, CA 91101, Tel: 818-793-8971, Telex: 701 215 ASCI; *Sls. Mgr.:* Wesley Ferris; *Dist. Mgr.:* B. Lee ..... **D•1137**

Local Sales Offices & Reps

IA	Des Moines, Beams Co.	515-255-1148
MN	Edina, Integrated Peripheral Sys.	612-831-0349
OH	Dayton, Ashby Assocs.	513-252-5627
VA	Vienna, Advanced Technlg. Assocs.	703-556-0500

ADVANCED TECHN. RESEARCH LABS., 5645 K General Washington Dr., Alexandria, VA 22312, Tel: 703-750-2920; Empl.: 12; *Sls. Mgr.:* Bob Palma, Sr.; *Dist. Mgr.:* Bob Palma, Sr.

ADVANCED TOOL TECHNOLOGY, INC., Sub. of Alliance Resch. Corp., 18217 Parthenia St., Northridge, CA 91325, Tel: 213-993-1202, Telex: 181011; *Sls. Mgr.:* Lou Davis

ADVANCE ENGRG., 18225 So. Hoover St., Gardena, CA 90248, Tel: 213-321-3100

AD-VANCE MAGNETICS, INC., 625 Monroe St., Rochester, IN 46975, Tel: 219-223-3158, TWX: 810-290-0294; FSC No.: 50788; Empl.: 30; *Sls. Mgr.:* Kay Nixon ..... **C•1720**

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
CA	El Cajon, A-Tronics	619-444-1501
CA	Los Altos, Frauman Assoc.	415-941-0660
CA	Woodland Hills, A-Tronics	213-703-7212
CT	Meriden, A. Allison	203-481-0405
FL	Orlando, Gillum Sales	305-857-2110
GA	Atlanta, Remco	404-447-6937
IL	Westchester, Brouillette	312-345-6500
MN	Edina, J. H. Hanson	612-893-9960
NY	Commack, RC Engrg.	516-543-3325
NC	Raleigh, Remco	919-847-5079
OH	Cincinnati, Makin Assocs.	513-871-2424
PA	W. Conshohocken, Eastern Comps.	215-825-8610
TX	Houston, Space Elctns.	713-266-9245
TX	Irving, Space Elctns.	214-251-3636
VA	Herndon, Eastern Comps.	703-368-3936

ADVANCE WIRE & CABLE, 1661 Industrial Way, Belmont, CA 94002, Tel: 415-592-4550, Telex: 334475; FSC No.: 57775; Empl.: 158; *Sls. Mgr.:* Ed Mittelbusher; *Dist. Mgr.:* Ed Mittelbusher

Local Sales Offices & Reps

AL	Decatur, Tenn Tech, Inc.	205-350-0630
AZ	Phoenix, Advance Elctrl. Sls.	602-243-4326
CA	Belmont, Advance Elctrl. Sls.	415-592-4550
CO	Denver, Advance Elctrl. Sls.	303-388-0923
FL	Palm Bay, R-Rep Co.	305-725-6993
GA	Atlanta, Tenn Tech, Inc.	404-622-5784
IL	Arlington Heights, Brainard-Wilson Mktg.	312-437-2700
IN	Carmel, Brainard-Wilson Mktg.	317-844-2800
KY	Fort Mitchell, G. W. Thelen Co.	606-341-8181
MD	Hunt Valley, Phoenix Elctrn. Sls.	301-628-2066
MA	Sharon, Adcour, Inc.	617-784-8123
MI	Pontiac, Matrix Elec.	313-338-7770
MN	Minneapolis, Jos-Co/Melius, Inc.	612-861-3343
NJ	Parlin, JMR Sls.	201-727-5335
NJ	Sicklerville, Brown Assocs.	609-629-2240
NY	Camillus, Ontec	315-672-8409
NY	East Setauket, JMR Sls., Inc.	516-689-8871
NY	Rochester, Ontec	716-464-8636
NY	Wappingers Falls, Ontec	914-462-7374
NC	Raleigh, Tenn-Tech, Inc.	919-266-3610
OH	Medina, G. W. Thelen Co.	216-723-1293
TN	Nashville, Tenn-Tech, Inc.	615-646-9811
TX	Houston, Advance Elctrl. Sls.	713-956-5436
WA	Seattle, Advance Elctrl. Sls.	206-575-4323
WI	Waukesha, Brainard-Wilson Mktg.	414-797-7940

A E CORP., 65 Wellesley Ave., Needham, MA 02194, Tel: 617-449-3142; Empl.: 10; *Sls. Mgr.:* H. Harrison

A E G TELEFUNKEN, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876, Tel: 201-722-9800, Telex: 833409; *Sls. Mgr.:* John Szafranski

A E G TELEFUNKEN, Semiconductor Grp., Rte. 22, Somerville, NJ 08876, Tel: 201-722-9800, Telex: 833409; *Sls. Mgr.:* Carl Golasa; *Dist. Mgr.:* Thomas Carlisle

AEL, INC, See American Electronic Labs

AEMC, 99 Chauncy, Boston, MA 02111, Tel: 617-451-0227, 800-343-1391, Telex: 95-1073; *Sls. Mgr.:* Jon Henderson

AERCOM, 405 Tasman Dr., Sunnyvale, CA 94086, Tel: 408-744-1320, TWX: 910-339-9308; Empl.: 50; *Sls. Mgr.:* H. Putnam

AEROCOM, 3090 S.W. 37th Ave., Miami, FL 33133, Tel: 305-448-6503, Telex: 51-9209; FSC No.: 81535; Empl.: 100; *Sls. Mgr.:* Thomas A. Coleman

AEROFLEX LABS., INTEGRATED MICROSYSTEMS DIV., See Aeroflex Labs., Microelectronics Div.

AEROFLEX LABS., MAGNETIC PRODS. DIV., 35 South Service Road, Plainview, NY 11803, Tel: 516-694-6700, TWX: 510-224-6417; Empl.: 490; *Sls. Mgr.:* Robert M. Slatkin ..... **B•1131, 1779**

Local Sales Offices & Reps

EXP	New York, Henley Overseas Sls., Inc.	212-687-9390

AEROFLEX LABS., MICROELCTRNS. DIV., 35 S. Service Rd., Plainview, NY 11803, Tel: 516-694-6700, TWX: 510-224-6417; FSC No.: 88379; Empl.: 100; *Sls. Mgr.:* Melvin D. Schwartz ..... **A•1660**

Local Sales Offices & Reps

AZ	Phoenix, The Knight Co.	602-994-1311
CA	Los Altos Hills, HB Mktg.	415-941-4080
CA	Los Angeles, The Knight Co.	213-670-2833
CA	San Diego, The Knight Co.	714-451-0529
CO	Parker, Parker Webster Co.	303-841-4888
CT	Simsbury, Multitronics Sls. Co.	203-651-0140
FL	Altamonte Springs, R. W. Mitscher Co., Inc.	305-788-6844
FL	Boca Raton, R. W. Mitscher Co., Inc.	305-368-3841
IL	Northfield, Feller Assocs., Inc.	312-446-8065
IA	Cedar Rapids, Feller Assocs., Inc.	319-364-0566
MD	Baltimore, Micro Comp, Inc.	301-247-0400
MI	Detroit, Electro Sls.	313-474-7320
MI	Kalamazoo, Electro Sls.	616-323-2416
MN	Minneapolis, International Elctrns, Inc.	612-571-0000
NJ	Cherry Hill, Danco Elctrn. Sls. Corp.	609-424-5590
NJ	Teaneck, T.J. Squared	516-864-2263
NY	Albany, Nu-Tekneex Mktg.	518-355-1829
NY	Hartsdale, T.J. Squared	516-864-2263
OH	Dayton, Electro Sls.	513-426-5551
TX	Garland, Tesco Inc.	214-681-1376
UT	Salt Lake City, Parker Webster Co.	801-266-9939
EXP	New York City, New York, Henley & Co.	212-687-9390

AEROSPACE OPTICS, INC., 3201 Sandy La., Fort Worth, TX 76112, Tel: 817-451-1141, Telex: 75-8461; Empl.: 83; *Sls. Mgr.:* R. E. Borkowski

AEROTECH, INC., 101 Zeta Dr., Pittsburgh, PA 15238, Tel: 412-963-7470, TWX: 710-795-3125; Empl.: 150; *Sls. Mgr.:* Robert Mitchell

Local Sales Offices & Reps

CA	Hermosa Beach, Aerotech West	213-376-9698
CA	Sunnyvale, Aerotech Northwest	408-738-1220
CT	Farmington, Aerotech Northeast	203-673-3330
FL	Winter Park, McMahan Assocs.	305-645-0463
MD	Rockville, Spectro Assoc.	301-279-2010
NM	Albuquerque, G. Moore Assocs.	505-262-1416
NC	Raleigh, McMahan/Zellman Assoc.	919-848-1965
OH	Columbiana, Aerotech Midwest	216-482-9957
TX	Richardson, John Moore Assocs.	214-690-4929

AEROTRONIC ASSOCS., INC., Riverside Dr., Contoocook, NH 03229, Tel: 603-746-4631; FSC No.: 67272; Empl.: 225; *Sls. Mgr.:* Gary Moravchik

AERTECH INDS., See TRW Microwave

AES CORP., 285 Newbury St., P.O. Box 2093, Peabody, MA 01960, Tel: 617-535-7310, Telex: 387852 AES CORP INTL; *Sls. Mgr.:* James F. West

A.E.S INTERCONNECTS, Box 248, Plainfield, IN 46168, Tel: 317-272-2551; FSC No.: 00529; Empl.: 150; *Sls. Mgr.:* Jim Barnes

AETNA ENGRG., P.O. Box 7749, Van Nuys, CA 91409-7749, Tel: 818-341-9409; Empl.: 6; *Sls. Mgr.:* T. W. Collins

AETNA TELECOMMUNICATIONS LABS., P.O. Box 723, 131 Flanders Rd., Westborough, MA 01581, Tel: 617-366-0400, Telex: 951356; *Sls. Mgr.:* Marjorie Katz

AFI/DATATROL, Addressograph Farrington, Inc., Brent Dr., Hudson, MA 01749, Tel: 617-568-1411; Empl.: 350; *Sls. Mgr.:* Tom Galloway

AGFA-GEVAERT, INC., 275 North St., Teterboro, NJ 07608, Tel: 201-288-4100, TWX: 710-990-6137; Empl.: 750

AHAM TOR INC (ATI), 999, 27901 Front St., Rancho California, CA 92390, Tel: 714-676-4151

AIE MAGNETICS, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210, Tel: 615-244-9024, Telex: 554466; FSC No.: 06978; Empl.: 300; *Sls. Mgr.:* J. Holeman

AIKEN ADVANCED SYS., Amstar Technical Products Company, Inc., 5901 Edsall Rd., Alexandria, VA 22304-4197, Tel: 703-370-0900, TWX: 710-832-0612; FSC No.: 60590; Empl.: 250; *Sls. Mgr.:* C. G. Gilmer

Local Sales Offices & Reps

AZ	Tucson, Aiken Advanced Sys.	602-886-3219
CA	Saratoga, Interface Intl.	408-741-0265
CO	Colorado Springs, J. Smith & Assocs.	303-597-5343
FL	Melbourne, Barkman & Assocs. Mktg.	305-254-1863
EXP	MALexington, R.J. Sickles Assocs.	617-682-5100
NM	Albuquerque, J. Smith & Assocs.	505-265-3406
NY	Brooklyn, Pensky Assocs.	718-763-4936
TX	Austin, Data Mktg. Assocs.	512-451-5174
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-780-2511
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
Can	Guelph, Ont., VALCOM	519-824-3220

AIL, DIV. CUTLER-HAMMER, See Eaton Corp. AIL Div.

AILTEC DIV. CUTLER-HAMMER, See Eaton Corp., Elctrn. Instrmn. Div.

AIMSCO INC., 4000-4024 22nd Ave. W., Seattle, WA 98199-0056, Tel: 206-284-5563, TWX: 910-444-1333; Empl.: 30; *Sls. Mgr.:* C. Ernst; *Dist. Mgr.:* E. Chadwick

AIPHONE, 1700 130th St. NE, Bellevue, WA 98005, Tel: 206-455-0510, Telex: 32-0288; Empl.: 42; *Sls. Mgr.:* Jim Morrison

AIRBORN, INC., 4321 AirBorn Dr., Addison, TX 75001, Tel: 214-931-3200, Telex: 79-4200, TWX: 910-860-5230; FSC No.: 10400;Multiple; Empl.: 350; *Sls. Mgr.:* J. L. Wolbrink ..... **C•1111-1118**

Local Sales Offices & Reps

AZ	Tempe, Piper Sls. Co.	602-949-0048
CA	Los Angeles, Air Born	213-670-7983
CA	Mountain View, Serra Assocs.	415-964-4300
CA	No. Hollywood, R. A. Strassner	213-761-1231
CA	San Diego, Ohm Spun Elctrns.	619-695-8102
FL	Melbourne, Reynolds & Assoc.	305-259-7000
IL	Des Plaines, ESCO Assoc.	312-298-5310
IA	Cedar Rapids, Dytronix	319-377-8275
KS	Wichita, Dytronix	316-838-0884
MN	Bloomington, PWC	612-831-5999
MO	Bridgeton, Dytronics, Inc.	314-291-4777
NH	Nashua, Solla - Tronics	603-882-7146
NJ	Manville, Dynorep	201-685-0135
NM	Albuquerque, Piper Sls. Co.	505-883-9090
NY	Kingston, R.P. Kennedy Co.	914-876-2700
NY	Rochester, R.P. Kennedy Co.	716-271-6322
OH	Dayton, Electro-Com	513-898-5140
OR	Beaverton, Don Smith Sls. Co.	503-643-8020
WA	Seattle, Don Smith Sls. Co.	206-633-3160
Can	Montreal, Que., Willagen Elctrns.	514-331-4283
Can	Rexdale, Ont., Willagen Elctrns.	416-675-1821

Local Distributors

TX	Addison, AirBorn Distribution Service	214-931-3200

CONTINENTAL WIRT, 130 Jamesway, South Hampton, PA 18966, Tel: 215-355-7080

AIR ELECTRO SUPPLY, INC., 7700 Gloria Ave., Van Nuys, CA 91406, Tel: 213-873-6400, 818-988-4400, Telex: 66-2459, TWX: 910-495-1794

AIR/FLEX INDS. INC., 2422 Merced Ave., S. El Monte, CA 91733, Tel: 818-579-7060; FSC No.: 22782; *Sls. Mgr.:* Karl Thorp

AIRFLYTE ELCTRNS. CO., 56 New Hook Rd., Bayonne, NJ 07002, Tel: 201-436-2230, TWX: 710-729-4489; Empl.: 70; *Sls. Mgr.:* John Piret ..... **B•1128, 1132-1137**

Local Sales Offices & Reps

CA	Culver City, Westaironics	213-641-4122
CA	Los Altos, Poltronics	415-941-3020
CT	No. Haven, Kitchen & Kutchin	203-239-0212
IL	Park Ridge, Probe Elctrns.	312-698-2044
MA	Lexington, Kitchen & Kutchin	617-862-8230
NJ	Kinnelon, Avionics Equip.	201-838-8105
NY	Rochester, R. P. Kennedy Co.	716-271-6322
PA	Philadelphia, R. P. Luce & Co.	215-884-8365
TX	Dallas, Jacobson Co.	214-363-7584

AIR LAND SYSTEMS CORPORATION, 2710 Prosperity Ave., Fairfax, VA 22031, Tel: 703-573-1100, Telex: 710-833-1174, TWX: Airland Frax; Empl.: 35; *Sls. Mgr.:* Frank Glaspell

AIRMATIC-ALLIED, 185 Park Dr., Wilmington, OH 45177, Tel: 513-382-1691; Empl.: 150

AIR MAZE CORP., 25000 Miles Rd., Cleveland, OH 44128, Tel: 216-292-6800, Telex: 98-5413; Empl.: 300; *Sls. Mgr.:* John Cummings; *Dist. Mgr.:* Bob Glasier

AIR-O-TRONICS PRODS., Box K, Morrisville, NY 13408, Tel: 315-684-3705; FSC No.: 16663; Empl.: 10; *Sls. Mgr.:* G. M. Trush

AIRPAX CORP., Woods Rd., Cambridge, MD 21613, Tel: 301-228-4600, Telex: 8-7715, TWX: 710-865-9655; FSC No.: 81541; Empl.: 550; *Sls. Mgr.:* D. Marshall ...**B•1226**

Local Sales Offices & Reps

AL	Huntsville, BCI	205-539-4411
AZ	Phoenix, Westrep	602-997-8899
CA	Pico Rivera, Westrep	213-949-2551
CA	San Diego, Westrep	714-276-0751
CO	Littleton, Lange Sls.	303-795-3600
CT	Wallingford, Selmark Assocs.	203-573-9088
FL	Ft. Lauderdale, ElectroComp	305-491-4141
GA	Chamblee, BCI	404-455-0405
IL	Palatine, Somers-Reagan, Inc.	312-991-1108
IN	Indianapolis, Leslie M. Devoe	317-842-3245
IA	Marion, Rep Assocs.	319-373-0152
MD	Baltimore, Pro-Rep, Inc.	301-653-3600
MA	Millis, Selmark	617-376-2914
MI	Troy, Pine Sls.	313-589-0350
MN	Hopkins, Peterson & Wolff	612-941-5400
MO	St. Louis, Delltron	314-869-4779
NY	Jericho, Airpax Corp.	516-822-2410
NY	Poughkeepsie, C. W. Floring	914-471-2973
NY	Rochester, Airpax Corp.	716-654-7470
NY	Syracuse, C.W. Floring & Assoc.	315-478-2144
NC	Winston-Salem, L.G. White	919-725-3612
OH	Cincinnatti, Baehr, Greenleaf	513-891-3826
OH	Cleveland, Baehr, Greenleaf	216-221-9030
OH	Columbus, Baehr, Greenleaf	614-486-4046
PA	Harleysville, T. Jackson	215-643-5560
PA	Pittsburgh, Russell F. Clark	412-242-9500
SC	Greenville, L.G. White	803-271-0630
TX	Dallas, Airpax Corp.	214-733-4377
UT	Salt Lake City, Lange Sls.	801-487-0843
VA	Richmond, L.G. White	804-740-7093
WA	Seattle, Don Smith	206-633-3160

AIRPAX CORP., Cheshire Div., Cheshire Indl. Pk., Box E, Cheshire, CT 06410, Tel: 203-272-0301, Telex: 962421, TWX: 710-455-4048; Empl.: 800; *Sls. Mgr.:* John Ricardi ..... **B•1138; D•1110**

Local Sales Offices & Reps

AL	Huntsville, B.C.I.	205-539-4411
AZ	Phoenix, Westrep	602-997-8899
CA	Anaheim, Westrep	213-404-3881
CA	San Diego, Westrep	619-276-0751
CA	Santa Clara, Airpax Corp.	408-980-0410
CO	Littleton, Lange Sls.	303-795-3600
CT	Wallingford, Selmark Assocs.	203-573-9088
FL	Ft. Lauderdale, Electrocomp Assocs.	305-491-4141
GA	Chamblee, B.C.I.	404-455-0405
IL	Palatine, Somers-Reagan, Inc.	312-991-1108
IN	Indianapolis, Leslie M. Devoe	317-842-3245
IA	Marion, Rep Assocs.	319-373-0152
MD	Baltimore, Pro-Rep, Inc.	301-653-3600
MA	Millis, Selmark Assocs.	617-376-2914
MI	Madison Heights, Pine Sls, Inc.	313-589-0350
MN	Bloomington, PWC	612-831-5999
MO	St. Louis, Delltron	314-869-4779
NH	Hopkinton, Selmark Assocs.	603-746-3299
NY	Jericho, Airpax Corp.	516-822-2410
NY	Rochester, Airpax Corp.	716-654-7470
NY	Syracuse, C.W. Floring & Assocs.	315-478-2149
OH	Cleveland, Baehr, Greenleaf & Assocs.	216-221-9030
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
PA	Harleysville, Thomas Jackson Assocs.	215-256-8877
PA	Pittsburgh, Russell F. Clark Co.	412-242-9500
SC	Greenville, L.G. White Southern, Inc.	803-271-0630
TX	Dallas, Airpax Corp.	214-733-4377
UT	Salt Lake City, Lange Sls.	801-487-0843
WA	Seattle, Don Smith Sls Co.	206-633-3160
WI	Wauwatosa, Larson Assocs.	414-258-0529

AIRPAX CORP., Ft. Lauderdale Div., 6801 W. Sunrise Blvd., Ft. Lauderdale, FL 33313, Tel: 305-587-1100, Telex: 51-4448, TWX: 510-955-9866; Empl.: 200

AIRPAX CORP., FREDERICK DIV., A North American Philips Co., Husky Park P.O. Box 500, Frederick, MD 21701, Tel: 301-663-5141, TWX: 710-862-0901; Empl.: 600; *Sls. Mgr.:* Al Knezevich; *Dist. Mgr.:* B. L. Reeder ..... **B•1263, 1742**

Local Sales Offices & Reps

AL	Huntsville, B.C.I.	205-539-4411

AZ Phoenix, Westrep 602-997-8899
CA Anaheim, Westrep 213-404-3881
CA San Diego, Westrep 619-566-6580
CA Santa Clara, Airpax Corp. 408-980-0410
CO Littleton, Lange Sls. 303-795-3600
CT Clinton, Selmark Assocs. 203-573-9088
FL Deerfield Beach, Electrocomp Assocs. 305-429-0802
GA Chamblee, B.C.I. 404-455-0405
IL Palatine, Somers-Reagan 312-991-1108
IN Indianapolis, Leslie M. De Voe Co. 317-842-3245
IA Marion, Rep Assocs., Inc. 319-373-0152
MD Columbia, Pro-Rep, Inc. 301-992-7460
MA Millis, Selmark Assocs. 617-376-2914
MI Madison Heights, Pine Sls. 313-589-0350
MN Edina, PWC, Inc. 612-831-5999
MO St. Louis, Delltron Co. 314-869-4779
NH Hopkinton, Selmark Assocs. 603-746-3299
NY Jericho, Airpax Corp. 516-822-2410
NY Poughkeepsie, C.W. Floring Assocs. .. 914-471-2973
NY Rochester, Airpax Corp. 716-654-7470
NY Syracuse, C.W. Floring Assocs. 315-478-2149
NC Winston-Salem, L. G. White Southern 919-725-3612
OH Cleveland, Baehr, Greenleaf & Assocs. 216-221-9030
OH Columbus, Baehr, Greenleaf & Assocs. 614-486-4046
OH Dayton, Baehr, Greenleaf & Assocs. .. 513-439-0724
PA Harleysville, Thomas Jackson Assocs. 215-256-8877
PA Pittsburgh, Russell F. Clark Co. 412-242-9500
TX Dallas, Airpax Corp. 214-867-7741
UT Salt Lake City, Lange Sls. 801-487-0843
WA Seattle, Don Smith Sls. 206-633-3160
WI Wauwatosa, Larson Assocs. 414-258-0529

Local Distributors

CA Santa Ana, Norstan Elctrns. 714-540-4165
OK Tulsa, Altair 918-665-0524
TX Houston, Altair 713-462-3029
TX Richardson, Altair 214-231-5166

AIRPOT, 27 Lois St., Norwalk, CT 06851, Tel: 203-846-2021, Telex: 643-688; *Sls. Mgr.:* Mark A. Gaberman

AIRTRON, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950, Tel: 201-539-5500, TWX: 710-986-7473; FSC No.: 80006; Empl.: 350

AIR-VAC ENGRG., 100 Gulf St., Milford, CT 06460, Tel: 203-874-2541; Empl.: 30

AJAX MAGNETHERMIC CORP., 1745 Overland Ave., N.E., Warren, OH 44482, Tel: 216-372-8511, Telex: 098-2482; Empl.: 500

AKG ACOUSTICS, INC., 77 Selleck St., Stamford, CT 06902, Tel: 203-348-2121; Empl.: 40; *Sls. Mgr.:* Peter Wellikoff

AKRO-MILS, 1293 S. Main St., Akron, OH 44301, Tel: 216-253-5593, Telex: 98-6321; Empl.: 200; *Sls. Mgr.:* W. J. Tonachio; *Dist. Mgr.:* D. Martin

ALADDIN ELCTRNS., See AIE Div. of Vernitron

ALAN GORDON ENTPRS., INC., P.O. Box 3914, 5362 Cahuenga Blvd., N. Hollywood, CA 91605, Tel: 818-985-5500, Telex: 662532 A-GB FOTO. LSA, TWX: 910-321-4526 GORDON NT LSA; *Sls. Mgr.:* D. Sahlenn

ALAN INDS., P.O. Box 1203, Columbus, IN 47201, Tel: 812-372-8869; FSC No.: 52750; Empl.: 36

Local Sales Offices & Reps

AL Huntsville, Saber Assocs. 800-327-0853
CA Los Angeles, RF Assocs. 213-478-1586
CA Palo Alto, RF Assocs. 415-494-3331
FL Bradenton, Saber Assocs. 800-327-0853
FL Longwood, Saber Assocs. 800-327-0853
FL Melbourne, Saber Assoc. 800-327-0853
GA Griffin, Saber Assocs. 800-327-0853
MD Randallstown, C. L. Malinow & Co. 301-922-2092
MA Needham, Addelco Corp. 617-444-4754
NY Liverpool, R. & D. Assocs. 315-457-0100
NY New Rochelle, Ascor Elctrns. 914-235-8838
NC Clayton, Saber Assocs. 800-327-0853
OH Dayton, Frederic L. Ohmer 513-434-1454
PA Lafayette Hill, M. Lader Co. 215-825-3177
SC Columbia, Saber Assoc. 800-327-0853
TX Dallas, Airep Elctrns. 214-349-4360
TX Houston, Airep Elctrns. 713-944-2055
EXP CT, Stamford, Dage Corp. 203-324-3123

ALARM CONTROLS, 19 Brandywine Dr., Deer Park, NY 11729, Tel: 516-586-4220; FSC No.: 55042; Empl.: 50; *Sls. Mgr.:* Howard Berger

ALASCO RUBBER & PLASTICS CORP., 617 Mountain View Ave. # 7, Belmont, CA 94002, Tel: 415-595-4100; FSC No.: 13862; Empl.: 25; *Sls. Mgr.:* Philip K. Nordberg

ALBAR, INC., 19013 36th Ave. W., Lynnwood, WA 98036, Tel: 206-771-4006; Empl.: 20; *Sls. Mgr.:* Merv Eaton

ALBEROX, New Bedford Ind'l. Pk., New Bedford, MA 02745, Tel: 617-995-1725; Empl.: 140 ..... **C•1617**

Local Sales Offices & Reps

CA Los Gatos, Alberox Corp. 408-358-1714
IL Chicago, Karl D. Engle Co. 312-539-1820
IN Indianapolis, Butler Components 317-253-5143
MA Weston, J. Goode Assocs. 617-235-3900
MI Birmingham, Clifford Armstrong Co. ... 313-851-1404
MN Minneapolis, Magner & Assocs. 612-483-0656
NY Fayetteville, S. F. Foster Co. 315-637-5427
NY Valley Stream, Levison Sls. 516-561-9696
OH Cleveland, Greenleaf & Assocs. 216-333-5480
PA Philadelphia, Shelton Sls. Corp. 215-248-0131
TX Dallas, C. M. Farmer Co., Inc. 214-339-4970
WA Seattle, Demarest Assocs. 206-523-3210

ALCO ELCTRN. PRODS., INC., 1551 Osgood St., N. Andover, MA 01845, Tel: 617-685-4371, TWX: 710-342-0552; Empl.: 300 ..... **B•1481-1483**

Local Sales Offices & Reps

AL Huntsville, Glen White Assocs. Inc. 205-883-7938
AZ Phoenix, Knight Co. 602-582-8506
CA Los Angeles, Knight Co. 213-670-2833
CA Redwood City, J. Heaton Co. 415-367-9000
CA San Diego, Knight Co. 619-571-7903
CO Littleton, Simpson & Assocs. 303-794-8381
FL Safety Harbor, Augat/ALCO 813-725-1037
FL Tamarac, Augat/ALCO 305-721-6021
GA Norcross, Glen White Assocs. Inc. 404-441-1447
IN Indianapolis, Rockford Controls 317-248-2518
MA Norwood, Augat Sls. 617-762-3164
MI Livonia, Luebbe Sls. Co. 313-477-3131
MN St. Paul, Countryman Assocs. 612-645-9151
NM Albuquerque, C. T. Carlberg & Assoc. 505-888-3883
NY E. Rochester, Tri-Tech Elctrns. 716-385-6500
NY Endwell, Tri-Tech Elctrns. 607-754-1094
NY Fayetteville, Tri-Tech Elctrns. 315-446-2881
NY Fishkill, Tri-Tech Elctrns. 914-897-5611
NY Great Neck, Cooper-Simon & Co. Inc. 516-487-1142
NC Raleigh, Glen White Assocs. Inc. 919-787-7023
OH Cincinnati, Luebbe Sls. Co. 513-891-5770
OH Cleveland, Luebbe Sls. Co. 216-333-0425
OH Columbus, Luebbe Sls. Co. 614-431-0474
OH Dayton, Luebbe Sls. Co. 513-294-0426
OR Beaverton, D. Smith Sls. Co. 503-643-8020
PA Pittsburgh, Luebbe Sls. Co. 412-931-0414
PA Trevose, P.S.A., Inc. 215-245-0513
TN Gray, Glen White Assocs. Inc. 615-477-8850
TX Dallas, Augat/ALCO 214-788-4211
TX Georgetown, Augat/ALCO 512-479-9447
TX Houston, Augat/ALCO 713-495-3100
UT Midvale, Simpson Assocs. Inc. 801-566-3691
VA Lynchburg, P.S.A. Inc. 800-233-4242
VA McLean, P.S.A. Inc. 800-233-4242
WA Seattle, D. Smith Sls. Co. 206-633-3160

Local Distributors

AL Huntsville, Arrow Elctrns. 205-882-2730
AL Huntsville, Hall-Mark Elexs. 205-837-8700
AZ Phoenix, Hall-Mark Elexs. 602-437-1200
AZ Phoenix, Kachina Elctrns. 602-269-6201
AZ Tempe, Acacia Sls. 602-894-2874
AR Little Rock, Carlton-Bates 501-562-9100
CA Burbank, Switching Devices 213-849-3211
CA Chatsworth, Arrow Elexs. 213-701-7500
CA Gardena, CA Switch & Signal 213-770-2330
CA Hollywood, Yale Radio Electric 213-465-3186
CA Irvine, Acacia Sales 714-660-0834
CA Los Angeles, Electric Switch 213-664-1141
CA Mountain View, Abacus Elctrns. 415-961-1500
CA Newport Beach, Arrow Elexs. 714-851-8961
CA Palo Alto, Zack Elctrns. 415-326-5432
CA Pasadena, Dow Radio 213-793-1195
CA Riverside, Elctrn. Supp. 714-683-7300
CA San Diego, Acacia Sls. 619-565-4365
CA San Diego, Arrow Elexs. 619-565-4800
CA San Diego, El-Com Inc. 619-578-0900
CA San Diego, Hall-Mark Elexs. 619-268-1201
CA San Francisco, Steven Engrg. 415-588-9200
CA San Jose, Hall-Mark Elexs. 408-946-0900
CA San Jose, Ratel Inc. 408-946-4300
CA Santee, Mouser Elexs. 619-449-2300
CA Sunnyvale, Acacia Sls. 408-745-7200
CA Sunnyvale, Arrow Elexs. 408-745-6600
CA Van Nuys, Pacific Switch Controls 213-873-4802
CO Denver, Arrow Elexs. 303-758-2100
CO Denver, Ragon Elexs. 303-744-1992
CO Englewood, Hall-Mark Elexs. 303-694-1662
CO Lakewood, Acacia Sls. 303-232-2882
CT Greenwich, Wise Comps. 203-531-4880
CT Hartford, Wes-Garde 203-525-6907
CT Stratford, Utronics 203-378-4201
CT W. Hartford, Atlantic Switch Controls .. 203-527-7705
CT Wallingford, Arrow Elexs. 203-265-7741
FL Ft. Lauderdale, Arrow Elexs. 305-776-7790
FL Ft. Lauderdale, Hall-Mark Elexs. 305-971-9280
FL Lakeland, Switch Controls 813-644-7564
FL Miami, Elctrn. Equip. 305-871-3500
FL Orlando, Hall-Mark Elexs. 305-855-4020
FL Orlando, Hammond Elctrns. 305-849-6060
FL Palm Bay, Arrow Elexs. 305-725-1480
FL Pompano Beach, Components South 305-971-0350
GA Norcross, Arrow Elexs. 404-449-8252
GA Norcross, Hall-Mark Elexs. 404-447-8000
IL Arlington Heights, Lo Dan Elctrns. 312-398-5311
IL Bensenville, Diplomat/Illinois 312-595-1000
IL Chicago, Newark Elctrns. 312-638-4411
IL Glen Ellyn, Rockford Controls Co. 312-469-6016
IL Itasca, Voyager Elexs. Corp. 312-773-4900
IL Palatine, OHM Elexs. 312-359-5500
IL Rockford, Midwest Assocs. Inc. 815-962-8036
IL Rosemont, Advent Elctrns. 312-298-4210
IL Schaumberg, Arrow Elexs. 312-397-3440
IL Wheaton, Conectrix 312-653-1460
IN Indianapolis, Arrow Elexs. 317-243-9353
IN Indianapolis, Graham Elexs. 317-634-8202
IN Indianapolis, Neunier Elex. Supply 317-635-3511
IN South Bend, Genesis Elctrns. 219-287-2911
IA Cedar Rapids, Arrow Elexs. 319-395-7230
IA Cedar Rapids, Deeco Inc. 319-365-7551
KS Lenexa, Hall-Mark Elexs Corp. 913-888-4747
KS Witchita, Lee Products 316-264-2172
MD Baltimore, A. S. I. 301-265-5100
MD Baltimore, Arrow Elexs 301-247-5400
MD Gaithersburg, Pioneer Wash. 301-921-0660
MD Kensington, Marine Air Supp. 301-949-9560
MD Rockville, Arrow Elexs 301-251-0644
MA Burlington, Heilind Elexs 617-272-5610
MA Canton, H. Young Jr. Co. 617-828-4880
MA Canton, Impact Sls. 617-821-1500
MA Hingham, Sager Elec. Supp. 617-749-6700
MA Lynn, Land Elctrns. 617-592-2220

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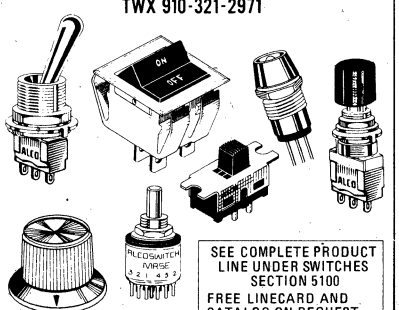

SEE COMPLETE PRODUCT LINE UNDER SWITCHES SECTION 5100
FREE LINECARD AND CATALOG ON REQUEST

MA Norwood, Gerber Elctrns. 617-769-6000
MA Woburn, Arrow Elexs 617-933-8130
MA Woburn, CNC 617-933-5017
MI Ann Arbor, Arrow Elexs 313-971-8220
MI Farmington Hills, Advent Elctrns. 313-477-1650
MI Grand Rapids, Arrow Elexs 616-243-0912
MI Zeeland, Tubergen & Assocs. Inc. 616-772-1548
MN Edina, Arrow Elexs 612-830-1800
MN Minneapolis, Newark Elexs 612-331-6350
MN St. Paul, Ragon 612-642-2828
MO Kansas City, Walter's Radio Supply ... 816-531-7015
MO Maryland Heights, Hall-Mark Elexs. ... 314-291-5350
MO St. Louis, Arrow Elexs. 314-426-4500
MO St. Louis, Olive Elctrn. Supp. 314-426-4500
MO St. Louis, Van Sickle Elexs. 314-621-5000
NH Manchester, Arrow Elexs. 603-668-6968
NJ Bellmawr, Mid Atlantic Elctrns. 609-931-5303
NJ Camden, General Radio 609-961-8560
NJ Clifton, J-Mar Elexs. Inc. 201-772-6400
NJ E. Marlton, Arrow Elexs. 609-596-8000
NJ Fairfield, Arrow Elctrns. 201-575-5300
NJ Springfield, Federated Purchaser 201-272-0505
NM Albuquerque, Arrow Elexs. 505-243-4566
NM Albuquerque, Walker Elex. Sup. 505-242-2288
NY Buffalo, Summit Distrs. 716-884-3450
NY Farmingdale, Arrow Elctrns. 516-293-4020
NY Hauppauge, Arrow Elexs. 516-231-1000
NY Hauppauge, Broadline Elexs. 516-231-4100
NY Hempstead, Elctrn. Equip. 516-538-5510
NY Liverpool, Arrow Elexs. 315-652-1000
NY Lynbrook, Peerless Radio 516-593-2121
NY Melville, Arrow Elexs. 516-694-6800
NY Rochester, Arrow Elexs. 716-275-0300
NY Rochester, Simcona Elctrns. 716-328-3230
NY Vestal, Pioneer/Harvey 607-748-8211
NC Raleigh, Arrow Elexs. 919-725-8711
NC Raleigh, Hall-Mark Elex. Inc. 919-722-9131
NC Winston-Salem, Arrow Elexs. 919-725-8711
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Centerville, Arrow Elexs. 513-435-5563
OH Cincinnati, Hughes-Peters 513-351-2000
OH Cleveland, Pruitt Energy Sources Inc. 216-566-1545
OH Columbus, Arrow Elexs. 614-885-8362
OH Columbus, Hughes-Peter 614-294-5351
OH Columbus, Ohioswitch 614-885-0319
OH Dayton, Stotts-Friedman 513-298-5555
OH Solon, Arrow Elexs. 216-248-3990
OK Tulsa, Arrow Elexs. 918-665-7700
OK Tulsa, Hall-Mark Elexs. 918-665-3200
OR Beaverton, Acacia Sales 503-646-3377
OR Beaverton, Component Resources Inc. 503-641-8188
PA Allentown, A.A. Peters 215-434-5237
PA Braddock, Leff Elexs. 412-351-5000
PA McKean, Advacom 814-476-7774
PA Monroeville, Arrow Elexs. 412-856-7000
PA Norristown, Century Elctrns. 215-631-5400
PA Philadelphia, Almo Elctrns. 215-698-4000
PA Philadelphia, Philadelphia Elexs. 215-568-7400
TN Knoxville, Indl. Elctrns. 615-573-7135
TX Austin, Arrow Elexs. 512-835-4180
TX Austin, Hall-Mark Elex. Corp. 512-258-8848
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TX El Paso, Ideal Industrial Elexs. 915-779-6643
TX Garland, Newark Elexs. 214-494-5911
TX Houston, Hall-Mark Elexs. Corp. 713-781-6100
TX Midland, E.S.I. 915-694-9657
TX Stafford, Arrow Elexs. 713-491-4100
TX Stafford, Southwest Elctrns. 713-240-4000
UT Salt Lake City, Arrow Elexs. 801-539-1135
UT Salt Lake City, Standard Supply 801-486-3371
VA Arlington, Arlington Elctrns. 703-524-2412
VA Arlington, Arrow Elexs. 804-282-0413
WA Bellevue, Almac/Stroum Elctrns. 206-643-9992
WA Bellevue, Arrow Elexs. 206-643-4800
WA Seattle, Zepher Elctrns. 206-241-1980
WI Madison, Arrow Elexs. 608-273-4977
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI Oak Creek, Arrow Elexs. 414-764-6600

ALCOSWITCH, See Alco Elctrn. Prods., Inc.

ALDEN COMPUTER SYSTEMS, 27 Strathmore Rd., Natick, MA 01760, Tel: 617-655-6610; *Sls. Mgr.:* Bob Whitten

ALDEN ELECTRONICS, INC., 40 Washington Street, Westboro, MA 01581, Tel: 617-366-8851, Telex: 94-8404; Empl.: 125; *Sls. Mgr.:* L. A. Farrington

ALDEN

ALDEN PRODUCTS CO., P.O. Box 860, 117 N. Main St., Brockton, MA 02403, Tel: 617-583-0160, Telex: 28-7793 ALDN UR; FSC No.: 01009; Empl.: 150; *Sls. Mgr.:* Donald J. Paul ..... **C•1119-1124**

Local Sales Offices & Reps

CA Tarzana, High Voltage Sales 213-881-9194
NY Babylon, Astrorep, Inc. 516-422-2500
WA Mercer Island, Electronic Comp. Sls. .. 206-232-9301

ALDES SYS., Alden Products Co., 262 N. Main St., P.O. Box 860, Brockton, MA 02403, Tel: 617-583-0160, Telex: 287 793 ALDN UR DDD, TWX: 617-583-7618; Empl.: 150; *Sls. Mgr.:* G. Morrison

A. L. DESIGN, INC., 4232 Ridge Lea Rd., Amherst, NY 14226, Tel: 716-833-6272; Empl.: 9

ALESSI INDS., INC., 3195-C Airport Loop Dr., Costa Mesa, CA 92626, Tel: 714-979-8912, TWX: 910-595-1528; *Sls. Mgr.:* Tim McFadden

ALFORD MFG. CO., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888, Tel: 617-935-8610, TWX: 710-348-1063; FSC No.: 07177; Empl.: 30; *Sls. Mgr.:* Fred Abel

ALGO, INC., 9198-C Red Branch Rd., Columbia, MD 21045, Tel: 301-730-7442; Empl.: 12; *Sls. Mgr.:* C.W. "Chuck" Alexander

Local Sales Offices & Reps

CA Novato, Ed Driscoll Assoc. 415-883-0353
FL Sarasota, Ram-Z Assoc. 813-951-9900
IL Park Ridge, Adtech Inc. 312-692-7320
MA Framingham, J.M. Lancaster Assoc. ... 617-875-8893
MO Grandview, Digital Sys. Sls. 316-685-9725
NJ Teaneck, Sci. Dvs. East 201-871-3916
OH Chesterland, EQS, Sys. Inc. 216-729-2222
TX Houston, Knox Mktg. 713-780-2516
VA Alexandria, Dyna-Repco 703-354-1222
WA Bellevue, Gerry Mara Assoc. 206-614-3535

ALINABAL, 28 Woodmont Rd., Milford, CT 06460, Tel: 203-877-3241, TWX: 710-462-1178; Empl.: 255

ALLACO PRODS. DIV., Bacon Industries, Inc., 192 Pleasant St., Watertown, MA 02172-2399, Tel: 617-926-2550, TWX: 710-327-6518; FSC No.: 99098; Empl.: 23; *Sls. Mgr.:* R.S. Cass

ALLEN AVIONICS, INC.

ALLEN AVIONICS, 224 E. 2nd St., Mineola, NY 11501, Tel: 516-248-8080 .... **A•1460-1463, 1584-1589, 2109**

Local Sales Offices & Reps

AZ Phoenix, J. F. Hurlbut Co. 602-952-2079
CA Arcadia, Van Gott & Assocs. 818-445-9728
CA Palo Alto, Adtek Assocs. 415-323-5414
CA San Diego, Van Gott & Assocs. 619-286-3633
CO Golden, J. F. Hurlbut Co. 303-279-7796
IL Elmhurst, Utronix Sls., Inc. 312-834-1100
MA Wayland, High-Tech Sls. 617-653-3838
MN Anoka, Ken Haugen & Assocs. 612-421-3595
MO Independence, Engrg. Svcs. Co. 816-254-3600
MO St. Louis, Engrg. Svcs. Co. 314-997-1515
NY Plainview, Eastern Metro Assocs. 516-931-1414
NY Rochester, J. G. Welch Assocs. 716-244-1100
NY Utica, J. G. Welch Assocs. 315-736-7821
OR Portland, Blum & Assocs., Inc. 503-643-8430
PA Huntingdon Valley, Rabal Assocs. 215-947-4825
TX Dallas, Bradenco Corp. 214-243-7261
UT Salt Lake City, J. F. Hurlbut Co. 801-973-4443
VA Alexandria, Vanguard Engrg. Sls. 703-768-1660
WA Lynnwood, Blum & Assocs., Inc. 206-775-6656
EXP CT, Stamford, Dage Corp. 203-324-3123

ALLEN-BRADLEY

ALLEN-BRADLEY CO., ELECTRONICS GROUP, Rockwell Corporation, 1201 S. Second St., Milwaukee, WI 53204, Tel: 414-671-2000, Telex: 26699 or 4311016; Empl.: 6500; *Sls. Mgr.:* Jack Kacsur; *Dist. Mgr.:* Chestley Grimsley ..... **A•1298-1301, 1784, 1787-1799, 1993-1995, 2068-2069**

Local Sales Offices & Reps

AL Birmingham, A-B Co. 205-988-4280
AK Anchorage, J. A. Tudor & Assocs. 907-344-5852
AZ Phoenix, A-B Co. 602-944-3303
AR Little Rock, C. H. Stout, Inc. 501-372-2555
CA City of Commerce, A-B Co. 213-724-5713
CA Hayward, A-B Co. 415-887-7888
CA Sacramento, A-B Co. 916-446-4064
CA San Diego, A-B Co. 619-292-4016
CO Denver, A-B Co. 303-985-8787
CT Stratford, A-B Co. 203-378-7364
FL Ft. Lauderdale, A-B Co. 305-771-0400
FL Jacksonville, A-B Co. 904-396-6010
FL Orlando, A-B Co. 305-894-9715
FL Tampa, Van & Smith Co. 813-877-8393
GA Doraville, A-B Co. 404-455-7422
ID Cedar Rapids, A-B Co. 319-377-3802
IL Chicago, A-B Co. 312-325-6750
IL Peoria, A-B Co. 309-697-8191
IL Rockford, A-B Co. 815-229-0920
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IA Bettendorf, A-B Co. 319-355-5316
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MD Baltimore, A-B Co. 301-265-5600
MA Framingham, A-B Co. 617-879-5900
MA Holyoke, A-B Co. 413-533-3962
MI Flint, A-B Co. 313-733-3560
MI Grand Rapids, A-B Co. 616-455-2250
MI Kalamazoo, A-B Co. 616-344-6163
MI Lansing, A-B Co. 517-349-6903
MI Madison Heights, A-B Co. 313-583-9400
MN Minneapolis, A-B Co. 612-781-3406
MS Jackson, A-B Co. 601-969-1811
KS Kansas City, A-B Co. 913-371-5668
MO Maryland Heights, A-B Co. 314-291-0083
NE Omaha, A-B Co. 402-592-2010
NJ Bloomfield, A-B Co. 201-338-4600
NM Albuquerque, A-B Co. 504-881-7270
NY Albany, A-B Co. 518-869-5373
NY Buffalo, A-B Co. 716-634-2711
NY Plainview, A-B Co. 516-349-1445
NY Rochester, A-B Co. 716-235-0080
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NC Charlotte, A-B Co. 704-394-9341
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OH Akron, A-B Co. 216-253-2106
OH Cincinnati, A-B Co. 513-793-7580
OH Cleveland, A-B Co. 216-442-0000
OH Columbus, A-B Co. 614-882-7722
OH Dayton, A-B Co. 513-435-7220
OH Toledo, A-B Co. 419-841-7726
OK Tulsa, A-B Co. 918-663-5120
OR Eugene, J. A. Tudor & Assoc. 503-686-1252
OR Portland, J. A. Tudor & Assoc. 503-288-5154
PA Bethlehem, A-B Co. 215-868-3131
PA Erie, A-B Co. 814-864-3066
PA King of Prussia, A-B Co. 215-337-1990
PA Pittsburgh, A-B Co. 412-923-1844
PA York, A-B Co. 717-848-2239
SC Charleston, A-B Co. 803-722-4073
SC Greenville, A-B Co. 803-268-9200
TN Knoxville, A-B Co. 615-588-0591
TN Memphis, C. H. Stout Co. 901-362-1616
TN Nashville, A-B Co. 615-366-7340
TX Austin, A-B Co. 512-467-0569
TX Dallas, A-B Co. 214-258-7767
TX Houston, A-B Co. 713-590-8282
TX San Antonio, A-B Co. 512-732-4362
UT Salt Lake City, Stevens Sls. Co. 801-487-8971
VA Richmond, A-B Co. 804-794-6900
WA Seattle, J. A. Tudor & Assoc. 206-682-7444
WA Spokane, J. A. Tudor & Assoc. 509-327-3328
WV Nitro, A-B Co. 304-755-8193
WI Appleton, A-B Co. 414-731-3202
WI Milwaukee, A-B Co. 414-671-2000
WY Casper, A-B Co. 307-266-4336

Local Distributors

AZ Phoenix, Schweber Elctrns. 602-997-4874
AZ Phoenix, Wyle Labs. 602-249-2232
CA Canoga Park, Marshall Inds. Elctrns. Grp. 818-999-5001
CA El Monte, Marshall Inds. Elctrns. Grp.... 818-442-7204

CA El Segundo, Wyle Labs. 213-322-8100
CA Irvine, Marshall Inds. Elctrns. Grp. 714-556-6400
CA Irvine, Schweber Elctrns. 714-863-0200
CA Irvine, Wyle Labs. 714-863-9953
CA Rancho Cordova, Wyle Labs. 916-638-5282
CA San Diego, Wyle Labs. 619-565-9171
CA Santa Clara, Schweber Elctrns. 408-748-4700
CA Santa Clara, Wyle Labs. 408-727-2500
CA Sunnyvale, Marshall Inds. Elctrns. Grp. 408-732-1100
CO Thornton, Wyle Distbn. Grp. 303-457-9953
CT Danbury, Schweber Elctrns. 203-748-7080
FL Hollywood, Schweber Elctrns. 305-927-0511
FL Orlando, Hammond Elctrns., Inc. 305-849-6060
GA Atlanta, Schweber Elctrns. 404-449-9170
IL Chicago, Newark Elctrns. 312-638-4411
IL Palatine, Ohm Elctrns., Inc. 312-359-5500
IN Ft. Wayne, Graham Elctrns. Supp., Inc. 219-423-3422
IN Indianapolis, Graham Elctrns. Supp., Inc. 317-634-8202
MD Gaithersburg, Schweber Elctrns. 301-840-5900
MA Bedford, Schweber Elctrns. 617-275-5100
MA Burlington, Marshall Elctrns. Grp. 617-272-8200
MI Livonia, Schweber Elctrns. 313-525-8100
MN St. Paul, Ragon Elctrns. 612-642-2828
MO Independence, Ragon Elctrns. 816-254-3410
MO St. Louis, Olive Elctrns., Inc. 314-426-4500
NJ Fairfield, Marshall Inds. Elctrns. Grp. 201-882-0320
NJ Fairfield, Schweber Elctrns. 201-227-7880
NY Hauppauge, Fairmont Elctrns. Sls. Corp. 516-231-3313
NY Rochester, Schweber Elctrns. 716-424-2222
NY Westbury, Schweber Elctrns. 516-334-7474
NC Greensboro, Hammond Elctrns., Inc. 919-275-6391
OH Cleveland, Schweber Elctrns. 216-464-2970
OH Columbus, Electronics Mktg. Corp. 614-229-4161
OR Hillsboro, Wyle Labs. 503-640-6000
PA Philadelphia, Almo Elctrns. Corp. 215-698-4000
TX Fort Worth, TTI, Inc. 817-831-0441
TX Houston, Harrison Equip. Co., Inc. 713-879-2600
TX Richardson, Wyle Labs. 214-235-9953
UT Salt Lake City, Wyle Labs. 801-974-9953
WA Bellevue, Wyle Labs. 206-453-8300
WI Milwaukee, Marsh Elctrns., Inc. 414-475-6000
Can Montreal, Quebec, Cesco Elctrns. Ltd. 514-735-5511
Can Quebec, Cesco Elctrns. Ltd. 418-524-4641
Can Toronto, Ont., Cesco Elctrns. Ltd. 416-661-0220

ALLEN-BRADLEY CO., Industrial Control Div., 1201 S. Second St., Milwaukee, WI 53201, Tel: 414-671-2000, Telex: 26699, TWX: 4311016; Empl.: 1600; *Dist. Mgr.:* Bob Anderson

ALLEN-BRADLEY CO., ELECTRONICS GROUP, Div. of Rockwell Corp., Magnetic Products Div., 5900 N. Harrison St., Shawnee, OK 74801, Tel: 405-275-2100, Telex: 796-208; *Sls. Mgr.:* Carl Tufts ..... **A•1298-1301**

ALLEN-BRADLEY CO., ELECTRONICS GROUP, Div.of Rockwell Corp., Microelectronic Products Div., Highway 29 N. Bryan Pk. Exit, Greensboro, NC 27410, Tel: 919-621-9010; *Sls. Mgr.:* Jack Polakowski ..... **A•2068-2069**

ALLEN-BRADLEY CO., ELECTRONICS GROUP, Div. of Rockwell Corp., Resistive Products Div., 1414 Allen-Bradley Dr., El Paso, TX 79935, Tel: 915-592-4888, Telex: 749-400; *Sls. Mgr.:* Jim Hadfield ..... **A•1993-1995**

ALLEN CO., INC., ROBERT G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, Tel: 818-765-8300, 800-423-3186, Telex: 18-2699; *Sls. Mgr.:* Carl M. Witas

ALLEN DATAGRAPH, INC., 24 Keewaydin Dr., Salem, NH 03079, Tel: 603-893-1983, TWX: 710-366-0504; *Sls. Mgr.:* David Colinan

ALLEN MFG., 22 E. Dudley Town Rd., Bloomfield, CT 06002, Tel: 203-242-8511, Telex: 710-425-0099; Empl.: 420; *Sls. Mgr.:* M. Kubick; *Dist. Mgr.:* M. Kubick

ALLIED CORP. AEROSPACE SECTOR, Bendix Communications Div., East Joppa Rd., Towson, MD 21204, Tel: 301-583-4000, TWX: 710-232-1823; Empl.: 1350; *Sls. Mgr.:* Palmer H. Arnold

ALLIED PRECISION ELCTRNS., 1816 C. Ponderosa, College Station, TX 77840, Tel: 409-693-5397; Empl.: 10; *Sls. Mgr.:* Charles Johnson/Dewey Liccioni

ALLIED SYSTEMS CORP., Box 18077, Greensboro, NC 27419, Tel: 919-299-2294; Empl.: 25; *Sls. Mgr.:* E. V. Saude

ALLMETAL SCREW PRODUCTS CO., INC., 821 Stewart Ave., Garden City, NY 11530, Tel: 516-222-1200, TWX: 510-222-8132; Empl.: 200; *Sls. Mgr.:* Fred C. Sidebotham

ALL-STATES, INC., 1801 W. Foster Ave., Chicago, IL 60640, Tel: 312-728-0525; FSC No.: 26863; *Sls. Mgr.:* E. J. Marinelli; *Dist. Mgr.:* E. J. Marinelli

ALLTECH ASSOCS. INC., Applied Science Labs., 2051 Waukegan Rd., Deerfield, IL 60015, Tel: 312-948-8600, Telex: 687-1132; FSC No.: 36-2696920; *Sls. Mgr.:* Pat Krebs

ALMOND INSTRUMENTS, See EG & G Almond Instruments

ALMOR CO., INC., PO Box 1790, 155 Crescent St., Brockton, MA 02403, Tel: 617-586-5406; *Sls. Mgr.:* Bill Wolfreys

ALPHA COMPS., 115 Eucalyptus Dr., El Segundo, CA 90245, Tel: 213-322-7780; Empl.: 12

ALPHA COMPS., 1106 E. Simpson Rd., Mechanicsburg, PA 17055, Tel: 717-697-8595, TWX: 510-650-4930; FSC No.: 52748

ALPHA DATA, 20750 Marilla St., Chatsworth, CA 91311, Tel: 818-882-6500, TWX: 910-494-4914; FSC No.: 7025; Empl.: 30; *Sls. Mgr.:* James S. Howard

Distributor

ALPHA DISTR. CORP., 550 E. Royalton Rd., Cleveland, OH 44147, Tel: 216-526-3716 ..... pgs. **643, 713, 815**

ALPHA INDS., INC.-MICROELECTRONIC DIV., 2800 Crystal Drive, Hatfield, PA 19440, Tel: 215-822-1311, TWX: 510-661-7370; FSC No.: 17540; *Sls. Mgr.:* Joe Diesso

ALPHA INDS., INC., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843, Tel: 617-681-8520, Telex: 949436, TWX: 710-342-8033; FSC No.: 17540; *Sls. Mgr.:* Frank Tarr

ALPHA INDS., INC.-MSD DIV., 20 Sylvan Rd., Woburn, MA 01801, Tel: 617-935-5150, Telex: 949436, TWX: 710-393-1236; FSC No.: 17540; *Sls. Mgr.:* Peter K. Butler; *Dist. Mgr.:* Nicholas Bishop

ALPHA INDS., INC., 20 Sylvan Rd., Woburn, MA 01801, Tel: 617-935-5150, Telex: 949436, TWX: 710-393-1236; FSC No.: 17540; Empl.: 1200

ALPHA INDS., INC. - TRG MILLIMETER COMP., 20 Sylvan Rd., Woburn, MA 01801, Tel: 617-935-5150, Telex: 949436, TWX: 710-393-1236; FSC No.: 17540; *Sls. Mgr.:* Peter K. Butler; *Dist. Mgr.:* Nicholas Bishop

ALPHA-M CORP., 3009 Wildflower Dr., Dallas, TX 75229, Tel: 214-620-0021; Empl.: 8; *Sls. Mgr.:* W. L. Cowley

Local Sales Offices & Reps
CA Panarama City, Viking Sls. 213-997-3933
FL Clearwater, Brennan Assocs. 313-446-5006
IN Indianapolis, Sukop & Cox 317-253-5501
MN Minneapolis, Heilites 612-861-6051
TX Dallas, Merit Co. 214-620-0021
WA Bellevue, Topp Engr. Sls. 206-747-5400

ALPHA MERICS CORP., 20931 Nordhoff St., Chatsworth, CA 91311, Tel: 818-709-1155, Telex: 182314, TWX: ALPHA-MER-CHCA 910-494-1931; *Sls. Mgr.:* Mark McGrew; *Dist. Mgr.:* Mark McGrew

ALPHA METALS, 600 Rte 440, Jersey City, NJ 07304, Tel: 201-434-6778, Telex: 12-5798; Empl.: 400; *Sls. Mgr.:* T. Marks

ALPHA PRODUCTS, INC., 5740 Corsa Ave. #104, Westlake Village, CA 91362, Tel: 818-889-9304

ALPHA-TEK, 7286 Murdy Circle, Huntington Beach, CA 92647, Tel: 714-847-7515

ALPHA WIRE CORP., 711 Lidgerwood Ave., P.O. Box 711, Elizabeth, NJ 07207, Tel: 201-925-8000, Telex: 6853017, TWX: 710-996-5895; Empl.: 575; *Sls. Mgr.:* Paul Dietlin

ALPS ELECTRIC (USA), INC., 3553 N. First St., San Jose, CA 95134, Tel: 408-946-6000, Telex: 157061; Empl.: 62 ..... **D•1057**

Local Sales Offices & Reps
AL Huntsville, Jack Harvey & Assocs. 205-536-4414
AZ Phoenix, Eltron 602-266-2164
CA Garden Grove, West Electronic Sls. Co. 714-829-0120
CA San Diego, Harvey King, Inc. 619-566-5252
CA Santa Clara, Nova-Tronix 408-727-9530
CO Englewood, Nelligan Co. 303-761-2121
CT Yalesville, Technology Sls. 203-269-8853
FL Clearwater, Jack Harvey & Assocs. 813-725-1841
FL Ft. Lauderdale, Jack Harvey & Assocs. 305-763-1945
GA Norcross, Jack Harvey & Assocs. 404-449-4643
IL Arlington Hgts., Micro Sls. 312-956-1000
IN Indianapolis, Alps Elec. (USA) 317-248-2577
IN Indianapolis, Jack Harvey & Assocs. 317-872-1031
IN Kokomo, Jack Harvey & Assocs. 317-453-4260
KS Kansas City, BC Electronic Sls. 913-342-1211
KS Wichita, BC Elctrn. Sls. 316-942-9840
KY Prospect, Jack Harvey & Assocs. 502-228-4100
MD Baltimore, Burgin-Kreh Assocs., Inc. 301-265-8500
MA Waltham, Technology Sls. 617-647-5700
MI Oak Park, A. Blumenberg Assocs. 313-968-3230
MN Minneapolis, PSI 612-944-8545
MO St. Louis, BC Elec. Sls. 314-291-1101
NJ Boonton, PAF Assocs. 201-335-0680
NY Albany, Reagan/Compar Albany 518-489-4777
NY Endwell, Reagan/Compar 607-723-8743
NY Fairport, Reagan/Compar 716-271-2230
NY New Hartford, Reagan/Compar 315-732-3775
NY Rockville Centre, Alps Elec. (USA) 516-766-3636
NY Smithtown, PAF Assocs. 516-360-0940
NC Greensboro, Wallace Elctrn. Sls. 919-996-2742
OH Rocky River, Norm Case Assocs. 216-333-0400
OK Tulsa, Norcom 918-832-7747
OR Aloha, Venture Elctrns. 503-642-9090
PA Willow Grove, Harry Nash Assocs. 215-657-2213
TN Johnson City, Jack Harvey & Assocs. 615-928-7588
TX Austin, Norcom 512-451-2757
TX Dallas, Norcom 214-386-4888
TX Houston, Norcom 713-778-0392
UT Salt Lake City, Nelligan Co. 802-261-1121
VA Lynchburg, Burgin-Kreh Assocs., Inc. 804-239-2626
WA Bellevue, Venture Elctrns. 206-454-4594
WI Milwaukee, Micro Sls., Inc. 414-782-1171

ALTEC LANSING, Altec Corp., 1250 N. Red Gum St., Anaheim, CA 92806, Tel: 714-632-7117, Telex: 665415; Empl.: 200; *Sls. Mgr.:* Gayle Campbell

ALTEK CO., P.O. Box 1128, Torrington, CT 06790, Tel: 203-482-7626; FSC No.: 53939; Empl.: 34; *Sls. Mgr.:* Stephen Altschuler

ALTEK CORP., 2150E Indl. Pkwy., Silver Spring, MD 20904, Tel: 301-622-3906, TWX: 710-825-0422; Empl.: 55; *Sls. Mgr.:* Lowell Nerenberg; *Dist. Mgr.:* Lowell Nerenberg

ALTUS CORP., 1610 Crane, San Jose, CA 95112; *Sls. Mgr.:* Don Keil

ALUMA TOWER CO., 1639 Old Dixie Hwy., Box 2806, Vero Beach, FL 32960, Tel: 305-567-3423, Telex: 803405

ALUMINUM FILTER, P.O. Box 1311, Santa Barbara, CA 93102, Tel: 805-684-7651, Telex: 658325, TWX: 910-336-1113; FSC No.: 17504; Empl.: 120; *Sls. Mgr.:* B. L. Baker

Local Sales Offices & Reps
CA Fremont, Vontek 415-651-7966
CA Reseda, Jerry Budenz & Assocs. 818-342-4276
CO Louisville, X-O Sales Inc. 303-666-7690
MA Brookline, Harman & Assocs. 617-232-6687
MN Edina, Peterson & Wolff 612-941-5400
OK Tulsa, NTR/Data Comp., Inc. 918-664-2180

Local Distributors
AZ Tucson, Air Filtration Prds. 800-528-1585

ALZBEAR CORP., 15411 Red Hill Ave., Unit F, Tustin, CA 92680, Tel: 714-557-0910; Empl.: 45; *Sls. Mgr.:* Al Robinson; *Dist. Mgr.:* Al Robinson

AMATOM ELCTRN. HARDWARE, 446 Blake St., New Haven, CT 06515, Tel: 203-397-3311, Telex: 963-419; FSC No.: 06540; Empl.: 55; *Sls. Mgr.:* Vince Maida

AMBER ELECTRO DESIGN INC., 4810 Jean Talon Blvd. W Ste 321, Montreal, Quebec, Canada H4P2N5, Tel: 514-735-4105, Telex: 05-827598; Empl.: 12; *Sls. Mgr.:* Wayne Jones

AMBI-TECH INDS., 319 Knickerbocker Ave., Hillsdale, NJ 07642, Tel: 201-666-0504; Empl.: 20; *Sls. Mgr.:* Al Nagler; *Dist. Mgr.:* Al Nagler

AMBROID CO., P.O. Box 1089, Taunton, MA 02780, Tel: 617-823-1726; Empl.: 10; *Sls. Mgr.:* J. F. Strauss

AMCO ENGRG., 3801 N. Rose St., Schiller Pk., IL 60176, Tel: 312-671-6670, TWX: 910-227-3152; Empl.: 350; *Sls. Mgr.:* F. A. Johnson ..... **C•1006-1007, 1625**

Local Sales Offices & Reps

AL	Huntsville, Kemp Instrs.	205-837-4304
AZ	Phoenix, The Knight Co.	602-994-1311
CA	Burlingame, The Knight Co.	415-697-2525
CA	Escondido, The Knight Co.	619-743-5136
CA	Los Angeles, Knight Co.	213-670-2833
CA	Orange County, Knight Co.	714-833-8250
CA	San Diego, Knight Co.	619-743-5136
CO	Englewood, FG Mktg. Co.	303-795-9176
CT	Stratford, Instr. Dynamics	203-378-6019
FL	Clearwater, WMM Assocs.	813-461-7074
GA	Atlanta, Kemp Instrs.	404-452-8050
IL	Schiller Park, R. L. Lang & Assocs.	312-671-3228
IN	Ft. Wayne, Aktron Corp.	219-747-3650
IA	Davenport, Rush & West	319-326-3091
KS	Olathe, Rush & West	913-764-2700
LA	Lafayette, Kemp Engrg.	318-269-9452
MD	Silver Spring, L. G. White & Co.	301-434-1555
MA	Wakefield, Instr. Dynamics	617-245-5100
MI	Livonia, Electro Sls. Assocs.	313-474-7320
MN	St. Paul, Bonament Heyda Co.	612-484-8531
MO	Ballwin, Rush & West	314-394-7271
NJ	Woodcliff Lake, J. Freid & Assocs.	201-391-6792
NM	Albuquerque, C. T. Carlberg Assocs.	505-888-3883
NY	Fairport, Naco Elctrns.	716-223-4490
NY	Great Neck, F & F Metro, Inc.	516-482-4080
NY	Syracuse, NACO Elctrns.	315-699-2651
NY	Utica, Naco Elctrns.	315-732-1801
NC	Winston Salem, L. G. White & Co.	919-725-3612
OH	Cleveland, Electro Sls. Assocs.	216-261-5440
OH	Dayton, Electro Sls. Assocs.	513-426-5551
OK	Tulsa, Don Shuhart Co.	918-747-4136
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
PA	Allison Park, Electro Sls. Assocs.	412-487-3801
PA	Edgemont, White/Whiddett Co.	215-353-6343
SC	Greenville, L. G. White & Co.	803-271-0630
TX	Dallas, Don Shuhart Co.	214-349-6000
TX	Houston, Kemp Engrg.	713-466-1465
VA	Richmond, L. G. White & Co.	804-740-7093
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
EXP	NJ, Mahwah, Intl. Sls. Div.	201-825-0473

AMDAHL COMMUNICATIONS SYS. DIV., Amdahl Corp., 2500 Walnut Ave., Marina del Rey, CA 90291, Tel: 213-822-3202; Empl.: 350

AMECON, INC., 1900 S. Chris La., Anaheim, CA 92805, Tel: 714-634-2220, 800-392-2292, TWX: 510-1000-364; *Sls. Mgr.:* Frank Carleone ..... **A•2110-2117**

AME CORP., 101 E. Main St., Little Falls, NJ 07424, Tel: 201-256-3939; Empl.: 12; *Sls. Mgr.:* Edward Dimitry ..... **B•1485**

Local Sales Offices & Reps

FL	Orlando, EAB,Inc.	305-898-7444
NJ	Wyckoff, Chanco, Inc.	201-891-7866
TX	Dallas, Control Comps. Corp.	214-458-8877
Can	Scarborough, Ont., Leecraft Inds.	416-439-6320

Local Distributors

Can	Scarborough, Ont., Leecraft Inds.	416-439-6320

AMERACE CORPORATION, Newburgh Rd., Hackettstown, NJ 07840, Tel: 201-852-1122, Telex: 6853377 AMERACE or 136435 HACK; FSC No.: 3L154;2270; Empl.: 275; *Sls. Mgr.:* J. Cooper

AMERACE CORP., Elastimold Div., Newburg Rd., P.O. Box 503, Hackettstown, NJ 07840, Tel: 201-852-1122 ..... **D•1111**

AMEREX, P.O. Box 2815, Riverside, CA 92516, Tel: 714-686-1400; *Sls. Mgr.:* Roger D. Orton

AMERICAN AEROSPACE CONTROLS, 570 Smith St., Farmingdale, NY 11735, Tel: 516-694-5100; Empl.: 48; *Sls. Mgr.:* Gregory D'Abramo ..... **B•1780-1781**

Local Sales Offices & Reps

CA	Los Angeles, Dyna Sls. Co.	213-268-1175

AMERICAN ALUMINUM, 230 Sheffield St., Dept. EEM, Mountainside, NJ 07092, Tel: 201-233-3500; Empl.: 125

AMERICAN AUTOMATION, 14731 Franklin Avenue, Tustin, CA 92680, Tel: 714-731-1661, TWX: 910-595-2670 AMAUTO TSTN; *Sls. Mgr.:* Paul Niquette ..... **D•1179**

Local Sales Offices & Reps

CA	Garden Grove, Advanced Digital Grp.	714-897-0319
MA	Boston, Resolve Technlg.	617-527-8834

AMERICAN CAPACITOR, 2080 Central Ave, Duarte, CA 91010, Tel: 818-357-8806, Telex: 910 333 9810; FSC No.: 59366; Empl.: 65; *Sls. Mgr.:* John Williams; *Dist. Mgr.:* John Williams

AMERICAN CHEMICAL ETCHING, See American Etching & Mfg.

AMERICAN COMPUTER HARDWARE CORP., 2205 S. Wright St., Santa Ana, CA 92705, Tel: 714-549-2688, Telex: 330038; Empl.: 30; *Dist. Mgr.:* Thomas Allen

AMERICAN CONTROL PRODUCTS, Div. of Precision Timer Co., Inc., 13 Westbrook Ind'l. Pk., Westbrook, CT 06498, Tel: 203-399-6253; Empl.: 35; *Sls. Mgr.:* F. F. Coulom

AMERICAN CYANAMID CO., Metal Coated Fibers Dept., One Cyanamid Plaza, Wayne, NJ 07470, Tel: 201-831-3148, Telex: 219-136, TWX: 710-988-3045; *Sls. Mgr.:* James Tonges

AMERICAN ELECTRIC CABLE CO., 181 Appleton St., Holyoke, MA 01040, Tel: 413-539-9893; Empl.: 125; *Sls. Mgr.:* Michael A. Bousquet

AMERICAN ELECTRONIC LABS., Box 552, Lansdale, PA 19446, Tel: 215-822-2929, TWX: 510-661-4976; Empl.: 1300

AMERICAN ELCTRN. LABS., INC., Antenna Div., P.O. Box 552, Lansdale, PA 19446

AMERICAN ELCTRN. LABS., INC., Govt. Grp. Div., P.O. Box 552, Lansdale, PA 19446

AMERICAN ELCTRN. LABS., INC., Hybrid/MIC Div., P.O. Box 552, Lansdale, PA 19446

AMERICAN ELCTRN. LABS., INC., Special Prods. Div., P.O. Box 552, Lansdale, PA 19446

AMERICAN ELCTRNS., 1600 E. Valencia Dr., Fullerton, CA 92631, Tel: 714-871-3020, TWX: 910-592-1256; FSC No.: 89321; Empl.: 200; *Sls. Mgr.:* B. G. Guy

AMERICAN ETCHING & MFG., 13730 Desmond St., Pacoima,, CA 91331, Tel: 213-896-1187; Empl.: 90

AMERICAN HV TEST SYSTEMS INC., Central Garrett Ind'l. Pk., Accident, MD 21520, Tel: 301-826-8651, Telex: 86223; Empl.: 45; *Sls. Mgr.:* Rolf B. Persson

AMERICAN INSULATED WIRE CORP., Leviton Mfg. Co., 36 Freeman St., Pawtucket, RI 02862, Tel: 401-726-0700, TWX: 710-384-0150; Empl.: 1300; *Sls. Mgr.:* Al Beauvais; *Dist. Mgr.:* Michael Koshgarian ..... **C•1747**

Local Sales Offices & Reps

CA	Los Angeles, Leviton/American	213-949-6575
FL	Coral Springs, EPM Corp.	305-755-5387
GA	Atlanta, Leviton/American	404-691-9303
IL	Chicago, Leviton/American	312-766-4100
LA	New Orleans, Leviton/American	504-834-9415
MA	Andover, Richard Purinton, Inc.	617-475-7055
MA	Boston, Associated Agencies	617-423-9880
MI	Detroit, Jim Groff Sls. Co.	313-933-3100
NY	New York, Leviton Corp. Headquarters	212-229-4040
NY	West Hempstead, Schmitt Indl. Mktg. Corp.	516-486-3510
NC	Charlotte, Over & Over, Inc.	919-872-2262
OH	Cleveland, Leviton/American	216-831-0615
TX	Houston, Leviton/American	713-956-2816
UT	Salt Lake City, Chuck Fields & Assocs.	801-531-6177
WA	Seattle, Leviton/American	206-576-0242

AMERICAN LASER SYS., INC., 106 Fowler Rd., Goleta, CA 93117, Tel: 805-967-0423, Telex: 4941760ALS; Empl.: 14; *Sls. Mgr.:* L. Shallenberger

AMERICAN MAGNETICS, 740 Watson Center Rd., Carson, CA 90745, Tel: 213-775-8651, TWX: 910-345-6258; Empl.: 175; *Sls. Mgr.:* Robert Mos

AMERICAN MAGNETICS, P.O. Box 8, Carterville, IL 62918, Tel: 618-985-4838; Empl.: 120

AMERICAN MAGNETICS, P.O. Box 2509, Oak Ridge, TN 37831-2509, Tel: 615-482-1056, Telex: 557-592; Empl.: 16; *Sls. Mgr.:* E. T. Henson

AMERICAN MICROSEMICONDUCTOR, INC., 133 Kings Rd., Madison, NJ 07940, Tel: 201-377-9566, TWX: 710-986-8500; Empl.: 15; *Sls. Mgr.:* W. M. Foley; *Dist. Mgr.:* D. B. Wilson ..... **A•1661, 2070-2071**

AMERICAN MICROSIGNAL, 8431 Monroe Ave., Stanton, CA 90680, Tel: 714-761-1222, TWX: 910-591-1202; Empl.: 80; *Sls. Mgr.:* Pat Nelson

AMERICAN MICROSYSTEMS, INC., See GOULD AMI

AMERICAN MONARCH, 2801-37th Ave., N.E., Minneapolis, MN 55421, Tel: 612-788-9161; Empl.: 300; *Sls. Mgr.:* B. Sutherland

AMERICAN PHOTONICS INC., 71 Commerce Dr., Brookfield Center, CT 06805, Tel: 203-775-8950; *Sls. Mgr.:* James A. Walyus

AMERICAN PLASTICRAFT CO., 814 N. Sacramento Blvd., Chicago, IL 60622, Tel: 312-722-7727, Telex: 910-221-6068; Empl.: 250; *Sls. Mgr.:* Larry J. Ferguson

AMERICAN POWER DEVICES, 7 Andover St., Andover, MA 01810, Tel: 617-475-4074, Telex: 951206; Empl.: 140; *Sls. Mgr.:* Robert Dimodana

AMERICAN RADIO RELAY LEAGUE, 225 Main St., Newington, CT 06111, Tel: 203-666-1541; Empl.: 120; *Sls. Mgr.:* Bobbie Chamalian

AMERICAN RESEARCH & ENGINEERING, 1500 Executive Dr., Elgin, IL 60120, Tel: 312-888-7245, TWX: 910-251-3008 ..... **B•1486-1487**

AMERICAN SWITCH CORP., 134 Water St., Wakefield, MA 01880, Tel: 617-246-1007, TWX: 710-348-6756; FSC No.: 54659; Empl.: 40; *Sls. Mgr.:* Mike Palmerino; *Dist. Mgr.:* Mike Palmerino ..... **B•1488-1491**

Local Sales Offices & Reps

MI	Grand Blanc, Intercomm	313-695-0665
AZ	Scottsdale, Bill Earl Assoc.	602-994-3813
CA	Arcadia, HMC, Inc.	818-447-0958
CA	Mountain View, Serra Assocs.	415-964-4300
CO	Lakewood, Andale	303-693-4331
FL	Orlando, OEM Mktg.	305-299-1000
GA	Lawrenceville, Tek-Rep Mktg.	404-963-1600
IL	Wheaton, Chadra-Schilke & Assoc.	312-653-8126
IN	Carmel, Nationwide Comps.	317-872-7207
IA	Marion, M-S-B Assocs.	319-377-6261
KS	Shawnee Mission, M-S-B Assocs.	913-432-2131
MA	Woburn, Boston Elctrn. Assocs.	617-938-3727
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
MO	St. Charles, M-S-B Assocs.	314-946-5577
NJ	Manville, Dyno Rep.	201-685-0135
OH	Willoughby, Nationwide Comps.	216-946-3226
PA	Elkins Park, Arnold Assocs.	215-742-0600
TX	Arlington, Comptech	817-265-6007
UT	Salt Lake City, Sage Sls.	801-467-5451
WA	Bellevue, Comtec	206-453-1188
EXP	CT, Litchfield, Intrade	203-567-5901
Can	Nepean, Ont., Reptronics	613-828-9274

Local Distributors

IN	Terre Haute, Midwest Supp.	812-232-0187
AL	Birmington, Forbes Distr.	205-251-4104
AL	Huntsville, Contact Elec.	205-881-9321
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Phoenix, Electro Comps.	602-258-2665

CA Buena Park, RPS Elctrns. 213-744-0355
CA Los Angeles, Elec. Switches 213-660-1310
CA San Diego, Deco Elec. 619-693-1595
CA San Jose, Rose Elctrns. 408-263-9700
CA Santa Monica, Master Distrs. 213-452-1229
CA Sunnyvale, Sierra West 408-747-1188
CA Tustin, Western Switch & Controls 714-731-4333
CA Van Nuys, Patane Avionics 818-988-4455
CO Denver, Integrated Elctrns. 303-292-6121
CO Englewood, Indl. Elctrns. 303-694-9444
CT Greenwich, Wise Comps. 203-531-4880
CT Norwalk, Park Distr. 203-853-2011
CT Wallingford, Mid-State Elctrns. 203-265-9900
FL Clearwater, Electronics Precepts 813-596-2742
FL Longwood, Intertec Comps. 305-834-7777
FL Oakland Pk., Zelcon 305-565-2555
GA Atlanta, Specialty Distr. 404-873-2521
IL Chicago, NEP Elctrns. 312-625-8400
IL Wheeling, Hawk Elec. 312-459-4030
IN Lafayette, CWY Elec. 317-448-1611
IA Cedar Rapids, Iowa Radio Supply 319-393-4510
IA W. Des Moines, Ramco Co. 515-225-6933
KS Wichita, Radio Inc. 316-264-2798
MD Beltsville, Petricko Sls. 301-937-4960
MD Beltsville, Treeko Sls. 301-937-8260
MD Kensington, Marine Air Supp. 301-949-9560
MI Grand Rapids, Calder Elec. 616-698-7400
MI St. Clair Shores, Spemco 313-771-2700
MN Eden Prairie, Cassidy Elctrns. 612-944-0100
MN Fridley, Voyager Elec. 612-571-7766
MN Minneapolis, Tortec Corp. 612-866-3662
NH Astrum Elctrns. 603-329-5656
NJ E. Brunswick, Brothers Elctrns. 201-238-2200
NJ Fair Lawn, Relay Specialties 201-797-3313
NM Albuquerque, Intl. Elctrns. 505-345-8127
NY Bohemia, Key Comps. 516-567-7500
NY E. Syracuse, Add Elctrns. 315-437-0300
NY Hempstead, Davis Elctrns. 516-483-9200
NY Mt. Vernon, QAR 914-699-2224
NC Winston-Salem, Kirkman Elect. 919-722-9131
OH Columbus, Whitehead Elctrns. 614-224-1186
OH Dayton, Stotts-Friedman 513-298-5555
OK Tulsa, Radio Inc. 918-587-9123
PA Erie, Duncombe Elctrn. 814-454-5278
PA Norristown, Kimberly James Co. 215-666-7286
PA Philadelphia, Shap Elctrns. 215-969-3300
RI Pawtucket, MAJOR/Edwards 401-725-7400
TN Chattanooga, Specialty Distr. 615-267-9531
TN Knoxville, Curle Elctrn. 615-266-4727
TX Arlington, Bell Comp. Sls. 817-461-5303
TX Austin, Galtronics 512-837-7470
TX Dallas, Force/Solid State 214-438-5700
TX El Paso, Intl. Elctrns. 915-598-3406
TX Ft. Worth, Industrial Elctrns. 817-731-7321
UT Salt Lake City, Standard Supp. Co. 801-486-3371
WA Kent, Pyramid Elctrn. 206-872-5800
WV Huntington, Electronic Supp. 304-523-6443
WI Mequon, Lakeview Elctrns. 414-377-8250
WI New Berlin, Nep Elctrn. 414-785-9100
Can Montreal, Prelco Elctrn. 514-389-8051

AMERICAN TECHNICAL CERAMICS CORPORATION, 1 Norden La., Huntington Sta., NY 11746, Tel: 516-271-9600, Telex: 221201, TWX: 510-226-6993; FSC No.: 29990;11272-868-73; Empl.: 497; *Sls. Mgr.:* R. Blumkin ..... **A•1007-1009**

Local Sales Offices & Reps

AZ Scottsdale, Faser Tech. Sls. 602-948-4404
CA El Segundo, Fetty/Schoenduve 213-322-4991
CA Mtn. View, Fetty/Schoenduve 415-962-8330
CA San Diego, Fetty/Schoenduve 619-292-5136
CO Englewood, FG Mktg. 303-795-9176
DC Washington, M. Lader Co. 202-296-2497
FL Lighthouse Point, R. C. Simon & Co. .. 305-941-2757
GA Norcross, Mountain Electro Prods. 404-448-5594
IL Chicago, Tech. Sls. 312-237-7210
MA Topsfield, R.F. Assocs. 617-887-9762
MN New Brighton, TWC Sls. 612-636-1770
MO Grandview, Harris-Hanson Co. 816-763-6200
MO St. Louis, Harris-Hanson Co. 314-432-3611
NY Rochester, Sweetco Assocs. 716-225-2383
NY Utica, Sweetco Assocs. 315-797-6721
PA Lafayette Hill, M. Lader Co. 215-825-3177
TX Richardson, Vector Sls. Co. 214-234-4291
WA Bellevue, SD-R2 206-747-9424

AMERICAN TIME PRODS. DIV., See Frequency Control Prods., Inc.

AMERICAN ULTRAVIOLET, 320 Commerce St., Chatham, NJ 07928, Tel: 201-635-8355, Telex: 13-9266; Empl.: 14; *Sls. Mgr.:* M. C. Stines; *Dist. Mgr.:* M. C. Stines

AMERICAN VOLPI CORP., 26 Aurelius Ave., Auburn, NY 13021, Tel: 315-253-9707; Empl.: 18; *Sls. Mgr.:* Bill Meeks

AMERICAN ZETTLER, 16881 Hale Ave., Irvine, CA 92714, Tel: 714-660-1670, Telex: 67-8472; Empl.: 200; *Sls. Mgr.:* D. O. Barkhurst ..... **B•1264-1274**

Local Sales Offices & Reps

AL Huntsville, Electro-Wise, Inc. 205-830-4764
AL Huntsville, MacKay, Smith & Assocs. .. 205-539-8000
AZ Scottsdale, Thorson Desert States, Inc. 602-998-2444
CA Fountain Valley, Components Ctr. 714-979-0433
CA Fullerton, Groh Assocs. 714-738-7105
CA Mountain View, G.C. Woempner 415-964-5454
CO Englewood, Delta Sls. Assocs. 303-799-0646
FL Boca Raton, Perrott Assocs. 305-792-2211
FL Clearwater, Perrott Assocs. 813-443-5214
FL Orlando, Perrott Assocs. 305-298-7748
GA Norcross, McKay, Smith & Assocs. 404-449-7444
IL Rolling Meadows, KMA Sls. 312-398-5300
IN Carmel, Berndt Assocs. 317-844-0114
KS Wichita, Baka Corp. 316-682-8411
MA Brockton, Forsberg Sls. 617-522-6300
MN Minneapolis, R.W. Marshall Co. 612-929-0457
MN New Brighton, Chris Elctrns. Distr. 612-631-2647
MO Ferguson, Baka Corp. 314-878-4224
NJ Cherry Hill, Danco Elctrn. Sls. 609-424-5590
NM Albuquerque, Thorson Desert States, Inc. 505-293-8555
NY Alexander, B.H. Tollefson Assocs. 716-591-1219
NY Auburn, B.H. Tollefson Assocs. 315-253-4109
NY Rochester, B.H. Tollefson Assocs. 716-271-4141
NC Raleigh, J & B Sls. 919-878-8600
NC Raleigh, Resco/Raleigh 919-781-5700
OH Cincinnati, Makin Assocs. 513-871-2424
OR Beaverton, Thorson Co. N.W. 503-644-5900
PA Montgomeryville, Pyttronics Inds. 215-643-2850
TX Dallas, Cypress Elctrns. 214-869-1435
TX Houston, AID Elctrns. 713-955-6204
TX Irving, AID Elctrns. 214-790-4761
UT Salt Lake City, Delta Sls. Assocs. 801-487-7571
WA Bellevue, Thorson Co. N.W. 206-455-9180
WI Milwaukee, KMA Sls. Co. 414-259-1771

Local Distributors

CA Irvine, Acacia Sls. 714-660-0834
CA Los Angeles, Master Distrs. 213-452-1229
CA San Diego, Acacia Sls. 619-565-4365
CA San Jose, Cypress Elctrns. 408-945-8400
CA Santa Clara, Components Ctr. 408-988-3751
CA Torrance, Cypress Elctrns. 213-533-6005
CO Lakewood, Acacia Sls. 303-232-2882
CT New Haven, The Green-Shaw Co. 203-397-0710
IL Northbrook, Classic Comps. 312-272-9650
IN Carmel, Altex Elctrns. 317-848-1323
MD Savage, Pyttronic Inds. 301-953-9650
MA Canton, Impact Sls. Co. 617-821-1500
MA Woburn, Time Elctrns./New Eng. 617-935-8080
MI Ypsilanti, Tamco, Inc. 313-572-1950
NJ Fairlawn, Relay Spec. 201-797-3313
NJ Rahway, R. E. Breuer Co., Inc. 201-388-5045
NY Farmingdale, Pride Elctrns. 516-293-4020
NY South Farmingdale, R. E. Breuer Co., Inc. 516-694-6597
OR Beaverton, Acacia Sls. 503-646-3377
TX Austin, AID Elctrns., Inc. 512-450-1938
TX Dallas, Wallace Elctrns. 214-340-0400
Can Richmond, B.C., Macom Agy. 604-271-2661
Can Vancouver, B.C., Intek 604-324-6831
Can Winnipeg, Man., L. A. Varah, Ltd. 204-633-6190

AMETEK, 2 Station Square, Paoli, PA 19301, Tel: 215-355-6900; Empl.: 100

AMETEK, DYNAMICS DIVISION, AMETEK, Inc., 5649 Peck Rd., Arcadia, CA 91006, Tel: 818-442-5981, TWX: 910-587-3534; FSC No.: 18098; Empl.: 105

AMETEK, INC, Hunter Spring Division, 1 Spring Ave., Hatfield, PA 19440, Tel: 215-822-2971, TWX: 510-661-4888; FSC No.: ;43560; Empl.: 270; *Sls. Mgr.:* F. J. York

AMETEK/RODAN DIV., 2905 Blue Star St., Anaheim, CA 92806, Tel: 714-630-0081, TWX: 910-591-1684; FSC No.: 15454;DESC-EQP-75-1387; Empl.: 100; *Sls. Mgr.:* Steve Iovin

Local Sales Offices & Reps

AL Huntsville, Alpha Mktg. 205-533-0766
CA Mountain View, Gene Woempner Co. 415-964-5454
CO Westminster, Straube Assocs. 303-426-0890
FL Coral Springs, H.A., Inc. 305-752-7520
IL Downers Grove, Richmar Elctrns. 312-968-0118
IN Ft. Wayne, Menze Sls. Co. 219-747-5616
IA Cedar Rapids, Snider Sls. 319-362-4410
KS Overland Park, S. W. Wollard Co. 913-898-6552
MI Lathrup Village, R. C. Nordstrom Co. .. 313-559-7373
MI Southfield, R. A. Casalou 313-559-0350
MN Mendota Hgts., G-II Sls. 612-454-3086
MO St. Louis, Abrams & Assocs. 314-569-0447
NJ Cherry Hill, Danco Elctrn. Sls. 609-424-5590
NM Albuquerque, Straube Assocs. 505-265-7759
NY Melville, Comtronic Assocs. 516-249-0505
NY Syracuse, Canavah-Scanlon Assocs. 315-437-1271
TX Dallas, Cunningham Comps. Corp. 214-233-4303
TX Houston, Cunningham Comps. Corp. .. 713-461-4197
UT Salt Lake City, Straube Assocs. 801-486-5473
VA Gladys, Ralley Entprs. 804-283-5656
WA Vancouver, R. Over Sls. 206-695-6179
EXP NY, Westbury, CPS Intl. 516-334-8500

AMF INC., AMF Cuno/General Filter Products Division, 400 Research Pkwy., Meriden, CT 06450, Tel: 203-237-5541, Telex: 962457; Empl.: 700; *Sls. Mgr.:* Gregg Samal

AMF/ELECTRO COMPS. DIV., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060, Tel: 305-973-8620, TWX: 510-956-9400; Empl.: 900; *Sls. Mgr.:* C. Smith; *Dist. Mgr.:* C. Smith

AMF POTTER & BRUMFIELD, See Potter & Brumfield

AMGLO, 5265 Michigan Ave., Rosemont, IL 60018, Tel: 312-671-4321; Empl.: 21

AMICON CORP., 25 Hartwell Ave., Lexington, MA 02173, Tel: 617-861-9600; Empl.: 300; *Sls. Mgr.:* James Gilliland

AMILON CORP., 49-12 30th Ave., Woodside, NY 11377, Tel: 718-274-1794; Empl.: 50; *Sls. Mgr.:* L. Rosenblatt

AMKEY, INC., Sub. American Pwr. Dvs., Inc., 220 Ballardvale St., Wilmington, MA 01887, Tel: 617-658-7800; *Sls. Mgr.:* P. D. Prevett

AMLAN, INC., 97 Thornwood Rd., Stamford, CT 06903, Tel: 203-322-1913, Telex: 643647; *Sls. Mgr.:* Mark Landeweer; *Dist. Mgr.:* Mark Landeweer ..... **C•1125-1128**

Local Sales Offices & Reps

AL Huntsville, Interep Assocs., Inc. 205-533-1730
CA Brea, Astralonics 213-691-6123
CA Santa Cruz, Krippner & Assocs. 408-429-9798
CA Westlake Village, Astralonics 818-706-0488
FL Oakland Park, Zelcon, Inc. 305-565-2555
FL Orlando, J-R Controls, Inc. 305-282-6920
FL Tampa, J-R Controls 813-961-9478
GA Norcross, Interep Assocs., Inc. 404-449-8680
IL Chicago, Electro-Tech Mktg. Assocs. .. 312-676-3151
MA Quincy, Marketing Svcs., Inc. 617-545-3031
MN St. Paul, Complete Sls. 612-644-0484
MO Grandview, R. R. Burton & Assocs. 816-763-5385
MO Maryland Heights, R. R. Burton & Assocs. 314-434-1628
MO St. Louis, R. R. Burton & Assocs. 314-647-6353
NJ Parlin, JMR Sls., Inc. 201-254-8484
NY E. Setauket, JMR Sales, Inc. 516-689-8871
NY N. Syracuse, JMR Sales, Inc. 315-458-6576
PA Phildelphia, Check Assocs. 205-487-3007
TN Greeneville, Interep Assocs., Inc. 615-639-3491
VA Reston, Tytronics Tech. Sls. 703-471-0440
WA Mukilteo, Krippner & Assocs. 206-743-3579
WI Brookfield, Electro-Tech Mktg. Assocs. 414-785-9554

Local Distributors

CA Sacramento, The Supp. Sta. 916-920-2919
CA San Jose, Sundown Sls. 408-995-6327
CA Westlake Village, Bond Electro Sls. ... 818-706-0322
CT New Haven, Greene-Shaw Co., Inc. ... 203-397-0710
CT Torrington, Northeast Connectors 203-482-2817
FL Oakland Park, Zelcon, Inc. 305-565-2555
FL Orlando, Southeast Comp. Svc., Inc. .. 305-298-0321
GA Atlanta, Trans-Southern Elctrns. 404-451-4425
MA Chelmsford, Dynamic Engrg. 617-250-0200
MA Melrose, Hollex, Inc. 617-665-2413
MA Norwood, Emtel Elctrns. 617-769-9500
MA Waltham, Vantage Elctrns. Corp. 617-894-8690

MA Westford, ESI 617-486-8495
MA Woburn, EPC 617-935-0400
MA Woburn, The Supp. Stat. 617-935-0400
MN New Brighton, Chris Elctrns. 612-631-2647
NY Mt. Sinai, KC Elctrns. 516-473-3347
OR Aloha, Pacific Elctrns. 503-642-3591
OR Pendleton, Round-Up Elctrns. 503-276-3152
PA Wayne, Peak Elctrns. 215-293-9000
RI Warwick, Cal-Greg Comps., Inc. 401-738-6170
VT South Burlington, Hooker Elctrns., Inc. 802-864-0885
WA Auburn, West-Air Intl. 206-631-1000
WA Kirkland, Priebe Elctrns., Inc. 206-821-4695
WA Seattle, Pacific Elctrns. 206-575-1050
WA Seattle, Signal Comm., Inc. 206-324-8400
Can Montreal West, Que., Hooker Elctrns. Can., Ltd. 514-487-5151

AMP

AMP INCORPORATED, Box 3608, Harrisburg, PA 17105, Tel: 717-564-0100, TWX: 510-657-4110; Empl.: 19,650; *Dist. Mgr.:* Niel Spatz ..... **A•1590; B•1118-1120, 1492-1493, 1706; C•1131-1152, 1748**

Local Sales Offices & Reps

CA Compton, AMP, Inc. 213-537-4490
CA Cupertino, AMP, Inc. 408-255-3830
CO Englewood, AMP, Inc. 303-773-0422
CT Windsor, AMP, Inc. 203-683-2715
FL Altamonte Springs, AMP, Inc. 305-869-6766
FL Boca Raton, AMP, Inc. 305-997-7005
GA Atlanta, AMP, Inc. 404-934-6363
IL Schaumburg, AMP, Inc. 312-351-5020
IN Carmel, AMP, Inc. 317-848-1250
MA Boston, AMP, Inc. 617-891-7500
MA Framingham, AMP, Inc. 617-879-3255
MI Southfield, AMP, Inc. 313-645-5590
MN Minneapolis, AMP, Inc. 612-831-8242
NJ Parsippany, AMP, Inc. 201-334-6664
NY Holbrook, AMP, Inc. 516-588-4430
NY Pittsford, AMP, Inc. 716-385-2860
NC Winston- Salem, AMP, Inc. 919-725-8968
OH Dublin, AMP, Inc. 614-764-8866
PA Berwyn, AMP, Inc. 215-647-6060
PA Malvern, AMP, Inc. 215-296-5303
TN Knoxville, AMP, Inc. 615-691-5711
TX Irving, AMP, Inc. 214-258-1114
VA Alexandria, AMP, Inc. 703-683-5955
WA Renton, AMP, Inc. 206-255-0064

Local Distributors

AL Huntsville, Powell Elctrns. 205-539-2731
AZ Phoenix, Dalis Elctrn. Supp. 602-275-2626
AZ Phoenix, Sterling Elctrns. Corp. 602-258-4531
CA Buena Park, RPS Elctrns. 213-744-0355
CA Canoga Park, Marshall Elctrns. Grp. 213-999-5001
CA El Monte, Marshall Ind. 213-422-6204
CA Fullerton, Pyramid Elctrns. 714-773-0781
CA Hawthorne, Electro-Sonic Comps. 213-679-9781
CA Irvine, Marshall Elctrns. Grp. 714-556-6400
CA San Diego, Marshall Elctrns. Grp. 619-578-9600
CA San Diego, RPS Elctrns. 619-292-5611
CA San Jose, Powell Elctrns. 408-943-9020
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CO Denver, CSID, Inc. 303-292-9594
CT Wallingford, Cronin Elctrns. 203-265-3134
FL Orlando, Hammond Elctrns. 305-849-6060
GA Norcross, Schweber Elctrns. Corp. 404-449-9170
IL Elk Grove, Schweber Elctrns. Corp. 312-364-3750
IL Elmhurst, Semiconductor Spec. 312-279-1000
IN Indianapolis, Graham Elctrns. 317-634-8202
KS Edwardsville, C. Tennant, Sons & Co. 913-441-1801
MD Columbia, Powell Elctrns. 301-631-4070
MD Gaithersburg, MS Elctrns. 301-921-0200
MA Needham, Cronin Elctrns. 617-449-5000
MA Winchester, Rush Industries, Inc. 617-729-5800
MI Grand Rapids, RS Elctrns. 616-241-3483
MI Livonia, RS Elctrns. 313-525-1155
MO St. Charles, Lectronix 314-946-6424
NH Hudson, C & H Elctrns. 603-882-1133
NJ Buffalo, Summit Distrs. 716-884-3450
NJ Fairfield, Marshall Elctrns. 201-882-0320
NJ Kenilworth, Federated Purchaser 201-272-0505
NY Farmingdale, Harrison Radio Corp. 516-293-7990
NY Lynbrook, Peerless Elctrns. 516-593-2121
NY Westbury, Schweber Elctrns. Corp. 516-334-7474
NC Raleigh, Southeastern Elctrns. 919-828-2311
OH Akron, Akron Elctrn. Supp. Co. 216-762-8818
OH Columbus, Hughes-Peters Inc. 614-294-5351
PA Philadelphia, Almo Elctrns. Corp. 215-698-4000
PA Philadelphia, Powell Elctrns. 215-365-1900
TN Nashville, Graham Elctrns. 615-242-2682
TX Austin, Kent Elctrns. Corp. 512-834-1900
TX Houston, Kent Elctrns. 713-780-7770
TX Irving, Hamilton-Avent Elctrns. 214-659-4157
TX Richardson, Kent Elctrns. Corp. 214-669-2600
UT Salt Lake City, Kimball Elctrns. 801-328-2075
WA Kent, Pyramid Elctrns. Supp., Inc. 206-872-5800

AMP DISTRIBUTOR MARKETING DIV, A Division of AMP Products Corporation, Harrisburg, PA 17105, Tel: 717-780-7025; Empl.: 24,500; *Sls. Mgr.:* Larry Backus ..... **B•1495; C•1130, 1683, 1749**

Local Sales Offices & Reps

Northern Wire & Cable, Inc.
CA Los Angeles 213-639-1691
CA Sacramento, Zack Elctrns. 916-446-3131
CA San Francisco 415-574-6006
IL Chicago 312-439-7800
PA Valley Forge 215-647-1000
TX Dallas (Irving) 214-258-1911

Local Distributors

EMSCO
AL Birmingham, Ack Radio Supp. Co. 205-322-0588
AL Birmingham, Forbes Distrbg. 205-251-3941
AL Decatur, Forbes Distrbg. 205-353-4546
AL Huntsville, Forbes Distrbg. 205-533-4150
AL Huntsville, Powell Elctrns., Inc. 205-539-2731
AL Mobile, Forbes Distrbg. 205-479-4535
AL Mobile, Specialty Distrs. 205-344-0450
AZ Phoenix, Dalis Elctrn. Supp. 602-275-2626
AZ Phoenix, Electronic Parts Co., Inc. 602-277-7281
AZ Phoenix, Sterling Elctrns. 602-268-2121
AZ Tempe, Hamilton/Avnet Elctrns. 602-231-5100
AR Little Rock, Carlton-Bates Co. 501-562-9100
AR Little Rock, Electro Entprs., Inc. 501-664-9207
AR Little Rock, Inter-Conn Elctrns., Inc. 501-753-7264
AR Pine Bluff, Carlton Bates Co. 501-535-1354
CA Bakersfield, Jack C. Arbuckle Co. 805-325-5816
CA Buena Park, RPS Elctrns., Inc. 213-744-0355, 714-521-5230
CA Canoga Park, Marshall Inds. 819-999-5001
CA Cerritos, El-Com, Inc. 213-404-2961
CA Costa Mesa, Mar Vac Elctrns., Inc. 714-540-3280
CA El Monte, Marshall Inds. 818-442-7204
CA Fountain Valley, Components Ctr., Inc. 714-979-0433
CA Fresno, Jack C. Arbuckle Co. 209-264-6554
CA Fullerton, Pyramid Elctrns., Inc. 714-773-0781
CA Gardena, California Switch & Signal 213-770-2300
CA Hawthorne, Electro-Sonic Comps., Inc. 213-679-9781
CA Irvine, Marshall Inds. 714-556-6400
CA Manhattan Bch., Prime Electro Prods. Co. 213-379-3642
CA Monrovia, Erik-A-Elctrn. Distr. 213-574-1020
CA North Hollywood, Alatec Prods. 213-875-1790
CA Northridge, Acort Inds., Inc. 213-993-6444
CA Oakland, Brill Elctrns. 415-834-5888
CA Palo Alto, Zack Elctrns. 415-326-5432
CA Sacramento, Hamilton/Avnet Elctrns. 916-925-2216
CA Sacramento, Sacramento Elctrns. 916-441-4821
CA San Bernardino, Hurley Elctrns. 714-885-0721
CA San Diego, El-Com, Inc. 619-578-0900
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CA San Diego, RPS Elctrns., Inc. 619-292-5611
CA San Diego, Western Radio, Inc. 619-268-4400
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CO Denver, Marshall Inds. 303-427-1818
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FL Orlando, Hammond Elctrns., Inc. 305-849-6060
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GA Atlanta, Ack Radio Supp. Co. 404-351-6340
GA Atlanta, Specialty Distrbg. Co. 404-873-2521
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HI Honolulu, Technical Mktg. Corp. 808-841-4175
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WV Kenova, Burco Distrs. 304-453-6387
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Refer to Amperex, Slatersville Div. for sales office information.

AMPEREX ELECTRONIC CORP., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802, Tel: 516-931-6200, TWX: 510-221-1839; Empl.: 270; *Sls. Mgr.:* Robert Carlin; *Dist. Mgr.:* Robert Carlin

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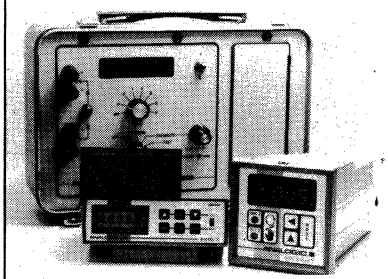

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MA	Hopkinton, Power Mark, Inc.	617-435-9200
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
MN	Golden Valley, J. R. Assocs.	612-546-4110
MO	Maryland Heights, Ramsey Assocs.	314-878-5042
NJ	Boonton, PAF Assocs.	201-335-0680
NM	Albuquerque, Cleveland Entprs.	505-265-7893
NY	New Hartford, PDQ Assocs.	315-768-8167
NY	Smithtown, PAF Assocs.	516-360-0940
OH	Chagrin Falls, Midwest Mktg. Assocs.	216-247-6655
OH	Dayton, Midwest Mktg. Assocs.	513-433-2511
PA	Churchville, Dynamic Elec.	215-322-2611
PA	Pittsburgh, Staples	412-881-5990
TX	Houston, A.C.U. Data	713-580-2451
TX	Houston, Analogic Corp.	713-280-9048
Can	Mississauga, Ont., Tracan Elctrns.	416-625-7752
CA	Pasadena, RDX Corp.	213-681-3451
CA	San Diego, RDX Corp.	619-278-6863
CA	Sunnyvale, RDX Corp.	408-734-4500
CT	Portland, B.B.I.	203-342-0648
IL	Downers Grove, Physics Equip.	312-960-4054
MA	Holbrook, McLellan Assocs.	617-767-4771
MO	St. Louis, Engrg. Svcs. Co.	314-997-1515
NY	Frankfort, Kapitol Instr. Sls.	315-894-4245
NY	New York, Flowmaster	212-741-9675
NY	Rochester, C. V. Sls.	716-328-0680
NY	Williamsville, C. V. Sls.	716-759-2923
OK	Tulsa, Data Mktg. Assocs.	918-438-4911
PA	Pittsburg, R.D.P. Corp.	412-487-2217
TX	Austin, Data Mktg. Assocs.	512-451-5174
TX	Dallas, Data Mktg. Assocs.	214-661-0300
UT	Salt Lake City, Westek Data Prods.	801-261-0999
VA	Richmond, Commonwealth Controls	804-271-7700
WA	Seattle, Brett Assocs.	206-431-8090

Digital Panel Instrs., Load Cell Digitizing Sys. & Temperature Instr.

AL	Birmingham, Regal Controls	205-967-5770
CA	Pasadena, RDX Corp.	213-681-3451
CA	San Diego, RDX Corp.	619-278-6863
CA	Sunnyvale, RDX Corp.	408-734-4500
IL	Buffalo Grove, Laganowski & Assocs.	312-520-0130
IL	Downers Grove, Physics Equip.	312-960-4054
IL	Naperville, Synergy Sys.	312-369-2021
ME	Boothbay, Linekin	207-633-5363
MA	Belmont, Hi Tech Controls	617-489-0851
MA	Danvers, Analogic	617-777-4500
MN	Eden Prairie, Elctrn. Instr. Consits.	612-937-9701
MO	St. Louis, Engineering Svcs. Co.	314-997-1515
NM	Albuquerque, Qualtech	505-243-5605
NY	Frankfort, Kapital Instrs.	315-894-4245
NY	NewYork, Flowmaster	212-741-9675
NC	Charlotte, Zelco	704-523-2961
OH	Dayton, P. J. Navin Co.	513-434-8940
OH	Dayton, RDP Corp	513-253-6175
OK	Tulsa, Data Mktg. Assocs.	918-741-4911
PA	Pitttsburg, RDP Corp.	412-487-2217
TN	Knoxville, Paris Co.	615-966-2141
TX	Austin, Data Mktg. Assocs.	512-451-5174
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Richmond, Commonwealth Controls	804-271-7700

ANALOGIC CORP., Data Conversion Prods. Grp., Audubon Rd., Wakefield, MA 01880, Tel: 617-246-0300, Telex: 94-9307, TWX: 710-348-0425; Empl.: 2000; *Sls. Mgr.:* Leonard D. Sacon ..... **D•1138-1139**

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns, Assocs., Inc.	205-881-5031
AZ	Scottsdale, Arcom Sls., Inc.	602-947-5745
CA	Carson, AMASCO	213-516-8561
CA	San Jose, Analogic Corp.	408-247-6401
CA	Sunnyvale, AMASCO	408-733-8690
CO	Wheat Ridge, Westek Data Prods., Inc.	303-431-9876
CT	Portland, BBI	203-342-0648
FL	Boca Raton, Beacon Elctrns. Assocs., Inc.	305-393-3500
FL	Clearwater, Beacon Elctrns. Assocs., Inc.	813-796-2378
FL	Maitland, Beacon Elctrns. Assocs., Inc.	305-647-3498
FL	Melbourne, Beacon Elctrns. Assocs., Inc.	305-724-8010
GA	Atlanta, Beacon Elctrns. Assocs.	404-256-9640
IL	Rosemont, Synmark Sls. Co.	312-825-3455
MA	Holbrook, McLellan Assocs.	617-767-4771
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
MO	St. Louis, Engrg. Svcs. Co.	314-997-1515
NJ	Boonton, PAF Assocs.	201-335-0680
NY	Smithtown, PAF Assocs.	516-360-0940
NY	Syracuse, Labtronics	315-455-7314
NC	Raleigh, Beacon Elctrns. Assocs., Inc.	919-787-0330
OH	Chagrin Falls, Midwest Mktg. Assocs.	216-247-6655
OH	Cincinnati, Analogic Corp.	606-371-0064
OH	Dayton, Midwest Mktg. Assocs.	513-433-2511
OK	Tulsa, Norcom, Inc.	918-832-7747
PA	Norristown, Denco Data Equip. Corp.	215-630-8990
TX	Austin, Norcom, Inc.	512-451-2757
TX	Dallas, Norcom	214-386-4888
TX	Houston, Norcom, Inc.	713-778-0392
TX	San Antonio, Norcom, Inc.	512-680-4513
UT	Salt Lake City, Westek Data Prods., Inc.	801-261-0999
Can	Montreal, Tracan Elctrns. Corp.	514-636-8380
Can	Ottawa, Tracan Elctrns. Corp.	613-722-7667
Can	Toronto, Tracan Elctrns. Corp.	416-625-7752

ANALOG MODULES, INC., 126 Baywood Avenue, Longwood, FL 32750, Tel: 305-339-4356/4355, Telex: ANALOG MOD C1 467617; FSC No.: 61651; Empl.: 22; *Sls. Mgr.:* Ian D. Crawford ..... **D•1004**

ANALOG SYSTEMS, P.O. Box 35879, Tucson, AZ 85740-5879, Tel: 602-293-4923, TWX: 910-952-1185; FSC No.: 58976; Empl.: 13; *Sls. Mgr.:* Sharon Raban; *Dist. Mgr.:* Sharon Raban

ANALOG TECHNOLOGY CORP., 15859 E. Edna Pl., Irwindale, CA 91706, Tel: 213-960-4004, TWX: 910-584-1855; *Sls. Mgr.:* James L. Lawrence, Jr.

ANALYTICAL MEAS., 31 Willow St., Chatham, NJ 07928, Tel: 201-273-7500; Empl.: 35

ANALYTICS COMMUNICATIONS SYS., 1820 Michael Faraday Dr., Reston, VA 22090, Tel: 703-471-0892, Telex: 710-833-0326; Empl.: 35; *Sls. Mgr.:* Paul G. Jones

ANAREN MICROWAVE, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057, Tel: 315-432-8909, Telex: 937351, TWX: 710-541-1507; FSC No.: 31597; Empl.: 310

ANCHOR SPECIALTY MFG. INC., 300 Hollister Rd., Teterboro, NJ 07608, Tel: 201-288-1939; Empl.: 10

AN/COM INDUSTRIES, P.O. Box 530, 5521 Cleon Ave., N. Hollywood, CA 91603, Tel: 818-769-5518, TWX: 910-498-5713; *Sls. Mgr.:* E. J. Wubben; *Dist. Mgr.:* E. J. Wubben

AND, 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-9916, TWX: 910-374-2353; Empl.: 30; *Sls. Mgr.:* Dean Ransom

ANDEEN-HAGERLING, INC., 31899 Miles Road, Chagrin Falls, OH 44022, Tel: 216-349-0370; Empl.: 14; *Sls. Mgr.:* Gwen Glazer

Local Sales Offices & Reps

OH	Cleveland, TIBY Co.	216-371-5335

ANDERS, INC., 77 Wolcott Rd., Simsbury, CT 06070, Tel: 203-658-7666; FSC No.: 52045; Empl.: 18; *Sls. Mgr.:* R. A. Grover

ANDERSEN LABS., 1280 Blue Hills Ave., Bloomfield, CT 06002, Tel: 203-242-0761, TWX: 710-425-2390; FSC No.: 03947; Empl.: 125 ..... **A•1591**

Local Sales Offices & Reps

CA	Mountain View, Peninsula Tech. Sls. ..	415-965-3636
CA	San Marcos, Midwin & Olifson	619-571-0177
CA	Santa Ana, SSK USA, Inc.	714-250-4073
CA	Tarzana, Midwin & Olifson	213-996-9093
CA	Tustin, SC Cubed	714-731-9206
IL	Northfield, Feller Assocs.	312-446-8065
IA	Cedar Rapids, Feller Assocs.	319-364-0566
MD	Owings Mill, Neal Deoul Assocs., Inc.	301-795-5775
MA	Wayland, High-Tech Sls.	617-653-3838
NY	Melville, Carnes Assocs.	516-694-1600
PA	Huntingdon Valley, Rabal Assoc.	215-947-4825
TX	Dallas, McDonald Assocs.	214-238-1858
Intl	Japan, Tokyo, Japan Telescomm Corp.	403-5301
Can	Bolton, Ont., MacKay Assocs.	416-857-4302
Can	Quebec, R. F. Microwave, Ltd.	514-335-2335

ANDERSON-BELL CO., P.O. Box 191, Canon City, CO 81212, Tel: 303-275-1661, Telex: 499-4230; *Sls. Mgr.:* Carol Fontecchio; *Dist. Mgr.:* Carol Fontecchio

ANDERSON ELCTRNS., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648, Tel: 814-695-4428, TWX: 510-691-2516; Empl.: 85; *Sls. Mgr.:* W. H. Anderson ..... **A•1313**

Local Sales Offices & Reps

CA	Fullerton, GRU Assocs.	714-738-0903
CA	Santa Clara, Logan Sls	408-496-0660
CT	Branford, LJM Assocs.	203-488-7995
FL	New Port Richey, Lobo Mktg. Assocs., Inc.	813-848-8578
GA	Lawrenceville, B. T. Funderburk, Inc. ..	404-963-9495
IL	South Elgin, R.K. Elctrn.	312-695-8552
MA	Plymouth, Newby, Inc.	617-746-3869
MI	Lathrup Village, R. C. Nordstrom & Co.	313-559-7373
NY	Smithtown, L.I., PAF Assocs.	516-360-0940
NY	Syracuse, Murcan Sls. Corp.	315-437-0734
NC	Raleigh, B. T. Funderburk, Inc.	919-782-3493
OH	Dayton, Dynel Co.	513-434-6467
PA	Rydal, Espy Sls.	215-576-0780
TX	Plano, GW Prods.	214-422-1746
WA	Seattle, Harry Levinson Co.	206-382-1300
Can	Mississauga, Ontario, Gidden-Morton Assocs.	416-671-8111

ANDERSON POWER PRODS., Div. of High Voltage Engrg., 145 Newton St., Boston, MA 02135, Tel: 617-787-5880, Telex: 940453

ANDREW CORP., 10500 W. 153rd St., Orland Pk., IL 60462, Tel: 312-349-3300, Telex: 25-3897, TWX: 910-651-3340; *Sls. Mgr.:* Carl Van Hecke

ANDREWS BEARING CORP., MPB Corp., New Cut Road, Spartanburg, SC 29304, Tel: 803-583-4541, TWX: 810-282-2578; *Sls. Mgr.:* Michael S. Diblasi; *Dist. Mgr.:* Jack E. Barker

ANDRICH SYS., INC., 1699 Roosevelt Ave., Bohemia, NY 11716, Tel: 516-589-5656; *Sls. Mgr.:* Robert G. Andrews

ANDROMEDA SYS., 9000 Eton Ave., Canoga Park, CA 91304, Tel: 818-709-7600, TWX: 910-444-1248; Empl.: 23; *Sls. Mgr.:* Mike Morgan; *Dist. Mgr.:* Mike Morgan

ANDROTEK/DMI, Box 29098, Columbus, OH 43229, Tel: 614-882-7821; *Sls. Mgr.:* James M. Shively

ANGENIEUX INC., 120 Derry Rd., Hudson, NH 02051, Tel: 603-889-2116, Telex: 94-3469; *Sls. Mgr.:* Edward A. Wollensak

ANGO ELECTRONICS CORP., Post Office Box 112, Harrison, NJ 07029, Tel: 212-685-6336, 201-484-1115, Telex: 421531; *Sls. Mgr.:* Brian K. Yuen ..... **C•1008**

ANN ARBOR TERMINALS, 6175 Jackson Rd., Ann Arbor, MI 48103, Tel: 313-663-8000, Telex: 706905; Empl.: 50; *Sls. Mgr.:* Gary DeLuca

ANORAD CORP., 110 Oser Ave., Hauppauge, NY 11788, Tel: 516-231-1990, TWX: 510-227-9894; Empl.: 235

ANRO ELCTRN. INDS., 300 Wildcat Rd., Downsview, ON, Canada, Tel: 416-661-2600; Empl.: 85; *Sls. Mgr.:* E.H. Jones

ANSCO, 1243 West 134th St., Gardena, CA 90247, Tel: 1-800-421-1270, 1-800-821-3308, 213-532-7780; Empl.: 25+; *Sls. Mgr.:* Melvin Preston

ANSLEY ELECTRONICS, DIVISION OF THOMAS & BETTS, See T & B/Ansley Corp.

ANSONICS, INC., P.O. Box 910, Halfway, OR 97834, Tel: 503-742-7475; Empl.: 6

ANTENNACRAFT, Box 1005, Burlington, IA 52601, Tel: 319-754-7575

ANTENNA RESCH. ASSOCS., 11317 Frederick Ave., Beltsville, MD 20705, Tel: 301-937-8888, Telex: 908754; FSC No.: 04190; Empl.: 25; *Sls. Mgr.:* H.W. Rapalus

ANTENNA SPECIALISTS, 12435 Euclid Ave., Cleveland, OH 44106, Tel: 216-791-7878, Telex: 980-732; Empl.: 1000; *Sls. Mgr.:* Larry Kline

ANTEX DIV., 7 Hawkes St., Marblehead, MA 01945, Tel: 617-631-7100; *Sls. Mgr.:* C. Loutrel; *Dist. Mgr.:* C. Loutrel

ANTEX ELECTRONICS CORP., 16100 S. Figueroa St., Gardena, CA 90248, Tel: 213-532-3092, TWX: 910-344-7381; Empl.: 53; *Sls. Mgr.:* J. Antrim; *Dist. Mgr.:* K. Ross

ANTONA CORP., 2100 S. Sawtelle Blvd., Suite 205, Los Angeles, CA 90025, Tel: 213-473-8995; Empl.: 4

ANTRONIC CORP., 7755 E. Redfield Rd., Ste. 300, Scottsdale, AZ 85260, Tel: 312-287-5110

APAHOUSER-ELCOM, INC., 101 Walnut St., Watertown, MA 02172, Tel: 617-924-1500; FSC No.: 53721; Empl.: 90; *Sls. Mgr.:* Fred Gately

APA DIVISION, 399 Executive Blvd., Elmsford, NY 10523, Tel: 914-592-7322, Telex: 646186; *Sls. Mgr.:* Carl Gruenberg

A. P. CIRCUIT CORP., 513 East 86th St., P.O. Box 1350, New York, NY 10028, Tel: 212-737-1348, Telex: 428759 ..... **A•1592**

Local Sales Offices & Reps

MI	Detroit, Comtel Instrs.	313-255-1970
OH	Cleveland, Comtel Instrs.	216-442-8080
OH	Dayton, Comtel Instrs.	513-298-7573

APEX MICROTECHNOLOGY CORP., 2895 W. Rudasil Road, Tucson, AZ 85741, Tel: 602-746-0849, TWX: 910-952-1176; Empl.: 65; *Sls. Mgr.:* Rita Olschewski; *Dist. Mgr.:* Rita Olschewski ..... **D•1005**

Local Sales Offices & Reps

AZ	Tempe, Mar Tech. Assocs., Inc.	602-747-8098
CA	Los Altos, Kolm Mktg.	415-948-2635
CA	San Diego, California Elctrn. Mktg.	619-692-3551
CA	Santa Ana, California Elctrn. Mktg.	714-835-2702
CO	Denver, W. H. Howard Assocs.	303-426-3499
IL	Chicago, L.G.S. Sls.	312-456-0616
MD	Ellicott City, Nelson Elctrns.	301-747-7887
MA	Malden, J.K. Assocs.	617-321-2922
MN	Bloomington, Merril Franklin Co.	612-854-9446
NY	Smithtown, T & K Sls.	516-724-3456
OH	Fort Wayne, TX Sales	219-489-4447
TX	Dallas, Repmasters	214-247-6236
TX	Houston, Repmaster	713-692-8204

Local Distributors

Intl	Austria, Wien, Nano-80	0222-65-15-22
Intl	Finland, Helsinki, Turion Oy	90-372144
Intl	France, Orsay, Microel	907-08-24
Intl	Germany, Nauheim, Emtron Vertriebs GmbH	(06152) 6003
Intl	India, Bombay, Elmatronic Dvs.	362421
Intl	Ireland, Co. Louth, Success Elect.	042-72374
Intl	Israel, Giuataim, EIM	03-77-40-41
Intl	Italy, Milanino, Servotecnia S.A.S. ...39/02-619-53-27	
Intl	Japan, Tokyo, Kyokuto Boeki Kaisha	244-3511
Intl	Netherlands, Oosterhout, Klaasing Elctrns.	01620-51400
Intl	Norway, Oslo, Eltron	02-462-870
Intl	South Africa, Johannesburg, Advanced Semiconductor	27/11802-4107
Intl	Sweden, Stockholm, Scancopter AB ..	046-828-9425
Intl	Switzerland, Zug, Anatech AG	042-315-477
Intl	Taiwan, Taipei, Hitek Co. Ltd.	536-1157
Intl	UK, Sunbury-on-Thames, Pascall Elctrns.	09327-87418

API INSTRS., 1601 Trapelo Rd., Waltham, MA 02254, Tel: 617-890-2000, Telex: 92-3445, TWX: 710-324-0681; FSC No.: 20905; Empl.: 350; *Sls. Mgr.:* R. Yates; *Dist. Mgr.:* G. Wood

APM-HEXSEAL, 44 Honeck St., Englewood, NJ 07631, Tel: 201-569-5700, Telex: 13-3403; Empl.: 65; *Sls. Mgr.:* Kenneth Schwinn; *Dist. Mgr.:* Kenneth Schwinn

APOLLO LASERS, INC., 9201 Independence Ave., Chatsworth, CA 91311, Tel: 213-709-1111, Telex: 66-2278; Empl.: 82; *Sls. Mgr.:* John Q. Adams

APOLLO MAGNETICS CORP., 2720 W. Beverly Blvd., Los Angeles, CA 90057, Tel: 213-381-2500, TWX: 910-321-4348; Empl.: 420 ..... **D•1058**

Local Sales Offices & Reps

CT	Stratford, Gerald Rosen	203-375-5456
MA	Framingham, Gerald Rosen	617-879-5505
NH	Hollis, Gerald Rosen	603-465-7902
NY	Rochester, J. W. Welch	716-244-1100
NY	Utica, J. W. Welch	716-244-1100
OK	Oklahoma City, MGR Elctrns.	918-366-0125
TX	Dallas, MGR Elctrns.	214-349-9940

APPLETON PAPERS INC., P.O. Box 359, Appleton, WI 54912, Tel: 414-734-9841; Empl.: 3,500; *Sls. Mgr.:* Doug Adams ..... **D•1059**

APPLIED CIRCUITS, INC., 36-06 43rd. Ave., Long Island City, NY 11101, Tel: 212-786-7200; Empl.: 20

APPLIED CIRCUIT TECHNLG. (ACT), 2931 La Jolla St., Anaheim, CA 92806, Tel: 714-632-9230; *Sls. Mgr.:* Hank Pselos

APPLIED COMMUNICATIONS, Amstar Tech. Prods. Co., 5490 Spectrum Drive, Frederick, MD 21701, Tel: 301-694-5300, TWX: 710-828-9706; Empl.: 150; *Sls. Mgr.:* Joseph Rock

APPLIED COMMUNICATIONS, 9125 Gaither Rd., Gaithersburg, MD 20877, Tel: 301-948-5210, TWX: 701-828-9706; Empl.: 200; *Sls. Mgr.:* Joseph Rock

APPLIED CONTROL, 1275 Bloomfield Ave., Fairfield, NJ 07006-2828, Tel: 201-227-5454; FSC No.: 4A725; Empl.: 26; *Sls. Mgr.:* Monica E. Merel

APPLIED DATA COMMUNICATIONS, 14272 Chambers Rd., Tustin, CA 92680, Tel: 714-731-9000; Empl.: 75

APPLIED DIGITAL DATA SYSTEMS INC., 100 Marcus Blvd., Hauppauge, NY 11787, Tel: 516-231-5400, TWX: 510-227-9886; Empl.: 760; *Sls. Mgr.:* Dennis O'Donnell

APPLIED ELECTRO TECHNOLOGY, INT.
AN **STI** COMPANY

APPLIED ELECTRO TECHNLG., INT., STI Company, 2220 So. Anne St., Santa Ana, CA 92704, Tel: 714-556-6570, TWX: 910-595-1797; FSC No.: 52797; Empl.: 25; *Sls. Mgr.:* Deborah Core ..... **B•1275**

Local Sales Offices & Reps

AL	Odenville, Hubert Satterfield	205-629-5939
CA	Mountain View, Scientific Technlg.	415-965-0910
CA	San Jose, Rick Schloss	408-274-3304
OR	Eugene, Dennis Ellingsen	503-484-5564
PA	King of Prussia, Joseph McCready	215-527-5921
TX	Richardson, Dwain Lawhon	214-231-2289

APPLIED ENGRG. PRODS., P.O. Box A-D, Amity Sta., New Haven, CT 06525, Tel: 203-387-5282, TWX: 710-465-1173; FSC No.: 19505; Empl.: 65; *Sls. Mgr.:* C. Goff; *Dist. Mgr.:* C. Goff

APPLIED INSTRS., INC., 25 Will Place, Brooklyn, NY 11207, Tel: 212-257-0885; *Sls. Mgr.:* I. L. Litty

APPLIED MAGNETICS, 75 Robin Hill Rd., Goleta, CA 93117, Tel: 805-683-5353, TWX: 910-334-1195; FSC No.: 11935; Empl.: 4500; *Sls. Mgr.:* O. M. Fundingsland

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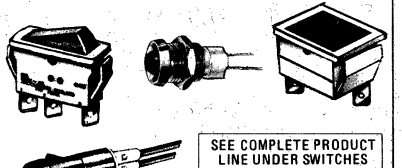

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APPLIED MICROSYSTEMS CORP., 5020-148th Ave. NE C-1002, Redmond, WA 98073-1002, Tel: 206-882-2000, 800-426-3925, Telex: 152471; Empl.: 140; *Sls. Mgr.:* Joe Gomula

APPLIED MICRO TECHNLG., A Burr Brown Co., 3669 E. 44th Street, Tucson, AZ 85713, Tel: 602-622-8605, TWX: 910-952-1164; Empl.: 15; *Sls. Mgr.:* Lee Davis

APPLIED MICROWAVE DIV. EPSCO, See Epsco Microwave

APPLIED POWER CONVERSION
DIVISION OF TECHNOLOGY DYNAMICS, INC.

APPLIED POWER CONVERSION, Technology Dynamics, Inc., 100 School St., Bergenfield, NJ 07621, Tel: 201-664-7636 ..... **D•1500-1507**

Local Sales Offices & Reps

CA	Sunnyvale, Sourcetronics, Inc.	408-988-8801
CA	West Lake Village, Powerdyne Assocs.	818-991-0632
CO	Aurora, Butler Tech. Sls.	303-343-3787
FL	Orlando, Gramar, Inc.	305-894-3351
MD	Hagerstown, Stinson Assocs., Inc.	301-790-1193
VA	Reston, Stinson Assocs., Inc.	703-620-0088

APPLIED RESEARCH, INC., 160 Dupont St., Plainview, NY 11803, Tel: 516-349-9200; Empl.: 50; *Sls. Mgr.:* S. Klipper ..... **A•1702-1703**

Local Sales Offices & Reps

CA	Los Angeles, EBA Microwave	213-822-7510
CA	Orange, E. Bell Assocs.	714-857-6079
MA	Lowell, Russell Engrg.	617-458-7146
NY	Great Neck, Industron Assocs.	516-487-2620

APPLIED RESEARCH LABS, 9545 Wentworth, P.O. Box 129, Sunland, CA 91040, Tel: 818-352-6011, Telex: 673299; Empl.: 300 (USA); *Sls. Mgr.:* Brian Myerscough

APPLIED SOLAR ENERGY CORP., Photosensor Div., 15251 E. Don Julian Rd., City of Industry, CA 91749, Tel: 818-968-6581, TWX: 910-584-4890; Empl.: 160; *Sls. Mgr.:* T. Scott Thorpe

APPLIED SYS., 26401 Harper Ave., St. Clair Shores, MI 48081, Tel: 313-779-8700; Empl.: 15; *Sls. Mgr.:* Marty Wyrod

A P PRODUCTS INCORPORATED, 9450 Pineneedle Dr., Box 540, Mentor, OH 44060, Tel: 216-354-2101, TWX: 810-425-2250; Empl.: 84; *Sls. Mgr.:* Kathy M. Dusa

APSCO, INC., Sub. of The National Copper & Smelting Co., 5976 Heisley Road, Mentor, OH 44060, Tel: 216-942-3871; Empl.: 270; *Sls. Mgr.:* A. Stuart Hamilton III

APTEK MICROSYSTEMS, 700 N. W. 12th Ave., Deerfield Beach, FL 33441, Tel: 305-421-8450, Telex: 441020; Empl.: 250; *Sls. Mgr.:* Joseph F. Centeno

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A.P.W. CO., INC., 72 W. Main, Rockaway, NJ 07866, Tel: 201-627-0643; Empl.: 18

AQ SYS., 1736 Front St., Yorktown Hgts., NY 10598, Tel: 800-431-2104; Empl.: 15; *Sls. Mgr.:* Charles E. Fitzsimmons; *Dist. Mgr.:* Charles E. Fitzsimmons

AQUALARM INC., 544 W. 182nd, Gardena, CA 90248, Tel: 213-321-5873

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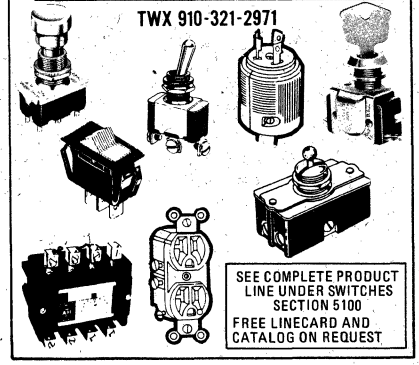

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KS Wichita, Palatine Sls. 316-776-0065
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OH Lancaster, Cain & Co. 614-654-4800
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WA Seattle, Datacom Assocs. 206-285-2525

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CA Fountain Valley, Arrow Hart Div. 714-964-2758
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CA Gardena, California Switch & Signal .. 213-770-2330
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TX Austin, Comptech Sls. 512-331-8922
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CA Santa Clara, Ross Mktg. Assocs. 408-988-8111
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CT Clinton, Selmark Assocs. 203-573-9088
FL Melbourne, Raycom, Inc. 305-259-7988
FL Orlando, Raycom, Inc. 305-859-5504
FL Plantation, Raycom, Inc. 305-741-6690
FL Wellborn, Raycom, Inc. 904-963-5023
GA Duluth, Raycom, Inc. 404-446-9015
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IN Indianapolis, Technical Reps., Inc. 317-882-4407
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MI Grand Rapids, Burcaw Co. 313-573-4605
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MN St. Paul, Arkco Sls. 612-777-7454
MO Florissant, WEB Elctrns. 314-921-5720
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OH Cleveland, KT/DEPCO 216-442-6200
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TX Houston, Bonser-Philhower Sls. 713-531-4144
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CT Wallingford, Cronin Elctrns., Inc. 203-265-3134
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FL Melbourne, Raycom, Inc. 305-259-7988
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IA Cedar Rapids, Bergquist Elctrns. 319-366-8733
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MN Minneapolis, Bergquist 612-835-2322
MN Minneapolis, Control Design Supp., Inc. 612-721-1628
MO Kansas City, L Comp 816-221-2400
NH Salem, Glynn Elctrns. 603-893-8313
NJ Atlantic Highlands, Freedom Elctrns. .. 201-872-2300
NJ Englewood, Powell Elctrns. 201-894-0800
NJ Rockaway, Tonar Ind. 201-586-9000
NJ West Berlin, GCI Corp. 609-768-6767
NY Central Islip, Domino Comp. 516-582-3050
NY Farmingdale, Addem Sls., Inc. 516-882-0993
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NY Lynbrook, Peerless Radio 516-593-2121
NY Poughkeepsie, Kabelton, Inc. 914-473-1222
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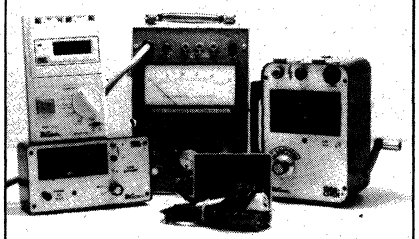

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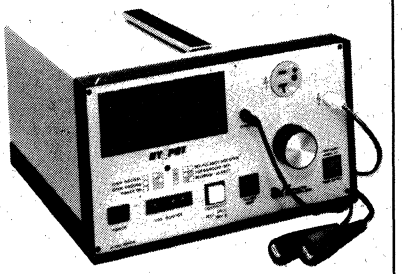

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NC	Charlotte, W. R. Daniel & Assocs.	704-376-8603
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WI	Appleton, Carl Stracka & Assocs.	414-734-7847

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ASSOCIATED SPRING, BARNES GRP., 18 Main St., Bristol, CT 06010, Tel: 203-583-1331, Telex: 962449, TWX: 710-454-0592; Empl.: 1850; *Sls. Mgr.:* R. Hufsmith

ASSOCIATED TESTING LABS., Div. of Kidde, Inc., 53 Second Ave., Burlington, MA 01803, Tel: 617-272-9050; Empl.: 80; *Sls. Mgr.:* Robert H. Croft

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ASTEC USA, LTD., A BSR Intl. Co., 2880 San Tomas Expwy., # 200, Santa Clara, CA 95051, Tel: 408-748-1200, Telex: 4745018 ASTEC UI, TWX: 310-474-5018; *Sls. Mgr.:* Russ Sinagra ..... **D•1512-1514**

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-533-9281
AZ	Phoenix, Compass Mktg. & Sls.	602-996-0635
AZ	Tucson, Compass Mktg. & Sls.	602-293-1220
CA	San Diego, SR Elctrns.	619-560-8330
CA	Santa Clara, Astec (USA) Ltd.	408-748-1200
CA	Santa Clara, I Squared	408-988-3400
CA	Thousand Oaks, SC Cubed	805-496-7307
CA	Tustin, SC Cubed	714-731-9206
CO	Wittleton, Lange Sales Inc.	303-795-3600
PA	Huntingdon Valley, Omega Elctrns. Sls.	215-947-4135
GA	Norcross, 20th Century Mktg.	404-446-1999
IL	Rolling Meadows, Sumer	312-991-8500
IN	Indianapolis, Leslie Devoe	317-842-3245
MA	Burlington, Mill-Bern Assocs.	617-273-1313
MA	Glenburnie, Tri-Mart	301-761-6000
MN	Bloomington, Elctrn. Sls. Agency	612-884-8291
MO	Bridgeton, Centech, Inc.	314-219-4230
NM	Albuquerque, Compass Mktg. & Sls.	505-888-0800
NY	E. Rochester, Tri-Tech Elctrns.	716-385-6500
NY	Elmont, Crane & Egert Corp.	516-872-0800
NY	Jamaica, SJ Assocs.	212-291-3232
OH	Beachwood, Elctrn. Salesmasters	216-831-9555
OK	Tulsa, West Assocs.	918-665-4365
OR	Tigard, Components West, Inc.	503-684-1617
TN	Knottsville, 20th Century Mktg.	615-690-1618
TX	Austin, West Assocs.	512-454-3681
TX	Dallas, West Assocs.	214-248-7060
TX	Houston, West Assocs.	713-777-4108
UT	Salt Lake City, Lang Sls., Inc.	801-487-0843
WA	Bellevue, SDR Squared	206-747-9424
WA	Liberty, Comps. West., Inc.	509-255-6224
WA	Redmond, Comps. West	206-885-5880
WI	Brookfield, Sumer, Inc.	414-784-6641

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CA	Calabasas, Wyle Labs.	213-322-8100,818-880-9000
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CA	Rancho Cordova, Wyle Labs.	916-638-5282
CA	San Diego, Wyle Labs.	619-565-9171
CA	Santa Clara, Wyle Labs.	408-727-2500
CO	Phoenix, Wyle Labs.	602-249-2232
CO	Thornton, Wyle Labs.	303-457-9953
OK	Tulsa, Quality Comps.	918-664-8812
OR	Hillsboro, Wyle Labs.	503-640-6000
TX	Addison, Quality Comps.	214-733-4306
TX	Austin, Quality Comps.	512-835-0220
TX	Sugarland, Quality Comps.	713-491-8812, 713-240-2255
UT	Salt Lake City, Wyle Labs.	801-974-9953
WA	Bellevue, Wyle Labs.	206-453-8300

ASTON ELECTRONICS, INC., Aston Electronic Designs, Ltd., 531 North Murlen Rd., Olathe, KS 66062, Tel: 913-782-4007; *Sls. Mgr.:* D. MacClymont

ASTRO CIRCUIT, 100 Hale St., Lowell, MA. 01851, Tel: 617-458-3240, TWX: 710-343-0754; Empl.: 220; *Sls. Mgr.:* Don Gingras

ASTROCOM ELECTRONICS, INC., Box 370, Oneonta, NY 13820, Tel: 607-432-1930

ASTRO DYNAMICS, INC., 2 Gill St., Woburn, MA 01801, Tel: 617-935-4944; Empl.: 50

ASTRO-GEO-MARINE, INC., 202 E. Cota St., Santa Barbara, CA 93101, Tel: 805-965-7005; FSC No.: 51473; Empl.: 15

ASTRO INSTRUMENT CORP., 2501 NW 17th Ln., Pompano Beach, FL 33064, Tel: 305-973-8900, TWX: 510-956-9601; FSC No.: 51761; *Sls. Mgr.:* Peter J. Sinatra, Jr.

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Local Distributors

CA	Los Angeles, Henry Radio	213-820-1234
CA	Northridge, Ora Elctrns.	213-701-5848
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GA	Marrietta, NBC Mktg.	404-424-9097
IL	Joliet, Communications Assoc.	815-744-6444
IL	Joliet, Primus Elctrns.	815-436-8945
MD	Cockleysville, Tessco.	301-252-0860
NJ	Clifton, Meridian Comms.	201-473-1623
OH	Cincinnati, Cartwright Comms.	513-489-1755
TX	Dallas, M. Hutton Co.	214-484-0580

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ASTROSYSTEMS, 6 Nevada Dr., Lake Success, NY 11042, Tel: 516-328-1600, TWX: 510-223-0411; Empl.: 150; *Sls. Mgr.:* Howard Lazarus ... **D•1183, 1517, 1888**

Local Sales Offices & Reps

AL	Huntsville, Kemp Engrg.	205-837-4304
AZ	Mesa, Foxco Equip., Inc.	602-820-8685
AR	El Dorado, Indust. Controls Assoc.	501-862-2051
AR	Searcy, Industrial Controls Assocs.	800-643-1109
CA	Cerritos, Foxco Equip.	213-921-3421
CA	Long Beach, Saber Entprs., Inc.	213-595-5645
CO	Englewood, Dynatech	303-773-2830
DE	Garrison Lake, Broge-Matarese, Inc.	302-653-5005
FL	Melbourne, Reynolds & Assocs.	305-259-7000
GA	Atlanta, Kemp Instrs.	404-452-8050
IL	Elgin, JHS Assocs.	312-741-9070
IN	Mishawaka, Engineered Sls.	219-255-5111
IA	Cedar Rapids, Di-Tronix, Inc.	319-377-8275

KS Wichita, Di-Tronix, Inc. 316-838-0884
LA Baton Rouge, Industrial Controls Assocs. 800-643-1109
MA Ashland, Polytek Assocs., Inc. 617-881-4741
MA Southborough, Motion Engrg. 617-485-2144
MO Bridgeton, Di-Tronix, Inc. 314-291-4777
MO Raytown, Di-Tronix, Inc. 816-365-6340
NY Cazenovia, D & O Engrg. 315-655-8602
NY Youngstown, D & O Engrg. 716-745-3915
NC Charlotte, Jake Rudisill Assoc. Inc. 704-377-6901
OH Cleveland, Instr. Sys. 216-845-8800
OH Dayton, Instr. Sys. 513-294-2838
OR Portland, Frys Controls, Inc. 503-226-2620
PA Pittsburgh, Instrumentation Sys. 412-823-7005
PA Warminster, Multi-Measurements 215-675-3082
TN Memphis, Industrial Controls Assocs. 800-643-1109
TX Dallas, Data Mktg. Assocs., Inc. 214-661-0330
TX Fort Worth, Indust. Controls Assoc. ... 800-643-1109
TX Houston, Indust. Controls Assoc. 501-862-2051
TX Humble, Industrial Controls Assocs. ... 800-643-1109
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WA Seattle, Datacom & Assocs., Inc. 206-285-2525
WI Appleton, Bu-Nell Eng. Co. 414-733-4242
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Can Willowdale, Ont., Arthur Rosenblum Sls. 416-224-1177

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ATEC, INC., Box 19426, 8219 Kempwood Dr., Houston, TX 77055, Tel: 713-468-7971, Telex: 77-4132 FLEKS HOU; FSC No.: 09552; Empl.: 82; *Sls. Mgr.:* F. Sawberger

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ATLANTIC SCIENTIFIC CORP., 2711 S. Harbour City Blvd., Melbourne, FL 32901, Tel: 305-725-8000, Telex: 755959; *Sls. Mgr.:* Murray W. Boggs

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ATLANTIC SWITCH CONTROLS, INC., 5 Coliseum Ave., Nashua, NH 03063, Tel: 603-880-1971

ATLAS ENERGY SYS., 9457 Rush St., S. El Monte, CA 91733, Tel: 213-575-0755, TWX: 910-587-3531; Empl.: 35; *Sls. Mgr.:* J. Thompson

ATLAS ENGRG. CORP., 10 Cheney St., Dorchester, MA 02121, Tel: 617-445-7100; FSC No.: 07001; Empl.: 61; *Sls. Mgr.:* Norman Scotch

ATLAS EYELETS, Pinkham St., Fairhaven, MA 02719, Tel: 617-997-9491; *Sls. Mgr.:* Arthur S. Tisch

ATLAS SOUND DIV., 10 Pomeroy Rd., Parsippany, NJ 07054, Tel: 201-887-7800, Telex: 13-6119; Empl.: 350; *Sls. Mgr.:* Paul Grote; *Dist. Mgr.:* David A. Chambers

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PA Paoli, Stitzer Assocs. 215-644-5500
TX Dallas, Rem-Air Comp. Corp. 214-234-1069

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AZ Phoenix, EGR 602-840-0320
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ATV RESEARCH, INC., 1301 Broadway, Dakota City, NE 68731, Tel: 402-987-3771; *Sls. Mgr.:* Mel Shadbolt

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AUDIO EQUIP., Div. W. Kidde & Co., Inc., 706 Forrest St., Charlottesville, VA 22901, Tel: 804-977-8050, TWX: 510-587-5461; Empl.: 50

AUDIOSEARS, South St., Stamford, NY 12167, Tel: 607-652-7305; FSC No.: 97101; Empl.: 140; *Sls. Mgr.:* D. Hartwell

AUDIOSONE, INC., 617 Fan Hill Rd., Monroe, CT 06468, Tel: 203-268-4372, 203-268-6703; *Sls. Mgr.:* Rudolph Duris

AUDIOTRONICS CORP., 7428 Bellaire Ave., N. Hollywood, CA 91605, Tel: 818-765-2645, Telex: 69-1241; Empl.: 300; *Sls. Mgr.:* Roy Schaub

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AUGAT/PYLON CO., INC., P.O. Box 2510, Attleboro Falls, MA 02763, Tel: 617-699-7646, TWX: 948095; Empl.: 200; *Sls. Mgr.:* John Deichl

AULT, INCORPORATED, 1600 Freeway Blvd., Minneapolis, MN 55430, Tel: 612-560-9300, TWX: 910-756-3435; Empl.: 300; *Sls. Mgr.:* John Newhouse ..... **D•1518-1519**

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CA San Diego, West Elctrn. Sls. 619-576-9268
CA Santa Clara, Magna Sls. 408-727-8753
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CO Denver, William J. Purdy 303-753-6800
CT Manchester, G/M Assocs. 203-646-4443
CT Wallingford, Marathon Sls., LTD 617-875-3566
FL Boca Raton, QXI, Inc. 305-392-2626
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IA Des Moines, Beams Co. 515-255-1148
KS Shawnee Mission, Beams Co. 913-631-0300

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MI Plymouth, Jay Mktg. Assocs. 313-459-1200
MO St. Louis, Beams Co. 314-434-8448
NV Carson City, Magna Sls. 702-883-1471
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NY Lynbrook, P. Saftler Assocs. 516-593-7880
NC Greensboro, L & D, Inc. 919-292-3201
OH Cleveland, Lyons Corp. 216-659-9224
OH Dayton, E. Lyons Co. 513-278-0714
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MA Sharon, Adcour 617-784-8123
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Can St. Laurent, Que., Tech-Rep Elctrns., Ltd. 514-337-6046

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AURIC CORP., 470 Frelinghuysen Ave., Newark, NJ 07114, Tel: 201-242-4100; Empl.: 35

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CA San Carlos, Westronics Assocs. 415-592-1417
CA San Diego, Thorson Co. 619-292-8525
CA Signal Hill, Thorson Co. 213-595-0361
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FL Orlando, Sci. Devices - SE 305-841-8180
FL Shalimar, Sci. Devices - SE 904-651-4407
GA Atlanta, Sci. Devices-SE 404-452-8709
IL Elk Grove, Loren Green Assoc. 312-593-0282
IN Indianapolis, Loren Green Assoc. 317-293-9827
MA Reading, Scheinfein Assocs. 617-944-2304
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MN Minneapolis, Loren Green Assoc. 612-571-6666
NY Frankfort, Kapital Instr. Sls. 315-894-4245
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NC Winston Salem, Sci. Devices-SE 919-765-5766
OH Dayton, Ashby Assocs. 513-252-5627
OH Lyndhurst, Ashby Assocs. 216-461-0826
OR Portland, Cascade Data Mktg. 503-641-9266
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TX Houston, Sci. Devices - Gulfcoast 713-864-1711
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Local Sales Offices & Reps

AL Huntsville, CRS Elctrns., Inc. 205-533-2444
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GA Atlanta, CRS Elctrns., Inc. 404-396-3720
MD Laurel, CSDS, Inc. 301-490-3800
MA Manchester, Alard, Galagan & Assocs. 617-526-7733
MN Spring Lake Park, Holmgren Assocs. .. 612-786-7641
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NY Carle Place, Olkon Corp. 516-747-2330
NC Raleigh, CSR Elctrns. 919-878-9200
OH Dayton, Rockford Controls Ohio, Inc. .. 513-898-5452
OH Euclid, Rockford Controls Ohio, Inc. ... 216-731-5250
OH Reynoldsburg, Rockford Controls Ohio, Inc. 216-731-5250
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TX Dallas, MGR Elctrns. 214-942-6041
EXP Israel, Tel Aviv, Star-Tronies 703-385-0139

AUTOMATIC CONNECTOR, INC., 400 Moreland Rd., Commack, NY 11725, Tel: 516-543-5000, TWX: 510-226-3744; FSC No.: 94375; Empl.: 250; *Sls. Mgr.:* William Pitcher

AUTOMATIC SWITCH CO., 50-60 Hanover Road, Florham Park, NJ 07932, Tel: 1-201-966-2000, Telex: 136422; Empl.: 1,200; *Sls. Mgr.:* Wayne Bouchard

AUTOMATIC TEST SYSTEMS, 23 Poplar St., Malden, MA 02148, Tel: 617-322-1107

AUTOMATIC TIMING & CONTROLS CO., 201 So. Gulph Rd., King of Prussia, PA 19406, Tel: 215-337-5500, 800-441-8245, Telex: 84-6437; Empl.: 300; *Sls. Mgr.:* R. L. Swanson ..... **D•1112**

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VA Richmond, Jobe & Co. 804-282-6508
WA Seattle, J. A. Tudor & Assocs. 206-682-7444
WA Spokane, J. A. Tudor & Assocs. 509-327-3328
WI Cedarburg, Automation Engrg. 414-377-7500

AUTOMATION ASSOCS., 1212 Westheimer #120, Austin, TX 78752, Tel: 512-458-4412

AUTOMATION DISPLAYS INC., 3833 N. White Ave., Eau Claire, WI 54703, Tel: 715-834-9595; Empl.: 38

AUTOMATION DYNAMICS, 77 Brookside Pl., Hillsdale, NJ 07642, Tel: 201-666-2458; FSC No.: 53089; Empl.: 40

AUTOMATION COMPONENTS, INC., One Short Ave., Peckville, PA 18452, Tel: 717-489-7508

AUTOMATION PRODS., INC., 3030 Max Roy, Houston, TX 77008, Tel: 713-869-0361, Telex: 775-959

AUTOMATION UNLTD., 10H Roessler Rd., Woburn, MA 01801, Tel: 617-933-7288, Telex: 949329; *Sls. Mgr.:* Stephen A. Gould

AUTOSPLICE, INC., 59-12, 37th Ave, Woodside, NY 11377, Tel: 718-429-0500, Telex: 420902, TWX: 968171; Empl.: 86; *Sls. Mgr.:* O. Nedelkovich

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AUTO-SWAGE PRODS., 726 River Rd., Shelton, CT 06484, Tel: 203-929-1401, Telex: 963-542; Empl.: 170; *Sls. Mgr.:* R. Mikulsky ..... **C•1685**

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CA Corte Medera, Paul O'Neal & Assocs. 415-924-1691
CA Glendale, Haldeman & Frazier 818-957-4554
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OH Chagrin Falls, Bray Assocs. 216-247-4474
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Can Candiac, Que., W. H. Elctrns. Registered 514-632-3685

AUTOTROL, P.O. Box 557, Crystal Lake, IL 60014, Tel: 815-459-3080, Telex: 72-2417; Empl.: 140; *Sls. Mgr.:* Thomas Heldt

AUTO-TROL TECH., 12500 N. Washington St., Denver, CO 80233, Tel: 303-452-4919, TWX: 910-320-0772; Empl.: 600; *Sls. Mgr.:* Jim Norrod

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AVANTEK, INC., 3175 Bowers Ave., Santa Clara, CA 95054, Tel: 408-496-6710, Telex: 34-6337, TWX: 910-339-9274; Empl.: 2268

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AVEL-LINDBERG, INC., Peacock Alley 116, 1 Padanaram Rd., Danbury, CT 06811, Tel: 203-797-8698, TWX: 710-456-9984; Empl.: 4; *Sls. Mgr.:* Rowland Mattin

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MA Canton, D. Taggart Assocs. 617-828-6064

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MA Hingham, Sager Electrical Supp. Co. .. 617-749-6700
NY New York, Martin Audio/Video Corp. 718-541-5900

AVEX ELCTRNS., 1683 Winchester Rd., P.O. Box 1026, Bensalem, PA 19020, Tel: 215-638-1515; FSC No.: 58414; *Sls. Mgr.:* Mike Battery Batley; *Dist. Mgr.:* Mike Batley ..... **D•1416**

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GA Atlanta, Rakes Engrg. and Mktg. 404-447-6937
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MN Edina, JH Hansen 612-893-9960
MO St. Louis, Harris Hanson Co. 314-432-3611
NV Las Vegas, 3-B Assocs. 805-581-5681
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NC Raleigh, Rakes Engrg. and Mktg. 919-847-5079
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TX Dallas, Seaton Corp. 214-380-0414
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AVIONICS, Box 200, Niagara-On-Lake, ON, Canada, Tel: 416-468-3632; Empl.: 25

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GA Byron, Unitron (Joe Joiner) 912-956-2866

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CA San Diego, Interstate Mktg. 619-292-8117
CA San Jose, Quadrep Inc. 408-946-4000
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CO Denver, Elcom 303-337-2300
FL Clearwater, Dyne-a-Mark 813-441-4702
FL Fort Lauderdale, Dyne-a-Mark 305-771-6501
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OR Hillsboro, Western Tech. Sls. 503-640-4621
PA Coraopolis, F.J. Campisano Co. 412-264-5151
TX Austin, Ammon & Rizos Co. 512-454-5131
TX Dallas, Ammon & Rizos Co. 214-644-5591
TX Houston, Ammon & Rizos Co. 713-781-6240
UT Salt Lake City, Elcom, Inc. 801-485-7415
VA Lynchburg, Burgin-Kreh Assoc. 804-239-2626
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Can Kirkland, Que., Longman Sls. 514-694-3911
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Can Ottawa, Ont., Longman Sls. 613-564-0100

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CA Los Angeles, Kierulff Elctrns. 213-725-0325
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CA San Jose, Cetec Elctrns. 408-980-0110
CA San Jose, Eric Elctrns. 408-262-1111
CA San Jose, IEC 408-263-1100
CA Santa Clara, Wyle Elctrns. 408-727-2500
CA Southgate, Cetec Elctrns. 213-773-6521
CA Sun Valley, Q.C. Comps. 818-700-2622
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CA Tustin, Kierulff Elctrns. 714-731-5711
CO Denver, Arrow Elctrns. 303-696-1111
CO Denver, IEC 303-292-6121
CO Denver, Kierulff Elctrns. 303-371-6500
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FL Palm Bay, Arrow Elctrns. 305-725-1480
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WI Oak Creek, Arrow Elctrns. 414-764-6600
Can Downsview, Ont., Future Electrns 514-694-7710

AXEL ELCTRNS., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418, Tel: 718-291-3900, TWX: 710-582-2618; FSC No.: 13058; Empl.: 210; *Sls. Mgr.:* J. Alaimo

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BALLY ELECTRONICS, Bally Mfg., 10750 W. Grand Ave., Franklin Park, IL 60131, Tel: 312-451-7223; Empl.: 300; *Sls. Mgr.:* Lam McGannon

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BAKER CO., INC., Drawer E - Sanford Airport, Sanford, ME 04073, Tel: 207-324-8773; Empl.: 150

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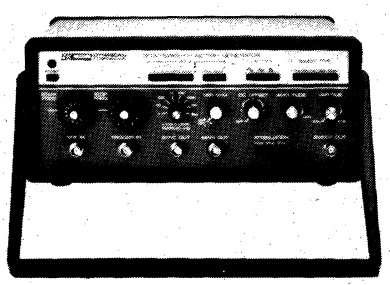

Model 3030

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CA	Laguna Hills, Elotek Sys. Inc.	714-830-4856
CA	Los Angeles, Elotek Sys., Inc.	213-416-9190
CA	San Diego, Elotek Sys., Inc.	619-438-4856
CA	San Jose, MCH Assocs.	408-246-7330
CO	Denver, Fry-Gates, Inc.	303-321-6818
CT	Southington, Scheinfein Assocs.	203-621-3492
FL	Orlando, Micro Spec, Inc.	305-299-6508
GA	Lilburn, Micro Spec, Inc.	404-921-3840
IL	Arlington Hgts., Dytec/Central	312-394-3380
IN	Indianapolis, Dytec/Central	317-247-1316
KS	Kansas City, Marsland Assocs.	913-888-2840
MA	Reading, Scheinfein Assocs.	617-944-2304
MI	Madison Hgts., WKM Assocs.	313-588-2300
MO	St. Louis, Marsland Assocs.	314-991-1399
NJ	Elmwood Park, L & M Assocs.	201-797-0441
NM	Albuquerque, Fry-Gates, Inc.	505-262-1525
NY	Canandaigua, Mamula Sls.	716-394-5560
NY	New York, L & M Assocs.	212-243-6155
OH	Cleveland, WKM Assoc.	216-267-0445
OH	Dayton, WKM Assoc.	513-434-7500
OH	Independence, WKM Assocs.	216-524-5930
OR	Portland, Westcon	503-283-0132
PA	Andalusia, L & M Assocs.	215-245-6658
PA	Pittsburgh, WKM Assoc.	412-292-2953
SC	Rock Hill, Micro Spec, Inc.	803-366-3015
TN	Nashville, Micro Spec. Inc.	615-383-4064
TX	Austin, Lear Assocs.	512-450-1059
TX	Richardson, Lear Assocs.	214-231-5388
UT	Salt Lake City, Zeus Elctrns.	801-534-0500
VA	Alexandria, Dyna Rep Co.	703-354-1222
WI	Elm Grove, Dytec/Central	414-784-9686

BALL ELCTRN. SYS. DIV., Ball Corp., P. O. Box 64376, St Paul, MN 55164, Tel: 612-786-8900, TWX: 910-563-3552; FSC No.: 612-786-4577; Empl.: 150; *Sls. Mgr.:* Richard C. Scarle

BALL ELECTRONIC, Systems Div., 9300 W. 108th Circle, Broomfield, CO 80020, Tel: 303-460-5256, Telex: 45776; Empl.: 500; *Sls. Mgr.:* R. Scarle

BALSTON, 703 Massachusetts Ave., Lexington, MA 02173, Tel: 617-861-7240, Telex: 92-3481; Empl.: 50; *Sls. Mgr.:* J. Alpert

BALZERS OPTICAL GRP., 170 Locke Dr., Marlboro, MA 01752, Tel: 617-481-9860, Telex: 951-562; Empl.: 136; *Sls. Mgr.:* C. A. Burke

B & B MOTOR & CONTROL CORP., Apple Hill Commons, Burlington, CT 06013, Tel: 203-673-7151, Telex: 14-1484; Empl.: 90; *Sls. Mgr.:* Sam Mandel

Local Sales Offices & Reps

CT	Berlin	203-828-8550
FL	Clearwater	800-845-1020
IL	Chicago, B & B Motor & Control Corp.	312-681-0089
IN	Indianapolis	317-248-0396
KY	Louisville	502-589-7753
MA	Boston, B & B Motor & Control Corp.	617-890-4944
NH	Nashua, B & B Motor & Control Corp.	603-883-1062
NJ	Piscataway	201-572-0500
NY	Baldwin, B & B Motor & Control Corp.	212-784-1313
NY	Elmira	607-732-6599
NY	Long Island City, B & B Motor & Control Corp.	212-784-1313
NY	Rochester	716-424-7040
NC	Charlotte	704-375-0577
OH	Cincinnati	513-381-1885
SC	Greenville	803-268-5702
TX	Dallas	214-641-0857
TX	Houston	713-820-7931

B & G PRECISION ELCTRNS., 538 Maple Ave., Doylestown, PA 18901, Tel: 215-348-4413; *Sls. Mgr.:* Eugene R. Bigay; *Dist. Mgr.:* Xavier Garcia

B & K PRECISION, INDUSTRIAL ELECTRONICS PRODUCT GROUP, Dynascan Corporation, 6460 W. Cortland, Chicago, IL 60635, Tel: 312-889-9087, Telex: 253475; FSC No.: 08098, 18110, 48560, 30678; Empl.: 250; *Sls. Mgr.:* Dennis Hoy
D•1186-1190, 1386-1388, 1521

Local Sales Offices & Reps

AL	Alabaster, Maitland K. Smith, Inc.	205-664-3093
AR	Little Rock, Erickson Sls., Inc.	501-225-7379
CA	Irvine, Mike Roth Sls.	714-250-0722
CA	Pleasanton, Moulthrop Sls.	415-463-0450
CO	Denver, K-C Marketers, Inc.	303-733-5561
FL	Maitland, Hutto, Hawkins, Peregoy	305-831-2474
GA	Tucker, Maitland K. Smith	404-939-3322
HI	Honolulu, Omega Hawaii, Inc.	808-946-2983
IL	Arlington Hgts., Brainard-Wilson Mktg.	312-437-2700
KS	Shawnee Mission, Lowell-Kangas & Assocs.	913-631-3515
LA	Chalmette, Erickson Sls.	504-271-1976
MD	Perry Hall, Electra-Tech	301-256-2723
MA	Woburn, W & D Mktg.	617-935-5610
MI	Southfield, Robert Milsk Co., Inc.	313-354-3310
MN	Minneapolis, HMR, Inc.	612-888-2122
MO	St. Louis, Lowell-Kangas Assocs.	314-821-4050
NJ	Medford, Champion Elctrn. Sls. Co.	609-983-0932
NY	Bellmore, Selectra Sls.	516-221-7865
NY	East Greenbush, Warren Kaufman & Assocs.	518-477-9864
NY	Rochester, Warren Kaufman & Assocs.	716-266-2728
NC	Charlotte, Maitland K. Smith, Inc.	704-372-2681
OH	Cleveland, Marlow Assocs.	216-991-6500
OH	Columbus, Marlow Assocs.	614-885-7643
OK	Broken Arrow, Erickson Sls., Inc.	918-455-4276
OR	Portland, Dussault & Assocs.	503-641-8540
PA	Pittsburgh, Marlow Assocs.	412-367-8886
TX	Austin, Erickson Sls., Inc.	512-244-3068
TX	Dallas, Erickson Sls.	214-739-5833
TX	Houston, Erickson Sls., Inc.	713-266-1604
VA	Dumfries, Electra-Tech	703-670-6962
WA	Seattle, Dussault & Assocs.	206-527-5454
WI	Waukesha, Brainard-Wilson Mktg.	414-797-7940
EXP	NY, Plainview, Empire Exporters	516-293-5582

BANNER ENGRG. CORP., 9714 - 10th Ave. N., Minneapolis, MN 55441, Tel: 612-544-3164, Telex: 29-1011; *Sls. Mgr.:* Floyd Schneider

BARBER-COLMAN CO., Indl. Instrs. Div., P.O. Box 2940, 1354 Clifford Ave., Loves Park, IL 61132, Tel: 815-877-0241, Telex: 257327; Empl.: 5000; *Sls. Mgr.:* John Parry

BARCEL WIRE & CABLE CORP., Electronics Div., 2851 Aton Ave., Irvine, CA 92714

BARKSDALE CONTROLS DIV., Transamenca DeLaval, 3211 Fruitland Ave., P.O. Box 58843, Los Angeles, CA 90058, Tel: 213-589-6181; Empl.: 325; *Sls. Mgr.:* R. C. Wolf

BARNES & REINECKE, INC., 2375 Estes Ave., Elk Grove Village, IL 60007, Tel: 312-640-7200; Empl.: 290

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BARNES ENGRG., 1645 So. Claudina Way, Anaheim, CA 92805, Tel: 714-533-7530; FSC No.: FSCM 53823 S.I.C. 3469; Empl.: 38; *Sls. Mgr.:* Gordon Mackenzie
C•1010-1024

Local Sales Offices & Reps

OH	Cleveland, Components, Inc.	216-243-9200
OH	Miamisburg (Dayton), Components, Inc.	513-866-0661
PA	Pittsburgh, Components, Inc.	412-824-1600

BARNES ENGRG., 44 Commerce Rd., P.O. Box 53, Stamford, CT 06904, Tel: 203-348-5381, Telex: 965921, TWX: 710-474-3367; Empl.: 300; *Sls. Mgr.:* H. R. Hofmann, Jr.

BARON-BLAKESLEE, INC., Sub. Purex Inds., Inc., 2001 N. Janice Ave., Melrose Pk., IL 60160, Tel: 312-450-3900, Telex: 25-4701; *Sls. Mgr.:* B. Uffer

BARON WIRE & CABLE, 1811 W. Bryn Mawr Ave., Chicago, IL 60660, Tel: 312-728-7480, Telex: 72-4322; Empl.: 50; *Sls. Mgr.:* Al Desaluo

BARRY CONTROLS, Barry Wright Corp., 700 Pleasant St., Watertown, MA 02172, Tel: 617-923-1150, TWX: 710-327-1290; FSC No.: 81860; *Sls. Mgr.:* Philip R. Littlewood

BARSOM INC., See IR Scientific

BARTLETT INSTRUMENT CO., 14th & Ave. 'M', P.O. Box 445, Ft. Madison, IA 52627, Tel: 319-372-8366; Empl.: 25; *Sls. Mgr.:* P. R. Bartlett

BASCOM-TURNER INSTRS., 111 Downey St., Norwood, MA 02062, Tel: 617-769-9660, Telex: 92-2413; Empl.: 35; *Sls. Mgr.:* D. Weise; *Dist. Mgr.:* S. Holly

BASE TEN SYS., One Electronics Dr., Box 3151, Trenton, NJ 08619, Tel: 609-586-7010, Telex: 4754158, TWX: 510-685-5692; FSC No.: 30377; Empl.: 255; *Sls. Mgr.:* Oleh Pavlovsky

BASF SYS., Crosby Dr., Bedford, MA 01730, Tel: 617-271-4000, 800-343-4600, Telex: 92-3423; Empl.: 1,300; *Sls. Mgr.:* David F. Pippin

BASIC ELECTRONICS, INC., 11762 Western Ave. "Q", Stanton, CA 90680, Tel: 714-530-2400; Empl.: 30; *Sls. Mgr.:* Tom Jones; *Dist. Mgr.:* Tom Jones

BASIC MEASURING INSTS., 402 Lincoln Centre Dr., Foster City, CA 94404, Tel: 415-570-5355; *Sls. Mgr.:* Robert Moore

BASIC SYSTEMS, 1919 S. 129 5. Ave., Tulsa, OK 74108, Tel: 918-437-7066; Empl.: 20; *Sls. Mgr.:* Karen Duggan; *Dist. Mgr.:* Karen Duggan

BASLER ELEC., Rte. 143, Highland, IL 62249, Tel: 618-654-2341, TWX: 910-996-2522; Empl.: 1,233

BASLER ELEC. CIRCUITS, INC., 204 Highland Dr., P.O. Box 1165, Taylor, TX 76574, Tel: 512-352-7683; Empl.: 110; *Sls. Mgr.:* Warwick R. Tobias

BAUSCH & LOMB, 820 Linden Ave., Rochester, NY 14625, Tel: 716-338-6000, Telex: 97-2286; *Sls. Mgr.:* Martin Green

BAUSCH & LOMB, 820 Linden Ave., Rochester, NY 14625, Tel: 716-338-6314, Telex: 98-8286; Empl.: 500

BAUSCH & LOMB, O.S.D. Div., 1400 N. Goodman St., Rochester, NY 14692, Tel: 716-338-6000, Telex: 97-8231; Empl.: 5000; *Sls. Mgr.:* Martin L. Green

BAY COMPONENTS, INC., 1806 Dreams Landing Way, Annapolis, MD 21401, Tel: 301-266-6767, Telex: 710-867-8567; Empl.: 55; *Sls. Mgr.:* Lois Levit

BAYLEY INSTR. CO., Box 357, Kenwood, CA 95452, Tel: 707-833-6014

BAY PRODS., 8701 Torresdale Ave., Phila., PA 19136, Tel: 215-DE8-7300, Telex: 83-4434; Empl.: 150; *Sls. Mgr.:* Frank Stewart

BAYTRON, See M/A-Com Millimeter Products Inc.

BBC BROWN BOVERI GOERZ METRAWATT

BBC-METRAWATT/GOERZ, 2150 W. 6th Ave., Broomfield, CO 80020, Tel: 303-469-5231, 800-821-6327, Telex: 4970869; Empl.: 20; *Sls. Mgr.:* Andy Zeidler/Mac McChesney ..... **D•1192-1193**

Local Sales Offices & Reps

Multimeter

AL	Birmingham, Adams & Assocs.	205-788-0305
CA	Sun Valley, Teqni-Rep. Assocs.	818-768-4223
CO	Louisville, Stan Sliz Assocs.	303-666-4760
FL	Lake Park, Adams & Assocs.	305-694-1543
GA	Marietta, Adams & Assocs.	404-973-0853
HI	Honolulu, Hawaiian Indl. Inst. Sls. Corp.	808-533-5170
LA	Kenner, Assoc. Mktg. Grp.	504-443-5072
MA	Norwood, Mac Innis Corp.	617-762-8090
MI	Livonia, Harvey Sls.	313-591-1975
MN	Edina, Pec/Levi & Assocs.	612-944-8540
NJ	Medford, Jack McCoy Assocs.	609-953-0770
NM	Tijeras, Stan Sliz Assocs.	505-281-3856
NY	Kew Gardens, Jack Brown Elec.	212-805-0343
NY	Liverpool, Jack Brown Elec.	315-622-3211
NY	Whitestone, Jack Brown Elec.	212-767-1977
NC	Charlotte, Adams & Assocs.	704-552-7800
NC	Greensboro, Adams & Assocs.	919-272-6838
PA	Dawnington, Jack Brown Elec.	215-363-0350
TX	Dallas, Assoc. Mktg. Grp.	214-241-7190
TX	Houston, Assoc. Mktg. Grp.	713-466-8673
UT	So. Jordan, Stan Sliz Assocs.	801-254-4141
WA	Seattle, Northmar	206-524-5170

Recorder

AL	Huntsville, Newcomb Assocs.	205-837-3233
CA	Berkeley, Rotech	415-428-2044
CA	Woodland Hills, Friedman & Assocs.	818-702-0665
CO	Arvada, Air-Row Entprs.	303-421-4204
GA	Roswell, Newcomb Assocs.	404-641-7942
HI	Honolulu, Hawaiian Indl. Inst. Sls. Corp.	808-533-4232
IL	Rolling Meadows, Commodore-I	312-394-5441
MD	Rockville, Dela Technlg.	301-881-6292
MA	Sharon, Reptek	617-784-6700
MI	Trenton, I & C Sls.	313-671-1320
MN	Burnsville, Commodore-I	612-894-5488
MT	Billings, Geo Research	406-248-6771
NY	Albany, L-Tron	518-482-1987
NY	Rochester, L-Tron	716-436-4410
NY	Roslyn Heights, Penzias Assocs.	516-621-8522
NC	R.T.P., Newcomb Assocs.	919-549-0486
OH	Cincinnati, I & C Sls.	513-772-3101
OR	Portland, Westcon	503-283-0132
TX	Austin, Acudata	512-346-4033
TX	Houston, Acudata	713-580-2451
TX	Plano, Acudata	214-424-3567

BBK, INC., 75 Travis Ave., Binghamton, NY 13904, Tel: 607-772-8119; *Sls. Mgr.:* Jerome Kunze

B-D CRYSTAL ENTPRS., INC., 1727 W. Galbraith Rd., Cincinnati, OH 45239, Tel: 513-522-3300, Telex: 21-4545; *Sls. Mgr.:* Janet Wood, Charles Fithen

BDS COMPUTER CORP., 800 Maude Ave., Mountain View, CA 94043, Tel: 415-964-2115, TWX: 910-373-2005; *Sls. Mgr.:* Dave Lester

BEAD ELECTRONIC CONNECTORS, Bead Chain Manufacturing Co., 10878 Wiles Rd., Box 9897, Coral Springs, FL 33075, Tel: 305-753-3639; Empl.: 150; *Sls. Mgr.:* Bruce Thomas; *Dist. Mgr.:* Bruce Thomas ..... **C•1162-1167**

Local Sales Offices & Reps

CA	Anaheim, Galaxie Sls. Intl.	714-937-5622
CO	Denver, Gribble Sls. Engrg.	303-278-1495
CT	Kensington, Metal Tech., Inc.	203-828-1148
FL	Coral Springs, Janco Sls.	305-755-0631
IL	Chicago, Electro Mech. Sls. Co.	312-777-0554
IN	Indianapolis, Hoster & Sieloff Assocs.	317-842-3700
MI	Detroit, Fox Inds., Inc.	313-363-7183
MN	Minneapolis, Gribble Sls. Engrg.	612-788-7028
TX	Dallas, Gribble Sls. Engrg.	214-221-5109
VA	Williamsburg, Dyneers, Inc.	804-229-3612

Local Distributors

CA	Anaheim, Beta Inds.	714-978-7544

BEAD ELCTRNS., Div. Bead Chain Mfg. Co., 110 Mountain Grove St., Bridgeport, CT 06605, Tel: 203-334-4124; Empl.: 175; *Sls. Mgr.:* Mrs. B. M. Krafcik ..... **C•1686-1688**

Local Sales Offices & Reps

CA	Anaheim, Galaxie Sls. Intl.	714-937-5622
CO	Denver, Gribble Sls. Engrg.	303-279-4545
CT	Kensington, Metal Tech, Inc.	203-828-1148
FL	Coral Springs, Janco Resch. & Sls. Co.	305-755-0631
IL	Chicago, Electro-Mech Sls. Co.	312-777-0554
IN	Indianapolis, Hoster & Sieloff Assocs.	317-842-3700
MI	Union Lake, Fox Inds.	313-363-7183
MO	Independence, Gribble Sls. Engrg.	816-796-4333
TX	Lewisville, Gribble Sls. Engrg.	214-221-5109
VA	Williamsburg, Dyneers	804-229-3612
EXP	NJ Rochelle Park, Richmen Metals & Comps.	201-796-6271

BEA ELECTRO-OPTICS, INC., 690 First Ave., Des Plaines, IL 60016, Tel: 312-298-1420, Telex: 882903; *Sls. Mgr.:* George E. Magerl; *Dist. Mgr.:* Vic Halkyn

BEAL COMMUNICATIONS, Beneficial Properties, 11020 Audelia Rd. Ste. C 101, Dallas, TX 75243, Tel: 214-340-2044, 214-340-2045; Empl.: 7; *Sls. Mgr.:* Robert Farrier

BEAM TUBE CO., INC., 11 Beach St., Milford, MA 01757, Tel: 617-473-0660; FSC No.: 5960; Empl.: 25; *Sls. Mgr.:* Joseph A. Casciano

BEAN RUBBER MFG. CO., 1623 S. 10th St., San Jose, CA 95112, Tel: 408-293-2790; FSC No.: 18545; *Sls. Mgr.:* Kris Mosher

BEARING INSPECTION, 10041 Shoemaker Ave., Santa Fe Springs, CA 90670, Tel: 213-944-6251; Empl.: 31

BEAU PRODUCTS DIV., Vernitron Corp., Box 10, Laconia, NH 03247, Tel: 603-524-5101, TWX: 710-364-1843; FSC No.: 13150; Empl.: 230; *Sls. Mgr.:* John Jansen; *Dist. Mgr.:* Larry Murphy ..... **C•1168-1170**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, The Knight Co.	602-582-8506
CA	Los Angeles, The Knight Co.	213-670-2833
CA	Santa Clara, Nova-Tronix Elec. Sls.	408-727-9530
CO	Denver, W.J. Purdy Co.	303-753-6800
FL	Orlando, Cartwright & Bean	305-422-4531
GA	Atlanta, Cartwright & Bean	404-233-2939
IL	Lisle, W-G Controls	312-963-5954
LA	Kenner, Cartwright & Bean	504-466-0020
MA	Needham, R. Perron & Co.	617-449-6162
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
MO	Kansas City, Forristal-Young Sls. Co.	816-358-6771
NH	Dover, R. Perron & Co.	603-742-2321
NJ	West Caldwell, Grimm, Siegel Assoc.	201-575-9300
NM	Albuquerque, C.T. Carlberg & Assoc.	505-883-3883
NY	Buffalo, Rudell-Merrifield Assoc	716-634-4300
NC	Charlotte, Cartwright & Bean	704-377-5673
OH	Cleveland, Jim Finnegan & Co.	216-238-5905
OK	Oklahoma City, Erickson Sls.	405-682-2947
PA	Broomall, L.D. Lowery	215-356-5300
PA	Pittsburgh, Jim Finnegan	412-561-4687
TN	Memphis, Cartwright & Bean	901-276-4442
TX	Dallas, Erickson Sls.	214-739-5833
WA	Medina, Henry Paulman Sls. Co.	206-455-3311
WA	Seattle, Don Smith Sls. Co.	206-633-3160

BEAU TECH, P.O. Box 598, Portland, ME 04122, Tel: 207-775-6139; Empl.: 9

BEAVER LABS, P. O. Box 202, Kingston, MA 02364, Tel: 617-585-5666; Empl.: 5

BEC INC., 2709 N. Broad St., Philadelphia, PA 19132, Tel: 215-229-9800; *Sls. Mgr.:* Bob Kandel

BECKMAN INDUSTRIAL CORP., Cedar Grove Div., 89 Commerce Rd., Cedar Grove, NJ 07009, Tel: 201-239-6200, TWX: 710-994-5781

BECKMAN INDUSTRIAL CORP., Electronic Technologies Div., 2500 Harbor Blvd, Fullerton, CA 92634, Tel: 714-871-4848, Telex: 06-78413, TWX: 910-592-1260; FSC No.: 73138; Empl.: 2600; *Sls. Mgr.:* Roger Jones; *Dist. Mgr.:* Philip Graham

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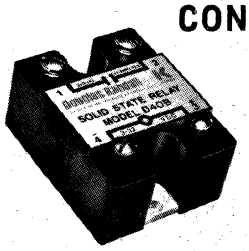

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BECKMAN INSTRS., 2500 Harbor Blvd., Fullerton, CA 92634, Tel: 714-871-4848, Telex: 06-7413; Empl.: 12000

BECKMAN INSTRS., HELIPOT DIV., See Beckman Instrs., Electro-Prods. Grp.

BEECHWOOD MFG., 310 S. Ohmer, Indianapolis, IN 46219, Tel: 317-356-2493; *Sls. Mgr.:* Robt. Cox

BEEDE ELECTRICAL INSTR. CO., S. Main St, Penacook, NH 03303, Tel: 603-753-6362, TWX: 710-364-6977; Empl.: 500; *Sls. Mgr.:* Mike Harbour

BEHLMAN DIV., CALIFORNIA INSTRS., Div. of Norlin Inds., 5150 Convoy St., San Diego, CA 92111, Tel: 619-279-8620, Telex: 695-047; FSC No.: 16067; Empl.: 90

BEHLMAN ENGINEERING, 1142 Mark Ave., Carpinteria, CA 93013, Tel: 805-684-8311; FSC No.: 53636; *Sls. Mgr.:* Edward C. Bertolet/Frank Chase; *Dist. Mgr.:* John White ..... **D•1898-1905**

Local Sales Offices & Reps

AL	Huntsville, Reynolds & Assocs.	305-259-7000
AZ	Phoenix, J. Smith & Assocs., Inc.	602-267-0981
AZ	Phoenix, R. L. Davis	602-955-2266
CA	Cupertino, T. Louis Snitzer	408-257-8333
CA	Del Mar, T. Louis Snitzer	714-226-0305
CA	Los Angeles, T. Louis Snitzer	213-836-6170
CO	Colorado Springs, J. Smith & Assocs., Inc.	303-597-5343
FL	Melbourne, Reynolds & Assocs.	305-259-7000
FL	Satellite, Reynolds & Assocs.	305-773-4700
GA	Atlanta, Reynolds & Assocs.	404-252-5360
IL	Wheeling, Ed Joyner & Co.	312-520-1200
IN	Noblesville, R & D Elctrns.	317-849-2026
MD	Rockville, Farrell Assocs.	301-424-9460
MA	Needham, Addelco Corp.	617-444-4754
MI	Farmington Hills, Carter, McCormic & Peirce, Inc.	313-477-7700
MN	St. Paul, Dytec No.	612-645-5816
MO	Independence, Engineering Svcs. Co.	816-254-3600
MO	St. Louis, Engineering Svcs. Co.	314-997-1515
NM	Albuquerque, J. Smith & Assocs., Inc.	505-265-3406
NY	Great Neck, Industron Assocs., Inc.	516-487-2620
NC	Raleigh, Reynolds & Assocs.	305-259-7000
OH	Cleveland, Carter, McCormic & Peirce, Inc.	216-779-5100
OH	Dayton, Carter, McCormic & Peirce, Inc.	513-836-0951
OK	Tulsa, Testech, Inc.	918-665-7788
PA	Pittsburgh, Carter, McCormic & Peirce, Inc.	412-372-4415
TX	Austin, Testech, Inc.	512-327-7033
TX	Houston, Testech, Inc.	713-956-0837
TX	Richardson, Testech, Inc.	214-644-5010
WA	Seattle, Datacom Assocs.	206-285-2525
Can	Burnaby, B.C., Atelco, Inc.	604-299-9331
Can	Calgary, Alberta, Atelco, Inc.	403-230-1697
Can	Montreal, Que., Atelco, Inc.	514-481-7733
Can	Ottawa, Ont., Atelco, Inc.	613-596-5894
Can	Scarborough, Ont., Atelco, Inc.	416-497-2208

BEI

BEI MOTION SYSTEMS CO., Corporate Off., 166 Geary St., Ste. 1400, San Francisco, CA 94108, Tel: 415-788-6840, Telex: 910-380-5402; Empl.: 5 ..... **B•1782-1783**

Local Sales Offices & Reps

CA	Santa Ana, BEI Motion Sys. Co.	714-973-8510
CA	Santa Clara, BEI Motion Sys. Co.	408-986-9006
CO	Westminster, BEI Motion Sys. Co.	303-426-1566
GA	Lawrenceville, BEI Motion Sys. Co.	404-963-0673
IL	Rockford, BEI Motion Sys. Co.	815-968-9528
MA	Wakefield, BEI Motion Sys. Co.	617-245-3851
MI	Plymouth, BEI Motion Sys. Co.	313-451-0359
OH	Cincinnati, BEI Motion Sys. Co.	513-232-4545
OR	Beaverton, Thorson Co. NW	503-644-5900
PA	Exton, BEI Motion Sys. Co.	215-363-5444
TX	Hurst, BEI Motion Sys. Co.	817-284-4313
WA	Bellevue, Thorson Co. Northwest	206-455-9180
Can	Montreal, Miller Engrg., Ltd.	514-748-6169
Can	Willowdale, Miller Engrg., Ltd.	416-499-4421

BEI MOTION SYS. CO., Computer Prod. Div., 1755 B La Costa Meadows Dr., San Marcos, CA 92069, Tel: 619-471-2600; *Sls. Mgr.:* Everett McElroy ..... **B•1783**

BEI MOTION SYS. CO., Digital Prods. Div., P.O. Box 3838, Little Rock, AR 72203, Tel: 501-851-4000, TWX: 910-722-7384; Empl.: 103; *Sls. Mgr.:* H. O. Tyler .... **B•1782**

Refer to BEI Motion Sys. Co., Corporate Off., San Francisco, CA for sales office information.

BEI MOTION SYS. CO., General Control Systems Div., 564 Alpha Dr., Pittsburgh, PA 15238, Tel: 412-963-0515; *Sls. Mgr.:* Chic Sweeney ..... **B•1783**

Refer to BEI Motion Sys. Co., Corporate Off., San Francisco, CA for sales office information.

BEI MOTION SYS. CO., Industrial Encoder Div., 7230 Hollister Ave., Goleta, CA 93117, Tel: 805-968-0782; *Sls. Mgr.:* Glenn Avolio ..... **B•1782**

Refer to BEI Motion Sys. Co., Corporate Off., San Francisco, CA for sales office information.

BEI MOTION SYSTEM COMPANY, Kimco Division, 150 Vallecitos de Oro, San Marcos, CA 92069, Tel: 619-744-5671, TWX: 910-322-1168; Empl.: 43; *Sls. Mgr.:* William Byrnes ..... **B•1783**

BEI MOTION SYS. CO., Position Controls Div., 819 Reddick Ave., Santa Barbara, CA 93103, Tel: 805-966-1538, TWX: 910-334-4903; *Sls. Mgr.:* K. Capps ..... **B•1782**

Refer to BEI Motion Sys. Co., Corporate Off., San Francisco, CA for sales office information.

COOPER INDUSTRIES **BELDEN**

BELDEN, Electronic Wire & Cable, P.O. Box 1980, Richmond, IN 47375, Tel: 317-983-5200, TWX: 810-345-1393; Empl.: 2180; *Sls. Mgr.:* Bill Donahoe ..... **C•1742, 1750-1789**

Local Sales Offices & Reps

Regional Sales Offices

CA	Cannon Country, John Duffin	805-252-2525
CA	Hayward, Harry Furst	415-278-1607
CA	Irvine	714-474-1200
CA	Lafayette, Mark Warren	415-284-5064
CA	Placentia, Rick Webber	714-524-7619
CA	San Diego, Judy Hummerich	619-484-5766
CA	Torrance, Dave Wilhide	213-373-1967
CO	Englewood, Terry Godwin	303-694-3292
FL	Orlando, Brad Hahn	305-291-7739
GA	Norcross, Tom Beane	404-925-0679
IL	Naperville, Kelley Smith	312-961-1249
IL	Palatine, Phil Dunn	312-358-9336
IL	St. Charles, Joe Prechodnik	312-377-9464
IN	Richmond	317-983-5200
KS	Shawnee, Dave Phelps	913-268-6528
LA	St. Rose, Kyle Ingram	504-464-0125
MA	Framingham, John Kennedy	617-872-4585
MA	Wayland, Cathie Hamel	617-651-1213
MN	Plymouth, Ken Pratt	612-593-0907
MN	Spring Park, Jim Hughes	612-471-9478
NY	Huntington Station, Dale Ambery	516-549-9731
NY	Oyster Bay, Mike Wakeland	516-922-3762
OK	Broken Arrow, Jeff Cooper	918-251-2027
PA	Bethel Park, J. D. Allen	412-831-9312
PA	Exton, Tom Deckard	215-363-2874
PA	Rosemont, Brian Easley	215-525-3268

TN Hendersonville, Dale Diedrichs 615-822-3861
TX Carrollton, Tim Fast 214-492-0937
TX Dallas 214-788-4300
TX Dallas, Mike Kipper 214-553-0521
TX Houston, Charles Amonett 713-350-2271
TX Plano, Mary McQuistion 214-423-2335
VA Richmond, Karen Jones 804-747-1090

Local Sales Reps.
AZ Scottsdale, W. Atkins 602-998-7355
CA Huntington Beach, E. Kerezsi 714-848-2157
CA Newark, R. Tribendis 415-490-0838
CA Northridge, J. Duffin 213-993-8919
CA San Jose, S. Landis 408-723-7117
CA Tustin, W. Caughlin 714-832-5278
CT South Bury, L. Kerchief 212-264-8012
FL Boca Raton, G. Pedigo 305-482-1279
GA Atlanta 404-934-6767
GA Marietta, J. Fienning 404-973-6212
IL Oakbrook 312-789-0800
IN Indianapolis, L. Brown 317-849-1945
IN Richmond, J. Daggy 317-962-6103
MD Columbia, E. Wunder 301-997-4480
MA Framingham 617-872-7846
MA Framingham, A. Harris 617-872-2066
MA Franklin, S. LaRocco 617-528-1896
MO Clayton, Fletcher Lane 314-725-1488
NY Rochester, T. Centofonti 716-461-0818
NY Sunnyside, E. Mammone 212-361-0993
NC Raleigh, A. Hatcher 919-848-3342
OH Medina, H. Flanders 216-725-4285
OR Lake Oswego, D. Clicquennoi 503-638-0271
SC Columbia, G. Owen 803-781-9739
TX Austin, M. Mullery 512-345-5204
TX Houston, C. Amonett 713-350-2271
TX Houston, M. Masucci 713-721-6023
WA Bellevue, S. Abernethy 206-885-5808
WI Milwaukee, M. Lucky 414-355-4986

BELDEN, Fiber Optics, 2000 S. Batavia Ave., Geneva, IL 60134, Tel: 312-232-8900, TWX: 910-237-1681

bel BEL FUSE INC.

BEL FUSE, 198 Van Vorst St., Jersey City, NJ 07302, Tel: 201-432-0463, TWX: 710-730-5301; Empl.: 225; *Sls. Mgr.:* A. Sutta; *Dist. Mgr.:* S. Rader ..... **A•1468-1486; B•1230-1232**

Local Sales Offices & Reps

Delay Lines
AL Huntsville, EMA, Inc. 205-830-4030
AZ Scottsdale, SMS & Assocs. 602-998-0831
CA Escondido, Cirolia Elctrn. 619-743-3015
CA Los Angeles, Corcoran Assocs. 213-823-4589
CA Santa Clara, Thresum Assocs. 408-996-9889
CO Boulder, Front Range Mktg. 303-443-4780
CT Branford, L.J.M. Assocs. 203-488-4244
FL Altamonte Springs, Semtronics Assocs. 305-831-8233
FL Clearwater, Semtronic Assocs. 813-461-4675
FL Fort Lauderdale, Semtronics Assocs. 305-731-2484
GA Atlanta, Beacon Elctrns. 404-256-9640
IL Chicago, MGA 312-775-1151
IN Indianapolis, Insul-Reps, Inc. 317-251-1994
MA Wellesley Hills, Sturdy Co. 617-235-2330
MI Bloomfield Hills, Enco Mktg. 313-642-0203
MN So. St. Paul, Northport Engr. 612-457-8000
NH Milford, D. A. Crowley Assocs. 603-673-7050
NJ East Brunswick, Winch Sls. Assocs. 201-828-4615
NM Albuquerque, SMS & Assocs. 505-883-9765
NY E. Rochester, Tri-Tech Elctrns. 716-385-6500
NY Fayetteville, Tri-Tech Elctrns. 315-446-2881
NY Roslyn Hgts., Winch Sls. Assocs. 516-621-6378
NC Raleigh, Beacon Elctrns. 919-787-0330
OH Cleveland, J. Finnegan & Co. 216-238-5905
PA Bala Cynwyd, Friedman & Assocs. 215-667-1838
TN Knoxville, Insul-Reps 615-691-7586
TX Austin, Oeler & Menelaides 512-453-0275
TX Dallas, Oeler & Menelaides 214-361-8876
TX Houston, Oeler & Menelaides 713-682-1083
UT Salt Lake City, Front Range Mktg. 801-364-6481
WA Kirkland, A/D Elctrns. 206-821-3205
PR Hato Rey, M. Anderson Co. 809-751-2026
Can Downsview, Ont., Cantronics 415-665-8020

Fuses
CA Huntington Beach, Corcoran Assocs. 714-841-4759
CA Playa Del Rey, Corcoran Assocs. 213-823-4589
CA Sunnyvale, W. W. Posey 408-746-0771
CO Boulder, Front Range Mktg. 303-443-4780
IL Chicago, MGA 312-775-1151
IN Indianapolis, Insul-Reps, Inc. 317-842-5203
MI Bloomfield Hills, Enco Mktg., Inc. 313-642-0203
MN S. St. Paul, Northport Engrg., Inc. 612-457-8000
NH Milford, David A. Crowley & Assocs. 603-673-7050
NJ So. Orange, Ira Brody 201-992-1727
NM Albuquerque, Syntech 505-266-7951
NY East Rochester, Tri-Tech Elctrns. 716-385-6500
NY Fayetteville, Tri-Tech Elctrns. 315-446-2881
NY Hempstead, L.I., Kahgan Sls. 516-538-2300
PA Philadelphia, Check Assocs. 215-487-3007
TN Knoxville, Insul-Reps., Inc. 615-691-7586
UT Salt Lake City, Front Range Mktg. 801-364-6481
WA Kirkland, A/D Elctrns., Inc. 206-821-3205
PR Hato Rey, Max Anderson Co., Inc. 809-751-2026
Can Downsview, Ont., Cantronics 416-665-8020

Local Distributors

Fuses
CA Santa Ana, Amco Tech. 714-957-3003
DE Danbury, Future Elctrns. 203-743-9594
FL Clearwater, Future Elctrns. 813-441-4771
IN Indianapolis, MAR Elctrns. 317-875-4510
IA Cedar Rapids, Deeco Elctrns. 319-365-7551
MD Columbia, D-K Elctrns. 301-995-1950
MA Boston, Future Elctrns. 617-366-2400
MN New Brighton, Chris Elctrns. 612-631-2647
MO St. Charles, Finnigan Elctrns. 314-946-6201
NJ Mt. Laurel, Future Elctrns. 609-778-7600
NY Liverpool, Future Elctrns. 315-451-2371
OR Beaverton, Component Resources 503-641-8488
PA Harrisburg, Cumberland Elctrns. 717-232-9715
PA Lyndora, Seneca Fuse 412-285-8544
UT Salt Lake City, Future Elctrns. 801-972-8489
UT Salt Lake City, Standard Supp. Co. 801-486-3371
Can Pointe Claire, Quebec, Future Elctrns. 514-694-7710
CA El Segundo, Force Elctrns. 213-772-1324
NH Hudson, C & H Elctrns. 603-882-1133
CA Anaheim, Deco Elctrns. 714-630-8252
CA City of Industry, Ital Elctrns. 213-968-8515
CA Hayward, KEA Elctrns. 415-887-2900
CA San Diego, Sigma Elctrns. 619-763-0545
CA San Jose, Force Elctrns. 408-943-1324
CT Norwalk, Cobra Comps. 203-847-6442
FL Boca Raton, D & R Assocs. 305-395-2341
MA Canton, Electronic Packaging Comps. 617-821-2111
NH Hudson, C & H Elctrns. 603-882-1133
NY Bohemia, Key Comps. 516-567-7500
TX Dallas, Fuses, Inc. 214-341-6407

BELL, FLOYD, ASSOCS., INC., 897 Higgs Ave., Columbus, OH 43212, Tel: 614-488-3193, TWX: 810-482-1763; FSC No.: 56493; *Sls. Mgr.:* Tom Shain ... **D•1023**

Local Sales Offices & Reps

CA Pasadena, Paul Nurches Co. 213-681-8957
CA Redwood City, Hickey Indl. Sls. Corp. 415-368-3849
CO Denver, Moss Mktg. 303-455-7205
FL Casselberry, Barrett & Assocs. 305-699-0311
FL Melbourne, Barrett Assocs. 305-727-2491
FL Miami, Barrett Assocs. 305-681-4957
FL Palm Harbor, Barrett Assocs. 813-785-1954
IL Mt. Prospect, Robert Adams Sls. Co. .. 312-297-8733
KY Edgewood, ELECCO 606-341-0330
MD Columbia, Tyler Griffin Co. 301-995-1215
MA Scituate, New England Area Reps. 617-545-6327
MI Jenison, R.C. Nordstrom 616-457-5762
MI Lathrup Village, R.C. Nordstrom 313-559-7373
MN Minneapolis, A.J. Warner Co. 612-729-7371
NJ Ocean, P. Saftler Assocs. 516-593-7880
NY Fulton, P. Saftler Assocs. 315-592-7184
NY Lynbrook, P. Saftler Assocs. 516-593-7880
OR Aloha, Elctrn. Comp. Sls. 503-245-2342
PA Paoli, Tyler Griffin Co. 215-647-1550
TX Dallas, Jim D. Gray & Assocs. 214-341-7190
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301

BELL, F. W., INC., 6120 Hanging Moss Rd., Orlando, FL 32807, Tel: 305-678-6900, TWX: 810-853-3115; FSC No.: 18479; *Dist. Mgr.:* Edward S. Wilush ..... **B•1784-1785; D•1113, 1194-1195, 1977**

Local Sales Offices & Reps

CA Milpitas, Maxim Elctrn. Sls. 408-946-6001
CA Pasadena, Jim Robins Assoc. 818-795-9118
CO Denver, Moss Mktg. 303-455-7205
FL Indian Rock Beach, Par Assoc. 813-596-8841
GA Atlanta, Par Assoc. 404-391-9117
IL Downers Grove, Splon Assoc. 312-963-7011
MA Needham Hgts., Shain Assoc. 617-449-4380
MI Royal Oak, Dave Ray & Assocs. 616-792-9831
NM Albuquerque, Moss Mktg. 505-292-7505
NY White Plains, Cane Tech. Sls. 914-694-9240
OH Chagrin Falls, RPM Indl. Sls. 216-247-3295
PA Paoli, T. Griffin Co. 215-644-7710
TX Carrollton, Seaton Corp. 214-380-0414

Local Distributors

AZ Phoenix, Jensen Tools & Alloys 602-968-6231
CA Milpitas, Maxim Elctrn. Sls. 408-946-6001
CA Pasadena, Jim Robins Assoc. 818-795-9118
CA Pasadena, Pasadena Elctrns. 818-796-5844
CO Denver, Moss Mktg. 303-455-7205
GA Atlanta, Process Meas. Co. 404-696-7481
IL Rolling Meadows, Commodore-1 312-394-5441
MA Needham Hgts., Shain Assocs. 617-449-4380
NY White Plains, Cane Tech. Sls. 914-694-9240
OH Chagrin Falls, RPM Indl. Sls. 216-247-3295
OH Dayton, National Instr. Distrs. 513-435-4503
PA Paoli, Tyler Griffin Co. 215-644-7710
TN Chattanooga, Edwin Bohr Elctrns. 615-877-8207
TX Houston, Quality Instr. Lab. 713-524-0528

BELL & HOWELL/CEC DIV., 360 Sierra Madre Villa, Pasadena, CA 91109, Tel: 213-796-9381, Telex: 67-5415, TWX: 910-582-3205; Empl.: 500

BELL AUDIO SERVICE CO., Magnetic Programming, Inc., 6740-G Huntley Road, Worthington, OH 43085, Tel: 614-846-2766; Empl.: 20; *Sls. Mgr.:* Thomas A. Curran

BELL CO., INC., 106 Morrow Ave., Box 92E, Trussville, AL 35173, Tel: 205-655-2135; Empl.: 19; *Sls. Mgr.:* R. Bell; *Dist. Mgr.:* Neil H. Bell

J. W. Miller Division
BELL INDUSTRIES

BELL INDS., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, Tel: 213-537-5200, TWX: 910-346-6740; FSC No.: 76493; Empl.: 55 ..... **A•1210-1217**

Local Sales Offices & Reps

AZ Phoenix, Moore Sls. 602-274-4558
AR El Dorado, D. Bellew Sls. 501-863-8325
CA Santa Clara, Logan Sls. Co. 408-496-0660
CO Denver, Wm. J. Purdy Co. 303-777-1411
FL Ft. Lauderdale, Hutto-Hawkins-Peregoy 305-971-5750
FL Maitland, Hutto-Hawkins-Peregoy 305-831-2474
GA Atlanta, Millar Elctrns. 404-261-6160
HI Gardena, CA, Bidwell Sls. Assoc. 213-770-0300
IL Chicago, Ken Levy & Assocs. 312-763-5000
IN Indianapolis, Elctrn. Reps. 317-894-1414
IN South Bend, Elctrn. Reps. 219-277-4565
LA Metairie, D. Bellow Sls. 504-887-1195
MD Columbia, Par-Nell Sls. Co. 301-992-5454
MA N. Scituate, W. A. Hendrickson Co. 617-545-0652
MI Grand Rapids, Burcaw Co. & Assoc. Inc. 313-573-4605
MI Warren, Burcaw Co. & Assoc. Inc. 313-573-4605
MN Eden Prairie, Electro Mark, Inc. 612-944-5850
MO Raytown, Marty Taraski Sls. Co. 816-358-1442
NJ Englewood, Baum & Epstein Assoc. .. 201-569-7600
NM Albuquerque, Wm. J. Purdy Co. 505-266-7959
NY Syracuse, PI'Tronics, Inc. 315-455-7346
NC Raleigh, Millar Elctrns. 919-787-9585
OH St. Marys, T. Shelby & Co. 419-394-3377
OR Portland, Earl & Brown Co. 503-245-2283
PA Langhorne, Par-Nell Sls. Co. 215-750-0380
TN Memphis, D. Bellew Sls. 901-452-1468
TX Ft. Worth, Chet Wells & Co. 817-284-0261
UT Salt Lake City, Wm. J. Purdy Co. 801-486-8557
WA Seattle, Earl & Brown Co. 206-284-1121
EXP NY, New York, Roburn Agencies 212-989-5939

Local Distributors

AZ Tempe, Bell Industries/EDD 602-966-7800
AZ Tempe, Circuit Specialists 602-966-0764
CA Buena Park, RPS Elctrns. 714-521-5230
CA Garden Grove, Bell Industries/EDD ... 714-220-0681
CA Gardena, Bell Industries/EDD 213-515-1800
CA Mountain View, Abacus Elctrns. 415-961-1500
CA Palo Alto, Zack Elctrns. 415-326-5432
CA Riverside, Elctrn. Supp. 714-683-7300
CA Sacramento, Integrated Elctrns. 916-424-5297
CA San Diego, Bell Industries/EDD 619-268-1277
CA San Jose, Cypress Elctrns. 408-945-8400
CA San Jose, Quement Elctrns. 408-998-5900
CA Sunnyvale, Bell Industries/EDD 408-734-8570
CA Thousand Oaks, Bell Inds./Ventura/EDD 805-499-6821
CO Denver, Bell Industries/EDD 303-424-1985
CO Denver, Integrated Elctrns. 303-292-6121
CO Denver, Ragon Elctrn. Parts 303-744-3601

CT Danbury, Pilgrim Elctrns. 203-792-7274
CT New Haven, Greene-Shaw Co. 203-397-0710
CT Wallingford, Sager Elctrcl. Supp. 203-265-4600
FL West Palm Beach, Nurmi Elctrns. 305-686-8553
IL Chicago, Bell Industries/EDD 312-640-1910
IL Chicago, Newark Elctrns. 312-784-5100
IL Palatine, Ohm/Elctrns, Inc. 312-359-5500
IN Fort Wayne, Graham Elect./Div. Bell Ind. 219-423-3422
IN Indianapolis, Graham Elect./Div. Bell Ind. 317-634-8202
IN Indianapolis, Meunier Elctrn. Supp. 317-635-3511
IA Cedar Rapids, Bell Industries/EDD ... 319-395-0730
LA New Orleans, Wm. B. Allen Supp. 504-525-8222
MD Gaithersburg, MS Elctrns. 301-921-0200
MA Hingham, Sager Elctrcl. Supp. 617-749-6700
MA Newton, Greene-Shaw Co. 617-969-8900
MN Minneapolis, Ind. Comps., Inc. 612-831-2666
MN Thief River Falls, Dici-Key Corp. 218-681-6674
MO Saint Louis, Olive Elctrns. 314-426-4500
NJ Camden, General Radio 609-964-8560
NJ East Hanover, State Elctrn. Parts 201-887-2550
NM Albuquerque, Bell Industries/EDD 505-292-2700
NY Bohemia, Key Comps. 516-567-7500
NY Buffalo, Summit Elctrns. 716-887-2800
NY Hempstead, Davis Elctrns. 516-483-9200
NY Rochester, Summit Elctrns. 716-334-8110
NY Rome, Rome Elctrns. 315-337-5400
NC Raleigh, Southeastern Elctrns. 919-828-2311
OH Columbus, Hughes-Peters, Inc. 614-294-5351
OH Dayton, Bell Industries/Micro-Mil Div. 513-434-8231
OH Dayton, Stotts-Friedman Corp. 513-298-5555
OK Tulsa, Radio, Inc. 918-587-9123
OR Portland, Bell Industries/EDD 503-241-4115
PA Allentown, P. A. Peters, Inc. 215-434-5237
PA Braddock, Leff Elctrns. 412-351-5000
PA Philadelphia, PEI Genesis 215-568-7400
PA Reading, Barbey Elctrns. 215-376-7451
PA Willow Grove, Resco Elctrns. 215-659-4575
TN Hixson, Techni-Tronics, Inc. 615-842-0514
TX Dallas, Wholesale Elctrns./Ind. Div. ... 214-824-3001
TX Fort Worth, TTI, Inc. 817-831-0441
TX Houston, Lenert Co. 713-225-1465
UT Salt Lake City, Bell Industries/EDD ... 801-972-6969
VA Charlottesville, Virginia Radio 804-296-4184
WA Bellevue, Bell Industries/EDD 206-747-1515
WI Milwaukee, Bell Industries/EDD 414-547-8879
WI Milwaukee, Marsh Elctrns. 414-475-6000

BELLOFRAM CORP., A Rexnord Co., 30 Blanchard Rd., Burlington, MA 01803, Tel: 617-272-2100, 800-225-1031, Telex: 94-9457; Empl.: 400; *Sls. Mgr.:* Steve Jackson; *Dist. Mgr.:* Steve Jackson

BELL PA PRODS., See Bell Audio Sys.

BELTING INDS. CO. INC., 20 Boright Ave., Kenilworth, NJ 07033, Tel: 201-272-8591, Telex: 138045; Empl.: 125; *Sls. Mgr.:* Harry K. Denaker

BEMCO, 9908 San Fernando Rd., Pacoima, CA 91331, Tel: 818-899-5296, TWX: 910-496-1520; Empl.: 45; *Sls. Mgr.:* John Riddle; *Dist. Mgr.:* Brian Duggan

BENDIX CORP., Electrical Comps. Div., Sidney, NY 13838, Tel: 607-563-5324, Telex: 932 456, TWX: 510-261-7550; FSC No.: 77820; Empl.: 3000; *Dist. Mgr.:* G. Anderson

BENDIX CORP., Electric Power Div., Hwy. 35, Eatontown, NJ 07724, Tel: 201-542-2000, Telex: 132-444 TWX: 710-722-6686; FSC No.: 83298;Multiple; Empl.: 950; *Sls. Mgr.:* R. Freeman; *Dist. Mgr.:* Cal Schrum

BENDIX CORP., Electrodynamics Div., 11600 Sherman Way, N. Hollywood, CA 91605, Tel: 818-765-1010, TWX: 910-499-2151; Empl.: 1200

BENDIX CORP., MOTOR COMPS. DIV., See Facet Entprs.

BENDIX CORP., Test Systems Div., Teterboro, NJ 07608, Tel: 201-288-2000, TWX: 710-990-6136; Empl.: 1,077

BENJAMIN ELECTROPRODUCTS, INC., Robins Div., 80 Smith St., Farmingdale, NY 11735, Tel: 516-293-7744, Telex: 12-7908; Empl.: 50

BENSON, INC., 2690 Orchard Parkway, P.O. Box 32059, San Jose, CA 95152-2059, Tel: 408-945-1000, Telex: 4941178 BENUW, TWX: 8104941178 BENUW; Empl.: 400; *Sls. Mgr.:* Alexander Salottolo

BENTHOS, INC., Edgerton Dr., N. Falmouth, MA 02556, Tel: 617-563-5917, 617-540-5500, Telex: 820673; Empl.: 80; *Sls. Mgr.:* R. K. Church

BENTLY NEVADA CORP., P.O. Box 157, Minden, NV 89423, Tel: 702-782-3611, Telex: 354437

BERG, W. M., INC., 499 Ocean Ave., East Rockaway, NY 11518, Tel: 516-599-5010; Empl.: 150; *Sls. Mgr.:* C. Keenan

BERGER-LAHR CORP., Fitzgerald Dr., Jaffrey, NH 03452, Tel: 603-532-7701, Telex: 92-8445; Empl.: 50; *Sls. Mgr.:* Wolfgang Hartert

BERGQUIST, 5300 Edina Ind'l., Minneapolis, MN 55435, Tel: 612-835-2322, TWX: 910-576-2423; FSC No.: 55285; Empl.: 105; *Sls. Mgr.:* Bob Savage; *Dist. Mgr.:* Larry Kocon

BERGQUIST SWITCH, INC., Bergquist Co., 5300 Edina Indl. Blvd., Edina, MN 55435, Tel: 612-835-2322, TWX: 910-576-2423; *Sls. Mgr.:* Lamar Popp

BNC

BERKELEY NUCLEONICS CORP., 1198 Tenth St., Berkeley, CA 94710, Tel: 415-527-1121, Telex: 677-1167; Empl.: 30; *Sls. Mgr.:* E. J. Buchs ..... **D•1196**

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BERKELEY PROCESS CONTROL, INC., 5327-K Jacuzzi St., Richmond, CA 94804, Tel: 415-526-3333; Empl.: 8; *Sls. Mgr.:* Paul Sagues; *Dist. Mgr.:* Paul Sagues

BERKSHIRE TRANSFORMER CORP., Route 341, P.O. Box 129, Kent, CT 06757, Tel: 203-927-3541; FSC No.: 89870; Empl.: 105; *Sls. Mgr.:* David Barbieri

BERK TEK, INC., Box 60, RD 1, Reading, PA 19607, Tel: 215-376-8071, TWX: 510-651-0511; Empl.: 350; *Sls. Mgr.:* Chester Klinke; *Dist. Mgr.:* Chester Klinke

Local Sales Offices & Reps
AZ Scottsdale, Bill Earl Assocs. 602-994-3813
CA Los Angeles, The Knight Co. 213-670-2833
CA Milpitas, Maxim Elctrn. Sls. 408-946-6001
FL Tampa, APM 813-886-2457
IL Des Plaines, Electron Mktg. 414-547-1505
MD Wheaton, Electronic Data Assocs. 301-699-1843
MA Shrewsbury, B&N Assoc. 617-845-1613
MI Orchard Lake, TPM & Assoc. 313-851-2784
MN St. Paul, Arkco Sls. 612-777-7454
NY Poughkeepsie, C.W. Floring & Assoc. 914-471-2973
NY Syracuse, C.W. Floring & Assoc. 315-478-2149
NC Raleigh, B. T. Funderburk, Inc. 919-782-3493
OR Tualatin, NICOR 503-692-0421
PA Huntingdon Valley, Inacker Sls. 215-947-5660
TX Houston, Yeager, Sumners & Assocs. 713-271-8104
UT Salt Lake City, Aspen Sls. 801-943-1346
Can Mississauga, Ontario, Micronex Co. ... 416-624-1076

BERMAR CORP., P.O. Box 12844, Research Triangle Park, NC 27709, Tel: 919-489-4316; *Sls. Mgr.:* M. Conland

BA
BERTAN ASSOCIATES, INC.

BERTAN ASSOCS., 121 New South Rd., Hicksville, NY 11801, Tel: 516-433-3110, TWX: 510-221-2144; FSC No.: 6130; Empl.: 140; *Sls. Mgr.:* Howard Bertan ..... **D•1522-1535**

Local Sales Offices & Reps
AZ Phoenix, Thor Engrg. 602-437-1463
CA Encino, King-Way Assoc. 213-788-4124
CA Los Altos, Cain-White & Co. 415-948-6533
CO Boulder, H. Bass Assocs. 303-530-7509
CT Madison, Dave Minshall 203-421-4561
FL DeBary, DJE Assocs. 305-668-6827
GA Lawrenceville, Electramark 404-963-4793
IL Arlington Hgts., Coombs Assocs. 312-439-9810
IN Fort Wayne, Coombs Assocs. 219-747-4017
IA Cedar Rapids, Coombs Assocs. 319-362-4116
MD Randallstown, Beacon North 703-591-1300
MI Farmington, Carter, McCormic & Peirce 313-477-7700
MO Bridgeton, Electro Mechanical Assoc. 314-291-8661
NM Albuquerque, Thorson Co. 505-293-8555
NY Fairport, NACO Elctrns. Corp. 716-223-4490
NY Syracuse, NACO Elctrns. Corp. 315-699-2651
NY Utica, NACO Elctrns. Corp. 315-732-1801
OH Cleveland, Geotronix 216-526-2535
OR Portland, Showalter Instrs. 503-224-8487
PA Audubon, Holmes Assocs. 215-666-0636
TX Dallas, Automated Motion Control 214-340-4192
TX Denton, Automated Motion Control ... 817-382-4159
UT Bountiful, H. Bass Assoc. 801-295-7100
VA Fairfax, Beacon North 703-591-1300
WA Bellevue, Showalter Instrs. 206-746-6032
WI Milwaukee, Coombs Assocs. 414-351-6123

BERTSCH U.S., SYCAMORE RESCH. CTR., 2142F Industrial Ct., Vista, CA 92083, Tel: 619-727-7420; FSC No.: 619-727-4436; Empl.: 25; *Sls. Mgr.:* B. Linko

BEST ELECTRICS DIV., 400 Boren Ave. North, Seattle, WA 98109, Tel: 206-382-1300, TWX: 910-444-2154; Empl.: 8 ..... **B•1743**

Local Sales Offices & Reps
CA Mountain View, Straube Assocs. 415-969-6060
CO Westminster, Straube Assocs. 303-426-0890

BEST POWER TECHNOLOGY, P.O. Box 280, Necedah, WI 54646, Tel: 608-565-7200, 800-356-5794, Telex: 701934; Empl.: 60; *Sls. Mgr.:* Terrance D. Paul

BEST WAY TOOLS, 171 Brook Ave., Deer Park, NY 11729, Tel: 516-586-4702; Empl.: 49

BETA TRANSFORMER TECHNOLOGY CORP., One Comac Loop, Ronkonkoma, NY 11779, Tel: 516-588-2505

BG ELCTRNS., 30 South St., Mt. Vernon, NY 10550, Tel: 914-664-5591, Telex: 6818048; FSC No.: 33791; Empl.: 36

B-G INSTRUMENTS, P.O. Box 67, Alta Loma, CA 91701, Tel: 714-989-4802, 980-2826, Telex: 517174; *Sls. Mgr.:* John Baum ..... **D•1060**

Local Sales Offices & Reps
WA Spokane, B-G Instrs., Inc. 509-238-4757

B. G. LABORATORIES, INC., 75 Travis Ave., Binghamton, NY 13904, Tel: 607-722-2376, Telex: 510-252-0185; FSC No.: 26522; Empl.: 150; *Sls. Mgr.:* Carol Clason

B. H. ELCTRNS., 331 Bremer Bldg., St. Paul, MN 55101, Tel: 612-228-6463, Telex: 297080; FSC No.: 3677; Empl.: 300; *Sls. Mgr.:* Fred LaMarche ..... **A•2122-2123**

Local Sales Offices & Reps
AZ Fountain Hills, Halbar Assocs. 602-837-2464
CA Glendale, Halbar Assocs. 213-246-8263
CA San Mateo, Halbar Assocs. 415-349-4700
CO Denver, Electro Comp. Sys. 303-781-5904
IL Chicago, I. E. Hampton & Assocs. 312-593-2410
MI Detroit, I. E. Hampton & Assocs. 313-851-0820
MI St. Joseph, I. E. Hampton & Assocs. ... 616-983-0862
MN Osseo, Gaffney Sls. Co. 612-425-5484
NH Nashua, C & C Sls. 603-889-8350
NJ Dunellen, J. A. Maguire 201-752-8480
NY Syracuse, C & L Sales 315-451-7810
OR Portland, Halbar & Assocs. 206-696-0170
PA Broomall, TCA Assocs. 215-353-2022
TX Dallas, Aid Elctrns. 214-790-4761
WA Redmond, Halbar Assocs. 206-882-0990
WI Theinsville, TFL Assoc. 414-242-6800

B.H. INDS., INC., 5784 Venice Blvd., Los Angeles, CA 90019, Tel: 213-937-4763; Empl.: 6

BICC-VERO ELCTRNS., INC., 40 Lindeman Drive, Trumbull, CT 06611, Tel: 203-372-0038, TWX: 510-227-8890; Empl.: 50; *Sls. Mgr.:* Michael Humphrey; *Dist. Mgr.:* Christine A. Martin

Local Sales Offices & Reps
AL Huntsville, Raycom 205-859-2017
CA Anaheim, Bicc-Vero Elctrns. 714-630-2030
CA San Diego, Professional Sls. 619-578-8831
CA San Jose, H Tech Sls. 408-279-2443
CA Sunnyvale, BICC-Vero (Wally Light) ... 408-738-6911
CO Arvada, Delconac 303-422-7023

CT Milford, Todino Engrg. 203-874-6643
FL Melbourne, Star-Tec 305-727-2247
FL Palm Bay, Star Tec 305-727-2247
GA Duluth, Raycom Inc. 404-446-9015
KS Overland Park, Barnes-Midwest Sls. .. 913-341-9317
MD Lutherville, J. A. Dougherty Sls. 301-321-7890
MA Needham Hgts., Todino Engrg. 617-444-7925
MN St. Paul, Proud Inds. 612-646-9428
NY Kingston, P.R.M. Elctrns. 914-331-0872
NY Macedon, PRM 315-986-3742
NY Pleasantville, BICC-Vero (Robert Hoffman) 914-769-6197
NC Raleigh, Raycom 919-847-8276
NC Raleigh, Tingen Tech. Sls. 919-781-1100
OH Chesterland, K-T Mktg. 216-729-3588
OH Cleveland, KT/Depco 216-442-6200
OH Westchester, KT/Depco 513-874-0236
OR Beaverton, Luscombe 503-636-6664
PA Hatboro, Delta Squared 215-441-4178
PA Hatboro, Rep Force 215-441-4178
PA Pittsburgh, KT/Depco 412-367-1011
TX Austin, Texport 512-834-8374
TX Garland, Texport 214-681-1376
TX Houston, Texport Elctrn. Sls. Co. 713-777-1443
TX Mesquite, BICC-Vero (Robert Land) ... 214-289-1153
UT Salt Lake City, Chuck Fields & Assocs. 801-531-6177
WA Renton, Luscombe Engrg. 206-223-1541

Local Distributors

CA Los Angeles, Dyna Svc. 213-268-8531
CT Wallingford, Mid-State Elctrns. 203-265-9900
FL Dania, Summit Distr. 305-920-6253,920-6509
IL Arlington Hgts., Redel Labs 312-253-5000, 529-0500
IN Ft. Wayne, Graham Elctrns. 219-423-3422
IN Indianapolis, Graham Elctrns. 317-634-8202
LA Baton Rouge, Menard 504-355-0323
MD Baltimore, Resco 301-823-0070
MA Framingham, NOW Elctrns. 617-872-5876
MI Lansing, Demco Controls 517-321-1700
MI Madison Heights, McNaughton-McKay Elec. Co. 313-399-7500
NJ Pennsauken, Resco 609-662-4000
NJ Springfield, Route Elctrns. 201-467-0266
NY Buffalo, Summit Distr. 716-884-3450
NY Hempstead, Davis Elctrns. 516-483-9200
NY Rochester, Summit Distr. 716-442-3494
NC Raleigh, Resco 919-781-5700
OH Cincinnatti, Graham Elctrns. 513-772-1661
PA Braddock, Leff Elctrs. 412-351-5000
PA Greensburg, Leff Elctrns. 412-834-5400
TX Houston, City Elctrns. 713-621-1060
TX Houston, Electrolot 713-957-1982
WI Mequon, Taylor Elctrns. 414-241-4321

BICRON ELCTRNS., Box 807, Barlow St., Canaan, CT 06018, Tel: 203-824-5125; FSC No.: 10617; Empl.: 105; *Sls. Mgr.:* Peter B. Kent

Local Sales Offices & Reps

CO Denver, Omega, Ltd. 303-762-1921
IL Rolling Meadows, KMA Sls. Co. 312-398-5300
OH Cleveland, Arthur H. Baier Co. 216-461-6161
OH Dayton, Arthur H. Baier Co. 513-276-4128
PA Media, Homer Smith Co. 215-543-2434
PA Pittsburg, Gormley Elec. 412-795-8010
UT Salt Lake City, Omega, Ltd. 303-762-1921
VA Salem, Homersmith, Inc. 215-543-2434
WI Milwaukee, KMA Sls. Co. 414-259-1771

BIDDLE INSTRUMENTS, A Thorn EMI Co., 510 Township Line Rd., Blue Bell, PA 19422, Tel: 215-646-9200, Telex: 83-4423 BIDDLE PMTG; Empl.: 285; *Sls. Mgr.:* R. S. Kennedy

BIKOR, 1504 W. 228th St., Torrance, CA 92718, Tel: 213-539-6320, TWX: 910-349-6667; Empl.: 50; *Sls. Mgr.:* James Rorke ..... **D•1536**

Local Sales Offices & Reps

MO St. Louis, B & H Assocs. 314-434-4425
NJ Hasbrouck Hgts., Comp. Tech. Sls. 201-288-7400
NY Rochester, Tae-Rep 716-586-8710

BINDICATOR, P.O. Box 9, 1915 Dove St., Port Huron, MI 48060, Tel: 313-987-2700; *Sls. Mgr.:* Rick Secord; *Dist. Mgr.:* Rick Secord

BIO-IMAGING RESEARCH, #1 Bio-Imaging Plaza, 425 Barclay Blvd., Lincolnshire, IL 60069, Tel: 312-564-3190; *Sls. Mgr.:* J. G. Close

BIOSPHERICAL INSTRS., INC., 4901 Morena Blvd. #1003, San Diego, CA 92117, Tel: 619-270-1315; *Sls. Mgr.:* Dennis Bryan

BIRD, RICHARD H., & CO., INC., 1 Spruce St., Waltham, MA 02154, Tel: 617-894-0160, Telex: 923-441; FSC No.: 17706; Empl.: 50; *Sls. Mgr.:* R.J. Cameron

BIRD ELCTRN., 30303 Aurora Rd., Cleveland, OH 44139, Tel: 216-248-1200, Telex: 706898 Bird Elec. UD; FSC No.: 70998; Empl.: 250; *Sls. Mgr.:* W. L. Yochum; *Dist. Mgr.:* Greg Johns

BIRTCHER CORP., See EG & G Birtcher

BISHOP ELECTRONICS CORP., 3729 San Gabriel River Pkwy., Pico Rivera, CA 90660, Tel: 213-695-0446, 213-692-9391, TWX: 910-586-1922

BISHOP GRAPHICS, INC., 5388 Sterling Center, Westlake Village, CA 91359, Tel: 818-991-2600, Telex: 66-2400 BISHOP WKVG; Empl.: 160; *Sls. Mgr.:* Lynn Knudsen

Bivar

BIVAR, INC., 4 Thomas, Irvine, CA 92718, Tel: 714-951-8808; FSC No.: 32559; Empl.: 22; *Sls. Mgr.:* E. 'Bill' Muldoon ..... **C•1025**

Local Sales Offices & Reps

CA San Diego, Qualtronics Co. 619-695-0118
CO Westminster, D. Barth 303-427-8679
IL Chicago, Berndt Assocs., Inc. 312-283-0713
IN Indianapolis, Wilson Tech. Sls. 317-298-3345
KS De Soto, Midtec Assocs. 913-441-6565
MA Newtonville, C. Segel 617-969-6900
MI Milford, Dodsworth 313-875-5755
MN Minneapolis, Berndt Assocs. 612-546-2021
MO Florissant, Midtec Assocs. 314-837-5200
NJ Berkeley Heights, Cambridge-Allen ... 201-464-0203
NY Syracuse, T-Squared Elctrns. 315-463-8592
NC Raleigh, B. T. Funderburk 919-782-3493
OH Cincinnati, Tri-State Mktg. 513-761-7993
OR Beaverton, Eclipse Mktg. Grp. 503-642-1661
OR Portland, Eclipse Mktg. Grp. 503-644-2550
PA Elkins Park, K. B. Erdman Co. 215-224-1833
TX Richardson, Draper Co. 214-680-1650
WA Redmond, Eclipse Mktg. Grp. 206-885-6991
WI Milwaukee, Berndt Assocs. 414-545-8400
Can Mississauga, Ont., Wilson Elctrns. 416-677-7280

Local Distributors

AZ Phoenix, EKO Sales 602-275-7501
CA Fountain Valley, Components Ctr. 714-979-0433
CA Mountain View, Energy Sls. 415-969-0800
CA San Diego, Sigma Elctrns. 619-565-2000
CA Santa Clara, Components Ctr. 408-988-3751
CA Santa Fe Springs, F T R Fasteners 714-957-0202, 213-946-6464
CA Sunnyvale, R. C. Dudek 408-734-3830
CA Sunnyvale, Vic/Tal Sls. 408-738-3450
CA Temple City, Fastening Sys. 213-579-4600
CA Westlake Village, R. C. Dudek 213-707-1310
CO Englewood, Indus. Elctrns. 303-694-9444
CT East Haven, J. V. Elctrns. 203-469-2321
CT Milford, Plastic & Metal Comps. Co. ... 203-877-2723
GA Norcross, Atlanta Hardware Specialty 404-449-3000
GA Peachtree City, Spyraflo, Inc. 404-487-7600
IL Chicago, EMF 800-621-0080,312-889-8323
IL Chicago, Waldom Elctrns. 312-585-1212
IL Elmhurst, Miltex Sls. 312-941-7100
MD Gaithersburg, Capitol Fasteners 301-948-9310
MA Burlington, Contact East 617-272-5051
MA Marlboro, Hardware Specialty Co. 617-481-8622
MA Waltham, Electronic Fasteners 617-890-7780
MA Winchester, RUSH 617-729-5800
MN Eden Prairie, S. W. Anderson Co. 612-941-4108
NH Londonderry, E.P.E. Corp. 603-669-9181
NY Central Islip, Domino Comps. 516-582-3050
NY Long Island City, Hardware Specialty Co. 212-361-9393
NY Mt. Vernon, QAR Elctrns. 914-699-2224
NY Plainview, Tower Fastener Co. 516-349-7670
NY Rochester, Masline Elctrns. 716-546-5373
NC Raleigh, Century Elctrn. Comps. 919-872-2203
NC Raleigh, Century Fasteners 919-787-1800
OH Cincinnati, Hughes-Peters 513-351-2000
OH Columbus, Hughes-Peters 614-294-5351
OH Englewood, Argent Inds. 513-836-8633
OH Solon, REH/Electra 216-248-1636
OR Beaverton, Component Resources 503-641-8488
OR Beaverton, Murphy Elctrns. 503-642-2001
PA Huntington Valley, Plastic & Metal Prods. 215-322-2000
PA Norristown, Century Elctrns. 215-631-5400
PA Pittsburgh, Alder-Tronics 412-821-5565
TX Grand Prairie, Tech Supp. 214-660-4888
WA Redmond, Energy Sls. 206-883-2343
WA Redmond, Murphy Elctrns. 206-881-1234
WA Seattle, Component Resources 206-454-8666
WA Seattle, Pacific Elctrns. 206-575-1050
Can Mississauga, Ont., Rush/Ontario 416-677-7280

BIW CABLE SYS., INC., 65 Bay St., Dorchester, MA 02125, Tel: 617-265-2102, Telex: 94-0604; FSC No.: 71102; Empl.: 600; *Sls. Mgr.:* E. McCormick

BLACK & WEBSTER, 219 Bear Hill Rd., Waltham, MA 02254, Tel: 617-890-9100, Telex: 951102; Empl.: 80

BLACK BOX CORP., Micom Sys., P.O. Box 12800, Pittsburgh, PA 15241, Tel: 412-746-5500, Telex: 510-697-3125; *Sls. Mgr.:* Peter Highberg

BLACKHAWK NETWORKS CORP., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545, Tel: 608-752-8701, TWX: 910-350-8266; FSC No.: 12724; Empl.: 10

BLANCK, A. R., CO., Box 249, Rutherford, NJ 07070, Tel: 201-933-2091; Empl.: 6; *Sls. Mgr.:* Dr. A. R. Blanck; *Dist. Mgr.:* Dr. A. R. Blanck

BLATEK INDS., INC., Box 574, Bellefonte, PA 16823, Tel: 814-355-4910; Empl.: 20; *Sls. Mgr.:* Linda C. Feltman ..... **B•1787**

Local Sales Offices & Reps

CA Burbank, Modco 818-848-2215
CO Littleton, McCarthy Co. 303-773-0643
CT Woodbridge, Elctrn. Mktg. 203-397-1461
MI Benton Harbor, McNabb & Assocs. ... 616-925-2166

BLH ELCTRNS., 75 Shawmut Road, Canton, MA 02021, Tel: 617-821-2000, Telex: 92-3413, TWX: 710-324-0683; FSC No.: 03089; Empl.: 250; *Sls. Mgr.:* C. Wesley

BLILEY ELEC. CO., 2545 W. Grandview Blvd., Erie, PA 16506, Tel: 814-838-3571, Telex: 510-696-6886; FSC No.: 71034;3098; Empl.: 200; *Sls. Mgr.:* H. A. Yocum ..... **A•1316-1323**

Local Sales Offices & Reps

AL Huntsville, R. W. Mitscher Co. 205-882-6050

BLILEY REPRESENTATIVES COVER THESE STATES:

Southern California, Arizona
CAIN TECHNOLOGY, INC.

Northern California, Northwestern Nevada
GENE C. WOEMPNER COMPANY

Massachusetts, Connecticut, Maine, New Hampshire, Vermont, Rhode Island
STURGEON COMPANY

New York (Metropolitan NYC), Northern New Jersey
SCHMITT INDUSTRIAL MARKETING CORP.

New York State (excluding Metropolitan NYC), Virginia, North & South Carolina, Georgia, Mississippi, Alabama, Tennessee, Maryland, Delaware, Florida, Eastern Pennsylvania, Southern New Jersey, Canadian Provinces of Ontario & Quebec
R.W. MITSCHER CO., INC.

Washington, Oregon
DUSSAULT & ASSOCIATES, INC.

Texas, Louisiana, Arkansas, Oklahoma
VECTOR SALES CO., INC.

Missouri, Kansas, Nebraska, Southern Iowa, Middle & Southern Illinois
AME SALES, INC.

See adjacent listing for the address and telephone number of your Bliley representative.

Bliley
ELECTRIC COMPANY

CA Los Angeles, Cain Technology, Inc. ... 213-477-9054
CA Mountain View, Gene C. Woempner Co. ... 415-964-5454
CA Orange, Cain Technology, Inc. ... 714-997-7311
CT Hartford, Sturgeon Co. ... 203-249-7800
FL Altamonte Springs, R. W. Mitscher Co. ... 305-788-6844
FL Boca Raton, R. W. Mitscher Co. ... 305-368-3841
GA Lawrenceville, R. W. Mitscher Co. ... 404-923-3239
MD Laurel, R. W. Mitscher Co. ... 301-498-6090
MA Needham, Sturgeon Co. ... 617-444-6603
MO St. Louis, AME Sales, Inc. ... 314-965-1779
NY Bainbridge, R. W. Mitscher Co. ... 607-967-7192
NY Buffalo, R. W. Mitscher Co. ... 716-633-7970
NY Pittsford, R. W. Mitscher Co. ... 716-586-4012
NY Red Hook, R. W. Mitscher Co. ... 914-758-8375
NY Rochester, R. W. Mitscher Co. ... 716-227-0839
NY Utica, R. W. Mitscher Co. ... 315-733-0171
NY West Hempstead, Schmitt Indl. Mktg. Corp. ... 516-486-3510
NC Charlotte, R. W. Mitscher Co. ... 704-598-8644
NC Raleigh, R. W. Mitscher Co. ... 919-848-0941
OR Portland, Dussault & Assocs. Inc. ... 503-641-8780
PA Huntingdon Valley, R. W. Mitscher Co. ... 215-355-4452
TN Johnson City, R. W. Mitscher Co. ... 615-929-7258
TX Richardson, Vector Sls. Co. ... 214-234-4291
VA Midlothian, R. W. Mitscher Co. ... 804-744-4676
WA Seattle, Dussault & Assocs., Inc. ... 206-527-5454
EXP CT, Stamford, Dage Corp. ... 203-324-3123

BLUE M

BLUE M, A UNIT OF GENERAL SIGNAL, 138th & Chatham Sts., Blue Island, IL 60406, Tel: 312-385-9000, TWX: 910-689-3398; Empl.: 420; *Sls. Mgr.:* H. G. Mathews ... **D•1165**

Local Sales Offices & Reps

AZ Tempe, Blue M ... 602-894-2305
CA El Monte, Blue M ... 818-442-6672
CA Sunnyvale, Blue M ... 408-734-8734
DE Wilmington, Blue M ... 302-478-6983
FL Winter Park, Blue M ... 305-671-6655
GA Atlanta, Blue M ... 404-455-3452
KS Overland Park, Blue M ... 913-888-6483
MA Natick, Blue M ... 617-651-1616
MI Taylor, Blue M ... 313-281-2107
NY Nanuet, Blue M ... 914-623-0900
NY Syracuse, Blue M ... 315-437-0192
NC Charlotte, Blue M ... 704-527-2492
OH Cincinnati, Blue M ... 513-821-6278
OH Hudson, Blue M ... 216-656-1177
TX Garland, Blue M ... 214-272-2509
TX San Marcos, Blue M ... 512-353-8003
WA Seattle, Blue M ... 206-763-1030

BLUFFTON PRODUCTS, INC., Tegam, Inc., 7230 North Ridge Road, Madison, OH 44057, Tel: 216-946-3572; *Sls. Mgr.:* Doug Bradley

BLUM, JULIUS & CO., INC., Box 292, Carlstadt, NJ 07072, Tel: 201-438-4600, Telex: 13-3491; Empl.: 40

BMS DATA HANDLING, INC., 12155 Magnolia, Riverside, CA 92503, Tel: 714-359-8824; Empl.: 16; *Sls. Mgr.:* Thomas H. Mitchell

BODINE ELEC. CO., 2500 W. Bradley Pl., Chicago, IL 60618, Tel: 312-478-3515, Telex: 25-3646; Empl.: 800; *Sls. Mgr.:* R. E. Ford; *Dist. Mgr.:* R. E. Ford ... **B•1140**

Local Sales Offices & Reps

CA Al Hambra, C. E. Mello ... 818-282-2000
CA San Jose, E. W. Duemmlein ... 408-243-4800
KS Shawnee Mission, J. S. Gleeson & Assocs. ... 913-362-4422
MA Andover, L. R. Cascino ... 617-470-0050
MI Plymouth, Steve Cavender ... 313-453-2730
NY Massapequa, D. V. Mayorga ... 516-541-1611
NY Rochester, Application Specialists ... 716-586-6226
NY Syracuse, Application Specialists ... 315-437-2813
OH Hudson, J. H. Basten ... 216-656-4226
OR Portland, D. E. Johnson ... 503-246-3131
TX Richardson, General Power Equip. ... 214-783-8371
VA McLean, J. S. Hsia ... 703-734-1739
EXP IL, Chicago, Export Dept., Bodine Elec. ... 312-478-3515

Local Distributors

AL Mobile, Brownell Instrs. & Conts. Co. ... 205-479-5405
AK Anchorage, Airport Machinery Co ... 907-272-0544
AZ Phoenix, Minarik Elec. Co. ... 602-233-3000
CA Carson, Power Trans. Specialties ... 213-631-7502
CA Los Angeles, Minarik Elec. Co. ... 213-624-3161
CA Mountain View, King Bearing, Inc. ... 415-968-8316
CA San Diego, Minarik Elec. Co. ... 619-560-6632
CA San Jose, King Bearing, Inc. ... 408-998-5464
CA San Jose, Republic Supp. Co. ... 408-279-2202
CA San Leandro, Republic Supp. Co. ... 415-357-2211
CA Santa Clara, Minarik Elec. Co. ... 408-727-0575
CO Denver, Wazee Elec. Co. ... 303-623-8658
CT Berlin, B & B Motor & Control ... 203-828-8550
CT Hartford, Machine Drives & Controls ... 203-728-0403
CT Norwalk, Machine Drives & Controls ... 203-846-2007
FL Hialeah, Condo Elec. & Ind. Supp., Inc. ... 305-691-5400
FL Jacksonville, Electrical-Mech. Dr., Inc. ... 904-783-2730
FL Orlando, Brownell Instrs. & Conts. Co. ... 305-843-6770
FL Tampa, Electrical-Mech. Dr., Inc. ... 813-621-8675
GA Hapeville, Brownell Instrs. & Conts. Co. ... 404-762-5181
IL Aurora, Industrial Supp. Co. ... 312-844-5500
IL Chicago, Excel Elec. Svc. Co. ... 312-421-7220
IL Chicago, Harris & Lee ... 312-372-7272
IL Rockford, Harris & Lee ... 815-398-0606
IN Indianapolis, B & B Motor & Control ... 317-248-0396
IA Cedar Rapids, Precision Bearing Co. ... 319-365-5276
IA Des Moines, Precision Bearing Co. ... 515-265-9811
KS Kansas City, Kornfeld Thorp Elec. ... 913-321-7070
MA Medford, Empire Elctrl. Co. ... 617-395-5000
MA Somerville, Electro Sls. Co., Inc. ... 617-666-0500
MI Detroit, Howard Elec. Co. ... 313-923-0430
MI Grand Rapids, MacKay Ind. Sls. ... 616-241-1671
MN Minneapolis, Boustead Elec. & Mfg. ... 612-544-9131
MO St. Louis, Zeller Elec., Inc. ... 314-638-9641
NE Omaha, Precision Bearing Co. ... 402-444-3939
NV Reno, Republic Supp. Co. ... 702-677-1761
NJ Cherry Hill, Jos. T. Fewkes & Co. ... 609-424-5810
NJ Piscataway, B & B Motor & Control ... 201-572-0500
NY Binghamton, K. J. Elec. Corp. ... 607-772-1760
NY East Syracuse, K. J. Elec. Corp. ... 315-437-2826
NY Long Island City, B & B Motor & Control ... 718-784-1313
NY Rochester, B & B Motor & Control ... 716-424-7040
NC Charlotte, Brownell Instrs. & Conts. Co. ... 704-597-1270
NC Charlotte, Mize Co., Inc. ... 704-375-5761
OH Cleveland, Reserve Elec. Co. ... 216-771-5764
OH Dayton, Thal Mor Assoc., Inc. ... 513-298-9939
OK Oklahoma City, Dagwell Dixie Co. ... 405-232-7671
OK Tulsa, Southwest Drives, Inc. ... 918-834-4231
OR Portland, Campbell Ind. Supp. ... 503-231-4820
PA Altoona, Miller Elec. Svc. & Supp. ... 814-942-9943
PA Pittsburgh, Braunlich-Roessie ... 412-471-6995
SC Taylors, B & B Motor & Control ... 803-268-5702
TN Memphis, Brownell Instrs. & Conts. Co. ... 901-795-8487
TN Nashville, Tennessee Machinery Co. ... 615-244-8150
TX Dallas, Motion Inds. ... 214-351-2211
TX Fort Worth, Motion Inds. ... 817-335-8131
TX Houston, B & B Motor & Control ... 713-820-7931
TX Houston, Research Des., Inc. ... 713-995-8591
VA Richmond, Ind. Supp. Corp. ... 804-355-8041
WA Seattle, Campbell Ind. Supp. Co. ... 206-447-7100
WA Seattle, Industrial Elec. ... 206-329-3900
WA Spokane, Campbell Ind. Supp. Co. ... 509-838-8288
WA Tacoma, Campbell Ind. Supp. Co. ... 206-383-2431
WI Milwaukee, Trester Svc. Elec. ... 414-264-8170
WI New Berlin, Elec. Sls. & Engrg. ... 414-782-2400

BOEING MICROELECTRONICS, PCB OPNS., M/S: 88-34, Box 24666, Seattle, WA 98124, Tel: 206-773-1083, Telex: 32-9430, TWX: 910-423-1563; Empl.: 120; *Sls. Mgr.:* M.A. Schalk

BOKER'S, INC., 3104 Snelling Ave., Minneapolis, MN 55406, Tel: 612-729-9365

BOMAR CRYSTAL, 201 Blackford Ave., Middlesex, NJ 08846, Tel: 201-356-7787, 800-526-3935, TWX: 710-480-4560; Empl.: 75; *Sls. Mgr.:* Phil Casciano

BOMCO, See MuShield Co.

BONUS-BILT, INC., Hofmann Inds., 1096 Air Way, Glendale, CA 91201, Tel: 213-245-9177, 800-692-8888; Empl.: 100; *Sls. Mgr.:* Don Nunnery

BOONTON ELCTRNS. CORP., 791 Route 10, Randolph, NJ 07869, Tel: 201-584-1077, TWX: 710-986-8215 BOONTRONICS; FSC No.: 04901; Empl.: 180; *Sls. Mgr.:* J. Garthwaite ... **D•1197**

Local Sales Offices & Reps

AL Huntsville, Sci. Devices ... 205-536-1969
AZ Phoenix, Aztec Entprs. ... 602-943-8178
CA North Hollywood, O'Halloran Assocs. ... 213-877-0173
CA Palo Alto, O'Halloran Assocs. ... 415-326-1493
CO Denver, Aztec Entprs. ... 303-779-5285
CT Mt. Carmel, Sci. Devices ... 203-248-9361
FL Orlando, Sci. Devices ... 305-841-8180
FL Shalimer, Sci. Devices ... 904-651-4407
IL Elmhurst, Sector Engrg. Sls., Inc. ... 312-530-7850
IN Indianapolis, Sector Engrg. Sls., Inc. ... 317-842-1120
KS Overland Park, Ramsey Assoc. ... 913-649-6996
MD Silver Spring, Sel-Tronics ... 301-589-3391
MA Lexington, R. J. Sickles ... 617-862-5100
MN Minneapolis, Sector Engrg. Sls., Inc. ... 612-593-1809
MO Maryland Hgts., Ramsey Assoc. ... 314-878-5042
NJ Englewood Cliffs, Sci. Devices ... 201-871-3916
NM Albuquerque, Aztec Entprs. ... 505-262-1688
NY Rochester, Sci. Devices ... 716-334-2445
NC Winston-Salem, Sci. Devices ... 919-765-5776
OH Centerville, Micro Sls. ... 513-433-8171
OH N. Olmsted, Micro Sls. ... 216-734-3080
OR Portland, Sci. Devices ... 503-292-6934
PA Melrose Park, R. Meyers ... 215-224-1663
TX Austin, Testech ... 512-327-7033
TX Houston, Testech ... 713-956-0837
TX Richardson, Testech ... 214-644-5010
UT Ogden, Aztec Entprs. ... 801-621-1655
WA Bellevue, Sci. Devices ... 206-747-5169
WI Milwaukee, Sector Engrg. Sls., Inc. ... 301-589-3391

bopla ENCLOSURES SYSTEMS

BOPLA ENCLOSURES, 1350 Beverly Rd., Ste. 115-338, McLean, VA 22101, Tel: 703-549-7242, Telex: 298598 ROSE UR; FSC No.: 4Y520; Empl.: 17 ... **C•1026**

BORG-WARNER THERMOELECTRICS, BORG-WARNER CORP., See TECA, ThermoElectric Cooling America Corp.

BORROUGHS, Lear Siegler, Inc., 3002 N. Burdick St., Kalamazoo, MI 49007, Tel: 616-342-0161, Telex: 224322; Empl.: 417

BOSCH, ROBERT, CORP., 2800 S. 25th Ave., Broadview, IL 60153, Tel: 312-865-5200, Telex: 23-5563; *Sls. Mgr.:* Dieter Bloecks; *Dist. Mgr.:* Dave Robson ... **B•1296-1297**

Local Sales Offices & Reps

AL Huntsville, 20th Century Mktg. ... 205-533-9287
AZ Scottsdale, Luscombe Engrg. ... 602-949-9333
CA Campbell, Luscombe Engrg. ... 408-370-2020
CA Pasadena, Luscombe Engrg. ... 213-684-2000
CA San Diego, Luscombe Engrg. ... 619-295-4300
CO Longmont, Piper Sls. ... 303-651-2378
CT Madison, Conti Younger Assocs. ... 203-245-1136
FL Enterprise, D.J.E. Assocs., Inc. ... 305-321-6623
GA Norcross, 20th Century Mktg. ... 404-446-1999
IL Woodridge, Trend-Tronics, Inc. ... 312-985-0626
IA Davenport, Rush & West ... 319-326-3091
KS Kansas City, Rush & West ... 913-764-2700
MA Burlington, Conti Younger ... 617-273-1582
MN Minneapolis, H.M.R., Inc. ... 612-888-2122
MO Ballwin, Rush & West Assocs. ... 319-394-7271
NY Yonkers, Sonkin Assocs. ... 914-968-8282
NC Raleigh, 20th Century Mktg. ... 919-782-4333
PA Cornwells Hts., William Staats Co. ... 215-639-5231
TN Memphis, 20th Century Mktg. ... 901-756-4681
TX Dallas, P.J. Scanlon Co. ... 214-231-4661
WA Mercer Island, Electronic Comp. Sls. ... 206-232-9301
WI Waukesha, Trend-Tronics, Inc. ... 414-542-4919

Local Distributors

CA Santa Monica, Distributor Specialists ... 213-393-9666
IL Woodridge, Trend-Tronics, Inc. ... 312-985-0626
NY Yonkers, Sonkin Assocs. ... 914-968-8282

Boschert

BOSCHERT INC., 384 Santa Trinita Ave., Sunnyvale, CA 94086, Tel: 408-732-2440, TWX: 910-339-9241; Empl.: 1500; *Sls. Mgr.:* Lloyd Schiller; *Dist. Mgr.:* Lloyd Schiller ... **D•1537-1540**

Local Sales Offices & Reps

AZ Scottsdale, American Mktg. 602-948-2778
CA Fountain Valley, K-Two Sls. 714-968-4726
CA San Diego, Harvey King 619-566-5252
CA Santa Clara, Criterion 408-988-6300
CA Sunnyvale, Boschert 408-732-2440
CO Aurora, Electrodyne 303-695-8903
FL Clearwater, Dyne-A-Mark 813-441-4702
FL Ft. Lauderdale, Dyne-A-Mark 305-771-6501
FL Maitland, Dyne-A-Mark 305-831-2097
IL Elk Grove Village, Control Sls. 312-595-2110
IN Indianapolis, SAI Mktg. 317-241-9276
IA Cedar Rapids, Stan Clothier 319-395-0245
KS Augusta, Design Solutions 316-775-7424
MA Marlboro, Eastern Micro 617-480-0400
MI Brighton, SAI Mktg. 313-227-1786
MN Minneapolis, Stan Clothier Co. 612-944-3456
MO St. Louis, Design Solutions 314-961-7170
NJ Cherry Hill, Power Squared 609-424-6622
NJ Totowa, Boschert 201-256-4046
NY Huntington, Morgan Elctrns. 516-549-5180
OH Centerville, SAI Mktg. 513-435-3181
OH Shaker Hgts., SAI Mktg. 216-751-3633
TX Austin, O. M. Sales 512-452-1838
TX Houston, O. M. Sales 713-789-4426
TX Richardson, O. M. Sales 214-690-6746
UT Salt Lake City, Electrodyne 801-486-3801
WI Thiensville, Control Sls. 414-242-4580

Local Distributors

AL Huntsville, Arrow Elctrns. 205-882-2730
AL Huntsville, Marshall 205-881-9235
AZ Tempe, Anthem 602-244-0900
AZ Tempe, Arrow Elctrns. 602-968-4800
AZ Tempe, Marshall Inds. 602-968-6181
CA Canoga Park, Marshall Inds. 213-999-5001
CA Chatsworth, Anthem 213-700-1000
CA Chatsworth, Arrow Elctrns. 818-701-7500
CA El Monte, Marshall Inds. 213-442-7204
CA Irvine, Marshall Inds. 714-556-6400
CA San Diego, Anthem 619-453-9005
CA San Diego, Arrow Elctrns. 619-565-4800
CA San Diego, Marshall Inds. 619-578-9600
CA San Jose, Anthem 408-946-8000
CA Sunnyvale, Arrow Elctrns. 408-745-6600
CA Sunnyvale, Marshall Inds. 408-732-1100
CA Tustin, Anthem 714-730-8000
CA Tustin, Arrow Elctrns. 714-595-2860
CO Aurora, Arrow Elctrns. 303-696-1111
CO Denver, Marshall Inds. 303-427-1818
CO Englewood, Anthem 303-790-4500
CT Wallingford, Arrow Elctrns. 203-265-7741
CT Wallingford, Marshall Inds. 203-265-3822
FL Ft. Lauderdale, Marshall Inds. 305-928-0661
FL Palm Bay, Arrow Elctrns. 305-725-1480
GA Norcross, Arrow Elctrns. 404-449-8252
GA Norcross, Marshall Inds. 404-923-5750
IL Schaumberg, Marshall 312-490-0155
IL Schaumburg, Arrow Elctrns. 312-397-3440
IN Indianapolis, Arrow Elctrns. 317-243-9353
IA Cedar Rapids, Arrow Elctrns. 319-395-7230
KS Lexena, Marshall Ind. 913-492-3121
MD Gaithersburg, Marshall Inds. 301-840-9450
MA Burlington, Marshall Inds. 617-272-8200
MI Ann Arbor, Arrow Elctrns. 313-971-8220
MI Livonia, Marshall 313-525-5850
MN Edina, Arrow Elctrns. 612-830-1800
MN Plymouth, Marshall 612-559-2211
MO St. Louis, Arrow Elctrns. 314-567-6888
NJ Fairfield, Marshall Inds. 201-882-0320
NJ Marlton, Arrow Elctrns. 609-596-8000
NJ Mt. Laurel, Marshall Inds. 609-234-9100
NM Albuquerque, Arrow Elctrns. 505-243-4566
NY Endwell, Marshall 607-754-1570
NY Hauppauge, Arrow Elctrns. 516-231-1000
NY Hauppauge, Marshall Inds. 516-273-2424
NY Liverpool, Arrow Elctrns. 315-652-1000
NY Melville, Arrow Elctrns. 516-694-6800
NY Rochester, Arrow Elctrns. 716-427-0300
NY Rochester, Marshall 716-235-7620
NC Winston-Salem, Arrow Elctrns. 919-725-8711
OH Centerville, Arrow Elctrns. 513-435-5563
OH Dayton, Marshall 513-236-8088
OH Solon, Arrow Elctrns. 216-248-3990
OK Tulsa, Arrow Elctrns. 918-665-7700
OR Beaverton, Marshall 503-644-5050
OR Lake Oswego, Anthem Elctrns. 503-684-2661
PA Monroeville, Arrow Elctrns. 412-856-7000
TX Austin, Marshall 512-458-5654
TX Dallas, Arrow Elctrns. 214-386-7500
TX Dallas, Marshall Inds. 214-233-5200
TX Houston, Arrow Elctrns. 713-530-4700
TX Houston, Marshall Inds. 713-789-6600
WA Bellevue, Arrow Elctrns. 206-643-4800
WA Bellevue, Marshall Inds. 206-747-9100
WA Redmond, Anthem 206-881-0850
WI Oak Creek, Arrow Elctrns. 414-764-6600

BOSTON SYSTEMS OFFICE, 469 Moody St., Waltham, MA 02254-9164, Tel: 617-894-7800, TWX: 710-324-0760; Empl.: 80; *Sls. Mgr.:* Francis X. O'Brien; *Dist. Mgr.:* Debra DellaCamera (International)

BOURNS, INC., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, Tel: 714-781-5050, TWX: 910-332-1252; Empl.: 4000; *Sls. Mgr.:* R. A. Sickler; *Dist. Mgr.:* Dennis Lause ..... **A•1800-1803, 1996-2008**

Local Sales Offices & Reps

AL Huntsville, CSR Elctrns. 205-533-2444
AZ Phoenix, Shefler-Kahn 602-257-9015
CA Encino, Great American Rep Co. 818-990-4870
CA San Diego, SR Elctrns. 619-560-8330
CA San Jose, QuadRep, Inc. 408-946-4000
CA Tustin, Great American Rep Co. 714-954-0371
CO Parker, Parker Webster 303-841-4888
FL Altamonte Springs, Dyne-A-Mark 305-831-2097
FL Clearwater, Dyne-A-Mark 813-441-4702
FL Ft. Lauderdale, Dyne-A-Mark 305-771-6501
FL Palm Bay, Dyne-A-Mark 305-727-0192
GA Atlanta, CSR Elctrns. 404-396-3720
ID Boise, Intermountain Technlg. 208-322-5022
IL Elk Grove Village, John G. Twist Co. 312-593-0200
IN Carmel, Technlg. Mktg. Corp. 317-844-8462
IN Ft. Wayne, Technlg. Mktg. Corp. 219-432-5553
IA Cedar Rapids, REP Assocs. Corp. 319-373-0152
KY Louisville, Technlg. Mktg. Corp. 502-499-7808
MD Baltimore, Micro-Comp. 301-247-0400
MA Lexington, John E. Boeing Co. 617-862-2500
MI Detroit, Rathburg Assocs. 313-882-1717
MN Edina, Mel Foster 612-941-9790
MO Bridgeton, Centech 314-291-4230
MO Raytown, Centech 816-358-8100
NJ Bellmawr, Thomas Assocs. 609-933-2600
NM Albuquerque, Shefler-Kahn Co. 505-296-0749
NY Ithaca, B. Dean 607-257-1111
NY Melville, Comtronic Assocs. 516-249-0505
NY Wappingers Falls, Bourns 914-297-1180
NC Raleigh, CSR Elctrns. 919-878-9200
OH Richfield, Bear Mktg. 216-659-3131
OK Oklahoma City, Ammon & Rizos 405-942-2552
OR Portland, J. J. Backer 503-297-8744
OR Salem, J. J. Backer 503-362-0717
TX Austin, Ammon & Rizos 512-454-5131
TX Dallas, Ammon & Rizos 214-644-5591
TX Houston, Ammon & Rizos 713-781-6240
UT Salt Lake City, Parker Webster 801-266-9939
VA Huddleston, Micro-Comp 301-247-0400
WA Seattle, J. J. Backer 206-285-1300

Local Distributors

AL Huntsville, Hall-Mark Elctrns. 205-837-8700
AL Huntsville, Hamilton/Avnet Elctrns. 205-837-7210
AL Huntsville, Pioneer/Washington 205-837-9300
AL Huntsville, Schweber 205-882-2200
AZ Phoenix, Elctrn. Parts Co. 602-277-7281
AZ Phoenix, Hall-Mark Elctrns. 602-243-6601
AZ Phoenix, Schweber Elctrns. 602-997-4874
AZ Phoenix, TTI 602-861-0222
AZ Tempe, Acacia Sls. 602-894-2874
AZ Tempe, Bell Inds. 602-966-7800
AZ Tempe, Elctrn. Supp. 602-258-4769
AZ Tempe, Hamilton/Avnet 602-231-5100
CA Canoga Park, Schweber Elctrns. 213-999-4702
CA Chatsworth, Avnet Elctrns. 213-700-2600
CA Chatsworth, TTI 818-709-1010
CA Citrus Hts, Hall-Mark Elctrns. 916-443-7282
CA Compton, Harper S.I.D. 213-979-5090
CA Costa Mesa, Avnet Elctrns. 714-754-6111
CA Costa Mesa, Avnet Elctrns. 213-558-2313
CA Costa Mesa, Hamilton Elctrns. 714-641-4100
CA Culver City, Hamilton Electro Sls. 213-558-2883/84
CA Culver City, Hamilton Electro Sls. 213-558-2121
CA El Segundo, Hall-Mark Elctrns. 213-643-9101
CA Garden Grove, Bell Inds. 213-444-0301
CA Gardena, Bell Inds. 213-515-1800
CA Irvine, Acacia Sls. 714-549-0954
CA Irvine, Schweber Elctrns. 714-556-3880
CA Irvine, Schweber Elctrns. 714-863-0261
CA Oakland, Brill Elctrns. 415-834-5888
CA Riverside, Elctrn. Supp. Corp. 714-787-9220
CA Roseville, Bell Inds. 916-969-3100
CA Sacramento, Hamilton/Avnet 916-920-3150
CA Sacramento, Schweber Elctrns. 916-929-9732
CA San Diego, Acacia Sls. 619-565-4365
CA San Diego, Bell Inds. 619-268-1277
CA San Diego, Elctrn. Supp. 619-278-5020
CA San Diego, Hall-Mark Elctrns. 619-268-1201
CA San Diego, Hamilton/Avnet 619-571-7500
CA San Jose, TTI 408-943-9155
CA Santa Ana, Teknopak 714-558-8840
CA Santa Clara, Schweber Elctrns. 408-748-4700
CA Santa Clara, Schweber Elctrns. 408-496-0200
CA Sunnyvale, Acacia Sls. 408-745-7200
CA Sunnyvale, Bell Inds. 408-734-8570
CA Sunnyvale, Hall-Mark Elctrns. 408-773-9990
CA Sunnyvale, Hamilton/Avnet 408-743-3300
CA Tustin, Hall-Mark Elctrns. 714-669-0681
CA Woodland Hills, Avnet Elctrns. 213-884-3322
CO Denver, Newark Elctrns. 303-757-3351
CO Englewood, Hall-Mark Elctrns. 303-790-1662
CO Englewood, Hamilton/Avnet 303-779-9998
CO Lakewood, Acacia Sls. 303-232-2882
CO Wheat Ridge, Bell Inds. 303-424-1985
CT Danbury, Hamilton/Avnet 203-797-2856
CT Danbury, Schweber Elctrns. 203-792-3500
CT Hamden, Almo Elctrns. Corp. 203-288-6556
CT Norwalk, Pioneer Std. 203-853-1515
CT Statford, TTI 203-375-1400
CT Wallingford, Midan Elctrns. 203-265-2077
FL Altamonte Springs, Pioneer Std. 305-834-9090
FL Altamonte Springs, Schweber Elctrns. 305-331-7555
FL Clearwater, Hall-Mark Elctrns. 813-530-4543
FL Dania, Summit Distrs. 305-920-625
FL Ft. Lauderdale, Hall-Mark Elctrns. 305-971-9280
FL Ft. Lauderdale, Hamilton/Avnet 305-971-2900
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Ft. Lauderdale, Pioneer/Washington 305-771-7520
FL Hollywood, Schweber Elctrns. 305-927-0511
FL Largo, Graham Elctrns. 813-541-4434
FL Orlando, Hall-Mark 305-855-4020
FL Orlando, Hammond Elctrns. 305-849-6060
FL Orlando, Pioneer/Orlando 305-834-9090
FL Orlando, TTI 305-859-1000
FL St. Petersburg, Hall-Mark Elctrns. 813-576-8691
FL St. Petersburg, Hamilton/Avnet 813-576-3930
FL Winter Park, Hamilton/Avnet 305-628-3888
GA Norcross, Hall-Mark Elctrns. 404-447-8000
GA Norcross, Hamilton/Avnet 404-447-7500
GA Norcross, Hammond Elctrns. 404-449-1996
GA Norcross, Pioneer/Washington 404-448-1711
GA Norcross, Schweber Elctrns. 404-449-9170
GA Norcross, TTI 404-662-0911
IL Bensenville, Hall-Mark Elctrns. 312-860-3800
IL Bensenville, Hamilton/Avnet 312-860-8523
IL Chicago, Bell Inds. 312-982-9210
IL Chicago, Newark Elctrns. 312-638-4411
IL Elk Grove Village, Pioneer Std. 312-437-9680
IL Elk Grove Village, Schweber Elctrns. 312-364-3750
IL Palatine, Ohm Elctrns. 312-359-5500
IN Carmel, Hamilton/Avnet 317-844-9333
IN Fort Wayne, Graham Elctrns. 219-423-3422
IN Indianapolis, Graham Elctrns. 317-634-8202
IN Indianapolis, Pioneer Std. Elctrns. 317-849-7300
IN Lafayette, Graham Elctrns. 317-423-5564
IA Cedar Rapids, Bell Inds. 319-395-0730
IA Cedar Rapids, Hamilton/Avnet 319-362-4757
IA Cedar Rapids, Schweber Elctrns. 319-373-1417
KS Lenexa, Hall-Mark Elctrns. 913-888-4747
KS Overland Park, Schweber Elctrns. 913-492-2921
KS Overland Pk., Hamilton/Avnet Elctrns. 913-888-8900
LA New Orleans, Wm B Allen Supp. 504-525-8222
MD Baltimore, Radio Elec. Svc. Co. 301-529-0500
MD Beltsville, Radio Elec. Svc. Co. 202-937-9100
MD Columbia, Hall-Mark Elctrns. 301-796-9300
MD Columbia, Hamilton/Avnet 301-995-3500
MD Gaithersburg, Almo Elctrns. Corp. 301-670-0090
MD Gaithersburg, Pioneer/Washington 301-921-0660
MD Gaithersburg, Schweber Elctrns. 301-840-5900
MA Bedford, Schweber Elctrns. 617-275-5100
MA Burlington, Lionex Corp. 617-657-5170
MA Canton, Almo Elctrns. Corp. 617-821-1450
MA Lexington, Pioneer Std. 617-863-1200
MA Norwood, Gerber Elctrns. 617-769-6000
MA Wilmington, RC Comps. 617-273-1860
MA Woburn, Hall-Mark Elctrns. 617-935-9777
MA Woburn, Hamilton/Avnet 617-273-7500
MI Flint, RS Elctrns. 313-762-5800
MI Grand Rapids, Hamilton/Avnet 616-243-8805
MI Grand Rapids, RS Elctrns. 616-241-3483
MI Kalamazoo, RS Elctrns. 616-381-5470
MI Livonia, Hamilton/Avnet 313-522-4700
MI Livonia, Pioneer Std. Elctrns. 313-525-1800
MI Livonia, RS Elctrns. 313-525-1155
MI Livonia, Schweber Elctrns. 313-525-8100
MI Roseville, RS Elctrns. 313-779-2450
MI Wyandotte, RS Elctrns. 313-AV2-5880
MN Bloomington, Hall-Mark Elctrns. 612-854-3223
MN Eden Prairie, Schweber Elctrns. 612-941-5280
MN Edina, Schweber Elctrns. 612-941-5280
MN Minneapolis, Newark Elctrns. 612-331-6350
MN Minnetonka, Hamilton/Avnet 612-932-0600
MN Minnetonka, Pioneer Std. Elctrns. 612-935-5444
MO Earth City, Hamilton/Avnet 314-344-1200
MO Earth City, Schweber Elctrns. 314-739-0526
MO Maryland Hts, Hall-Mark Elctrns. 314-291-5350
NH Hudson, C&H Elctrns. 603-882-1133
NH Manchester, Schweber Elctrns. 603-625-2250
NJ Camden, General Radio 609-964-8560

NJ Cherry Hill, Hall-Mark Elctrns. 609-424-7300
NJ Cherry Hill, Hamilton/Avnet 609-424-0110
NJ Clifton, J-Mar Elctrns. 201-772-6400
NJ Fairfield, Hall-Mark Elctrns. 201-575-4415
NJ Fairfield, Hamilton/Avnet 201-575-3390
NJ Fairfield, Lionex 201-227-7960
NJ Fairfield, Schweber Elctrns. 201-227-7880
NJ Pine Brook, Pioneer Std. 201-227-1262
NM Albuquerque, Bell Inds. 505-292-2700
NM Albuquerque, Elctrn. Parts 505-293-6161
NM Albuquerque, Elctrn. Parts Co. 505-293-6161
NM Albuquerque, Hamilton/Avnet Elctrns. 505-765-1500
NM Las Cruces, Elctrn. Parts Co. 505-523-4578
NY Bohemia, TTI 516-567-1500
NY Buffalo, Summit Distrs. 716-884-3450
NY E. Syracuse, Hamilton/Avnet 315-437-2647
NY Fairport, Pioneer-Harvey 716-381-7070
NY Hauppauge, Hamilton/Avnet 516-231-9800
NY Hauppauge, Lionex 516-273-1660
NY Hauppauge, Mast Distrs. 516-273-4422
NY Hauppauge, Pioneer-Harvey 516-231-9200
NY Melville, Hamilton/Avnet 516-454-6000
NY Rochester, Hamilton/Avnet Elctrns. ... 716-475-9130
NY Rochester, Schweber Elctrns. 716-424-2222
NY Rochester, Summit Distrs. 716-334-8110
NY Ronkonkoma, Hall-Mark Elctrns. 516-737-0600
NY Vestal, Pioneer Std. 607-748-8211
NY Westbury, Schweber Elctrns. 516-334-7474
NC Charlotte, Pioneer/Washington 704-527-8188
NC Greensboro, Hammond Elctrns. 919-275-6391
NC Raleigh, Hall-Mark Elctrns. 919-872-6286
NC Raleigh, Hall-Mark Elctrns. 919-872-0712
NC Raleigh, Hamilton/Avnet 919-878-0819
NC Raleigh, Schweber Elctrns. 919-876-0000
OH Beachwood, Schweber Elctrns. 216-464-2970
OH Cincinnati, Hall-Mark Elctrns. 513-563-5980
OH Cincinnati, Hughes-Peters 513-351-2000
OH Cleveland, CAM/Ohio 216-461-4700
OH Cleveland, Hamilton/Avnet 216-831-3500
OH Cleveland, Pioneer Std. 216-587-3600
OH Columbus, Graham Elctrns. 614-895-1590
OH Columbus, Hughes-Peters 614-294-5351
OH Dayton, Bell Inds. 513-434-8213
OH Dayton, Hamilton/Avnet 513-433-0610
OH Dayton, Pioneer Std. 513-236-9900
OH Dayton, Schweber Elctrns. 513-439-1800
OH Maumee, RS Elctrns. 419-893-0721
OH Solon, Hall-Mark Elctrns. 216-349-4632
OH Westerville, Hall-Mark Elctrns. 614-891-4555
OK Tulsa, Hall-Mark Elctrns. 918-665-3200
OK Tulsa, Schweber Elctrns. 918-622-8000
OR Beaverton, Acacia Sls. 503-646-3377
OR Beaverton, Almac Elctrns. 503-641-9070
OR Lake Oswego, Bell Inds. 503-241-4115
OR Lake Oswego, Hamilton/Avnet Elctrns. 503-635-8831
PA Horsham, Lionex Corp. 215-443-5150
PA Horsham, Pioneer/Washington 215-674-4000
PA Horsham, Schweber Elctrns. 215-441-0600
PA Lancaster, CAM/RPC 717-392-8141
PA Philadelphia, Almo Elctrns. Corp. 215-698-4000
PA Pittsburgh, Almo Elctrns. Corp. 412-931-5990
PA Pittsburgh, CAM/RCP 412-782-3770
PA Pittsburgh, Pioneer Std. Elctrns. 412-782-2300
PA Pittsburgh, Schweber Elctrns. 412-782-1600
SC Greenville, Hammond Elctrns. 803-233-4121
TN Nashville, Graham Elctrns. 615-242-2682
TX Austin, Hall-Mark Elctrns. 512-258-8848
TX Austin, Hamilton/Avnet 512-837-8911
TX Austin, Harrison Equip. Co. 512-458-3555
TX Austin, Pioneer Std. Elctrns. 512-835-4000
TX Austin, Schweber Elctrns. 512-458-8253
TX Dallas, Hall-Mark Elctrns. 214-343-5000
TX Dallas, Hall-Mark Elctrns. 214-341-1147
TX Dallas, Harrison Equip. Co. 214-239-2750
TX Dallas, Pioneer Std. Elctrns. 214-386-7300
TX Dallas, Schweber Elctrns. 214-661-5010
TX El Paso, Ideal Indl. Elctrn. Supp. 915-779-6647
TX Fort Worth, TTI 214-429-1440
TX Houston, Hall-Mark Elctrns. 713-781-6100
TX Houston, Hamilton/Avnet 713-975-3501
TX Houston, Harrison Equip. Co. 713-879-2600
TX Houston, Pioneer Std. 713-988-5555
TX Houston, Pioneer Std. Elctrns. 214-386-7300
TX Houston, Schweber Elctrns. 713-784-3600
TX Irving, Hamilton/Avnet 214-659-4100
TX Stafford, Harrison Equip. 713-879-2600
UT Salt Lake City, Bell Inds. 801-972-6969
UT Salt Lake City, Hamilton/Avnet 801-972-2800
WA Bellevue, Almac Elctrns. 206-643-9992
WA Bellevue, Bell Inds. 206-747-1515
WA Bellevue, Hamilton/Avnet 206-643-3950
WI Brookfield, Schweber Elctrns. 414-784-9020
WI Mequon, Taylor Elec. 414-241-4321
WI Milwaukee, Electronic Expd. 414-228-8100
WI New Berlin, Hamilton/Avnet 414-784-4510
WI Oak Creek, Hall-Mark Elctrns. 414-761-3000
WI Waukesha, Bell Inds. 414-547-8879

BOURNS INSTRS., INC., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506, Tel: 714-781-5433; *Sls. Mgr.:* Ken Pinkham; *Dist. Mgr.:* Ken Pinkham

BOURNS INSTRS., INC., Industrial Div., 1960 Chicago Ave., Unit F, Riverside, CA 92503, Tel: 714-781-5147, Telex: 676401, TWX: 910-332-1281; *Sls. Mgr.:* Tom McCarthy

BOURNS MAGNETIC DIV., Technical Products Group, Box 1398, Romoland, CA 92380, Tel: 714-657-5195, TWX: 910-332-1304; Empl.: 120; *Sls. Mgr.:* Dennis Dalbeck

BOWMAN INDUSTRIES, 9300 Hall Rd., Downey, CA 90241

Bowmar

BOWMAR/ALI, Bowmar Instr. Corp., 531 Main St., Acton, MA 01720, Tel: 617-263-8365, TWX: 710-347-1441; Empl.: 175; *Sls. Mgr.:* Allen Warner ..... **D•1331-1333**

Local Sales Offices & Reps

CA LaCanada, Brooks-Moore & Assocs. .. 818-790-8358
CA Orange, Brooks-Moore & Assocs. 714-771-1220
CA Palo Alto, Mollard Mktg. 415-961-0456
CA Santa Ana, Brooks-Moore & Assocs. .. 714-544-8900
CT Madison, Eastronix, Inc. 203-421-4514
IL Des Plaines, Lincoln, Hodges & Assocs. 312-297-3810
KS Overland Park, Barry Sls. 913-642-0270
LA Baton Rouge, Mid-South Sls. 504-924-0106
LA Lafayette, Mid-South Sls. 318-233-2546
LA Lake Charles, Mid-South Sls. 318-433-0356
LA Slidell, Mid-South Sls. 504-641-7480
ME Camden, Bernard Sullivan Assocs. 207-236-8394
MD Columbia, Tyler Griffin Co. 301-995-1215
MA Bedford, Eastronix, Inc 617-275-5775
MI Farmington, Amtech Reps. 313-474-8300
MN Minneapolis, Waltham Sls. Co. 612-781-2778
MO St. Louis, Barry Sls. 314-821-2525
NJ Plainfield, Cosine, Inc. 201-654-3551
NY Clarence, Trott Elctrns. 716-634-8500
NY Pittsford, Trott Elctrns. 716-586-8251
OH Cuyanoga Falls, J. C. Hofstetter Co. ... 216-929-8009
OH Dayton, J. C. Hofstetter Co. 513-296-1010
OH Medina, J. C. Hofstetter Co. 216-241-4880
OR Portland, Frank Jackson Assocs. 503-292-2638
PA Hickory, J. C. Hofstetter Co. 412-356-2305
PA Paoli, Tyler Griffin Co. 215-647-1550
TX Carrollton, Seaton Corp. 214-380-0414
UT Salt Lake City, Measurement Consits. 801-364-3174
VT Shelburne, Eastronix, Inc. 802-985-3743
WA Redmond, Frank Jackson Assocs. 206-881-7277
WI Waukesha, Lincoln, Hodges & Assocs. 414-542-3087

Local Distributors

AZ Phoenix, Metermaster 602-437-1425
CA Los Angeles, E. I. L. 213-685-7020
CA Palo Alto, Metermaster 415-968-0313
CA Ridgecrest, E. I. L. 619-375-5550
CA San Diego, Metermaster 619-560-4841
CA Santa Clara, E. I. L. 408-727-0396
CO Denver, E. I. L. 303-534-4160
CT Middletown, E. I. L. 203-346-6646
FL Palm Bay, E. I. L. 305-725-8300
GA Atlanta, Horton Instr. Co. 404-231-3131
GA Norcross, Metermaster 404-446-0166
IL Bridgeview, E. I. L. 312-430-2292
IL Chicago, DALEC 312-283-0300
IL Elk Grove Village, Metermaster 812-593-8650
IL Itasca, Metermaster 312-250-0606
IN Indianapolis, E. I. L. 317-545-1373
KY Louisville, E. I. L. 502-454-3420
LA Slidell, Mid-South Sls. Co., Inc. 504-641-7480
MD Sparks, E. I. L. 301-771-4800
MA Billerica, Metermaster 617-523-2580
MA Burlington, E. I. L. 617-272-9450
MN Minneapolis, Process Meas. Co. 612-544-4035
NJ North Caldwell, Hosica Labs. 201-256-7724
NJ Pennsauken, E. I. L. 609-488-0474
NJ Plainfield, Integral Control Sys. Corp. .. 201-561-2323
NY Hauppauge, E. I. L. 516-231-6333
NY Rochester, E. I. L. 716-442-2430
NC Charlotte, Trott Elctrns., Inc. 704-376-2237
OH Cleveland, Metermaster 216-651-4100
OH Dayton, E. I. L. 513-435-2134
OR Portland, Westcon, Inc. 503-283-0132
PA Philadelphia, Electric Tachometer Corp. 215-726-7723
PA Pittsburgh, E. I. L. 412-731-5230
TX Dallas, E. I. L. 214-931-1236
TX Garland, Metermaster 214-271-5671
TX Houston, E. I. L. 713-271-3100
TX Houston, Quality Instr. Lab., Inc. 713-524-0528
VA Alexandria, E. I. L. 703-354-4330
VA Virginia Beach, E. I. L. 804-499-3746
WA Seattle, E. I. L. 206-762-0880
Can Longueuil, Que., E. I. L. 514-651-4844
Can Mississauga, Tor., E. I. L. 416-624-6660
Can Woodbridge, Ont., R. H. Nichols Co., Ltd. 416-851-8871

Bowmar

BOWMAR INSTRUMENT CORP., Aerospace Div., 8000 Bluffton Rd., Ft. Wayne, IN 46809, Tel: 219-747-3121, TWX: 810-332-1510; FSC No.: 99479; Empl.: 215; *Sls. Mgr.:* Herb Black ..... **B•1707**

Local Sales Offices & Reps

CA Uplander Way, Westaironics, Inc. 213-641-4122
CO Castle Rock, Romulus Elctrns., Ltd. ... 303-688-5127
CT Haver Hill, LK Assocs. 617-373-1313
CT Lee, LK Assocs. 413-243-1158
FL Melbourne, Saber Assocs. 305-724-0920
GA Smyrna, Spartech 404-446-7300
IL Rolling Meadows, KMA Sls. Co. 312-398-5300
IA Cedar Rapids, Ard Sls. Inc. 319-393-6392
MN Bloomington, Electronic Sls. Agy. 612-884-8291
MO St. Louis, Abrams Assocs. 314-569-0447
NJ Matawan, Bowmar Instr. Corp. 201-526-0400
NY Syracuse, Fountain Young Co., Inc. ... 315-437-7733
OH Dayton, Raystan Controls 513-278-3559
TX Addison, Robert R. Thomas Co. 214-233-8235
WI Milwaukee, JM Sls. Co. 414-546-0040
Can Ottawa Ont., Subtec, Ltd. 613-738-1470

BOWMAR INSTRUMENT CORP., Commercial Products Div., 4640 126th Ave. N., Clearwater, FL 33520, Tel: 813-576-2525, TWX: 810-863-0375; Empl.: 127; *Sls. Mgr.:* Walt Kunz

BOWMAR/TIC, INC., 850 Lawrence Dr., Newbury Park, CA 91320, Tel: 805-498-2161, TWX: 910-336-1265; FSC No.: 99957; Empl.: 100; *Sls. Mgr.:* Reece Kendall

BOW SOLDER PRODS., 900 Hobson St., Union, NJ 07083, Tel: 201-686-6040, 800-526-4496; Empl.: 38; *Sls. Mgr.:* J. Moran

BRADY CO., 574A Somerset St., N. Plainfield, NJ 07060, Tel: 201-753-7988; *Sls. Mgr.:* Ed Brady; *Dist. Mgr.:* John Blaze

BRADY, W.H., CO., Elctrn. Prods. Div., 6150 N. Flint Rd., Milwaukee, WI. 53201, Tel: 414-332-8100, Telex: 26-677; *Sls. Mgr.:* David D. Tatham

BRADY, W. H., CO., Indl. Prods. Div., 2221 W. Camden Rd., Milwaukee, WI 53201, Tel: 414-351-6630, Telex: 26-677, TWX: 910-262-3151; *Sls. Mgr.:* G. W. Gyllstrom; *Dist. Mgr.:* G. W. Gyllstrom

BRADY, W.H., CO. NAMEPLATE DIV., See Brady, W.H., Co., Elctrn. Prods. Div

BRADY, W. H., CO., Xymox Div., 8225 W. Parkland Ct., P.O. Box 571, Milwaukee, WI 53201, Tel: 414-355-8300, Telex: 26-677, TWX: 910-262-3151; FSC No.: 85480; *Sls. Mgr.:* G. R. Manich; *Dist. Mgr.:* G. R. Manich

BRAEMAR CORP., 11400 Rupp Drive, Burnsville, MN 55337, Tel: 612-890-5135; Empl.: 130; *Sls. Mgr.:* P. L. Musgrove

BRAILSFORD & CO., 670 Milton Rd., Rye, NY 10580, Tel: 914-967-1820; Empl.: 25

BRAND DIELECTRICS, INC., Route 203, N. Windham, CT 06256, Tel: 203-423-6321; Empl.: 5; *Sls. Mgr.:* Philip Harvey

BRANDEN, T. G., CORP., 5565 S.E. Intl. Way, Portland, OR 97222, Tel: 503-659-9366; Empl.: 8; *Sls. Mgr.:* Ted Brandt

BRAND-REX, Electronic & Indl. Cable Div., Box 498, Willimantic, CT 06226, Tel: 203-456-8000, TWX: 710-440-2247; FSC No.: 71124; Empl.: 1000; *Sls. Mgr.:* J. F. Cichy

Local Sales Offices & Reps

CA	Laguna Hills, Brand-Rex	714-835-0802
CA	San Jose, Brand-Rex	408-247-9811
CO	Boulder, Component Prod. Sls., Inc.	303-530-2800
CT	Manchester, Manu-Rep, Inc.	203-646-6064
FL	Maitland, E.I.R., Inc.	305-660-9600
IN	Indianapolis, Insulation Reps.	317-251-1994
MD	Hanover, J. A. Maguire & Co.	301-796-0970
MA	Clinton, CWS, Inc.	617-368-8753
MI	Albuquerque, Power Entprs., Ltd.	505-298-1918
MI	Farmington Hills, Joseph H. Clark Sls. Co.	313-553-0610
MN	Edina, Grayden & Flemmer	612-941-1120
MO	Chesterfield, Durnin & Assocs.	314-532-9774
NJ	Dunellen, J. A. Maguire & Co.	201-752-8480
NJ	Pennsauken, J. A. Maguire & Co.	609-665-5136
NY	Pittsford, Kirby Mktg.	716-248-8750
OH	Chagrin Falls, Joseph H. Clark Sls.	216-247-7848
OR	Beaverton, Barrett, Squibb & Assocs.	503-642-1661
SC	Greenwood, Bamco	803-229-6801
TN	Knoxville, Insul-Reps	615-691-7586
TX	Richardson, C. J. Tellier Co.	214-231-6348
VA	Portsmouth, J. A. Maguire & Co.	804-398-0202
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991

Local Distributors

AZ	Tucson, A.E. Petsche Co., Inc.	602-746-3128
CA	Carson, A. E. Petsche Co., Inc.	213-639-9500
CA	Inglewood, Storm Prods.	213-649-6141
CA	Santa Clara, Storm Prods.	408-749-9400
CA	Torrance, Blake Wire & Cable	213-515-0561
CO	Broomfield, Storm Prods.	303-466-1991
FL	Ft. Lauderdale, K.S.M. Elctrns.	305-971-5900
FL	Orlando, Cablematics/Action Wire	305-293-1618
GA	Norcross, A. E. Petsche Co., Inc.	404-441-1709
IL	Addison, K.S.M. Elctrns.	312-953-9473
IL	Rosemont, Dearborn Wire & Cable	312-696-1000
KS	Wichita, A.E. Petsche Co., Inc.	316-943-9358
MA	Woburn, Pacer Elctrns.	617-935-8330
MN	Minneapolis, Bergquist Co.	612-835-2322
NH	Amherst, North Country Wire Supp.	603-889-0063
NY	Endicott, Rogan Elctrns.	607-754-3590
NY	Fairport, Pacer Elctrns.	716-377-0462
NY	Farmingdale, Vertx Elctrns.	516-293-9880
NY	Farmingdale, Weico Elctrns.	516-293-0050
NY	Hauppauge, Wintronics, Inc.	516-234-8040
NY	Johnson City, Help Elctrns.	607-729-3528
OR	Beaverton, Murphy Elctrns.	215-534-3900
PA	Folcroft, Delphi Elctrns.	215-534-3900
TX	Dallas, Storm Prods.	214-330-1381
TX	Garland, Southwest Cable	214-494-4009
TX	Houston, A.E. Petsche Co., Inc.	713-641-3386
WA	Redmond, Murphy Elctrns.	206-881-1234

BRANDT ELCTRNS., INC., 1220 Alderwood Ave., Sunnyvale, CA 94086, Tel: 408-734-8310, TWX: 910-339-9560; FSC No.: 57837; *Sls. Mgr.:* Frank D. Brandt

BRAXTON MFG., Echo Lake Rd. N., P.O. Box 429, Watertown, CT 06795, Tel: 203-274-6781, TWX: 710-477-0621; Empl.: 115; *Sls. Mgr.:* Mark W. Ritucci

BREEZE-ILLINOIS, TransTechnology Corp., 401 S. Main Street, P.O. Box 368, Wyoming, IL 61491, Tel: 309-695-2511, TWX: 510-390-3691; Empl.: 180; *Sls. Mgr.:* Patrick Banakis **C•1171, 1790-1792**

Local Sales Offices & Reps

CA	Woodland Hills, Cal Ward Sls.	213-883-2202
CO	Longmont, Todd & Fry Assocs.	303-776-7331
FL	St. Petersburg, Tech. Reps. Assocs.	813-577-2779
IL	Berkeley, Cadre Tech. Rep., Inc.	312-449-3900
KS	Desoto, Midtec Assocs., Inc.	913-441-6565
MI	Madison Heights, Pine Sls., Inc.	313-589-0350
MN	Bloomington, Merrill Franklin	612-854-9446
NY	Great Neck, Trionic Assocs.	516-466-2300
OH	Chagrin Falls, Pine Sls., Inc.	216-247-6198
PA	Pittsburgh, Pine Sls., Inc.	412-456-7471
TX	Bedford, DeArmond Entprs.	817-267-2048
WA	Bellevue, Lehr Assocs.	206-453-9993

BRELONIX, 106 No. 36th St., Seattle, WA 98103, Tel: 206-633-1964; Empl.: 10; *Sls. Mgr.:* A. L. DeVore

BREN-TRONICS, INC., 10 Brayton Ct., Commack, NY 11725, Tel: 516-499-5155, Telex: 22-1213 TTCUR; FSC No.: 51828; Empl.: 75; *Sls. Mgr.:* R. Mainzer

BREVEL MOTORS, INC., Sub. Vernitron Corp., Broad & 16th Sts., Carlstadt, NJ 07072, Tel: 201-933-0220; *Sls. Mgr.:* Jack Dominice **B•1141**

Local Sales Offices & Reps

AR	El Dorado, Industrial Control Assocs.	501-862-2051
CA	Los Angeles, Electric Motor Engrg.	213-469-7393
CT	Old Saybrook, M. L. Assocs.	203-388-9718
FL	Altamonte Springs, Machine Controls	305-788-6607
IL	Chicago, Jerry Golten Co.	312-792-1991
KS	Prairie Village, Darco Sls.	913-381-7913
MA	Ashland, M. L. Assocs.	617-485-6190
MN	St. Paul, Vikeland Sls.	612-645-4647
NJ	Teaneck, Herbert Rude & Assocs.	201-836-6778
NY	Penfield, Upstate Comps.	716-381-6070
NC	Raleigh, Leigh Sls.	919-872-1484
OH	Bucyrus, Sissler & Assocs.	419-562-9311
OH	Columbus, Sissler & Assocs.	614-488-4455
PA	Exton, Kiley Elec. Co.	215-363-8550
TN	Cleveland, Hicks Sls.	615-472-7398

Local Distributors

AZ	Phoenix, Johnstone	602-269-9354
CA	Baldwin Park, Johnstone	213-962-7138
CA	Los Angeles, Minarik	213-624-3161
CO	Denver, Johnstone	303-573-5626
CT	New Haven, Star Supp. Co.	203-772-2240
FL	Ft. Lauderdale, Johnstone	305-971-9350
GA	Norcross, Johnstone	404-446-0400
ID	Boise, Johnstone	208-377-1600
IL	Chicago, Harry Alter	312-376-3505
KS	Wichita, Johnstone	316-267-3629
LA	New Orleans, Harry Alter Co.	504-488-4435
MD	Rockville, Johnstone	301-251-0281
MA	Medford, Empire	617-395-5000
MI	Farmington Hills, Universal Elec. Prod.	313-476-9500
MO	Kansas City, Johnstone Corp.	816-842-3250
MT	Billings, Johnstone Corp.	406-252-1207
NE	Omaha, Johnstone Corp.	402-339-2342
NV	Sparks, Johnstone Corp.	702-356-6668
NJ	Cherry Hill, Motor and Control Sys.	609-424-5810
NJ	Gafield, The Harry Alter Co.	201-478-0455
NY	Manhattan, The Harry Alter Co.	212-255-5300
OH	Cleveland, Reserve Elec.	216-771-5764
OK	Oklahoma City, Johnstone Corp.	405-232-8576
OR	Portland, Johnstone Corp.	503-233-1151

BREW, RICHARD D., & CO., INC., 90 Airport Rd., Concord, NH 03301, Tel: 603-225-6605, Telex: 943-483; FSC No.: 98913; Empl.: 43

BRIAN INSTRUMENTS, INC., 626 S. State College Blvd., Fullerton, CA 92631, Tel: 714-992-5540, TWX: 910-350-7019; Empl.: 30; *Sls. Mgr.:* E. 'Chuck' Ouellette; *Dist. Mgr.:* Barbara M. Semain

BRIDGE COMPUTER CO., Sea Data Corp., 1 Bridge St., Newton, MA 02158, Tel: 617-244-8190, Telex: 951107; *Sls. Mgr.:* Elaine Doll

BRIGGS, C. A., CO., P.O. Box 151, Glenside, PA 19038, Tel: 215-885-2244, Telex: 83-4753; Empl.: 10; *Sls. Mgr.:* C. A. Briggs, Jr.

BRIM ELCTRNS., 120E Home Pl., Lodi, NJ 07644, Tel: 201-796-2886; FSC No.: 57834 **C•1793-1800**

Local Sales Offices & Reps

FL	De Bary, DJE Assocs.	305-668-6827
FL	Enterprise, DJE Assocs., Inc.	305-321-6623
MA	Millis, R G Assocs.	617-376-2044
MA	Stow, R G Assocs.	617-897-7146
EXP	NY, N.Y.C., Roburn Agencies	212-989-5939

Local Distributors

AL	Dothan, Carmichael Whls. Supp.	205-793-7066
CA	Canoga Park, Tim-Co. Sls.	213-992-5040
CA	San Diego, Shanks & Wright	619-239-0176
CT	Manchester, IMS	203-649-4415
CT	Waterbury, Suburban Supp.	203-757-1251
GA	Marietta, Atlanta Elec. Wire & Cable	404-955-6800
LA	New Orleans, Radio Parts	504-581-5959
MA	Billerica, Eastern Video Sys.	617-667-0009
MA	Lexington, Wholesale Elect. Supp.	617-862-3590
MA	Springfield, Electro-Term	413-734-6469
MA	Waltham, Linear Elect.	617-894-7300
MI	Troy, Northern Wire & Cable	313-589-0510
NH	Dover, American Radio Corp.	603-742-6800
NJ	Hackensack, Milcor	201-489-1313
NY	LIC, H.L. Dalis	212-361-1100
NY	N.Y.C., Center Indl.	212-YU9-6363
OK	Tulsa, Radio	918-587-9123
PA	Philadelphia, Spectrum Elec.	215-748-3010
RI	Newport, J & S Elctrn. Distb.	401-847-2977
TN	Knoxville, Bondurant Bros. Co.	615-573-9151
TX	Grand Prairie, Southwest Hardware & Fastever	214-264-4711
TX	Texarkana, Lavender Elec.	501-773-4631
TX	Texarkana, McCulloch Elctrns.	214-792-6923
VA	Norfolk, Todd Elec.	804-855-3111
WA	Seattle, Amateur Radio Supp.	206-767-3222

BRISTOL BABCOCK INC., 40 Bristol St., Waterbury, CT 06708, Tel: 203-575-3000, Telex: 962417, TWX: 203-754-1477; Empl.: 600; *Sls. Mgr.:* William H. Seeley

BRISTOL SAYBROOK, 97 Coulter St., Old Saybrook, CT 06475, Tel: 203-388-3414, Telex: 966-435; Empl.: 125; *Sls. Mgr.:* George S. Willis

Local Sales Offices & Reps

CA	Alhambra, C.E. Mello Co.	818-282-2000
CT	Old Saybrook, M-L Assoc.	203-388-9718
FL	Largo, Kirk Sls, Inc.	813-595-7353

Local Distributors

AL	Arab, Timer & Control Engr. Svc.	205-586-7671
CA	Los Angeles, Minarik Electic Co.	213-624-3161
MA	Somerville, Electro Sls. Co.	617-666-0500
NY	Sodus, AED Distributors	315-483-6561

BROOKS INSTR. DIV., Emerson Elec. Co., 407 W. Vine St., Hatfield, PA 19440, Tel: 215-362-3500, Telex: 846-181; Empl.: 1500; *Sls. Mgr.:* William Weierbach

BROOKS MFG. CO., 2016/24 Amber St., Philadelphia, PA 19125, Tel: 215-425-3395, 800-523-0130; Empl.: 70; *Sls. Mgr.:* G. Brooks; *Dist. Mgr.:* G. Brooks

Local Sales Offices & Reps

CA	Irvine, Mike Roth Sls.	714-850-1254
CA	San Francisco, Maddox Sls.	415-647-5560
FL	Miami, Roulson & Co.	305-666-4240
GA	Atlanta, Dewitt Austin Co.	404-393-3519
IL	Glenview, Reigel Assocs.	312-729-3824
MD	Towson, Ernie Stefkovic Assocs.	301-321-6008
MI	East Detroit, Jack M. Thorpe Co.	313-779-6363
NJ	Cherry Hill, Ernie Stefkovic Assocs.	609-667-4066
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BROOKS MKTG. CORP., 3569 Bristol Pike Bldg. 2 Ste 102, Bensalem, PA 19020, Tel: 215-244-0264, 1-800-523-1551; Empl.: 90; *Sls. Mgr.:* Joseph E. Brooks

BROWN BOVERI ELEC., Norristown Rd., Spring House, PA 19477, Tel: 215-628-7400, TWX: 510-661-0168; Empl.: 3,500

BROWN BOVERI ELECTRIC, INC., 167 Overland Drive, P.O. Box 648, West Columbia, SC 29171, Tel: 803-796-9502

BRUEL & KJAER INSTRS. INC., 185 Forest St., Marlboro, MA 01752, Tel: 617-481-7000, TWX: 710-347-1187; FSC No.: 617-485-0519; Empl.: 40

Local Sales Offices & Reps

CA	Anaheim, Bruel & Kjaer Instrs.	714-978-8066
CA	Foster City, Bruel & Kjaer Instrs.	415-574-8155
IL	Hoffman Estates, Bruel & Kjaer Instrs.	312-358-7582
MD	Gaithersburg, Bruel & Kjaer Instrs.	301-948-0494
MA	Marlborough, Bruel & Kjaer Instrs.	617-481-7000, ext. 139
MI	Livonia, Bruel & Kjaer Instrs.	313-522-8600
NJ	West Caldwell, Bruel & Kjaer Instrs.	201-526-2284
TX	Houston, Bruel & Kjaer Instrs.	713-645-0167
WA	Seattle, Bruel & Kjaer Instrs.	206-625-1112

BRUSH MAGNETIC HEADS, Div. of Brush Ind., Inc., 3rd & Reagan Sts., P.O. Box 638, Sunbury, PA 17801-0638, Tel: 717-286-5611, 800-233-0362, TWX: 510-655-0222; FSC No.: 19418; Empl.: 80; *Sls. Mgr.:* D. Stephen Morrison

WESTINGHOUSE ELEC. CORP., Bryant Circuit Devices Div., 500 Sylvan Ave., Bridgeport, CT 06606, Tel: 203-334-5561, Telex: 643-817, TWX: 710-453-8709; Empl.: 1000; *Sls. Mgr.:* G. V. Curtin

BSR (USA) LTD, Route 303, Blauvelt, NY 10913

BTU ENGRG. CORP., Bruce Sys., Esquire Rd., N. Billerica, MA 01862, Tel: 617-667-4111, Telex: 94-7489; Empl.: 600; *Sls. Mgr.:* D. Barry

BUBBL-TEC, 6800 Sierra Ct., Dublin, CA 94566, Tel: 415-829-8705, TWX: 910-389-6890; Empl.: 19; *Sls. Mgr.:* T. J. Netoff

BUCHANAN, See Control Prods. Div., Amerace Corp.

BUCKBEE-MEARS CO., Nashua Div., 100 Northeastern Blvd., P.O. Box 888, Nashua, NH 03062, Tel: 603-883-5541, Telex: 94-0340; *Sls. Mgr.:* Randolph Roody

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CA Santa Clara, Engrg. Assocs. 408-988-5001
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GA Atlanta, Par Assoc. 404-391-9117
IL Mt. Prospect, Robert Adams Sls. 312-297-8733
KS De Soto, Midtec Assoc. 913-441-6565
MA Belmont, Elctrn. Comps. & Svc. 617-484-8680
MN Minneapolis, A. J. Warner Co. 612-729-7371
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PA Paoli, T. Griffin Co. 215-647-1550
TX Dallas, Advance Tech. Sls. 214-340-1300
WA Mercer Island, Elctrns. Comp. Sls. 206-232-9301

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CA Redwood City, Hi-Cor 415-368-3849
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MI Ann Arbor, Wedemeyer Elctrns. 313-665-8611
NY Hauppauge, Broadline Elctrn. Dist. 516-231-4100
TX El Paso, Ideal Indl. Elctrn. 915-779-6647
WA Redmond, Dorn Sls. Assocs. 206-885-1885
WA Seattle, Radar Elec. 206-282-2511

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BUD RADIO, 4605 E. 355th St., Willoughby, OH 44094, Tel: 216-946-3200, TWX: 810-427-2604; Empl.: 200; *Sls. Mgr.:* A.N. Haas; *Dist. Mgr.:* Blair Haas

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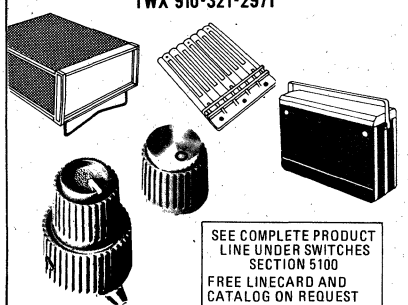

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CA Temple City, Fastening Systems 818-579-4600
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WI Brookfield, Cable Comps. 414-785-1060
Can Quebec, Simfer Indl. Prod. 515-354-0886

BUNKER RAMO, see Amphenol, An Allied Co.

BUNTING MAGNETICS, 500 So. Spencer Rd., Newton, KS 67114, Tel: 316-284-2020; Empl.: 100; *Sls. Mgr.:* Robert J. Bunting

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NY Buffalo, Niagara Elec. Sls. 716-886-4000
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NY Rochester, Niagara Elec. Sls. 716-271-1223
NC Burlington, Murphy & Cota 919-584-6450
OH Cincinnati, Anderson-Bolds, Inc. 513-528-5680
OH Cleveland, Anderson-Bolds, Inc. 216-229-4700
OH Worthington, Anderson-Bolds Inc. 614-885-3933
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TX Dallas, William Reese Assocs. 214-351-0703
TX Houston, William Reese Assocs. 713-463-1453
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MI St. Clair Shores, Spemco 313-771-2700
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NH Manchester, Cohen Machinery Co. Inc. 603-624-4324
NJ Fairlawn, Relay Specialties 201-797-3313
NY Gloversville, Montano Elctrl. Supp. 518-725-3139
NY Woodside, Switches Unlimited 212-478-5000
NC Durham, Triangle Elec. Motor 919-596-1333
NC Gastonia, JMT Elctrns. & Control 704-867-4401
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PA Harrisburg, Cumberland Elctrns. 717-233-5883
PA Philadelphia, Esco Elctrl. Supp. 215-923-6050
RI Providence, J & H Elec. Co., Inc. 401-421-7840
TX San Antonio, Sherman Elec. Supp. Inc. 512-224-1001
VA Roanoke, Peoples Elctrn. Supp. 703-342-8933

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BURROUGHS CORP., Borroughs Place, Rm. 4C-51, Detroit, MI 48232, Tel: 313-972-7000, Telex: 164125; Empl.: 65,000

BURTON ELECTRICAL ENGINEERING, Wyle Laboratories, 111 Maryland Street, P.O. Box 217, El Segundo, CA 90245-0217, Tel: 213-772-1406, Telex: 858485, TWX: 910-348-6699; FSC No.: 81861; Empl.: 55; *Sls. Mgr.:* Howard Doty

BUSSCO INC., 119 Standard St., El Segundo, CA 90245, Tel: 213-322-6580, TWX: 910-348-6295; FSC No.: 29593; Empl.: 87

BUSSMANN DIV., P.O. Box 14460, St. Louis, MO 63178, Tel: 314-394-2877, Telex: 44 841; FSC No.: ;Multiple; Empl.: 3000; *Sls. Mgr.:* George Ockuly; *Dist. Mgr.:* George Ockuly

BYTEK COMPUTER SYSTEMS CORP., 1021 S. Rogers Circle, Boca Raton, FL 33431, Tel: 305-994-3520, Telex: 510-952-7637; Empl.: 15; *Sls. Mgr.:* Madeline Selwitz

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CA Costa Mesa, Tekcom 714-645-5263
CO Denver, Aurora Mktg. 303-758-3051
FL Miami Beach, Infotech Intl. 305-948-7951
MN Minneapolis, Amex Inc. 612-375-9191

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CABLE SYSTEMS, INC., 210 Broadway, Everett, MA 02149, Tel: 617-389-7080, TWX: 710-348-1760; FSC No.: 33426; Empl.: 175; *Sls. Mgr.:* A. Janelle

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AZ Tucson, Clemick-Neenan & Assocs. .. 910-495-1722
CA Santa Ana, Wyne Champa Assocs. ... 714-557-2959
CT Tolland, TMR Corp. 203-872-3624
MD Ellicott City, Marketing Technlg. 301-465-5944
MA Tewksbury, Sequel Assocs. 617-851-4010
NY Commack, MTR Technlg. 516-543-1200

CABLEWAVE SYSTEMS, INC., 718 North Colony Road, Wallingford, CT 06492, Tel: 203-265-6560

CABLEWAVE SYS., 60 Dodge Ave., North Haven, CT 06473, Tel: 203-239-3311, TWX: 710-465-0244; Empl.: 250; *Sls. Mgr.:* William Meola/Ed Hurley; *Dist. Mgr.:* Ed Hurley

CABLEX, INC., 14 Inverness Dr. E. H-136, Englewood, CO 80112, Tel: 303-792-5760; Empl.: 50; *Sls. Mgr.:* Reed C. Mulder; *Dist. Mgr.:* Reed C. Mulder

CABOT BERYLCO, Div. Cabot Corp., PO Box 1296, Reading, PA 19603, Tel: 215-921-5000, TWX: 510-651-0677; Empl.: 600; *Sls. Mgr.:* Thomas N. Marks

CABTRON SYS., INC., 200 N. Anets Dr., Northbrook, IL 60062, Tel: 312-498-6090; Empl.: 30; *Sls. Mgr.:* Mike Gober ..... **C•1029**

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AZ	Tempe, Sierra Tech. Grp.	602-894-2335
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CO	Englewood, Sierra Tech. Grp.	303-741-0227
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MD	Silver Spring, Ansell Engrg.	301-949-1655
MA	Reading, Meco, Inc.	617-944-6660
MI	Livonia, H. Lowell Co.	313-464-2722
MN	St. Paul, Countryman Assocs.	612-645-9151
MO	Kansas City, Prod. Automation	816-737-3030
MO	St. Charles, Prod. Automation	314-441-6600
NJ	Mt. Lakes, N.J. Comps. for Elctrns.	201-334-2921
NM	Albuquerque, Sierra Tech. Grp.	505-294-8408
NY	Syracuse, Ossmann Instrs.	315-437-7052
OH	Cleveland, Geotronix	216-526-2535
OH	Columbus, Geotronix	614-457-8472
PA	Albrightville, Centurion Linear	717-722-0166
TX	Addison, Dunbar Assocs.	214-239-7151

CADDELL-BURNS MFG., 40 E. 2nd St., Mineola, NY 11501, Tel: 516-746-2310; Empl.: 30 ..... **A•1218-1229**

CADDELL COIL CORP., 35M Main St., Poultney, VT 05764, Tel: 802-287-4055, Telex: 752092; Empl.: 6; *Sls. Mgr.:* James Caddell

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FL	Sebastian, R.B. Caddell	305-562-4496

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WA	Bellevue, Elctrn. Sources	206-451-3500

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CADNETIX CORPORATION, 5757 Central Ave., Boulder, CO 80301, Tel: 303-444-8075; Empl.: 150

CAELUS COMPUTER, Equipment & Supplies, P.O. Box 6297, San Jose, CA 95150, Tel: 408-729-1800; Empl.: 25; *Sls. Mgr.:* Elaine Green

CAERE CORP., 100 Cooper St., Los Gatos, CA 95030, Tel: 408-395-7000, Telex: 910-597-5391; Empl.: 60+; *Dist. Mgr.:* Terry Livermore

CAI, 550 W. Northwest Hwy., Barrington, IL 60010, Tel: 312-381-2400, Telex: 25-4268, TWX: 910-651-1904; Empl.: 650

CAIG LABS., 1175-0 Industrial Ave., Escondido, CA 92025, Tel: 619-743-7143; Empl.: 15

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CA	Glendale, Western Elctrn. Supp.	213-246-4861
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IL	Hillsdale, Complete Reading Elec.	312-547-5400
LA	Lafayette, Ralphs Elctrns. Supp.	318-233-0105
MI	Grand Rapids, Stotts-Friedman	616-459-0216
MO	Kansas City, Walters Radio Supp.	816-531-7015
NY	New York, Argil Elctrns.	212-691-8111
OH	Cleveland, Complete Reading Elec.	216-267-1000
TX	El Paso, Midland Specialty Co.	915-533-9555
VA	Norfolk, Priest Elctrns.	703-855-0105
VA	Norfolk, Radio Parts Distr. Co.	703-461-8095

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CAL COUNT, 5407 Port Royal Rd., Springfield, VA 22151, Tel: 703-321-9625, Telex: 440732, TWX: 440733; Empl.: 35

CAL CRYSTAL LAB., INC., 1142 N. Gilbert, Anaheim, CA 92801, Tel: 714-991-1580, 800-854-XTAL, TWX: 910-591-1892; *Sls. Mgr.:* Herb Plumhoff

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VA	Front Royal, Eltron Sls., LTD.	703-635-7201

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CA	Santa Clara, Basic Sys.	408-727-1800
CT	Collinsville, Dynamic Sls.	203-693-6567
FL	Melbourne, Raycom, Inc.	305-259-7988
GA	Duluth, Raycom, Inc.	404-446-9015
MA	Burlington, Dynamic Sls.	617-272-5676
NY	White Plains, Cane Techn. Sls.	914-694-9240
OH	Chesterland, EQS	313-961-3042
TX	Garland, Carey, McMahill & Zerbe Co.	214-681-1414
TX	Houston, Carey, McMahill & Zerbe Co.	713-771-1500
WA	Bellevue, Topp Engrg. Sls. Co.	206-747-5401

Local Distributors

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CA	Pleasant Hill, Calex Mfg. Co.	415-932-3911

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Local Sales Offices & Reps

AZ	Phoenix, Relcom	602-893-1209
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CA	Irvine, Quadrep S.	714-261-8141
CA	San Diego, Power Assocs.	619-275-0641
CA	San Jose, Quad Rep	408-946-4000
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TX	Austin, Technlg. Sls.	214-346-9940
TX	Dallas, Technlg. Sls.	214-380-0200
TX	Houston, Technlg. Sls.	713-266-2473
WA	Bellevue, Crown Elctrns.	206-643-8100
Can	Don Mills, Ont., RD Assocs.	416-444-0959

Local Distributors

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CA	Huntington Beach, Sci. Dvcs. West	714-840-3501
CA	Los Altos, Jay Stone Assocs.	415-948-4563
CO	Denver, Aztec Entprs.	303-779-5285
FL	Melbourne, Saber Assocs.	800-327-0853
IL	Chicago, EIA, Inc.	312-298-2290
IN	Indianapolis, EIA, Inc.	317-257-7231
KS	DeSoto, Midtec Assocs.	913-441-6565
LA	Baton Rouge, SESCO	510-993-3103
MA	Waltham, McBar Assocs.	617-890-0233
MN	Minneapolis, Prairie Assocs.	612-559-7550
MO	Florissant, Midtec Assocs.	314-837-5200
NJ	Teaneck, Sci. Dvcs. East, Inc.	201-837-1004
NM	Albuquerque, Aztec Entprs.	505-262-1688
NY	Fayetteville, Andrews Co.	315-637-3144
OH	Dayton, Hocker Assocs.	513-298-8638
OK	Tulsa, SESCO	918-622-3868
PA	Springhouse, Sci. Dvcs. East	215-643-3335
TX	Austin, SESCO	512-892-2490
TX	Dallas, SESCO	214-231-9364
TX	Houston, SESCO	713-999-3510
UT	Ogden, Aztec Ent., Inc.	801-621-1655
VA	McLean, Creative Mktg. Assoc. Ltd.	703-442-9100
WA	Bellevue, Showalter Instrs., Inc.	206-746-7970
Can	Ottowa, Ont., A.I.M.	613-722-8286

CALIFORNIA MICRO DEVICES, INC., 215 Topaz Street, Milpitas, CA 95035, Tel: 408-263-3214

CALIFORNIA MICROWAVE, 990 Almanor Ave., Sunnyvale, CA 94086, Tel: 408-732-4000, Telex: 35 2016, TWX: 910-339-9231; Empl.: 1200

CALIFORNIA MINICOMPUTER SYS., 5534 Westlawn Ave., Los Angeles, CA 90066, Tel: 213-640-2930, TWX: 910-343-6489; Empl.: 50; *Dist. Mgr.:* R. D. Mowry

CALLYER INSULATED WIRE CO., 100 Higginson Ave., Lincoln, RI 02865, Tel: 401-723-7800

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Local Sales Offices & Reps

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AZ	Tempe, Delta Elctrn. Sls.	602-224-1601
CA	San Diego, Noo Rep. Tech. Sls.	619-483-4861
CA	Santa Clara, Calmark Corp.	408-984-2618
CO	Denver, Spectrum Mktg.	303-480-9991
FL	Clearwater, WMM Assocs.	813-461-7074
GA	Atlanta, Remco	404-447-6937
IL	Elk Grove, Martec	312-956-8090
KS	DeSoto, Midtec Assocs.	913-441-6565
MA	Westboro, Tech. Mktg. Svcs. Co.	617-366-6655
MN	Minneapolis, Comps. Grp.	612-374-1250
MO	Florissant, Midtec Assocs.	314-837-5200
NH	Windham, Tech. Mktg. Svcs.	603-434-2716
NJ	Madison, Livera-Polk Assocs.	201-377-3220
NY	Cooperstown, Fitzelle Assocs.	607-547-9333

NY Glen Head, Livera-Polk Assocs. 516-759-9300
NC Raleigh, Remco 919-847-5079
OH Miamisburg, Electronics, Inc. 513-866-3340
OR Troutdale, Comtec 503-227-2111
PA Horsham, Dalbrook Corp. 215-441-8380
TX Richardson, Zonk Assocs. 214-238-7651
UT Ogden, Spectrum Mktg. 801-972-8552
WA Bellevue, Comtec 206-453-1188
EXP Cappoquin, Ireland, Calmark-Kileen, Ltd. .. 058-54205
EXP San Gabriel, CA, Calmark Corp. 213-287-0451

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AZ Phoenix, Aero-Space Computer Supps. 602-861-1785
AZ Phoenix, Scottsdale Tool & Supp. 602-273-7376
CA Anaheim, Henry Mann West 213-995-3900
CA Fremont, Terminal Sls. Corp. 415-656-7722
CA San Jose, Cypress Elctrns. 408-945-8400
CA Torrance, Cypress Elctrns. 213-533-6005
CO Denver, Solder Tec. 303-922-6214
FL Longwood, Intertec Comps. 305-834-7777
IL Elk Grove, Martec Assocs. 312-956-8090
MA Waltham, Etchomatic 617-893-2020
MA Westboro, TMSC Elctrn. Supp. 617-366-8462
MN Minneapolis, Aero-Space Computer Supp. 612-884-4725
NJ Collingswood, Index 609-429-4055
NJ Nutley, Nationwide Circuit Prods. 201-667-1333
NY Elmsford, Multimetrics Co. 914-347-3667
PA Huntingdon Valley, Henry Mann, Inc. .. 215-355-7200
TX Dallas, Cypress Elctrns. 214-869-1435
TX Richardson, Zec Sls. 214-238-7651
UT Salt Lake City, Solder Tec 801-974-0444
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EXP CA, San Gabriel, Calmark Corp. 213-287-0451
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EXP Singapore, Singapore, Mazda Elctrn. 2987851

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CAL-R, INC., P.O. Box 1397, Santa Monica, CA 90406, Tel: 213-450-1761, TWX: 910-343-6966; FSC No.: 14193; Empl.: 130; *Sls. Mgr.:* J. F. Catrambone ..... **A•1829-1831; B•1745-1747**

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IN Kokomo, Schillinger & Assocs. 317-452-4057
IN South Bend, Schillinger & Assocs. 219-291-6258
MN Minneapolis, Bill Deming & Assocs. ... 612-888-5000
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CA Canoga Park, Timco Sls. 818-992-5040
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FL Tampa, Impala Elctrns. 813-885-4747
IN Indianapolis, Meunier Elctrns. Supp. ... 317-635-3511
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MI Grand Rapids, S. F. Elctrns. 616-459-0216
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NY Valley Stream, L & S Elctrns. 516-561-2474
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WA Redmond, Halbar Assocs. 206-882-0990

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C.A.M. GRAPHICS CO., INC., 145 Toledo St., Farmingdale, NY 11735, Tel: 516-694-1315, TWX: 510-224-6181; FSC No.: 63203; *Sls. Mgr.:* Manny Cardinale

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CA Los Angeles, Universal Comps. 213-641-4255
CO Boulder, Front Range Mktg. 303-443-4780
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FL Boca Raton, Beacon Elctrns. 305-392-3500
FL Clearwater, Beacon Elctrns. 813-796-2378
FL Maitland, Beacon Elctrns. 305-647-3498
FL Melbourne, Beacon Elctrns. 305-724-8010
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AR El Dorado, Industrial Control Assocs. 501-863-2051
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CA San Jose, J.T. McFarland Assoc. 408-286-9333
CT Wolcott, Vanguard Elctrns. 203-879-9310
FL Orlando, Motion Technology 404-972-5050
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IL Glenview, JHS Assocs. 312-998-1960
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NY Sidney, A & D Devices 607-563-8488
NC Charlotte, Motion Technology 704-525-9855
OH Galion, Retronics 419-468-3253
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PA Wayne, Technical Indl. Sls. 215-688-0220
TX Dallas, Blackburn Assocs. 214-692-8885
TX Houston, Blackburn Assocs. 713-463-1356
WA Spokane, Controltek 509-922-2971
WI Milwaukee, EMCO 414-242-0800

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NJ Bridgewater, Semi-Matic Co. 201-231-0606
OH Cincinnati, G. Nichols 513-891-5104
TX Dallas, Charles Schleeweis 214-386-9747

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CA Santa Ana, El Dorado Sls. 714-954-0285
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CT Woodbury, Lindco Assoc. Inc. 203-263-0629
FL Altamonte Springs, C-Assocs. 305-831-1717
GA Alpharetta, Futron, Inc. 404-587-3853
IL Wilmette, Wasserman Assocs. 312-256-3566
IN Indianapolis, Willson Technical Sls. ... 317-298-3345
IA Marion, M-S-B Assocs., Inc. 319-377-6261
KS Shawnee, M-S-B Assocs., Inc. 913-432-2131
MD Pillesville, Imagitron Sls. Co. 301-521-2020
MA Tyngsboro, Comptech, Inc. 617-649-3030
MN Minneapolis, DeBeck-Hays Assocs. ... 612-835-3610
MO St. Charles, M-S-B Assocs., Inc. 314-946-5577
NJ Fort Lee, Neeco 201-461-2789
NC Raliegh, Hi-Tech Assocs. 919-781-4139
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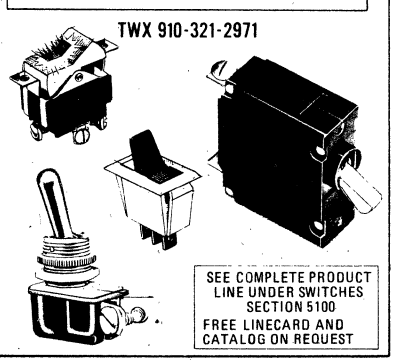

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OR Beaverton, Wm. J. Purdy Co. 503-641-9373
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TN Knoxville, Cartwright & Bean 615-693-7450
TX Dallas, J. Y. Schoonmaker Co. 214-349-1650
TX Houston, J. Y. Schoonmaker Co. 713-686-0371
UT Salt Lake City, W. J. Purdy Co. 801-486-8557
VA Charlottesville, Lowery & Assoc. 804-973-6672
WA Redmond, William J. Purdy Co. 206-882-3144
WI Milwaukee, IRI, Inc. 414-259-0966

CAROLINA STEEL & WIRE, I-20 & S.C. 6, Lexington, SC 29072, Tel: 803-359-5501, Telex: 573355; FSC No.: 72954; Empl.: 125

CARPENTER MFG. CO., INC., Fairgrounds Dr., P.O. Box 188, Manlius, NY 13104-0188, Tel: 315-682-9176; *Sls. Mgr.:* Joseph T. De Peter

CARPENTER TECHN., Box 662, Reading, PA 19603, Tel: 215-371-2000, Telex: 836-432; Empl.: 4500; *Sls. Mgr.:* R. J. Weiler

CARROLL TOUCH TECHNOLOGY, P.O. Box 1309, Round Rock, TX 78680, Tel: 512-244-3500; *Sls. Mgr.:* Alan Hochman

CARSON MFG. CO., INC., 5453 N. Rural St., P.O. Box 20464, Indianapolis, IN 46220, Tel: 317-257-3191; Empl.: 75

CARTER MFG. CORP., Sugar Rd., Bolton, MA 01740, Tel: 617-779-5501; FSC No.: 03929; Empl.: 35; *Sls. Mgr.:* L. W. Tedstone

CARTER MOTOR, 2707 W. George St., Chicago, IL 60618-7898, Tel: 312-588-7700

CASSO-SOLAR, P.O. Box 163, U.S. Route 202, Pomona, NY 10970, Tel: 914-354-2500, Telex: 475-4099; Empl.: 50; *Sls. Mgr.:* Rolf Kates

CASTALL, INC., Weymouth Indl. Park, E. Weymouth, MA 02189, Tel: 617-337-6075, Telex: 955-439; FSC No.: 04-2459700; Empl.: 30; *Sls. Mgr.:* Joe McDonough

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AL Huntsville, B.J.R. Mfr. Rep. 205-881-3569
CA Tarzana, Power Comp. Sls. 818-881-9111
CO Denver, Electro Indl. 303-623-5534
FL Indian Harbour, Bill Toy Assocs. 305-773-5805
IL Chicago, Electro-Mech Sls. Co. 312-777-0554
MN Minneapolis, Norton Assocs. 612-881-6226
NJ Berkeley Heights, Cambridge-Allen & Assoc. 201-464-0203
TX Austin, Delta Comp. 512-458-4288
TX Seagoville, Delta Comp. 214-287-6333
WA Seattle, J. J. Assocs. 206-246-6619
Can Markham, Ontario, Matrix Technlg. 416-477-4442

CATALYST RESEARCH, Mine Safety Appliances Co., 1421 Clarkview Rd., Baltimore, MD 21209, Tel: 301-296-7000, Ext. 304, Telex: 87-768; Empl.: 400; *Sls. Mgr.:* Edward S. Hatch, Jr.; *Dist. Mgr.:* Edward Hatch ... **D•1417**

CATEL TELECOMMUNICATIONS, United Scientific Corp., 4800 Patrick Henry Dr., Santa Clara, CA 95054, Tel: 408-988-7722, TWX: 910-338-2263; Empl.: 190; *Sls. Mgr.:* Dick Old; *Dist. Mgr.:* Wendell Woody

CATON CONNECTOR CORP., Jones River Indl. Pk., 20 Wapping Rd., Kingston, MA 02364, Tel: 617-585-4315, TWX: 710-391-7546; FSC No.: 52196; Empl.: 25; *Sls. Mgr.:* D. Galambos ..... **C•1172**

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CA Fullerton, ISI 714-773-0411
FL Enterprise, DJE Assocs. 305-321-6623
OH Dayton, Delta Sales 513-271-5444
TX Dallas, CCI 817-484-9691
TX Ft. Worth, CCI 817-292-5803

CATRONIX CORP., 620 P/T Stne, Suite 1802, Atlanta, GA 30308, Tel: 404-881-1100; *Sls. Mgr.:* Dr. Charls Pearson

CAYPIN INDUSTRIES, INC., P. O. Box 9737, Ft. Wayne, IN 46899, Tel: 219-432-1515, 1-800-348-1771, Telex: 232-409; FSC No.: 6850

CCD IMAGING, Fairchild Camera & Instr. Corp., 450 National Ave., Mountain View, CA 94043, Tel: 415-493-8001; *Sls. Mgr.:* John Miller

C-COR ELCTRNS., 60 Decibel Rd., State College, PA 16801, Tel: 814-238-2461, TWX: 510-670-3513; FSC No.: 12775; Empl.: 600; *Sls. Mgr.:* D. Pisarcik

CDRL DATA, INC., 320 West Lone Cactus Drive Ste. 6, Phoenix, AZ 85027, Tel: 602-582-8844; FSC No.: 56060; Empl.: 25; *Sls. Mgr.:* James J. Edwards

CDS - COLORADO DATA SYS., 3301 W. Hampden, Unit C, Englewood, CO 80110, Tel: 303-762-1640, TWX: 910-933-0193; Empl.: 35; *Sls. Mgr.:* Louis Klahn

CEA DIVISION OF BERKLEONICS, INC., A Subsidiary of EG & G, 1 Aerovista Pk., San Luis Obispo, CA 93401, Tel: 805-544-5454, TWX: 910-351-6705; FSC No.: 04932; Empl.: 120; *Sls. Mgr.:* Jerry Satuloff

CEAG ELEC. CORP., Power Supp. Div., 1324 Motor Pkwy., Hauppauge, NY 11788, Tel: 516-582-4422, TWX: 510-227-4904; FSC No.: 57973; *Dist. Mgr.:* Bryce Wiedeman

CEC, 330 W. Taft Ave., Orange, CA 92665, Tel: 714-637-2970; Empl.: 50

CELANESE PLASTICS, 26 Main St., Chatham, NJ 07928, Tel: 201-635-2600; *Sls. Mgr.:* L. F. Bond

CELCO, 70 Constantine Dr., Mahwah, NJ 07430, Tel: 201-327-1123, TWX: 710-988-1018; Empl.: 45; *Sls. Mgr.:* P. S. Christaldi

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AZ Tempe, Trembly Assocs. 602-967-2058
CA Palo Alto, Gado Instr. Sls. 415-961-2222
CA Westminster, Transducer Sys. 714-840-5357
CO Denver, Innovative Prods. 303-691-3575
FL Indian Rocks Beach, PAR Assocs. 813-596-8841
GA Atlanta, PAR Assocs. 404-391-9117
IL Hindsdale, I & C Sls. 312-323-8205
LA Baton Rouge, Charles Instrs. 504-273-3233
MA Sharon, Reptek 617-784-6700
MI Trenton, I & C Sls. 313-671-1320
MN Minneapolis, CMI Corp. 612-566-6930
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NV Las Vegas, Trembly Assocs. 702-739-9770
NJ Hillsdale, C.B. Assocs. 201-664-6230
NM Albuquerque, Trembly Assocs. 505-266-8616
NY Clarence, Trott Elctrns. 716-634-8500
NY Pittsford, Trott Elctrns. 716-586-8251
NC Charlotte, Par Assocs., Inc. 704-375-9403
OH Cincinnati, I & C Sls. 513-772-3101
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OR Portland, Fry Controls, Inc. 412-339-3565
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PA New Kensington, Bobar Instr., Inc. 412-339-3565
TX Austin, Advance Tech. Sls. 512-440-7677
TX Dallas, Advance Tech. Sls. 214-340-1300
TX Houston, Advance Tech. Sls. 713-440-3888
UT Salt Lake City, Trembly Assocs. 801-486-5292
WA Bellevue, Fry Controls, Inc. 206-282-9270

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CELESTION INDS., INC., Kuniholm Dr., Box 521, Holliston, MA 01746, Tel: 617-429-6706, Telex: 948417

CENTENT CO., 3879 S. Main St., Santa Ana, CA 92707, Tel: 714-979-6491; Empl.: 12; *Sls. Mgr.:* A. Freimanis

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CENTIGRAM CORP., 155A Moffett Park Dr., Sunnyvale, CA 94086, Tel: 408-734-3222, Telex: 171-994; *Sls. Mgr.:* Leonard H. Magnuson; *Dist. Mgr.:* Paul W. Masters

CENTRALAB, INC., A North American Philips Co., 4561 Colorado Blvd., Los Angeles, CA 90039, Tel: 818-240-4880, TWX: 910-497-2282; *Sls. Mgr.:* G. Ollen

CENTRALAB, INC., A North American Philips Co., 2566 Northwestern Ave., McClure Pk., West Lafayette, IN 47906, Tel: 317-463-2536, TWX: 810-342-1889

CENTRALAB, INC., A North American Philips Co., Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, Tel: 515-573-1300, TWX: 910-520-2493; *Sls. Mgr.:* L. Fette

CENTRALAB, INC., A North American Philips Co., 7158 Merchant Ave., El Paso, TX 79915, Tel: 915-779-3961; TWX: 910-964-1311

CENTRALAB, INC., A North American Philips Co., 5855 N. Glen Park Rd., Milwaukee, WI 53209, Tel: 414-228-7380, TWX: 910-262-3083; Empl.: 5000; *Sls. Mgr.:* F. Funk; *Dist. Mgr.:* R. Booker

CENTRAL DATA CORP., 1602 Newton Dr., Champaign, IL 61820, Tel: 217-359-8010, Telex: 910-245-0787; *Sls. Mgr.:* N. E. Mac Gregor

CENTRAL MICROWAVE CO., Alpha Inds., Inc., 12180 Prichard Farm Rd., Maryland Heights, MO 63043, Tel: 314-291-5270, Telex: 949436, TWX: 710-393-1236; FSC No.: 17540; Empl.: 120; *Sls. Mgr.:* William A. Ruff

CENTRE ENGRG., 2820 E. College Ave., State College, PA 16801, Tel: 814-237-0321, TWX: 510-670-3517; FSC No.: 51642; Empl.: 278; *Sls. Mgr.:* H.D. Shirey

CENTRONIC INC., 1101 Bristol Rd., Mountainside, NJ 07092, Tel: 201-233-7200, TWX: 910-350-3290; FSC No.: 7P396; Empl.: 300; *Sls. Mgr.:* Tony Green ..... **B•1204-1205**

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CA	Los Altos, Griot Assocs.	415-941-2533
CA	Santa Ana, Griot Assocs.	714-662-7525
CA	Santa Clara, Griot Assocs.	408-727-2880
CO	Denver, Griot Assocs.	303-427-1111
FL	Melbourne Bch., Millett Assocs.	305-725-5055
GA	Roswell, Electro Comp Sls.	404-992-2344
IL	Chicago, Coomb Assocs.	312-439-9810
MA	Concord, Nortech. Engrg. Sls.	617-259-0032
MI	Jackson, Norwood Scroggs Co.	517-750-1170
MN	Minneapolis, Intl. Sls.	612-831-8423
NY	Commack, RC Engrg.	516-543-3325
OH	Dayton, Ohmer Assocs.	513-434-1454
PA	Glenside, Koebert & Assocs.	215-887-2310

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CA	Santa Clara, Griot Assocs.	408-727-2880
CO	Westminster, Griot Assocs.	303-427-1111
FL	Melbourne Beach, Millett Assocs.	305-725-5055
GA	Roswell, Electro Comp Sls.	404-992-2344
IL	Arlington Heights, Coombs Assocs.	312-439-9810
IN	Ft. Wayne, Coombs Assocs.	219-747-7661
MA	Concord, Nortech Engrg.	617-259-0032
MI	Jackson, Norwood Scroggs	517-750-1170
MN	Minneapolis, International Sls.	612-831-8423
NM	Alburquerque, Griot Assocs.	505-883-1022
NY	Commack, RC Engrg.	516-543-3325
OH	Kettering, Ohmer Assocs.	513-434-1454
OR	Beaverton, Griot Assocs.	206-454-8592
PA	Glenside, Koebert Assocs.	215-887-2310
UT	Salt Lake City, Griot Assocs.	801-328-9471
WA	Seattle, Griot Assocs.	206-646-5627

CENTURY DATA SYS., Xerox Corp., 1270 N. Kraemer Blvd., Anaheim, CA 92806, Tel: 714-632-7500, Telex: 655437; Empl.: 901; *Sls. Mgr.:* Richard Brechtlein; *Dist. Mgr.:* Don Wilder

Ceramaseal

CERAMASEAL, Box 25, New Lebanon Center, NY 12126, Tel: 518-794-7800, Telex: 14-5442; FSC No.: 07601; Empl.: 80; *Sls. Mgr.:* Gene D. Sawin ..... **C•1173**

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AZ	Phoenix, Wadsworth/Bryant	602-275-7366
CA	Atherton, Wadsworth/Bryant	415-321-3619
CA	Hacienda Hgts., Wadsworth/Bryant	213-330-5592
CO	Golden, J. F. Hurlbut Co.	303-279-7796
FL	Orlando, Physimetrics	305-894-8081
GA	Atlanta, Physimetrics	464-955-0155
IL	Mt. Prospect, Automation Equip. Co.	312-398-7550
KS	De Soto, Midtec Assocs.	913-441-6565
MD	Baltimore, R. A. Wafer Assoc.	301-744-1133
MA	Boston, P-J Engrg. Sls.	617-783-0510
MO	Florissant, Midtec Assocs.	314-837-5200
NY	Rochester, Canavan-Scanlon Assoc.	716-424-1830
NY	Syracuse, Canavan-Scanlon Assoc.	315-437-1271
NC	Charlotte, JWL Assoc.	704-523-3001
PA	Feasterville, Knowles Assocs.	215-322-7100
PA	Pittsburgh, Kurt J. Lesker Co.	412-892-2996
TN	Knoxville, Physimetrics	615-966-7553
TX	Richardson, Spectra Sls.	214-234-3600
WA	Seattle, J.J. Assocs.	206-246-6619

CERAMAWIRE, Box 1084, Cranford, NJ 07016, Tel: 201-276-1170; *Sls. Mgr.:* Joe Savare

CERAMIC MAGNETICS, INC., 87 Fairfield Rd., Fairfield, NJ 07006, Tel: 201-227-4222, Telex: 138 730; Empl.: 50

CERA-MITE CORP., 1327 Sixth Ave., Grafton, WI 53024, Tel: 414-377-3500

CERMETEK MICROELECTRONICS INC., 1308 Borregas Ave., Sunnyvale, CA 94088, Tel: 408-752-5000, TWX: 910-379-6931; Empl.: 110; *Sls. Mgr.:* Ken Archbold

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CETEC RAYMER, 7315 Fulton Ave., No. Hollywood, CA 91605, Tel: 213-875-0423; Empl.: 50; *Sls. Mgr.:* Hugh T. Wilcox

CGIS, A COMSAT CO., 7701 N. Lamar Blvd., Austin, TX 78752, Tel: 512-451-7938; Empl.: 150; *Sls. Mgr.:* Jack Johannsen

CGRS MICROTECH, P. O. Box 102, Langhorne, PA 19047, Tel: 215-757-0284; Empl.: 5; *Sls. Mgr.:* J. Swope; *Dist. Mgr.:* J. Swope

CGTI, 2 Windward Ave., White Plains, NY 10605, Tel: 914-949-3719, TWX: 710-568-1305; Empl.: 210; *Sls. Mgr.:* G. N. Snider

CHABIN CORP., 890 Fortress St., Chico, CA 95926, Tel: 916-891-6410, TWX: 910-536-1001; *Sls. Mgr.:* Peter Tunis

CHADWICK-HELMUTH, 4601 N. Arden Dr., El Monte, CA 91731, Tel: 213-575-6161, Telex: 194-271; Empl.: 75; *Sls. Mgr.:* John Beach

CHA INDUSTRIES, 3565 Haven Avenue, Menlo Park, CA 94025, Tel: 415-363-8011, Telex: 334426; *Sls. Mgr.:* Jack Patten

CHALCO ENGRG., 15126 S. Broadway, Gardena, CA 90248, Tel: 213-FA1-0121, TWX: 910-346-7026; Empl.: 95

CHAMPLAIN CABLE, PO Box 7, Winooski, VT 05404, Tel: 802-655-2121, TWX: 510-299-0018; FSC No.: 05973; Empl.: 425; *Sls. Mgr.:* J. Brooks

CHANNEL INDS., 839 Ward Dr., Santa Barbara, CA 93111, Tel: 805-967-0171, Telex: 658416; Empl.: 75

CHAPMAN CORP., P.O. Box 10700, Portland, ME 04104, Tel: 207-773-4726; Empl.: 60; *Dist. Mgr.:* Elizabeth Angell

CHARLES RIVER DATA SYSTEMS, INC., 983 Concord St., Framingham, MA 01701, Tel: 617-626-1000, Telex: 681-7373; Empl.: 170; *Sls. Mgr.:* S. K. Stephenson

CHARTPAK, 1 River Rd., Leeds, MA 01053, Tel: 413-584-5446; Empl.: 195

CHASSIS-TRAK, General Devices Co., Inc., P.O. Box 39100, Indianapolis, IN 46239, Tel: 317-897-7000, Telex: 27-2169; FSC No.: 06666; Empl.: 190; *Sls. Mgr.:* H. L. Crouch ..... **C•1062-1063**

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AL	Huntsville, Hughes Assoc.	205-533-9108
AZ	Phoenix, Snyder Engr.	602-279-2010
CA	Fullerton, Groh Assocs.	714-738-7105
CA	Mountain View, G. Woempner	415-964-5454
CO	Boulder, R. F. Mayo Assoc.	303-499-2155
CT	Waterbury, Coakley, Boyd & Abbett	617-444-5470
FL	Lighthouse Point, J. Krutek & Assoc.	305-941-6544
GA	Atlanta, Hughes Assoc.	404-252-7486
IL	Glencoe, Howard Benjamin Assoc.	312-835-0150
IN	Noblesville, Century Elctrns.	317-849-2026
KS	Shawnee Mission, Lowell, Kangas & Assoc.	913-631-3515
MA	Needham, Coakley, Boyd & Abbett	617-444-5470
MN	St. Paul, Northport Engrg.	612-457-8000
MS	Corinth, Hughes Assoc.	601-287-2915
MO	St. Louis, Lowell, Kangas & Assocs.	314-821-4050
NH	Plaistow, Coakley, Boyd & Abbett	617-444-5470
NJ	Mountainside, Henry G. Richter	201-233-4615
NY	Fayetteville, H. G. Richter	315-637-6713
NC	Raleigh, Hughes Assoc.	919-782-2065
OH	Cleveland, Electronic Comps.	216-261-4103
OH	Miamisburg, Electronic Comps.	513-866-3340
OK	Tulsa, Advance Tech. Sls.	918-664-0482
PA	Doylestown, Monterio Assoc.	215-345-5855
TN	Morristown, Hughes Assoc.	615-587-2433
TX	Austin, Advance Tech. Sls.	512-440-7677
TX	Dallas, Advance Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888
WA	Olympia, Bergford Assoc.	206-866-2001
EXP	IN, Indianapolis, General Devices	317-897-7000

CHATHAM CONTROLS, 33 River Rd., Chatham, NJ 07928, Tel: 201-635-8892; FSC No.: 04814; Empl.: 11

CHATSWORTH DATA CORP, Cablemaster Div., 20710 Lassen St., Chatsworth, CA 91311, Tel: 818-341-9200; Empl.: 65; *Sls. Mgr.:* Hank Boehm ..... **D•1199**

Local Sales Offices & Reps

MA	Waltham, W. M. Hague	617-863-5600
NJ	Marlton, Javie Pickle	609-596-6900
OH	Cleveland, Triad Assoc	216-248-3350

CHATSWORTH DATA CORP, Impact-o-Graph Div., 20710 Lassen St., Chatsworth, CA 91311, Tel: 213-341-3000; Empl.: 50

CHEM-MIXX CORP., 55 North St., Medford, MA 02155, Tel: 617-395-7270; Empl.: 9; *Sls. Mgr.:* James Hart

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CA	South Gate, A. G. Barstow Co.	213-569-8125
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MO	Maryland Hgts., T. B. Moore Co.	314-434-6844
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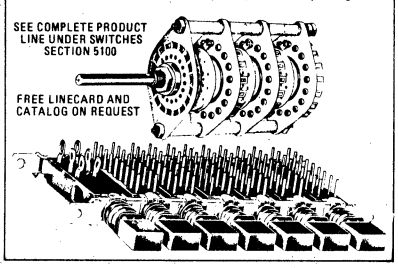

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CHERRY ELECTRICAL PRODS. CORP., 3623 Sunset Ave., Waukegan, IL 60087, Tel: 312-578-3500, TWX: 910-235-1572; Empl.: 2000; *Sls. Mgr.:* Robert Terwall; *Dist. Mgr.:* George Seyk ..... **B•1024, 1521-1533, 1708-1712**

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AZ Phoenix, O'Donnell Assocs. S.W. 602-944-9542
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CA San Diego, O'Donnell Assocs. 619-578-1645
CA Torrance, O'Donnell Assocs. 213-539-9664
CO Boulder, Front Range Mktg. 303-443-4780
CT North Haven, Coakley, Boyd & Abbett 203-239-6217
FL Coral Springs, CBC Elctrns. 305-755-1111
FL Longwood, CBC Elctrns. 305-831-5380
GA Atlanta, CSR Elctrns. 404-396-3720
IL Waukegan, Cherry Elec. Prod. Corp. 312-578-3500
IN Ft. Wayne, Menze Sls. 219-747-5616
IA Cedar Rapids, Dy-Tronix 319-377-8275
IA Wichita, Dy-Tronix, Inc. 316-838-0884
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MI Grand Rapids, Miltimore Sls. 616-942-9721
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OK Tulsa, Genzel Sls. & Assoc. 918-622-7744
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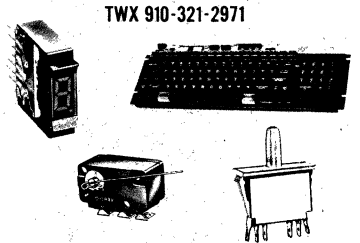

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TX Houston, Bonser-Philhower Sls. 713-531-4144
TX Richardson, Bonser-Philhower Sls. 214-234-8438
UT Salt Lake City, Front Range Mktg. 801-364-6481
VA Reston, Colrud Corp. 703-620-6612
WA Seattle, Jas. J. Bacher Co. 206-285-1300
WI Wauwatosa, Larsen Assocs. 414-258-0529

Local Distributors

AL Birmingham, Ack Radio Supp. Co. 205-322-0588
AL Huntsville, Powell Elctrns. 205-539-2731
AZ Phoenix, Cetec Elctrns. 602-277-7951
AZ Phoenix, Elctrn. Parts 602-277-7281
AZ Tempe, Fisher-Brownell 602-967-1464
AR Little Rock, Carlton-Bates 501-562-9100
CA Alhambra, Fisher-Brownell 213-289-0255
CA Chatsworth, Diplomat Elctrns. 213-341-4411
CA Costa Mesa, Diplomat Elctrns. 714-549-8401
CA Gardena, Cal Switch 213-770-2330
CA Irvine, Cetec Elec. 714-250-4141
CA Los Angeles, Electric Switches 213-660-1310
CA Oakland, Brill Elctrns. 415-834-5888
CA San Diego, Diplomat Elctrns. 619-292-5693
CA San Diego, Fisher-Brownell 619-560-8545
CA Santa Clara, Cetec Elec. 408-980-0110
CA Santa Clara, Fisher-Brownell 408-988-6041
CA Southgate, Cetec Elctrns. 213-773-6521
CA Sunnyvale, Diplomat Elctrns. 408-744-1555
CO Denver, Denver Wintronics 303-431-7161
CO Denver, Integrated Elec. 303-292-6121
CT Wallingford, Midan Elec. 203-265-2077
FL Ft Lauderdale, Powell Elec. 305-972-4300
FL Ft. Lauderdale, KSM Elctrns. 305-971-5900
GA Atlanta, Ack Radio Supp. Co. 404-351-6340
GA Atlanta, KSM Elctrns. 404-458-2013
IL Bensenville, Diplomat Elctrns. 312-595-1000
IL Champaign, Klaus Radio 217-356-1896
IL Chicago, Newark Elctrns. 312-638-4411
IL Palatine, OHM Elctrns. 312-359-5500
IL Wheeling, Hawk Elctrns. 312-459-4030
IN Ft. Wayne, Graham 219-423-3422
IN Indianapolis, Genesis Elctrn. 317-637-5571
IN Indianapolis, Graham Elec. 317-634-8202
IN South Bend, Genesis Elctrns. 219-287-2911
IA Cedar Rapids, Advent Elctrn. 319-363-0221
KS Edwardsville, C. Tennant Sons & Co. 913-441-1801
KY Louisville, P. I. Burks Co. 502-589-3960
MD Columbia, Maryland 301-621-4070
MD Savage, Pyttronic Ind. 301-792-0780
MA Billerica, A. W. Mayer Co. 617-229-2255
MA Needham, Cronin Elctrns. 617-449-5000
MI Livonia, Rep-Tron Elctrns. 313-525-2700
MI Troy, Empire Elec. Inc. 313-585-8130
MN Minneapolis, Newark Elec. 612-331-6350
MN Minneapolis, Stark Elctrns. 612-332-1325
MO Kansas City, Walters Radio Supp. 316-531-7015
MO St. Charles, Finnigan Elctrns. 314-946-6201
NJ Bellmawr, Mid-Atlantic Elec. 609-931-5303
NJ Clifton, J-Mar Elec., Inc. 201-772-6400
NM Albuquerque, Elctrn. Parts 505-293-6161
NY Hauppage, C. Tennant Sons & Co. 516-434-8200
NY Liverpool, Diplomat Elec. 315-652-5000
NY Lynbrook, Peerless Radio Corp. 516-593-2121
NY Melville, Diplomat Elec. 516-454-6334
NY Mt. Vernon, QAR Ind'l. Elctrn. Sls. 914-699-2224
NY Rochester, Rochester Radio & Supp. Co. 716-454-7800
NC Cary, Powell Elctrns. 919-467-1212
NC Winston-Salem, Kirkman Elctrn. 919-722-9131
OH Cincinnati, Graham Elec. 513-772-1661
OH Cincinnati, Hughes-Peters 513-351-2000
OH Columbus, Hughes-Peters 614-294-5351
OH Dayton, Esco Elec. 513-293-1133
OH Middlesburg Hts., Selectronics 216-243-9700
OH Worthington, Reptron 614-436-6675
OK Tulsa, Radio, Inc. 918-587-9123
OR Portland, Radar Elctrns. 503-232-3404
OR Portland, Tekelectric Control 503-246-5451
PA Montgomeryville, Pyttronic Ind. 215-643-2850
PA Phildelphia, Powell Elec. 215-365-1900
TN Nashville, Graham Elec. 615-242-2682
TX Dallas, Wallace Elec. Co. 214-340-0400
TX Houston, Force Elec. 713-561-8644
TX Irving, Solid State Elctrns. Co. 214-438-5700
TX Richardson, Fisher-Brownell 214-235-3177
TX San Antonio, Sherman Elctrns. Supp. 512-224-1004
TX Stafford, Southwest Elctrn. 713-240-4000
UT Salt Lake City, Diplomat Elctrns. 801-486-4134
UT Salt Lake City, Standard Supp. Co. 801-486-3371
VA Richmond, Sterling Elctrns. 804-226-2190
WA Bellevue, Integrated Elec., Inc. 206-455-2727
WA Seattle, Radar Elctrns. 206-282-2511
WI Milwaukee, Marsh Elctrns. 414-475-6000
Can Burnaby, B.C., Rae Ind. Elec., Ltd. 604-291-8866
Can Downsview, Ont., Trade Elctrns. Supp. 416-661-7111
Can Edmonton, Alb., Rae Ind. Elec., Ltd. 403-451-4001
Can London, Ont., C. M. Peterson Co., Ltd. 519-434-3204
Can Mississauga, Ont., Prelco Elec., Ltd. 416-678-0401
Can Montreal, Que., Prelco Elec., Ltd. 514-389-8051
Can Nepean, Ont., Prelco Elec., Ltd. 613-726-1800

CHERRY SEMICONDUCTOR CORP, 2000 S. County Trail, East Greenwich, RI 02818, Tel: 401-885-3600; Empl.: 200

CHESSELL CORP., Penns Trail, Newtown, PA 18940, Tel: 215-968-0660, Telex: 83-1701; Empl.: 50; *Sls. Mgr.:* D. Neal ..... **D•1403**

Local Sales Offices & Reps

AL Birmingham, Spader & Assocs. 205-879-1366
AZ Phoenix, Southwest Controls, Inc. 602-267-1171
CA Fountain Valley, Yardley Instrs. 714-963-1000
CA Oakland, Sabre Controls 415-444-0635
CO Lakewood, Process Controls 303-232-4996
FL Clearwater, TCI 813-446-8628
GA Aeworth, Elam Engrg. 404-974-3300
IL Lombard, Patricie & Douglas 312-971-1800
IL Peoria, Tecco 309-692-2312
IN Ft. Wayne, Domino Unltd. 219-747-5621
KY Louisville, Domino 502-425-2848
LA Baton Rouge, Rise Inc. 504-766-4645
MD Towson, Flotech 301-321-6565
MA Waltham, Techn. Entprs. 617-890-5300
MI Farmington Hills, Anderson Elctrns. 313-553-7600
MN Minneapolis, The Mark Co. 612-920-6280
MO St. Louis, Adelphi, Inc. 314-821-1232
NV Reno, Applied Indl. Controls Corp. 702-356-7401
NM Albuquerque, Southwest Controls, Inc. 505-884-6202
NY Rochester, Cascade Control Corp. 716-385-1410
NY White Plains, MIT Sls. 914-946-5077
NC Charlotte, Algay Controls 704-366-6976
OH Dayton, P. J. Navin Co. 513-434-8940
OH Willoughby, P. J. Navin Co. 216-255-1411
OK Tulsa, Dave Allert Co. 918-743-7705
TN Knoxville, George C. Paris 615-966-2141
TX Arlington, Pan-Tech Controls Co. 817-640-3232
TX Burleson, Chessell Corp. 817-572-4392
TX Corpus Christi, Cecorp 512-289-6181
TX Houston, Process Instruments, Inc. 713-893-3310
UT Midvale, Bee and Tee Controls 801-566-7722
VA Richmond, Advance Control Equip. Co. 804-270-7182
WA Bellevue, Topp Engrg. Sls. Corp. 206-747-5400
WI Brookfield, Bll, Inc. 414-786-1980

CHESTER CABLE, Oakland Ave., Chester, NY 10918, Tel: 914-469-2141, TWX: 510-249-4813; *Sls. Mgr.:* William R. Dungan

CHESTERFIELD PRODS., 37 Midland Ave., Elmwood Park, NJ 07407, Tel: 201-797-9655; Empl.: 35; *Sls. Mgr.:* M. Perry ..... **A•1593**

Local Sales Offices & Reps

AZ Tucson, WJM Sls. 602-888-4847
CA Burbank, Biztek Co., Inc. 818-766-4890
CA Palo Alto, J M Assocs. 415-857-1260
CO Loveland, Morbak Mktg. 303-669-8900
FL Maitland, D. J. Ellis & Assocs., Inc. 305-645-1101
IN South Bend, Schillinger Assocs., Inc. 219-282-4570
KS Overland Park, Barnes-Midwest Sls. 913-341-9317
MD Towson, Holden Engrg. 301-823-3763
MA Framingham, Bengal Assocs. 617-877-2639
MA Randolph, Bengal Assocs. 617-961-4120
MN Chanhassen, Barnes Sls. Assocs. 612-934-2907
NJ Elmwood Park, L & M Assocs. 201-797-0441
NY New York, L & M Assocs. 212-243-6155
OH Dayton, Markus Barnett Assocs., Inc. 513-433-0758
PA Andalusia, L & M Assocs. 215-245-6658
TX Richardson, Carl Tinch Sls. Co. 214-231-1322

CHICAGO CONDENSER CORP., 2900 West Chicago Ave., Chicago, IL 60622, Tel: 312-227-7070

CHICAGO LASER SYSTEMS, INC., 4034 N. Nashville Ave., Chicago, IL 60634, Tel: 312-282-2710, Telex: 671-1269; *Sls. Mgr.:* Bernard Alpiner, V.P.

CHICAGO LOCK CO., 4311 W. Belmont Ave., Chicago, IL 60641, Tel: 312-282-7177, Telex: ITT 4994023; Empl.: 426; *Sls. Mgr.:* Don Meisinger; *Dist. Mgr.:* Dale N. Padjen ..... **B•1534**

Local Sales Offices & Reps

CA Oceanside, Sales Engineer 619-726-9499

CHICAGO MINIATURE, 4433 N. Ravenswood Ave., Chicago, IL 60640, Tel: 312-784-1020

CHICAGO SWITCH, INC., 1714 N. Damen, Chicago, IL 60647, Tel: 312-489-5500, TWX: 910-221-5252; Empl.: 250; *Sls. Mgr.:* A. Steiner; *Dist. Mgr.:* A. Steiner

CHLORIDE POWER ELECTRONICS, 10931 Pellicano Drive, El Paso, TX 79935, Tel: 915-592-9985, Telex: 910-964-1364; FSC No.: 08715; Empl.: 1000; *Sls. Mgr.:* Gordon Goodygar

CHOMERICS, INC., 77 Dragon Ct, Woburn, MA 01888, Tel: 617-935-4850, TWX: 710-393-0173; Empl.: 500; *Sls. Mgr.:* Kevin A. Dunne

CHORUS DATA SYSTEMS, P.O. Box 810, 27 Proctor Hill Rd., Hollis, NH 03049, Tel: 603-465-7100; *Sls. Mgr.:* Bruce Monk

CHR INDS., 407 East St., P.O. Box 1911, New Haven, CT 06509, Tel: 203-777-3631, TWX: 710-465-0264; Empl.: 116

CHRISLIN INDS., 31352 Via Colinas, Westlake Village, CA 91362, Tel: 818-991-2254, TWX: 910-494-1253; Empl.: 38; *Sls. Mgr.:* Edward M. Ross; *Dist. Mgr.:* Edward M. Ross

CHRISTIANSEN RADIO INC., 1950 San Remo, Laguna Beach, CA 92651, Tel: 714-497-1506; Empl.: 9

CHRISTIE, S. D., ASSOCS. INC., 693 Locust St., Mt. Vernon, NY 10552, Tel: 212-597-1773, 914-699-7223; Empl.: 8; *Sls. Mgr.:* Sam D. Christie

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CHRISTIE ELEC. CORP., 20665 Manhattan Pl., Torrance, CA 90501, Tel: 213-320-0808, TWX: 910-349-6260; FSC No.: 02294; Empl.: 200; *Sls. Mgr.:* Alan C. Augusta; *Dist. Mgr.:* Alan C. Augusta ..... **D•1547-1549**

Local Sales Offices & Reps

AZ	Phoenix, PLS Assocs.	602-246-6614
CA	Tustin, John Franek Co.	714-832-0290
CO	Englewood, Omega Ltd.	303-762-1921
CO	Englewood, PLS Assocs.	303-773-1218
FL	Orlando, Newco & Assocs.	305-422-7700
GA	Lithia Springs, Newco, Inc.	404-941-6077
MD	Laurel, CSDS	301-490-3800
MA	Needham, Shain Assocs.	617-449-4380
MO	St. Louis & Grandview, Harris-Hanson	816-763-6200,314-432-3611
NJ	Hohokus, Hansen & Hughes	201-652-7055
NM	Albuquerque, Fry Gates Inc.	505-262-1525
NC	Charlotte, Newco, Inc.	704-527-7070
OH	Chesterland, EQS Systems	216-729-2222
PA	Philadelphia, Technical Instr. Sls. Co.	215-836-2222
SC	Florence, Newco, Inc.	803-662-4878
TX	Richardson, C. Tinch	214-231-1322
TX	Richardson, Carl Tinch Sls. Co.	214-231-1322
UT	Midvale, PLS Assocs.	801-566-0671
UT	Salt Lake City, Omega Ltd.	801-277-8061

CHROMALOX INSTRS. & CONTROLS, 100 Heil-Quaker Blvd., La Vergne, TN 37086-3536, Tel: 615-793-3900, Telex: 55-5129; Empl.: 110; *Sls. Mgr.:* John Cox

CHROMATICS, 2558 Mountain Indl. Bldg., Tucker, GA 30084, Tel: 404-493-7000, TWX: 810-766-8099

CHRONO-LOG CORP., 2 W. Park Rd., Havertown, PA 19083, Tel: 215-853-1130, Telex: 831579; Empl.: 20; *Sls. Mgr.:* David Biberman ..... **D•1061**

CHRONOMITE LABS, 21011 S. Figueroa St., Carson, CA 90745, Tel: 213-320-9452; Empl.: 15

CHURCHILL CORP., 344 Franklin St., Melrose, MA 02176, Tel: 617-665-4700; FSC No.: 94867; Empl.: 30; *Sls. Mgr.:* W. Schermerhorn

CIMCO WIRE & CABLE, INC., See Pirelli Cable

CINCH, See TRW Connector Div.

CINCINNATI ELCTRNS., 2630 Glendale Milford Rd., Cincinnati, OH 45241, Tel: 513-733-6100, Telex: 21-4452, TWX: 810-464-8151; FSC No.: 80045; Empl.: 1100; *Sls. Mgr.:* Samuel M. Thomas, Jr.

CINCINNATI ELECTRONICS CORP.

CINCINNATI ELECTROSYS., 469 Wards Corner Rd., Loveland, OH 45140, Tel: 513-831-4347

Local Sales Offices & Reps

GA	Atlanta, GM Assocs.	404-487-9409
IN	Indianapolis, Dan Larner	513-831-4347

CINCINNATI SUB-ZERO PRODS., 12011 Mosteller Rd., Cincinnati, OH 45241, Tel: 513-772-8810, Telex: 214390 SUBZERO CIN; Empl.: 80; *Sls. Mgr.:* George Molenaar ..... **D•1166**

Local Sales Offices & Reps

CA	Diamond Bar, Benedict Mktg.	714-861-9940
IA	Cedar Rapids, Arrow Tech. Sls.	319-396-8030
MI	Orchard Lake, Schober & Assocs., Inc.	313-363-1888
MN	Minneapolis, Arrow Tech. Sls., Inc.	612-545-4481
MO	St. Louis, Arrow Tech. Sls., Inc.	314-991-1399
NJ	Teaneck, Irv Rudnick, Inc.	201-836-7392
NY	Buffalo, Davies Indl. Svcs., Inc.	716-896-3600
OH	Dayton, Boco, Inc.	513-224-0220
TX	Dallas, Merit Co.	214-620-0021

CIPHER DATA PRODS., INC., P.O. Box 85170, San Diego, CA 92138, Tel: 619-578-9100, TWX: 910-335-1251; Empl.: 1750; *Sls. Mgr.:* Frank Kirchhoff; *Dist. Mgr.:* Ruth Lewellyn

CIPRICO INC., 2955 Xenium Lane, Plymouth, MN 55441, Tel: 612-559-2034; Empl.: 71; *Sls. Mgr.:* Stu Reile ..... **D•1062**

Local Sales Offices & Reps

AL	Huntsville, Interep Assocs.	205-533-1730
AL	Mobile, Interep Assocs.	205-478-1036
AZ	Scottsdale, Frontier Technlg.	602-998-4438
CA	Larkspur, Data Rep.	415-461-8776
CA	Los Alamitos, Gemini Assocs.	213-594-9618
CA	Los Gatos, Data Rep	408-279-1212
CA	North Hollywood	818-846-2633
CA	San Diego	619-268-1181
CA	Sepulveda	818-891-1000
CO	Parker, Advanced Data Mktg.	303-841-4908
FL	Jupiter, Southeastern First Rep.	305-746-8587
FL	Kissimmee, Southeastern First Rep.	305-846-1306
FL	Melbourne, Southeastern First Rep	305-259-6373
GA	Norcross, Interep Assocs.	404-449-8680
HI	Honolulu, Sam O. Hirota.	808-533-3070
IL	Elmhurst, First Rep	312-530-2450
IN	Indianapolis, Carter, McCormic & Peirce	317-844-4175
KS	Shawnee Mission, Panatek	913-362-3349
MD	Baltimore, L. G. White & Co., Inc.	301-358-7803
MD	Silver Spring, L. G. White	301-434-1555
MI	Farmington Hills, Carter, McCormic & Peirce	313-477-7700
MN	Golden Valley, J. R. Assocs.	612-546-4110
NJ	Springfield, Gebhardt Marketing	201-376-4415
NY	New Hartford, PDQ Assocs.	315-768-8167
NY	W. Seneca, PDQ Assocs.	716-674-7816
NC	Carey, Engineering Dvcs., Inc.	919-469-9323
OH	Cleveland, Carter, McCormic & Peirce	216-779-5100
OH	Cleveland, Diamond Point Intl.	216-238-0200
OH	Dayton, Carter, McCormic & Peirce	513-836-0951
OK	Tulsa, Microlog, Inc.	918-665-7788
OR	Portland, Northwest Mktg. Assoc.	503-620-0441
PA	Jenkintown, Monument Technical Assocs.	215-884-3737
PA	Pittsburgh, Carter, McCormic & Peirce	412-372-4415
TN	Greenville, Interep Assocs.	615-639-3491
TX	Austin, Microlog.	512-327-7033
TX	Houston, Microlog.	713-956-0837
TX	Richardson, Microlog.	214-644-5010
WA	Bellevue, Northwest Mktg. Assoc.	206-455-5846
Can	Nepean, Ontario, Multilek Inc.	613-226-2365

CIRCLE ELECTRONICS, A Division of F-Dyne Elctrns., 3501 Electronics Way, W. Palm Beach, FL 33407, Tel: 305-844-1310; *Sls. Mgr.:* John Strickland

CIRCUIT ASSEMBLY CORP., 18 Thomas St., Irvine, CA 92718-2703, Tel: 714-855-7887, TWX: 910-595-1971; FSC No.: 52072; Empl.: 275; *Sls. Mgr.:* Edward Cadden

Local Sales Offices & Reps

AL	Brownsboro, JHU Assocs.	205-536-7455
AZ	Scottsdale, Harris & Croy Sls.	602-941-9059
AZ	Tucson, Harris & Croy Sls.	602-293-5393
CA	Chatsworth, Raltech, Inc.	818-700-0933
CA	Los Altos, Elrepco	415-962-0660
CA	San Diego, Varigon Assocs.	619-576-0100
CO	Aurora, Sage Sls.	303-750-3591
CT	Wallingford, Com Sls.	203-269-7964
FL	Orlando, Tech-Rep Assocs.	305-855-2648
GA	Atlanta, JHU Assocs.	404-662-0792
IL	Itasca, L-Tec, Inc.	312-773-2900
IN	Indianapolis, Frank Kahsar Sls.	317-888-8396
MA	Needham, Com Sls.	617-444-8071
MI	Grand Haven, Frank Kahsar Sls.	616-846-7590
MN	Osseo, Gaffney Sls.	612-425-5484
MO	Grandview, Harris Hanson Co.	816-763-6200
MO	St. Louis, Harris-Hanson Co.	314-432-3611
NJ	Englewood Cliffs, Masin Esco, Inc.	201-569-8868
NM	Albuquerque, Syntech	505-266-7951
NY	Hauppauge, Masin Esco, Inc.	516-273-3500
NY	Rochester, Apex Assocs., Inc.	716-254-6050
OH	Cincinnati, Frank Kahsar Sls.	513-922-3133
OH	Columbus, Frank Kahsar Sls.	614-252-4009
OH	Hudson, Frank Kahsar Sls.	216-650-1089
PA	Hatboro, Jacobsen Assoc.	215-674-2937
TX	Austin, Barry Sls., Inc.	512-837-3616
TX	Houston, Barry Sls., Inc.	713-784-5860
TX	Richardson, Barry Sls., Inc.	214-234-0255
UT	Salt Lake City, Sage Sls.	801-467-5451
VA	Front Royal, Eltron Sls., Ltd.	703-635-7201
WI	Milwaukee, L-Tec, Inc.	414-774-1000
EXP	CASanta Ana, Mann Overseas	714-250-0622
Can	Rexdale, Ont., Source Elctrns.	416-675-6235

Local Distributors

AZ	Phoenix, Arizona Comps.	602-279-9446
AZ	Phoenix, Tri-Tek	602-995-9352
AZ	Tempe, Circuit Specialist	602-966-0764
CA	Fullerton, Carden Elctrns.	714-526-7882
CA	San Diego, Mann San Diego	619-578-1550
CA	San Diego, Ryno Elctrns.	619-453-8430
CA	San Jose, Rose Elctrns.	408-263-9700
CA	Santa Ana, Mann Southwest Corp.	714-558-3202
CA	Santa Clara, Mann Elctrns.	408-988-6061
CO	Denver, C.S.I.D.	303-292-9594
CT	Norwalk, Park Distrs.	800-243-5006
CT	Wallingford, Midstates Elctrns.	203-265-9900
FL	Miami, Electronic Equip.	305-871-3500
FL	W. Palm Beach, Nurmi Elctrn. Supp.	305-684-0321
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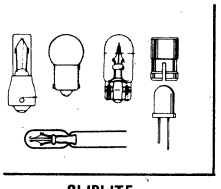

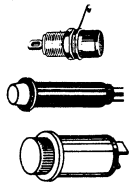

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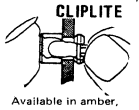

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UT Provo, Omega Elctrns. 801-375-4664
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WA Costa Mesa, Mann Overseas 714-557-4080
WI Waukesha, Bell Inds. 414-547-8879

CIRCUITECH, INC., FCS Industries, 527 Industrial Way West, Eatontown, NJ 07724, Tel: 201-493-4102; Empl.: 75; *Sls. Mgr.:* Jim Harrison

CIRCUITS, INC., 59 Deming Rd., Berlin, CT 06037, Tel: 203-828-3526; Empl.: 105

CIRCUIT TECHN., 160 Smith St., Farmingdale, NY 11735, Tel: 516-293-8686, TWX: 510-224-6555; Empl.: 600; *Sls. Mgr.:* Mel Spitz

CIRTECH, EG & G, 15237 Cherry St., Stanley, KS 66223, Tel: 913-681-2801, TWX: 910-749-6806; FSC No.: 5915; Empl.: 75; *Sls. Mgr.:* Dick Spingler

Local Sales Offices & Reps

AZ Tempe, Chapman & Assocs. 602-894-6775
CA Los Angeles, Cain Technlg., Inc. 213-477-9054
CA San Jose, Frequency Control Assocs. 408-446-0200
FL Winter Park, Microwave Mktg. 305-678-2141
IN Ft. Wayne, Technology Mktg. Corp. ... 219-432-5553
IA Cedar Rapids, J.R. Sls. Engrg. 319-393-2232
MD Potomac, Cetech Elctrns. 301-983-2140
NY Melville, RF Elctrn. Sls. 516-420-8890
PA Lancaster, Electro-Rep 717-299-5877

CITEL, INC., 3060 Raymond St., Santa Clara, CA 95050, Tel: 408-727-6562, TWX: 910-338-0540; *Sls. Mgr.:* Paul Macdonald

CLAIREX ELECTRONICS, 560 S. 3rd Ave., Mt. Vernon, NY 10550, Tel: 914-664-6602, Telex: 137308; Empl.: 300; *Sls. Mgr.:* Gerald Smith ..... **B•1206-1209**

Local Sales Offices & Reps

AL Huntsville, K & E Assocs. 205-883-9720
CA Escondido, Clairex Elctronics 619-749-8474
IL Chicago, Berndt Assoc. 312-283-0713
IN Carmel, Berndt Assoc. 317-884-0114
KS Overland Park, Advanced Techn. Sls. 913-492-4333
MD Silver Springs, Youth Assoc. Inc. 301-598-5740
MA Bolton, Clairex 617-779-2780
MI Ferndale, Hilltronics 313-398-5556
MN Minneapolis, H.M.R. 612-920-8200
MO St. Louis, A.T.S. Inc. 314-227-4448
NY Seaford, Abbott Assoc. 516-781-5256
NC Raleigh, Crossroads Elect. Assoc. 919-362-4099
OH Cleveland, Geotronix 216-526-2535
OH Trotwood, Geotronix Inc. 513-854-5939
PA Media, W. Reeves 215-566-6709
TX Austin, J. B. Guenther 512-258-0004
TX Dallas, J. B. Guenther 214-691-8500
WA Seattle, H. Levinson 206-323-5100
WI Milwaukee, Berndt Assoc. 414-545-8400
EXP NJ, Oradell, Sylvan Ginsbury 201-261-3200

Local Distributors

CA Culver City, EV Roberts 213-870-9561
CT Wallingford, Sager Elctrns. 203-265-4600
FL Miami, Elctrn. Equip. 305-871-3500
IL Chicago, Bell Indus. 312-982-9210
IN Indianapolis, Graham Elctrns. 317-634-8486
MD Rockville, All American Transistor 301-251-1205
MA Hingham, Sager Elctrns. 617-749-6700
MA Norwell, Bordewieck Eng. Sls. 617-659-4915
MI Ann Arbor, Wedemeyer Elctrn. 313-665-8611
MN Minneapolis, Stark Elctrns. 612-332-1325
MO St. Louis, Van Sickle Radio Elect. 314-621-5000
NJ Mt. Laurel, D.F. Assocs. 609-234-5324
NY Buffalo, Summit Distr. 716-884-3450
NC Charlotte, Dixie Elctrns. 704-377-4348
OH Columbus, Hughes Peters 614-294-5351
OK Tulsa, Altair 918-665-0523
SC Columbia, Dixie Radio 803-779-5332
TN Knoxville, Dixie Elctrns. 615-938-4131
TX Houston, Altair 713-462-2410
TX Richardson, Altair 214-231-5166
WA Seattle, Radar Elec. 206-282-2511
Can Willowdale, Ont., Electro Sonic 416-494-1666

CLARE RELAYS

CLARE DIVISION, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645, Tel: 312-262-7700, Telex: 25-3775; Empl.: 2400; *Sls. Mgr.:* S. N. Horowitz; *Dist. Mgr.:* S. N. Horowitz ..... **B•1260, 1302-1306**

Local Sales Offices & Reps

AL Huntsville, General Instr., Clare Div. ... 205-883-9130
AZ Scottsdale, Summit Sls. 602-998-4850
CA El Segundo, General Instr., Clare Div. 213-322-7745
CA Irvine, J. V. Earley & Assocs. 714-833-1806
CA San Jose, Ruppert Sls. & Engrg. 408-998-8717
CO Westminster, Western Region Mktg. .. 303-430-8883
CT Brookfield, Kanan Assocs. 203-775-0494
FL Casselberry, Sales Engrg. Concepts .. 305-834-6225
GA Norcross, Electramark 404-446-7915
IL Arlington Heights, General Instr., Clare Div. 312-981-0630
IL Rolling Meadows, Sumer, Inc. 312-991-8500
IN Indianapolis, Schank Elctrn. Mktg. 317-842-6204
IA Des Moines, SPS Assocs. 515-225-0607
KS Olathe, SPS Assocs. 913-764-4460
MD Randallstown, Beacon North, Inc. 703-591-1300
MA Needham Heights, Kanan Assocs. 617-449-7400
MA Woburn, General Instr., Clare Div. 617-938-0666
MN Eden Prairie, Aldridge Assocs. Inc. 612-944-8433
MO St. Ann, SPS Assocs. 314-423-7673
NJ Palisades Park, Janco Technlg. 201-941-4008
NY Buffalo, Quality Comps., Inc. 716-837-5430
NY Hicksville, General Instr., Clare Div. ... 516-933-3645
NY Manlius, Quality Comps., Inc. 315-682-8885
NC Raleigh, Zucker Assocs. 919-782-8433
OH Columbus, Baehr, Greenleaf & Assoc. 614-486-4046
OH Lakewood, Baehr, Greenleaf & Assoc. 216-221-9030
OR Hillsboro, Western Tech. Sls. 503-640-4621
PA Erdenheim, Omni Sls. 215-233-4600
TX Dallas, Electra Reps 214-248-3852
TX Houston, Electra Reps 512-339-1163
UT Salt Lake City, Western Region Mktg. 801-355-7239
VA Forest, Beacon North, Inc. 804-239-8486
WA Bellevue, Western Tech. Sls. 206-641-3900
WI Brookfield, Sumer, Inc. 414-784-6641
Can Rexdale, Ont., Generl Instr. Of Can., Ltd. 416-249-8341

CLARKE-HESS COMM. RESCH. CORP., 17 West 17th St., New York, NY 10011, Tel: 212-255-2940, Telex: 971308 RAPID NYK ATT: CH, TWX: 710-582-2292 RAPID NYK ATT: CH; FSC No.: 34423; Empl.: 14 ..... **D•1200-1201**

Local Sales Offices & Reps

CA Burlingame, B.H.L. Assocs. 415-342-7850
IL Chicago, Pat Lind Elctrns. 312-726-3513
IN Indianapolis, Pat Lind Elctrns. 317-632-7444
MN Circle Pines, Pat Lind Elctrns. 612-786-5770
WI Milwaukee, Pat Lind Elctrns. 414-224-0146

CLAROSTAT MFG., Washington St., Dover, NH 03820, Tel: 603-742-1120, TWX: 510-297-4455; FSC No.: 12697; Empl.: 600; *Sls. Mgr.:* H. E. Taylor

CLARY CORP., Precision Instrs. Div., 320 W. Clary Ave., San Gabriel, CA 91776, Tel: 818-287-6111, TWX: 910-589-3369; Empl.: 50; *Sls. Mgr.:* John R. Janner

CLAUSS CUTLERY CO., Box 667, Fremont, OH 43420, Tel: 419-332-7344; Empl.: 175

CLEAN ROOM PRODS., 56 W. Penataquit Ave., Bay Shore, NY 11706, Tel: 516-968-8282, Telex: 645151; Empl.: 52; *Sls. Mgr.:* Florence Gaconnier

CLEMENS MFG., 630 So. Berry Rd., St. Louis, MO 63122, Tel: 314-961-7228; Empl.: 3

CLEVELAND CRYSTALS, Box 17157, Euclid, OH 44117, Tel: 216-486-6100, TWX: 810-421-8031; FSC No.: 8K400; Empl.: 45; *Sls. Mgr.:* P. D. Marlowe

CLEVELAND MICA CO., 1360 Hird Ave., Lakewood, OH 44107, Tel: 216-226-1360; Empl.: 50

CLIFFORD, INC., 83 Main Street, Bethel, VT 05032, Tel: 800-451-4381; Empl.: 42; *Sls. Mgr.:* Martha C. McKinney

CLIFTON PRECISION, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018, Tel: 215-622-1000, TWX: 510-669-9782; FSC No.: 86197; Empl.: 1000; *Sls. Mgr.:* J. Gum ..... **B•1144**

Local Sales Offices & Reps

AZ Phoenix, Clifton Precision 602-242-0910
CA Cupertino, Clifton Precision 408-996-7507
CA Norco, Clifton Precision 714-736-6515
CA San Clemente, Clifton Precision 714-492-6904
CA Woodland Hills, Clifton Precision 818-347-0603
CO Aurora, Midwest Meridian 303-341-7550
FL Longwood, Boetto Corp. 305-331-1771
IL Elk Grove Village, Midwest Meridian .. 312-640-9540
IA Cedar Rapids, Midwest Meridian 319-365-6561
MA W. Newton, Larcom Inc. 617-244-2053
MN Prior Lake, Midwest Meridian 612-447-8222
MO Maryland Hgts., Midwest Meridian 314-878-4441
NY Greenlawn, Reflex Elctrn. 516-549-1888
OH Fairborn, Midwest Meridian 513-879-7100
OR Beaverton, Ravencraft 503-646-9261
PA Clifton Heights, Eastern Sls. 215-622-1000
TX Ft. Worth, Midwest Meridian 817-654-2132

CLIMATRONICS, 140 Wilbur Pl., Bohemia, NY 11716, Tel: 516-567-7300, Telex: 971329; Empl.: 46

CLINTON ELCTRNS., 6701 Clinton Rd., Rockford, IL 61111, Tel: 815-633-1444, Telex: 257-484; *Sls. Mgr.:* John Hartman

CLIPLITE, See Visual Communications

CMC INSTR. DIV., Connecticut microComputer Inc., 568 Danbury Road, New Milford, CT 06776, Tel: 203-354-9395, TWX: 710-456-0052; *Sls. Mgr.:* Shirley Fletcher

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Local Sales Offices & Reps

MA Sharon, Adcour Inc. 617-784-8123
MI Detroit, Bill Teplitz Associates 216-439-3265
OH Cincinatti, Teplitz Assocs. 513-481-1648
OH Cleveland, Teplitz Assocs. 216-439-3265

CMV SOFTWARE SPECIALISTS INC., 2720 W. 12th Street, Sioux Falls, SD 57104, Tel: 605-338-6645

COAST COIL CO., 5333 W. Washington Blvd., Los Angeles, CA 90016, Tel: 213-936-6188; Empl.: 50

COASTCOM, P.O. Box 27068, Concord, CA 94527, Tel: 415-825-7500, TWX: 910-481-5781; FSC No.: 415 682-2015; Empl.: 180; *Sls. Mgr.:* Scott Ledgerwood

COAXIAL DYNAMICS, 15210 Industrial Parkway, Cleveland, OH 44135, Tel: 216-267-2233, Telex: 980630; Empl.: 36; *Sls. Mgr.:* R. J. Scott ..... **D•1203**

Local Sales Offices & Reps

AZ Tucson, W.J.M. Sales 602-888-4847
CA North Highlands, Robert H. Hutter & Assoc. 916-961-6391
DE Newark, Tom Wright & Assoc. 301-398-3748
IA Cedar Rapids, S & O Sales 319-393-1845
OH Dayton, R.P.A. Co. 513-252-7067

COBA

COBA, INC., P. O. Box 14920B 28TH Ave. N., Plymouth, MN 55441, Tel: 612-559-3772; Empl.: 6 ..... **B•1535-1537**

Local Sales Offices & Reps

AZ	Phoenix, Eltron	602-266-2164
CA	Brea, Masco	714-529-0867
CA	Los Angeles, Masco	213-295-7782
CO	Aurora, Mountain View Mktg.	303-360-9641
CT	Guilford, A & M Electrns.	203-453-1612
IN	Indianapolis, Insul-Reps, Inc.	317-251-1994
MA	Needham, A & M Electrns.	617-444-8170
MI	Brighton, AP Assocs.	313-229-6550
MN	Mound, Allyn Assocs.	612-472-4784
MO	Gladstone, Delltron Co., Inc.	816-436-7445
MO	St. Louis, Delltron Co., Inc.	314-869-4779
NY	Great Neck, MOS Assocs.	516-487-3966
OH	Dublin, AP Assocs.	1-800-624-5496
OH	Fairview Park, AP Assocs.	1-800-624-5496
OR	Tigard, Electronic Comp. Sls.	503-245-2342
PA	Horsham, Dalbrook	215-441-8380
UT	Murray, Mountain View Mktg.	801-264-8488
WA	Mercer Island, Electronic Comp. Sls.	206-232-9301
Can	Point Claire, Quebec, COBA Elctrns., Inc.	514-694-1335

Local Distributors

AL	Huntsville, Component Distrs.	205-883-7501
AR	Little Rock, Component Distrs.	501-227-6278
CA	Hollywood, Yale Elec.	213-465-3186
CA	Manhattan Beach, Prime Electro	213-379-3642
CA	San Carlos, Logan Elctrns.	415-594-0700
CA	Santa Monica, Master Distrs.	213-452-1229
CA	Sunnyvale, Target Elctrns.	408-734-5611
CO	Englewood, Industrial Elctrns.	303-694-9444
CT	Shelton, Century Elec. Supp.	203-736-2684
FL	Fort Lauderdale, Component Distrs.	305-971-4950
FL	Fort Lauderdale, KSM Elctrns.	305-971-5900
GA	Atlanta, KSM Elctrns.	404-458-2013
GA	Norcross, AP Sls. Co.	1-800-624-5496
IL	Chicago, UPCO Distrs.	312-631-1122
MD	Beltsville, Petricko Sls., Inc.	301-937-4960
MO	Valley Park, Beckwith Computer & Elctrns.	314-225-4846
NC	Raleigh, Component Distrs.	919-834-9465
TX	Dallas, Heilind Elctrns., Inc.	214-351-2050

COBEHN, INC., 226 Passaic Ave., Fairfield, NJ 07006, Tel: 201-227-6675; Empl.: 5; *Sls. Mgr.:* George L. Henzel

COBER ELCTRNS., 102 Hamilton Ave., Stamford, CT 06902, Tel: 203-327-0003, TWX: 710-474-3371; FSC No.: 28909; Empl.: 100; *Sls. Mgr.:* Saul Haffner

CODAR TECHNOLOGY, INC., 1428 Florida Avenue, Longmont, CO 80501, Tel: 303-776-0472; Empl.: 18

CODENOLL TECHNOLOGY CORP., 1086 N. Bwy., Yonkers, NY 10701, Tel: 914-965-6300, Telex: 646159; *Sls. Mgr.:* Lori Principe

CODI SEMICONDUCTOR, INC., 350 Hurst Ave., Linden, NJ 07036, Tel: 201-862-8484, Telex: 844-796; FSC No.: 16352;19500; Empl.: 48; *Sls. Mgr.:* Joe LaBruna; *Dist. Mgr.:* Joe LaBruna

COGENEL/ENTRELEC DIV., 2 Ram Ridge Rd., Spring Valley, NY 10977, Tel: 914-425-7460, Telex: 0996619; Empl.: 50; *Sls. Mgr.:* F. D. Leynaert

COGNITRONICS, 25 Crescent St., Stamford, CT 06906, Tel: 203-327-5307, TWX: 710-474-3523; Empl.: 200; *Sls. Mgr.:* Vincent Harrison/Lawrence Ganzall

COHERENT COMMUNICATIONS SYS. CORP., 60 Commerce Dr., Hauppauge, NY 11788, Tel: 516-231-1550, Telex: 94-1439; Empl.: 175; *Sls. Mgr.:* Bertram J. Ralph

COHERENT, INC., 3210 Porter Dr., Palo Alto, CA 94304, Tel: 415-493-2111, Telex: 34-8304; Empl.: 1,300; *Sls. Mgr.:* William Shiner/Paul Crosby

COHU, INC., Elctrns. Div., Box 85623, San Diego, CA 92138, Tel: 619-277-6700, TWX: 910-335-1244; Empl.: 178; *Sls. Mgr.:* H. Winter

COILCRAFT, 1102 Silver Lake Rd., Cary, IL 60013, Tel: 312-639-6400, TWX: 910-651-2251

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COLBER CORP., 26E Buffington St., Irvington, NJ 07111, Tel: 201-371-9500, TWX: 710-995-4416; Empl.: 50; *Sls. Mgr.:* Roberta Bryner ..... **A•1832**

Local Sales Offices & Reps

CT	Vernon, G.M. Assocs.	203-646-4443
IN	Fort Wayne, Walter W. Bieberich	219-432-2537
MI	Grosse Pointe Farms, Ed Walter	313-882-3746
PA	Oreland, CMS Mktg.	215-887-1325
TN	Fairview, Walter W. Bieberich	615-799-0120

COLE-HERSEE CO., 20 Old Colony Ave., Boston, MA 02127-2467, Tel: 617-268-2100, Telex: 94-0901; *Sls. Mgr.:* Wesley L. Peterson

COLE INSTRUMENT CORP.

COLE INSTR., 2650 S. Croddy Way, Santa Ana, CA 92704, Tel: 714-556-3100; Empl.: 50; *Sls. Mgr.:* P. Hanson ..... **B•1538**

Local Sales Offices & Reps

AL	Huntsville, Rakes Engrg. & Mktg.	205-533-3763
AZ	Scottsdale, Semi Systems Arizona Inc.	602-991-1151
CA	Anaheim, Gabriel & Assocs.	714-666-0660
CA	Santa Clara, Context Engrg.	408-748-8676
CT	Glastonbury, Barton Assocs.	203-633-9417
HI	Lihei, Aloha Assocs.	808-941-1574
IL	Wheaton, Chadra Schilke & Assocs.	312-653-8126
KS	Merriam, Midwest Technical Sls.	913-236-8555
MD	Silver Spring, Carwithen Assocs.	301-589-9040
MA	Salem, Barton Assocs.	617-745-4310
MI	Birmingham, Forand Sls. Co.	313-644-0087
MN	Minneapolis, Voltage Control Sls.	612-553-1051
MO	St. Charles, Midwest Technical Sls.	314-441-1012
NJ	Garwood, E.R. Mertz & Assocs.	201-232-4643
NM	Albuquerque, Semi Systems Arizona Inc.	505-344-1517
NY	Fayetteville, R.D. Sherman Inc.	315-637-9861
OH	Cleveland, Jim Finnegan & Co.	216-238-5905
PA	Broomall, TCA	215-353-2022
TX	Dallas, Control Components Inc.	214-458-8877

COLEX, INCORPORATED, 15028 Beltway Dr., Dallas, TX 75234, Tel: 214-458-2779, TWX: 703143 CLEX US; Empl.: 25; *Sls. Mgr.:* Joe Dean; *Dist. Mgr.:* Joe Dean

COLLINS AVIONICS DIVISIONS, Rockwell Intl., 400 Collins Rd. NE, Cedar Rapids, IA 52498, Tel: 319-395-1000, Telex: 464-421, TWX: 910-525-1321; Empl.: 4,325; *Sls. Mgr.:* R. D. Thorpe

COLLINS TRANSMISSION SYS. DIV., See Rockwell Intl., Commercial Elctrns. Opers.

COLLMER SEMICONDUCTOR, INC., 14368 Proton Rd., Dallas, TX 75234-3335, Tel: 214-233-1589, TWX: 910-860-5462; Empl.: 20; *Sls. Mgr.:* Gene Uecker

COLMAN MOTOR PRODUCTS, INC., A Barber-Colman Co., P. O. Box 1240, Rockford, IL 61105-1240, Tel: 815-968-0660, Telex: 4330367; Empl.: 600

Local Sales Offices & Reps

AR	Fort Smith, Electro-Related Prods.	501-452-4030
CA	San Jose, Motion Control, Inc.	408-997-0544
CA	San Marino, Motion Control Southern	818-796-0189
CO	Longmont, Todd & Fry Assoc.	303-776-7331
CT	So. Windsor, Maher Assoc.	203-644-2481
FL	Boca Raton, E. A. Kershaw & Co.	305-482-3003
IL	Northfield, Lenhart Assocs., Inc.	312-446-7460
IN	Ft. Wayne, Menze Sls.	219-747-5616
MA	Lynn, Maher Assocs.	617-581-3244
MI	Detroit, B.L. Hitt & Assoc.	414-476-2210
MN	Minneapolis, Jos-Co/Melius, Inc.	612-861-3343
NJ	River Edge, Maher Assoc.	201-261-2225
NJ	Williamstown, Precision Motion Sls.	609-629-4757
NY	Albany, Robert F. Lamb Co.	518-869-3355
NY	Buffalo, Robert F. Lamb Co.	716-874-4900
NY	Rochester, Robert F. Lamb Co.	716-323-1250
NY	Syracuse, Robert F. Lamb Co.	315-455-2469
NC	Garner, Candor Co.	919-779-1855
OR	Portland, DHS Sls., Inc.	503-285-9790
OK	Tulsa, J. B. Guenther, Inc.	918-660-5126
PA	Abington, Indl. Mkts. Specialists	215-659-0444
SC	Greenville, Candor Co.	803-297-6261
SC	Myrtle Beach, Candor Co.	803-448-8361
TN	Chattanooga, Candor Co.	615-894-9686
TX	Austin, J.B. Guenther, Inc.	512-472-3825
TX	Dallas, J. B. Guenther, Inc.	214-691-8500
VA	Blacksburg, Candor Co.	703-953-2197
WI	Milwaukee, Badgerep	414-258-6630
EXP	WI, Milwaukee, Dummann World Trade	414-464-0100

COLORADO CRYSTAL CORP., 2303 W. 8th St., Loveland, CO 80537, Tel: 303-667-9248; FSC No.: 33096; Empl.: 135; *Sls. Mgr.:* David Lind ..... **A•1324**

Local Sales Offices & Reps

CA	Los Altos, Kolm Mktg. Assoc.	415-948-2635
CO	Loveland, Morbak Mktg.	303-669-8900
KS	Mission, Robinson & Assocs.	913-262-1374
MA	Randolph, Bengal	617-961-4120
OR	Beaverton, L. D. Elctrns.	503-649-6177
PA	Glenside, Koebert	215-887-2310
WA	Spokane, L. D. Elctrns.	509-922-4883

COLORADO DATA SYSTEMS, INC., 3301 W. Hampden Ave., Unit C, Englewood, CO 80110, Tel: 303-762-1640, TWX: 910-933-0193; Empl.: 35; *Sls. Mgr.:* Louis J. Klahn, Jr.; *Dist. Mgr.:* Louis J. Klahn, Jr.

Local Sales Offices & Reps

AZ	Phoenix, Odyssey 1	602-246-8846
NY	Rochester, Scientific Dvcs., New York, Inc.	716-334-2445
CA	San Jose, Moxon Elctrns.	408-298-7290
CT	Mt. Carmel, Scientific Dvcs.-CT.	203-248-9361
PA	Springhouse, Pennsylvania Sci. Dvcs.	215-643-3335
WA	Bellevue, Showalter Instrs., Inc.	206-746-7970
MA	Waltham, Scientific Dvcs.-New Eng., Inc.	617-890-2252
MO	Maryland Heights, Dytec/South, Inc.	314-569-2990
Can	N. Vancouver, B.C., Jerome & Francis Co., Ltd.	604-986-1286
NJ	Teaneck, Scientific Dvcs. East, Inc.	201-837-8720
NM	Albuquerque, Odyssey 1	505-265-6645
CA	Anaheim, Moxon Elctrns.	714-635-7600
OH	Dayton, WKM, Inc.	513-434-7500
CO	Englewood, Odyssey 1	303-773-8176
TX	Dallas, Data Mktg. Assocs., Inc.	214-661-0300
FL	Melbourne, Saber Assocs., Inc.	800-327-0853
IL	Arlington Heights, Dytec/Central, Inc.	312-394-3380
VA	McLean, Creative Mktg. Assocs., Ltd.	703-442-9100
Can	Ottawa, Ont., A.I.M. Elctrns., Inc.	613-722-8286
MN	St. Paul, Dytec/North, Inc.	612-645-5816

COLORADO VIDEO, INC., Box 928, Boulder, CO 80306, Tel: 303-444-3972, TWX: 910-940-3248; Empl.: 47; *Sls. Mgr.:* Jim Dole

COLORGRAPHIC COMMUNICATIONS CORP., 2379 John Glenn Dr. Ste. 105, P.O. Box 80448, Atlanta, GA 30366, Tel: 404-455-3921, Telex: 700574; Empl.: 50; *Sls. Mgr.:* H. Woody Pritchett

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COLUMBIA COMPS., 9 Division St., Sidney, NY 13838, Tel: 607-563-3520; FSC No.: 59178; Empl.: 12; *Sls. Mgr.:* Helen Montren

COLUMBIA ELEC. MFG., 4519 Hamilton Ave. N.W., Cleveland, OH 44114, Tel: 216-361-8060; Empl.: 60; *Sls. Mgr.:* H. W. Sussman

COLUMBIA ELCTRN. CABLES DIV., See Carol Cable Co., Inc., Columbia Elctrn. Cables Div.

COLUMBIA RESCH. LABS., Macdade Blvd. & Bullens La., Woodlyn, PA 19094, Tel: 215-532-9464, TWX: 510-669-3625; FSC No.: 07571; Empl.: 90; *Sls. Mgr.:* Jack Sarty

COLUMBUS ELEC. MFG., Box 289A Rt # 2, Piney Flats, TN 37686, Tel: 615-538-8191; Empl.: 160

COLUMBUS INSTRUMENTS, 950 N. Hague Ave., Columbus, OH 43204, Tel: 614-488-6176, Telex: 246514; *Sls. Mgr.:* Jan Czekajewski

COMARK CORP., 93 W St., P. O. Box 474, Medfield, MA 02052, Tel: 617-359-8161, Telex: 703156; Empl.: 50

COMCLOK, INC., 1142 N. Gilbert St., Anaheim, CA 92801, Tel: 714-991-1580, 800-854-XTAL, TWX: 910-591-1892; *Sls. Mgr.:* Herb Plumhoff ..... **A•1325**

Local Sales Offices & Reps

AZ	Scottsdale, Western High Tech Mktg.	602-949-0873
CA	Arcadia, HMC	818-447-0958
MA	Malden, J-K Assocs.	617-321-2922
NM	Albuquerque, Western High Tech Mktg.	505-262-2461
TX	Houston, TCI Elctrns.	713-774-5019
VA	Front Royal, Eltron Sls., Ltd.	703-635-7201

COMDATA CORP., 7900 N. Nagle Ave., Morton Grove, IL 60053, Tel: 312-470-9600

COMDESIGN, 751 S. Kellogg Ave., Goleta, CA 93117, Tel: 805-964-9852, TWX: 910-334-1189; Empl.: 125; *Sls. Mgr.:* Ralph M. Armstrong; *Dist. Mgr.:* Donald Sullivan

COMLINEAR CORP., 2468 E. 9th St., Loveland, CO 80537, Tel: 303-669-9433, Telex: 45-0881; FSC No.: 62839; Empl.: 40; *Sls. Mgr.:* John Perzow

COMMERCIAL ELEC. HEATING DEVICES & MFG., INC., 1008 E. Garvey Blvd., Monterey Park, CA 91754, Tel: 213-288-9445; Empl.: 12

COMMERCIAL SYS. LABS., Commercial Sys. Grp., P.O. Box 2710, Auburn, AL 36831, Tel: 205-821-1133; *Sls. Mgr.:* Buzz Mershon; *Dist. Mgr.:* Buzz Mershon

COMMUNICATION ASSOCS., 200 McKay Rd., Huntington Sta., NY 11746, Tel: 516-271-0800, Telex: 510-226-6998; Empl.: 150; *Sls. Mgr.:* Alfred Carlson

COMMUNICATION CABLE, 5 Glen Rd., Manchester, CT 06040, Tel: 203-647-1468; Empl.: 40; *Sls. Mgr.:* E. V. Marozzi

COMMUNICATION CABLES & CONNECTORS, The Dutton Co., 8255 Black Run Rd., Nashport, OH 43830, Tel: 614-828-2468; Empl.: 30; *Sls. Mgr.:* Don Ritterbusch; *Dist. Mgr.:* Don Ritterbusch

COMMUNICATION MACHINERY CORP., 1421 State St., Santa Barbara, CA 93101, Tel: 805-963-9471, TWX: 910-334-3508; Empl.: 50; *Sls. Mgr.:* Russ Sharer

COMMUNICATIONS INSTRS., INC., Box 520, Fairview, NC 28730, Tel: 704-628-1711, Telex: 577436; FSC No.: 58614; Empl.: 450; *Sls. Mgr.:* R. McClinton ..... **B•1298-1301**

Local Sales Offices & Reps

AL	Huntsville, Conley Assocs.	205-882-0316
AZ	Phoenix, PLS Assoc. Inc.	602-246-6477
CA	Los Angeles, Wiley Co.	213-666-1611
CA	San Diego, Wiley Co.	619-571-2881
CA	Santa Clare, Ross Mktg.	408-988-8111
CO	Englewood, PLS Assocs.	303-773-1218
CT	Guilford, A & M Elctrns.	203-453-1612
FL	Boca Raton, Conley Assocs.	305-395-3108
FL	Ovieda, Conley Assocs.	305-365-3283
FL	Tampa, Conley Assocs.	813-885-7658
GA	Atlanta, Conley Assocs.	404-447-6992
IL	Glenview, CII	312-792-2508
IN	Indianapolis, Schank Elctrn. Mktg.	317-842-6204
IA	Cedar Rapids, C. H. Horn & Assocs.	319-393-8703
KS	Desoto, Midtec Assocs.	913-441-6565
MD	Ellicott City, Doss Elctrns.	301-465-1336
MA	Needham, A & M Elctrns.	617-444-8170
MO	St. Louis, John G. Macke Co.	314-432-2830
NM	Albuquerque, PLS Assocs.	505-255-2330
NY	Lynbrook, HLJ Comp. Tech.	516-599-2999
NY	Macedon, M. M. Hare Co.	315-986-3742
NC	Raleigh, Conley Assocs.	919-876-9862
OH	Cleveland, Baehr-Greenleaf & Assocs.	216-221-9030
OH	Columbus, Baehr-Greenleaf & Assocs.	614-486-4046
OH	Dayton, Baehr-Greenleaf & Assocs.	513-439-0724
OR	Portland, Syscom Sls. Co.	503-644-2505
UT	Salt Lake City, PLS Assocs.	801-466-8729
WA	Bellevue, Syscom Sls. Co.	206-641-5080

COMMUNICATIONS TECHNOLOGY CORP., 2237 Colby Ave., Los Angeles, CA 90064, Tel: 213-478-5061, TWX: 910-342-6983; Empl.: 250

COMMUNICATION TECHNIQUES INC., 36 Route 10, East Hanover, NJ 07936, Tel: 201-884-2580, TWX: 710-986-8265; FSC No.: 53213; *Sls. Mgr.:* Louis R. Trummel

COMPAC™

COMPAC, 279 Skidmore Rd., Deer Park, NY 11729, Tel: 516-667-3933, TWX: 510-227-1064; FSC No.: 62099; Empl.: 50; *Sls. Mgr.:* Peter C. Rao ..... **A•1594, 1706-1707; C•1046-1049**

Local Sales Offices & Reps

AZ	Scottsdale, Territorial Mktg.	602-994-8665
CA	Agoura, Cal-Rep	213-991-1940
CA	Cupertino, Durra Elctrn. Sls.	408-255-2084
FL	Clearwater, Beacon Elctrn. Assoc.	813-796-2378
IL	Prospect Heights, R-Tek, Inc.	312-459-6170
IN	Ft. Wayne, R-Tek, Inc.	219-432-8783
MA	Haverill, L-K Assoc.	617-373-1313
NJ	Haddonfield, Mills-Brown Assoc.	609-429-1005
NY	Deer Park, Compac	516-667-3933
NY	Stoney Brook, Gama Metro	516-751-2072
NY	Utica, B. D. Hummel Co.	315-736-7821
TN	Johnson City, Beacon Elctrn. Assoc.	615-282-2421
TX	Garland, Carey, McMahill & Zerbe	214-681-1414
TX	Houston, Carey, McMahill & Zerbe	713-771-1500
VA	Fairfax, Schibley Assocs.	703-591-3008

Local Distributors

AL	Huntsville, Component Distrs.	205-883-7501
AR	Little Rock, Component Distrs.	501-227-6278
CA	Cupertino, Elctrn. Resources	408-996-8858
FL	Ft. Lauderdale, Component Distrs.	305-971-4950
LA	New Orleans, Component Distrs.	504-525-9668
NY	Deer Park, R. F. Comp. Sources	516-242-6748
NY	Utica, B. D. Hummel Co.	315-736-7821
NC	Raleigh, Component Distrs.	919-781-0262
VA	Falls Church, Component Distrs.	703-241-8227

COMPACT SOFTWARE, INC., Comsat Corp., 1131 San Antonia Rd., Palo Alto, CA 94303, Tel: 415-966-8440; *Sls. Mgr.:* Henry Wong

COMPEX CORP., 35A East Main St., Marlton, NJ 08053, Tel: 609-596-9388; Empl.: 13

Local Sales Offices & Reps

AZ	Phoenix, Odyssey 1	602-246-8846
CA	North Hollywood, Crown Elctrns., Inc.	213-877-3550
CA	Saratoga, E. Reid Miller, Corp.	408-257-6927
FL	Boca Raton, R.W. Mitscher Inc.	305-368-3841
NH	Amherst, Callahan & Tremblay	603-883-9000
NJ	Englewood, Cooper Assocs.	201-871-4985
NJ	Morrestown, Stern Assocs.	609-234-0661
NM	Alburquerque, Odyssey 1	505-265-6645
NY	Buffalo, R.W. Mitscher Co., Inc.	716-633-7970
OH	Lancaster, Cain-Forlaw Co., Inc.	614-654-4800
TX	Dallas, Texas Avionics	214-363-6324
Can	Neapean, Ont., Intrade Canada, Inc.	613-727-1272

COMPLEXX SYSTEMS INC., 4930 Research Dr., Huntsville, AL 35805, Tel: 205-830-4310, Telex: 880114; Empl.: 30; *Sls. Mgr.:* Bill Thomas; *Dist. Mgr.:* Pat Bourgeois

COMPLIANCE DESIGN INC., 593 Massachusetts Ave., Boxboro, MA 01719, Tel: 617-264-4668; *Sls. Mgr.:* Ira Barry

COMPONENT GENERAL, INC., 13620 Wright Cir., Tampa, FL 33625, Tel: 813-855-6655; Empl.: 30; *Sls. Mgr.:* James A. Cook

Local Sales Offices & Reps

CA	Irvine, EBA	714-857-6079
CA	Los Angeles, EBA	213-822-7510
CA	Palo Alto, Mollard Mktg.	415-961-0456
DC	Washington, M. Lader Co.	202-296-2497
MA	Andover, Bee Assoc.	617-475-2124
MN	Minneapolis, Comstrand	612-788-9234
MO	Grandview, R. R. Burton	816-763-5385
NY	Bayside, Robert Diamond Inc.	718-423-7330
NY	Buffalo, Ed Westgren Assoc.	716-632-0011
PA	Lafayette Hill, M. Lader Co.	215-825-3177
PA	Murrysville, Pittsburgh Sls. Assoc.	412-327-3268
EXP	CT, Stamford, Control Devices	203-322-7300

COMPONENT MFG. SVC., INC., 1 Component Park, W. Bridgewater, MA 02379, Tel: 617-580-0111, TWX: 710-390-1081; Empl.: 500; *Sls. Mgr.:* R. E. Owens; *Dist. Mgr.:* R. E. Owens

COMPONENT RESEARCH CO. INC., 1655-26 St., Santa Monica, CA 90404, Tel: 213-829-3615, TWX: 910-343-6864; FSC No.: 12517;Multiple; Empl.: 230; *Sls. Mgr.:* Sylvia Kellerman ..... **A•1014-1063**

COMPONENTS CORP., 6 Kinsey Pl., Denville, NJ 07834, Tel: 201-627-0290; FSC No.: 26364; Empl.: 20; *Sls. Mgr.:* W. H. Gordon

COMPONENT SPECIALTIES CORP., 9143 E. La Rosa Dr., Temple City, CA 91780, Tel: 213-283-0015; FSC No.: 28984; Empl.: 45; *Sls. Mgr.:* D.R. Heins

COMPUTER PRODUCTS™
POWER CONVERSION GROUP

COMPOWER DIV., Computer Prods., Inc., 2220 Lundy Ave., San Jose, CA 95131, Tel: 408-942-1600, Telex: 172760 Compower Corp.; Empl.: 116; *Sls. Mgr.:* Lyle Bennett; *Dist. Mgr.:* Tazz A. Pettebone ..... **D•1446, 1552-1558, 1584-1585**

Refer to Computer Prods., Inc., Pompano Beach, FL for sales offices and representatives and for distributor listings.

COMPUCART, Versa Tec Corp., 107 N. Rome Ave., Tampa, FL 33606, Tel: 800-237-9024, 813-251-2431

COMPUCORP, 2211 Michigan Ave., Santa Monica, CA 90404, Tel: 213-829-7453, Telex: 4720106, TWX: 910-342-6510; Empl.: 450; *Sls. Mgr.:* Joe Thorpe; *Dist. Mgr.:* Richard Venn

COMPU-LITE CORP., 711 W. 17th St. # F12, Costa Mesa, CA 92627, Tel: 714-645-1501; FSC No.: 51420; Empl.: 50; *Sls. Mgr.:* W.D. Cobben

COMPUNETICS, INC., 2000 Eldo Rd., Monroeville, PA 15146, Tel: 412-373-8110; Empl.: 100; *Sls. Mgr.:* Jerry Schmitt

Local Sales Offices & Reps

CT	Marion, Sands Co., Inc.	203-628-4363
FL	Ft. Lauderdale, Southland Comp., Inc.	
MI	Troy, C. B. Jensen & Assocs.	313-643-0506
MN	Mound, Allyn Assocs.	612-472-4784
MO	St. Louis, Harris-Hauson Co.	314-432-3611
NJ	Wayne, SHL Assocs.	201-790-1714
NC	Smithfield, ADI	919-934-8136
OH	Cleveland, Jim Finnegan & Co.	216-238-5905

COMPUPRO, 3506 Breakwater Ct., Hayward, CA 94545, Tel: 415-786-0909; *Sls. Mgr.:* Jim Lanphear; *Dist. Mgr.:* Kevin Coonan

COMPUSCAN, INC., 81 Two Bridges Rd. Bldg. No. 2, Fairfield, NJ 07006, Tel: 201-575-0500; Empl.: 300 + ; *Sls. Mgr.:* Peter F. Polizzano

COMP-U-STAFF, 1 Investment Pl., Towson, MD 21204, Tel: 301-828-0788; Empl.: 180; *Sls. Mgr.:* Catherine Harper

COMPUTALKER, Compuvoice, Inc., 1730 21st Street, Santa Monica, CA 90404, Tel: 213-828-6546; Empl.: 5; *Sls. Mgr.:* Ron Anderson; *Dist. Mgr.:* Ron Anderson

COMPUTER AVIONICS, 2 Southgate Dr., Mt. Carmel, IL 62863, Tel: 618-263-4343; Empl.: 64; *Sls. Mgr.:* Jerry R. Hart

COMPUTER CABLE & PRODS. INC., Affil. Vertex Elctrns., 147 Gazza Blvd., Farmingdale, NY 11735, Tel: 516-293-1610, Telex: 14-3155, TWX: VERTEX FDLE; FSC No.: 6T500; Empl.: 100; *Sls. Mgr.:* Michael Scanzano; *Dist. Mgr.:* Penny Shaw

COMPUTER COMPONENTS INC.
629 FIFTH AVENUE, PELHAM, NEW YORK 10803

COMPUTER COMPONENTS, INC., 629 Fifth Ave., Pelham, NY 10803, Tel: 914-738-1611; FSC No.: 12965; Empl.: 25; *Sls. Mgr.:* G. Tsokris ..... **B•1307**

COMPUTER CONVERSIONS CORP., 6 Dunton Ct., E. Northport, NY 11731, Tel: 516-261-3300, TWX: 510-226-0448; FSC No.: 51086; Empl.: 100; *Sls. Mgr.:* S. J. Renard ..... **D•1140-1141**

Local Sales Offices & Reps

CA	Buena Park, Motion Control	714-994-6952
CA	N. Hollywood, Crown Elctrns.	213-877-3550
CO	Denver, WH Howard Co.	303-426-3499
IL	Downers Grove, GnH Sls.	312-985-3764
MA	Brookline, Technology Prods.	617-731-0858
MI	Newport, Industrial Sensors	313-289-3374
MN	Minneapolis, Busch Elctrns.	612-835-2044
NY	Penfield, Barthel Entprs.	716-377-3018
NC	Kannapolis, Bass & Assocs.	704-933-1762
PA	Ingoma, Greye Glass	412-366-6664
TX	Dallas, Jacobson Co.	214-363-7584

COMPUTER CORP. OF AMERICA, 675 Massachusetts Ave., Cambridge, MA 02139, Tel: 617-492-8860, Telex: II 710-320-6479, TWX: 710-320-6479; *Sls. Mgr.:* Mr. Robert Roda

COMPUTER DESIGN & APPLICATIONS INC., 411 Waverly Oaks Rd., Waltham, MA 02154, Tel: 617-647-1900, Telex: 232-2240; *Sls. Mgr.:* Thomas Goliash

COMPUTER DETAILING CORP., 301 York Rd., Warminster, PA 18974, Tel: 215-675-4831; Empl.: 10; *Sls. Mgr.:* Norman Atterman

COMPUTER DEVICES, 749 Middlesex Turnpike, Nutting Lake, MA 01865, Tel: 617-663-4980, Telex: 949398; Empl.: 100; *Sls. Mgr.:* Robert L. Hengen; *Dist. Mgr.:* Dick Leeman

COMPUTER DEVICES CORP., 63 Austin Blvd., Commack, NY 11725, Tel: 516-543-4220; Empl.: 50 ..... **A•1487**

Local Sales Offices & Reps

MD	Baltimore, R. A. Wafer Assocs.	301-744-1133
EXP	NY, New Rochelle, Montclair Elctrns.	914-576-1400

COMPUTER DYNAMICS, 105 S. Main St., Greer, SC 29651, Tel: 803-877-7471; *Sls. Mgr.:* Kurt Priester

COMPUTER FIELD SERVICES, INC., 6 Federal Street, Danvers, MA 01923, Tel: 617-774-2930; *Sls. Mgr.:* Stephen B. Miles

COMPUTER INSTRS., 100 Madison Ave., Hempstead, NY 11550, Tel: 516-483-8200, TWX: 510-222-4189; Empl.: 50; *Sls. Mgr.:* F. Cooper; *Dist. Mgr.:* F. Mitchell

COMPUTER MAINTENANCE CORP., 405 Murray Hill Pkwy, East Rutherford, NJ 07073, Tel: 201-866-6400; Empl.: 61; *Sls. Mgr.:* Anthony Scordo

COMPUTER OPTICAL PRODUCTS, INC.
Subsidiary of Hathaway Corp.

COMPUTER OPTICAL PRODS., INC., Sub. of Hathaway Corp., 9353 Eton Ave., Chatsworth, CA 91311-5866, Tel: 818-882-0424, TWX: 215-406; Empl.: 150; *Sls. Mgr.:* Brian Gillespie

THE COMPUTER PLACE, D & D Financial Entprs. Inc., 4595 Van Epps Rd., Brooklyn Hts., OH 44131, Tel: 216-351-7444, TWX: 810-421-8446; Empl.: 41; *Sls. Mgr.:* William C. Briggs

COMPUTER POWER, 124E W. Main St., High Bridge, NJ 08829, Tel: 201-735-8000, Telex: 847481; FSC No.: 3643; Empl.: 145; *Sls. Mgr.:* George A. Ardolino; *Dist. Mgr.:* Stanley A. Smith, Jr.

COMPUTER PRODUCTS
POWER CONVERSION GROUP

COMPUTER PRODS. INC., Power Conversion Grp., 2981 Gateway Dr., Pompano Bch., FL 33069-4803, Tel: 305-974-5500, TWX: 510-956-3098; FSC No.: 62125; Empl.: 800; *Sls. Mgr.:* Martin L. Gross; *Dist. Mgr.:* Dale T. Raveney ..... **D•1446, 1551-1585**

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech Sls. Engrg.	205-533-2100
AZ	Tempe, Elec-Com Assocs.	602-967-8644
CA	Danville, Power Conversion Grp.	415-837-8593
CA	Folsom, Manco	916-985-0370
CA	Los Angeles, Power Partners, Inc.	213-215-0800
CA	Santa Clara, Manco	408-496-6611
CO	Parker, Parker Webster Co.	303-841-4888
FL	Coral Springs, EPM Corp.	305-755-5387
FL	Orlando, EPM Corp.	305-425-6149
GA	Atlanta, Electro-Mech Sls. Engrg.	404-447-6478
ID	Boise, Intermountain Technlg.	208-322-5022
IL	Des Plaines, Janus, Inc.	312-298-9330
IL	Glenview, Power Conversion Grp.	312-998-6715
IN	Indianapolis, Fred A. Dorsey & Assocs.	317-842-0060
KS	Overland Park, J. F. Guernsey Co.	913-381-2225
KY	Louisville, Fred A. Dorsey & Assocs.	502-426-3540
MD	Columbia, Professional Reps.	301-992-7460
MA	Woburn, Power Conversion Grp.	617-933-0237
MI	Livonia, Lowell Wendt Mktg.	313-464-2722
MN	Bloomington, Smiley Scott Assocs.	612-888-5551
MO	Florissant, J. F. Guernsey Co.	314-921-5720
NJ	Englewood, Tecnimat	201-569-4200
NM	Albuquerque, Elec-Com Assocs.	505-898-6101
NY	Binghamton, Empire Tech. Assocs.	607-772-0651
NY	Fayetteville, Power Unltd.	315-637-5291
NC	Raleigh, Electro-Mech Sls. Engrg.	919-851-8165
OH	Cleveland, Geotronix	216-526-2535
OH	Trotwood, Geotronix	513-252-6700
OK	Bixby, MGR Elctrns.	918-369-5186
OR	Portland, Power Sources Unltd.	503-292-0820
PA	Norristown, Denco	215-630-8990
TN	Nashville, Electro-Mech Sls. Engrg.	615-885-0073
TX	Austin, MGR Elctrns.	512-250-0926
TX	Dallas, MGR Elctrns.	214-238-5246
UT	Salt Lake City, Parker Webster	801-266-9939
WA	Lynnwood, Power Sources Unltd.	206-743-6641
WI	Milwaukee, Janus, Inc.	414-476-9104

Local Distributors

CA	Milpitas, Power Systems Distrs.	408-263-1063
CA	N. Hollywood, B. J. Wolfe Entprs.	213-877-5518
CT	Milford, R. C. Comps.	203-847-0006
FL	Ft. Lauderdale, Dielco	305-973-8700
IL	Chicago, Bell Inds.	312-982-9210
MD	Columbia, Aztech Elctrs.	301-995-1760
MA	Wilmington, RC Comps.	617-273-1860
MI	Livonia, LWC Distrs.	313-464-7700
OH	Cleveland, Alpha Distrs.	216-526-3716
OK	Tulsa, Norvell Elctrns.	918-663-1247
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	Norristown, Century Elctrn. Comps.	215-631-5400
TX	Austin, Norvell Elctrns.	512-458-8106
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Houston, Norvell Elctrns.	713-777-1666
WA	Bellevue, Bell Inds.	206-747-1515
WI	Waukesha, Bell Inds.	414-547-8879
Can	Concord, Ontario, Kaytronics	416-669-2262
Can	Kanata, Ontario, Kaytronics	613-592-6606
Can	Surrey, BC, Kaytronics	604-581-5005
Can	Ville St. Pierre, Quebec, Kaytronics	514-367-0101

COMPUTERS INTERNATIONAL, 3540 Wilshire Blvd., Los Angeles, CA 90010, Tel: 213-386-3111, TWX: 910-321-4209; FSC No.: 381-7467; *Dist. Mgr.:* Jim Baker

COMPUTER SYSTEM ASSOCS., 7564 Trade St., San Diego, CA 92121, Tel: 619-566-3911; Empl.: 10; *Sls. Mgr.:* Patricia Chovinard; *Dist. Mgr.:* Patricia Chovinard

COMPUTER SYSTEMS PRODUCTS, 740 Washington Ave N, Minneapolis, MN 55401, Tel: 612-338-0995, 800-422-2537; Empl.: 20+; *Sls. Mgr.:* Tom Kalgrem; *Dist. Mgr.:* Gary Doan

COMPUTER TALK, INC., Box 148, Morrison, CO 80465, Tel: 303-697-5485; Empl.: 20

COMPUTER TERMINAL SYS., 89 Arkay Drive, Hauppauge, NY 11788, Tel: 516-435-2916, Telex: 291411, 291413, TWX: 510-224-6050; FSC No.: 33948; Empl.: 120; *Sls. Mgr.:* K. Oliver

COMPUTERVISION CORP., 201 Burlington Rd., Bedford, MA 01730, Tel: 617-275-1800

COMPUTERWARE, INC., 8480-I Tyco Rd., Vienna, VA 22180, Tel: 703-821-8200; Empl.: 14; *Sls. Mgr.:* Betsy Henderson

COMPUTERWISE, 4006 E 137th Terr., Grandview, MO 64030, Tel: 816-765-3330; Empl.: 20; *Sls. Mgr.:* William W. Brown; *Dist. Mgr.:* William W. Brown

COMPUTROL DIV. KIDDE AUTOMATED SYS., INC., 15 Ethan Allen Hwy., Ridgefield, CT 06877-6297, Tel: 203-544-9371, Telex: 643358; Empl.: 90; *Sls. Mgr.:* Chuck Brewer

COMPUTYPE, INC., 2285 W. County Road "C", St. Paul, MN 55113, Tel: 612-633-0633, 800-328-0852, TWX: 910-563-3699

COMSPEC INC., 10700 Hammerly 5120, Houston, TX 77043, Tel: 713-461-4487, TWX: 910-881-4763; Empl.: 41; *Sls. Mgr.:* Rick Risinger; *Dist. Mgr.:* Rick Risinger

COMSTRON CORP., 200 E. Sunrise Hwy., Freeport, NY 11520, Tel: 516-546-9700, TWX: 510-225-3699; Empl.: 97 ..... **A•1327-1329, 1595; D•1204-1205**

Local Sales Offices & Reps

AZ	Phoenix, Odyssey 1	602-246-8846
CA	Anaheim, Blair Assocs.	714-635-1350
CA	San Diego, Interstate Mktg. Assocs.	714-292-8117
CA	Sunnyvale, Applied Sys.	408-773-0616
CA	Woodland Hills, Interstate Mktg. Assocs.	213-883-7606
CO	Castle Rock, Odyssey I	303-688-3555
FL	Altamonte Springs, Dyne-A-Mark Corp.	305-831-2097
FL	Clearwater, Dyne-A-Mark Corp.	813-441-4702
FL	Fort Lauderdale, Dyne-A-Mark Corp.	305-944-5031
FL	Ft. Lauderdale, Reynolds & Assocs.	305-581-6611
FL	Melbourne, Reynolds Assocs.	305-259-7000
FL	Palm Bay, Dyne-A-Mark Corp.	305-727-0192
FL	St. Petersburg, Reynolds & Assocs.	813-360-1484
GA	Acworth, Reynolds & Assocs.	404-451-9558
GA	Marietta, Comstron/Southeast	404-973-3325
IL	Arlington Heights, Dytec Cen.	312-394-3380

IN Indianapolis, Dytec Cen. 317-247-1316
KS Lenexa, Dytec South 913-888-0215
MI Madison Hts., WKM Assocs. 313-588-2300
MN St. Paul, Dytec North 612-645-5816
MO Maryland Hts., Dytec South 314-569-2990
NJ Englewood Cliffs, Sci. Dvcs. East 201-871-3916
NM Albequerque, Odyssey 1 505-265-6645
NC Spring Hope, Reynolds & Assocs. 305-259-7000
OH Dayton, WKM Assocs., Inc. 513-434-7500
OH Independence, WKM Assocs., Inc. 216-524-5930
PA Pittsburgh, WKM Assocs., Inc. 412-892-2953
PA Spring House, Sci. Dvcs. East 215-643-3335
TX Dallas, Marcom 214-351-4532
VA McLean, Creative Mktg. Assocs. 703-442-9100
VA McLean, Creative Mktg. Assocs. 703-440-9100

COMTECH MICROWAVE CORP., Comtech Corp., 63 Oser Ave., Hauppauge, NY 11788, Tel: 516-435-4646, Telex: 971403 COMMIC HAUP; FSC No.: 61381; *Sls. Mgr.:* M. Javits

COM/TECH SYSTEMS, 505 Eighth Ave., New York, NY 10018, Tel: 212-594-5377; Empl.: 9

COMTEC INFOR. SYS., INC., 53 John St., Cumberland, RI 02864, Tel: 401-724-8500, TWX: 710-387-1171; Empl.: 75; *Sls. Mgr.:* R. A. Hamilton

COMTEK, INC., 309 Breesport, San Antonio, TX 78216, Tel: 512-340-8253

C-con™ COMPONENTS CONCEPT INDUSTRIES

CONCEPT INDUSTRIES, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, Tel: 213-699-0918, Telex: 883123; Empl.: 17; *Sls. Mgr.:* Brad Marsh; *Dist. Mgr.:* Kathy Sawyer ..... **A•1064-1065, 1833**

Local Sales Offices & Reps
CA Huntington Beach, Mil-Com Sls. 714-840-2424
CA Livermore, O'Reilly Elctrns. 415-443-5343
FL Indian Harbor Beach, Bill Toy Assocs. 305-773-5805
IL Medina, Gentry Sls. 312-893-9352
SC Tega Cay, NU South Sls. 803-548-2238

Local Distributors
CA Irvine, Kelex Elctrns. 714-863-1230
CA La Selva Beach, Coast Comps. 408-684-1185
CA Livermore, O'Reilly Elctrns. 415-443-5343
CA Los Angeles, All Elctrns. 213-380-8000
CA San Diego, Sigma Elctrns. 619-565-2000
CA Santa Clara, Capacitors Unlimited 408-946-7676
CA Tustin, Caltronics 714-730-0350
FL Melbourne, T. C. Pridmore 305-727-2491
NY Dix Hills, Aries Elctrns. 516-499-0369
TX Garland, J & S Elctrns. 214-487-8808

CONCORD DATA SYSTEMS, 303 Bear Hill Rd., Waltham, MA 02154, Tel: 617-890-1394, Telex: 95-1793; Empl.: 160

CONCORD ELCTRNS., 30 Great Jones St., Dept. JE, New York, NY 10012, Tel: 212-777-6571, TWX: 710-581-4930; Empl.: 225; *Sls. Mgr.:* Josie Wheaton ..... **C•1174-1175**

CONDENSER PRODS., P.O. Box 997, Brooksville, FL 33512, Tel: 904-796-3561; Empl.: 26; *Sls. Mgr.:* Pat K. Johnson

CONDITIONING SEMICONDUCTOR DEVICES, Box 2116, Wayne, NJ 07470, Tel: 201-335-6723, Telex: 219023; FSC No.: 60644; Empl.: 20; *Sls. Mgr.:* A. G. Zimmerly; *Dist. Mgr.:* Jill Mullen

CONDOR INC. D.C. POWER SUPPLIES

CONDOR D.C. POWER SUPPLIES, INC., 201 Flynn Rd., Camarillo, CA 93010, Tel: 805-484-2851, 800-235-5929, Telex: 910-336-1140; Empl.: 220; *Sls. Mgr.:* Fred Adams ..... **D•1587-1599**

Local Sales Offices & Reps
AL Huntsville, Pen-Tech 205-881-9298
CA Pasadena, RDX Corp. 213-681-3451
CA San Diego, RDX Corp. 619-292-7744
CA Sunnyvale, RDX Corp. 408-734-4500
CO Denver, R. Mktg. 303-455-5360
FL Casselberry, Pen-Tech 305-645-3444
FL Deerfield Beach, Pen-Tech 305-421-4989
GA Marietta, Pen-Tech 404-424-1931
IL Schaumberg, Engrg. Prods. 312-882-7640
IN Greenfield, Engrg. Prods. 317-894-7156
IA Coralville, Engrg. Prods. 319-354-5344
MD Wheaton, Brimberg Sls. 301-946-2670
MA Wayland, Daner Hayes, Inc. 617-655-0888
MN Edina, Engrg. Prods. 612-835-9022
NJ Bellmawr, TAI 609-933-2600,215-627-6615
NY Yonkers, Sonkin Assocs. 914-968-7736
NC Greensboro, Pen-Tech 919-852-6000
OH Dayton, Thompson Assocs. 513-435-7733
PA Mars, Thompson Assocs. 412-776-6495
TX Dallas, Seaton Corp. 214-380-0414
UT N. Salt Lake City, R. Mktg. 801-298-2631
WA Bellevue, Al Smith Co. 206-746-6770

Local Distributors
CA Costa Mesa, FLW 800-225-5359
CA Hayward, FLW 415-786-9070
FL Orlando, GMI 305-894-3354
IL Schaumberg, Engrg. Prods. 312-882-7640
MD Wheaton, Brimberg Sls. 301-946-2760
MI Madison Heights, McNaughton-McKay 313-399-7500
MN Edina, Engrg. Prods. 612-835-9022
NY Yonkers, Kintronics 914-968-8282
TX Houston, American Analog 713-941-7265
Intl Belgium, Mulder-Hardenburg 031-680032
Intl Denmark, Danika Supp. 09-432122
Intl England, Gresham/Powerdyne ..... (025-672)4246
Intl Finland, Oy Ferrado AB 0-550002
Intl France, AK Electronique 01-5755353
Intl Holland, Mulder-Hardenburg BV 023-319184
Intl Norway, Powerbox AS 02-535-837
Intl Sweden, Power Box AB 0518-11920
Can Toronto, Ont., Duncan Inst. Ltd. 416-742-4448

CONDOR PACIFIC INDS., INC., 8053 Deering Ave., Canoga Park, CA 91304, Tel: 818-347-8331, Telex: 65-1442; Empl.: 40

CONDOR SYSTEMS, INC., 2605 S. Winchester Blvd., Campbell, CA 95008, Tel: 408-866-5900, Telex: 184819 Systems SANTA; FSC No.: 62065; *Sls. Mgr.:* Dick Keenly; *Dist. Mgr.:* Ed Brown

CONDUCTIVE RUBBER TECHNLG., 1235 Coast Village Rd., Santa Barbara, CA 93108, Tel: 805-969-5805, Telex: 658-305

CONECTRIX, INC., 376 E. Gunderson St., Carol Stream, IL 60188, Tel: 312-653-1460

CONFORMING MATRIX, Box 5126, Pt. Pl. Sta., Toledo, OH 43611, Tel: 419-729-3777; Empl.: 35

CONKLIN INSTR. CORP., West Rd., Pleasant Valley, NY 12569, Tel: 914-635-2136; FSC No.: 914-635-2510; Empl.: 65; *Sls. Mgr.:* Tom Dolan

Local Sales Offices & Reps
CT Bethel, Gemini Elctrn. Sls. 203-748-5506
GA Newnan, Dolan Assocs. 404-251-1102
NJ Kinnelon, R.J. Alvarez, Inc. 201-838-5641
OH Howard, Denman Assocs. 614-397-6240
WA Seattle, BF Sls. & Engrg. 206-364-3287

CONNECT-AIR INTERNATIONAL, INC., 50 37th St. N.E., Auburn, WA 98002, Tel: 206-939-4880, TWX: 910421-1492; Empl.: 50; *Sls. Mgr.:* Ron Jones

CONNECTICUT HARD RUBBER CO., See CHR Inds.

CONNECTICUT MICROWAVE CORP., 106 Powder Mill Rd., Box 389, Canton, CT 06019, Tel: 203-693-4247; FSC No.: 50974; Empl.: 16; *Sls. Mgr.:* S. T. Urbank

CONNECTOR CORP., 6025 N. Keystone Ave., Chicago, IL 60646, Tel: 312-539-3108, TWX: 910-221-6059 ..... **C•1176-1177**

CONNECTOR INDS. OF AMER. DIV., Microdot Mfg., 639 N. Wayne, Cincinnati, OH 45215, Tel: 513-733-3680; FSC No.: 32076; Empl.: 35; *Sls. Mgr.:* K. C. Neal

HCW

CONNOR-WINFIELD CORP., 109 Turner Ct., POB L, W. Chicago, IL 60185, Tel: 312-231-5270, TWX: 910-230-3231; FSC No.: 21022; Empl.: 35; *Sls. Mgr.:* John Hoag ..... **A•1331-1334**

Local Sales Offices & Reps
CA Agoura Hills, C.D.H. Assocs. 818-707-1970
CA Los Altos, Frauman Assocs. 415-941-0660

CONOLOG CORP., 5 Columbia Rd., Somerville, NJ 08876, Tel: 201-722-8081

CONRAC CORP., System Comps. Div., 1700 S. Mountain Ave., Duarte, CA 91010, Tel: 213-359-9141, Telex: 96-5978; Empl.: 200; *Sls. Mgr.:* Albert N. Caputo

CONRAC DIV., Conrac Corp., 600 N. Rimsdale Ave., Covina, CA 91722, Tel: 213-966-3511, Telex: 67-0437; Empl.: 450

CONSELL, 463 Payne Dr., Cheshire, CT 06410, Tel: 203-272-5750; Empl.: 3; *Sls. Mgr.:* A. R. Aikman

CONSOLIDATED CONTROLS, 15 Durant Ave., Bethel, CT 06801, Tel: 203-743-6721, Telex: 969615, TWX: 710-456-0446; FSC No.: 02750; Empl.: 650; *Sls. Mgr.:* A.F. Jakubauskas

CONSOLIDATED ELECTRONIC WIRE & CABLE, 11044 King St., Franklin Park, IL 60131, Tel: 312-455-8830, TWX: 910-227-1705; FSC No.: 73612; Empl.: 57; *Sls. Mgr.:* Karl Rankin; *Dist. Mgr.:* Steve Boynton

CONSOLIDATED PRODUCTS CORP., P.O. Box 67, Idyllwild, CA 92349, Tel: 714-659-2183

CONSOLIDATED RESISTANCE CO. AMERICA, 222 Lake Ave., Yonkers, NY 10701, Tel: 914-YO3-5900; Empl.: 20

CONSOLINK CORP., 1275 S. Sherman Dr., Longmont, CO 80501, Tel: 303-651-2014, TWX: 910-320-0786; Empl.: 40; *Sls. Mgr.:* Dan Zec; *Dist. Mgr.:* Rhonda Cashion

CONSUMERTRONICS, 2011 Crescent Dr., Alamogordo, NM 88310, Tel: 505-434-0234; Empl.: 5; *Sls. Mgr.:* Laurie Laurencia

CONTACT, INC., 5 Elm Ave., Hudson, NH 03051, Tel: 603-883-7708; FSC No.: M07015; Empl.: 11; *Sls. Mgr.:* T. Foresta; *Dist. Mgr.:* R. Reid

CONTACT EAST, 7 Cypress Dr., Burlington, MA 01803, Tel: 617-272-5051; *Sls. Mgr.:* Kai Juel

CONTACT ELECTRONICS, INC., 30 Plymouth St., Fairfield, NJ 07006, Tel: 201-575-7660, 800-221-1451, Telex: 130-216; Empl.: 50; *Sls. Mgr.:* Thomas E. Bodnar; *Dist. Mgr.:* Jaime N. Korosler

CONTEL INFO. SYS., INC., Continental Tel. Corp., 130 Steamboat Rd., Great Neck, NY 11024, Tel: 516-829-5900; Empl.: 450

CONTINENTAL DATA SYS., 131 N. Ludlow St., Dayton, OH 45402, Tel: 513-222-8626; Empl.: 4

CONTINENTAL ELECTRONICS MFG. CO., P.O. Box 270879, Dallas, TX 75227, Tel: 214-381-7161, Telex: 73-398; FSC No.: 52151; Empl.: 400; *Sls. Mgr.:* R. L. Floyd, Domestic Broadcast

CONTINENTAL RESOURCES, INC., 175 Middlesex Tpke., Bedford, MA 01730, Tel: 617-275-0850, TWX: 710-326-0833; Empl.: 275; *Sls. Mgr.:* Michael Mattleman

CONTINENTAL SPECIALTIES CORP., See Global Specialties Corp.

CONTINENTAL WIRE & CABLE, Gulton Rd., P. O. Box 1863, York, PA 17405, Tel: 717-792-2644, Telex: 84-0437; Empl.: 250; *Sls. Mgr.:* Edward W. Holland III; *Dist. Mgr.:* William L.Druck

CONTOURS, INC., P.O. Box 1041, Middletown, CT 06457, Tel: 203-347-5694; FSC No.: 033501; *Sls. Mgr.:* Peter L. DeVit

CONTRAVES GOERZ CORP., 610 Epsilon Dr., Pittsburgh, PA 15238, Tel: 412-967-7700, Telex: 86-6237, TWX: 710-664-2082; FSC No.: 51261; *Sls. Mgr.:* Henry M. Voss; *Dist. Mgr.:* Ronald L. Ekas

CONTROL CONCEPTS CORP., P.O. Box 1380, Binghamton, NY 13902-1380, Tel: 607-724-2484; Empl.: 41; *Sls. Mgr.:* Oral R. Evans ..... **B•1233**

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	800-327-0853
AZ	Scottsdale, Power Specialists	602-996-4100
CA	Los Alamitos, Power Specs.	213-594-9418
CA	Redwood City, Ault Assocs.	415-367-1710
CA	Simi Vally, Power Specialist Co.	
CA	Vista, Power Specialist Co.	619-726-4799
FL	Melbourne, Saber Assocs.	800-432-6288
GA	Norcross, Saber Assocs.	800-327-0853
IL	Elk Grove Village, Loren Green Assocs.	312-593-0282
IN	Fort Wayne, Domino	219-747-5621
MA	Needham, Shain Assocs.	617-449-4380
MI	Livonia, Electro Sls. Assocs.	313-474-7320
MI	Portage, Electro Sls. Assocs.	616-323-2416
MN	Springlake Park, Holmgren Assocs.	612-786-7641
NY	Binghamton, TAE-Rep, Inc.	607-692-3705
NY	Great Neck, Phase 4, Inc.	516-482-1790
NY	Rochester, TAE-Rep, Inc.	726-586-8710
NC	Clayton, Saber Assocs.	800-327-0853
OH	Cleveland, Electro Sls. Assocs.	216-261-5440
OH	Dayton, Electro Sls. Assocs.	513-426-5551
OK	Edmond, Data Aids	405-478-5000
OR	Portland, SPS Elctrns.	503-297-6919
PA	Montgomeryville, Eastern Sci. Mktg.	215-368-4570
NJ	Vincentown, Eastern Scientific Mktg.	609-268-0250
TX	Austin, Data Aids	512-327-8600
TX	Dallas, Data Aids	214-620-1551
TX	The Woodlands, Data Aids	713-363-3838
WA	Redmond, SPS Elctrns.	206-392-5256
WI	Glendale, Stapleman Corp.	414-352-5777
Can	Toronto, Ont., Norgay Entrps., Ltd.	416-239-3025

CONTROL DATA CORP., P.O. Box O, Minneapolis, MN 55440, Tel: 1-800-828-8001 Operator 82, In MN 612-921-4400; Empl.: 50,000

CONTROL ELCTRNS. CO., INC., 107-B Allen Blvd., Farmingdale, NY 11735, Tel: 516-694-0125; FSC No.: 95924; Empl.: 60; *Sls. Mgr.:* Harold Goldstein; *Dist. Mgr.:* Jack Leonard ..... **A•1488**

Local Sales Offices & Reps

CA	Sherman Oaks, R.T. Assocs.	213-788-7588
FL	Melbourne, VPI	305-727-3305
FL	Tampa, VPI	813-832-2041
IL	Chicago, Electro-Tech Mktg. Assoc.	312-676-3151
MD	Ellicott City, VPI	301-461-2525
MA	W. Medway, J. Gallagher	617-533-7292
MN	Fridley, Teskey & Assocs.	612-571-0876
PA	Montgomery, VPI	215-474-3200
TX	Dallas, Texas Avionics Co.	214-363-6324
WI	Brookfield, Electro-Tech Mktg. Assocs.	414-785-9554
EXP	FL, Hallandale, Emec	305-925-6366

CONTROL ENGRG., INC., 1686 Riverdale St., West Springfield, MA 01089, Tel: 413-781-1330; Empl.: 7; *Sls. Mgr.:* Mark Kimball

CONTROL EQUIP. CORP., 171 Lincoln St., Lowell, MA 01851, Tel: 617-459-0573; Empl.: 10

CONTROLEX/EANCO, See Fincor

CONTROL INDS. INC., 530 Burnside Ave., Inwood, NY 11696, Tel: 212-471-9800; Empl.: 40

CONTROL LASER CORP., 11222 Astronaut, Orlando, FL 32821, Tel: 305-851-2540, Telex: 564407; *Sls. Mgr.:* John F. Rogers

CONTROLLED ENVIR. EQUIP. CORP., 3 Delta Drive, Westbrook, ME 04092, Tel: 207-854-9126; Empl.: 5; *Sls. Mgr.:* M. F. Peck

CONTROLLED POWER COMPANY

CONTROLLED POWER CO., 1955 Stephenson Hwy., Troy, MI 48083, Tel: 1-800-521-4792, TWX: 810-232-3401 ..... **D•1876, 1910-1915**

Local Sales Offices & Reps

AL	Birmingham, James E. Heusser Agy., Inc.	205-836-3896
AK	Anchorage, Alaska Computer Environment	907-562-2406
AZ	Phoenix, Gruber Assocs.	602-863-2655
CA	LaJolla, Wheelock	619-454-3473
CA	Mountainview, Westech Sls.	415-961-1422
CO	Monument, Precision Environments	303-480-3330
DE	Wilmington, Data Concepts Corp.	302-654-3388
GA	Atlanta, United Engrg. Co. Inc.	404-256-4871
IL	Hoffman Estates, Carvel Engrg.	312-885-8800
IN	Carmel, Ralph Wendel	317-844-2230
KS	Mission, West & Assocs.	913-246-5356
KY	Louisville, Jenkins & Assocs.	502-451-4441
MI	Lansing, Hammond Assocs., Inc.	517-372-4112
MI	Lathrup Village, Carpenter-Cunningham & Assocs.	313-559-9610
MN	Edina, Carvel Engrg.	612-835-7929
MO	Ballwin, Cassidy & Assocs.	314-391-1802
NJ	Cherry Hill, Data Concepts Corp.	609-429-1510
NJ	Englewood Cliffs, Power Conversions & Control	201-569-0015
NM	N.E. Albequerque, Sun Data Sys., Inc.	505-292-1022
NY	Buffalo, Bromor Co.	716-874-4595
NC	Winston Salem, Carrington Elctrl.	919-968-8580
OH	Cleveland, Carter, McCormick & Peirce	216-779-5100
OH	Englewood, Carter, McCormick & Peirce	513-836-0951
OR	Beaverton, Ratec Corp.	503-643-5824
PA	Pittsburgh, Carter, McCormick & Peirce	412-372-4415
SC	Maldin, Carrington Elec. Sls.	803-297-9769
TN	Nashville, Jenkins & Assocs., Inc.	615-256-7606
TX	Dallas, Engineered Computer Rooms	214-644-1963
WA	Seattle, R. W. Campbell	206-622-3403
WV	Charleston, Dave Gandy & Assocs.	304-343-7414
WI	New Berlin, Carvel Engrg.	414-784-7007
Can	Nepean, Ontario, Mech-Co., Ltd.	613-225-0210

CONTROL MODULE, 380 Enfield St., Enfield, CT 06082, Tel: 203-745-2433, Telex: 643167; Empl.: 160; *Sls. Mgr.:* Peter C. DiMaria

CONTROL-O-MATION, INC, 7300 W. Huron River Dr., Dexter, MI 48130, Tel: 313-426-3935; Empl.: 70; *Sls. Mgr.:* Richard Lundy

CONTROL PRODUCTS, INC., 280 Ridgedale Ave., E. Hanover, NJ 07936, Tel: 201-887-9400; FSC No.: 81901; Empl.: 62; *Sls. Mgr.:* J. R. Nile

CONTROL PRODS., Devar, Inc., P.O. Box 589, Bridgeport, CT 06601, Tel: 203-368-6751, Telex: 96-4234; Empl.: 80; *Sls. Mgr.:* T. W. Tomasko

CSI CONTROL SCIENCES INCORPORATED

CONTROL SCIENCES, INC., 9509 Vassar Ave., Chatsworth, CA 91311, Tel: 818-709-5510, Telex: 4970496(CSI); FSC No.: 53317; Empl.: 14; *Sls. Mgr.:* Rhod Zimmerman ..... **D•1142-1146**

Local Sales Offices & Reps

IL	Rolling Meadows, KMA Sales	312-398-5300
IN	Ft. Wayne, J & B Engrg.	219-483-2813
MN	St. Paul, Northstar Motion & Control	612-770-5311
MO	Peculiar, PEM Sales	816-884-4784
MO	St. Louis, PEM Sales	314-427-7200
NY	Victor, A & D Devices	716-924-9171
OH	Cleveland, Geotronix	216-526-2535
OH	Columbus, Geotronix	614-457-8472
PA	Media, Homer Smith Sls.	215-543-2434
WI	Milwaukee, KMA	414-259-1771

CONTROLS UNLIMITED, INC., 4823 North Ridge Rd., Perry, OH 44081, Tel: 216-259-2500; Empl.: 35

CONTROL SYSTEMS, 2855 Anthony Lane, Minneapolis, MN 55418, Tel: 612-789-2421, Telex: 756601

CONTROL TECHNOLOGY CO., 41-16 29th St., Long Island City, NY 11101, Tel: 718-361-2133; FSC No.: 14545; Empl.: 35; *Sls. Mgr.:* H. Cooper ..... **D•1986-1987**

Local Sales Offices & Reps

CA	Claremont, W. Roth & Assocs.	714-621-1019
Can	Montreal, Que., Control Tech. Elctrns. CTC Canada, Ltd.	514-733-3279

CONTROL TECHNOLOGY, INC., 8200 N. Classen Blvd., Ste. 101, Oklahoma City, OK 73114, Tel: 405-840-3163, Telex: 910-831-3231; *Sls. Mgr.:* Charles Weddington; *Dist. Mgr.:* Charles Weddington

CONVER CORP., 10629 Bandley Dr., Cupertino, CA 95014, Tel: 408-255-0151, TWX: 910-338-2036; Empl.: 40; *Sls. Mgr.:* Robert Lloyd; *Dist. Mgr.:* Lyne Hare

CONVERSION EQUIP. CORP., 330 W. Taft Avenue, Orange, CA 92665, Tel: 714-637-2970; Empl.: 50; *Sls. Mgr.:* Patrick M. D'Acre

CONVERTER CONCEPTS INC

CONVERTER CONCEPTS, INC., Industrial Pkwy., Pardeeville, WI 53954, Tel: 608-429-2144, TWX: 910-280-2630; Empl.: 120; *Sls. Mgr.:* Michael J. Schoenwald; *Dist. Mgr.:* Michael J. Schoenwald ..... **D•1600-1603**

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-883-1712
AZ	Phoenix, Thor Engrg.	602-437-1463
CA	Goleta, The Thorson Co.	805-964-8751
CA	Hayward, Pacific Mktg.	415-887-1620
CA	Signal Hill, The Thorson Co.	213-595-0361
FL	Boca Raton, Perrott Assocs.	305-792-2211
FL	Clearwater, Perrott Assocs.	813-443-5214
FL	Orlando, Perrott Assoc.	305-298-7748
GA	Atlanta, JWL Assocs.	404-429-8010
IL	Rolling Meadows, KMA Sls.	312-398-5300
MA	Natick, Wayland Engrg. Sls.	617-655-6080
MN	Minneapolis, JMI	612-861-3343
NY	Syracuse, Pi-Tronics	315-455-7346
NC	Raleigh, JWL Assocs.	919-787-4826
OH	Dayton, Bradcor	513-294-5477
OH	Euclid, Bradcor Elctrns.	216-261-0888
PA	Glenside, Koebert Assoc.	215-887-2310
TX	Garland, Tesco	214-681-1376
TX	Houston, Tesco	713-777-1443
WA	Linnwood, Power Sources Unltd.	206-784-3336
WI	Milwaukee, KMA Sales	414-259-1771
Can	Rexdale, Ont., Electro-Source, Inc.	416-675-4490

CONVEX CORP., P.O. Box 17225, Dulles Intl. Airport, Washington, DC 20041, Tel: 703-661-8900; Empl.: 24

COOL-AMP CONDUCTO-LUBE CO., 8621 S.W. 17th Ave., Portland, OR 97219, Tel: 503-244-2230; Empl.: 5; *Sls. Mgr.:* Audrea Dick

COONER WIRE CO., 9186 Independence Ave., Chatsworth, CA 91311, Tel: 818-882-8311; *Sls. Mgr.:* Steven W. Smith ..... **C•1820-1826**

Local Sales Offices & Reps

CA	Cupertino, Cooner Wire Co.	408-773-1444

COOPER GROUP, PO Box 30100, Raleigh, NC 27622, Tel: 919-781-7200, Telex: 579497

C0-ORD SWITCH DIV., See LVC Inds., Inc.

COORS PORCELAIN, 600 Ninth St., Golden, CO 80401, Tel: 303-278-4000, Telex: 45593; Empl.: 1700

COOSOL, 3013 Harbor Blvd., Costa Mesa, CA 92626, Tel: 714-545-2216; Empl.: 20; *Sls. Mgr.:* Aram Solomonian; *Dist. Mgr.:* Aram Solomonian

CORBY INDS. INC., P. O. Box 2838, Allentown, PA 18001, Tel: 215-433-1412, Telex: 847318 CORBYUHL; Empl.: 22; *Sls. Mgr.:* Glenn M. Matz; *Dist. Mgr.:* Lewis S. Walters

CORCOM, INC., 1600 Winchester Rd., Libertyville, IL 60048, Tel: 312-680-7400, TWX: 687-1058; FSC No.: 05245; Empl.: 1000 ..... **A•1596**

Local Sales Offices & Reps

AL	Huntsville, Robert O. Whitesell	205-883-5110
AZ	Phoenix, I.S.D.S.	602-971-6250
CA	Los Angeles, I.S.D.S.	213-478-0183
CA	Mountain View, Straube Assocs.	415-969-6060
CA	San Diego, I.S.D.S.	619-571-1544
CA	Santa Ana, I.S.D.S.	714-973-2162
CA	Woodland Hills, I.S.D.S.	818-883-7130
CO	Arvada, Straube Assocs.	303-426-0890
CT	Madison, Conti-Younger Assocs.	203-245-1136
CT	Norwalk, Wincor Sls.	203-348-7741
FL	Maitland, E.I.R. Inc.	305-660-9600
FL	Oldsmar, E.I.R. Inc.	813-786-2156
FL	Plantation, E.I.R. Inc.	305-581-6905
FL	Plantation, E.I.R. Inc.	305-791-8243
ID	Boise, Cascade Comps.	208-343-9886
IL	Rolling Meadows, Sumer, Inc.	312-991-8500
IN	Ft. Wayne, Robert O. Whitesell	219-432-5591
IN	Indianapolis, Robert O. Whitesell	317-359-9283
IN	Kokomo, Robert O. Whitesell	317-457-9127
IA	Cedar Rapids, PMR, Inc.	319-362-9177
KS	Overland Park, PMR, Inc.	913-381-0004
KS	Wichita, PMR, Inc.	316-684-4141
KY	Louisville, Robert O. Whitesell	502-426-7696
MD	Ellicott City, Marketing Technlg.	301-465-5944
MA	Burlington, Conti-Younger Assocs.	617-273-1582
MI	Grand Rapids, Robert O. Whitesell	616-942-5420
MI	Southfield, Robert O. Whitesell	313-559-5454
MI	St. Joseph, Robert O. Whitesell	616-983-7337
MN	Edina, Mel Foster Co.	612-941-9790
MO	Maryland Heights, PMR, Inc.	314-569-1220
NM	Albuquerque, Straube Assocs.	505-292-0428
NY	Endicott, Noeth-Honsinger Assocs.	607-754-3214
NY	Manhasset, Win-Cor Elctrn. Sls.	516-627-9474
NY	Pittsford, Noeth-Honsinger Assocs.	716-586-9002
NC	Raleigh, Zucker Assoc.	919-782-8433

CORD ELECTRONICS

PASSIVE COMPONENTS—Meters, Lamps, Potentiometers, Quartz Crystals & Filters, Xenon Flash Tubes & Trigger Coils, Miniature Speakers & Phone Capsules, Chokes, Coils, IFT, Inductors, Headsets, Boom Mic Headsets, Microphones, Mic Cartridges & Cables, Cords, Cables, Plugs, Jacks, Assemblies, Telephone Handsets, Modular Cords & Jacks, Switches.

POWER PRODUCTS—SPS (30W to 200W, 1 to 5 outputs), DC to DC (30W to 150W, 1 to 5 outputs), Magnetic Components.

FIBER OPTICS—Fiber Phone, Terminated Fiber Cables, Active Connectors.

CUSTOM MANUFACTURED PRODUCTS

CORD ELECTRONICS INCORPORATED

177 Cantiague Rock Road,
Westbury, N.Y. 11590

Phone: (516) 935-3640

Telex: 4758020 FAX: (516) 935-0780

OH	Cincinnati, Robert O. Whitesell	513-521-2290
OH	Cleveland, Robert O. Whitesell	216-447-9020
OH	Columbus, Robert O. Whitesell	614-888-9396
OH	Dayton, Robert O. Whitesell	513-298-9546
OR	Lake Oswego, Cascade Comps.	503-635-2227
PA	Pittsburgh, Robert O. Whitesell	412-963-6161
PA	Trevose, Professional Svc. Assoc.	215-245-0513
TN	Knoxville, Robert O. Whitesell	615-694-9476
TX	Austin, K & H Sls.	512-258-8841
TX	Plano, K & H Sls.	214-423-6520
UT	Salt Lake City, Straube Assocs.	801-263-2640
VA	Lynchburg, Marketing Technlg.	804-384-6459
WA	Seattle, Cascade Comps.	206-888-3717
WI	Brookfield, Sumer, Inc.	414-784-6641

Local Distributors

AL	Huntsville, Pioneer	205-837-9300
AZ	Phoenix, Cetec Elctrns.	602-272-7951
CA	Canoga Park, Marshall Inds.	818-999-5004
CA	Chatsworth, Diplomat Elctrns.	818-314-4411
CA	Costa Mesa, Diplomat Elctrns.	714-549-8401
CA	El Monte, Marshall Inds.	213-442-7204
CA	Irvine, Cetec Elctrns.	714-250-4141
CA	Irvine, Marshall Ind.	714-660-0951
CA	San Diego, Cetec Elctrns.	619-278-5020
CA	San Diego, Diplomat Elctrns.	619-292-5693
CA	San Diego, Marshall Ind.	619-578-9600
CA	Santa Clara, Cetec Elctrns.	408-263-7373
CA	South Gate, Cetec Elctrns.	213-773-6521
CA	Sunnyvale, Diplomat/Westland	408-734-1900
CA	Sunnyvale, Marshall Ind.	408-732-1100
CO	Denver, Marshall Ind.	303-427-1818
CO	Wheatridge, Diplomat Elctrns.	303-422-9229
CT	Danbury, Diplomat Elctrns.	203-797-9674
CT	E. Haven, J.V. Elctrns.	203-499-2457
FL	Clearwater, Diplomat Elctrns.	813-443-4515
FL	Deerfield Beach, Pioneer	305-771-7520
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Orlando, Hammond Elctrns.	305-849-6060
FL	Orlando, Pioneer	305-834-9090
GA	Atlanta, Marshall Ind.	404-923-5750
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Elk Grove Village, Pioneer/Chicago	312-437-9680
IL	Palatine, OHM Elctrns.	312-359-5500
IN	Indianapolis, Graham Elctrns.	317-634-8202
IN	Indianapolis, Pioneer	317-849-7300
MD	Beltsville, Resco/Washington	301-937-9100
MD	Gaithersburg, Pioneer	301-921-0660
MD	Savage, Pyttronic Inds.	301-792-0780
MD	White Marsh, Resco	301-529-0500
MA	Burlington, Marshall Ind.	617-272-8200
MA	Newton, Greene Shaw	617-969-8900
MA	Norwood, Gerber Elctrns.	617-769-6000
MI	Livonia, Pioneer	313-525-1800
MI	Livonia, R.S. Elctrns.	313-525-1155
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	Minnetonka, Pioneer/Twin Cities	612-935-5444
MN	St. Paul, Gopher Elctrns.	612-483-3322
MO	St. Louis, Olive Elctrns.	314-426-4500
NJ	Bellmawr, Mid Atlantic Elctrns. Corp.	609-931-5303
NJ	Totowa, Diplomat Elctrns.	201-785-1830
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Melville, Diplomat Elctrns.	516-454-6400
NY	Mt. Vernon, QAR Indl. Elctrn. Sls.	914-699-2224
NY	Rochester, Rochester Radio Supp.	716-454-7800
NY	Rochester, Summit Distrs.	716-334-8110
NC	Greensboro, Hammond Elctrns.	919-275-6391
OH	Cleveland, Pioneer	216-587-3600
OH	Dayton, Pioneer	513-236-9900
OR	Beaverton, Almac Elctrns.	503-641-9070
PA	Montgomeryville, Pyttronic Inds.	215-242-6700
PA	Philadelphia, Almo Elctrns. Corp.	215-698-4000
PA	Pittsburgh, Pioneer	412-782-2300
SC	Columbia, Dixie Elctrns.	803-779-5332
TX	Austin, Pioneer	512-835-4000
TX	Dallas, Pioneer	214-386-7300
TX	Fort Worth, TTI	817-831-0441
TX	Houston, Pioneer	713-988-5555
UT	Salt Lake City, Diplomat/Alta Land	801-486-4134
WA	Bellevue, Almac Elctrns.	206-643-9992
WI	Milwaukee, Marsh Elctrns.	414-475-6000

CORD ELECTRONICS INCORPORATED (Formerly the OEM Division of MURA)

CORD ELECTRONICS, INC., 177 Cantiague Rock Rd., Westbury, NY 11590, Tel: 516-935-3640, Telex: 475-8020; FSC No.: 516-935-0780; Empl.: 25; *Sls. Mgr.:* William Mercurio .... **A•2009; B•1023; C•1827; D•1024, 1605**

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg., Inc.	205-533-5165
AR	Little Rock, Welch & Doby, Inc.	501-455-2199
CA	San Diego, Littlefield & Smith Assocs.	619-455-0055
CA	Saratoga, Frequency Control Assocs.	408-446-0200
CA	Saratoga, Santana Sls.	714-827-9100
CO	Aurora, Sage Sls.	303-750-3501
CT	Manchester, G. M. Assocs.	203-646-4443
FL	Casselberry, HAI Elctrns., Inc.	305-831-4892
FL	Coral Springs, HAI	305-752-7520
GA	Atlanta, DHR Mktg.	404-451-9848
IL	Highland Park, Bransky Sls.	312-433-2375
IN	Indianapolis, Elctrn. Reps.	317-894-1414
IA	Bettendorf, Weisler & Assocs., Inc.	319-344-0566
LA	Manderville, Design Mktg.	713-237-2319
MD	Timonium, Eastern Comps. Sls. Corp.	301-561-5811
MA	Framingham, G.M. Assocs.	617-872-4871
MI	Adrian, Elctrn. Salesmasters	517-263-2500
MI	Livonia, Elctrn. Salesmasters	313-421-2520
MN	Minneapolis, O.E.M. Elctrl. Sls., Inc.	612-559-2448
MS	Jackson, Welch & Doby, Inc.	601-932-5534
MO	Ellisville, Weisler Assocs.	314-394-4543
MO	N. Kansas City, Weisler Assocs.	816-421-1679
NH	Exeter, G. M. Assocs.	603-778-7472
NM	Alburquerque, Syntech	505-266-7951
NY	Jericho (Downstate), J-Square Mktg., Inc.	516-935-3200
NY	Rochester, J. G. Welch Assocs., Inc.	716-244-1100
NY	Utica, J. G. Welch Assocs., Inc.	315-736-7821
NC	Charlotte, DHR Mktg., Inc.	704-335-1215
NC	Greensboro, DHR Mktg., Inc.	919-273-2671
NC	Raleigh, DHR Mktg.	919-876-5450
OH	Beachwood, Elctrn. Salesmasters	800-328-1848
OH	Cleveland, Arthur H. Baier & Assocs.	216-461-6161
OH	Dayton, Arthur H. Baier & Assocs.	513-276-4128
OK	Tulsa, Design Mktg., Inc.	918-622-7744
OR	Beaverton, Quest Mktg., Inc.	503-641-7377
PA	W. Conshohocken, Eastern Comps.	215-825-8610
SC	Greenville, DHR Mktg.	803-235-3594
TN	Memphis, Welch & Doby, Inc.	901-683-8099
TX	Dallas, Design Mktg., Inc.	214-680-9767
TX	Hurst, Design Mktg., Inc.	817-268-2004
TX	Round Rock, Design Mktg., Inc.	512-255-9896
UT	Salt Lake City, Sage Sls.	801-467-5451
WA	Bellevue, Quest Mktg., Inc.	206-747-9424
WI	Cedarburg, Bransky Sls.	414-377-6837
PR	Puerto Rico, Casanova Indl. Sls.	809-753-8674
Can	Waterloo, Ont., Rytech Co.	519-743-4521

CORLUND ELCTRNS. CORP., 3543 Old Conejo Rd., Newbury Park, CA 91320, Tel: 805-499-6947; Empl.: 45; *Sls. Mgr.:* John Redmond

CORNELL-DUBILIER ELECTRONICS, 150 Avenue 'L', Newark, NJ 07105, Tel: 201-589-7500, Telex: 03-8366

CORNELL-DUBILIER ELECTRONICS, Div. of Federal Pacific Electric Co., 1605 East Rodney French Blvd., New Bedford, MA 02744, Tel: 617-996-8561

CORNELL-DUBILIER ELCTRNS., Wayne Interchange, Plaza 1, Wayne, NJ 07470, Tel: 201-256-2000; *Sls. Mgr.:* A. Cavuto ..... **A•1067, 1597; B•1309**

Local Sales Offices & Reps

AZ	Tempe, Electronics Dvcs. & Sls.	602-438-1547
CA	Los Altos, Ewing-Foley, Inc.	415-941-4525
CA	San Diego, Harvey King	619-566-5252
CO	Westminster, Western Region Mktg.	303-430-8883
FL	Fort Lauderdale, Dyne-A-Mark Corp.	305-771-6501
IL	Rolling Meadows, Eagle Tech. Sls., Inc.	312-991-0700
IN	Carmel, Technology Mktg.	317-844-8462
MD	Glen Burnie, Faion Lott & Co.	301-744-4611
MA	Needham Heights, Coakley, Boyd & Abbett	617-444-5470
MI	Detroit, Rathsburg Assocs.	313-882-1717
MN	Minneapolis, Electric Comp. Sls.	612-933-2594
MO	Bridgeton, Dy-Tronix, Inc.	314-291-4771
NY	Syracuse, Leonard D. Allen	315-437-8387
NC	Cary, Montgomery Mktg., Inc.	919-467-6319
OH	Dayton, The Lyons Corp.	513-278-0714
TX	Richardson, R. F. Kimball Co, Inc.	214-231-3447
WA	Bellevue, Northwest Mktg. Assocs.	206-455-5846
PR	Santurce, Sudouest Import Sls. Corp.	809-726-7635

Local Distributors

AL	Huntsville, Arrow Elctrns., Inc.	205-882-2730
AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AZ	Phoenix, Arizona Comp. Co.	602-269-5655
AZ	Phoenix, Hall-Mark Elctrns.	602-243-6601
AZ	Tempe, Arrow Elctrns., Inc.	602-968-4800
AZ	Tempe, Bell Inds.	602-966-7800
CA	Chatsworth, Arrow Elctrns., Inc.	213-701-7500
CA	Chatsworth, Integated Elctrns. Corp.	213-009-2200
CA	Chatsworth, QC Comps.	818-700-2622

CA Chatsworth, Shelley Elctrns. 213-009-3333
CA Englewood, Hall-Mark Elctrns. 303-694-1662
CA Fountain Valley, Component Ctr., Inc. 714-979-0433
CA Garden Grove, Bell Inds. 714-895-7801
CA Garden Grove, National Capacitor Corp. 714-892-7749
CA Irvine, Integrated Elctrns. Corp. 714-540-5600
CA Palo Alto, Zack Elctrns. 415-326-5432
CA Sacramento, Arrow Elctrns. Inc. 916-925-7456
CA San Diego, Arrow Elctrns., Inc. 619-565-4800
CA San Diego, Hall-Mark Elctrns. 619-268-1201
CA San Diego, Shelley Elctrns. 619-453-7133
CA San Fernando, Petell Elctrns. 818-365-9841
CA San Francisco, Zack Elctrns. 415-626-1444
CA San Jose, Integrated Elctrns. Corp. 408-287-6488
CA San Jose, Shelley Elctrns. Corp. 408-942-9111
CO Lakewood, Acacia Sls. 303-232-2882
CO Wheatridge, Bell Inds. 303-424-1985
CT Greenwich, Wise Comp. 203-531-4880
CT Stratford, Utronics, Inc. 203-378-4201
CT Wallingford, Arrow Elctrns. 203-265-7741
FL Ft. Lauderdale, Arrow Elctrns. 305-776-7790
FL Ft. Lauderdale, Hall-Mark Elctrns. 305-971-9280
FL Ft. Lauderdale, Hammond Elctrns., Inc. 305-973-7103
FL Orlando, Hall-Mark Elctrns. 305-855-4020
FL Orlando, Hammond Elctrns., Inc. 305-849-6060
FL Palm Bay, Arrow Elctrns., Inc. 305-725-1480
GA Norcross, Arrow Elctrns., Inc. 404-449-8252
GA Norcross, Hall-Mark Elctrns. 404-447-8000
IL Bensenville, Hall-Mark Elctrns. 312-860-3800
IL Chicago, Bell Inds. 312-982-9210
IL Chicago, Newark Elctrns. 312-638-4411
IL Elk Grove Village, GBL/Goold Elctrns. 312-593-3220
IL Itasca, Voyager Elctrns. 312-773-4900
IL Palatine, OHM Elctrns. 312-359-5500
IL Rosemont, Advent Elctrns., Inc. 312-297-6200
IL Schaumburg, Arrow Elctrns., Inc. 312-397-3440
IL Skokie, Kellner Elctrns. 312-677-1120
IN Fort Wayne, Graham Elctrns. 219-423-3422
IN Indianapolis, Arrow Elctrns. 317-243-9353
IN Indianapolis, Graham Elctrn. Supp., Inc. 317-634-8202
IA Cedar Rapids, Advent Elctrns., Inc. 319-363-0221
IA Cedar Rapids, Bell Inds. 319-395-0730
IA Cedar Rapids, Deeco, Inc. 319-365-7551
IA Cedar Ropids, Arrow Elctrns., Inc. 319-395-7230
KS Lenexa, Hall-Mark Elctrns. 913-888-4747
KS Wichita, RSC Elctrns., Inc. 316-267-5213
LA New Orleans, William B. Allen, Inc. 504-525-8222
MD Baltimore, A.S.I. Elctrns. 301-265-5200
MD Baltimore, Arrow Elctrns., Inc. 301-247-5200
MD Bethesda, Arrow Elctrns., Inc. 301-564-3000
MD Columbia, Hall-Mark Elctrns. 301-621-4228
MD Gaithersburg, Pioneer Washington Elctrns. 301-948-0710
MD Rockville, Capital Radio Whls., Inc. 301-881-2270
MA Hingham, Sager Elctrl. Supp. 617-749-6700
MA Newton, Green-Shaw, Inc. 617-969-8900
MA North Chelmsford, Pilgrim Elctrns. 617-251-8746
MA Wilmington, RC Comp., Inc. 617-657-4310
MA Woburn, Arrow Elctrns., Inc. 617-933-8130
MA Woburn, Jaco Elctrns., Inc. 617-933-7760
MI Ann Arbor, Arrow Elctrns. 313-971-8220
MI Grand Rapids, Arrow Elctrns. 616-243-0912
MI Livonia, Pioneer/Michigan 313-525-1800
MN Bloomington, Hall-Mark Elctrns. 612-852-3223
MN Edina, Arrow Elctrns., Inc. 612-830-1800
MN Minneaolis, Stark Elctrrns. Supp. 612-332-1325
MO Kansas City, Electronics Supp. 816-931-0250
MO Maryland Heights, Hall-Mark Elctrns. 314-291-5350
MO St. Louis, Arrow Elctrns. 314-567-6888
MO St. Louis, Olive Elctrns. 314-426-4500
NH Manchester, Arrow Elctrns., Inc. 603-668-6968
NJ Cherry Hill, Hall-Mark Elctrns. Corp. 609-424-7300
NJ East Brunswick, Brothers Elctrns. 201-238-2200
NJ East Hanover, State Elctrns. Parts Corp. 201-887-2550
NJ Fairfield, Arrow Elctrns. 201-575-5300
NJ Fairfield, Hall-Mark Elctrns. 201-575-4415
NJ Kenilworth, Federated Purchased 201-272-0505
NJ Marlton, Arrow Elctrns., Inc. 609-596-8000
NJ Moorestown, Arrow Elctrns., Inc. 609-235-1900
NM Albuquerque, Arrow Elctrns., Inc. 505-243-4566
NM Albuquerque, Electronic Parts Co., Inc. 505-293-6161
NY Biminghamton, Help Elctrns., Inc. 607-729-3528
NY Bohemia, Key Comps., Inc. 516-567-7500
NY Buffalo, Summit Distrs., Inc. 716-877-2800
NY Central Islip, Semicap Elctrns. Corp. 516-582-4400
NY Elmsford, Ancar Elctrns. Supp., Inc. 914-592-7100
NY Farmingdale, Arrow Intl. 516-293-6363
NY Farmingdale, Semispecialists of Amer. 516-293-2710
NY Hauppauge, Arrow Elctrns., Inc. 516-231-1030
NY Hauppauge, Broad Line Elctrns. 800-645-5444
NY Hauppauge, Fairmont Elctrn.Sls. Corp. 516-231-3312
NY Hauppauge, Jaco Elctrns., Inc. 516-273-5500
NY Liverpool, Arrow Elctrns., Inc. 315-652-1000
NY Melville, Arrow Elctrns., Inc. 516-391-1300
NY Rochester, Arrow Elctrns., Inc. 716-275-0300
NY Rochester, Masline Elctrns. 716-546-5373
NY Rochester, Rochester Radio Supp. Co. 716-454-7800
NY Rochester, Simcona Elctrns. Corp. 716-238-3230
NY Rochester, Summit Elctrns. of Roch., Inc. 716-334-8110
NY Rockville Center, Douglas Elctrns. 716-764-5710
NY Rome, Rome Elctrns. 315-337-5400
NY Ronkonkoma, Hall-Mark Elctrns. 516-737-0600
NC Greensboro, Hammond Elctrns. 919-275-6391
NC Raleigh, Arrow Elctrns. 919-876-3132
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Akron, Akron Electrns. Supp. Co. 218-762-8818
OH Centerville, Arrow Elctrns., Inc. 513-435-5563
OH Cincinnati, Hall-Mark Elctrns. 513-563-5980
OH Cincinnati, Hughes Peters, Inc. 513-351-2000
OH Cleveland, Pioneer/Cleveland 216-587-3600
OH Columbus, Arrow Elctrns. 614-885-8362
OH Columbus, Hughes Peters 614-294-5351
OH Dayton, Bell Inds. 513-434-8231
OH Dayton, Pioneer Elctrns. 513-236-9900
OH Dayton, Stotts Friedman 513-298-5555
OH Highland Heights, Hall-Mark Elctrns. 216-473-2907
OH Solon, Arrow Elctrns., Inc. 216-248-7500
PA Montgomeryville, Pyttronic Inds. 215-242-6700
PA Norristown, Century Elctrn. Co., Inc. 215-631-5400
PA Phildelphia, Shap Elctrns. Co., Inc. 215-969-3300
PA Pittsburgh, Pioneer/Pittsburgh 412-782-2300
SC Columbia, Dixie Elctrns. 803-779-5332
TX Austin, Arrow Elctrns., Inc. 512-835-4180
TX Austin, Hall-Mark Elctrns. 512-258-8858
TX Dallas, Arrow Elctrns., Inc. 214-386-7500
TX Dallas, Captronics, Inc. 214-340-3592
TX Dallas, Hall-Mark Elctrns. 214-343-5000
TX Dallas, Harrison Equip. Co. 214-239-2750
WI Madison, Arrow Elctrns. 608-273-4977
WI Milwaukee, Electronic Exp. 414-228-8100
WI Milwaukee, Industrial Elctrns. Corp. of Wis. 414-276-1212
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI New Berlin, Hall-Mark Elctrns. 414-707-7844
WI Oak Creek, Arrow Elctrns. 414-764-6600
WI Waukesha, Bell Inds. 414-784-0235
Can Calgary, Alb., Varah's 403-255-9550
Can Don Mills, Ont., Saynor Elctrns. 416-445-2340
Can Downsview, Ont., Future Elctrns. 416-638-4771
Can Hamilton, Ont., Varah's 416-561-9311
Can Ottawa, Ont., Carsten Elctrns. 613-729-5138
Can Ottawa, Ont., Future Elctrns. 613-820-8313
Can Ottawa, Ont., Varah's 613-726-8884
Can Pointe Claire, Que., Future Elctrns. 514-694-7710
Can Scarborough, Ont., Carsten Elctrns. 416-495-9999
Can St. Laurent, Que., Carsten Elctrns. 514-334-8321
Can Vancouver, BC, Future Elctrns. 604-438-5545
Can Vancouver, BC, Varah's 604-873-3211
Can Winnipeg, BC, Varah's 204-633-6190

CORNING GLASS WORKS, Materials Business, Main Plant, MP 21-3, Corning, NY 14831, Tel: 607-974-4102, Telex: 932-499; Empl.: 30000; *Sls. Mgr.:* Bryan Lanahan

CORNING GLASS WORKS, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830, Tel: 607-974-8725, Telex: 932481; Empl.: 8000; *Sls. Mgr.:* Graham Wells; *Dist. Mgr.:* Betsey Murray .. **A•1068-1069, 1835**

Local Sales Offices & Reps

AL Huntsville 205-830-4030
AZ Phoenix 602-943-6602
CA Escandido 619-741-0496
CA Orange 714-771-5160
CA Santa Clara 408-249-6481
CO Denver 303-422-4547
FL Plantation 305-581-3251
FL St. Petersberg 813-894-1171
FL Tampa 813-932-1723
FL W. Palm Beach 305-686-1325
GA Rosewell 404-992-7240
IL Arlington Heights 312-228-6070
MD Columbia 301-964-0225
MA Littleton 617-486-3125
MN Eagon 612-544-0206
MN Shore View 612-780-5044
NY Horse Head 607-974-8615
NC Raleigh 919-876-1100
OH Gahanna 614-476-0028
OR Beaverton 503-649-9199
PA Broomall 215-356-5300
PA Pittsburgh 412-531-2002
TX Plano 214-578-9360
TX Round Rock 512-445-1686
Can Montreal, Que. 514-866-9581

CORNING GLASS WORKS, Memory Prods Dept., 3900 Electronic Dr., Raleigh, NC 27604, Tel: 919-876-1100, TWX: 510-928-1840; Empl.: 17; *Sls. Mgr.:* A. Greenlaw

CORNING GLASS WORKS, Telecomm Prods Dept., BH-5, Corning, NY 14830, Tel: 607-974-9000, Telex: 932498; Empl.: 28,000

CORNING MEDICAL & SCIENTIFIC, See Corning Glass Works, Corning Elctrns.

CORTEC, INC., 15811 Chemical La., Huntington Bch., CA 92649, Tel: 714-897-2529; Empl.: 35

CORTRON DIV., 400 W. Grand Ave., Elmhurst, IL 60126, Tel: 312-279-9110, TWX: 910-254-0154; Empl.: 300; *Sls. Mgr.:* Bob Inglis

COSAR, 3121 Benton St., Garland, TX 75042, Tel: 214-276-9487, 800-527-1207, Telex: 730-764; FSC No.: 20891; Empl.: 50; *Sls. Mgr.:* Jerry Jarka

COSMO PLASTICS CO., 3239 W. 14th St., Cleveland, OH 44109, Tel: 216-861-5594; Empl.: 500; *Sls. Mgr.:* B. Gordon

COSMOS, INC., 19530 Pacific Hwy. S. Suite 102, Seattle, WA 98188, Tel: 206-824-9942, TWX: 910-380-8627; Empl.: 18; *Sls. Mgr.:* Jim Harding; *Dist. Mgr.:* Jim Brewer

COST EFFECTIVE SYSTEMS, INC., Two LeMans Pl, Pine Brook, NJ 07058, Tel: 201-575-5514, Telex: 4944668; *Sls. Mgr.:* Phyllis Gross

COTO CORPORATION

COTO CORPORATION, 55 DuPont Drive, Providence, RI 02907, Tel: 401-943-2686, TWX: 710-381-8016; Empl.: 200; *Sls. Mgr.:* W. Poisson ..... **B•1310-1311**

Local Sales Offices & Reps

CA Lomita, Component Mktg. Assoc. 213-326-1460
CA San Diego, D Squared Sls. 619-560-6266
CA Saratoga, Testco Inc. 408-253-1900
CO Denver, Spectrum Sls. 303-480-9991
IL Downers Grove, Richmar Elctrns. 312-968-0118
IN Indianapolis, Richmar Elctrns. 317-846-6383
NY Melville, Jarms Assoc. 516-752-0404
OR Portland, Ecco Mktg. 503-254-5588
PA Gladwyn, Manreps 215-649-6300
TX Plano, Richmar Elctrns. 214-867-8224
VA Front Royal, Eltron Sls. Ltd. 703-635-7201
WA Seattle, Ecco Mktg. 206-364-0200
WA Spokane, Ecco Mktg. 509-924-4410
WI Butler, Richmar Elctrns. 414-781-1730

Local Distributors

Intl England, Surrey, Rhopoint 08833-OX-7988

COTRONICS, 3379 Shore Pkwy., Brooklyn, NY 11235, Tel: 718-646-7996; Empl.: 15; *Sls. Mgr.:* Alan Marks

COUNTIS INDS., 2670 Lockheed Way, Carson City, NV 89701, Tel: 702-882-6123; Empl.: 12; *Sls. Mgr.:* T. J. Countis; *Dist. Mgr.:* T. J. Countis

CREATIVE MICRO SYSTEMS, 3822 Cerritos Ave., Los Alamitos, CA 90720, Tel: 213-493-2484; Empl.: 40; *Sls. Mgr.:* Elaine Prossen

COVER CRAFT CORP., 540 Commercial St., Manchester, NH 03102, Tel: 603-889-6811; *Sls. Mgr.:* Terry M. Pratt; *Dist. Mgr.:* Terry M. Pratt

COVOX, INC., 675 D Conger St., Eugene, OR 97402, Tel: 503-342-1271, Telex: 706017; Empl.: 25; *Sls. Mgr.:* M. R. Stewart

CPS INC., 110 Wolfe Rd., Sunnyvale, CA 94086, Tel: 408-738-0530, Telex: 35-7450; FSC No.: 31640; Empl.: 80; *Sls. Mgr.:* Wanda Shearin ..... **D•1607**

Local Sales Offices & Reps

MA	Burlington, Intersell	617-273-3844
NY	Great Neck, Industron Assocs.	516-487-2620

CRAIG SYSTEMS CORP., 10 Industrial Way, Amesbury, MA 01913-4848, Tel: 617-388-5662, TWX: 710-347-0590; FSC No.: 81902; Empl.: 300; *Sls. Mgr.:* Robert A. Legrow; *Dist. Mgr.:* Robert A. Legrow

CRAMER INC., 625 Adams St., Kansas City, KS 66105, Tel: 913-621-6700, TWX: 910-743-6856; Empl.: 200; *Sls. Mgr.:* Thomas R. Hyland

CRAMER COIL & TRANSFORMER CO., INC., 1121 15th Ave., Grafton, WI 53024, Tel: 414-377-7040; Empl.: 65; *Sls. Mgr.:* Philia G. Hayes

CRAMER CO., Mill Rock Rd., Old Saybrook, CT 06475, Tel: 203-388-3574, Telex: 966-453; Empl.: 200; *Sls. Mgr.:* A. V. Beauregard; *Dist. Mgr.:* E. Latourette

Local Sales Offices & Reps

CA	Anaheim, Spectrum Assocs.	714-630-6977
CA	Palo Alto, Mollard Mktg.	415-961-0456
IL	Elk Grove, Martec Assocs.	312-956-8090
NJ	East Orange, Willgold Sls. Corp.	201-678-7700
NY	East Syracuse, Application Specialists Inc.	315-437-2813
NY	Rochester, Application Specialists Inc.	716-586-6226
NC	Charlotte, Motion Tech.	704-525-9855
OH	Medina, J. C. Hofstetter	216-241-4880
PA	Edgemont, White/Whiddett Co.	215-353-6343
WA	Mercer Island, Andersen Assocs.	206-232-0484

CREARE, INC., Etna Rd., P.O. Box 71, Hanover, NH 03755, Tel: 603-643-3800, Telex: 953101; Empl.: 75; *Sls. Mgr.:* R. M. Zieserl

CREATIVE PACKAGING CO., 1202 Kentucky Ave., Indianapolis, IN 46285

CRESTRON ELEC., 101 Broadway, Cresskill, NJ 07626, Tel: 201-894-0660

Stil Crestronics

A Division of Applied Electro Technology Int.

CRESTRONICS DIV., Applied Electro Technlg., Int., 2220 S. Anne St., Santa Ana, CA 92704, Tel: 714-556-6570, TWX: 910-595-1797; FSC No.: 52797; Empl.: 25; *Sls. Mgr.:* D. Core; *Dist. Mgr.:* D. Dore ..... **D•1609**

CROMEMCO, 280 Bernardo Ave., Mountain View, CA 94043, Tel: 415-964-7400, TWX: 910-379-6988; Empl.: 500; *Sls. Mgr.:* Tom Keating; *Dist. Mgr.:* Tom Keating

CROMPTON INSTRS., 2763 Higgins Road, Elk Grove Village, IL 60007, Tel: 714-841-2901, Telex: 280540, TWX: 692309; FSC No.: 53498; *Sls. Mgr.:* J. Berger

CROMPTON INSTRS., Hawker Siddley, 2763 Old Higgins Rd., Elk Grove Village, IL 60007, Tel: 312-593-1107, Telex: 28-0540; *Sls. Mgr.:* Tony A. Pitt

CROSS ELCTRNS., 100 Commonwealth Dr., Warrendale, PA 15086, Tel: 412-776-1591; Empl.: 35; *Sls. Mgr.:* L. R. Craig

CROSSPOINT, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, Tel: 201-941-4455; FSC No.: FSCM 52116; Empl.: 13; *Sls. Mgr.:* Joseph M. Cartelli; *Dist. Mgr.:* Joseph M. Cartelli ..... **B•1539**

Local Sales Offices & Reps

CA	No. Hollywood, Crown Elctrns.	213-877-3550
CA	Redwood City, Caltronic Assocs.	415-365-2545
CT	Weston, CJA Assoc.	203-226-4317
FL	St. Petersburg, R. L. Matus & Assocs.	813-896-4133
GA	Buford, R. L. Matus & Assocs.	404-945-2946
MI	Brighton, Michigan Mktg. & Sls.	313-229-6218
NJ	Wayne, GT Assocs.	201-694-6040
NY	Syracuse, Lenard Co.	315-479-9191
OH	Cleveland, A.S.A.	216-662-6080
OH	Dayton, Mohawk Intronics	513-434-8873
TX	Dallas, Glidden Electro Equip.	214-341-0610
TX	Houston, Glidden Electro Equip.	713-681-1415

CROUSE HINDS CO. - AV. LTG., 1200 Kennedy Rd., Windsor, CT 06095, Tel: 203-683-4300

CROUZET CONTROLS, INC., 1083 State Pkwy., Schaumburg, IL 60195, Tel: 312-843-2200, Telex: 206 297; Empl.: 18; *Sls. Mgr.:* Ben Delcourt ..... **B•1145, 1315-1316, 1541**

Local Sales Offices & Reps

AZ	Phoenix, Flexible Technlg.	602-996-6421
CA	San Marino, Motion Control of So. CA	818-796-0189
CA	Santa Clara, Cummings & Assocs.	408-247-8656
CO	Denver, Control Agency	303-936-6641
FL	Tamarac, Davmik Sls.	305-920-2222
IA	Des Moines, Jos-Co/Melius, Inc.	515-277-8597
MA	Wellesley, Electro Kinetics	617-235-9415
MN	Minneapolis, Jos-Co/Melius.	612-861-3343
MO	Webster Grove, Schutz & Assocs. Ind. Sls., Inc.	314-962-2622
NY	Fairport, Tac Sls.	716-425-1070
NY	Syosset, Motion Control Sls.	516-921-5656
NC	Tryon, Halliday & Assoc.	704-894-8205
OH	Cincinnati, Bob Gilbert & Assocs.	513-574-1932
PA	Bensalem, William D. Staats Co.	215-639-5231
TX	Dallas, Automated Motion Control	214-340-4192
UT	Salt Lake City, Control Agency	801-328-4305
WA	Bellevue, Sea Inc.	206-883-4999
WA	Vancouver, Sea Inc.	206-573-5161
Can	St. Hubert, Que., Decofer	514-678-2252
Can	Weston, Ont., Keldco Controls	416-743-6356

Local Distributors

CA	Burlingame, Elec. Control Devices	415-348-0791
CA	Los Angeles, Master Distr.	213-452-1229
FL	Lakeland, A. A. Elec.	813-665-6941
FL	Pembroke Pines, Donza Intl.	305-987-1122
IN	Ft. Wayne, Graham Elctrns.	219-423-3422
IN	Indianapolis, Graham Elctrns.	317-634-8202
IN	Indianapolis, Vonnegut Indl. Prods.	317-899-8800/8877
IA	Bettendorf, Custom Controls Ltd.	319-335-4787
MA	Wellesley, Electro-Mechanical Distr.	617-235-1565
MI	Comstock Park, Mor Elec.	616-784-1121
MI	Grand Rapids, S-F Electronics	616-459-0216
MI	Royal Oak, George Instr. Co.	313-280-1111
MI	Saginaw, Fischer-Flack	517-752-4181
MN	St. Paul, Powermation	612-645-0781
NE	Omaha, Lakeland Engrg.	402-734-2600
NJ	Edison, Howman Applied Control Prods.	201-797-3313
NJ	Fair Lawn, Relay Specialties	201-797-3313
NJ	W. Trenton, Electronic Svc. Div.(Roller Bearing Co)	609-882-7400
NY	Commack, Monarch Comps.	516-499-1770
NC	Asheville, Electric Supply Co.	704-255-8899
NC	Gastonia, J.M.T. Elctrn. Supp.	704-867-4401
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
ND	Bismarck, Border States Elec.	701-258-6060
OH	Cincinatti, Hughes-Peters.	513-351-2000
OH	Cleveland, Reserve Elec. Co.	216-771-5764
OH	Columbus, Hughes-Peters.	614-294-5351
OH	Dayton, Duellman Elctrns.	513-461-5010
OK	Tulsa, Radio.	918-587-9123
OR	Portland, Familian Automated Valve	503-287-8383
PA	Allentown, P. A. Peters.	215-434-5237
PA	Philadelphia, Herbach & Rademan	215-426-1700
SC	Greenville, Holder Elec. Supp.	803-271-7111
TX	Ft. Worth, Swieco.	817-335-6521
WA	Kent, Motors & Controls Corp.	206-872-8010
WA	Seattle, Eicher-Richards Co.	206-523-7888
WI	Waukesha, Powermation	414-542-2868

CROVEN CRYSTALS, 500 Beech St., Whitby, ON, Canada L1N 5S5, Tel: 416-668-3324, TWX: 610-384-2750; FSC No.: 00809; Empl.: 250; *Sls. Mgr.:* R. McCormick ..... **A•1335**

Local Sales Offices & Reps

AZ	Mesa, Sedco Sls.	602-835-6281
CA	San Mateo, Melvin Sls.	415-349-7444
CA	Van Nuys, R.L. Assocs.	213-782-7826
FL	Palm Bay, Spartech Assocs.	305-727-8045
GA	Smyrna, Spartech Assocs.	404-432-3644
MA	Milton, Naton Assoc.	617-698-0670
MO	Blue Springs, Chesco	816-229-1404
MO	St. Charles, Chesco	314-946-6677
NJ	Cherry Hill, Harry J. White	609-428-4544
NY	Melville, Carnes Assocs.	516-694-1600
OH	Englewood, Clayton-Ellier Co.	513-836-3556
TX	Arlington, W. Pat Fralia	817-640-9101
VA	Springfield, Tech Reps Inc.	703-569-6868
WI	Mequon, Artmor Ltd.	414-241-4040

IOR CRYDOM

A DIVISION OF INTERNATIONAL RECTIFIER

CRYDOM DIVISION, Int'l. Rectifier, 1521 Grand Ave., El Segundo, CA 90245, Tel: 213-322-4987, Telex: 67-4660, TWX: 910-348-6283; Empl.: 100; *Sls. Mgr.:* John Deith; *Dist. Mgr.:* Bob Arnstein ..... **B•1312-1314**

Local Sales Offices & Reps

AL	Huntsville, EMA, Inc.	205-830-4030
AZ	Phoenix, Eltron	602-266-2164
CA	Pleasanton, Sierra Sls. Engrg.	415-463-2250
CA	San Diego, Cerco	619-450-1754
CA	Tustin, Morgan Johnson Co., Inc.	714-832-7282
CO	Westminster, Control Agy.	303-427-4179
CT	Fairfield, NRG, Ltd.	203-384-1112
GA	Rosswell, EMA, Inc.	404-992-7240
ID	Boise, N.R. Schultz Co.	208-377-8686
IL	Schaumberg, Microtex, Inc.	312-885-1131
IN	Carmel, Technology Mktg. Corp.	317-844-8462
IN	Ft. Wayne, Technology Mktg. Corp.	219-432-5553
KS	Merriam, Midwest Tech. Sls.	913-236-8555
KS	Wichita, Midwest Tech. Sls.	316-262-7240
KY	Louisville, Technology Mktg. Corp.	502-449-7808
MD	Phoenix, Phoenix Elctrn. Sls.	301-628-2066
MA	Lexington, AD Sys. Sls.	617-861-6370
MI	Royal Oaks, Dave Ray & Assocs.	313-280-0000
MN	Eden Prairie, Electronic Innovators, Inc.	612-941-0830
MO	St. Charles, Midwest Tech. Sls.	314-441-1012
NV	Reno, Unitronics Mktg., Inc.	702-825-1978
NJ	Glen Rock, North East Comps. Co., Inc.	201-447-0600
NY	Binghamton, GEN-TECH Elctrns.	607-648-8833
NY	Liverpool, GEN-TECH Elctrns.	315-451-3480
NY	Melville, Parallax Sls.	516-351-1000
NY	Pittsford, GEN-TECH Elctrns.	716-381-2820
NY	Pleasant Valley, GEN-TECH Elctrns.	914-635-3233
NC	Pineville, EMA, Inc.	704-541-0929
NC	Winston Salem, EMA, Inc.	919-784-6953
OH	Cincinnati, Luebbe Sls. Co.	513-891-5770
OH	Cleveland, Cleveland Luebbe Sls.	216-333-0425
OH	Columbus, Luebbe Sls. Co.	614-431-0474
OH	Dayton, Luebbe Sls. Co.	513-294-0426
OK	Tulsa, ION Assocs., Inc.	918-664-0186
OR	Beaverton, N.R. Schultz Co.	503-643-1644
PA	Pittsburgh, Luebbe Sls. Co.	412-931-0414
PA	Spring House, Deltatronics Inc.	215-542-0250
TN	Donelson, EMA, Inc.	615-883-1414
TN	Jonesboro, EMA, Inc.	615-742-8081
TX	Austin, ION Assocs., Inc.	512-331-7251
TX	Grand Prairie, ION Assocs., Inc.	214-647-8225
TX	Houston, ION Assocs., Inc.	713-977-4354
UT	Salt Lake City, Control Agy.	801-972-8787
WA	Bellevue, N.R. Schultz Co.	206-454-0300
WI	Waukesha, Microtex, Inc.	414-542-5352

Local Distributors

CA	Los Angeles, Kierulff Electronics	213-725-0325
CA	Los Angeles, Master Distrs.	213-452-1229
CA	Pico Rivera, Amfac Elec. Supp.	213-949-7841
CA	San Francisco, South, Stevens Engineering	415-588-9200
IL	Chicago, Newark Elect.	312-784-5100
MA	Hingham, Sager Electric	617-749-6700
NJ	Fair Lawn, Relay Specialties	201-797-3313
NY	Farmingdale, Milgray Elctrns.	516-420-9800
NY	Melville, Arrow Elctrns.	516-694-6800
NY	Westbury, Schweber Electronics	516-334-7474

CRYOMAGNETICS, INC., 795 Oak Ridge Tpk., Oak Ridge, TN 37830, Tel: 615-482-9551; *Sls. Mgr.:* R. M. Ennis, Jr.

CRYSTALOID ELCTRNS., Box 628, Hudson, OH 44236, Tel: 216-655-2429, Telex: 241-244; Empl.: 130; *Sls. Mgr.:* Sharon Werstler

CRYSTEK CORP, P.O. Box 06135, Ft. Myers, FL 33906, Tel: 813-936-2109, TWX: 510-951-7448; FSC No.: 13454; Empl.: 150

CSI Capacitors

CSI CAPACITORS, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069, Tel: 619-747-4000, Telex: 697832; FSC No.: 10026; Empl.: 50; *Sls. Mgr.:* H. R. Smith ..... **A•1070**

Local Sales Offices & Reps

AZ Tempe, Cleveland Entprs. of AZ 602-820-1127
CA San Jose, Comtech Mktg. 408-365-7474
CA San Jose, Silicon Valley Sls. 408-286-7510
CA Tarzana, High Voltage Sls. 213-881-9194
FL Orlando, Glenn Tech. Sls. Co. 305-299-8700
IL Chicago, Esco Assocs. 312-763-0800
KY Louisville, K. W. Elctrn. Sls. 512-451-1860
MA Framingham, Sullivan Tech. Sls. 617-620-0195
NJ Leonia, Peter E. Schmitt Co. 201-944-2806
NM Albuquerque, Cleveland Entprs. 505-265-7893
NY Cazenovia, S. T. Woolard 315-655-8145
OH Dayton, K. W. Elctrn. Sls. 513-890-2150
PA Washington Crossing, DVS Co. 215-493-4642
TX Dallas, Cunningham Comps. Corp. 214-233-4303
TX Houston, Cunningham Comps. Corp. .. 713-461-4197

CPSI, 40 Linnell Circle, Billerica, MA 01821, Tel: 617-272-6020, 800-325-3110, TWX: 710-347-0176; Empl.: 150; *Sls. Mgr.:* S. Corbit

C-TEK INCORPORATED

C-TEK INC., 4 Railroad Ave., Wakefield, MA 01880, Tel: 617-246-1720, Telex: 882485; Empl.: 15; *Sls. Mgr.:* John Vanaman ..... **D•1114-1115**

Local Sales Offices & Reps

AZ Phoenix, Thor Eng. 602-437-1463
CT Ansonia, R. H. Sturdy Co. 203-734-2186
MA Waltham, Calibron Instrs. 617-894-6440
MA Wellesley Hills, R. H. Sturdy Co. 617-235-2330
MI Southfield, Fred H. Gehrke & Assocs. 313-559-5363
MN St. Paul, Northstar Motion & Control .. 612-770-5311
NJ Sparta, E.S. Williams 201-729-4049
NY Champlain, Premier Automation 514-684-6610
NY Syosset, Motion Control Sls. 516-921-5656
NC Charlotte, Jake Rudisill Assocs. 704-377-6901
OH Cincinatti, KCH Co. 513-931-1686
VA Richmond, Jake Rudisill Assocs. 804-320-0201
WA Seattle, Eicher-Richards Co. 206-523-7888

Local Distributors

NY Clarence, Trott Elctrns. 716-634-8500
NY Pittsford, Controlled Motion Prods. 716-381-1933
NY Pittsford, Trott Elctrns. 716-586-8251
NC Charlotte, Trott Elctrns. 704-376-2237

CTI-CRYOGENICS, 266 Second Ave, Waltham, MA 02254, Tel: 617-890-9400, Telex: 92-3442; Empl.: 350; *Sls. Mgr.:* R. A. Bryce

CTS CORPORATION, 905 North West Blvd., Elkart, IN 46514, Tel: 219-293-7511, TWX: 810-294-2167; Empl.: 8,200; *Dist. Mgr.:* J. C. Wells ..... **A•1336-1357, 1663-1667; B•1542-1546**

Local Sales Offices & Reps

AL Huntsville, Interep Assocs. 205-533-1730
AL Mobile, Interep Assocs., Inc. 205-478-1036
AZ Phoenix, Compass Mktg. & Sls. 602-996-0635
AZ Tucson, Compass Mktg. & Sls., Inc. ... 602-293-1220
CA Calimesa, Eltronics 714-795-1521
CA Fremont, CTS Corp. 415-659-1704
CA Los Altos, Ewing & Foley, Inc. 415-941-4525
CA South Pasadena, CTS Corp. 213-682-1137
CO Denver, ELCOM 303-337-2300
CT Wallingford, CompRep Assocs. 203-269-1145
FL Altamonte Springs, Electrocomp Assocs. 305-429-0802
FL Deerfield Beach, Electrocomp Assocs. 305-429-0802
FL Melbourne, Electrocomp Assocs. 305-242-0621
FL St. Petersburg, Electrocomp Assocs. .. 813-327-9677
GA Norcross, Interep Assocs. 404-449-8680
IL Addison, CTS Corp. 312-543-5021
IN Carmel, Brainard-Wilson Mktg. 317-844-2800
IN Indianapolis, Elctrn. Reps. 317-894-1414
IA Cedar Rapids, Seltec Sls. Corp. 319-393-1114
KS Overland Park, Advanced Tech. Sls. .. 913-642-6675
MD Columbia, Professional Reps. 301-992-7460
MA Westwood, CompRep Assocs. 617-329-3454
MI Southfield, J. L. Montgomery Assocs. 313-358-2616
MN Minneapolis, Robert W. Marshall Co. .. 612-929-0457
MN Minneapolis, S & R Sls. 612-559-3090
MO St. Charles, Buckman & Assocs. 314-946-6201
MO St. Louis, Advanced Tech. Sls. 314-878-2921
NM Albuquerque, Compass Mktg. & Sls. .. 505-888-0800
NY E. Syracuse, Nycom 315-437-8343
NY Jamaica, S-J Sales Assocs. 212-291-3232
NY Pittsford, Kirby Mktg., Inc. 716-248-8750
NC Raleigh, Zucker Assocs. 919-782-8433
OH Cleveland, Baehr, Greenleaf & Assocs. 216-221-9030
OH Columbus, Baehr, Greenleaf & Assocs. 614-486-4046
OH Dayton, Baehr, Greenleaf & Assocs. .. 513-439-0724
OK Tulsa, Southern States Mktg. 918-665-8338
OR Beaverton, Electronics Tech. Sls. 503-641-5180
PA Mars, Baehr, Greenleaf & Assocs. 412-776-2151
PA Trevose, P.S.A. Inc. 215-245-0513
TN Greeneville, Interep Assocs. 615-639-3491
TX Austin, Southern States Mktg. 512-452-9459
TX Houston, Southern States Mktg. 713-558-4900
TX Richardson, Southern States Mktg. 214-238-7500
UT Salt Lake City, ELCOM 801-485-7415
WA Kirkland, Electronics Tech. Sls. 206-827-8086
PR Mayaguez, CompRep de Puerto Rico 809-832-9529
Can Streetsville, Ont., CTS of Canada, Ltd. 416-826-1141

Local Distributors

AL Huntsville, Hall-Mark/Huntsville 205-837-8700
AL Huntsville, RM Elctrns. Co., Inc. 205-852-1550
AZ Tempe, Bell Inds. 602-966-7800
AZ Tempe, Marshall Inds. 602-968-6181
CA Canoga Park, Marshall Inds. 213-999-5001
CA Chatsworth, Arrow Elctrns., Inc. 213-701-7500
CA Garden Grove, Bell Inds. 714-895-7801
CA Gardena, Bell Inds. 213-515-1800
CA Irvine, Marshall Inds. 213-443-3724,714-556-6400
CA Irvine, Ratel Elctrns. 714-768-0855,213-637-0839
CA Los Angeles, Richey/Western Elctrns., Inc. 213-820-3777
CA Newport Beach, Arrow Elctrns., Inc. ... 714-851-8961
CA Orange, Richey/Western Elctrns., Inc. 714-634-2811
CA Roseville, Bell Inds. 916-969-3100
CA San Diego, Arrow Elctrns., Inc. 714-565-4800
CA San Diego, Marshall Inds. 714-578-9600
CA San Diego, Richey/Western Elctrns., Inc. 714-271-4511
CA San Jose, Ratel Elctrns. 408-946-4300
CA San Jose, Rose Elctrns. 408-263-9700
CA Santa Clara, Richey/Western Elctrns., Inc. 408-727-7411
CA Sunnyvale, Arrow Elctrns., Inc. 408-745-6600
CA Sunnyvale, Bell Inds. 408-734-8570
CA Sunnyvale, Marshall Inds. 408-732-1100
CO Aurora, Arrow Elctrns., Inc. 303-696-1111
CO Denver, Integrated Elctrns. Co., Inc. ... 303-292-6121
CO Englewood, Industrial Elctrns., Inc. 303-694-9444
CT New Haven, The Green-Shaw Co., Inc. 203-393-0710
CT Wallingford, Arrow Elctrns., Inc. 203-265-7741
CT Wallingford, Marshall Inds. 203-265-3822
CT Wallingford, MIDAN Elctrns., Inc. 203-265-2077
FL Deerfield Beach, Arrow Elctrns., Inc. ... 305-429-8200
FL Fort Lauderdale, Hall-Mark/Miami 305-971-9280
FL Largo, Graham Elctrns./Bell Inds. 813-541-4434
FL Orlando, Hall-Mark/Orlando 305-855-4020
FL Orlando, Marshall Inds. 305-841-1878
FL Palm Bay, Arrow Elctrns., Inc. 305-725-1480
GA Norcross, Arrow Elctrns., Inc. 404-449-8252
GA Norcross, Graham Elctrns./Bell Inds. .. 404-662-0923
GA Norcross, Hall-Mark/Georgia 404-447-8000
GA Norcross, Marshall Inds. 404-923-5750
IL Bensenville, Hall-Mark Elctrns. Corp. .. 312-860-3800
IL Chicago, Bell Inds. 312-982-9210
IL Lombard, RM Elctrns. Co., Inc. 312-932-5150
IL Schaumburg, Arrow Elctrns., Inc. 312-397-3440
IL Shaumburg, Marshall Inds. 312-490-0155
IN Fort Wayne, Graham Elctrns./Bell Inds. 219-423-3422
IN Indianapolis, Arrow Elctrns., Inc. 317-243-9353
IN Indianapolis, Graham Elctrns./Bell Inds. 317-634-8202
IN Indianapolis, RM Elctrns. Co., Inc. 317-291-7110
IN Lafayette, Graham Elctrns./Bell Inds. 317-423-5564
KS Lenexa, Hall-Mark/Kansas City 913-888-4747
KS Lenexa, Marshall Inds. 913-492-3121
MD Baltimore, Arrow Elctrns., Inc. 301-247-5200
MD Baltimore, Hall-Mark/Baltimore 301-796-9300
MD Gaithersburg, Marshall Inds. 301-840-9450
MA Newton, The Greene-Shaw Co., Inc. .. 617-969-8900
MA Woburn, Arrow Elctrns., Inc. 617-933-8130
MI Ann Arbor, Arrow Elctrns., Inc. 313-971-8220
MI Ann Arbor, Graham Elctrns./Bell Inds. 313-971-9093
MI Grand Rapids, RM Elctrns. Co., Inc. ... 616-531-9300
MI Livonia, Marshall Inds. 313-525-5850
MI Livonia, RS Elctrns. 313-525-1155
MN Bloomington, Hall-Mark/Minneapolis .. 612-854-3223
MN Edina, Arrow Elctrns., Inc. 612-830-1800
MN Minneapolis, Industrial Comps., Inc. ... 612-831-2666
MN Plymouth, Marshall Inds. 612-559-2211, 612-559-2255
MO Maryland Hgts., Hall-Mark/St. Louis ... 314-291-5350
MO St. Louis, Arrow Elctrns., Inc. 314-567-6888
MO St. Louis, Graham Elctrns./Bell Inds. .. 314-821-1541
MO St. Louis, Olive Elctrns., Inc. 314-426-4500
NE Lincoln, Scott Elctrn. Supp. Corp. 402-466-8221
NH Manchester, Arrow Elctrns., Inc. 603-668-6968
NJ Cherry Hill, Hall-Mark/Cherry Hill 215-355-7300
NJ Clifton, Vantage Comps., Inc. 201-667-1840
NJ Fairfield, Arrow Elctrns., Inc. 201-575-5300
NJ Fairfield, Marshall Inds. 201-882-0320
NJ Marlton, Arrow Elctrns., Inc. 609-235-1900
NJ Mt. Laurel, Marshall Inds. 609-234-9100, 215-627-1920
NM Albuquerque, Arrow Elctrns., Inc. 505-243-4566
NM Albuquerque, Bell Inds. 505-292-2700
NY Buffalo, Summit Distrs. 716-884-3450
NY East Syracuse, Marshall Inds. 315-432-0644
NY Endwell, Marshall Inds. 607-754-1570
NY Farmingdale, Semispecialists of America, Inc. 516-293-2710
NY Hauppauge, Arrow Elctrns., Inc. ..... 516-694-6800, Ext. 316/317
NY Hauppauge, Marshall Inds. 516-273-2424
NY Jamaica, Archer Ind. Distrs., Inc. 212-291-3232
NY Liverpool, Arrow Elctrns., Inc. 315-652-1000
NY Melville, Arrow Elctrns., Inc. 516-694-6800
NY Mt. Vernon, QAR Ind. Elctrn. Sls., Inc. .. 914-699-2224
NY Rochester, Arrow Elctrns., Inc. 716-427-0300
NY Rochester, Marshall Inds. 716-235-7620
NY Rome, Rome Elctrns., Inc. 315-337-5400
NC Raleigh, Hall-Mark/Raleigh 919-832-4465
NC Raleigh, RESCO/Raleigh 919-781-5700
NC Winston Salem, Arrow Elctrns., Inc. 919-725-8711
OH Centerville, Arrow Elctrns., Inc. 513-435-5563
OH Cincinnati, Graham Elctrns./Bell Inds. 513-772-1661
OH Columbus, Graham Elctrns./Bell Inds. 614-895-1590
OH Dayton, Marshall Inds. 513-236-8088
OH Solon, Arrow Elctrns., Inc. 216-248-3990
OH Solon, Hall-Mark/Cleveland 216-349-4632
OH Solon, Marshall Inds. 216-248-1788
OH Westerville, Hall-Mark Elctrns. Corp. ... 614-891-4555
OK Tulsa, Hall-Mark/Tulsa 918-665-3200
OR Tigard, Moore Elctrns. 503-684-3100
PA McKean, ADVACOM/Erie 814-476-7774
PA Monroeville, Arrow Elctrns., Inc. 412-856-7000
PA Philadelphia, Philadelphia Elctrns., Inc. 215-568-7400
TN Nashville, Graham Elctrns./Bell Inds. 615-242-2682
TX Austin, Arrow Elctrns., Inc. 512-835-4180
TX Austin, Hall-Mark/Austin 512-258-8848
TX Austin, Southwest Elctrns., Inc. 512-837-8971
TX Dallas, Arrow Elctrns., Inc. 214-386-7500
TX Dallas, Hall-Mark Elctrns., Inc. 214-341-1147
TX Dallas, Marshall Inds. 214-233-5200
TX Houston, Arrow Elctrns., Inc. 713-491-4100
TX Houston, Hall-Mark/Houston 713-781-6100
TX Richardson, Southwest Elctrns., Inc. ... 214-234-3050
TX Stafford, Southwest Elctrns., Inc. 713-491-4900
UT Salt Lake City, Bell Inds. 801-972-6969
WA Bellevue, Arrow Elctrns., Inc. 206-643-4800
WA Seattle, Zepher Elctrn. Sls. Corp. 206-241-1980
WI Oak Creek, Arrow Elctrns., Inc. 414-764-6600
WI Oak Creek, Hall-Mark/Milwaukee 414-761-3000
WI Waukesha, Bell Inds. 414-547-8879

CTS CORPORATION, Asheville Division, P.O. Box 100, Skyland, NC 28776, Tel: 704-684-6451, TWX: 510-935-0059; *Sls. Mgr.:* T. B. Haney

'Refer to CTS Corp., Elkhart, IN, for sales offices & representatives & for distributor listings.'

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CTS CORPORATION, Berne Division, 406 Parr Rd., Berne, IN 46711, Tel: 219-589-3111, TWX: 810-323-1580; Empl.: 1100; *Sls. Mgr.:* Scott Bowman; *Dist. Mgr.:* Cliff Stults ..... **A•1836-1844, 2011**

'Refer to CTS Corp., Elkhart, IN, for sales offices & representatives & for distributor listings.'

CTS CORPORATION, Bentonville Division, 1300 S.E. 8th St., Bentonville, AR 72712, Tel: 501-273-9036

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CTS OF CANADA, LTD., 80 Thomas St., Streetsville, Ontario, Can. L5M 1Y9, Tel: 416-826-1141

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CTS ELECTRONICS CORP., PASO ROBLES DIV., Electromechanical Gp., 500 Linne Rd., Paso Robles, CA 93446, Tel: 805-238-0350, TWX: 910-351-6796; *Sls. Mgr.:* Jack Bell; *Dist. Mgr.:* Bob Tarkenton ..... **B•1542-1546**

'Refer to CTS Corp., Elkhart, IN, for sales offices & representatives & for distributor listings.'

CTS FABRI-TEK CONNECTOR INC., 9210 Science Center Dr., Minneapolis, MN 55428, Tel: 612-533-3533, TWX: 910-576-2717; FSC No.: 16512; Empl.: 300; *Sls. Mgr.:* John B. McKee

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CTS FABRI-TEK, INC., CTS Corporation, 6900 Shady Oak Rd., Eden Prairie, MN 55344, Tel: 612-941-9100, TWX: 910-576-2913; FSC No.: 21542; Empl.: 1400; *Sls. Mgr.:* Bruce Richardson

'Refer to CTS Corp., Elkhart, IN, for sales offices & representatives & for distributor listings.'

CTS CORPORATION, Elkhart Division, 1142 W. Beardsley Ave., Elkhart, IN 46514, Tel: 219-295-3575

Refer to CTS Corp., Elkhart, IN, for sales offices and representatives and for distributor listings.

CTS ELECTRONICS CORP.,, Knights Division, 400 Reimann Ave., Sandwich, IL 60548, Tel: 815-786-8411, TWX: 910-642-0860; Empl.: 500; *Sls. Mgr.:* Larry Barbary; *Dist. Mgr.:* Larry Barbary ..... **A•1336-1357**

'Refer to CTS Corp., Elkhart, IN, for sales offices & representatives & for distributor listings.'

CTS CORPORATION, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906, Tel: 317-463-2565, TWX: 810-342-1882; Empl.: 505; *Sls. Mgr.:* David C. Anderson ..... **A•1662-1667**

'Refer to CTS Corp., Elkhart, IN, for sales offices & representatives & for distributor listings.'

CTS ELECTRONICS CORP., Halex Division, 1202 McGaw Ave., Irvine, CA 92714, Tel: 714-261-6381, TWX: 910-595-2648; Empl.: 70; *Sls. Mgr.:* Gene P. Markley ..... **A•1662-1667**

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CTS CORPORATION, Monon Division, Highway 16 West, Monon, IN 47959, Tel: 219-253-6666

Refer to CTS Corp., Elkhart, IN, for sales offices and representatives and for distributor listings.

CTS ELECTRONICS CORP., San Jose Division, 660 Lenfest Rd., San Jose, CA 95133, Tel: 408-251-1600, Telex: 910-997-8006; Empl.: 500; *Sls. Mgr.:* Ed King; *Dist. Mgr.:* Charles Nadler

'Refer to CTS Corp., Elkhart, IN, for sales offices & representatives & for distributor listings.'

CTS FABRI-TEK CONNECTOR, INC., 400 Cokato St., Cokato, MN 55321, Tel: 612-941-9100

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CTS PRINTEX, INC., Circuits Division, 47010 Kato Rd., Fremont, CA 94538, Tel: 415-659-1770

Refer to CTS Corp., Elkhart, IN, for sales offices and representatives and for distributor listings.

CTS CORPORATION, Tool, Die & Machine Division, 3000 Engle Rd., Fort Wayne, IN 46809, Tel: 219-747-0531

Refer to CTS Corp., Elkhart, IN, for sales offices and representatives and for distributor listings.

CUESTA SYSTEMS, INC., 3440 Roberto Ct., San Luis Obispo, CA 93401, Tel: 805-541-4160; *Sls. Mgr.:* David V. Dickey

CUPLEX, INC., 1500 E. Hwy. 66, Garland, TX 75040, Tel: 214-276-0333, TWX: 910-860-5098; *Sls. Mgr.:* Grady C. Young

CURRENTECHNOLOGY CORP., 135 Prestige Pk. Circle, E. Hartford, CT 06108, Tel: 203-289-6831, TWX: 710-425-6063; *Sls. Mgr.:* Bob Ramage

CURRENT TECHNOLOGY, INC., 1400 S. Sherman, #202, Richardson, TX 75081, Tel: 214-238-5300; *Sls. Mgr.:* Barry Epstein; *Dist. Mgr.:* Peter Diamond

CURTIS ELECTRO DEVICES, INC., Box 4090, Mountain View, CA 94040, Tel: 415-964-3846; Empl.: 12; *Sls. Mgr.:* J. Curtis

CURTIS INDS., 8000 West Tower Ave., Milwaukee, WI 53223, Tel: 414-354-1500, TWX: 910-262-3035; FSC No.: 73631; Empl.: 160; *Sls. Mgr.:* P. J. McDonnell; *Dist. Mgr.:* A. M. Hungsberg ..... **A•1599; C•1178; D•1978**

Local Sales Offices & Reps

AL	Huntsville, K & E Assocs.	205-883-9720
AZ	Scottsdale, Memco Sls., Inc.	602-952-2254
AR	Hot Springs, Automation Supp., Inc.	501-767-5444
CA	Fullerton, GRU Assocs.	714-738-0903
CA	Santa Clara, Gagner-Toomey Assocs., Inc.	408-244-2200
CO	Parker, TMA/COLORADO	303-841-3435
CT	Milford, Sales Engrg.	203-877-2001
CT	New Fairfield, Sales Engrg. Co.	203-746-5604
FL	Altamonte Springs, Lawrence Assocs.	305-339-3855
FL	Boca Raton, Lawrence Assocs.	305-368-7373
FL	Clearwater, Lawrence Assocs.	813-584-8110
FL	W. Melbourne, Lawrence Assocs.	305-724-8294
GA	Doraville, K & E Assocs.	404-448-7025
IL	Downers Grove, Richmar Elctrns. Corp.	312-968-0118
MD	Gaithersberg, Naudain Assocs., Southern	301-258-5040
MI	Farmington Hills, W. R. Hummon & Assocs. Inc.	313-474-0661
MN	Spring Lake Park, Holmgren Assocs. Inc. of MN	612-786-7641
MO	Kansas City, Delltron Co., Inc.	816-436-6445
MO	St. Louis, Delltron Co., Inc.	314-869-4779
NH	Salem, Sales Engrg. Co.	603-893-5521
NJ	Manville, DynoRep, Inc.	201-685-0135
NJ	Marlton, Naudain Assocs.	609-235-1801
NY	Rochester, Ossmann Comp. Sls.	716-424-4460
NY	Syracuse, Ossmann Comp. Sls.	315-455-6611
NY	Vestal, Ossmann Comp. Sls. Corp.	607-754-3264
NC	Raleigh, Crossroads Elctrn. Assocs.	919-362-4099
OH	Aurora, Nationwide Comps., Inc.	216-425-3896
OH	Carmel, Nationwide Comp., Inc.	317-872-7207
OH	Dayton, Nationwide Comps., Inc.	513-299-5174
OH	Willoughby, Nationwide Comp.	216-946-3226
OR	Portland, Electronic Mktg., Inc.	503-252-0610
RI	Warwick, Sales Engrg.	401-738-1319
TN	Signal Mountain, Automation Supp., Inc.	615-866-6623
TX	Arlington, ProComp Sls. Co.	817-640-4336
TX	Houston, ProComp Sls. Co.	713-556-9622
UT	Salt Lake City, TMA/COLORADO	801-483-1009
WA	Redmond, Electronic Mktg. Grp.	206-883-0962
WI	Milwaukee, Richmar Elctrns.	414-781-1730
Can	Ontario, Chartwell Elctrns.	416-477-0400

Local Distributors

AL	Birmingham, M. G. Elctrns. & Equip.	205-328-4525
AL	Montgomery, Southern Controls	205-277-5030
AZ	Phoenix, Dalis Elctrns. Supp.	602-258-8151
AZ	Phoenix, Electro-Comps. Distr.	602-258-2665
AZ	Phoenix, McGraw Edison Co.	602-275-4731
AR	El Dorado, Electra Inc.	501-862-4901
CA	Buena Park, Control Design	714-521-5040
CA	Burlingame, Rose Elctrns.	415-348-2740
CA	Orange, County Wholesale Elec.	714-633-6440
CA	San Carlos, Control Design Supp.	415-592-4806
CA	San Jose, Rose Elctrns.	408-263-9700
CA	Santa Clara, Allied Elctrns.	408-985-2323
CA	Santa Monica, Master Distrs.	213-395-2637
CA	So. San Francisco, Steven Engrg.	415-583-5868
CO	Colorado Springs, Summit Fasteners	303-593-7700
CO	Denver, Integrated Elctrns.	303-534-6121
CT	Fairfield, W.M. Entprs.	203-333-0129
CT	Hartford, Electrical Supp.	203-527-7111
FL	Alta Monte, Control Des. Supp.	305-788-3220
FL	Lakeland, A-A Electric	813-665-6941
FL	Miami, Elctrn. Equip.	305-871-3500
FL	Miami, Hummel Indl. Sls.	305-651-0196
FL	Winter Park, Deanco	305-671-5100
GA	Atlanta, A.C. Equip.	404-451-2747
GA	Atlanta, A-A Electric	404-449-8670
GA	Dalton, Dick Henderson Indl.	404-278-8307
GA	Marietta, Deanco	404-429-0126
GA	Stone Mountain, Control Des. Supp.	404-979-3500
IL	Addison, Lectro Comps.	312-543-1680
IL	Chicago, Electro-Kinetics	312-595-6700
IL	Elgin, Allied Elctrns.	312-697-8200
IL	Elk Grove Village, Nu-Way Elctrns.	312-437-7120
IL	Genoa, Control Des. Supp.	815-784-6515
IL	Hoffman Estates, Control Design	312-882-7232
IL	Palatine, OHM Elctrns.	312-359-5500
IL	Peoria, Klaus Radio & Elec.	309-691-4840
IL	Quincy, Klaus Radio, Inc.	217-223-7560
IL	Rockford, Muntz Elec.	815-968-8866
IN	Elkhart, Elkhart Supp.	219-264-4156
IN	Ft. Wayne, Graham Elec.	219-423-3422
IN	Indianapolis, Control Design	317-788-4559
IN	Indianapolis, Graham Elctrns.	317-634-8202
IN	Indianapolis, Peerless Elctrn.	317-635-2361
IN	Mishawaka, Panel Parts	219-259-0026
IN	South Bend, Koontz-Wagner Elec.	219-232-2051
IN	Wabash, Wabash Elec. Supp.	219-563-4146
IA	Marion, Brenneman & Assocs.	319-377-6394
IA	Marion, Control Des. Supp.	319-373-2923
IA	West Des Moines, Ramco	515-225-6933
KS	Kansas City, Kornfeld-Thorp Elec.	913-321-7070
KS	Wichita, L Comp	316-265-5100
KY	Lexington, American Elec. Supp.	606-353-5664
KY	Louisville, Peerless Elctrn. Equip.	502-637-7677
LA	Harahan, MG Elctrn.	504-733-0070
LA	Lafayette, Ralph's Indl. Elctrns.	318-234-4507
ME	Aberdeen, Harco Elctrns.	301-838-7990
ME	Portland, Leen Co.	207-774-6266
ME	Portland, Rockingham Elec. Supp.	207-772-4614
MD	Gaithersburg, Deanco	301-948-5444
MA	Allston, Apparatus Svc.	617-787-1300
MA	Middleboro, Glynns Elctrns.	617-947-4262
MA	Springfield, T. F. Cushing	413-788-7341
MA	West Springfield, Control Engrg.	413-781-1330
MA	Woburn, Brownell-Electro	617-935-7820
MI	Augusta, Great Lakes Elctrns.	616-731-4156
MI	Detroit, Madison Elec.	313-875-1560
MI	Grand Rapids, S-F Elctrn. Supp.	616-495-0216
MI	Hibbing, NWR Elctrns. Corp.	218-262-5228
MI	Madison Hgts., McNaughton-McKay	313-399-7500
MI	Muskegon, Fitzpatrick Elec. Supp.	616-722-6621
MN	Minneapolis, Control Design	612-721-1628
MN	Minneapolis, Stark Elctrn. Supp.	612-332-1325
MO	Maryland, Lcomp St. Louis	314-291-6200
MO	St. Louis, Control Design	314-426-3150
MO	St. Louis, L Comp, Inc.	314-291-6200
NJ	Englewood, Techn. Elctrn. Distrs.	201-894-0800
NJ	Fairfield, Relay Specialties	201-797-3313
NY	Albany, Adirondack Elctrns.	518-456-0203
NY	Bohemia, Kay Comp.	516-567-7500
NY	Buffalo, Wehle Elec.	716-854-3270
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Hempstead, Elctrn. Equip.	516-538-5510
NY	Henrietta, CAM/RPC Ind.	716-334-5510
NY	Ithaca, Deanco, Inc.	607-257-4444
NY	Mamaroneck, Logicomp Elec.	914-698-9332
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Rochester, Wehle Elec.	716-275-0200
NC	Charlotte, Dixie Elctrns.	704-377-5413
NC	Greenboro, Hammond Elec.	919-275-6391
NC	Greensboro, Hammond Elect.	919-275-6391
NC	Winston-Salem, Dixie Elctrns.	919-724-5961
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Akron, Akron Elctrn. Supp.	216-773-9183
OH	Cincinnati, Hughes-Peters	513-251-2000
OH	Cleveland, Gateway Megatech	216-944-5801
OH	Columbus, Hughes-Peters	614-294-5351
OH	Columbus, McJunkin Corp.	614-294-3711
OH	Dayton, Esco Inc.	513-226-1133
OH	Toledo, Girkins Elec.	419-243-9238
OH	Warren, REM Elctrn. Supp.	216-373-1300
OH	Wickliffe, Gateway Megatech	216-444-5801
OK	Tulsa, Altair Co.	918-252-5781
OK	Tulsa, Oil Capitol Elctrns.	918-622-8520

PA Erie, REM Elctrns. 814-453-5626
PA Malvern, Control Design 215-296-0150
PA McKean, Advacom 814-476-7774
PA Philadelphia, Lindley Elec. 215-329-7005
PA Pittsburgh, CAM/RPC Indl. Elctrns. ... 412-782-3770
PA Pittsburgh, Mosebach Elec. 412-488-5000
PA Yeadon, Earl B. Beach Co. 215-622-2210
PA York, Electronic Comp. 717-843-8971
SC Columbia, Dixie Elctrns. 803-779-5332
SC Florence, Dixie Elctrns. 803-669-8201
SC Greenville, Dixie Elctrns. 803-232-5357
SC Greenville, Hammond Elctrns. 803-233-4121
TN Knoxville, Dixie Elctrns. 615-938-4131
TX Austin, Active Comp. Tech. 512-452-5254
TX Austin, Altair Co. 512-837-4970
TX Dallas, Active Comp. Tech. 214-980-1880
TX Dallas, Control Design 214-358-1441
TX Fort Worth, Allied Elctrns. 817-336-5401
TX Houston, Active Comp. Tech. 713-496-4000
TX Houston, Altair Co. 713-462-3029
TX Richardson, Altair Co. 214-231-5166
UT Salt Lake City, Kimball Elctrn. 801-328-2075
VA Richmond, Sterling Elctrns. 804-226-2190
WA Kent, C. B. Parsons & Co. 206-762-7373
WA Seattle, C. B. Parsons & Co. 206-762-7373
WI Cedarburg, A-A Electric 414-377-8000
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WI Milwaukee, Marsh Elctrns. 414-475-6000
WI Milwaukee, Midwestern Elec. 414-449-1500
WI New Berlin, Control Design 414-784-1015

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CURTIS INSTRS., INC., 200 Kisco Ave., Mt. Kisco, NY 10549, Tel: 914-666-2971, TWX: 710-571-2163; FSC No.: 18530; Empl.: 95; *Sls. Mgr.:* Rhoda McDonald ..**D•1117**

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CA Burlingame, Polach & Bensinger 415-697-2525
CA Seal Beach, Texel Engrg. 213-596-9411
CO Littleton, Grifco 303-795-1989
FL Longwood, NSL Assocs. 305-629-5226
IL La Grange Park, Bierhaus Sls. 312-354-5100
IN Ft. Wayne, Aktron Sls. 219-747-3650
MA Brookline, Harman Assocs. 617-232-6687
MN Minnetonka, S. J. Collins 612-933-7661
NY Manhasset, WinCor Elctrn. Sls. Corp. ... 516-627-9474
OH Chagrin Falls, K. F. Naverz 216-338-8450
PA Media, W. Reeves Assocs. 215-566-6709
TX Dallas, Etron Corp. 817-498-8924
WA Lynnwood, Blum & Assocs. 206-775-6656
WI Milwaukee, Bierhaus Sls. 414-963-0318

CUSHMAN ELCTRNS., 2450 N. 1st St., San Jose, CA 95131, Tel: 408-263-8100, TWX: 810-338-0556; Empl.: 400; *Sls. Mgr.:* Harris Fuller

CUSTOM CABLE, 242 Butler, Westbury, NY 11590, Tel: 516-334-3600; Empl.: 15; *Sls. Mgr.:* J. Michelman; *Dist. Mgr.:* D. Pollack

CUSTOM COIL & TRANSFORMER, Box 2369, Zanesville, OH 43701, Tel: 614-452-6973, TWX: 810-238-2629; Empl.: 80

CUSTOM CONNECTOR, 1738 E. 30th St., Cleveland, OH 44114, Tel: 216-241-1679; Empl.: 36; *Sls. Mgr.:* Larry Weider

CUSTOM CONTROL SYS., 21 E. Canon Perdido St., Santa Barbara, CA 93101, Tel: 805-965-7577; Empl.: 2; *Sls. Mgr.:* Fred Winter

CUSTOM ELCTRNS., Browne St., Oneonta, NY 13820, Tel: 607-432-3880, TWX: 510-241-8292; FSC No.: 23280; Empl.: 110; *Sls. Mgr.:* D. Hathaway

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CA Brea, Masco Elec. 714-529-0866
CA San Jose, Richards Assocs. 408-297-3010
IL Chicago, Rozner Sls. 312-283-0022
MD Ellicot City, Nelson Assocs. 301-747-7887
MA Stow, Musello Assocs. 617-369-5900
TX Houston, Custom Elctrns., Inc. 713-686-4874
EXP NY, Baldwin, Milano Bros. Intl. 516-223-9000

CUSTOM PRODS. GRP., Sys. Dev. Corp.-A Burroughs Co., P.O. Box 517, Paoli, PA 19301, Tel: 215-648-7660, Telex: 215-647-9961, TWX: 510-668-7243; *Sls. Mgr.:* Spiro Greenwood; *Dist. Mgr.:* Sarah Jones-Chambers

CUSTOM SCI. INSTRS., 13 Wing Dr., Cedar Knolls, NJ 07927, Tel: 201-538-8500, Telex: 25-4328; Empl.: 20; *Sls. Mgr.:* Henry J. Bultman, Jr.

CUTLER HAMMER GRP., EATON CORP., Aerospace Controls/Systems Div., 2074 Whitfield Ave. East, Sarasota, FL 33578, Tel: 813-758-7726

CUTLER-HAMMER, INC., SHALLCROSS RESISTOR PRODS., See RCL Shallcross, Inc.

CUTLER-HAMMER PRODS., See Eaton Corp./Cutler-Hammer Prods.

CVC PRODS., 525 Lee Rd., Rochester, NY 14603, Tel: 716-458-2550, Telex: 97-8269; Empl.: 160; *Sls. Mgr.:* Steven Rothstein

CW INDUSTRIES, 130 James Way, Southhampton, PA 18966, Tel: 215-355-7080, Telex: 831470; FSC No.: 79727; Empl.: 450; *Sls. Mgr.:* Keith D. Nelson

CYBERNETIC MICRO SYS., P.O. Box 3000, 3000 Hwy. 84, San Gregorio, CA 94074, Tel: 415-726-3000, Telex: 171-135 Attn: CYBERNETICS; *Sls. Mgr.:* K. Moty

CYBERSONIC CORP., Box 38, Glenside, PA 19038, Tel: 215-885-1734, Telex: 83-4753; Empl.: 11; *Sls. Mgr.:* Norman Rivers

CYBERSYSTEMS, INC., 7540 South Memorial Pkwy., Huntsville, AL 35802, Tel: 205-883-4410; FSC No.: 66; Empl.: 25; *Sls. Mgr.:* Mike Long

CYBER SYS., INC., 2031 E. Cerritos Ave., Anaheim, CA 92806, Tel: 714-722-2051, Telex: 692-375; *Sls. Mgr.:* Charles Muhle

CYCLO-TRONICS, INC., 1345 N. Old Rand Rd., Wauconda, IL 60084, Tel: 312-526-0800; Empl.: 10

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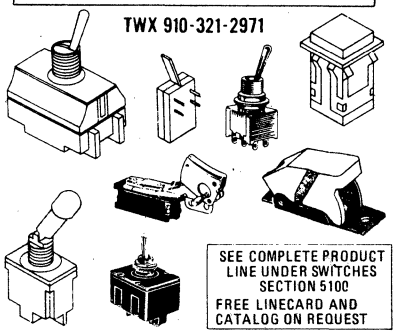
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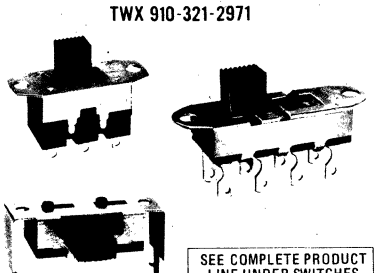
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CYTEC CORP., 107 N. Washington St., E. Rochester, NY 14445, Tel: 716-381-4740; *Sls. Mgr.:* Harry Turner ..... **D•1207**

Local Sales Offices & Reps

MA Burlington, Tritek 617-272-4550
NY Frankfort, Kapital Sls. 315-896-4225

DABURN ELCTRNS. & CABLE, 70 Oak St., Norwood, NJ 07648, Tel: 201-768-5400, TWX: 710-991-9856; FSC No.: 25706; *Sls. Mgr.:* Randy Hibshman ... **C•1828-1837**

Local Sales Offices & Reps

CA Anaheim, Galaxie Sls. 714-752-1580
CA Palo Alto, Reliable 415-494-3266
CO Aurora, Sage Sls. 303-750-3501
FL Casselberry, H A, Inc. 305-695-8592
FL Coral Springs, H A, Inc. 305-752-7520
GA Atlanta, Eff Mktg. Force 404-948-6023
IL Elgin, Markar Sls. 312-888-2207
IN Carmel, STB & Assocs. 317-844-9227
LA Kenner, Assoc. Mktg. Grp. 504-443-5072
MA No. Scituate, W. A. Hendrickson 617-545-0652
MI Grand Rapids, Carl Orwant Assocs. ... 616-241-4927
MN Minneapolis, R. K. Sls. 612-786-5713
MO Raytown, Marty Taraski 816-358-1442
NY N.Y.C., Robt. Smith Assocs. 212-541-4885
NY Plainview, Robt. Smith Assocs. 516-681-3155
OH Cincinnati, John Olsen Co. 513-574-7711
OH Goshen, John Olsen Co. 513-722-1497
OR Hillsboro, Rhodes Sls. 503-640-6666
PA King of Prussia, Freedman-Malta 215-337-9211
PA Pittsburgh, John Olsen Co. 412-279-2550
TX Dallas, Assoc. Mktg. Grp. 214-241-7190
VA Arlington, Howard Golonpaul & Assocs. 703-525-5898
Can Montreal, Que., Avotronics 514-697-2135

DADEN ASSOCS., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653, Tel: 714-770-1522, TWX: 910-596-1324; FSC No.: 57032; Empl.: 26; *Sls. Mgr.:* Dennis Hook

Local Sales Offices & Reps

CA Los Angeles, McDougall-McLaughlin .. 213-477-8556
CA Saratoga, E. Reid Miller Corp. 408-257-6927
FL Winter Park, Microwave Mktg. 305-678-2141
MA Chelmsford, BBC 617-256-6593
TX Dallas, Southwest Microwave Elctrns. 214-669-1195

DAICO INDUSTRIES, INC.

DAICO INDS., INC., Box 5225, Compton, CA 90224, Tel: 213-631-1143, TWX: 910-346-6741; FSC No.: 28983; Empl.: 170; *Sls. Mgr.:* James Adamson ... **A•1708-1709**

Local Sales Offices & Reps

AZ Phoenix, Faser Tech. Sls. 602-948-4404
CA Los Altos, Cain-White & Co. 415-948-6533
CA Los Angeles, Midwin & Olifson 213-838-3455
CA San Diego, Midwin & Olifson, Inc. 619-571-0177
FL Palm Bay, Spartech Assocs. 305-727-8045
GA Smyrna, Spartech Assocs. 404-446-7300
IL Mt. Prospect, Cain-Forlaw Co. 312-253-3578
ME Ogunquit, Micronic Assocs. 617-933-2121
MD Burtonsville, Eastern Instrmn. 301-384-8500
NJ Hackensack, Technical Mktg. Assocs. 201-342-4008
OH Lancaster, Cain-Forlaw Co. 614-654-4800
PA Newtown Square, SWR Assocs. 215-353-6711
TX Dallas, McDonald Assocs. 214-238-1858

DAI-ICHI SHOJI OF AMER., INC., 150 Fifth Ave., New York, NY 10011, Tel: 212-691-9050, Telex: 429120 DSANY; Empl.: 3; *Sls. Mgr.:* A. Takayama ..... **A•1071; B•1548-1549; C•1179**

DALE ELECTRONICS, INC., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601, Tel: 402-564-3131; FSC No.: 91637; Empl.: 2800; *Sls. Mgr.:* Darrel Smejkal; *Dist. Mgr.:* Jerry Jilek ..... **B•1025-1027**

Local Sales Offices & Reps

AL Huntsville, JWL Assocs. 205-883-1712
AZ Tempe, Dale Elctrns. Sls. 602-966-0291
CA Los Alamitos, Reed Elctrn. Mktg. 213-598-6676
CA Redwood City, J. S. Heaton Co. 415-367-9000
CA San Diego, Reed Elctrn. Mktg. 619-452-1456
CO Loveland, Dale Elctrns. Sls. 303-667-7500
FL Lake Park, Graham Assocs. 305-622-4049
FL Melbourne, Graham Assocs. 305-773-6631
FL Winter Garden, Graham Assocs. 305-656-9369
GA Marietta, JWL Assocs. 404-429-8010
ID Boise, LD Elctrns. 208-343-2741
IL Chicago, Indl. Reps. 312-647-7755
IN Fort Wayne, Scott Elctrns. 219-484-7865
IN Indianapolis, Scott Elctrns. 317-897-9976
KS Shawnee Mission, Dale Sls. 913-432-9140
MD Glen Burnie, Tri-Mark 301-761-6000
MA Wakefield, Howard C. Jappe Co. 617-245-9359
MI Plymouth, Jay Mktg. Assocs. 313-459-1200
MN Bloomington, Merrill Franklin Co. 612-854-9446
MO St. Louis, Industrial Reps., Inc. 314-227-7401
NJ Fairlawn, Kaelber & Mack 201-797-7782
NY Commack, Kaelber & Mack 516-499-2924
NY Ithaca, Dale Elctrns. Sls. 607-272-6212
NC Pineville, JWL Assocs. 704-541-5750
NC Raleigh, JWL Assocs. 919-787-4826
OH Cincinnati, Scott Elctrns. 513-791-2513
OH Cleveland, Scott Elctrns. 216-473-5050
OH Dayton, Scott Elctrns., Inc. 513-294-0539
OH Reynoldsburg, Scott Elctrns. 614-863-1281
OR Beaverton, LD Elctrns. 503-649-6177
PA Horsham, TMI 215-441-4300
PA Pittsburgh, Scott Elctrns. 412-963-6116
TX Dallas, E. F. Aymond Co. 214-826-7620
TX Houston, E. F. Aymond Co. 713-880-8229
TX San Antonio, E. F. Aymond Co. 512-366-1526
WA Snohomish, LD Elctrns. 206-568-0511
WA Spokane, LD Elctrns. 509-922-4883
WI Milwaukee, Indl. Reps. 414-259-0965

Local Distributors

AL Huntsville, Hamilton/Avnet 205-837-7210
AZ Phoenix, T.T.I., Inc. 602-861-0222
AZ Tempe, Acacia Sls., Inc. 602-894-2874
AZ Tempe, Hamilton/Avnet 602-231-5100
AZ Tempe, Shelley Elctrns. 602-894-2058
CA Chatsworth, Avnet Elctrns. 818-700-6264
CA Chatsworth, Hamilton/Avnet 818-700-6536
CA Chatsworth, Shelly Elctrns. 818-998-3333
CA Chatsworth, T.T.I., West 818-709-1010
CA Costa Mesa, Avnet Elctrns. 714-754-6021
CA Costa Mesa, Hamilton Electro Sls. 714-641-4100
CA Culver City, Hamilton Electro Sls. 213-558-2883
CA Culver City, Hamilton/Avnet 213-558-2662
CA Huntington beach, Inductor Supp., Inc. 714-891-4524
CA Irvine, Acacia Sls. 213-971-2428
CA Ontario, Hamilton/Avnet 714-989-8816
CA Sacramento, Hamilton/Avnet 916-920-3150
CA San Diego, Anacia Sls., Inc. 619-565-4365
CA San Diego, Hamilton/Avnet 619-571-7536
CA San Diego, Shelley Elctrns. 619-453-7133
CA San Jose, Shelley Elctrns. 408-942-9111
CA San Jose, T.T.I., Inc. 408-943-9155
CA Sunnyvale, Acacia Sls. 408-745-7200
CA Sunnyvale, Hamilton/Avnet 408-734-3358
CO Boulder, Shelley Elctrns. 303-442-2718
CO Commerce City, Waco Elctrns. 303-289-4743
CO Denver, Newark Elctrns. 303-757-3351
CO Englewood, Hamilton/Avnet 303-740-1020
CO Lakewood, Acacia Sls., Inc. 303-232-2882
CT Danbury, Hamilton/Avnet 203-797-2802
CT Stratford, Electro/Comp. 203-375-5811
FL Ft. Lauderdale, Hamilton/Avnet 305-979-5211
FL Orlando, T.T.I., II 305-859-1000
FL Palm Beach Gardens, Legri S. Resistor 305-845-7101
FL St. Petersburg, Hamilton/Avnet 813-576-3930
FL Tampa, Shelley Elctrns., Inc. 813-884-0946
FL Winter Park, Hamilton/Avnet 305-628-3888
GA Atlanta, Specialty Distr. Co., Inc. 404-873-2521
GA Norcross, Hamilton/Avnet 404-447-7504
GA Norcross, T.T.I., Inc. 404-662-0911
IL Bensenville, Hamilton/Avnet 312-860-8558
IL Chicago, Bell Ind. 312-982-9210
IL Chicago, Newark Elctrns. 312-638-4411
IL Crystal Lake, Sub-Sem 815-459-4139
IL Palatine, Ohm Elctrns. 312-359-5500
IN Carmel, Hamilton/Avnet 317-844-9333
IN Ft. Wayne, Graham Elctrns. 219-423-3422
IN Indianapolis, Graham Elec. 317-634-8202
IA Cedar Rapids, Deeco, Inc. 319-365-7551
IA Cedar Rapids, Hamilton/Avnet 319-362-4757
KS Overland Park, Hamilton/Avnet 913-541-7922
MD Beltsville, RESCO 301-937-9100
MD Columbia, Hamilton/Avnet 301-995-3525
MD White Marsh, RESCO 301-529-0500
MA Billerica, A. W. Mayer Co. 617-229-2255
MA Waltham, Sterling Elctrns. 617-894-6200
MA Woburn, Hamilton/Avnet 617-273-7562
MA Woburn, T.T.I. 617-938-8800
MI Grand Rapids, Hamilton/Avnet 616-243-8805
MI Grand Rapids, S-F Elctrn. Supp. 616-459-0216
MI Livonia, Hamilton/Avnet 313-522-4700
MI Livonia, R-S Elctrns. 313-525-1155
MI Livonia, Reptron Elctrns. 313-525-2700
MI Oak Park, Newark Elec. 313-967-0600
MN Minneapolis, Stark Elctrns. 612-332-1325
MN Minnetonka, Hamilton/Avnet 612-932-0674
MO Earth City, Hamilton/Avnet 314-344-1254
NH Manchester, Hamilton/Avnet 603-524-9400
NJ Cherry Hill, Hamilton/Avnet 609-424-0117
NJ Cranford, G.S.I. Elec. 201-272-6400
NJ Fairfield, Hamilton/Avnet 201-575-3490
NJ Kenilworth, Federated Purchaser 201-272-0505
NM Albuquerque, Hamilton/Avnet 505-765-1500
NY Bohemia, Shelley Elctrns., Inc. 516-567-7751
NY Bohemia, L.I., T.T.I., New York 516-567-1500
NY Buffalo, Summit Distr. 716-884-3450
NY E. Syracuse, Hamilton/Avnet 315-437-2641
NY Endwell, A.S.I. Elctrns. 607-754-3823
NY Farmingdale, Command Elctrns. 516-293-1212
NY Hauppauge, Fairmont 516-231-3313
NY Hauppauge, Hamilton/Avnet 516-231-9800
NY Rochester, Hamilton/Avnet 716-475-9130
NY Rochester, Simcona Elctrns. 716-328-3230
NY Rome, Rome Elctrns. 315-337-5400
NY Valley Stream, L&S Elctrns. 516-561-2474
NY W. Hempstead, March Elctrns. 516-486-6511
NC Raleigh, Hamilton/Avnet 919-878-0819
NC Raleigh, RESCO 919-781-5700
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Cleveland, Hamilton/Avnet 216-831-3500
OH Cleveland, Pioneer Standard 216-587-3600
OH Dayton, Hamilton/Avnet 513-439-6700
OH Dayton, Pioneer Standard 513-236-9900
OH Dayton, Stotts-Friedman Co. 513-298-5555
OH Westerville, Hamilton/Avnet 614-882-7004
OK Tulsa, Radio, Inc. 918-587-9123
OR Beaverton, Acacia Sls. 503-646-3377
OR Lake Oswego, Hamilton/Avnet 503-635-8831
OR Portland, Radar Elec. 503-232-3404
PA McKean, Advacom 814-476-7774
PA Philadelphia, Herbach & Rademan 215-426-1700
PA Pittsburgh, CAM/RPC 412-782-3770
PA Pittsburgh, Hamilton/Avnet 412-281-4150
PA York, E.C.I., Inc. 717-846-5334
TX Austin, Hamilton/Avnet 512-837-8911
TX Dallas, Sterling Elctrns. 214-243-1600
TX Ft. Worth, T.T.I., Inc. 817-831-0441
TX Houston, Hamilton/Avnet 713-975-3516
TX Houston, Lenert Co. 713-225-1465
TX Houston, Sterling Elctrns. 713-627-9800
TX Irving, Hamilton/Avnet 214-659-4111
UT Salt Lake City, Hamilton/Avnet 801-972-2800
WA Bellevue, Hamilton/Avnet 206-453-5842
WA Seattle, Radar Elec. 206-282-2511
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI New Berlin, Hamilton/Avnet 414-784-4510

DALE ELECTRONICS, INC., El Paso Div., P.O. Box 26728, El Paso, TX 79926, Tel: 915-592-3253; FSC No.: 91637; Empl.: 272; *Sls. Mgr.:* Douglas Wagenknecht; *Dist. Mgr.:* Jerry Jilek ..... **A•1845-1863**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE ELECTRONICS, INC., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, Tel: 402-371-0080; FSC No.: 91637; Empl.: 1200; *Sls. Mgr.:* Jim Filips; *Dist. Mgr.:* Jerry Jilek ..... **B•1748-1749**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE ELECTRONICS, INC., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, Tel: 602-967-7874; FSC No.: 22929; Empl.: 139; *Sls. Mgr.:* Mike Brown; *Dist. Mgr.:* Jerry Jilek ..... **A•1358-1359**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE ELECTRONICS, INC., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, Tel: 605-665-9301; FSC No.: 09969; Empl.: 400; *Sls. Mgr.:* John Elliot; *Dist. Mgr.:* Jerry Jilek .... **A•1231-1237, 2125-2132; C•1180-1183**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE WESTERN THERMISTOR DIVISION, See Dale Norfolk Division

DAMON/ELCTRNS. DIV., 80 Wilson Way, Westwood, MA 02090, Tel: 617-329-2460, TWX: 710-348-6722; Empl.: 90; *Sls. Mgr.:* Edward J. Doherty ..... **A•1360**

Local Sales Offices & Reps

AZ Phoenix, Sanford Sls. Assocs. 602-957-3570

CA N. Hollywood, Jewett Co. 213-789-8103
CA Palo Alto, Waldman Assocs. 415-961-4100
DC Washington, Stemler Assocs. 301-944-8262
FL Melbourne, Repcom 305-254-1877
MD Baltimore, Stemler Assocs. 301-944-8262
MA Waltham, Del Tech Sls. 617-890-1020
NJ Cherry Hill, Stemler Assocs. 609-966-4070
NJ Hackensack, T.M.A. Assoc. 201-342-4008
NY Cazenovia, S. T. Wollard Co. 315-655-8145
TX Ft. Worth, El-Tec Sls. 817-268-2896

D & B POWER, INC.

D & B POWER, INC., 204 N. Fehr Way, P.O. Box 40M, Bayshore, NY 11706, Tel: 516-586-5955; FSC No.: 54337; Empl.: 25; *Sls. Mgr.:* Gordon Best; *Dist. Mgr.:* Dan Hall ..... **D•1610-1611**

Local Sales Offices & Reps
CA Pasadena, Electro Mecha. Instrs. 818-795-7193
CA Sunnyvale, Schwerin & Merrill 408-735-7900
MD Randallstown, Beacon North, Inc. 301-655-2265
NY Cortland, Net Sls. Co. 607-756-6592
NY DeRuyter, Net Sls. Co. 315-662-7996
NY East Setauket, Edgerton Elctrn. 516-751-7089
NY Fairport, Net Sls. Co. 716-467-4538
NY Troy, Net Sls. Co. 518-274-4758
VA Fairfax, Beacon North, Inc. 703-591-1300

Local Distributors
MA Shannon, Adcour, Inc. 617-784-8123

D & L SALES CO. INC., 296 Preakness Ave., Paterson, NJ 07502, Tel: 201-684-8223/8224; Empl.: 10

DMC DANIELS MANUFACTURING CORPORATION

DANIELS MFG. CORP., 6103 Anno Ave., Orlando, FL 32809, Tel: 305-855-6161, Telex: 564321; FSC No.: 5935; Empl.: 150; *Sls. Mgr.:* John Jago-Ford; *Dist. Mgr.:* Tina Holder ..... **C•1741**

Local Sales Offices & Reps
AZ Scottsdale, Nelligan Co. 602-990-1415
CA Irvine, DMC Western Sls. Off. 714-660-1901
CO Englewood, Nelligan 303-761-2121
CT Orange, DMC Northeastern Sls. Off. .. 203-799-2343
FL Zephyrhills, Tool Tronics & Hydrospace 813-782-7177
TX Fort Worth, Wadco 817-284-4445
UT Salt Lake City, Nelligan Co. 801-261-1121
WA Redmond, Pan Pacific Electronics 206-881-7252

Local Distributors
CA Burbank, Stratos, Inc. 213-245-8914
CO Englewood, Columbine Fabricators ... 303-761-2121
CT Hamden, Connector Company 203-288-0044
FL Zephyrhills, Tool Tronics & Hydrospace 813-782-7177
NJ South River, Da-Green Electronics 201-254-2735
TX Fort Worth, Wadco 817-284-4445
WA Redmond, Pan Pacific Electronics 206-881-7252
Can Ontario, Patlon Aircraft 416-624-5572

DAN-L INC., 229 Laurel Rd., E. Northport, NY 11731, Tel: 516-757-8000; FSC No.: 28327; Empl.: 22

DANMAR INDS., 9705 Lurline Ave., Chatsworth, CA 91311, Tel: 818-882-7979/5280; FSC No.: 31690; Empl.: 6; *Sls. Mgr.:* Mukund Patel

DANTEL, 2991 N. Argyle Ave., Fresno, CA 93727, Tel: 209-292-1111, Telex: 35-5457; FSC No.: 56960; Empl.: 110; *Sls. Mgr.:* Peter Normandin

DANTRONICS, INC., 3175 Hafner Ct., St. Paul, MN 55112, Tel: 612-484-2108; Empl.: 22

DASH, STRAUS & GOODHUE, INC., 593 Massachusetts Ave., Boxboro, MA 01719, Tel: 617-263-2662; Empl.: 7; *Sls. Mgr.:* Ira Barry

DASOFT DESIGN SYSTEMS, INC., 2550 9th St. # 113, Berkeley, CA 94710, Tel: 415-486-0822; Empl.: 8

DATABASE DESIGN INC., 2020 Hogback Rd., Ann Arbor, MI 48104, Tel: 313-971-5363, TWX: 810-223-2412; FSC No.: 7030-0003; Empl.: 35; *Sls. Mgr.:* Terry R. McGown

DATA, INC., 7702 Emerald Ave., Box 2071, Ft. Collins, CO 80525, Tel: 303-493-1222; Empl.: 3; *Sls. Mgr.:* Sharon Shilling; *Dist. Mgr.:* Sharon Shilling

D.A.T.A., INC., Cordura Co., P.O. Box 26875, San Diego, CA 92126, Tel: 619-578-7600, TWX: 910-322-1340; Empl.: 39

DATA CAPTURE TECHNOLOGY, Hathaway Instruments, 5436-F South Mingo Rd., Tulsa, OK 74146, Tel: 918-627-7521, Telex: 796355; FSC No.: 7E812; Empl.: 50; *Sls. Mgr.:* Gary DeShazer; *Dist. Mgr.:* Gary DeShazer

DATA CHECK CORP., 10070 Willow Creek Rd., San Diego, CA 92131, Tel: 619-578-0101, TWX: 910-335-1596; FSC No.: 55792; *Sls. Mgr.:* Al Agent

DATACHRON INC., 3186 J Airway Ave., Costa Mesa, CA 92626, Tel: 714-751-2211, Telex: 678401; FSC No.: 56259; Empl.: 16; *Sls. Mgr.:* Clyde Davis

DATACOM, INC., Box 278, Ft. Walton Beach, FL 32548, Tel: 904-244-6121, TWX: 510-730-7693; Empl.: 50

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DATACON, INC., 60 Blanchard Rd., Burlington, MA 01803, Tel: 617-273-5800, Telex: 951651; FSC No.: 617 273 4809; Empl.: 400; *Sls. Mgr.:* Stephen J. Day .... **C•1705**

Local Sales Offices & Reps
AZ Phoenix, Cristee - Meade Co. 602-867-6000
CA Chatsworth, DataCon 818-700-0600
CA Mountain View, DataCon 415-967-5700
CA Santa Clara, DC Elctrns. 408-980-1199
CO Lakewood, Christee - Meade Co. 303-232-0287
FL Orlando, Mackay Smith & Assocs. 305-423-4353
GA Decatur, DataCon 404-373-1212
GA Norcross, Mackay Smith 404-449-7444
IL Lisle, W. G. Controls 312-963-5954
IL Schaumburg, DataCon 312-529-7690
IN Indianapolis, CC Elctrns., Inc. 317-255-1508
MA Burlington, DataCon 617-273-5800
MN St. Paul, Countryman Assocs. 612-645-9151
NY Bohemia, DataCon 516-589-1100
NC Cary, Mackay Smith 919-467-5400
PA Newton Square, Hagy Assocs. 215-459-0504
TN Chattanooga, Mackay Smith 615-899-6951
TX Carrollton, DataCon 214-245-6161
TX Richardson, Lear Assocs. 214-231-5388
WA Seattle, Gompf & Assocs. 206-575-6999

DATA-CONTROL SYS., Commerce Dr., Box 860, Danbury, CT 06810, Tel: 203-743-9241, TWX: 710-456-0376; FSC No.: 08539; Empl.: 87

DATA CONVERSION, See Analogic Corp., Data Conversion Prods. Grp.

DATACOPY CORP., 1215 Terra Bella Ave., Mountain View, CA 94043, Tel: 415-965-7900, Telex: 701994 DATACOPY UO; Empl.: 75; *Sls. Mgr.:* Charles Joseph

data delay devices, inc.®

DATA DELAY DEVICES, 385 Lakeview Ave., Clifton, NJ 07011, Tel: 201-772-1106 ..... **A•1489-1501**

Local Sales Offices & Reps
AZ Phoenix, Tech Sls., Inc. 602-246-1614
CA El Toro, Martronix 714-858-0632
CA Mountain View, Weseloh/Swanson & Assocs. 415-961-0565
GA Stone Mountain, Mountain Electro Prods., Inc. 404-448-5594
MA Woburn, Radian Assocs., Inc. 617-933-7386
TX Irving, IMPAQ Sales Co. 214-257-3677

Local Distributors
CA Sunnyvale, Target Elctrns. 415-961-1170

DATA-DESIGN LABS., P.O. Box 711, 7925 Center Ave., Cucamonga, CA 91730, Tel: 714-987-2511; Empl.: 1300; *Sls. Mgr.:* M. L. Sneller

DATA DEVICE CORP., See ILC Data Device Corp.

DATA DISPLAY PRODUCTS, Box 91072, Los Angeles, CA 90009, Tel: 213-640-0442, Telex: 664690; FSC No.: 15513; Empl.: 20; *Sls. Mgr.:* William F. Million

DATADYNE, Box 247, King of Prussia, PA 19406, Tel: 215-666-5751; FSC No.: 53032; Empl.: 23; *Sls. Mgr.:* James Riggs

DATA ENGINEERING, INC., 2515 N. State Rd. 7 Ste. 207, Margate, FL 33063, Tel: 974-7861

DATA GENERAL, 4400 Computer Dr., Westboro, MA 01581, Tel: 617-366-8911, Telex: 920-329, TWX: 710-390-1217; Empl.: 18,000; *Sls. Mgr.:* Frank Keaney

DATA INSTRUMENTS, INC., 4 Hartwell Pl., Lexington, MA 02173, Tel: 617-861-7450, TWX: 200081; Empl.: 250; *Sls. Mgr.:* Ernest C. Lutfy ..... **B•1790**

Local Sales Offices & Reps
CA Riverside, Jim Mitchell 714-684-6404
CA San Carlos, Elctrn. Engrg. Assocs. 415-593-2189
CO Boulder, Herb Bass Assocs. 303-530-7509
GA Decatur, Bandy & Co. 404-296-1027
HI Kihei, Aloha Assocs. 808-879-5296
MO Kansas City, Delltron Co. 816-436-6445
MO St. Louis, Delltron Co. 314-869-4779
NY Buffalo, The Robert F. Lamb Co.
OH Mansfield, Bob Young 419-522-3738
PA Broomall, Robert Snyder 215-356-1418
TX Dallas, Griffin Sls. 214-234-5013
UT Bountiful, Herb Bass Assocs. 801-295-7100
WA Redmond, S.E.A. Sls. 206-883-4999
WA Vancouver, S.E.A. Sls. 206-573-5161
Can Don Mills, Ontario, Intertechnology 416-445-5500

DATA I/O CORP., 10525 Willows Rd. N.E., Redmond, WA 98073-9746, Tel: 206-881-6444, Telex: 15-2167; Empl.: 550

Local Sales Offices & Reps
CA Costa Mesa, Data I/O 714-662-1182
CA Santa Clara, Data I/O 408-727-0641
NH Nashua, Data I/O 603-889-8511

DATAK CORP., 65 Seventy-First St., Guttenberg, NJ 07093, Tel: 201-869-2200; *Sls. Mgr.:* Theresa Pflueger ..... **C•1100, 1590, 1838**

Local Sales Offices & Reps
CA Burlingame, Polach & Bensinger 415-697-2525
CA West Covina, Don Forth Assocs. 213-919-2322
CO Broomfield, Conners Co. 303-466-9628
FL Bradenton, T. G. & Assocs. 813-753-5632
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IN Indianapolis, Elmarcon, Inc. 317-846-0221
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NY Rochester, Warren Kaufman & Assocs. 716-266-2728
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PA Library, Buckeye Mktg. Grp. 412-854-5727
RI Coventry, Adams-McGregor 401-821-1320
RI Lincoln, Adams-McGregor 401-726-1300
TX Dallas, J & J Sls. Co. 214-328-9739
WA Woodenville, McLaughlin Long, Inc. ... 206-743-1161

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AL Birmingham, Forbes Distrbg. 205-251-4104
AK Anchorage, Alaska Elctrns. Supp. 907-563-3774
AZ Phoenix, Tri-Tek 602-995-9352
AZ Tucson, Inland Elctrns. 602-889-5301
CA Berkeley, Al Lasher's Elec. 415-843-5915
CA Canoga Park, Sandy's Elec. 213-346-8353
CA Chatsworth, Priority One Elctrns. 818-709-5464
CA El Cerrito, Trumbull Co. 415-525-7242
CA Palo Alto, Zack Elctrns. 415-326-5432
CA San Francisco, Zack Elctrns. 415-626-1444
CA San Jose, Quement Elctrns. 408-998-5900
CO Boulder, Boulder Whls. Elctrns. 303-530-1666
CT Greenwich, Wise Comps. 203-531-4880
CT Hartford, Hatry Elec. 203-527-1881
CT Wallingford, Tron Town U.S.A. 203-237-5598
FL Miami, Elctrn. Equip. 305-871-3500
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FL St. Petersburg, Knapp of Florida 813-392-0406
GA Atlanta, Ack Elctrn. Supp. 404-351-6340
GA Atlanta, Specialty Distrb. Co. 404-873-2521

HI Honolulu, Honolulu Elec. 808-949-5564
IL Berwyn, B-B & W, Inc. 312-749-1710
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IL Niles, Joseph Elec. 312-297-4200
IL Northbrook, Reproduction Specialists 312-564-0404
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IA Cedar Rapids, Deeco, Inc. 319-365-7551
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LA New Orleans, Southern Radio Supp. 504-524-2343
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MA Hingham, Sager Elctrl. Supp. 617-749-6700
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MI Flint, Shand Elctrns. 313-743-8940
MI Livonia, Norwest Elec. 313-261-4551
MN Minneapolis, Acme Elctrns. 612-338-4754
MO Kansas City, Elctrn. Supp. 816-931-0250
MO St. Louis, Gateway Elec. 314-427-6116
MO St. Louis, Van Sickle 314-621-5000
NE Lincoln, Scott Elec. Supp. 402-466-8221
NV Las Vegas, Hurley Elec. 702-384-5666
NV Reno, Elect. Distr. Co. 702-323-2766
NH Dover, American Radio 603-742-6800
NH Hudson, C & H Elec. 603-882-1133
NJ Raritan, Masters Elctrn. 201-725-3533
NJ Ringoes, Scientific Inst. Svcs. 201-788-5550
NY Buffalo, Summit Distr. 716-887-2800
NY Hauppauge, Broadline Elctrns. 516-231-4100
NY Long Island City, H. L. Dalis, Inc. 212-361-1100
NC Raleigh, Southeastern Elctrns. 919-828-2311
OH Cincinnati, URI Elec. 513-761-4030
OH Columbus, Whitehead Elctrns. 614-224-1186
OK Oklahoma City, Trice Wholesale 405-524-4411
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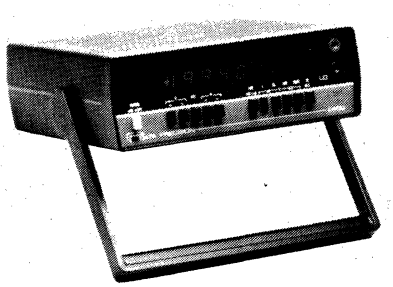
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TX El Paso, Ideal Indl. Elec. Supp. 915-779-6647
TX Houston, Gateway Elctrns. 713-978-6575
UT Salt Lake City, Kimball Elec. 801-328-2075
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VA Norfolk, Priest Elctrns. 804-855-0105
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WV Charleston, Elctrn. Materials Corp. 304-344-3577
WI Milwaukee, Indl. Elctrns. 414-276-1212

DATA-MATCH CORP., 3810 Oakcliff Ind. Ct., Doraville, GA 30340, Tel: 404-441-0408; *Sls. Mgr.:* Charles L. Frazier III

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CA Santa Ana, California Elctrn. Mktg. 714-835-2702
CA Santa Clara, Fischer Assocs. 408-733-7350
IL Rosemont, Synmark Sls. Co. 312-825-3455
MI Troy, C. B. Jensen & Assocs. 313-643-0506
MN Minneapolis, Johnson Co. 612-941-4825
NH Nashua, Access Sys. Corp. 603-888-8160
NJ Kenilworth, Ventronics, Inc. 201-272-9262
OR Portland, Abacus Sls., Inc. 503-777-8111
TX Plano, Texas Sls. Co. 214-867-0644

Local Distributors
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CA San Diego, Diplomat Elctrns. 619-292-5693
CA Santa Clara, RM Elctrns./I.S.C. 408-496-0411
CA Sunnyvale, Diplomat Elctrns. 408-734-1900
CO Wheat Ridge, Diplomat Elctrns. 303-422-9229
CT Danbury, Diplomat Elctrns. 203-797-9674
FL Clearwater, Diplomat Elctrns. 813-443-4514
GA Norcross, Diplomat Elctrns. 404-449-4133
IL Bensenville, Diplomat Elctrns. 312-595-1000
IL Elk Grove Village, RM Elctrns. 312-364-6622
IN Indianapolis, RM Elctrns. 317-291-7110
MD Columbia, Diplomat Elctrns. 301-995-1226
MA Woburn, A.C.I. 617-935-7230
MA Woburn, Diplomat Elctrns. 617-935-6611
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MN Minneapolis, Glenmark, Inc. 612-941-4825
NH Manchester, Components North 603-624-4661
NJ Cherry Hill, Diplomat Elctrns. 609-751-0518
NJ Totowa, Diplomat Elctrns. 201-785-1830
NY Liverpool, Diplomat Elctrns. 315-652-5000
NY Melville, Diplomat Elctrns. 516-454-6400
PA Horsham, RM Elctrns. 215-674-1181
TX Austin, A.C.T./Diplomat 512-452-5254
TX Dallas, A.C.T./Diplomat 214-980-1888
TX Dallas, RM Elctrns. 214-869-2080
TX Houston, A.C.T./Diplomat 713-975-8447
UT Salt Lake City, Diplomat Elctrns. 801-486-4134
WI New Berlin, RM Elctrns. 414-784-4420

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AZ Phoenix, Motion Technology 602-991-1782
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CA San Jose, Motion Technology 408-923-0990
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CO Englewood, Integrated Motion Sys. 303-762-1817
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IL Rolling Meadows, KMA Sls. 312-398-5300
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MI Troy, Xanthus 313-528-2000
MN Minneapolis, Trask Engrg. 612-537-2434
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NY Clark Mills, KLM-Garner 315-853-6126
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NC Charlotte, MacKay, Smith & Assocs. 704-372-1188
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OH West Chester, Fehrco 513-777-4248
TX Dallas, Automated Motion Control 214-340-4192
TX Denton, Automated Motion Control 817-382-4159
WA Bellevue, Al Smith Co. 206-746-6770
WA Vancouver, Al Smith Co. 206-892-9912
WI Milwaukee, KMA Sls. 414-259-1771

DATA PLUS, INC., 7205E Lockport Pl., Lorton, VA 22079, Tel: 800-368-3747; Empl.: 20; *Sls. Mgr.:* George E. Pritz

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DATA PROCESSING DESIGN, 1400 N. Brasher St., Anaheim, CA 92807, Tel: 714-970-2373, Telex: 182-278; Empl.: 50

DATAPRODUCTS, 6200 Canoga Ave., Woodland Hills, CA 91365, Tel: 213-887-8000, Telex: 67-4734; Empl.: 5700; *Sls. Mgr.:* Keith Bauserman; *Dist. Mgr.:* L. Bowne

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CA Mountain View, Thorson West 415-964-9300
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CA San Diego, Gemini Assocs. 619-268-1181
CO Denver, RML Assocs. 303-757-6654
CT Bloomfield, J & J Assocs., Inc. 203-242-4940
FL Orlando, Col-Ins-Co. 800-432-4480
GA Atlanta, Col-Ins-Co. 800-327-6600
IL Oak Brook, Dataram Corp. 312-789-3710
IL Skokie, Mar-Con Assocs., Inc. 312-675-6450
MD Rockville, Technical Sls. Assocs. 301-340-0600
MA Sterling, Dataram Corp. 617-422-6090
MA Winchester, J & J Assocs., Inc. 617-729-5770
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NJ Haddonfield, G. L. Williams Assocs. 609-428-6060
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TX Dallas, Thorson Southwest 214-233-5744
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DATA SPECIALTIES, INC., 3455 Commercial Ave., Northbrook, IL 60062, Tel: 312-564-1800, Telex: 206230; Empl.: 110; *Sls. Mgr.:* John H. Kindsvater, Jr.

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IL	Elk Grove Village, Memeco Sls. & Svc.	312-228-9555
IA	Bettendorf, Miller Mech. Spec.	319-355-4485
IA	Des Moines, Mifler Mech. Spec., Inc.	515-243-4287
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MO	Kansas City, Economy Power & Instr.	816-523-1010
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NY	Syracuse, Robert F. Lamb Co.	315-455-2469
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OK	Tulsa, Automatic Eng.	918-585-5703
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PA	Coraopolis, Baker Process Equip.	412-264-8271
PA	Warminster, Multi-Measurements, Inc.	215-675-3082
TN	Memphis, FLW Southeast, Inc.	901-345-3563
TX	Dallas, JO Instr.	214-263-2025
TX	Houston, JO Instr.	713-468-8087
WA	Seattle, Branom Instr.	206-762-6050
Can	Calgary, Alberta, Instrument Service Labs	403-255-3448
Can	Toronto, Ontario, Willer Engr.	416-499-4421

Local Distributors

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MN	Royal Oak, George Instrs.	313-280-1111
NY	Rochester, EIC Elctrns.	716-544-4392
OH	Dayton, National Inst. Dist.	513-435-4503
Can	Richmond, BC, Instrument Svc. Labs	604-278-4511

DATA TECHNOLOGY, INC., 4 Gill St., Woburn, MA 01811, Tel: 617-935-8820, Telex: 95-1351; Empl.: 85; *Sls. Mgr.:* D. Skenderian

DATA TERMINALS & COMMUNICATIONS, 590 Division St., Campbell, CA 95008, Tel: 408-378-1112, TWX: 910-590-2436; *Dist. Mgr.:* Michael R. Wood

DATATEX CORP., 10935 S. Wilcrest Dr., Houston, TX 77099, Tel: 713-495-3100; Empl.: 100; *Sls. Mgr.:* Glenn Messerschmitt; *Dist. Mgr.:* K. Pelletier

DATATRAN CORP., 1195 South Huron St., Denver, CO 80223, Tel: 303-778-0870; Empl.: 2; *Sls. Mgr.:* Cindi L. Kemper; *Dist. Mgr.:* Cindi L. Kemper

DATATRAN LABS, P.O. Box 384, Sussex, NJ 07461, Tel: 914-856-4313; Empl.: 18; *Sls. Mgr.:* Richard E. Johnson

DATA TRANSLATION, 100 Locke Dr., Marlboro, MA 01752, Tel: 617-481-3700, Telex: 4430109; FSC No.: 61867; Empl.: 145; *Sls. Mgr.:* Ellen Wirka

DATATRON, INC., 2942 Dow Ave., Tustin, CA 92680, Tel: 714-544-9970, TWX: 910-595-1589; Empl.: 125

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DATATRONIC SYSTEMS CORP., Computer Sciences Div., P.O. Box 44128, Panorama City, CA 91412, Tel: 818-988-5290; Empl.: 150

DATAVOICE CORP., 180 N. La Salle St. Ste 700, Chicago, IL 60601, Tel: 312-831-4488; Empl.: 8; *Sls. Mgr.:* J. Seifert

DATAWARE SYS. LEASE, INC., 30 Bay St., Staten Island, NY 10301, Tel: 212-447-4911, Telex: 421394, TWX: 710-588-6738; *Sls. Mgr.:* Ben Welwart

DATAWEST, 7333 E. Helm Dr., Scottsdale, AZ 85260, Tel: 602-948-3280, TWX: 910-950-1289

DATAWRAP inc.

DATAWRAP, INC., 13 Henshaw St., Woburn, MA 01801, Tel: 617-938-8911; Empl.: 16; *Sls. Mgr.:* Tony Lockwood ..... **D•1979**

DATEC, INC., 200 Eastowne Dr., Ste. 116, Chapel Hill, NC 27514, Tel: 919-929-2135; Empl.: 75; *Sls. Mgr.:* Walt Lovett ..... **D•1049**

Local Distributors

AZ	Phoenix, Sunwest Data Sys.	602-271-0500
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CA	San Diego, Western Scientific	619-744-7117
FL	Orlando, Currie, Peak & Frazier	305-855-0843
FL	Plantation, Jetronics	305-472-0900
GA	Alpharetta, Terminals Plus, Inc.	404-475-6686
GA	Atlanta, Infotec, Inc.	404-458-1400
IA	Cedar Rapids, Norand Corp.	319-369-3100
LA	Matairie, T. L. Data (American Teledata)	504-456-1400
MA	Framingham, Data Comm. Sys. Inc.	617-620-1800
MI	Ann Arbor, Complete Technology	313-996-9600
NJ	Cherry Hill, The Datastore, Inc.	609-779-0200
NJ	Northvale, Glasgal Comms.	201-768-8082
NJ	Union, Transnet Corp.	201-688-7800
NM	Albuquerque, Sunbelt Data	505-266-7731
NY	Hauppauge, Manchester Equip. Co.	516-435-1199
NY	Islip, The Technology Consortium	516-293-6898
NC	Durham, Microglyphics	919-493-8444
OH	Brecksville, Electronic Engrg. Co.	216-526-4350
OH	Cleveland, Delta Products Co., Inc.	216-731-3537
OR	Beaverton, Data Dvcs.	503-641-5500

DA-TECH CORP., 92 Steamwhistle Dr., Ivyland, PA 18974, Tel: 215-322-9410; Empl.: 75; *Sls. Mgr.:* Bradford W. Bentz

GE DATEL

DATEL, General Electric Co., 11 Cabot Blvd., Mansfield, MA 02048, Tel: 617-339-9341, Telex: 95-1340, TWX: 710-346-1953; Empl.: 650; *Sls. Mgr.:* H. Batchelder ..... **D•1083, 1147, 1346**

Local Sales Offices & Reps

Tech. Mktg., Inc.

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AZ	Phoenix, Tech. Sls.	602-246-1614
CA	Santa Ana, Datel	714-835-2751
CA	Sunnyvale, Datel	408-733-2424
CO	Denver, Cleveland Entprs. of Colo.	303-751-3252
CT	Hamden, JBL Assocs.	203-281-3161
FL	Coral Springs, H. A., Inc.	305-752-7520
GA	Atlanta, Electronic Mfrs' Agts.	404-329-0530
HI	Honolulu, Adtech.	808-941-0708
IL	Elmhurst, Sector Engrg. Sls., Inc.	312-530-7850
IN	Indianapolis, Sector Engrg. Sls., Inc.	317-842-1120
IA	Davenport, Ensco-Rep, Inc.	319-386-6600
KS	Overland Park, Ensco-Rep, Inc.	913-381-7557
KS	Wichita, Ensco-Rep Inc.	316-683-1070
MA	Mansfield, Datel	617-339-9341
MI	Livonia, Electro Sls. Assocs.	313-474-7320
MI	Portage, Electro Sls. Assocs.	616-323-2416
MN	Minneapolis, Electro Sls. Assocs.	612-546-4110
MN	Minneapolis, J. R. Assocs.	612-546-4110
MO	Maryland Heights, Ensco-Rep, Inc.	314-423-3935
NJ	Perth Amboy, Astrorep, Inc.	201-826-8050
NM	Albuquerque, Cleveland Entprs.	505-265-7893
NY	Babylon, Astrorep	516-422-2500
NY	Liverpool, R & D Assocs.	315-457-0100
NC	Winston-Salem, Comp. Concepts	919-765-3484
OH	Cleveland, Instrmn Sys., Inc.	216-845-8800
OH	Dayton, Instrmn Sys., Inc.	513-294-2838
OR	Portland, TASCO, Inc.	503-245-8168
PA	Glenside, Wyncote Instrmn.	215-572-6500
PA	Pittsburgh, Instrmn Sys., Inc.	412-243-1111
PA	Pittsburgh, Instrmn. Sys., Inc.	412-823-7005
TX	Austin, Technical Mktg., Inc.	512-835-0064
TX	Carrollton, Tech. Mktg., Inc.	214-387-3601
TX	Houston, Tech. Mktg.	713-777-9228
TX	Houston, Technical Mktg., Inc.	713-783-4497
UT	Salt Lake City, Cleveland Entprs. of Colo.	801-355-8424
VA	Arlington, H. J. Heffernan	703-522-6666
WA	Bellevue, TASCO, Inc.	206-453-1414
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IN Lafayette, CWY Elctrns. 317-447-4617
IA Cedar Rapids, Iowa Radio Supp. 319-364-6154
IA Davenport, Warren Radio 319-322-5301
IA Marion, Control Des. 319-373-2923
IA West Des Moines, Ramco Co. 515-225-6933
KS Kansas City, Kornfield Thorp Elec. 913-321-7070
KS Topeka, Carroll Radio 913-234-6677
KY Ashland, Ashland Elec. Co. 606-324-4107
KY Bowling Green, Randolph, Hale & Meredith 502-781-1460
KY Louisville, Peerless Elctrn. Equip. 502-637-7677
LA Shreveport, Indl. Elec. Supp. 318-222-9459
MD Aberdeen, Harco Elctrns. 301-838-7990
MA Boston, Ralph Pill Elec. Supp. 617-269-8200
MA Brighton, Interstate Elctrns. Equip. 617-782-9000
MA Burlington, QPL Elctrns. 617-229-2424
MA Newton Upper Falls, Instock Prods. ... 617-964-6200
MI Augusta, Great Lakes Elec. 616-731-4156
MI Farmington Hills, Advent Elctrns. 313-477-1650
MI Flint, Roth Elec. Supp. 313-234-8661
MN Minneapolis, Control Design 612-721-6555
MO Kansas City, Western Extralite 816-421-8404
MO St. Louis, Control Design 314-426-3150
MO St. Louis, Van Sickle Radio Elctrns. ... 314-621-5000
NE Omaha, West Dodge Elec. 402-393-8071
NJ Edison, William Elctrns. Supp. 201-985-3700
NJ Fairlawn, Relay Specialties 201-797-3313
NJ Paterson, Feldman Brothers 201-742-7329
NJ Raritan, Masters Elctrn. 201-725-3533
NY Hempstead, Elctrn. Equip. Co. 516-895-5757
NY Lynbrook, Peerless Radio Corp. 516-593-2121
NY Rochester, Masline Elctrns. 716-546-5373
NC Charlotte, Control Des. 704-588-4410
NC Raleigh, Southeastern Radio Supp. ... 919-828-2311
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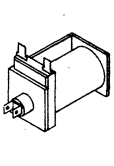
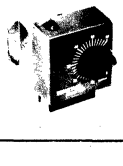

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OH Toledo, Warren Radio Supp. 419-248-3364
OH Wickliffe, Gateway Elctrns. 216-944-8565
OK Tulsa, Radio, Inc. 918-587-9123
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PA Erie, REM Elctrns. 814-453-5626
PA Malvern, Control Design 215-296-0150
PA Philadelphia, Lindley Elec. 215-329-7005
SC Greenville, Hammond Elec. 803-233-4421
SD Aberdeen, Plainco 605-225-7100
TN Chattanooga, Curle Elctrns. 615-266-4728
TN Knoxville, CED 651-521-6262
TN Memphis, Warren Radio 901-274-2460
TX Dallas, Control Design 214-358-1441
TX Dallas, Watson Elec. Supp. 214-742-8441
TX Garland, J & S Elec. 214-487-8808
TX Lubbock, R & R Elec. Co. 806-765-7727
TX San Antonio, Blackburn Drives Controls 512-349-2621
UT Salt Lake City, Kimball Elctrns. 801-328-2075
VA Ashland, Hermitage Distrs. 801-328-2075
VA Staunton, Southern Elec. 703-886-6218
WI Manitowoc, Englewood Elec. 414-684-6653
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI New Berlin, Control Design 414-784-1015

DELTRON, INC., P.O. Box 1369, Wissahickon Ave., N. Wales, PA 19454-9990, Tel: 215-699-9261, TWX: 510-661-8061; Empl.: 175-180; *Sls. Mgr.:* Jack Phillips

DELTRONIC CRYSTAL INDS., 215 Rt. 10, Bldg. 3, Sec. 5, Randolph, NJ 07869, Tel: 201-361-2222, Telex: 13-6170; Empl.: 8

DENNIS CHEMICAL, 2700 Papin St., St. Louis, MO 63103, Tel: 314-771-1800; Empl.: 70; *Sls. Mgr.:* Charles F. Seger III; *Dist. Mgr.:* Charles F. Seger III

DENNISON KUBE, Div. Dennison Computer Supplies Inc., 132 Calvary St., Waltham, MA 02254-0472, Tel: 617-899-0012, Telex: 94-0179; FSC No.: 17691; Empl.: 150; *Sls. Mgr.:* Alfred J. Black

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DENSITRON CORPORATION

DENSITRON CORP., 20775 Western Ave., Torrance, CA 90501, Tel: 213-618-9647, TWX: 910-349-6200; FSC No.: 62483; Empl.: 65; *Sls. Mgr.:* Robert Turner; *Dist. Mgr.:* Robert Turner ..... **B•1029-1031**

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AL Huntsville, Elctrn. Mktg., Inc. 205-837-7363
AZ Phoenix, Chaparral Elctrn., Inc. 602-252-0897
CA Laguna Hills, Comp. Mktg. Assocs. 714-951-6046
CA Lomita, Comp. Mktg. Assocs. 213-326-1460
CA San Mateo, Comp. Mktg. Assocs. 415-345-7373
CA Simi Valley, (CMA) Repco 805-583-5710
CO Arvada, Delconec 303-422-7023
FL Coral Springs, E.P.M. Corp. 305-755-5387
FL Orlando, E.P.M. Corp. 305-425-6149
GA Atlanta, Elctrn. Mktg. Assoc., Inc. 404-448-1215
IL Park Ridge, Bob Burns & Assocs., Inc. 312-775-1233
IA Davenport, Ensco-Rep, Inc. 319-386-6600
KS Overland Park, Ensco-Rep, Inc. 913-381-7557
KS Wichita, Ensco-Rep, Inc. 316-683-1071
MA Braintree, Nova Assocs. 617-848-9330
MI Southfield, R. C. Nordstrom & Co. 313-559-7373
MN Minneapolis, Electro-Serv 612-338-3475
MO Maryland Heights, Ensco-Rep, Inc. 314-423-3935
NY Mastic, Optimum Sls. Co. 516-589-4664
NY Rochester, J. G. Welch Assocs. 716-244-1100
NY Utica, J. G. Welch Assocs. 315-736-7821
NC Raleigh, Elctrn. Mktg. Assoc., Inc. 919-847-8800
OH Dayton, Dynel Co. 513-434-6467
PA Wynnewood, Metz-Benham Assocs., Inc. 215-896-7300
SC Greenville, Elctrn. Mktg. Assoc., Inc. 803-233-4637
TX Austin, Delta Comp., Inc. 512-458-4288
TX Seagoville, Delta Comp., Inc. 214-287-6333
UT Salt Lake City, Delconec, Inc. 801-531-6177
WA Seattle, J. J. Assocs., Inc. 206-246-6619
WI Milwaukee, Taylor Mktg. & Sls. 414-332-1211

DESIGNATRONICS, INC., See Automatic Coil Corp., Sub. Designatronics, Inc.

DESIGN AUTOMATION, INC., 809 Massachusetts Ave., Lexington, MA 02173-3992, Tel: 617-862-8998, Telex: 951833 SBSB WOR; Empl.: 5

DESIGN TECHNOLOGY, 7760 Vickers St., San Diego, CA 92111-1871, Tel: 619-268-8194; *Sls. Mgr.:* Pam Hamilton; *Dist. Mgr.:* Sherry Kuzara

DESPATCH INDS., P.O. Box 1320, Minneapolis, MN 55440, Tel: 612-331-1873, Telex: 29-0704; Empl.: 475; *Sls. Mgr.:* T. Hostad

DEST CORP., 2380 Bering Dr., San Jose, CA 95131, Tel: 408-946-7100; Empl.: 50; *Sls. Mgr.:* Richard Dixon

DETORONICS CORPORATION, 10660 E. Rush St., S. El Monte, CA 91733, Tel: 818-579-7130, TWX: 910-587-3436; FSC No.: 29867; Empl.: 45

DEUTSCH CO., Deutsch Fiber Optics Div., 7001 W. Imperial Hwy., Los Angeles, CA 90045, Tel: 213-649-1400; *Sls. Mgr.:* Ken Ahmad

DEUTSCH FASTENER, 1315 East Grand Ave., El Segundo, CA 90245, Tel: 213-322-8840, Telex: 66-4453, TWX: 910-348-6676; Empl.: 300; *Sls. Mgr.:* Ian J. Skone-Rees

DEUTSCH RELAYS, INC., 65 Daly Road, East Northport, NY 11731, Tel: 516-499-6000

DEVCO ENGRG., Control Sys. Div., 36 Pier Lane West, Fairfield, NJ 07006, Tel: 201-CA8-0321, Telex: 139-340; Empl.: 36

DEVELCO, INC., 404 Tasman Dr., Sunnyvale, CA 94089-1797, Tel: 408-734-5700, TWX: 910-339-9295; Empl.: 50; *Sls. Mgr.:* W. J. Baker

DEVELOPMENT ASSOCIATES, 1520 S. Lyon, Santa Ana, CA 92705, Tel: 714-835-9512; Empl.: 6

DEXCEL, Div. of Gould, 2285C Martin Ave., Santa Clara, CA 95050, Tel: 408-727-9833, TWX: 910-338-0180; Empl.: 210; *Sls. Mgr.:* Art Kawai

DEXTER RESEARCH CTR., INC., 7300 Huron River Dr., Dexter, MI 48130, Tel: 313-426-3921, Telex: 757075 DEXTER RES UD; Empl.: 22; *Sls. Mgr.:* D. M. Szeles

DGS ASSOCS., 1353 Sarita Way, Santa Clara, CA 95051, Tel: 408-554-1469, Telex: 6502163796

DIALIGHT CORP., 203 Harrison Pl., Brooklyn, NY 11237-1587, Tel: 718-497-7600, TWX: 710-584-5487; Empl.: 400; *Sls. Mgr.:* I. Jaffe ..... **B•1032-1038, 1550-1551**

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AL Huntsville, Cartwright & Bean 205-830-1540
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CA Anaheim, Westrep 213-404-3881
CA Pleasanton, Moulthrop Sls. 415-463-0450
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FL Deerfield Bch., Cartwright & Bean 305-429-3400
FL Orlando, Cartwright & Bean 305-422-4531
GA Atlanta, Cartwright & Bean 404-233-2939
IL Chicago, D. Dolin Sls. 312-498-6770
IN Indianapolis, Elctrn. Reps. 317-894-1414
KS Overland Park, Advanced Tech. Sales 913-642-6675
LA Covington, Cartwright & Bean 504-892-1780
MI Ferndale, Hilltronics 313-398-5556
MN Minneapolis, Professional Sales For Ind. 612-944-8545
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NY Liverpool, Gen-Tech 315-451-3480
NC Charlotte, Cartwright & Bean 704-377-5673
NC Raleigh, Cartwright & Bean 919-876-4130
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PA Allison Park, K.W. Elctrn. Sls. 412-487-4300
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TN Memphis, Cartwright & Bean 901-276-4442
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WI Milwaukee, D. Dolin Sls. 414-482-1111

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CA Costa Mesa, Diplomat Westates 714-549-8401
CA Gardena, Bell Indus. 213-515-1800
CA Inglewood, Newark Elctrns. 213-671-7387
CA Los Angeles, Richey Western Elctrns. 213-820-3777
CA Sacramento, Sacramento Elctrns. 916-441-4821
CA San Diego, Fisher/Brownell 714-560-8545
CA San Diego, Richey Western Elctrns. 714-565-4444
CA Santa Clara, Fisher/Brownell 408-988-6041
CA Santa Clara, Richey Western Elctrns. 408-727-7411
CA Sun Valley, Richey Western Elctrns. 213-768-3800
CA Sunnyvale, Bell Indus. 408-734-8570
CA Sunnyvale, Time Elect. 408-734-9888
CO Denver, CSID Inc. 303-292-9594
CO Denver, Newark Denver Elctrns. 303-757-3351
CT Wallingford, Sager Elctrl. Supply 203-265-4600
FL Ft. Lauderdale, Peerless Radio 305-973-4141
FL Orlando, Hammond Elctrns. 305-849-6060
GA Atlanta, Specialty Dist. 404-873-2521
IL Chicago, Newark Elctrns. 312-638-4411
IL Northbrook, Classic Comps. Supp. 312-272-9650
IL Palatine, OHM Elctrns. 312-359-5500
IL Peoria, Klaus Radio & Elect. 309-691-4840
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LA New Orleans, Southern Radio Supp. 504-524-2343
MD Baltimore, Resco/Baltimore 301-529-0600
MD Gaithersburg, Pioneer Wash. Elect. 301-948-0710
MD Rockville, Capitol Radio Whlsrs. 301-881-2270
MA Hingham, Sager Elec. Supp. 617-749-6700
MA Norwood, Gerber Elctrns. 617-769-6000
MA Springfield, T.F. Cushing 413-788-7341
MA Wilbraham, Ind'l. Comps. 413-596-3854
MI Ann Arbor, Wedemeyer Elctrn. Supp. 313-665-8611
MI Livonia, RS Elctrns. 313-525-1155
MI Oak Park, Newark Elctrn. 313-967-0600
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MO Kansas City, LCOMP 816-221-2400
MO Kansas City, Walters Radio Supp. 816-531-7015
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NE Lincoln, Scott Elctrn. Supp. 402-466-8221
NJ Hanover, State Elctrns. 201-887-2550
NJ Kenilworth, Federated Purchaser 201-272-0505
NJ Pennsauken, Resco Elctrns. 609-662-4000
NY Buffalo, Summit Dists. 716-887-2800
NY Elmsford, Ancar Elctrns. Supp. 914-592-7100
NY Endwell, ASI Elect. 607-754-3823
NY Farmingdale, Arrow Elctrns. 516-694-6800
NY Hauppauge, Broadline Elec. Dists. 516-231-4100
NY Long Island City, Dalis Indl. Elect. 212-361-1100
NY Lynbrook, Peerless Radio 516-593-2121
NY Rochester, Summit Elctrns. 716-334-8110
NY Rome, Rome Elctrns. 315-337-5400
NY Woodbury, Pioneer/Harvey 516-921-8700
NC Greensboro, Hammond Elctrns. 919-275-6391
NC Raleigh, Southeastern Elctrns. 919-828-2311
OH Akron, Akron Elctrn. Supp. 216-762-8818
OH Akron, Sun Radio 216-434-2171
OH Cincinnati, Hughes-Peters 513-351-2000
OH Cincinnati, URI Elctrns. 513-761-4030
OH Cleveland, Pioneer-Cleveland 216-587-3600
OH Columbus, Hughes-Peters 614-294-5351
OH Dayton, Pioneer/Dayton 513-236-9900
OH Dayton, Stotts-Friedman 513-298-5555
OH Solon, REPCO Elctrn. 216-248-8900
OK Tulsa, Radio, Inc. 918-587-9123
OR Beaverton, Almac Elctrns. 503-641-9070
PA McKean, Advacom 814-476-7774
PA Montgomeryville, Pyttronic Indus. 215-643-2850
PA Philadelphia, Almo Elctrns. 215-698-4000
PA Philadelphia, Philadelphia Elctrns. 215-568-7400
PA Pittsburgh, Cam RPC Elect. 412-782-3770
PA Reading, Barbey Elctrns. 215-376-6116
RI Providence, Wm. Dandreta 401-861-2800
SC Greenville, Hammond Elctrns. 803-233-4121
TN Kingsport, Radio Elec. Supp. 615-247-8111
TN Nashville, Carlton-Bates Co. 615-244-3562
TN Nashville, Electra Dist. 615-329-3971
TX Dallas, Norvell Elctrns. 214-233-0020
TX Garland, Newark Elctrns. 214-494-5911
TX Houston, Newark Elctrns. 713-782-4800
TX Stafford, Harrison Equip. 713-879-2600
UT Salt Lake City, Standard Supp. 801-486-3371
VA Norfolk, Priest Elctrns. 804-855-0105
VA Richmond, Sterling Elctrns. 804-226-2190
WA Bellevue, Almac Elctrns. 206-643-9992
WI Milwaukee, Elctrn. Expeditors 414-228-8100
WI Milwaukee, Indl. Elect. 414-276-1212
WI Milwaukee, Marsh Elctrns. 414-475-6000

DIAL PRODS. CO., 19-21 Cottage St., Bayonne, NJ 07002, Tel: 201-HE7-0720; Empl.: 100; *Sls. Mgr.:* Beverly Malen

DIAMOND MAGNETICS, P.O. Box 4736, San Luis Obispo, CA 93403, Tel: 805-544-4019; Empl.: 10; *Sls. Mgr.:* Lyle Nighswonger

DIAMOND SHAMROCK CORP, 1100 Superior Ave, Cleveland, OH 44114, Tel: 216-694-5000

DIANACHART INC., 129 Hibernia Ave., Rockaway, NJ 07866, Tel: 201-625-2299; Empl.: 10; *Sls. Mgr.:* D. Brodie

DI/AN CONTROLS, INC., 944 Dorchester Ave., Boston, MA 02125, Tel: 617-288-7700, TWX: 710-333-1732; FSC No.: 06900; Empl.: 135; *Sls. Mgr.:* C. S. Aspinwall, Jr.; *Dist. Mgr.:* C. S. Aspinwall, Jr.

DIA-NETICS, INC., 18823 Napa St., Northridge, CA 91324, Tel: 818-886-2616; Empl.: 35

DIEGO POWER, 5350 Eastgate Mall, San Diego, CA 92121, Tel: 587-1925; Empl.: 12; *Sls. Mgr.:* Jack Jaquay ..... **D•1916**

Local Sales Offices & Reps

CA	Campbell, Elcor Assocs.	408-866-5505
CA	Garden Grove, Elcor Assocs.	714-895-3422
CT	Hamden, AMI, Inc.	203-288-5288
IL	Rolling Meadows, Commodore I	312-394-5441
MA	Acton, AMI, Inc.	617-263-2766
MN	Burnsville, Commodore I	612-894-5488
NJ	Lodi, SDM Reps., Inc.	201-368-0123
NY	Rochester, SDM Reps., Inc.	716-247-8770
OH	Miamisburg, Swenson Assocs.	513-866-3233
WA	Seattle, Datacom Assocs.	206-285-2525

DIELECTRIC COMMUNICATIONS, General Signal, Tower Hill Rd., Raymond, ME 04071, Tel: 207-655-4555, 800-341-9678, Telex: 710-229-6890; FSC No.: 08441; Empl.: 250; *Sls. Mgr.:* Rolf Olsen

DIELECTRIC INSTR. CORP., 761 Franklin Ave., Pittsburgh, PA 15221, Tel: 412-731-6566; Empl.: 7

DIELECTRIC LABS., 69 Albany St., Cazenovia, NY 13035, Tel: 315-655-8710, TWX: 710-541-1530; FSC No.: 55153; Empl.: 65; *Sls. Mgr.:* David Carter

DIETZ DESIGN, INC., 100 Electronics Pkwy., Belton, MO 64012, Tel: 816-331-4911; Empl.: 75

DIETZGEN CORP., 250 Wille Rd., Des Plaines, IL 60018, Tel: 312-635-5200; Empl.: 200

DIGELEC, INC., Affil. Wavetek Corp., 586 Weddell Drive, Suite 1, Sunnyvale, CA 94089, Tel: 408-745-0722, Telex: 821877; *Sls. Mgr.:* Karl Sturz

DIGIAC CORP., 175 Engineers Rd., Hauppauge, NY 11788, Tel: 516-273-8600, TWX: 510-227-9879; Empl.: 25; *Sls. Mgr.:* L. Keckeisen; *Dist. Mgr.:* S. Opperer

DIGI-DATA CORP., 8580 Dorsey Run Rd., Jessup, MD 20794, Tel: 301-498-0200, Telex: 87-580; Empl.: 75; *Sls. Mgr.:* Allen Grams

DIGIMAX INSTRS. CORP., 5625 Kearny Villa Rd., San Diego, CA 92123, Tel: 619-569-6582, Telex: 697120-DATAMAX; FSC No.: 5T492; *Sls. Mgr.:* Dan Burton; *Dist. Mgr.:* Dan Burton

DIGITAL COMMUNICATIONS ASSOCS., INC., 303 Technology Pk., Norcross, GA 30092, Tel: 404-448-1400, Telex: 261333 DCAATL; Empl.: 500; *Dist. Mgr.:* Jerry Buran

DIGITAL DATA SYS., 1551 N.W. 65 Ave., Plantation, FL 33313, Tel: 305-792-3290, Telex: 9109974751 (DIGITAL); Empl.: 20; *Sls. Mgr.:* Floyd Simon; *Dist. Mgr.:* A. Gomez

DIGITAL DEV. CORP., 8650 Balboa Ave., San Diego, CA 92123, Tel: 619-278-9920, Telex: 69-54-30; Empl.: 430; *Sls. Mgr.:* Charles Theodore

DIGITAL DYNAMICS, INC., 108 Water St., Watertown, MA 02172, Tel: 617-923-4315, Telex: 9580076; Empl.: 26; *Sls. Mgr.:* Eric Kapust

DIGITAL ELCTRNS., 26142 Eden Landing Rd., Ste. 2, Hayward, CA 94545, Tel: 415-786-0520, Telex: 334422; *Sls. Mgr.:* Bob Christensen

DIGITAL EQUIP., One Iron Way, Marlborough, MA 01752

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DIGITAL EQUIPMENT CORP., 33 Cabot Rd., Woburn, MA 01801, Tel: 800-225-5385 ..... **D•1063-1065**

DIGITAL GRAPHIC SYS., 2629 Terminal Blvd., Mountain View, CA 94043, Tel: 415-962-0200; *Sls. Mgr.:* Radcliffe Goddard

DIGITAL MICROSYSTEMS, 1755 Embarcadera, Oakland, CA 94606, Tel: 415-532-3686, TWX: 910-366-7310; Empl.: 200; *Sls. Mgr.:* Terry Forde

DIGITAL MEDIA, 3178 Gibraltar Ave., Costa Mesa, CA 92626, Tel: 714-751-1373; *Sls. Mgr.:* David Scott

DIGITAL PATHWAYS, INC., 1060 E. Meadow Cir., Palo Alto, CA 94303, Tel: 415-493-5544, TWX: 910-379-5034; *Sls. Mgr.:* Jan Legassick

DIGITAL POWER CORP., 686 East Gish Rd., San Jose, CA 95112, Tel: 408-288-5600, TWX: 910-338-0579; *Sls. Mgr.:* Claude Adkins

DIGITAL PRODUCTS, INC., 600 Pleasant St., Watertown, MA 02172, Tel: 617-924-1680; Empl.: 25; *Sls. Mgr.:* William M. Kahn

DIGITAL RADIO CORP., 8901 La Cienega Blvd., Inglewood, CA 90301, Tel: 213-670-8611; *Sls. Mgr.:* Arvin L. Perry

DIGITAL TRANSMISSION TECHNIQUES, INC., P.O. Box 1847, Wayne, NJ 07470, Tel: 201-831-1615; Empl.: 3; *Sls. Mgr.:* Charles Herbst

DIGITEC CORP., 918 Woodley Rd., P.O. Box 458, Dayton, OH 45401, Tel: 513-254-6251, Telex: 6874219 W.U.I.; FSC No.: 16152; Empl.: 135; *Sls. Mgr.:* Jerry Rozek; *Dist. Mgr.:* Jerry Rozek ..... **D•1066, 1149, 1348**

Local Sales Offices & Reps

AL	Huntsville, W. A. Brown	205-883-8660
CA	Huntington Beach, AWC	714-969-2468
CA	Santa Clara, Johnson Assocs.	408-984-4626
CT	New Canaan, R. J. Sickles Assoc.	203-966-4630
IL	Des Plaines, Marsland Assocs.	312-298-2620
IN	Indianapolis, Marsland Assocs.	317-924-3568
IA	Cedar Rapids, Marsland Assocs.	319-396-8030
KS	Shawnee, Marsland Assocs.	913-631-5400
MI	Southfield, Comtel-Instr.	313-358-2505
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Louis, Marsland Assocs.	314-878-2402
NJ	Cedar Grove, KLS	201-785-4450
NJ	Cherry Hill, Sci. Reps.	609-482-0059
NM	Albuquerque, Fry-Gates	505-262-1525
NY	Glens Falls, Glen Instrs.	518-798-1993
NY	Rochester, Glen Instrs.	716-338-7148
OH	Cleveland, Comtel-Instr.	216-442-8080
OH	Dayton, Comtel-Instr.	513-298-7573
PA	Pittsburgh, Comtel-Instr.	412-922-5720
TX	Houston, Adaptive Controls	713-995-9791
UT	Salt Lake City, Meas. Conslts.	801-364-3174
VA	Fairfax, Scientific Reps.	703-385-0600
VA	Richmond, Cavalier	804-794-4033

DIGITECH INDUSTRIES, INC., 66 Grove St., Ridgefield, CT 06877, Tel: 203-438-3731, Telex: 969-623; Empl.: 70

DIGITEK INC., P.O. Box 468, Kenmore, WA 98028, Tel: 206-485-6571; *Sls. Mgr.:* Paul J. McManus; *Dist. Mgr.:* Paul J. McManus

DIGITRAN CO., Becton Dickinson & Co., 3100 New York Dr., Pasadena, CA 91107, Tel: 818-791-5600, Telex: 67-5485, TWX: 910-588-3794; Empl.: 300

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns. Assoc.	205-881-5031
AZ	Scottsdale, Arcom Sls.	602-947-5745
AR	Little Rock, Beacon Elctrn. Assoc.	501-224-5449
CA	Anaheim, Westrep	213-404-3881, 714-527-2822
CA	San Diego, Westrep	619-276-0751
CA	Santa Clara, Westrep	408-988-8833
CO	Littleton, Omega, Ltd.	303-798-7040
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Clearwater, Beacon Elec. Assoc.	813-796-2378
FL	Ft. Lauderdale, Beacon Elec. Assocs.	305-491-1054
FL	Maitland, Beacon Elec. Assocs.	305-647-3498
FL	Melbourne, Beacon Elec. Assoc.	305-724-8010
GA	Atlanta, Beacon Elctrns. Assoc.	404-256-9640
IL	Elk Grove Village, Carlson Elctrn. Sls.	312-956-8240
IN	Ft. Wayne, R. O. Whitesell & Assoc.	219-432-5591
IN	Indianapolis, R. O. Whitesell & Assoc.	317-359-9283
IN	Kokomo, R. O. Whitesell & Assoc.	317-457-9127
IA	Des Moines, The Beams Co.	515-255-1148
KS	Shawnee Mission, The Beams Co.	913-631-0300
KY	Louisville, R. O. Whitesell & Assoc.	502-426-7696
MD	Silver Spring, Marktron	301-460-6100
MD	Timonium, Marktron	301-252-7111
MA	Burlington, Kitchen & Kutchin	617-229-2660
MI	Grand Rapids, R. O. Whitesell & Assoc.	616-942-5420
MI	Southfield, R. O. Whitesell & Assoc.	313-559-5454
MI	St. Joseph, R. O. Whitesell & Assoc.	616-983-7337
MO	St. Louis, The Beams Co.	314-569-1060
NJ	Haddonfield, Sunday-O'Brien	609-429-4013
NJ	Hasbrouck Hgts., Comp-Tech Sls.	201-288-7400
NY	New York, Comp-Tech Sls.	516-593-2628
NY	Rochester, Ossmann Comp. Sls.	716-424-4460
NY	Syracuse, Ossmann Comp. Sls.	315-455-6611
NC	Greensboro, Beacon Elctrns. Assoc.	919-275-9997
NC	Raleigh, Beacon Elec. Assoc.	919-787-0330
OH	Cincinnati, R. O. Whitesell & Assoc.	513-521-2290
OH	Cleveland, R. O. Whitesell & Assoc.	216-447-9020
OH	Columbus, R. O. Whitesell & Assoc.	614-888-9396
OH	Dayton, R. O. Whitesell & Assoc.	513-298-9546
PA	Pittsburgh, R. O. Whitesell & Assoc.	412-963-6161
TX	Dallas, Allied Comps.	214-238-0408
TX	Houston, Allied Comps.	713-988-1600
TX	Hurst, Allied Comps.	817-589-0456
TX	Round Rock, Allied Comps.	512-244-1166
UT	Riverton, Omega, Ltd.	801-254-6723
VA	Charlottesville, Marktron	301-460-6100
WA	Bellevue, Underwood Hanify	206-451-8223
WA	Vancouver, Underwood Hanify	503-641-4463
WI	Milwaukee, Carlson Elctrn. Sls.	414-476-2790

Local Distributors

AL	Huntsville, Comp. Distrs.	205-883-7501
AL	Huntsville, Powell Elec.	205-539-2731
AZ	Tempe, Powell Elctrns.	602-967-7538
AR	Little Rock, Comp. Distrs.	501-227-6278
CA	Cerritos, El-Com	213-404-2961
CA	Fullerton, Pyramid	714-773-0781, 213-691-0561
CA	San Diego, El-Com	619-578-0900
CA	San Jose, Powell Elctrns.	408-943-9020
CA	Santa Clara, Pyramid Elec.	408-727-9810
CO	Denver, CSID, Inc.	303-292-9594
CT	Hamden, Impact Elctrns.	203-281-1331
FL	Ft. Lauderdale, Comp. Distrs.	305-971-4950
FL	Ft. Lauderdale, Powell Electr./Fla.	305-972-4300
GA	Norcross, Comp. Distrs.	404-441-3320
IL	Mt. Prospect, Magnuson Elctrns.	312-956-0700
IN	Indianapolis, Graham Elec.	317-634-8202
MD	Columbia, Powell Electr.	301-621-4070
MA	Canton, Impact Sls. Co.	617-821-1500
MA	West Borough, Powell Electrns.	617-336-6100
MI	Livonia, Pioneer/Michigan	313-525-1800
MI	St. Clair Shores, Specialties Mfg.	313-771-2700
MN	St. Paul, Magnuson Elec.	612-227-8495
NJ	Hasbrouck Hgts., Tory Sls.	201-288-5656
NY	Rochester, Modutex Corp.	716-647-9700
NC	Cary, Powell Elec.	919-467-1212
NC	Raleigh, Comp. Distrs.	919-834-9465
OH	Cleveland, Pioneer-Cleveland	216-587-3600
OH	Columbus, Elctrns. Mktg. Corp.	614-299-4161
OH	Dayton, Pioneer/Dayton	513-236-9900
OK	Tulsa, Norvell Elctrns.	918-663-1247
OR	Beaverton, Shannon, Ltd.	503-644-8077, 800-426-4615
PA	Philadelphia, Powell Electr.	215-365-1900
PA	Pittsburgh, Pioneer/Pittsburgh	412-782-2300
WA	Kent, Shannon, Ltd.	206-763-0545

DIGITUS CORPORATION, 22 West 25th Street, Baltimore, MD 21218, Tel: 301-467-3223, TWX: 908248 SVCETCY; Empl.: 12; *Sls. Mgr.:* Mr. Henry Mo; *Dist. Mgr.:* Mr. Henry Mo

DILLON, W. C., & CO., National Controls, Inc., 2320 Airport Blvd., Santa Rosa, CA 95401, Tel: 707-527-5555, TWX: 510-744-2076; Empl.: 500

DIMCO-GRAY, 8200 S. Suburban Rd., Dayton, OH 45459, Tel: 513-433-7600, Telex: 288-367; Empl.: 150; *Sls. Mgr.:* R. Cramer

DIMENSIONS UNLIMITED, INC., 1636 Gervais Ave., St. Paul, MN 55109, Tel: 612-770-5630; *Sls. Mgr.:* Dennis Getter

DIODES INC., 9957 Canoga Ave., Chatsworth, CA 91311, Tel: 818-882-4920, 800-821-1178; Empl.: 30; *Sls. Mgr.:* Tim Regan; *Dist. Mgr.:* Tim Regan

DIONICS, 65 Rushmore St., Westbury, NY 11590, Tel: 516-997-7474, TWX: 510-222-0974; Empl.: 85; *Sls. Mgr.:* Mel Geffner

DIO-REY, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, Tel: 201-941-4455; FSC No.: FSCM 52116; Empl.: 13; *Sls. Mgr.:* Joseph M. Cartelli; *Dist. Mgr.:* Joseph M. Cartelli ..... **B•1040-1046**

Local Sales Offices & Reps

CA No. Hollywood, Crown Elctrns. 213-877-3550
CA Redwood City, Caltronic Assocs. 415-365-2545
CT Weston, CJA Assoc. 203-226-4317
FL St. Petersburg, R. L. Matus & Assocs. 813-896-4133
GA Buford, R. L. Matus & Assocs. 404-945-2946
IL Lake Zurich, L & B Assocs. 312-438-7917
MI Brighton, Michigan Mktg. & Sls. 313-229-6218
NJ Wayne, GT Assocs. 201-694-6040
NY Syracuse, Lenard Co. 315-479-9191
OH Cleveland, A.S.A. 216-662-6080
OH Dayton, Mohawk Intronics 513-434-8873
TX Dallas, Glidden Electro Equip. 214-341-0610
TX Houston, Glidden Electro Equip. 713-681-1415

DISC INSTRUMENTS, Honeywell, 102 E. Baker St., Costa Mesa, CA 92626, Tel: 714-979-5300, TWX: 910-595-1987; Empl.: 175; *Sls. Mgr.:* Don Risk

DISPLAY DEVICES, Box 667, Encinitas, CA 92024, Tel: 619-753-0113; FSC No.: 26107

DISPLAY INTERFACE CORP., 525 Boston Post Rd., P.O. Box 250, Milford, CT 06460, Tel: 203-877-7661; *Sls. Mgr.:* Leigh H. Hickcox

DISPLAYS, INC., Mifflin Countey Indl. Pk., Rte. 4, Box 6AAA, Lewistown, PA 17044, Tel: 717-242-2541, Telex: 842540; Empl.: 50

Local Sales Offices & Reps

IL Des Plaines, Esco Assocs. 312-298-5310
MA Framingham, Bay Colony Reps. 617-620-0607

DISPLEX, INC., Alexander Place, Glen Cove, NY 11542, Tel: 516-671-4400, Telex: 46-6886 NOHILL CI; Empl.: 12; *Sls. Mgr.:* Alan Kushner; *Dist. Mgr.:* Alan Kushner ..... **D•1619, 1917**

Local Sales Offices & Reps

CA Gardena, Bidwell Sls. 213-532-7305
CA Westlake Village, WEW Entprs. 213-707-1551
IL Elmhurst, First Rep Co. 312-530-2450
MD Wheaton, Brimberg Sls. 301-946-2670
MA Needham, Addelco Corp. 617-444-4754
NY Great Neck, F & F Metro 516-482-4080
OH Cleveland Heights, Seltech 614-451-3868
OH Columbus, Seltech 614-451-3865
OR Portland, Belusko & Co. 503-222-4279
TN Nashville, Computer Power Corp. 615-366-1703
PR Casuas, Micro-Tech Sys & Controls. .. 809-783-0100

DISTRIBUTED COMPUTER SYS., 223 Crescent St., Waltham, MA 02154, Tel: 617-899-6619, TWX: 710-324-6476; Empl.: 32; *Sls. Mgr.:* Garry Stephens

DISTRIBUTED LOGIC CORP. (DILOG), 12800-G Garden Grove Blvd., Garden Grove, CA 92643, Tel: 714-534-8950, Telex: 681399; FSC No.: 95-3205555; Empl.: 105; *Sls. Mgr.:* Dennis Edwards; *Dist. Mgr.:* Dennis Edwards

Distributor

DISTRIBUTOR SPECIALISTS, 632 Santa Monica Blvd., Santa Monica, CA 90401, Tel: 213-393-9666 ..... pgs. **708, 775**

DIVERSIFIED CASE CO., Ellis Ave., Off. 2, Whitesboro, NY 13492, Tel: 315-736-3028; Empl.: 75; *Sls. Mgr.:* John Fitzsimmons

DIVERSIFIED ELECTRONICS, INC.

DIVERSIFIED ELCTRNS., INC., Indl. Controls Div., 119 N. Morton Ave., Evansville, IN 47711, Tel: 812-426-2806; Empl.: 55; *Sls. Mgr.:* Ken Qualls ..... **B•1322**

Local Sales Offices & Reps

CA Danville, Stuart Assocs. 415-837-8197
CA Signal Hill, California Electro Sls. Co. .. 213-595-7427
CO Denver, Empire Elctrl. Sls. 303-744-1776
FL Leesburg, Diversified Elctrns. 800-874-0619
GA Atlanta, Grady Duckett 404-451-3529
IL Des Plaines, Antek/Lincoln, Hodges & Assocs. 312-297-0885
IN Seymour, Diversified Elctrns. Inc. 812-522-1481
IA Bettendorf, Weisler & Assocs. 319-344-0566
MD Fulton, S. Jefferies 301-792-7452
MO Ellisville, Weisler & Assocs. 314-394-4543
MO Kansas City, Weisler & Assocs. 816-421-1679
NY Great Neck, Frank Tylinski Co. 516-466-9070
NC Charlotte, Sentry Power 704-535-1774
NC Wake Forrest, Sentry Power Controls 704-535-1774
OH Cleveland, Arthur Baier 216-461-6161
OH Cleveland, Syntron, Inc. 216-572-2848
OH Dayton, Arthur Baier 513-276-4128
OR Forest Grove, Doran Sls. Assocs., Inc. 503-357-3333
PA Narberth, S. A. Jefferies 215-664-8500
TX Houston, Weisler & Assocs. 713-467-1847
UT Salt Lake City, Conely Engrg. Co. 801-972-5923
WA Green Acres, Doran Sls. Assocs., Inc. 509-922-2317
WA Redmond, Doran Sls. Assocs., Inc. 206-855-1885
WI Janesville, Antek Mktg. Assocs. 608-754-4214
EXP MO, St. Louis, Brauner Export Co. 314-426-2600
Can Mississauga, Ont., Knox Elctrl. Specialities, Inc. 416-646-6080

Local Distributors

AL Birmingham, MG Elctrns. & Equip., Co., Inc. 205-328-4525
AL Mobile, Specialty Distrg. Co. 205-344-0450
AR Rogers, Evans Elec. Motor Centers ... 501-636-0721
CA Cathedral City, Consolidated Elec. 714-328-1131
CA Danville, Cal-West Supp. 415-837-8245
CA Fresno, Electric Motor & Supp. 209-233-1155
CA Long Beach, Mag-Trol/Long Beach, Inc. 213-435-3451
CA Palm Springs, Lake Service 619-320-2727
CA Palo Alto, Elctrl. Matls., Inc. 415-494-0400
CA Redondo Beach, Elctrl. Power & Controls, Inc. 213-772-8890
CA South El Monte, Walton Electrical Controls, Inc. 213-442-4610
CO Denver, Control Comps, Inc. 303-371-2727
CO Golden, Utility Control & Equip. Co. ... 303-425-1990
DC Washington, Wesco 202-833-5250
FL Crystal River, Crems Indl. Sls. 813-795-2230
FL Ft. Lauderdale, Graybar Elec. 305-467-1453
FL Ft. Myers, Con. Elec. Supp. Co. 813-332-1515
FL Jacksonville, Graybar Elec. 904-356-7611
FL Lakeland, A-A Elc. 813-665-6941
FL Largo, Graybar Elec. 813-535-6460
FL New Port Richey, Pasco Elec. Sup. ... 813-842-8405
FL Orlando, Consolidated Elec. 305-849-6532
FL Tallahassee, Graybar Elec. 904-222-5332
FL Tampa, Electric Supp. of Tampa 813-872-1894
FL W. Palm Beach, Nurmi Elctrn. Supp., Inc. 305-686-8553
GA Albany, Specialty Distrbg. Co., Inc. 912-435-1711
GA Athens, Specialty Distrbg. Co., Inc. 404-548-1334
GA Atlanta, Dapco, Inc. 404-458-6341
GA Atlanta, Specialty Distrbg. Co., Inc. 404-873-2521
GA Augusta, Speciality Distrbg. Co., Inc. .. 404-722-1526
GA Brunswick, Specialty Distrbg. Co., Inc. 912-265-1927
GA College Park, Specialty Distrbg. Co., Inc. 404-763-3828
GA Columbus, Specialty Distrbg. Co., Inc. 404-327-7414
GA Macon, Specialty Distrbg. Co., Inc. 912-743-5421
GA Marietta, Specialty Distrbg. Co., Inc. ... 404-422-4333
GA Norcross, A-A Electric 404-449-8670
GA Savannah, Graybar Elec. 912-232-1121
GA Savannah, Specialty Distrbg. Co., Inc. 912-234-1684
GA Valdosta, Specialty Distrbg. Co., Inc. .. 912-242-4910
ID Coeur d'Alene, R. C. Worst & Co., Inc. 208-664-2133
ID Idaho Falls, Electrical Supp. 208-523-2800
ID Pocatello, Electrical Supp. 208-233-1362
ID Rexburg, Electrical Supp. 208-356-7282
IL Bloomingdale, Seversen Engrg. 312-529-0501
IL Fairfield, Precision Elec. Co. 618-842-7000
IL Mt. Prospect, Legend Elctrl. Sls. 312-952-0090
IN Evansville, Hutch & Son, Inc. 812-425-7201
IN Indianapolis, Genesis Elec. 317-637-5571
IN Indianapolis, Jackson Controls Co., Inc. 317-887-3111
IN Vincennes, Valley Elec. 812-882-7860
KS Salina, American Elec. 913-823-2248
KY Louisville, CDE/E & H Elec. Supp. Co. 502-587-0991
KY Louisville, Peerless Elec. 502-637-7677
KY Louisville, Peterson Elec. Supp. Co., Inc. 502-491-5010
ME Auburn, Gilman Elec. Supp. 207-784-6906
MD Baltimore, Infinity Sys., Inc. 301-358-8500
MD Baltimore, Wesco 301-327-4300
MD Salisbury, Wesco 301-742-2193
MN Minneapolis, Texa Minn Prods. 612-861-2900
MO St. Louis, United Elec. Supp. 314-771-5555
NE Omaha, West Dodge Elec. 402-393-8071
NH Manchester, Graybar Elec. 603-624-4341
NJ Audubon, Universal Elctrns. Supp. Co. 609-547-3430
NJ E. Rutherford, A-A Elec. 201-777-5477
NJ Fairlawn, Relay Specialties 201-797-3313
NY Long Island, Graybar Elec. 212-392-2000
NY Maybrook, Air Power House 914-457-3113
NY Whitestone, Power Electro Supp. Co., Inc. 212-767-1447
NC Charlotte, Southern Elec. Svc. Co. 704-372-4832
NC Huntersville, Scott Equip. 704-875-1611
OH Cincinnati, Wesco 513-542-4300
OH Cleveland, Milner Elec. 216-361-0300
OK Oklahoma City, Evans Elec. Motor Centers 405-631-1344
OK Tulsa, Cooper Supp. Co. 918-628-1500
OK Tulsa, Evans Elec. Motor Centers 918-587-1566
OR Bend, North Coast Elec. Co., Inc. 503-382-6211
OR Coos Bay, North Coast Elec. Co., Inc. 503-267-2145
OR Eugene, North Coast Elec. Co., Inc. ... 503-343-7701
OR Klamath Falls, North Coast Elec. Co., Inc. 503-884-4171
OR Medford, North Coast Elec. Co., Inc. ... 503-772-7131
OR Portland, North Coast Elec. Co., Inc. ... 503-228-5111
OR Portland, Reed Elec. Sls. & Supp., Inc. 503-223-8191
OR Tualatin, North Coast Elec. Co., Inc. ... 503-620-3910
PA Bala-Cyn-Wyd, Wesco 215-581-9314
PA Erie, Wesco 814-454-8191
PA Johnstown, Wesco 814-536-8761
PA Monroeville, Wesco 412-325-1300
PA Philadelphia, Mechanical Specialties, Inc. 215-331-5555
PA Pittsburgh, Wesco 412-255-4290
PA York, Wesco 717-843-0891
SC Columbia, J. W. Vaughn Co. 803-779-2690
SC Greenville, Shealy Elctrl. Whlsrs. 803-242-6880
TN Chattanooga, Specialty Distrbg. Co., Inc. 615-267-9531
TX Ft. Worth, Swieco, Inc. 817-335-6521
TX Houston, Commercial Equip. 713-237-8682
TX Houston, Hedco 713-224-4771
TX Midland, Energy Sys., Inc. 915-694-9657
TX San Antonio, Summers Elec. 512-824-1451
TX Waco, Smith Pump Co. 817-776-0377
TX Wichita Falls, Evans Elec. Motor Ctrs. 817-723-7466
UT S. Salt Lake, Engineered Control Sys., Inc. 801-487-6226
VA Alexandria, Calvert-Jones Co., Inc. 703-370-5850
VA Chantilly, Engineered Svcs., Inc. 703-471-6310
VA Danville, Wesco 804-792-2274
VA Hampton, Wesco 804-826-6730
VA Lynchburg, Wesco 804-845-0948
VA Norfolk, Wesco 804-625-7451
VA Petersburg, Wesco 804-732-1222
VA Richmond, Wesco 804-353-7353
VA Roanoke, Wesco 703-344-3271
WA Longview, North Coast Elec. Co., Inc. 206-423-1550
WA Moses Lake, Inland Elctrl. Supp. Co. .. 509-765-1251
WA Renton, Debenham 206-251-5055
WA Richland, Wesco 509-783-1397
WA Spokane, North Coast Elec. Co., Inc. .. 509-922-1317
WA Spokane, Power Pump & Elec. Supp. 509-534-5616
WV Beckley, Wesco 304-252-8633
WV Bluefield, Wesco 304-325-6151
WV Bridgeport, Wesco 304-624-6311
WV Parkersburg, Wesco 304-485-6541
WI Cedarburg, A-A Elec. 414-377-7500
WI Green Bay, Climatic Control Co., Inc. .. 414-336-4060
WI Madison, Climatic Control Co., Inc. 608-273-1717
WI Milwaukee, Climatic Control Co., Inc. .. 414-259-9070
WI Monroe, Precision Drive & Control, Inc. 608-328-5600
WY Casper, Crum Elec. Supp. Co. 307-266-1278
WY Casper, Wesco 307-266-3740
WY Gillette, Wesco 307-687-0014
EXP Jamaica, Kingston, Calcon Exporters 809-926-3320
Intl St. Thomas, Power Sys., Inc. 809-776-0217
PR Bayamon, Jenson Protective Dvcs. ... 809-798-3264

DIVERSIFIED TECHNLG., P.O. Box 748, Ridgeland, MS 39157, Tel: 601-856-4121, Telex: 585326, TWX: 810-966-2626; Empl.: 65; *Sls. Mgr.:* Bill Long; *Dist. Mgr.:* Bill Long

DIXON INDS., 386 Metacom Ave., Bristol, RI 02809, Tel: 401-253-2000, Telex: 927706

DIXSON, INC., INSTRUMENT DIV., Box 1449, Grand Junction, CO 81502, Tel: 303-242-8863, TWX: 910-929-6991; Empl.: 250; *Sls. Mgr.:* Ray Carlson ..... **D•1349**

Local Sales Offices & Reps

AL	Birmingham, Sesco-Birmingham	205-988-8304
AZ	Phoenix, Finn-Pat Co. Inc.	602-954-0301
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Newark, Jacobson & Assocs.	415-791-2336
CO	Lakewood, Loritz Controls	303-232-7803
CT	Hamden, Pond Tech. Sls.	203-281-0005
FL	North Palm Beach, Sesco-Miami	305-832-0770
GA	Atlanta, Sesco-Atlanta	404-458-6423
IL	Bartlett, JJS Mktg. Svcs.	312-830-1670
LA	Baton Rouge, Sesco-Baton Rouge	504-928-4951
ME	W. Buxton, Pond Tech. Sls.	207-637-2200
MA	Waltham, Pond Tech. Sls.	617-890-5535
MI	Swartz Creek, JJS Mktg. Svcs.	313-635-7305
MN	Chanhassen, Elctrn. Instr. CnsltS.	612-445-7056
MO	Manchester, Control Sys. Des.	314-227-4212
NY	Mt. Vernon, Sonkin Assocs.	914-668-9809
NY	North Syracuse, Naco Elctrns.	315-699-2651
NC	Cary, Sesco-Raleigh	918-467-7482
OK	Tulsa, Sesco-Tulsa	918-622-3868
OR	Portland, Instr. Rep. Assocs.	503-245-6103
PA	King of Prussia, FLW of PA, Inc.	215-337-4343
TN	Knoxville, Sesco-Knoxville	615-588-5455
TX	Austin, Sesco-Austin	512-892-2490
TX	Dallas, Sesco-Dallas	214-231-9364
TX	Houston, Sesco-Houston	713-999-3510
WA	Seattle, Instr. Rep. Assocs.	206-762-0707
EXP	Toronto, Ontario, Versatile Meas. Instr.	416-239-8161

DMA SYS., 601 Pine St., Goleta, CA 93117, Tel: 805-683-3811; *Sls. Mgr.:* Don M. Minami

DOCUMATION, Box 1240, Melbourne, FL 32901, Tel: 305-725-5500, TWX: 510-959-6286; Empl.: 2800; *Sls. Mgr.:* K. Nelson; *Dist. Mgr.:* D. Carson

DODGE-MASTER-REEVES, Reliance Electric, P. O. Box 99502, Cleveland, OH 44199, Tel: 800-245-4501, in OH 800-245-4497

D. O. INDUSTRIES, 317 E. Chestnut St., E. Rochester, NY 14445, Tel: 716-385-4920, Telex: 200802; FSC No.: 716-381-7032; *Sls. Mgr.:* Jeremy Goldstein

DOLAN-JENNER INDS., Box 1020, Woburn, MA 01801, Tel: 617-935-7444, Telex: 94-8161; Empl.: 120; *Sls. Mgr.:* S. Futran; *Dist. Mgr.:* S. Futran

Local Sales Offices & Reps

CA	Hollywood, Duncan Engrg.	213-462-5880
CA	Mountain View, C/G Assocs.	415-968-6062
CO	Denver, Gribble Sls.	303-279-4545
IL	Buffalo Grove, Jim Laganowski Assoc.	312-520-0130
MA	Hingham, R. J. Wilson	617-749-7575
MI	Walled Lake, Static Controls Corp.	313-363-4500
MN	Minneapolis, Gribble Sls.	612-788-7028
MO	Independence, Gribble Sls.	816-796-4333
NJ	Mt. Laurel, Speck Indl. Controls	609-778-8924
NJ	Rivervale, Budd-Tronics	201-666-5030
NY	Frankfort, Kapital Instr. Sls.	315-894-4245
NC	Greensboro, Ron Ingle	919-273-4042
OH	Novelty, Rogers Sls.	216-338-8500
TN	Knoxville, Stephenson Controls & Sys.	615-588-7473
TX	Lewisville, Gribble Sls.	214-221-5109
WI	Cedarburg, TFL Assocs.	414-377-7030

DOLCH LOGIC INSTRS., 2029 O'Toole Avenue, San Jose, CA 95131, Tel: 408-945-1881, TWX: 910-338-2023; *Sls. Mgr.:* Terry Larson

DOLPH, JOHN C., CO., New Rd., Monmouth Junction, NJ 08852, Tel: 201-329-2333; *Sls. Mgr.:* J. E. Rooze

DONGAN ELECTRIC MFG. CO., 2987 Franklin St., Detroit, MI 48207, Tel: 313-964-3500

DONTECH INC., 601-606 Airport Indl. Blvd., Doylestown, PA 18901, Tel: 215-348-5010, Telex: 685 1155 DONTK; *Sls. Mgr.:* Bernard Sherer

DORAN MFG. CO., 2851 Massachusetts Ave., Cincinnati, OH 45225, Tel: 513-681-5424; Empl.: 40; *Sls. Mgr.:* Russ DeMar

DORMAN BOGDONOFF CORP., Corp. Center, Willow Pond, Andover, MA 01810, Tel: 617-470-0001, Telex: 710-347-0333; *Sls. Mgr.:* Charles P. Centore

DORMEYER INDS., 3418 N. Milwaukee, Chicago, IL 60641, Tel: 312-283-4000, TWX: 910-221-3831; Empl.: 400; *Sls. Mgr.:* Richard Henry

DOTRONIX, 160 First St. SE, New Brighton, MN 55112, Tel: 612-633-1742, TWX: 910-563-3541; Empl.: 130; *Sls. Mgr.:* L. R. Lemke

Local Sales Offices & Reps

GA	Atlanta, E. G. Holmes & Assocs.	404-451-6161
ME	Newton, Gerber Sls. Corp.	617-969-2620
MN	New Brighton, Dotronix	612-633-1742
TX	Dallas, MGR	214-238-5246

DOUGLAS ELCTRNS., 718 Marina Blvd., San Leandro, CA 94577, Tel: 415-483-8770

DOUGLAS RANDALL, 6 Pawcatuck Ave., Pawcatuck, CT 06379, Tel: 203-599-2075, Telex: 6814060; Empl.: 125; *Sls. Mgr.:* N. Paulson ..... **B•1323-1331**

Local Sales Offices & Reps

AZ	Tempe, Trembly Assoc.	602-967-2058
CA	Anaheim, Galaxie Sls. Int'l.	714-937-5622
CA	Oakland, Powermatic Assoc.	415-635-6825
CA	San Diego, Qualtronics	619-695-0118
CO	Wheat Ridge, Trembly Assoc.	303-421-8900
CT	Yalesville, JMG-Glynn Connecticut	203-265-9452/2498
FL	Maitland, Ellis & Assoc.	305-645-1101
GA	Lilburn, W. A. Stancil	404-962-5643
IL	Chicago, Ropek-Cahill-Vogt	312-631-0070
MA	Norwood, JMG, Inc.	617-762-5333
MI	Southfield, Fred H. Gehrke & Assoc.	313-559-5363
MN	Osseo, Gaffney Sls. Co.	612-425-5484
MO	Kansas City, Delltron Co. Inc.	816-436-6445
MO	St. Louis, Delltron Co.	314-869-4779
NV	Las Vegas, Trembly Assoc.	702-739-9770
NJ	Morristown, Andrews & Andrews	201-569-8800
NM	Albuquerque, Trembly Assoc.	505-266-8616
NY	Fayetteville, C. W. Floring & Assocs.	315-637-4552
NY	Glen Head, Andrews & Andrews	516-692-8686
NY	Rochester, J. G. Welch Assoc.	716-244-1100
NY	Syracuse, C. W. Floring & Assoc.	315-478-2149
NC	Raleigh, Leigh Sls.	919-872-1484
OH	Cleveland, Geotronix Mktg. Assoc.	216-526-2535
OH	Trotwood, Geotronix, Inc.	513-252-6700
OR	Beaverton, Caruso & Northcutt	503-646-4973
PA	Glenside, Elcom	215-885-1715
TX	Dallas, Paramount Controls	214-341-4561
WA	Bellevue, Caruso & Northcutt	206-454-9699
Can	Mont., Que., Solid State Engrg. Co.	514-481-3313

Local Distributors

CA	Chatsworth, Mil-Comm Dist.	213-998-3111
CA	S. San Francisco, Steven Engrg.	415-588-9200
MA	Middleboro, Glynn Elect.	617-947-4262
OH	Cleveland, Alpha Corp.	216-526-3716
TX	Houston, Alpha Distr. Corp.	713-464-4662
EXP	Jerusalem, Efraim Ben Yakir	
Intl	London, England, Kynmore Eng.	01-839-2371

DOW CHEMICAL CO., 2020 Dow Center, Midland, MI 48640, Tel: 517-636-1000, Telex: 227455, TWX: 810-266-9490; Empl.: 53,300

DOW CORNING CORP., Box 0994, Midland, MI 48686-0994, Tel: 517-496-4000, Telex: 227450, TWX: 810-266-9006; Empl.: 5800

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DOW-KEY MICROWAVE CORPORATION, 1110 Mark Ave., Carpenteria, CA 93013-2918, Tel: 805-684-4560, TWX: 910-336-1141; FSC No.: 00471; Empl.: 130; *Dist. Mgr.:* Jack Dysart ..... **A•1710**

Local Sales Offices & Reps

AZ	Tempe, Gassner & Clark	602-968-9037
CA	Mountain View, Peninsula Tech. Sls.	415-965-3636
CA	Torrance, Detomasi & Grupp, Inc.	213-327-1775
CO	Englewood, Sierra Tech. Grp., Inc.	303-790-1700
FL	Melbourne, Saber Assocs., Inc.	305-724-0920
FL	Melbourne, Saber Assocs., Inc.	305-742-0920
IL	Schaumburg, Gassner & Clark	312-882-8608
IA	Cedar Rapids, H. R. Brown Sls. Co.	319-366-0635
MD	Beltsville, Applied Engrg. ConsltS.	301-792-2211
MA	Lowell, Matrix Sls., Inc.	617-458-2096
MN	Minneapolis, De Beck-Hays Assocs., Inc.	612-835-4649
MN	St. Paul, De Beck	612-635-4649
MO	St. Louis, Abrams & Assocs.	314-569-0447
NM	Albuquerque, Data Handling	505-884-0284
NY	Casenovia, S. T. Woolard Co.	315-655-8145
NY	Melville, Metro-Mics	516-271-6677
NY	Rochester, Lamb Comps., Inc.	716-323-1250
OH	Cincinnati, Delta Sls.	513-271-5444
OR	Tigard, Components West, Inc.	503-684-6171
PA	Paoli, Tyler Griffin Co.	215-647-1550
TX	Houston, Lear Assocs., Inc.	713-488-7893
TX	Richardson, Lear Assocs., Inc.	214-231-5388
WA	Redmond, Components West, Inc.	206-885-5880
Can	Mississauga, Ont., Vitel Elctrns.	416-676-9720

Local Distributors

TX	Ft. Worth, Allied Elctrns.	817-336-5041

DRACON DIV., See Harris Corp., Dracon Div.

DRAKE, R. L., CO., 540 Richard St., Miamisburg, OH 45342, Tel: 513-866-2421, Telex: 28-8017; *Sls. Mgr.:* Richard Renken; *Dist. Mgr.:* Richard Renken

DRANETZ TECHNOLOGIES, INC, Computer Products Division, 1000 New Durham Rd., P.O. Box 4019, Edison, NJ 08818-4019, Tel: 201-287-3680, Telex: 499-7808, TWX: 710-997-9553; FSC No.: 23207; Empl.: 230; *Sls. Mgr.:* A. Orlacchio ..... **D•1167**

Local Sales Offices & Reps

AL	Huntsville, Kemp Instrs., Inc.	205-837-4304
AZ	Scottsdale, Barnhill Assocs., Inc.	602-947-7841
CA	Redondo Beach, Ward/Davis Assocs., Inc.	213-643-6977
CA	Santa Clara, Ward/Davis Assocs., Inc.	408-245-3700
CO	Englewood, Barnhill Assocs., Inc.	303-779-3600
CT	Mount Carmel, Scientific Dvcs. - Conn.	203-248-9361
FL	Melbourne, Datarep, Inc.	305-259-8924
FL	Orlando, Datarep, Inc.	305-843-5224

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GA Atlanta, Kemp Instrs., Inc. 404-452-8050
IL Elk Grove Village, Loren Green Assocs. Central, Inc. 312-593-0282
IN Indianapolis, Loren Green Assocs. Central, Inc. 317-293-9827
KS Shawnee, Atech, Inc. 913-268-9644
LA Lafayette, Kemp Instrs., Inc. 318-269-9452
MI Brighton, Stress Anls. Svcs. 313-632-6110
MI Farmington, Carter, McCormic & Peirce, Inc. 313-477-7700
MN Edina, Carvel Engrg. & Sls. Co. 612-835-7929
MN Minneapolis, Loren Green Assocs., Inc. 612-571-6666
MO St. Louis, Atech, Inc. 314-576-2884
NE Lincoln, Harry Ferris Co. 402-464-6148
NJ Lodi, SDM Reps., Inc. 201-368-0123
NM Albuquerque, Barnhill Assocs., Inc. 505-299-7658
NY Rochester, SDM Reps., Inc. 716-247-8770
NC Charlotte, Baesel & Assocs., Inc. 704-375-1044
OH Cleveland, Carter, McCormic & Peirce, Inc. 216-779-5100
OH Englewood, Carter, McCormic & Peirce, Inc. 513-836-0951
OR Portland, Topp Engrg. Sls. Corp. 503-244-7265
PA Monroeville, Carter, McCormic & Peirce, Inc. 412-372-4415
PA Plymouth Meeting, Elctrn. Mktg. Assocs., Inc. 215-828-7400
TX Austin, Barnhill Assocs., Inc. 512-451-0217
TX Houston, Barnhill Assocs., Inc. 713-688-9971
TX Richardson, Barnhill Assocs., Inc. 214-231-2573
UT Murray, Barnhill Assocs., Inc. 801-262-3000
WA Bellevue, Topp Engrg. Sls. Corp. 206-747-5400
Can Toronto, Ont., Atelco, Inc. 416-497-2208

DRANETZ TECHNOLOGIES, INC., General Instrument Division, 1000 New Durham Rd., P.O. Box 4019, Edison, NJ 08818-4019, Tel: 201-287-3680, Telex: 4997808, TWX: 710-997-9553; FSC No.: 23207; Empl.: 230; *Sls. Mgr.:* A. Orlacchio

Local Sales Offices & Reps

AL Huntsville, Kemp Instrs., Inc. 205-837-4304
CA Costa Mesa, Ward/Davis Assocs., Inc. 714-556-0955
CA Redondo Beach, Ward/Davis Assocs., Inc. 213-643-6977
CA Santa Clara, Ward/Davis Assocs., Inc. 208-245-3700
GA Atlanta, Kemp Instrs., Inc. 404-452-8050
IL Elk Grove Village, Loren Green Assocs., Central, Inc. 312-593-0282
IN Indianapolis, Loren Green Assocs., Central, Inc. 317-293-9827
KS Shawnee, Atech, Inc. 913-268-9644
LA Lafayette, Kemp Instrs., Inc. 318-269-9452
MI Southfield, Comtel Instrs. Co. 313-358-2505
MN Minneapolis, Loren Green Assocs., Inc. 612-571-6666
MO St. Louis, Atech, Inc. 314-576-2884
NY Rochester, Harmony Labs 716-458-3376
NC Charlotte, Baesel & Assocs., Inc. 704-375-1044
OH Cleveland, Comtel Instrs. Co. 216-442-8080
OH Dayton, Comtel Instrs. Co. 513-298-7573
OH Hilliard, Comtel Instrs. Co. 614-876-8305
OR Portland, Topp Engrg. Sls. Corp. 503-244-7265
PA Pittsburgh, Comtel Instrs. Co. 412-922-5720
PA Plymouth Meeting, Electronic Mktg. Assocs., Inc. 215-828-7400
WA Bellevue, Topp Engrg. Sls. Corp. 206-747-5400-1
Can Toronto, Ont., Atelco, Inc. 416-497-2208

DRANETZ TECHNOLOGIES, INC., Industrial Products Division, 1000 New Durham Rd., P.O. Box 4019, Edison, NJ 08818-4019, Tel: 201-287-3680, Telex: 499-7808, TWX: 710-997-9553; FSC No.: 23207; Empl.: 230; *Sls. Mgr.:* A. Orlacchio

Local Sales Offices & Reps

AL Huntsville, Kemp Instrs., Inc. 205-837-4304
CA Orange, Sterling West 714-997-1862
CA Pasadena, Jim Robins & Assocs. 818-795-9118
CA San Jose, D.P. Assocs., Inc. 408-296-1492
CO Wheatridge, MC2 303-431-2262
FL Melbourne, Datarep, Inc. 305-259-8924
FL Orlando, Datarep, Inc. 305-843-5224
GA Atlanta, Kemp Instrs., Inc. 404-462-8050
IL Elk Grove Village, MEMECO Sls. & Svc. Corp. 312-228-9555
LA Lafayette, Kemp Instrs., Inc. 318-269-9452
MI Brighton, Stress Analysis Svcs. 313-632-6110
MN Bloomington, Arjay Sls. 612-854-4972
MO Raytown, Power Spec., Inc. 816-353-6550
MO St. Charles, Gramlich Elec. Power 314-928-1075
NE Lincoln, Harry Ferris Co. 402-464-6148
NJ Bayonne, Long, Poveromo & Assocs., Inc. 201-858-3745
NM Albuquerque, MC2 505-293-9090
NY Syracuse, O. R. Lawrence Co. 315-455-5587
NC Charlotte, Baesel & Assocs., Inc. 704-375-1044
OH Medina, Stress Analysis Svcs. 216-725-7733
OH Middletown, Stress Analysis Svcs. 513-422-7900
OK Stillwater, Acudata, Inc. 405-743-1886
OR Portland, Topp Engrg. Sls. Corp. 503-244-7265
PA Carnegie, Stress Analysis Svcs. 412-344-5555
PA Plymouth Meeting, Electronic Mktg. Assocs., Inc. 215-828-7400
TX Austin, Acudata, Inc. 512-478-1018
TX Houston, Acudata, Inc. 713-580-2451
TX Houston, Payne Assocs./EMS Engrg. 713-537-0056
TX Plano, Acudata, Inc. 214-424-3567
TX Rockdale, K & K Elctrns. 512-446-3773
UT Salt Lake City, MC2 801-364-3174
WA Bellevue, Topp Engrg. Sls. Corp. 206-747-5400-1
Can Toronto, Ont., Atelco, Inc. 416-497-2208

DRAWN METAL PRODUCTS, 6143 W. Howard St., Niles, IL 60648, Tel: 312-647-8941; Empl.: 60; *Sls. Mgr.:* Tom Amundson

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DREEFS SWITCH, INC., 3782 Hawthorn Ct., Waukegan, IL 60087, Tel: 312-662-7667, 800-323-9605, Telex: 703784; Empl.: 63; *Sls. Mgr.:* Ed Magiera; *Dist. Mgr.:* Ed Magiera ..... **B•1553-1555**

Local Sales Offices & Reps

AZ Tempe, Trembly Assocs., Inc. 602-967-2058
CA Anaheim, Spectrum Assocs., Inc. 714-630-6977
CA Sunnyvale, Schwerin Merrill, Inc. 408-735-7900, 312-662-7667
CO Wheat Ridge, Trembly Assocs., Inc. ... 303-421-8900
CT Madison, Reptron Sls. 203-245-2242
IL Roselle, MSL & Assocs. 312-893-9555
IL Waukegan, Dreefs Switch, Inc. 800-323-9605
MA Newton Highlands, WM. Valle Assocs., Inc. 617-965-0002
MO Raytown, Centech, Inc. 816-358-8100
NJ Ocean, P. Saftler Assocs.,Inc./Gordon 201-922-3014
NM Albuquerque, Trembly Assocs., Inc. ... 505-266-8616
NY Fulton, P. Saftler Assocs. 315-592-7184
NY Lynbrook, P. Saftler Assocs. 516-593-7880
OH Cleveland, Goory Sls. Co. 216-777-2011
OH Toledo, Jim Finnegan Co. 419-865-5306
OR Portland, Controltek Sls., Ltd. 503-641-0877
OR Portland, Controltek, Sls. 503-641-0877
PA Malvern, Stitzer Assocs. 215-644-5500
TX Dallas, Blackburn Assocs., Inc. 214-692-8885
TX Houston, Blackburn Assocs., Inc. 713-463-1354
UT Salt Lake City, Trembly Assocs., Inc. .. 801-486-5292
WA Seattle, Controltek Sls., Ltd. 206-467-0622
WI Mequon, Badgerep, Inc. 414-241-9200
Can Concord, Astec Comps. 416-669-4022

Local Distributors

CA San Jose, Cypress Elctrns. 408-945-8400, 800-538-5112
CA Torrance, Cypress Elctrns. 213-530-1900
CO Wheat Ridge, Cypress Elctrns., Inc. ... 303-431-2622
IL Wheeling, Hawk Elctrns. 213-459-4030, 800-843-4295
TX Dallas, Cypress Elctrns., Inc. 214-869-1435
TX McKinney, Sunbelt Elctrns. 214-542-1432
Can Mississauga, Ont., Prelco Elctrns., Ltd. 416-745-9370,800-387-3874

DRESSEN-BARNES ELCTRNS., 1600 E. Valencia Dr., Fullerton, CA 92631, Tel: 714-871-3020, TWX: 910-592-1256; FSC No.: 89321; Empl.: 220; *Sls. Mgr.:* B. Guy

DRESSER INDS., 1505 Elm St., Dallas, TX 75201, Tel: 214-746-6000, Telex: 73-2489, TWX: 910-861-4136; Empl.: 55,000

DUKANE CORP., Communications Sys. Div., 2900 Dukane Dr., St. Charles, IL 60174, Tel: 312-584-2300, Telex: 720426; Empl.: 700; *Sls. Mgr.:* Jack Hollis; *Dist. Mgr.:* Jack Hollis

DUMONT ELCTRNS., See Thomson-CSF Comps. Corp., DuMont Div.

DUMONT INSTRUMENTATION, INC., 75 Mall Dr., Commack, NY 11725, Tel: 516-864-8500, TWX: 510-226-3739; Empl.: 15,000; *Sls. Mgr.:* H. Poschmann

DUMONT OSCILLOSCOPE LABS., 40 Fairfield Pl., W. Caldwell, NJ 07006, Tel: 201-575-8666, Telex: 219236 DOLI-UR; FSC No.: 30669; Empl.: 30; *Sls. Mgr.:* John Carter, Jr.

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Local Sales Offices & Reps

AL Huntsville, L. & D., Inc. 205-837-1469
AZ Tempe, Southwest E/M Engrg. 602-941-2828
AR El Dorado, Kemp Engrg. Co., Inc. 501-862-5869
CA Irvine, Comar Co. 714-540-1219
CA Mountain View, Caltron Comps. 415-964-3244
CA San Diego, Comar Co. 619-565-6097
CO Denver, Elcom 303-337-2300
CT Guilford, A & M Elctrn. 203-453-1612
FL Ft. Lauderdale, ElectroComp Assocs. 305-491-4141
FL Melbourne, ElectroComp Assocs. 305-242-0621
FL St. Petersburg, ElectroComp Assocs. 813-822-9677
GA Atlanta, L. & D., Inc. 404-455-3483
IL Rolling Meadows, KMA Sales Co. 312-398-5300
KS Shawnee Mission, Florence & Meyer 913-722-5210
LA Lafayette, Kemp Engrg. Co. 318-269-9452
MA Needham, A & M Elctrn. 617-444-8170
MI Farmington Hills, Elcon Michigan Sls. 313-855-3240
MN St. Paul, J. J. Exon Co. 612-636-5533
NY Clinton, Advanced Comps. 315-853-6438
NY Copiague, Sencor 516-842-7676
NY Endicott, Advanced Comps. 607-785-3191
NY N. Syracuse, Advanced Comps. 315-699-2671
NY Scottsville, Advanced Comps. 716-889-1429
NC Greensboro, L. & D., Inc. 919-292-3201
NC Raleigh, L. & D., Inc. 919-876-5301
OH Dayton, Rockford Controls Ohio 513-898-5452
OH Euclid, Rockford Controls Ohio 216-731-5250
OH Reynoldsberg, Rockford Controls Ohio 614-868-5577
OK Tulsa, Kemp Engrg. Co. 918-663-4501
OR Portland, Dussault & Assocs. 503-641-8540
PA Philadelphia, Sencor 215-698-9660
TN Seymour, Tennessee 615-573-6511
TX Addison, Kemp Engrg. Co. 214-931-7100
TX Houston, Kemp Engrg. Co. 713-466-1465
UT Salt Lake City, Elcom 801-532-7940
VA Richmond, L & D, Inc. 804-257-7717
WA Seattle, Dussault & Assocs. 206-527-5454
WI Milwaukee, KMA Sales Co. 414-259-1771

Local Distributors

AZ Phoenix, Aero-Space SW, Inc. 602-861-1785
CA Hollywood, Yale Radio Elec. Co. 213-465-3186
CA Sun Valley, Richey Elctrns. 213-875-2862
CO Englewood, Industrial Elctrns. 303-694-9444
IL Elk Grove, RM Co. 312-364-6622
IL Elk Grove Village, GBL Elctrns. 312-593-3220
LA Baton Rouge, Industrial Elctrn. Supp. .. 504-926-0513
LA Shreveport, Industrial Elctrn. Supp. 318-222-9459
MA Waltham, Sterling Elctrns. 617-894-6200
MN Minneapolis, The Bergquist Co. 612-835-2322
NY Hauppauge, Broadline Elctrns. 516-231-4100
NY Mt. Vernon, Kin-Tronics 914-668-9885
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Akron, Akron Elctrns. Supp. 216-762-8818
OK Tulsa, Southwest Elctrns. 918-583-7776
OR Portland, Radar Elec. 503-232-3404
PA Erie, REM Elctrns. Supp. 814-453-5626
PA McKeesport, Barno Radio 412-664-9394
TX Austin, Southwest Elctrns. 512-837-8971
TX Richardson, Southwest Elctrns. 214-234-3050
TX Stafford, Southwest Elctrns. 713-491-4900
UT Salt Lake City, Standard Supp. Co. 801-486-3371
WA Seattle, Radar Elec. 206-282-2511
WI Hartland, GW Elctrns. 414-276-1212

DUNEGAN CORPORATION, P.O. Box 3238, Mission Viejo, CA 92690, Tel: 714-831-9131, Telex: 68-3430; FSC No.: 66; Empl.: 70; *Sls. Mgr.:* Mike Kelly

DUOTONE, 6875 S.W. 81st St., S. Miami, FL 33143, Tel: 305-665-1121; Empl.: 20; *Sls. Mgr.:* S. Nester; *Dist. Mgr.:* S. G. Nester

DU PONT CONNECTOR SYSTEMS, 30 Hunter La., Camp Hill, PA 17011, Tel: 800-237-2374, TWX: 510-650-3538; *Sls. Mgr.:* J. McAluney; *Dist. Mgr.:* E. Abbott

DUPONT DE NEMOURS, E. I., & CO., 1007 Market St., Wilmington, DE 19898, Tel: 302-773-3218; Empl.: 130,000

DUPREE, INC., 9835 Dupree St., So. El Monte, CA 91733, Tel: 818-442-4700; Empl.: 60; *Sls. Mgr.:* Beverly Bowdry

DURACELL INTL., S. Broadway, Tarrytown, NY 10591, Tel: 914-591-7000, Telex: 131548, TWX: 710-564-0810; Empl.: 4000

DURAKOOL, 1010 N. Main St., Elkhart, IN 46514, Tel: 219-264-1116, Telex: 25-8482; Empl.: 200; *Sls. Mgr.:* Stan Kalin; *Dist. Mgr.:* Larry Hedeen/Dave Deuel

DURALITH, 525 Orange St., Millville, NJ 08332, Tel: 609-825-6900, TWX: 510-687-7520; Empl.: 500; *Sls. Mgr.:* James Potter

DURGIN & BROWNE, 80 Allen Rd., So. Burlington, VT 05401, Tel: 802-863-6873; Empl.: 35; *Sls. Mgr.:* Chris Riggs

DVE/CALTRONIC CO., LTD., A Sub. of Dee Van Entrp. Co., Ltd., 407 S. Palm Ave., Alhambra, CA 91803, Tel: 818-289-0310 ..... **D•1613**

DY-4 SYSTEMS INC., 888 Lady Ellen Pl., Ottawa, ON, Canada K1Z 5M1, Tel: 613-728-3711, Telex: 053-4969; Empl.: 90; *Sls. Mgr.:* Terry Black

DYLON DATA CORP., 9561 Ridgehaven Ct., San Diego, CA 92123, Tel: 619-292-5584, TWX: 910-335-1524; Empl.: 20; *Sls. Mgr.:* R. A. Comstock; *Dist. Mgr.:* Steve Komarek

DYMA ENGRG., Box 1535, Los Lunas, NM 87031, Tel: 505-865-6700; Empl.: 14; *Sls. Mgr.:* Wiley R. Cunningham; *Dist. Mgr.:* Patrick Cating

DYMEC, 8 Lowell Ave., Winchester, MA 01890, Tel: 617-729-7870, TWX: 710-348-6596; Empl.: 80; *Sls. Mgr.:* Bill Schromm

DYMEK CORP., 1851 Zanker Road, San Jose, CA 95070, Tel: 408-947-8700, Telex: 910-338-2174; Empl.: 65; *Sls. Mgr.:* Dan Cribbs; *Dist. Mgr.:* Dan Cribbs

DYNACIRCUITS INC., 11230 W. Addison, Franklin Park, IL 60131, Tel: 312-451-1700; *Sls. Mgr.:* Fred Stein

DYNAGE/CONTROLS, INC., 2 Willowbrook Rd., Cromwell, CT 06416, Tel: 203-635-6257, Telex: 753243 (OAKLEAFINC); Empl.: 9; *Sls. Mgr.:* Helen S. Mendello

Local Sales Offices & Reps

AZ Scottsdale, Williams Assocs. 602-947-4297
CA Mountain View, Claypool Controls Corp. 415-968-7488
CO Commerce City, Williams Assocs. 303-289-5647
CT Hamden, Applied Meas., Inc. 203-288-5288
FL Deland, Dell-Tech Control Co. 904-734-4200
IL Palatine, Delta Instrmn. 312-934-8328
IN Indianapolis, R. R. Harden Assocs., Inc. 317-849-1708
LA Metairie, Slaton & Assocs., Inc. 504-455-3855
MD Gaithersburg, Powell-Pendergraph, Inc. 301-921-4200
MA Acton, Applied Meas., Inc. 617-263-2766
MI Lathrop Village, Electro-Assocs. of Mich., Inc. 313-533-8797
MN Minneapolis, Busch-Elctrns., Inc. 612-835-2044
MO Ellisville, Advanced Ind. Sys. 314-458-2034
NJ Plainfield, Cosine, Inc. 201-654-3551
NM Albuquerque, Williams Assocs. 505-255-1638
NY Buffalo, Seelbach & Schmitt, Inc. 716-839-2300
OH Cleveland, Fox & Dole, Inc. 216-476-2625
OH Dayton, Mohawk Intronics 513-434-8873
OK Tulsa, Electronic Pneumatic Instrmn. .. 918-834-8400
OR Portland, Topp Engrg. Sls. Corp. 503-244-7265
PA Ingomar, Greye Glass Assocs. 412-366-6664
PA Pittsburgh, Greye Glass Assocs. 412-366-6664
PA Thornton, Sentech Co. 215-459-4260
TN Concord, Technical Automation, Inc. .. 615-966-5107
TX Corpus Christi, Collinsystems/Pro-Quip 512-887-9711
TX Houston, Collinsystems/Pro-Quip 713-464-9428
TX Weatherford, Collinsystems/Pro-Quip 817-599-8252
UT Salt Lake City, Applied Engrg. Prods. .. 801-532-5343
VA Richmond, Powell-Pendergraph, Inc. .. 804-270-1400
WA Bellevue, Topp Engrg. Sls. Corp. 206-747-5400
WI Milwaukee, Star Engrg. Sls. Corp. 414-645-3680

DYNAGE/POWER & MAGNETICS, Division Of Oakleaf, Inc., 2 Willowbrook Road, Cromwell, CT 06416, Tel: 203-635-3510, Telex: 753243 (OAKLEAFINC); Empl.: 9; *Sls. Mgr.:* Helen S. Mendello

Local Sales Offices & Reps

CT Cromwell, Oakleaf Engrg. Sls. 203-635-5213
NJ East Rutherford, L & L Comp. Sls. 201-933-8542
SD Hartford, Oakleaf Engrg. Sls. 605-528-6701

DYNALOY, INC., 7 Great Meadow La., Hanover, NJ 07936, Tel: 201-887-9270, Telex: 642-033; FSC No.: 27908; Empl.: 19

Local Sales Offices & Reps

CA Westminster, Contronic Devices 714-897-2266
FL Ft. Lauderdale, Etchomatic 305-563-5060
MA Waltham, Etchomatic 617-893-2020
MN Minneapolis, International Sls. 612-831-8423

DYNAMIC AIR ENGRG, INC., EMC Filter Div., 620 E. Dyer Rd., Santa Ana, CA 92705, Tel: 714-540-2081, TWX: 910-595-2588

DYNAMICS, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311, Tel: 818-998-8281, Telex: 69-6171; Empl.: 100; *Sls. Mgr.:* Tony Mastroianni

DYNAMICS RESEARCH CORP., Encoder Division, 60 Concord St., Wilmington, MA 01887, Tel: 617-658-6100; *Sls. Mgr.:* Dave Silva ..... **B•1793**

Local Sales Offices & Reps

AZ Phoenix, Thor Engrg. 602-437-1463
CA Laguna Beach, Comar Co. 714-240-0140
CA San Diego, Comar Co. 619-565-6097
CA San Jose, Motion Sys. 408-246-0641
CO Aurora, HI Tech. 303-696-7403
CT Ansonia, Sturdy Corp. 203-734-2186
FL Tampa, Brawley Tech. Sls. 813-251-6816
MD Columbia, Tyler Griffen 301-995-1215
MA Wellesley Hills, Sturdy Corp. 617-235-2330
MI Southfield, Fred H. Gehrke & Assocs. 313-559-5363
MN Newport, Applied Motion Technlg. 612-459-0600
MO St. Louis, Delltron Co. 314-869-4779
NJ Sparta, E.S. Williams Co. 201-729-4049
NY Pittsford, Controlled Motion Prods. Co. 714-381-1933
NC Charlotte, Jake Rudisill Assocs. 704-377-6901
OH Cincinnati, Kenneth C. Hoffman 513-931-1686
PA Paoli, Tyler Griffen 215-647-1550
TX Fort Worth, El-Tech Sls. 817-268-2896
TX Houston, C.R. Colvin Assocs. 713-961-1262
WI Colgate, Rep 1 & Assocs. 414-628-4016
Can Lachine, Que., Electro Design 514-636-4838

DYNAMIC TIME SYSTEMS, INC., 150 West 1230 North, Ste. 2, Provo, UT 84604, Tel: 801-377-9154; *Sls. Mgr.:* Graham Hawkins; *Dist. Mgr.:* Graham Hawkins

DYNAPAR, 1675 Delany Rd., Gurnee, IL 60031, Tel: 312-662-2666, TWX: 910-235-1865; Empl.: 100

DYNAPLEX INC., Interplex, 120-12 28th Ave., Flushing, NY 11354, Tel: 212-961-6750, TWX: 710-582-3048; *Sls. Mgr.:* Lester Zimmerman; *Dist. Mgr.:* Lester Zimmerman

DYNATECH CORP., 1225 E. Wakeham Ave., P.O. Box 1019, Dept. E, Santa Ana, CA 92702, Tel: 714-558-8755, TWX: 910-595-1951; Empl.: 340; *Sls. Mgr.:* Rick Burbank

DYNATEC INTERNATIONAL, 3594 West 1820 South, Salt Lake City, UT 84104, Tel: 801-973-9500, 800-722-7425; *Sls. Mgr.:* Robert Checketts; *Dist. Mgr.:* Robert Checketts

DYNATRONIX, INC., 105 Power St., Amery, WI 54001, Tel: 715-268-8118, 800-826-7172, TWX: 297861 DYTX UR; Empl.: 25; *Sls. Mgr.:* R. W. Kappler; *Dist. Mgr.:* R. W. Kappler, Natl. Sls. Mgr.

DYNISCO, 10 Oceana Way, Norwood, MA 02062, Tel: 617-769-6600, Telex: 092-4347; Empl.: 153

DYSAN CORP., 5201 Patrick Henry Dr., P.O. Box 58053, Santa Clara, CA 95050, Tel: 408-988-3472, Telex: 171551 DYSAN SNTA

Local Sales Offices & Reps

CA Culver City, Dysan Corp. 213-215-1754
CA Fair Oaks, Dysan Corp. 916-966-8039
CA Santa Clara, Dysan Corp. 408-727-9552
CA Santa Clara, Dysan Corp. 408-988-3472
CO Denver, Dysan Corp. 303-452-8487
GA Atlanta, Dysan Corp. 404-952-0919
IL Rolling Meadows, Dysan Corp. 312-577-2572
MA Chelmsford, Dysan Corp. 617-256-1900
MI Livonia, Dysan Corp. 313-525-8240
MN Bloomington, Dysan Corp. 612-854-4500
MO St. Louis, Dysan Corp. 314-434-4011
NJ Marlton, Dysan Corp. 609-596-8210
NY Forest Hills, Dysan Corp. 718-268-7656
OH Rocky River, Dysan Corp. 216-333-3725
TX Dallas, Dysan Corp. 214-256-7446
TX Houston, Dysan Corp. 713-961-1461
VA Springfield, Dysan Corp. 703-941-0566
WA Bellevue, Dysan Corp. 206-455-4724

DYTRONICS CO., See Ryan Intl. Corp.

DZUS FASTENER, 425 Union Blvd., W. Islip, NY 11795, Tel: 516-669-6000, Telex: 96-1454; FSC No.: 72794; Empl.: 100; *Sls. Mgr.:* George R. Davis

EAGLE ELECTRIC MFG. CO., INC., 45-31 Court Sq., L.I.C., NY 11101, Tel: 212-937-8000, Telex: ITTEAGLE 426774; *Sls. Mgr.:* Joseph Mannarino; *Dist. Mgr.:* John Chambers

EAGLE MAGNETIC COMPANY, INC., P.O. Box 24283, Indianapolis, IN 46224, Tel: 317-297-1030, TWX: 810-341-3386; Empl.: 44; *Sls. Mgr.:* Robert Jackson ..... **C•1723**

EAGLE-PICHER INDS., INC., Elctrns. Div., Box 47, Joplin, MO 64801, Tel: 417-623-8000, TWX: 910-774-4508; Empl.: 700

EAGLE SIGNAL CONTROLS, Mfg. Div. Gulf & Western Inds., Box 16100, Austin, TX 78761, Tel: 512-837-8300; Empl.: 600

EALING OPTICS CO., Ealing Corp., 22 Pleasant St., S. Natick, MA 01760, Tel: 617-655-7000, Telex: 948339; *Sls. Mgr.:* Peter Andreas

E & L INSTRUMENTS, INC., 61 First St., Derby, CT 06418, Tel: 203-735-8774, Telex: 963536; Empl.: 46

EAO SWITCH CORP., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, Tel: 203-877-4577, Telex: 96-4347; FSC No.: 61706; Empl.: 19; *Sls. Mgr.:* George T. Bracci ..... **B•1557**

Local Sales Offices & Reps

AL Huntsville, Conley and Assocs. 205-882-0316
AZ Scottsdale, Luscombe Engrg. Co. of AZ 602-949-9333
CA Campbell, Luscombe Engrg. Co. of S.F. 408-370-2020
CA Pasadena, Luscombe Engrg. Co. of L.A. 213-684-2000
CA San Diego, Luscombe Engrg. Co. of L.A. 619-295-4300
CO Boulder, Luscombe Engrg. Co. of CO 303-772-3342
CT Farmington, Ray Perron & Co., Inc. 203-673-4825
FL Boca Raton, Conley and Assocs. 305-395-6108
FL Deerfield Beach, Conley & Assocs. 305-421-7180, 305-358-3735
FL Oviedo, Conley and Assocs. 305-365-3283
GA Atlanta, Conley and Assocs. 404-447-6992
FL Tampa, Conley and Assocs. 813-885-7658
IL Arlington Hgts., Brainard-Wilson Mktg., Inc. 312-437-2700
IN Ft. Wayne, M/S Sls. & Assocs. 219-436-3023
IN Indianapolis, M/S Sls. & Assocs. 317-257-8915
KS Mission, Mertens Co. 918-432-9323
MD Columbia, Delta III Assocs., Inc. 301-730-4700
MA Needham, Ray Perron & Co., Inc. 800-225-4280, 617-449-6162
MI Plymouth, Jay Mktg. Assocs., Inc. 313-459-1200
MN Golden Valley, Highland Elctrn. Sls. 612-546-2123
MO St. Louis, Mertens Co. 314-993-6600
NH Dover, Ray Perron & Co., Inc. 603-742-2321, 800-225-4280
NJ Englewood, Sprung/Nussbaum 201-569-5666
NY Rochester, Apex Assocs., Inc. 716-254-6050
NC Raleigh, Conley and Assocs. 919-876-9862
OH Mentor, Jay Mktg. Assocs., Inc. 216-257-5244
OR Lake Oswego, Luscombe Engrg. Northwest 503-636-6664
PA Hatboro, Jacobsen Assocs. 215-674-2937
PA Pittsburgh, R. W. Kneip 412-823-0169
TX Dallas, Glidden Electro Equip. Co 214-341-0610
TX Houston, Glidden Electro Equip. Co. .. 713-681-1415
WI Milwaukee, Badgerep 414-258-6630

Local Distributors

AL Huntsville, R.M. Alabama 205-852-1550
AZ Phoenix, Minarik Elec. 602-233-3000

AZ Tempe, Fisher Brownell 602-967-1464
CA Alhambra, Fisher Brownell 714-739-2201
CA Burlingame, Electric Control Dvcs. 415-348-0791
CA Gardena, California Switch & Sig. 213-770-2330
CA Los Angeles, Minarik Elec. Co. 213-624-3161
CA San Diego, Fisher Brownell 619-560-8545
CA San Diego, Minarik Elec. Co. 619-560-6632
CA Santa Clara, Fisher Brownell 408-988-6041
CA Santa Clara, Minarik Elec. Co. 408-727-0575
CA Van Nuys, Patane Avionics, Inc. 818-988-4455
CO Denver, CSID, Inc. 303-292-9594
CT New Canaan, Impact Sls. Co. 203-972-1458
CT Shelton, Century Elec. Supp. 203-736-2684
FL Oviedo, Dixie Sls. 305-365-5211
GA Norcross, Marshall Elctrn. Grp. 404-923-5750
IL Elk Grove, Martec Assoc. 312-956-8090
IL Lombard, R.M. Illinois ... 312-364-6622,800-325-1433
IL Rosemont, Advent Elctrns., Inc. 312-297-6200
IN Indianapolis, R.M. Indiana 317-291-7110
KY Louisville, Peerless Elctrns. 502-637-7674
LA Baton Rouge, Menard Elctrns. 504-355-0323
LA Jefferson, Gulfside Co., Inc. 504-733-4481
ME Scarborough, Nelson & Wright 207-883-4388
MD Gaithersburg, Axis Elctrns. 301-840-9640, 800-492-3190
MA Canton, Impact Sls. Co. 617-821-1500
MI Grand Rapids, R. M. Elctrns. Co. 616-531-9300
MI St. Claire Shores, SPEMCO Switches 313-771-2700
MN Minneapolis, Electronic Ctr., Inc. 612-371-5200
NJ Cranford, Garden State Indl. Elctrns., Inc. 201-272-6400
NY Bohemia, Key Comps., Inc. 516-567-7500
NY Buffalo, Summit Distrs., Inc. 716-887-2800
NY New York, Martin-Audio/Video 212-541-5900
NY Rochester, Modutex Corp. 716-647-7900
NY Rochester, Summit Elctrns., Inc. 716-334-8110
NY Woodside, Switches Unlimited 718-478-5000
NC Charlotte, Elctrns. Mktg. Corp. 704-394-6195
NC Winston-Salem, Kirkman Elctrns., Inc. 919-722-9131,800-334-8688
OH Columbus, Electronics Mktg. Corp. 614-299-4161
OH Highland Hgts., Electronics Mktg. Corp. 216-442-3441
OK Tulsa, Radio, Inc. 918-587-9123
OR Portland, Minarik Elc. Co. 503-253-3402
PA Horsham, R. M. Philadelphia 215-674-1181
PA Lancaster, Advacom 717-299-5615
PA McKean, Advacom 814-476-7774
PA Norristown, Kimberly-James Co. 215-666-7286
PA Pittsburgh, Grant Indl. Controls, Inc. ... 412-787-9770
TX Dallas, R.M. Dallas 214-263-8361
TX Garland, Indl. Equip. Co. of Dallas 214-271-5494
TX Richardson, Fisher Brownell 214-235-3177
TX San Antonio, Minarik Elec. Co. 512-822-7097
WA Bellevue, Integrated Elctrns., Inc. 206-455-2727
WI Milwaukee, Marsh Elctrns. Corp. 414-475-6000

E-A-R DIV., Cabot Corp., 7911 Zionsville Rd., Indianapolis, IN 46268, Tel: 317-872-1111, TWX: 810-341-3412; *Sls. Mgr.:* Lawrence K. Landers ..... **C•1695**

EASCO/K-D TOOLS, 3575 Hempland Rd., Lancaster, PA 17604, Tel: 717-665-4557, Telex: 848429; *Sls. Mgr.:* Mark Lax

EASTERN AIR DEVICES MOTOR DIV., 1 Progress Dr., Dover, NH 03820, Tel: 603-742-3330, TWX: 510-297-4454; Empl.: 200; *Sls. Mgr.:* H. Dumas ..... **B•1146**

Local Sales Offices & Reps

AL Huntsville, Montgomery Mktg. 205-830-0498
CA Los Altos, Servo Data 415-964-1325
CA Tustin, Schoenbachler-Dobson Co. ... 714-544-1888
CO Boulder, R. G. Entprs. 303-447-9211
FL Orlando, Perrott Assoc. 305-275-1132
GA Norcross, Montgomery Mktg. 404-447-6124
IL Chicago, Berndt Assocs. 312-283-0713
IN Carmel, Berndt Assocs. 317-844-0114
IA Cedar Rapids, REPCO, South 319-373-0525
MA Framingham, Gerald Rosen Co. 617-879-5505
MN St. Paul, REPCO 612-488-0201
MO Independence, REPCO, South 816-254-3410
NJ Ridgefield, Rical Assocs. 201-945-5250
NY Rochester, Elcom Sls. 716-385-1400
NY Syracuse, ELCOM Sls. 315-685-8245
NC Cary, Montgomery Mktg. 919-467-6319
OH Cleveland, Jim Finnegan & Co. 216-238-5905
PA Paoli, ETC Sales 215-296-3527
TX Austin, Oeler & Menelaides Inc. 512-453-0275
TX Dallas, Oeler & Menelaides Inc. 214-361-8876
WA Seattle, Eltech 206-767-4330
WI Milwaukee, Berndt Assocs. 414-545-8400

EASTERN DELTA CORP., 29-09 S. Broadway, Fair Lawn, NJ 07410, Tel: 201-797-4200; FSC No.: 18105; Empl.: 35

EASTERN ELCTRNS. MFG. CORP., 180 Roberts St., East Hartford, CT 06108, Tel: 203-528-9821; Empl.: 100; *Sls. Mgr.:* M. Bengala

EASTERN MARKING MACHINES, 422 S Franklin St., Hempstead, NY 11550, Tel: 516-483-7070, Telex: 968095; Empl.: 8; *Sls. Mgr.:* P. Coburn; *Dist. Mgr.:* L. Sherman

EASTERN MICROWAVE, 4 Gill St., Woburn, MA 01801, Tel: 617-935-8600; FSC No.: 30616; Empl.: 45; *Sls. Mgr.:* Maximilian J. Fuchs

EASTERN SMELTING & REFINING CORP., 37-39 Bubier St., Lynn, MA 01901, Tel: 617-599-9000, Telex: 940108; *Sls. Mgr.:* Donald Decareau

EAST PENN. MFG. CO., INC., Main Office, Lyon Station, PA 19536, Tel: 215-682-6361; Empl.: 1200; *Sls. Mgr.:* John Rickolt/Stanley Glass

EASY HEAT-WIREKRAFT, 555 North Michigan St., Lakeville, IN 46536, Tel: 219-784-3011, Telex: 233159; *Sls. Mgr.:* Russell W. Riddle

EATON CORP., Aerospace Controls/Systems Div., 2074 Whitfield Ave., East, Sarasota, FL 33578, Tel: 813-758-7726

EATON CORP., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086, Tel: 408-733-3883, TWX: 910-339-9252; FSC No.: 54987; Empl.: 30

Local Sales Offices & Reps

AZ Tempe, Sierra Technl. Grp. 602-894-2335
CA Costa Mesa, EBA Microwave 714-857-6079
CA Sunnyvale, Loeswicks 408-745-6751
FL Winter Park, Microwave Mktg. 305-678-2141
IA Cedar Rapids, S & O Sls. 319-393-1845
KS Merriam, Midwest Tech. Sls. 913-236-8555
ME Ogunquit, Micronic Assocs. 617-933-2121
MD Silver Spring, Youth-Nelson Assocs. .. 301-598-5740
NY Fayetteville, R. D. Sherman & Co. 315-637-9861
PA Huntingdon Valley, Rabal Assoc., Inc. 215-947-4825
TX Dallas, Stevens Sls. Co. 214-350-2476
WA Seattle, Ecco Mktg. 206-364-0200

EATON CORP., A.I.L. Div., Comac Rd., Deer Park, NY 11729, Tel: 516-595-3094, TWX: 510-227-6073; FSC No.: 00752; Empl.: 2250; *Sls. Mgr.:* H. N. Kreisberg

EATON CORP., Microwave Products Division, 955 Benicia Avenue, Sunnyvale, CA 94086, Tel: 408-730-6300, TWX: 910-339-9556; FSC No.: 27338; Empl.: 400; *Sls. Mgr.:* J. R. Campbell

EATON CORP, Durant Products, 901 S. 12th St., Watertown, WI 53094, Tel: 414-261-4070, TWX: 910-260-3713; Empl.: 400; *Sls. Mgr.:* H. L. Sisson; *Dist. Mgr.:* Dennis G. Walz

EATON CORP., Elctrn. Instrmn. Div., 5340 Alla Rd., Los Angeles, CA 90066; Empl.: 400

EATON CORP., Printer Prods Oper., Technical Research Park, Riverton, WY 82501, Tel: 307-856-4821, Telex: 910 949 4864; Empl.: 185; *Sls. Mgr.:* Rich Phillips; *Dist. Mgr.:* Rich Phillips

EATON CORP., TEST SYS. DIV., Discrete Test, Precision Rd., Danbury, CT 06810, Tel: 203-797-1281, TWX: 710-456-5030; *Sls. Mgr.:* Dennis Riccio

EATON CORP., TEST SYS. DIV., Memory Test Sys., 21135 Erwin St., Woodland Hills, CA 91365, Tel: 213-887-5550, Telex: 69-8489; Empl.: 200+; *Sls. Mgr.:* Chuck Winick

EATON CORP, Yig-Tek Prods., 785 Palomar Ave., Sunnyvale, CA 94086, Tel: 408-737-7300, TWX: 910-339-9395; Empl.: 100

EATON CORP./CUTLER-HAMMER PRODS, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216, Tel: 414-449-7487, Telex: 26-716; FSC No.: 81640; *Sls. Mgr.:* J. R. McDonough; *Dist. Mgr.:* E. G. Caporellie

EBERHARD MFG. CO., DIV., Eastern Co., 21944 Drake Rd., Strongsville, OH 44136, Tel: 216-238-9720, Telex: 98-5301; FSC No.: 19220; *Sls. Mgr.:* Edward Hongosh

EBM INDS., INC., 525 New Britain Ave., Unionville, CT 06085, Tel: 203-674-1515, TWX: 710-423-8723; FSC No.: 62292; *Sls. Mgr.:* Robert Sobolewski ..... **C•1626-1628**

Local Sales Offices & Reps

AL Huntsville, Raycom 205-859-2017
AZ Scottsdale, Harris And Croy 602-951-9121
AZ Tucson, Harris and Croy 602-293-5393
CA Chatsworth, WCV-Raltech, Inc. 818-700-0933
CA Los Angeles, Wiley Co. 213-666-1611
CA Palo Alto, Abbott Engrg. 415-968-2265
CA San Diego, Cerco 619-450-1754
CA San Diego, Wiley Co. 619-571-2881
CA Santa Clara, Ross Mktg. Assocs. 408-988-8111
CO Littleton, Simpson Assocs. 303-794-8381
CT Clinton, Selmark Assocs. 203-573-9088
FL Melbourne, Raycom, Inc. 305-259-7988
FL Orlando, Raycom, Inc. 305-859-5504
FL Plantation, Raycom, Inc. 305-741-6690
FL Wellborn, Raycom, Inc. 904-963-5023
GA Fayetteville, Raycom 406-446-9015
IL Schaumburg, Micro-Tex, Inc. 312-885-1131
IN Columbus, Technical Reps. 812-376-9226
IN Indianapolis, Technical Reps. 317-882-4407
KS Overland Park, Web Elctrns. 913-381-7986
MD Columbia, Delta III 301-730-4700
MA Millis, Selmark Assocs. 617-376-2914
MI Warren, Burcaw Co. 313-573-4605
MI Wyoming, Burcaw 616-532-2756
MN St. Paul, Arkco Sls. 612-777-7454
MO Florissant, Web Elctrns. 314-921-5720
NH Hopkinton, Selmark Assocs. 603-746-3299
NJ Marlton, b.g.r. Assocs. 609-983-1020
NJ Palmyra, RD Indl. Sls. 609-829-4441
NJ Perth Amboy, Astrorep, Inc. 201-826-8050
NY Babylon, Astrorep, Inc. 516-422-2500
NY Buffalo, Rudell-Merrifield Assocs. 716-634-4300
NY Skaneateles, ADN/Rudell-Merrifield .. 315-685-8991
NC Raleigh, Raycom 919-847-8276
OH Cleveland, DT/Depco 216-442-6200
OH West Chester, KT/Depco 513-874-0236
OK Tulsa, Bonser-Philhower Sls. 918-744-9964
OR Portland, Earl & Brown Co. 503-245-2283
PA Harrison City, Rudell-Merrifield Assocs. 412-327-0858
TX Austin, Bonser-Philhower Sls. 512-346-9186
TX Dallas, Bonser-Philhower Sls. 214-234-8438
TX Houston, Bonser-Philhower Sls. 713-531-4144
UT Midvale, Simpson Assocs. 801-566-3691
WA Seattle, Earl & Brown Co. 206-284-1121
WA Seattle, Earl & Brown Co., Inc. 206-284-1121
WI Waukesha, Mirco-Tex, Inc. 414-542-5352

Local Distributors

AL Huntsville, Powell Elec. 205-539-2731
AZ Scottsdale, Hall Elctrns. 602-946-9977
AZ Tempe, Powell 602-967-7538
CA Anaheim, Deco Elec. 714-630-8252
CA Chatsworth, Integrated 213-998-2200
CA Costa Mesa, Powell 714-754-1717
CA Fullerton, Pyramid/Fullerton 714-773-0781
CA Fullerton, Young Sls. Co. 714-871-5355
CA Hollywood, Yale Elctrns. 213-465-3186
CA San Diego, Deco Elctrns. 619-693-1595
CA San Jose, Integrated 408-263-1100
CA San Jose, Powell Elec. 408-943-9020
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CA Sunnyvale, Target Elctrns., Inc. 408-734-5611
CO Denver, Integrated Elctrns. 303-292-6121
CO Englewood, Indl. Elctrns. 303-694-9444
CT Danbury, Pilgrim Elctrns. 203-792-7274
CT New Canaan, Impact 203-972-1458
CT Wallingford, Cronin Elec. 203-265-3134
FL Ft. Lauderdale, Powell Elec. 305-979-5606
FL Melbourne, Eurick 305-254-8718
FL Melbourne, Raycom, Inc. 305-259-7988
FL Pompano Beach, Peerless Radio 305-973-4141
FL Tampa, Reptron 813-855-4656
GA Atlanta, ACK Radio Supp. 404-351-6340
GA Fayetteville, Frankland 404-461-4026
IL Chicago, NEP Elctrns. 312-625-8400
IL Hoffman Estates, I.E.C. Intercomp 312-843-2040
IL Rosemont, Advent Elctrns. 312-297-6200
IN Indianapolis, Advent Elctrns. 317-872-4910
IA Cedar Rapids, Advent Elctrns. 319-363-0221
IA Cedar Rapids, Bergouist 319-366-8733
MD Beltsville, Resco/D.C. 301-937-9100
MD Columbia, Powell 301-621-4070
MD White Marsh, Resco/Baltimore 301-529-0500
MA Canton, Impact Sls. Co. 617-821-1500
MA Middleboro, Glynn Elctrns. 617-947-4262
MA Needham, Cronin 617-449-5000
MA Westborough, Powell 617-366-6100
MA Wilmington, J.V. Elctrns. 617-273-4300
MI Bloomington, NWR Elctrns. 612-854-7329
MI Farmington Hills, Advent Elctrns. 313-477-1650
MI Grand Rapids, S.F. Elctrns. 616-459-0216
MI Grand Rapids, T & W Elctrns. 616-241-3645
MI Lansing, Fulton Radio Supp. Co. 517-394-5020/2
MI Livonia, Reptron 313-525-2700

MN Minneapolis, Bergquist 612-835-2322
MN Minneapolis, Control Des. Supp. 612-721-1628
MO Kansas City, L Comp 816-221-2400
NH Salem, Glynn Elctrns. 603-893-8313
NJ Berlin, General Comps. 609-768-6767
NJ Englewood, Powell Elec. 201-894-0800
NJ Rockaway, Tonar Indus. 201-586-9000
NY Central Islip, Domino Comps. 516-582-3050
NY Farmingdale, Addem Sls. 201-882-0993
NY Hauppauge, Broadline Elec. Distr. 516-231-4100
NY Lynbrook, Peerless Radio 516-593-2121
NY Poughkeepsie, Kabelton, Inc. 914-473-1222
NY Rochester, Simcona 716-328-3230
NY Suffern, Nobel Elctrns. 914-357-4500
NC Cary, Powell Elec. 919-467-1212
NC Raleigh, Century 919-872-2203
OH Akron, Akron Elctrns. 216-762-8818
OH Dayton, Related Comps. 513-253-6116
OH North Royalton, Related Comp. 216-237-7271
OH Worthington, Reptron Ohio 614-436-6675
OR Beaverton, Norvac Elctrns. 503-644-1025
OR Tigard, Integrated Elctrns. 503-639-9661
PA Harrisburg, Advacom 717-545-5674
PA McKean, Advacom/Erie 814-476-7774
PA Norristown, Century Elctrn. Comp. Co. 215-631-5400
PA Phildelphia, Powell 215-365-1900
RI Warwick, Cal-Greg 401-738-6170
TN Hixson, Techni-Tronics 615-842-0514
WA Bellevue, Integrated Elctrns./Jaco 206-455-2727
WA Bellevue, Powell Elec. 206-641-4446
WI Mequon, Taylor Elec. Co. 414-241-4321
WI New Berlin, Nep Electrns. 414-785-9100

EBY CO., 2751 Southampton Rd., Philadelphia, PA 19154, Tel: 215-969-4200, TWX: 710-670-0452; FSC No.: 72825; Empl.: 150; *Sls. Mgr.:* C. R. Dedera ..... **C•1184-1185**

Local Sales Offices & Reps

AZ Tempe, Gassner & Clark 602-968-9037
CA Anaheim, Galaxie Sls. Intl. 714-752-1580
CA Los Altos, J. W. Wilhoit Co. 415-961-3660
CO Boulder, R. F. Mayo Assocs. 303-499-2155
FL Coral Springs, EPM Corp. 305-755-5387
GA Atlanta, Effective Mktg. Force 404-948-6023
IL Chicago, Rendell Sls. Co. 312-528-9025
IN Ft. Wayne, Given Corp. 219-432-5585
IA Cedar Rapids, Gassner & Clark 319-393-5763
MD Glen Burnie, Macrotech Assocs. 301-437-5588
MA Newton Upper Falls, Anchor Engrg. 617-964-6205
MI Brighton, Electronic Sources, Inc. 313-227-3598
MN Edina, Grayden & Flemmer 612-941-1120
NY Fairport, Bastian Sls. Agy., Inc. 716-223-0237
NY Melville, Comtronic Assocs. 516-249-0505
NY Syracuse, Bastian Sls. Agency, Inc. 325-437-1482
OH Dayton, J. N. Bailey & Assocs. 513-226-0512
OR Beaverton, Caruso & Northcutt, Inc. 503-646-4973
PA Springhouse, Deltatronics, Inc. 215-542-0250
TX Austin, Stevens Sls. Co. 512-250-5104
TX Dallas, Stevens Sls. Co. 214-350-2476
VA Gladys, Ralley Entprs., Inc. 804-283-5656
WA Bellevue, Caruso & Northcutt, Inc. 206-454-9699

Local Distributors

AL Birmingham, American Elec. Supp. Co. 205-254-3280
AL Huntsville, Contact Elctrns. 205-881-9321
AL Mobile, Electronic Supp. Co. 205-478-0455
AZ Phoenix, Lion Elctrn. Distrs. 602-869-9611
CA City of Industry, Ital Elctrn. Sls. 213-968-8515
CA Irvine, AMC Milliken 714-549-9811
CA San Carlos, Logan Elctrns. 415-594-0700
CA San Jose, Afcom 408-263-0660
CA Santa Ana, Amcotec Elec. Comp. Sls. 714-957-3003
FL Miami, Alpeco Intl. 305-592-2985
FL W. Palm Beach, Nurmi Elctrn. Supp. 305-686-8553
GA Atlanta, Accu-Tech Cable, Inc. 404-455-6422
GA Atlanta, ACK Radio Supp. 404-351-6340
GA Atlanta, Prehler Elctrns. 404-447-5540
GA Atlanta, Specialty Dist. Co., Inc. 404-873-2521
IL Chicago, Prehler Elctrns. 312-384-6100
IN Indianapolis, Prehler Elctrns. 317-841-0018
KY Bowling Green, Randolph, Hale & Meredith 502-781-1460
KY Hopkinsville, Randolph & Hale 502-885-5357
KY Louisville, P.I. Burkes Co. 502-589-3960
MD Columbia, Aztech Elctrns., Inc. 301-995-1760
MI Farmington Hills, Prehler Elctrns. 313-473-7200
MI Grand Rapids, S-F Elctrn. Supp. Co. 616-459-0216
MN Bloomington, Prehler Elctrns. 612-854-4106
NJ Union, Cougar Elctrns. 201-687-7722
NY Albany, E.E. Taylor 518-438-7811
NY Jamaica, Eby Sls. Co. of NY 212-291-3232
NY Long Island City, Hardware Specialty Co. 212-361-9393
NY Rome, Rome Elctrns. 315-337-5400
NC Raleigh, Carolina Cable & Conn. 919-876-9100
NC Raleigh, Prehler Elctrns. 919-876-9111
NC Raleigh, Southeastern Elctrns. 919-828-2311
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Dayton, Televox, Inc. 513-294-4499
OH Middleburg Heights, Prehler Elctrns. 216-243-5510
PA Allentown, Lehigh Elctrns. 215-433-3045
PA Philadelphia, Spectrum Elctrns., Inc. 215-748-3010
PA York, Electronic Comps. for Ind. 717-843-8971
SC Columbia, Dixie Elec. 803-779-5332
TN Chattanooga, Curle Elctrns. 615-266-4727
TN Chattanooga, Indl. Elec. Dist., Inc. 615-698-3413
TN Clarksville, Randolph, Hale & Matthews 615-647-2325
TN Cookville, Randolph & Parks 615-526-6184
TN Memphis, Bluff City Distrs. 901-345-9500
TN Nashville, Randolph & Rice 615-255-5602
TN Tullahoma, Randolph, Rice & Williams 615-455-4531
TX El Paso, Midland Specialty Co. 915-533-9555
VA Roanoke, Peoples Elctrn. Supp. 703-342-8933

ECD CORP., 196 Broadway, Cambridge, MA 02139, Tel: 617-661-4400, TWX: 710-320-6965; Empl.: 40

ECI COMPANY, Box 1565, Terra Haute, IN 47808, Tel: 812-232-4442; Empl.: 3

ECO INSTRS. DIV., Sea Data Corp., 1 Bridge St., Newton, MA 02158, Tel: 617-964-8360, Telex: 951107; Empl.: 40; *Sls. Mgr.:* Jill Shipman

ECOSOFT, INC., 6413 N. College Ave., Indianapolis, IN 46220, Tel: 317-255-6476; Empl.: 6; *Sls. Mgr.:* Emma Alkire

ECTRON CORP., 8159 Engineer Rd., San Diego, CA 92111, Tel: 619-278-0600, TWX: 910-335-1259; FSC No.: 24856; Empl.: 50; *Sls. Mgr.:* W. W. Hanford ..... **D•1007**

Local Sales Offices & Reps

AZ Phoenix, Aztec Entprs. 602-944-9185
CA Costa Mesa, FLW Inc. 714-751-7512
CA Hayward, FLW Inc. 415-487-2222
CA San Diego, FLW Inc. 619-277-0993
CA Van Nuys, FLW Inc. 818-989-5238
CO Denver, Aztec Entprs. 303-779-5285
FL Melbourne, Saber Assocs. 305-724-0920
GA Griffin, Saber Assoc. Inc. 800-327-0853
IL Elmhurst, Sector Engrg. Sls. 312-530-7850
IN Indianapolis, Sector Engrg. Sls. 317-842-1120
KS Overland Park, Ramsey Assocs. 913-649-6996
LA Baton Rouge, Sesco 504-928-4951
MD Rockville, Elctrn. Mktg. Assoc. 301-744-7700
MA Needham, Addelco Corp. 617-444-4754
MI Royal Oak, Satullo 313-549-3910
MN Minneapolis, Sector Eng. Sls. Inc. 612-593-1809
MO Maryland Hgts., Ramsey Assocs. 314-878-5042
NM Albuquerque, Aztec Entprs. 505-262-1688
NY East Syracuse, Ossmann Instrs. 315-437-7052
NY Plainview, Eastern-Metro Assoc. 516-931-1414
NY Rochester, Ossmann Instrs. 716-424-4460
NY Saratoga Springs, Ossmann Instrs. 518-377-8604
NC Clayton, Saber Assocs. 800-327-0853
OH Cleveland, Instrmn. Sys. 216-845-8800
OH Dayton, Instrmn. Sys. 513-294-2838
OK Tulsa, Sesco 918-622-3868
PA Pittsburgh, Instrmn. Sys. 412-243-1111
PA Plymouth Meeting, Elctrn. Mktg. Assoc. 215-828-7400
SC Columbia, Saber Assoc. Inc. 800-327-0853
TX Dallas, Sesco 214-231-9364
TX Houston, Sesco 713-999-3510
UT Ogden, Aztec Entprs. 801-621-1655
VA Chesapeake, Elctrn. Mktg. Assoc. 804-482-3318
WA Seattle, Datacom Assoc. Inc. 206-285-2525
WI Milwaukee, Sector Eng. Sls. Inc. 414-352-8280

EDAC INC., 20 Railside Rd., Toronto, ON, Canada M3A 1A4, Tel: 416-445-2292, TWX: 610-492-1398; FSC No.: 31781; Empl.: 120; *Sls. Mgr.:* Alan Little; *Dist. Mgr.:* Alan Little

EDA INSTRUMENTS, INC., 4 Thorncliffe Park Dr., Toronto, ON, Canada M4HIHI, Tel: 416-425-7800, Telex: 06 23222; Empl.: 50; *Sls. Mgr.:* Scott Hepburn

EDEN EQUIPMENT CO., 17649 Jacquelyn Lane, Huntington Beach, CA 92647, Tel: 714-842-8181

EDL, INC., 385 Oser Ave., Hauppauge, NY 11788, Tel: 516-435-2808, 1-800-DIAL EDL; Empl.: 50; *Sls. Mgr.:* Donna Oliveri

EDMAN CORP., Subsidiary of Rospatch, 7500 Main St., P.O. Box 750, Fishers, NY 14453-0750, Tel: 716-924-4000, TWX: 510-254-2896; Empl.: 170; *Sls. Mgr.:* Howard Potter

EDO CORP./ELINCO DIV., 272 Main Ave., Norwalk, CT 06851, Tel: 203-847-5861, Telex: 96-5945; FSC No.: 73693; Empl.: 87

EDO WESTERN CORP., EDO Corp., 2645 South 300 W., Salt Lake City, UT 84115, Tel: 801-486-7481/3846, Telex: 388-315; Empl.: 360; *Sls. Mgr.:* Doug Moore

EDWARDS CO., Signaling Prods. Div., P.O. Box 1188, Farmington, CT 06034, Tel: 203-678-0410; *Sls. Mgr.:* Al Canevari; *Dist. Mgr.:* Al Canevari

EECO INCORPORATED, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, Tel: 714-835-6000, Telex: 67-8420, TWX: 910-595-1550; Empl.: 625; *Sls. Mgr.:* Frank Bruder; *Dist. Mgr.:* Ken Plount ..... **B•1558-1561**

Local Sales Offices & Reps

CA El Monte, Cook Entprs. 213-686-2120
AL Huntsville, Montgomery Mktg. 205-830-0498
AZ Scottsdale, Thom Luke Sls. 602-941-1901
AR Fort Smith, Electra Reps. 501-452-4030
CA Fountain Valley, Bager Elctrns. 714-957-3367
CA Los Altos, Recht Assocs. 415-964-6321
CA San Diego, Harvey King Inc. 619-566-5252
CO Denver, Delltron Co. 303-373-0300
CT Danbury, Ray Perron & Co. 203-798-6392
CT Farmington, Ray Perron & Co. 203-673-4825
FL Pompano Beach, Ema, Inc. 305-943-3732
FL Winter Park, EMA, Inc. 305-671-6800
GA Norcross, Montgomery Mktg. 404-447-6124
IL Elk Grove Village, John G. Twist Co. 312-593-0200
IN Fort Wayne, M/S Sls. & Assoc. 219-484-1904
IN Indianapolis, M/S Sls. & Assocs. 317-257-8915
IA Cedar Rapids, Palatine Sls. 319-365-8071
KS Mission, Palatine Sls. 913-831-0555
MD Rockville, EMA (Elctrn. Mktg. Assts.) 301-881-5300
MA Needham, Ray Perron & Co. 617-449-6162
MI Livonia, Lowell Wendt Mktg. 313-464-2722
MN Bloomington, Elctrn. Sls. Agecy. 612-884-8291
MO Hazelwood, Palatine Sls. 314-839-0800
NJ Englewood, Tecnimat 201-569-4200
NY Endicott, Tech-Mark, Inc. 607-748-7473
NY Mendon, Techmark, Inc. 716-624-3840
NY Utica, Techmark, Inc. 315-733-0575
NC Cary, Montgomery Mktg. 919-467-6319
OH Aurora, EMA, Inc. 216-562-6104
OH Centerville, EMA, Inc. (Engr. Mktg. Assts.) 513-433-2800
OR Beaverton, Blair Hirsh Co. 503-641-1875
PA Plymouth Meeting, EMA (Elctrn. Mktg. Assts.) 215-828-7400
TX Austin, Electra Reps. Inc. 512-339-1163
TX Dallas, Electra Reps. Inc. 214-248-3852
UT Salt Lake City, Delltron Co. 800-692-2069
WA Lynnwood, Blair Hirsh Co. 206-774-8151
WI Brookfield, John G. Twist Co. 414-782-2670

Local Distributors

CA San Diego, Fisher Brownell 619-560-8545
AL Huntsville, Hall-Mark Elctrns. 205-837-8700
AL Huntsville, Marshall Inds. 205-881-9235
AZ Phoenix, Hall-Mark Elctrns. 602-437-1200
AZ Tempe, Fisher-Brownell 602-967-1464
AZ Tempe, Marshall Inds. 602-968-6181
CA Alhambra, Fisher Brownell 818-289-0255
CA Canoga Park, Hall-Mark Elctrns. 818-716-7300
CA Canoga Park, Marshall Inds. 818-999-5001
CA El Monte, Marshall Inds. 818-442-7204
CA Irvine, Marshall Inds. 714-660-0952
CA San Diego, Fisher Brownell 714-560-8545
CA San Diego, Hall-Mark Elctrns. 619-268-1201
CA San Diego, Marshall Inds. 619-576-9600
CA San Jose, Hall-Mark Elctrns. 408-946-0900
CA Santa Clara, Fisher Brownell 408-988-6041
CA Sunnyvale, Marshall Inds. 408-732-1100
CA Sunnyvale, Time Electronics 408-734-9888
CA Tustin, Hall-Mark Elctrns. 714-669-4700
CO Denver, Marshall Inds. 303-427-1818
CO Englewood, Hall-Mark Elctrns. 303-790-1662
CT Wallingford, Hall-Mark Elctrns. 203-269-0100
CT Wallingford, Marshall Inds. 203-265-3822
CT Wallingford, Sager Electrical Supply Co. 203-265-4600
FL Clearwater, Hall-Mark Elctrns. 813-530-4543
FL Orlando, Hall-Mark Elctrns. 305-855-4020
FL Orlando, Marshall Inds. 305-841-1878
FL Pompano Beach, Hall-Mark Elctrns. 305-971-9280

GA Atlanta, Marshall Inds. 404-923-5750
GA Norcross, Hall-Mark Elctrns. 404-447-8000
IL Bensenville, Hall-Mark Elctrns. 312-860-3800
IL Schaumburg, Marshall Inds. 312-490-0155
IN Indianapolis, Mar Elctrns., Inc. 317-875-4510
KS Lenexa, Hall-Mark Elctrns. 913-888-4747
MD Baltimore, Hall-Mark Elctrns. 301-988-9800
MD Gaithersburg, Marshall Inds. 301-840-9450
MA Billerica, Hall-Mark.Elctrns. 617-667-0902
MA Burlington, Marshall Inds. 617-272-8200
MA Hingham, Sager Elctrn. Supp. Co. 617-749-6700
MI Livonia, LWC Distrs. 313-464-7700
MN Bloomington, Hall-Mark Elctrns. 612-854-3223
MN Plymouth, Marshall Inds. 612-559-2211
MO Earth City, Hall-Mark Elctrn. 314-291-5350
MO St. Louis, Olive Elctrns. 314-426-4500
NJ Cherry Hill, Hall-Mark Elctrns. 609-355-7300
NJ Cherry Hill, Hall-Mark Elctrns. 609-424-7300
NJ Fairfield, Hall-Mark Elctrns. 201-575-4415
NJ Fairfield, Marshall Inds. 201-882-0320
NJ Mt. Laurel, Marshall Inds. 215-627-1920
NM Albuquerque, International Elctrns. 505-345-8127
NY Endwell, Marshall Inds. 607-754-1570
NY Hauppauge, Marshall Inds. 516-273-2424
NY Lynbrook, L.I., Peerless Radio Corp. 516-593-2121
NY Rochester, Marshall Inds. 716-235-7620
NY Ronkonkoma, Hall-Mark Elctrns. 516-737-0600
NC Raleigh, Hall-Mark Elctrns. 919-872-0712
OH Cincinatti, Hall-Mark Elctrns. 513-563-5980
OH Dayton, Marshall Ind. 513-236-8088
OH Solon, Hall-Mark Elctrns. 216-349-4632
OH Solon, Marshall Inds. 214-248-1788
OH Westerville, Hall-Mark Elctrns. 614-891-4555
OK Tulsa, Hall-Mark Elctrns. 918-665-3200
OR Beaverton, Almac/Stroum 503-641-9070
OR Beaverton, Marshall Inds. 503-644-5050
TX Austin, Hall-Mark Elctrns. 512-258-8848
TX Dallas, Hall-Mark Elctrns. 214-341-1147
TX Dallas, Marshall Inds. 214-233-5200
TX El Paso, International Elctrns. 915-598-3406
TX Houston, Hall-Mark Elctrns. 713-781-6100
TX Houston, Marshall Inds. 713-789-6600
TX Richardson, Fisher Brownell 214-235-3177
UT Murray, Hall-Mark Elctrns. 801-268-3779
WA Bellevue, Almac Elctrns. 206-643-9992
WA Bellevue, Marshall Inds. 206-747-9100
WA Spokane, Almac Elctrns. 509-924-9500
WI Oak Creek, Hall-Mark Elctrns. 414-797-7844
Can Burnaby, BC, RAE Indl. Elec. Ltd. 604-291-8866
Can Calgary, Alb., Cardinal Ind. Elec. Ltd. 403-259-6817
Can Edmonton, Alb., Cardinal Ind. Elec. Ltd. 403-483-6266
Can Ottawa, Ont., Carsten Elctrns., Ltd. 613-729-5138
Can Scarborough, Ont., Carsten Elctrns., Ltd. 416-495-9999
Can St. Laurent, Que., Carsten Elctrns., Ltd. 514-334-8321

EEMCO DIV., 4585 Electronics Pl., Los Angeles, CA 90039, Tel: 213-247-7060, TWX: 910-497-2269; FSC No.: 72121; Empl.: 350; *Sls. Mgr.:* D. Haymond; *Dist. Mgr.:* D. Haymond

EEV INC., 7 Westchester Plaza, Elmsford, NY 10523, Tel: 914-592-6050, Telex: 6818096; Empl.: 36; *Sls. Mgr.:* Tom Soldano

EFECTOR, INC., 201 So. Gulph Rd., King of Prussia, PA 19406, Tel: 215-337-5500, 800-441-8245, Telex: 84-6437; Empl.: 300; *Sls. Mgr.:* J. Kelly

EFI CORPORATION, 350 West 2700 South, Salt Lake City, UT 84115, Tel: 801-486-5871; Empl.: 35; *Sls. Mgr.:* George O. Stewart

EFRATOM, a division of Ball Corp., 18851 Bardeen Ave, Irvine, CA 92715, Tel: 714-752-2891, Telex: 68-5635; Empl.: 105 ..... **A•1361**

Local Sales Offices & Reps

CA Los Altos, Kolm Mktg. Assoc. 415-948-2635
CA Los Angeles, Cain Technlg. 213-477-9054
FL Sarasota, Bass Assocs. 813-922-9538
MA Natick, Wayland Engrg. Sls. 617-655-6080
NJ Pennsauken, Sci. Reps. 609-662-5222
NY Huntington, CDB Entprs. 516-692-5200
TX Houston, Sci. Devices 713-864-1711
TX Richardson, Sci. Devices 214-231-8106
VA Fairfax, Scientific Assocs. 703-385-0600

EG&G, INC., Electro-Optics Div., 35 Congress St., Salem, MA 01970, Tel: 617-745-3200, Telex: 681-7405 EGGSA; FSC No.: 25506; Empl.: 500; *Sls. Mgr.:* J. Murachver

EG & G ALMOND INSTRUMENTS, 1330 E. Cypress St., Covina, CA 91724, Tel: 818-967-9521, TWX: 910-584-1320; Empl.: 260; *Sls. Mgr.:* Dave Adams ..... **D•1620-1621**

Local Sales Offices & Reps

FL Orlando, Truex Assocs. 305-859-2160
MA Lexington, Circuit Sls. Co. 617-861-0567
NY Yonkers, Sonkin Assocs. 914-968-8282

EG&G BIRTCHER INDUSTRIAL PRODUCTS

EG & G BIRTCHER, 4505 N. Arden Dr., El Monte, CA 91731, Tel: 818-442-2572, Telex: 247345 EGGUR; *Sls. Mgr.:* H. Robert Sproul ..... **C•1051-1053**

Local Sales Offices & Reps

AL Huntsville, Mar-Tec, Inc. 205-883-5910
AZ Phoenix, Mercury Engrg. Sls. 602-244-0123
CA Brea, Masco 714-529-0866
CA San Diego, Masco 619-234-6905
CA Santa Clara, Nova-Tronix, Inc. 408-727-9530
CO Broomfield, Connors Co. 303-466-9628
FL Clearwater, Hutto, Hawkins, Peregory, Inc. 813-797-4447
FL Maitland, Hutto, Hawkins, Peregory, Inc. 305-831-2474
FL Pompano Beach, Hutto, Hawkins, Peregoy, Inc. 305-971-5750
GA Roswell, Mar-Tec, Inc. 404-992-0040
IL Rollings Meadows, Heartland Technlg. Mktg., Inc. 312-577-9222
KS Shawnee Mission, Midland Engrg. Sls. Assocs. 913-262-5500
MD Baltimore, Burgin Kreh Assocs., Inc. 301-265-8500
MA Burlington, Conti-Younger Assocs., Inc. 617-273-1582
MN Minneapolis, Hei-Lite Sls., Inc. 612-861-6051
NY Great Neck, Frank Tylinski Co., Inc. 516-466-9070
NY Syracuse, IA Hotze Assocs. 315-479-6641
NC Raleigh, Tingen Technlg. Sls., Inc. 919-878-4440
OH Cleveland, Jim Finnegan & Co. 216-238-5905
OH Dayton, Jim Finnegan & Co. 513-890-8322
OR Beaverton, Eclipse Mktg. Grp. 503-642-1661
TX Dallas, El-Com Mktg., Inc. 214-241-2166
VA Lynchburg, Burgin Kreh Assocs., Inc. 804-239-2626
WA Redmond, Eclipse Mktg. Grp. 206-885-6991
WI Milwaukee, Heartland Technlg. Mktg., Inc. 414-931-0606

Local Distributors

CA Cerritos, El-Com, Inc. 213-404-2961
CA Manhattan Beach, Prime Electro Prods. 213-379-1724
CA San Diego, El-Com 619-578-0900
CA San Jose, Bisco Inds. 408-946-8980
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CO Aurora, Jet Elctrns. Supp. Co., Inc. 303-364-5487
FL Pompano Beach, Peerless Radio Corp. of FL 305-973-4141
IL Franklin Park, Bisco Inds.
MA Winchester, Rush Inds., Inc. 617-729-5800
MN Minneapolis, Stark Elctrns., Inc. 612-322-1325
NH Hudson, C & H Elctrns., Inc. 603-882-1133
NY Bohemia, Caf Lac Inds. Sls., Inc. 516-567-4200
NY Buffalo, Summit Distrs. 716-884-3450
NY Lynbrook, Peerless Radio Corp. 516-593-2121
NY Rochester, Summit Distrs. 716-334-8110
OH Englewood, Argent Inds. 513-836-8633
TX Ft. Worth, Industrial Elctrns. 817-731-7321
TX Houston, Force Elctrns. 713-561-8644
TX Irving, Force Elctrns. 214-438-5700
WA Redmond, Murphy Elctrns. 206-881-1234

EG&G GAMMA SCIENTIFIC, Div. of EG&G Inc., 3777 Ruffin Rd., San Diego, CA 92123, Tel: 619-279-8034, Telex: 697938; Empl.: 75; *Sls. Mgr.:* Robert Ruff

EG&G GEOMETRICS, Div. of EG&G Inc., 395 Java Dr., Sunnyvale, CA 94089, Tel: 408-734-4616, Telex: 357435; FSC No.: 34314; *Sls. Mgr.:* Ross Johnson; *Dist. Mgr.:* Fritz Faber

EG&G RETICON, Div. of EG&G, 345 Potrero Ave., Sunnyvale, CA 94086-4197, Tel: 408-738-4266, Telex: 910-339-9343; *Sls. Mgr.:* John Skurla

EG&G ROTRON

EG & G ROTRON, Commercial Div., Saugerties, NY 12477, Tel: 914-246-3615, Telex: 551496; *Sls. Mgr.:* Michael Keating; *Dist. Mgr.:* Ralph Stevens ..... **C•1630-1636**

Local Sales Offices & Reps

AL Huntsville, Over & Over 205-837-7105
AZ Phoenix, Westrep 602-997-8899
CA Anaheim, Westrep 213-404-3881
CA Chatsworth, EG & G Rotron 818-709-2133
CA San Diego, Hadden Assoc. 619-565-9444
CA Santa Clara, Westrep 408-988-8833
CO Littleton, Lange Sls. 303-795-3600
CT Stamford, Circuit Sls. 203-322-0240
FL Apopka, G. Bohman 305-886-1882
GA Norcross, Over & Over, Inc. 404-449-6205
HI Honolulu, R. Clark 808-531-5897
IL Rolling Meadows, Sumer 312-991-8500
IN Indianapolis, F. J. Campisano 317-253-7651
IA Cedar Rapids, S & O Sls. 319-393-1845
KS Raytown, CenTech 816-358-8100
MD Columbia, L. D. Lowery 301-964-0225
MA Lexington, Circuit Sls. 617-861-0567
MI Detroit, Rathsburg Assocs. 313-882-1717
MN Mendota Heights, G-11 Sales 612-454-3086
MO Bridgeton, CenTech 314-291-4230
MO Raytown, CenTech 816-358-8100
NJ Springfield, F. Sylvester 201-376-3324
NY Saugerties, Rotron (Commercial Div.) 914-246-3615
NC Charlotte, Over & Over 704-527-3070
OH Cincinnati, F. J. Campisano 513-574-7111
OH Cleveland, Comp., Inc. 216-243-9200
OK Tulsa, Ammon & Rizos 918-663-8788
PA Broomall, L. D. Lowery 215-356-5300
TX Dallas, Ammon & Rizos 214-644-5591
TX Houston, Ammon & Rizos 713-781-6240
UT Salt Lake City, Lange Sls. 801-487-0843
WA Lynnwood, Blum & Assocs. 206-775-6656
WI Brookfield, Sumer, Inc. 414-784-6641
EXP NY, Great Neck, A. Auriema 516-487-0700

Local Distributors

Chatsworth, Arrow Elctrns. 818-701-7500
AL Huntsville, Arrow Elctrns. 205-882-2730
AL Huntsville, Hall-Mark Elctrns. 205-837-8700
AL Huntsville, Schweber Elctrns. 205-882-2200
AZ Phoenix, Cetec Elctrns. 602-272-7951
AZ Phoenix, Hall-Mark Elctrns. 602-243-6601
AZ Phoenix, Schweber Elctrns. 602-997-4874
AZ Tempe, Arrow Elctrns. 602-968-4800
CA Canoga Park, Hall-Mark Elctrns. 818-716-7300
CA Canoga Park, Schweber Elctrns. 818-999-4702
CA El Segundo, Hall Mark Elctrns. 213-643-9101
CA Gardena, Schweber Elctrns. 213-327-8409
CA Glendale, R. V. Weatherford 213-849-3451
CA Hayward, Arrow Elctrns. 415-487-4600
CA Irvine, Cetec Elctrns. 714-521-7412
CA Irvine, Schweber Elctrns. 714-863-0200
CA Los Angeles, Richey/Western 214-820-3777
CA Sacramento, Arrow Elctrns. 916-925-7456
CA Sacramento, Schweber Elctrns. 916-929-9732
CA San Diego, Arrow Elctrns. 619-565-4800
CA San Diego, Cetec Elctrns. 619-278-5020
CA San Diego, Hall-Mark Elctrns. 619-268-1201
CA San Diego, Schweber Elctrns. 619-450-0454
CA San Jose, Cetec Elctrns. 408-263-7373
CA San Jose, Hall-Mark Elctrns. 408-773-9990
CA San Jose, Schweber Elctrns. 408-946-7171
CA South Gate, Cetec Elctrns. 213-773-6521
CA Sunnyvale, Arrow Elctrns. 408-745-6600
CA Tustin, Arrow Elctrns. 714-838-5422
CA Tustin, Hall Mark Elctrns. 714-669-0681
CO Aurora, Hall-Mark Elctrns. 303-696-1111
CO Denver, R. V. Weatherford 303-428-6900
CO Englewood, Schweber Elctrns. 303-799-0258
CT Danbury, Schweber Elctrns. 203-748-7080
CT Wallingford, Arrow Elctrns. 203-265-7741
FL Altamonte Springs, Schweber Elctrns. 305-331-7555
FL Clearwater, Arrow Elctrns. 813-576-8995
FL Clearwater, Hall-Mark Elctrns. 813-530-4543
FL Deerfield Beach, Arrow Elctrns. 305-429-8200
FL Hollywood, Schweber Elctrns. 305-927-0511
FL Orlando, Hall-Mark Elctrns. 305-855-4020
FL Palm Bay, Arrow Elctrns. 305-725-1480
FL Pompono Beach, Hall-Mark Elctrns. 305-971-9280
GA Atlanta, Schweber Elctrns. 404-449-9170
GA Norcross, Arrow Elctrns. 404-449-8252
GA Norcross, Hall-Mark Elctrns. 404-447-8000
IL Bensenville, Hall-Mark Elctrns. 312-860-3800
IL Elk Grove, Schweber Elctrns. 312-364-3750
IL Schaumburg, Arrow Elctrns. 312-397-3440
IN Indianapolis, Arrow Elctrns. 317-243-9353
IA Cedar Rapids, Arrow Elctrns. 319-395-7230
IA Cedar Rapids, Schweber Elctrns. 319-373-1417
KS Kansas City, Schweber Elctrns. 913-492-2922
KS Lenexa, Hall-Mark Elctrns. 913-888-4747

KS Overland Park, Arrow Elctrns. 913-642-0592
MD Columbia, Arrow Elctrns. 301-995-0003
MD Columbia, Hall-Mark Elctrns. 301-796-9300
MD Gaithersburg, Schweber Elctrns. 301-840-5900
MA Bedford, Schweber Elctrns. 617-275-5100
MA Billerica, Hall Mark Elctrns. 617-935-9777
MA Woburn, Arrow Elctrns. 617-933-8130
MI Ann Arbor, Arrow Elctrns. 313-971-8220
MI Grand Rapids, Arrow Elctrns. 616-243-0912
MI Livonia, RS Elctrns. 313-525-1155
MI Livonia, Schweber Elctrns. 313-525-8100
MN Bloomington, Hall-Mark Elctrns. 612-854-3223
MN Edina, Arrow Elctrns. 612-830-1800
MN Edina, Schweber Elctrns. 612-941-5280
MN Minneapolis, I.C.I. 612-831-2666
MO Maryland Hts., Hall-Mark Elctrns. 314-291-5350
MO St. Louis, Arrow Elctrns. 314-567-6888
MO St. Louis, Schweber Elctrns. 314-739-0562
NH Manchester, Arrow Elctrns. 603-668-6968
NH Manchester, Schweber Elctrns. 603-625-2250
NJ Cherry Hill, Hall-Mark Elctrns. 609-424-7300
NJ Fairfield, Arrow Elctrns. 201-575-5300
NJ Fairfield, Hall-Mark Elctrns. 201-575-4415
NJ Fairfield, Schweber Elctrns. 201-227-7880
NJ Marlton, Arrow Elctrns. 609-596-8000
NM Albuquerque, Arrow Elctrns. 505-243-4566
NY Buffalo, Summit Elctrns. 716-884-3450
NY Buffalo, Summit Elctrns. 607-748-8211
NY Hauppauge, Arrow Elctrns. 516-231-1000
NY Liverpool, Arrow Elctrns. 315-652-1000
NY Rochester, Arrow Elctrns. 716-427-0300
NY Rochester, Schweber Elctrns. 716-424-2222
NY Ronkonkoma, Hall Mark Elctrns. 516-737-0600
NY Westbury, Schweber Elctrns. 516-334-7474
NC Raleigh, Hall-Mark Elctrns. 919-832-4465
NC Raleigh, Schweber Elctrns. 919-876-0000
NC Winston-Salem, Arrow Elctrns. 919-725-8711
OH Beachwood, Schweber Elctrns. 216-464-2970
OH Centerville, Arrow Elctrns. 513-435-5563
OH Cincinnati, Hall-Mark Elctrns. 513-563-5980
OH Cleveland, Hall-Mark Elctrns. 216-349-4632
OH Columbus, Arrow Elctrns. 614-885-8362
OH Dayton, Schweber Elctrns. 513-439-1800
OH Solon, Arrow Elctrns. 216-248-3990
OK Tulsa, Arrow Elctrns. 918-665-7700
OK Tulsa, Hall-Mark Elctrns. 918-665-3200
OK Tulsa, Schweber Elctrns. 918-622-8000
OR Beaverton, Almac Elctrns. 503-641-9070
OR Tigard, Arrow Elctrns. 503-684-1690
PA Horsham, Schweber Elctrns. 215-441-0600
PA Philadelphia, Almo Elctrns. 215-698-4000
PA Pittsburgh, Schweber Elctrns. 412-782-1600
TX Austin, Schweber Elctrns. 512-458-8253
TX Carrollton, Arrow Elctrns. 214-380-6464
TX Dallas, Hall-Mark Elctrns. 214-553-4300
TX Dallas, Schweber Elctrns. 214-661-5010
TX Houston, Arrow Elctrns. 713-530-4700
TX Houston, Hall-Mark Elctrns. 713-781-6100
TX Houston, Schweber Elctrns. 713-784-3600
UT Salt Lake City, Arrow Elctrns. 801-972-0404
UT Salt Lake City, Hall-Mark Elctrns. 801-268-3779
VA Richmond, Arrow Elctrns. 804-282-0413
WA Bellevue, Almac Elctrns. 206-643-9992
WA Bellevue, Arrow Elctrns. 206-643-4800
WI Brookfield, Schweber Elctrns. 414-784-9020
WI Oak Creek, Arrow Elctrns. 414-764-6600
WI Oak Creek, Hall-Mark Elctrns. 414-761-3000

EG & G ROTRON, Custom Div., Hasbrouck La., Woodstock, NY 12498, Tel: 914-679-5201, TWX: 510-247-9033; FSC No.: 82877; *Sls. Mgr.:* Mike Lyon; *Dist. Mgr.:* Mary Fellows ..... **B•1210**

EG & G TORQUE SYSTEMS, 36 Arlington St., Watertown, MA 02172, Tel: 617-924-6000, Telex: 95-1736; Empl.: 200; *Sls. Mgr.:* W. F. O'Leary; *Dist. Mgr.:* H. D. Waddell

EG & G VACTEC, 10900 Page Blvd., St. Louis, MO 63132, Tel: 314-423-4900, TWX: 910-764-0811; Empl.: 250; *Sls. Mgr.:* D. Hartley; *Dist. Mgr.:* D. Hartley ..... **B•1210**

Local Sales Offices & Reps
CA Encino, King-Way Assocs. 818-788-4124
CA Redwood City, Ault Assocs. 415-367-1710
CO Arvada, Arrowhead Sls. Corp. 303-423-5556
CT Gilford, A & M Elctrn. Reps. 203-453-1612
FL Orlando, EAB Assocs. 305-898-7444
IL Highland Park, T. B. Hunter Assocs. 312-433-7000
IN Fort Wayne, Scott Elctrns. 219-484-7865
IN Indianapolis, Scott Elctrns. 317-897-9976
MA Needham, A & M Elctrn. Reps. 617-444-8170
MI Southfield, O.E.M. Technical Sls. 313-444-1680
MI Troy, Scott Elctrns. 313-585-7690
MN Eden Prairie, Rockmore Sls. 612-941-1390
MO Independence, Engrg. Svcs. Co. 816-254-3600
MO St. Louis, Engrg. Svcs. Co. 314-997-1515
NJ Marlton, B.G.R. Assocs. 609-428-2440
NY Pittsford, C. W. Beach Co. 716-586-3200
NY Syracuse, C. W. Beach Co. 315-446-9587
OH Cincinnati, Scott Elctrns. 513-791-2513
OH Cleveland, Scott Elctrns. 216-473-5050
OH Kettering, Scott Elctrns. 513-294-0539
OH Reynoldsburg, Scott Elctrns. 614-863-1281
PA Pittsburgh, Scott Elctrns. 412-828-1073
TX Dallas, S. W. Mktg. Assocs. 214-341-8631
WA Bellevue, N. R. Schultz Co. 206-454-0300

Local Distributors
AZ Scottsdale, Instate Mktg. 602-244-9050
CA Encino, King Way West 818-788-4124
CA Palo Alto, Zack Elctrns. 415-326-5432
CA Santa Clara, Allied Elctrns. 408-727-1690
CO Denver, Integrated Elctrns. Co. 303-534-6121
FL Orlando, EAB, Inc. 305-898-7444
ID Boise, N. R. Schultz 208-377-8686
IL Chicago, Newark Elctrns. 312-638-4411
IL Elgin, Allied Elctrns. 312-697-8200
MO St. Louis, Olive Indl. Elec. 314-426-4500
OH Dayton, Televox, Inc. 513-294-4499
OR Beaverton, N. R. Schultz 503-643-1644
TX Fort Worth, Allied Elctrns. 817-336-5401
Intl Reading, Berkshire U.K., Norbain Opto Elctrns. Div. 0734-864411

EG&G WAKEFIELD ENGRG., 60 Audubon Rd., Wakefield, MA 01880, Tel: 617-245-5900, TWX: 710-348-6713; Empl.: 240; *Sls. Mgr.:* Ray A. Radford; *Dist. Mgr.:* Carl Swanson

EH ELECTRONICS, INC., Sub. EH Intl., Inc., 48507 Milmont Drive, Fremont, CA 94538, Tel: 415-651-2340, TWX: 910-366-7258; FSC No.: 13488; Empl.: 67; *Sls. Mgr.:* Donald F. Smith

EHRHORN TECHNOLOGICAL OPERS., INC., P.O. Box 888, Canon City, CO 81212, Tel: 303-275-1613; Empl.: 50; *Sls. Mgr.:* Terry Dillahunty

EIGEN VIDEO, P.O. Box 848, Nevada City, CA 95959, Tel: 916-272-3461, Telex: 298788 EIG UR; FSC No.: 59535; Empl.: 50

EIKONIX CORP., 23 Crosby Dr., Bedford, MA 01730, Tel: 617-275-5070

EI NORTH AMERICA, 15 W. 53rd St. Suite 47E, New York, NY 10019, Tel: 212-315-3099, Telex: 803347 'EINA'

EIP MICROWAVE, INC., 2731 North First St., San Jose, CA 95134, Tel: 408-946-5700, TWX: 910-338-0155; FSC No.: 34257; Empl.: 250; *Sls. Mgr.:* Robert Loft/Bill Dentinger

EITEL MFG., 2835 Laguna Canyon Rd., Laguna Beach, CA 92652, Tel: 714-494-2012; Empl.: 6; *Sls. Mgr.:* H. Mengel

ELANTEC, INC., 1996 Tarob Ct., Milpitas, CA 95035, Tel: 408-945-1323, 800-821-7429, TWX: 910-997-0649; FSC No.: 64762; Empl.: 90; *Sls. Mgr.:* Jerry Zis

ELCO CORP., Electronic Connector Div., Huntingdon Ind'l. Park, Huntingdon, PA 16652, Tel: 814-643-0700, TWX: 510-691-3117; Empl.: 500; *Sls. Mgr.:* J. J. Smith; *Dist. Mgr.:* John J. Galiney, Jr.

ELCO CORP., Interconnect Systems Div., 2250 Park Pl., El Segundo, CA 90245, Tel: 213-675-3311; *Sls. Mgr.:* T. Tuttle

ELCOM INDUSTRIES, INC., 10268 Bach Blvd., St. Louis, MO 63132, Tel: 314-429-3100

Local Sales Offices & Reps
CA Anaheim, Magna-Code, Inc. 714-821-7500
MA Newton Highlands, Butler Assocs., Inc. 617-965-1080

ELCOM SYSTEMS, INC., 932 Clint Moore Rd., Boca Raton, FL 33431, Tel: 305-994-1774; FSC No.: 32424; Empl.: 5; *Sls. Mgr.:* D. Pollachek ..... **A•1711**

Local Sales Offices & Reps
EXP MA, Mattapoisett, Clark Export-Import Co. 617-758-6448

ELCON PRODUCTS INTERNATIONAL COMPANY, 44036 Grimmer Blvd., Fremont, CA 94538, Tel: 415-490-4200, Telex: 910-381-7026; FSC No.: 85901; Empl.: 25; *Sls. Mgr.:* Shirley Gendreau; *Dist. Mgr.:* Shirley Gendreau

ELDEC CORP., Monitor & Control Div., 16700 13th Ave. W., P.O. Box 100, Lynnwood, WA 98046-0100, Tel: 206-743-1313, Telex: 32-8959, TWX: 910-449-2855

ELDEC CORP., Power Conversion Div., 16700 13th Ave. W., P.O. Box 100, Lynnwood, WA 98036, Tel: 206-743-1313, Telex: 32-8959, TWX: 910-449-2855

ELDEC CORPORATION, Sensing Systems Div., 16700 13th Ave. West, P.O. Box 100, Lynnwood, WA 98046-0100, Tel: 206-487-4000, Telex: 32-8959, TWX: 910-449-0873

ELDORADO INSTRS., 7303 Edgewater Dr., Oakland, CA 94621, Tel: 415-638-5656, TWX: 910-366-7258; FSC No.: 54495; *Sls. Mgr.:* Paul Magnusson

ELDRE CORPORATION, 1500 Jefferson Rd., Rochester, NY 14623, Tel: 716-427-7280, TWX: 510-253-4347; FSC No.: 19648; Empl.: 220; *Sls. Mgr.:* Harvey Erdle

Local Sales Offices & Reps
AL Huntsville, Elctrns. Mktg. Assocs. 205-837-7363
AZ Tucson, W.J.M. Sls. Co. 602-888-4847
CA Beverly Hills, ELDRE West 213-271-4485
CA Palo Alto, ELDRE West 415-325-0838
CO Denver, Spectrum Sls. 303-480-9991
FL Altamonte Springs, V. G. Sls. Co., Inc. 305-831-8688
FL Pompano Bch., V. G. Sls. Co., Inc. 305-971-0900
GA Atlanta, Electronic Mktg. Assocs. 404-448-1215
GA Norcross, Elctrns. Mktg. Assocs. 404-448-1215
IL Oak Park, ELDRE Midwest 312-383-1414
MD Ellicott City, Arbotek Assocs. 301-461-1323
MA Brookline, Harman Assocs. 617-232-6687
MO St. Louis, Cadon Techn. Sls. 314-645-8670
NJ Haddonfield, Tritek Sls. 609-429-1551
NM Albuquerque, W.J.M. Sls. Co. 505-898-5917
NY Rochester, ELDRE Corp. 716-427-7280
NC Raleigh, Electronic Mktg. Assocs. 919-847-8800
NC Winston-Salem, Ictrns. Mktg. Assocs. 919-722-5151
OH Cleveland, Marlow Assocs., Inc. 216-991-6500
OH Columbus, Marlow Assocs., Inc. 614-885-7643
OR Portland, Electronic Mktg. Grp. 503-252-0610
PA Pittsburgh, Marlow Assocs., Inc. 412-367-8886
SC Greenville, Elctrns. Mktg. Assocs. 803-233-4673
UT Ogden, Spectrum Sls. 801-972-8552
WA Redmond, Electronic Mktg. Grp. 206-882-0962

ELEC-TEK, INC., 10280 Alliance Rd., Cincinnati, OH 45242, Tel: 513-793-7937; FSC No.: 5U373; Empl.: 10; *Sls. Mgr.:* Rick Groth

ELECTRAC, INC., 1614 Orangethrope Way, Anaheim, CA 92801, Tel: 714-879-6021, Telex: 692433; FSC No.: 016154; Empl.: 21

ELECTRICAL INDS., 691 Central Ave., Murray Hill, NJ 07974, Tel: 201-464-3200, TWX: 710-984-7979; FSC No.: 20093; *Sls. Mgr.:* D.V. Wilson

ELECTRICAL INSTR. SVC., 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717; FSC No.: 32590;16034A; Empl.: 35

ELECTRICAL PLASTICS CORP., 500 Long Branch Ave., Long Branch, NJ 07740, Tel: 201-870-9500; Empl.: 50

ELECTRICAL STANDARDS DIV., E.S.R.S., Inc., 7337 Greenbush, N. Hollywood, CA 91605, Tel: 818-765-4224; Empl.: 6

ELECTRIC DEVICE, PO Box 337, Canfield, OH 44406, Tel: 216-533-3060

ELECTRIC FIELD MEASUREMENTS, Box 326, W. Stockbridge, MA 01266, Tel: 413-637-1929; Empl.: 3; *Sls. Mgr.:* L. Hegl

Distributor

ELECTRIC SWITCHES, INC., 2478 Fletcher Dr., Los Angeles, CA 90039, Tel: 213-660-1310, TWX: 910-321-2971; Empl.: 42; *Sls. Mgr.:* Louis Lim ..... **B•1516,1517,** pgs. **605, 614, 616, 632, 635, 637, 638, 639, 651, 657, 669, 672, 675, 676, 688, 689, 701, 709, 711, 719, 724, 726, 731, 736, 747, 751, 753, 766, 767, 768, 781, 786, 789, 794, 801, 803, 816.**

ELECTRIC TACHOMETER, 68th & Upland Sts., Philadelphia, PA 19142, Tel: 215-SA6-7723, Telex: 83-1475; FSC No.: 20049; Empl.: 50; *Sls. Mgr.:* F. M. Porter

ELECTRIC TIME COMPANY, INC., P.O. Box 298, Natick, MA 01760, Tel: 617-653-1341; FSC No.: 6645; Empl.: 10

ELECTRO ASSEMBLIES, 425 Huehl Rd. Bldg. 17, Northbrook, IL 60062, Tel: 312-498-6520

ELECTROCHEM INDS., Wilson Greatbatch Ltd., 10000 Wehrle, Clarence, NY 14031, Tel: 716-759-6901, Telex: 91-386; FSC No.: 6U589; *Sls. Mgr.:* R. Carey; *Dist. Mgr.:* L. Hanitz, M. Brookman

ELECTROCOM INDS., 1105 N. Ironwood Dr., S. Bend, IN 46615, Tel: 219-232-2743; FSC No.: 27114; *Sls. Mgr.:* B. Jaffe

ELECTRO COMP., INC., 2415 Main St., Stratford, CT 06497, Tel: 203-375-5811 ..... **A•1864-1865**

ELECTRO-CRAFT CORPORATION

ELECTRO-CRAFT, 1600 2nd St. S., Hopkins, MN 55343, Tel: 612-931-2700 ..... **B•1147-1149**

Local Sales Offices & Reps

CA	Westlake Village, Electro-Craft	818-889-3631
CO	Denver, Electro-Craft	303-839-5565
GA	Marietta, Electro-Craft	404-971-2669
IL	Palatine, Electro-Craft Corp.	312-991-4570
MA	Salem, Electro-Craft	603-893-5552
MN	Hopkins, Electro-Craft	612-931-2700
NH	Salem, Electro-Craft	603-893-5552
NJ	Cherry Hill, Electro-Craft	609-662-0555
OH	Cincinnati, Electro-Craft	513-474-4171

Local Distributors

Can	Edmonton, Alb., H.M. Mott Mktg., Ltd.	403-468-1292
Intl	England, Crewe, Electro-Craft, Ltd.	0270-584416
Intl	Finland, Helsinki, Stig Wahlstrom OY	90-5577 x51
Intl	France, Tekelec Airtronic	1-534-7535
Intl	Holland, Rotterdam, Van Gelder Compagnie B.V.	010-156622
Intl	India, Hyderabad, Kashinath & Co.	36942
Intl	Israel, Tel-Aviv, Abiry Agencies (1979), Ltd.	03-254106-253337
Intl	Italy, Milano, Parnoco S.r.l.	02-3452531/5
Intl	Japan, Tokyo 104, Midoriya Electric Co.	03-561-8851
Intl	Sweden, Johanneshov, L. Ostergren El.	08-815013
Intl	W. Germany, Darmstadt, Eduard Bautz G.m.b.H.	06151/82973
Intl	Hong Kong, Kowloon, Nanco Elctrns. Supp. Ltd.	3-335121-10
Intl	Japan, Toshima-Ku Tokyo, Sanyo Denki Co., Ltd.	03-917-5151
Intl	Korea, Seoul, Lucky-Gold Star Intl.	778-247315
Intl	Rep. of China, Taiwan, Sertek	02-7134022-7134027-7135435
Intl	Switzerland, Lohwisst Rasse, EME AG Zurich	019801111

ELECTROCUBE, 1710 So. Del Mar Ave., San Gabriel, CA 91776, Tel: 818-573-3300, TWX: 910-589-1609; FSC No.: 14752; Empl.: 175; *Sls. Mgr.:* E. F. Bryant; *Dist. Mgr.:* E. F. Bryant

ELECTRODATA, INC., 23020 Miles Rd., Bedford Heights, OH 44128, Tel: 216-663-3333, TWX: 810-427-2280; FSC No.: 34-1173465; Empl.: 15; *Sls. Mgr.:* Philip Ardire; *Dist. Mgr.:* Philip Ardire

ELECTRO DESIGN SYS., 100 W. 35th St., Ste. S, National City, CA 92050, Tel: 619-420-2351, Telex: 182827; Empl.: 35

ELECTRODYNAMICS

ELECTRODYNAMICS, INC., A Talley Inds. Co., 1200 Hicks Rd., Rolling Meadows, IL 60008, Tel: 312-259-0740, Telex: 28-1070; FSC No.: 10236; Empl.: 250; *Sls. Mgr.:* Frank Rafferty ..... **D•1119**

Local Sales Offices & Reps

CA	Alhambra, M. W. Riedel & Co.	213-283-7694
CA	Hayward, Avionics, Inc.	415-783-1131
CO	Denver, West, Inc.	303-773-8180
CT	Old Saybrook, FJS Assocs.	203-388-5374
FL	Clearwater, Delmac Sls.	813-447-5192
FL	Orlando, Delmac Sls.	305-898-4688
FL	Tamarac, Delmac Sls.	305-726-1330
IA	Cedar Rapids, J.R. Sales Engrg.	319-393-2232
MD	Severna Park, Delmarva Engrg. Assocs., Ltd.	301-647-8007
MA	Winchester, FJS Assocs.	617-729-3135
MN	New Brighton, TWC Sls.	612-636-1770
MO	Maryland Hgts., Midwest Meridian Corp.	314-878-4441
NJ	Clinton, Churchill Assocs.	201-735-8971
NY	Endicott, Noeth Honsinger Assocs.	607-754-3214
NY	Larchmont, Hingston Walsh Assocs., Inc.	914-834-5781
NY	Pittsford, Noeth Honsinger Assocs.	716-586-9002
OR	Portland, Caruso & Northcutt	503-646-4973
PA	Norristown, Rivco January Inc.	215-631-1414
TX	Hurst, Midwest Meridian	817-654-2132
UT	Salt Lake City, Meridian West	801-466-5739
WA	Bothwell, Caruso & Northcutt	206-454-9699

ELECTRO-DYNAMICS DEV. CO., 475 Mt. Hood Dr. S.W., Issaquah, WA 98027, Tel: 206-392-2493; *Sls. Mgr.:* W. A. Pommer

ELECTROFILM, 27727 Avenue Scott, Valencia, CA 91355, Tel: 805-257-2240, Telex: 65-1438; FSC No.: 85932; Empl.: 250; *Sls. Mgr.:* George Hulett

ELECTRO-FILMS, INC., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, Tel: 401-738-9150, TWX: 710-382-0405; Empl.: 100; *Sls. Mgr.:* Frank Urrico ..... **A•1866-1867**

Local Sales Offices & Reps

CA	Santa Ana, Weatherman Assocs.	714-544-1304
CA	Sunnyvale, NES Assocs.	408-738-3259
GA	Doraville, BCI, Inc.	404-455-0405
IL	Hinsdale, Willtech Corp.	312-655-4850
IN	Indianapolis, CC Electronics	317-255-1508
MA	Allston, Vector Sls.	617-787-2790
MA	Boston, Vector Assocs.	617-787-2790
MI	Livonia, Electro Sls. Assocs.	313-474-7320
MN	Minneapolis, Comprehensive Tech. Sls.	612-888-7011
NM	Albuquerque, Grady Moore Assocs.	505-262-1416
NY	Kew Gardens, Robert Smith Assocs.	212-780-0097
NY	New York, Robert Smith Assocs.	212-541-4885
NY	Plainview, Robert Smith Assocs.	516-681-3155
NY	Syracuse, Labtronics	315-455-7314
NC	Charlotte, BCI, Inc.	704-567-0473
NC	Raleigh, BCI, Inc.	919-781-9426
OH	Cleveland, Electro Sls. Assocs.	216-261-5440
OH	Dayton, Electro Sls. Assocs.	513-426-5551
PA	Allison Park, Electro Sls. Assocs.	412-487-3801
PA	Colman, EL Assocs.	215-822-2510
PA	Oreland, EFW Tech. Sls.	215-887-5300
TX	Austin, J. Clay Co.	512-346-7340
TX	Dallas, J. Clay Co.	214-350-1281
TX	Houston, Elctrn. Mktg. Assocs.	713-498-8120
WA	Seattle, MARS	206-747-3292
EXP	MA, Plainville, Teknis, Inc.	617-695-3591

ELECTRO IMPULSE, Box 870, Red Bank, NJ 07701-0870, Tel: 201-741-0404, TWX: 710-722-5717; FSC No.: 91161; Empl.: 99; *Sls. Mgr.:* Mark Rubin ..... **C•1637; D•1211**

Local Sales Offices & Reps

CA	Los Angeles, RDH Assocs.	213-396-4100
MA	Reading, Geder Assocs.	617-944-3105
NY	Greenvale, B. D. Aaron & Co.	516-621-0630
TX	Richardson, Spectra Sls. Corp.	214-234-3600
EXP	NJ, Oradell, Sylvan Ginsbury Ltd.	201-261-3200

Local Distributors

CA	Los Angeles, RDH Assocs.	213-396-4100
MA	Reading, Geder Assocs.	617-944-3105
NJ	Oradell, Sylvan Ginsbury	201-261-3200
NY	Greenvale, Bertram D. Aaron & Co.	516-621-0630
TX	Richardson, Spectra Sls.	214-234-3600

ELECTRO INDUSTRIES, Div. E.I. Elctrns., Inc., 1800 Shames Drive, Westbury, NY 11590, Tel: 516-334-0870; Empl.: 20; *Sls. Mgr.:* S. Kagan ..... **D•1350-1351**

For further information call toll free: 800-645-6342

ELECTRO KINETICS CO., Sub. HTL Inds., Inc., 402 E. Gutierrez St., Santa Barbara, CA 93102, Tel: 805-963-2055, TWX: 910-334-1177; FSC No.: 02101; Empl.: 260; *Sls. Mgr.:* N.G. Otis

ELECTROL

ELEC-TROL, INC., 26477 N. Golden Valley Rd., Saugus, CA 91350, Tel: 805-252-8330, Telex: 310-372-0331; FSC No.: 15636; Empl.: 650; *Sls. Mgr.:* Frank Cooper; *Dist. Mgr.:* Barbara J. Owens ..... **B•1332-1342**

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrn. Assocs.	205-881-5031
AZ	Scottsdale, TC Electronics	602-944-5153
AR	Little Rock, Beacon Elctrn. Assocs.	501-224-5449
CA	Garden Grove, Elsco	714-891-4621
CA	San Jose, Jeff Mallman	408-972-9072
CO	Denver, Elcom	303-337-2300
FL	Boca Raton, Beacon Elctrn. Assocs.	305-392-3500
FL	Clearwater, Beacon Elctrn. Assocs.	813-796-2378
FL	Maitland, Beacon Elctrn. Assocs.	305-647-3498
FL	Melbourne, Beacon Elctrn. Assocs.	305-724-8010
GA	Atlanta, Beacon Elctrn. Assocs.	404-256-9640
IL	Des Plaines, Lincoln, Hodges & Assocs.	312-297-3810
IN	Granger, Gregory Sls.	219-272-9626
KS	Overland Park, John F. Guernsey Co.	913-381-2225
MA	Framingham, Stone Comps.	617-875-3266
MN	Minneapolis, Westlund & Assoc.	612-866-5002
MO	Florissant, John F. Guernsey Co.	314-921-5720
NY	Clark Mills, KLM-Garner Co.	315-853-6126
NY	Mt. Vernon, Sonkin Assocs.	914-968-8282
NY	North Syracuse, KLM-Garner Co.	315-458-6214
NY	Pittsford, KLM-Garner Co.	716-381-8350
NC	Greensboro, Beacon Elctrn. Assocs.	919-275-9997
OH	Columbus, Mulligan & Assoc.	614-457-2242
OR	Portland, Earl & Brown Co.	503-245-2283
PA	Birchrunville, Jadelectronics	215-296-3800
TX	Houston, Aid Elctrns.	713-955-6204
TX	Irving, Aid Elctrns.	214-790-4761
UT	Salt Lake City, Elcom	801-485-7415
WA	Seattle, Earl & Brown Co.	206-284-1121
WI	Waukesha, Lincoln, Hodges & Assocs.	414-542-3087

Local Distributors

AL	Huntsville, Component Distrs.	205-883-7501
AZ	Tempe, Acacia Sls.	602-894-2874
CA	Anaheim, Arrow Elctrns.	714-774-5290
CA	Chatsworth, Arrow Elctrns.	213-701-7500
CA	Irvine, Acacia Sls.	714-549-0954
CA	San Carlos, Control Design	415-592-4806
CA	San Diego, Acacia Sls.	619-565-4365
CA	San Diego, Arrow Elctrns.	619-565-4800
CA	Santa Clara, Patane/Selectronics	408-496-6151
CA	Santa Monica, Master Distrs.	213-452-1229
CA	Sunnyvale, Acacia Sls.	408-745-7200
CA	Sunnyvale, Arrow Elctrns.	408-745-6600
CA	Van Nuys, Patane Avionics	213-988-4455
CO	Denver, Arrow Elctrns.	303-758-2100
CO	Lakewood, Acacia Sls.	303-232-2882
CT	Wallingford, Arrow Elctrns.	203-265-7741
FL	Clearwater, Diplomat Elctrns.	813-443-4514
FL	Ft. Lauderdale, Arrow Elctrns.	305-776-7790
FL	Ft. Lauderdale, Component Distrs.	305-971-4950
FL	Palm Bay, Arrow Elctrns.	305-725-1480
IL	Bensenville, Diplomat Elctrns.	312-595-1000
IL	Itasca, Voyager Elctrns.	312-773-4900
IN	Indianapolis, Arrow Elctrns.	317-243-9353
MA	Framingham, Jaks Elctrns.	617-875-3266
MA	Woburn, Arrow Elctrns.	617-933-8130
MA	Woburn, Diplomat Elctrns.	617-935-6611
MI	Ann Arbor, Arrow Elctrns.	313-971-8220
MN	Edina, Arrow Elctrns.	612-830-1800
MN	Fridley, Voyager Elctrns.	612-571-7766
MO	St. Louis, Arrow Elctrns.	314-567-6888
NH	Manchester, Arrow Elctrns.	603-668-6968
NJ	Fairlawn, Relay Specialties	201-797-3313
NJ	Moorestown, Arrow Elctrns.	609-235-1900
NJ	Saddle Brook, Arrow Elctrns.	201-797-5800
NY	Farmingdale, Arrow Elctrns.	516-694-6800
NY	Farmingdale, Arrow Elctrns.	516-293-6363
NY	Hauppauge, Arrow Elctrns.	516-231-1000
NY	Liverpool, Arrow Elctrns.	315-652-1000
NY	Rochester, Arrow Elctrns.	716-275-0300
NY	Rochester, Simcona Elctrns. Corp.	716-328-3230
NY	Yonkers, Kin-Tronics	914-968-7736
NC	Raleigh, Arrow Elctrns.	919-876-3132
NC	Winston Salem, Arrow Elctrns.	919-725-8711
OH	Centerville, Arrow Elctrns.	513-435-5563
OH	Dayton, Bell Inds.	513-435-8660
OH	Solon, Repco	216-248-8900
OR	Beaverton, Acacia Sls.	503-646-3377
PA	Monroeville, Arrow Elctrns.	412-856-7000
PA	Philadelphia, Shap Elctrns.	215-969-3300
TX	Dallas, Arrow Elctrns.	214-386-7500
TX	Houston, Force Elctrns. Co. of TX	713-772-8510
TX	Irving, Force Elctrns. Co. of TX	214-438-5700
TX	Stafford, Arrow Elctrns.	713-491-4100
UT	Salt Lake City, Diplomat Elctrns.	801-486-4134
WA	Bellevue, Arrow Elctrns.	206-643-4800
WI	Oak Creek, Arrow Elctrns.	414-764-6600

ELECTROL CO., 321 Dewey St., P.O. Box 29, York, PA 17405, Tel: 717-848-1722; Empl.: 30; *Sls. Mgr.:* Debra Dudley; *Dist. Mgr.:* Debra Dudley

ELECTROLOGIC, INC., 1359 28th St., Signal Hill, CA 90806, Tel: 213-595-0551; FSC No.: 213-595-0554; Empl.: 8; *Sls. Mgr.:* Don Masadao

ELECTROMAGNETIC INDUSTRIES, INC., Box 6440, Clearwater, FL 33518, Tel: 813-447-2511

ELECTRO-MAGNETIC PROCESSES, INC., 9616 Owensmouth Ave., Chatsworth, CA 91311, Tel: 818-882-6333, Telex: 499 2240 EMP UI; FSC No.: 51290; Empl.: 70; *Sls. Mgr.:* Arthur Sullivan

ELECTRO MATERIALS CORP. AMER., See EMCA, Sub. Rohm & Haas Advanced Matls. Co.

ELECTROMATIC CONTROLS CORP., 2495 Pembroke Road, Hoffman Estates, IL 60195-2010, Tel: 312-882-5757, TWX: 910-222-3452; FSC No.: 75203; Empl.: 400; *Sls. Mgr.:* Robert Martin

ELECTROMECH, INC., 528 Elm Street, Kearny, NJ 07032, Tel: 201-997-0950; Empl.: 40; *Sls. Mgr.:* Solomon Ezraseneh ..... **A•2134**

ELECTRO MECHANICAL DESIGN SERVICES, INC., 16698 Oakmont Ave., Gaithersburg, MD 20877, Tel: 301-840-5710; *Sls. Mgr.:* Patrick E. Roney

ELECTRO-MECHANICS CO., Box 1546, Austin, TX 78767, Tel: 512-835-4684, Telex: 767178

electro-mechanisms INCORPORATED

ELECTRO-MECHANISMS, 2745 E. Huntington Dr., Duarte, CA 91010, Tel: 818-359-2535; FSC No.: 52592; Empl.: 27 ..... **B•1466-1467**

Local Sales Offices & Reps

CA	Arcadia, Van Gott & Assoc.	818-445-9729
CA	Redwood City, Hickey Indl. Sls.	415-368-3849
CA	San Diego, Van Gott & Assocs.	619-280-1041
CO	Lakewood, Cristee-Meade Co.	303-232-0287
FL	Ft. Meyers, Rainbow Sls., Inc.	813-332-2210
IL	Addison, Engrd. Sls. Co.	312-832-8425
MD	Baltimore, R. P. Luce	301-752-8200
MN	St. Paul, Vikeland Sls., Inc.	612-645-4647
NJ	Piscataway, R. P. Luce	201-752-8750
NY	Buffalo, Good Comps.	716-634-4400
NY	New Hyde Park, R. P. Luce	516-437-4550
NC	Raleigh, G. P. O'Malley & Assoc., Ltd.	919-848-9865
OH	Dayton, Harvey Teplitz	513-898-4330
PA	Philadelphia, R. P. Luce & Co.	215-233-0999
TX	Dallas, Marcom	214-351-4532
WA	Vancouver, Ray Over Sls.	206-695-6179

ELECTRO-MECH COMPS., 1826 N. Floradale Ave., So. El Monte, CA 91733, Tel: 818-442-7180; FSC No.: 07150; Empl.: 75; *Sls. Mgr.:* Walter H. Trumbull; *Dist. Mgr.:* Margaret W. Ambrose ..... **B•1562-1563**

Local Sales Offices & Reps

CA	Los Angeles, Universal Comps. Co.	213-641-4255
CA	San Diego, Qualtronics	619-560-8955
CA	Santa Clara, Engrg. Assocs.	408-988-5001
CO	Englewood, Franklin Sls.	303-789-2526
CT	Milford, Todino Engrg.	203-874-6643
FL	Orlando, Publicover	305-898-9361
IL	Chicago, Indl. Rep.	312-647-7755
IN	Fort Wayne, Scott Elctrns.	219-484-7865
IN	Indianapolis, Scott Elctrns.	317-897-9976
MA	Needham Hgts., Todino Engrg.	617-444-7925
MI	Brighton, Michigan Mktg. & Sls.	313-229-6218
MN	Minneapolis, D. A. Case Assocs.	612-869-3700
NJ	Medford, Comp. Conslts.	609-654-5300
NY	Camillus, SHR	315-487-3232
NY	Mamaroneck, Bassin Tech.	914-698-9332
OH	Cincinnati, Scott Elctrns.	513-791-2513
OH	Cleveland, Scott Elctrns.	216-473-5050
OH	Dayton, Scott Elctrns.	513-294-0539
OH	Reynoldsburg, Scott Elctrns.	614-863-1281
OR	Forest Grove, Doran Sls.	503-357-3333
PA	Pittsburgh, Scott Elctrns.	412-963-6116
TX	Leander, McCoy Assocs.	512-259-1109
TX	Richardson, McCoy Assocs.	214-238-1017
VA	Front Royal, Eltron	703-635-7201
WA	Redmond, Doran Sls.	206-885-1885
WI	Milwaukee, Indl. Rep.	414-259-0965

Local Distributors

AZ	Phoenix, Parts Elctrn.	602-258-6476
CA	Los Angeles, Elec. Distr.	213-660-1310
CA	Los Angeles, Master Distrs.	213-452-1229
FL	Pompano Beach, Components South	305-971-0350
NY	Buffalo, Genesee Radio & Parts	716-873-9661
NY	Mamaroneck, Logi Comp Elctrns.	914-698-9332
Intl	England, Kensington, London, G.E. Elctrns.	01-727 0711/3
Intl	Israel, Holon, M.S.R. Engrg. & Dev.	847686
Intl	Switzerland, Oberengstringen, G & P Elctrns.	(01)643231/644555

ELECTRO-METRICS, Penril Corp., 100 Church St., Amsterdam, NY 12010, Tel: 518-843-2600, TWX: 710-446-4798; FSC No.: 18581; Empl.: 105; *Sls. Mgr.:* David Cook

ELECTRO NATL., Matthews Ave., Canton, MS 39046, Tel: 601-859-5511, TWX: 810-990-0938; FSC No.: M-54208; Empl.: 40

ELECTRONETICS, INC., Paine Field Bldg 335, Everett, WA 98204, Tel: 206-355-1855; Empl.: 10

ELECTRON, INC., P.O. Box 28640, San Diego, CA 92128, Tel: 216-681-4700, Telex: 98-0240; Empl.: 85

ELECTRONIC COIL CORP., Farmington Industrial Park, Farmington, CT 06032, Tel: 203-677-6731; Empl.: 127; *Sls. Mgr.:* Raymond Gorski, Jr.

ELECTRONIC COMPONENT ASSEMBLY, INC., 9500 Alto Drive, La Mesa, CA 92041, Tel: 619-464-0910; Empl.: 70; *Sls. Mgr.:* Daniel J. McGillicuddy

ELECTRONIC COMPONENTS GROUPE

ELECTRONIC COMPONENTS GROUPE, Stein Industries, Inc., 14143 21st Ave. No., Minneapolis, MN 55441, Tel: 612-559-0720, TWX: 910-576-1725; *Sls. Mgr.:* Ehrhard Goebel; *Dist. Mgr.:* Tom Coey ..... **B•1566**

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Scottsdale, SMS & Assocs.	602-998-0831
AR	Little Rock, Beacon Elctrns.	501-224-5449
CA	Cupertino, F & F Assocs.	408-446-2349
CA	Marina Del Ray, Spec-Rep, Inc.	213-827-7767
CO	Englewood, Electronic Comp. Sls.	303-781-5904
FL	Clearwater, Beacon Elctrns.	813-796-2378
FL	Ft. Lauderdale, Beacon Elec.	305-491-1054
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Downers Grove, Richmar Elec.	312-968-0118
IN	Indianapolis, Insul-Reps	317-842-5203
IA	Cedar Rapids, Palatine	319-365-8071
KS	Mission, Palatine	913-831-0555
MA	Plainville, Enterprise Tech., Inc.	617-695-4700
MN	Minneapolis, Comps. Representative Groupe	612-894-8055
MO	Hazelwood, Palatine	314-839-0800
NJ	Ho-Ho-Kus, D. J. Fisher Co., Inc.	201-652-0090
NM	Albequerque, Syntech	505-266-7951
NY	Fairport, TAC Sls., Inc.	716-425-1070
NC	Raleigh, Beacon Elctrns.	919-787-0330
OH	Cleveland, Components, Inc.	216-243-9200
OK	Tulsa, Southern States Mktg.	918-369-3233
TX	Austin, Southern States Mktg.	512-473-2741
TX	Houston, Southern States Mktg.	713-558-4900
TX	Richardson, Southern States Mktg.	214-238-7500
UT	Salt Lake City, Quality Comp. Sls.	801-268-8000
VA	Fairfax, Beacon North, Inc.	703-591-1300
WA	Kirkland, A/D Elctrns.	206-821-3205
WI	Butler, Richmar Elctrns.	414-781-1730

Local Distributors

CA	Hollywood, Yale Radio	213-465-3186
CA	Manhattan Beach, Prime Electro	213-379-3642
CA	Mountain View, Target Elctrns.	415-961-1170
CA	San Carlos, Logan Elec.	415-594-0700
CO	Englewood, Industrial Elctrns.	303-694-9444
CT	Shelton, Century Elec. Supp.	203-736-2684
MD	Beltsville, PSI	301-937-4960
MD	Columbia, D. K. Elctrns.	301-995-1950
MN	Mpls., Glenmark, Inc.	612-941-4825
WA	Seattle, Radar Elec.	509-747-3053

ELECTRONIC CONCEPTS, INC., Box 627 E, Eatontown, NJ 07724, Tel: 201-542-7880, Telex: 7107226661; Empl.: 240; *Sls. Mgr.:* Philip N. Lepore ..... **A•1072-1077**

Local Sales Offices & Reps

AZ	Tempe, Piper Sls. Co.	612-949-0048
CA	Colton, Elctrn. Concepts, Inc.	714-824-2525
CA	La Mirada, Select Elctrns.	714-739-8891
CA	Los Gatos, Elctrn. Concepts, Inc.	408-395-4224
CA	San Jose, Landia Sls. Grp.	408-280-5695
CO	Aurora, Sage Sls.	303-750-3501
FL	Sunrise, Electronic Concepts, Inc.	305-748-4604
IL	Wheaton, Elctrn. Concepts, Inc.	312-668-8747
MA	Wakefield, Omni-Rep	617-245-4511
MN	Minneapolis, Components Grp.	612-374-1250
MO	Grandview, Harris-Hanson Co.	816-763-6200
NJ	Englewood Cliffs, Ed Glass Assocs.	201-592-0200, 212-586-8440
OR	Portland, Components West	503-684-1671
MO	St. Louis, Harris-Hanson Co.	314-432-3611
PA	Lansdale, Industrial Comps., Inc.	215-368-3382
TX	Austin, Milred Assocs., Inc.	512-459-8602
TX	Houston, Milred Assocs., Inc.	713-937-0127
TX	Richardson, Milred Assocs., Inc.	214-644-6731
UT	Salt Lake City, Sage Sls.	801-467-5451
WA	Seattle, Components West	206-885-5880

Local Distributors

IL	Chicago, Nep Elctrns.	312-625-8400
NJ	Teterboro, Elcon Sls.	201-288-8170
TX	Dallas, R. V. Weatherford	214-931-7333
TX	Houston, R. V. Weatherford	713-688-7406
WI	New Berlin, Nep Elctrns.	414-785-9100

ELECTRONIC CONNECTOR DIV., Midland-Ross Corp., One Alewife Pl., Cambridge, MA 02140, Tel: 617-491-5400; *Sls. Mgr.:* Jim Gomes; *Dist. Mgr.:* Karen McMillan

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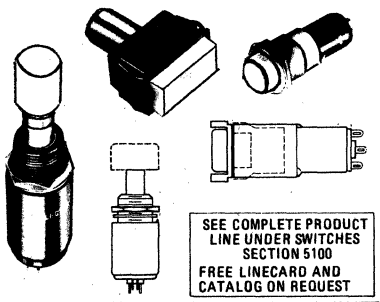

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ELECTRONIC CONTROLS DESIGN, 13626 S. Freeman Rd., Mulino, OR 97042, Tel: 503-829-9108, Telex: 703874 ECDINC UD; Empl.: 103; *Sls. Mgr.:* Rex Breunsbach

ELECTRONIC CONVENTIONS, INC., P.O. Box 92275, Worldway Postal Ctr., Los Angeles, CA 90009, Tel: 213-772-2965; *Sls. Mgr.:* William C. Weber, Gen. Mgr.

ELECTRONIC DEV. CORP., 11 Hamlin St., Boston, MA 02127-4198, Tel: 617-268-9696, Telex: 951596; FSC No.: 12619; *Sls. Mgr.:* R. B. Ross ..... **D•1213-1215**

Local Sales Offices & Reps

AL	Huntsville, MOCO	205-881-5968
AZ	Phoenix, R. A. Mayes Co.	602-279-5243
CA	Costa Mesa, Feeger, Lucas, Wolf	714-751-7512
CA	Hayward, Feeger, Lucas, Wolf	415-786-9070
CA	San Diego, Feeger, Lucas, Wolf	619-277-0993
CA	Van Nuys, Feeger, Lucas, Wolf	213-989-5237
CO	Englewood, R. A. Mayes Co.	303-761-9447
FL	Winter Haven, Lee Assocs.	813-294-5815
IL	Hoffman Estates, Carvel Engrg.	312-885-8800
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Overland Park, Ramsey Assts.	913-649-6996
MD	Gaithersburg, Powell-Pendergraph	301-921-4200
MA	Hudson, Datarep	617-481-0333
MI	Hazel Park, Tiby Co.	313-547-3550
MN	Edina, Carvel Engrg. & Sls.	612-835-7929
MO	St. Louis, Ramsey Assocs.	314-878-5042
NM	Albuquerque, R. A. Mayes Co.	505-292-2330
NY	E. Syracuse, Ossmann Instrs.	315-437-7052
NY	Rochester, Ossmann Instrs.	716-442-6990
NY	White Plains, Cane Techn. Sls.	914-694-9240
NC	Raleigh, Lee Assocs.	919-848-8818
OH	Cleveland, Tiby Co.	216-371-5335
OH	Dayton, Tiby Co.	513-277-3822
OR	Portland, Topp Engrg. Sls.	503-244-7265
PA	Willow Grove, Powell-Pendergraph	215-657-0330
TX	Dallas, Tech Rep Mktg.	214-241-2434
TX	El Paso, R. A. Mayes Co.	Enterprise 750
TX	Kemah, Hi Tech Sys.	713-783-3856
UT	West Jordan, R. A. Mayes Co.	801-292-6781
VT	Burlington, Data Reps.	802-864-0933
VA	Richmond, Powell-Pendergraph	804-270-1400
WA	Bellevue, Topp Engrg. Sls.	206-747-5400
WI	New Berlin, Carvel Engrg.	414-784-7007

ELECTRONIC DEVELOPMENT LABS., See EDL Inc.

ELCTRN. DEVICES, 21 Gray Oaks Ave., Yonkers, NY 10710, Tel: 914-965-4400, TWX: 710-560-0021; Empl.: 200; *Sls. Mgr.:* Dennis Dean; *Dist. Mgr.:* Dennis Dean

ELECTRONIC ENCLOSURES, Div. Wyle Labs, 225 South Aviation Blvd., El Segundo, CA 90245, Tel: 213-643-8181, TWX: 910-348-6699; FSC No.: 09097; Empl.: 400; *Sls. Mgr.:* Hillard W. Sorey ..... **C•1056**

Local Sales Offices & Reps

AL	Huntsville, Macro Mktg. Assocs.	205-833-9630
CA	Campbell, Carlson, Bob	408-370-1284
CA	Los Angeles, Chris Allen Elec. Encl.	213-643-8181
CA	San Diego, De LaTorre & Assocs.	213-323-0922
CO	Denver, Odyssey 1	303-688-3555
FL	Palmetto, Southeast Tech. Sls., Inc.	813-729-3112
IL	Elmhurst, Scott Assocs.	312-279-5681
MD	Randallstown, Imagitron Sls. Co.	301-521-2020
MI	Jackson, Norwood Scroggs Co.	517-750-1170
MN	St. Paul, Charles E. Bohlig & Assocs.	612-944-8404
NJ	Pennsauken, Elctrn. Encls.	609-665-6810
NJ	Randolph, D. Despins Elctrn. Encls.	201-361-2864
NM	Albuquerque, Odyssey 1	505-265-6645
NY	Binghamton, Precision Sls.	607-648-8833
NY	Liverpool, Precision Sls.	315-451-3480
NY	Pittsford, Precision Sls.	716-381-2820
NY	Pleasant Valley, Precision Sls.	914-635-3233
NY	Syracuse, Precision Sls.	315-472-3010
OH	Dayton, Technical Dvcs. Co.	513-890-6811
OR	Portland, Jas. J. Backer Co.	503-297-3776
TX	Houston, Zonk Engrg. Co.	713-895-9131
TX	Richardson, Zonk Engrg. Co.	214-238-7651
WA	Seattle, Jas. J. Backer Co.	206-285-1300

ELECTRONIC ENGRG. CO. OF CAL., See EECO

ELECTRONIC HARDWARE, 320 Broad Hollow Rd., Farmingdale, NY 11735, Tel: 516-752-1950; Empl.: 100

E|&S

ELECTRONIC INSTR. & SPECIALTY CORP., 42 Pleasant St., Stoneham, MA 02180, Tel: 617-438-5300, Telex: 948-025; FSC No.: 14908; Empl.: 180 ..... **B•1344-1345**

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-881-0413
AL	Huntsville, REMCO (Rakes Engr. & Mktg. Corp.)	205-533-3763
AZ	Glendale, Southwest Elctrn. Mktg.	602-278-0500
CA	Escondido, Cirolia Elctrn. Sls. Inc.	619-489-2452
CA	Granada Hills, C & W Comps.	213-368-4032
CA	Hayward, Pacific Mktg. Inc.	415-887-1620
CA	San Diego, Cirolia Elctrn. Sls.	619-743-3015
CO	Golden, J. F. Hurlbut Co.	303-279-7796
FL	Lighthouse Point, Jack Krutek & Assocs.	305-941-6544
GA	Atlanta, REMCO (Rakes Engr. & Mktg. Corp.)	404-447-6937
IL	Lincolnwood, Saffro & Assocs., Inc.	312-677-9720
IN	Carmel, Brainard-Wilson Mktg.	317-844-2800
MD	Woodbine, Naudain Assocs.-Southern	301-442-2270
MA	Stoneham, E I & S	617-438-5300
MN	Minneapolis, Peterson Sls. & Assocs.	612-944-0030
NJ	Perth Amboy, Astrorep	201-826-8050/51
NY	Babylon, Astrorep	516-422-2500
NY	Buffalo, Lynn Assocs., Inc.	716-631-0054
NC	Raleigh, REMCO	919-847-5079
OH	Cleveland, Jim Finnegan & Co.	216-238-5905
OR	Portland, SPS Elctrns.	503-297-6919
PA	Norristown, Rivco-January Inc.	215-631-1414
PA	Willow Grove, Harry Nash Assoc.	215-657-2213
TX	Dallas, P. J. Scanlon Co. Inc.	214-231-4661
UT	Salt Lake City, J. F. Hurlbut Co.	801-973-4443
WA	Redmond, SPS Elctrns.	206-323-4140
WA	Seattle, SPS Elctrns.	206-323-4140
WI	Lake Mills, Saffro & Assocs.	414-648-2605

Local Distributors

CA	San Jose, Cypress Elctrns.	408-945-8400
CA	Santa Clara, Cypress Elctrns.	408-727-7080
CA	Torrance, Cypress Elctrns.	215-530-1900
CT	New Haven, The Greene-Shaw Co.	203-397-0710
MD	Columbia, DK Elctrns.	301-995-1950
MA	Billerica, A. W. Mayer Co.	617-229-2255
MA	Newton, The Greene-Shaw Co.	617-969-8900
NJ	Fairlawn, Relay Specialties	201-797-3313
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Troy, Trojan Elctrn. Supp. Co.	518-274-4481
OK	Tulsa, Radio, Inc.	918-587-9123
TX	Houston, Gaumer Co.	713-460-5200

ELCTRN. INSTR. & SPEC. CORP., MC DIV., See Millen Comps.

ELECTRONIC KITS INTL., INC., 791 Redrock Rd., St. George, UT 84770, Tel: 801-628-3627; *Sls. Mgr.:* Gary Gibson; *Dist. Mgr.:* Charles Meinkey

ELECTRONIC MEASUREMENTS, 405 Essex Rd., Neptune, NJ 07753, Tel: 201-922-9300, Telex: 132-424; Empl.: 250; *Sls. Mgr.:* Charles Lehmann ..... **D•1622-1625**

Local Sales Offices & Reps

AL	Huntsville, Sci. Devices	205-536-1969
AZ	Phoenix, Sci. Devices	602-957-0401
CA	Huntington Beach, Sci. Devices	714-840-3501
CA	San Diego, Sci. Devices	619-573-0157
CA	San Jose, Sci. Devices	408-554-0455
CO	Broomfield, Sci. Devices	303-469-5145
FL	Orlando, Sci. Devices	305-841-8180
GA	Marietta, Sci. Devices	404-427-8660
IL	Chicago, Comtel	312-539-4838
IN	Indianapolis, Comtel	317-253-1681
IA	Cedar Rapids, Comtel	319-377-9434
MA	Winchester, FJS Assoc.	617-729-3135
MI	Southfield, Comtel	313-358-2510
MN	Wayzata, Comtel	612-476-1551
NM	Albuquerque, Sci. Devices	505-883-3668
NY	East Syracuse, Ossmann Insts.	315-437-7052
NJ	Ridgefield, Rical Assocs.	201-945-5250
NC	Winston-Salem, Sci. Devices	919-765-5776
OH	Dayton, WKM Assoc.	513-434-7500
PA	Pittsburgh, WKM Assoc.	412-892-2953
PA	Plymouth Meeting, Electronic Mktg. Assocs.	215-828-7400
TX	Austin, Alphatech	512-458-9179
WA	Bellevue, Al Smith Co.	206-746-6770
WA	Vancouver, Al Smith Co.	206-892-9912
WI	New Berlin, Comtel	414-544-6042

ELCTRN. MOLDING CORP., 96 Mill St., Woonsocket, RI 02895, Tel: 401-769-3800, TWX: 710-387-1350; FSC No.: 17117; Empl.: 350; *Sls. Mgr.:* Scott R. Tate; *Dist. Mgr.:* Irene S. Dulude ..... **C•1186-1188, 1698, 1706-1709**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean of GA	205-830-1540
AZ	Scottsdale, EDP & Assocs., Inc.	602-991-6119
CA	Huntington Beach, Pegasus	714-964-8731
CA	Mountain View, West Mark Assocs.	415-969-1700
CA	Torrance, EMC	213-325-5801
CO	Englewood, Delta Sls., Inc.	303-799-0646
FL	Deerfield Beach, Cartwright & Bean of FL	305-429-3400
FL	Orlando, Cartwright & Bean of FL	305-422-4531
GA	Atlanta, Cartwright & Bean of GA	404-233-2939
IL	Oak Brook, Winner Co.	312-655-3545
IN	Ft. Wayne, Denton Mktg.	219-627-5525
KS	Shawnee Mission, Lowell-Kangas & Assocs.	913-631-3515
LA	Kenner, Cartwright & Bean of TN	504-466-0020
MD	Pasadena, Macrotech Assocs.	301-437-5588
MA	Needham Heights, Todino Engrg. Sls.	617-444-7925
MI	Ferndale, Hilltronics, Inc.	313-398-5556
MN	Hopkins, The Kits Co.	612-933-1888
MS	Jackson, Cartwright & Bean of TN	601-981-1170
MO	St. Louis, Lowell-Kangas & Assocs.	314-821-4050
NJ	Englewood, Harold Gray Assocs.	201-894-0894
NJ	Sicklerville, Brown Assocs.	609-629-2240
NY	Binghamton, Empire Tech. Assocs.	607-772-0651
NC	Charlotte, Cartwright & Bean of GA	704-377-5673
NC	Raleigh, Cartwright & Bean of GA	919-781-6560
TN	Knoxville, Cartwright & Bean of TN	615-693-7450
TN	Memphis, Cartwright & Bean of TN	901-276-4442
TX	Austin, Mil-Rep Assocs.	512-459-8602
TX	Houston, Mil-Rep Assocs.	713-937-0127
TX	Richardson, Mil-Rep Assocs.	214-644-6731
UT	Salt Lake City, Delta Sls., Inc.	801-487-7571
Can	Brampton, Ont., Clark-Hurman Assocs.	416-453-1118
Can	Nepean, Ont., Clark-Hurman Assocs.	613-727-5626

Local Distributors

AL	Huntsville, Electro-Wise, Inc.	205-830-4764
AZ	Phoenix, Heilind Elctrns.	602-437-1060
CA	El Segundo, Force Elctrn.	714-522-1324
CA	San Jose, Force Elctrn.	408-943-1324
CO	Denver, C.S.I.D.	303-292-9594
CO	Wheat Ridge, ACT	303-422-9229
CT	Bethel, Heilind Elctrns.	203-797-8600
CT	Bridgeport, Millenium Elctrns.	203-372-2037
FL	Melbourne, Action Elctrns.	305-725-4920
FL	Orlando, Axtech Elctrns.	305-291-1681
IL	Elk Grove Village, Nu Way Elctrns.	312-437-7120
IA	Cedar Rapids, Bergquist	319-277-5155
MD	Columbia, Aztech Elctrns.	301-995-1760
MA	Boston, Vector Sls.	617-787-2790
MA	Burlington, Heilind Elctrns.	617-272-5610
MA	Woburn, EPC	617-935-0400
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MN	Minneapolis, Bergquist	612-835-2322
NJ	Pennsauken, RESCO Elctrns.	609-662-4000
NJ	Union, Meridian Supp. Co.	201-839-8665
NM	Albuquerque, Betatron	505-344-2381
NM	Albuquerque, International Elctrns.	505-345-8127
NY	Bohemia, L.I., Car-Lac Elctrns.	516-567-4200
NY	Lynbrook, L.I., Peerless Radio Corp.	516-593-2121
NY	Millbrook, Villarreal Elctrns.	914-677-3447
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Suffern, Nobel Elctrns.	914-357-4500
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Cincinnati, Schuster Elctrns.	513-489-1400
OH	Twinsburg, Schuster Elctrns.	216-425-8134
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Norvac Elctrns.	503-644-1025
PA	Allentown, Lehigh Elctrns.	215-433-3045
TX	Austin, Altair Co.	512-837-4970
TX	Austin, Heilind Elctrns.	512-834-9711
TX	Dallas, Heilind Elctrns.	214-351-2050
TX	Dallas, International Elctrns.	214-233-9323
TX	El Paso, International Elctrns.	915-598-3406
TX	Houston, Altair Co.	713-462-3029
TX	Houston, Lenert Co.	713-225-1465
TX	Richadson, Altair Co.	214-231-5166

ELECTRONIC NAVIGATION INDS, Emerson Electric Co., 100 Highpower Road, Rochester, NY 14623, Tel: 716-427-8300, Telex: 671-1542 ENI UW; FSC No.: 10226; Empl.: 200; *Sls. Mgr.:* Leonard A. Benedict ..... **D•1008-1009**

Local Sales Offices & Reps

AL	Huntsville, W. A. Brown Instrs.	205-883-8660
AZ	Tempe, Trembly Assocs.	602-967-2058
CA	Los Altos, Jay Stone Assocs.	415-948-4563
CA	Los Angeles, McDougall/McLaughlin Co.	213-477-8556
CO	Wheat Ridge, Trembly Assocs.	303-421-8900
FL	Orlando, W. A. Brown Instrs.	305-425-5505
GA	Norcross, W. A. Brown Instrs.	404-441-2980
IL	Elmhurst, Sector Engrg.	312-530-7850
IN	Indianapolis, Sector Engrg.	317-842-1120
KS	Overland Park, Ramsey Assocs.	913-649-6996
LA	Mandeville, W. A. Brown Instrs.	504-626-9701
MD	Silver Spring, Gawler Knoop Co.	301-589-4406
MI	Madison Heights, WKM Assocs.	313-588-2300
MN	Minneapolis, Sector Engrg.	612-593-1809
MO	Maryland Hgts., Ramsey Assocs.	314-878-5042
NV	Las Vegas, Trembly Assocs.	702-739-9770
NH	Nashua, JPR Elctrn. Sls.	603-889-8285
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Great Neck, RTI, Inc.	516-829-3770
NC	Durham, W. A. Brown Instrs.	919-479-5200
OH	Dayton, WKM Assocs.	216-434-7500
OH	Independence, WKM Assocs.	216-524-5930
PA	Mechanicsville, John Bell Assocs.	215-794-7075
PA	Pittsburgh, WKM Assocs.	412-892-2953
SC	Columbia, W. A. Brown Instrs.	803-798-8070
TN	Oakridge, W. A. Brown Instrs.	615-482-5761
TX	Houston, Lear Assocs.	713-488-7893
TX	Richardson, Lear Assocs.	214-231-5388
UT	Salt Lake City, Trembly Assocs.	801-486-5292
WA	Bellevue, Sci. Dvcs. Northwest	206-747-5169
WI	Milwaukee, Sector Engrg.	414-352-8280
Can	Toronto, Rayonics Scientific	416-736-1600

ELECT. PREC. COMP. CORP., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, Tel: 914-664-2333; FSC No.: 75898; Empl.: 8; *Sls. Mgr.:* Don Edwards ..... **A•1603, 1868; D•1217**

Local Sales Offices & Reps

CA	Granada Hills, W. H. Inds., Inc.	213-363-3910
CO	Denver, Midwest Meridian Corp.	303-341-7550
IL	Elk Grove Village, Midwest Meridian Corp.	312-640-9540
IA	Cedar Rapids, Midwest Meridian Corp.	319-365-6561
MA	Andover, William Crawford Assocs.	617-470-2122
MN	Prior Lake, Midwest Meridian Corp.	612-447-8222
MO	Marylan Heights, Midwest Meridian Corp.	314-878-4441
OH	Fairborn, Midwest Meridian Corp.	513-879-7100
TX	Fort Worth, Midwest Meridian Corp.	817-654-2132
WA	Kirkland, W.H. Industries	206-827-1024

ELECTRONIC PRODS. CORP., Interstate Indl. Plaza, R. D. # 5, York, PA 17402, Tel: 717-767-6517; Empl.: 16; *Sls. Mgr.:* M. E. Lehman; *Dist. Mgr.:* M. E. Lehman

ELECTRONIC RELAYS, 30 Plaza Dr., Westmont, IL 60559, Tel: 312-789-8166, TWX: 910-991-3903; FSC No.: 53087; Empl.: 29; *Sls. Mgr.:* Barbara Breibach; *Dist. Mgr.:* Barbara Breibach

ELECTRONIC RESEARCH CO., 7618 Wedd St., Overland Park, KS 66204, Tel: 913-631-6700, TWX: 910-749-6477; FSC No.: 13571; Empl.: 60; *Sls. Mgr.:* Charles Ditzler ..... **A•1362**

Local Sales Offices & Reps

Frequency Product

NJ	Riverdale, Comp-Tech Sls.	201-935-5454
NJ	Union, Comp-Tech Sls.	201-687-2484
NY	New Hyde Park, Comp-Tech Sls.	516-593-2628

ELECTRONIC SOLUTIONS, 9255 Chesapeake Drive, San Diego, CA 92123, Tel: 619-292-0242, 800-854-7086, TWX: 910-335-1169; FSC No.: 61081; Empl.: 90; *Sls. Mgr.:* R. J. Felker; *Dist. Mgr.:* Kim E. Mamer .... **D•1084-1086**

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
AZ	Tempe, Mar Tech	602-968-4944
CA	Anaheim, Qualtech South	714-639-9820
CA	Brentwood, Qualtech South	408-732-4800
CA	Los Angeles, Qualtech South	805-495-7100
CA	San Diego, Mesa Engrg.	619-278-8021
CA	Sunnyvale, Qualtech	408-732-4800
CT	Canton, Bell Controls	603-882-6984
FL	Melbourne, Southeastern First Rep	305-259-6373
GA	Atlanta, Remco	404-447-6937
IL	Chicago, Mar-Con Assocs.	312-675-6450
IA	Des Moines, The Beams Co.	515-255-1148
KS	Shawnee Mission, The Beams Co.	913-631-0300
MD	Rockville, Spectro	301-294-9770
MA	Nashua, Bell Controls	603-882-6984
MI	Livonia, Lowell Wendt	313-464-2722
MN	Minneapolis, Micro Res.	612-830-1454
MO	St. Louis, The Beams Co.	314-434-8448
NH	Nashua, Bell Controls	603-882-6984
NM	Albuquerque, Mar Tech Assocs.	602-968-4944
NJ	Springfield, Gebhardt Mktg.	201-376-4415
NC	Raleigh, Remco	919-847-5079
OH	Cleveland, Geotronix	216-526-2535
OH	Trotwood, Geotronix	513-252-6700
OR	Portland, Thorson Co., N.W.	503-644-5900
PA	Jenkintown, Monument Tech. Assocs.	215-884-3737
TX	Austin, Acudata	512-478-1018
TX	Houston, Acudata	713-580-2451
TX	Plano, Acudata	214-424-3567
WA	Bellevue, Thorson Co., N.W.	&
WI	Waukesha, Computer & Sys. Sls.	414-544-1141

Local Distributors

CA	Mountain View, I/O Sls., Inc.	415-968-1080
CT	Danbury, Pilgrim Elctrns.	203-792-7274
Can	Mississauga, Ont., Allan Crawford Assocs.	416-678-1500

ELECTRONIC SPACE SYS. CORP., Old Powder Mill Rd., Concord, MA 01742, Tel: 617-369-7200, Telex: 923480 ESSCO WCRD; FSC No.: 15175; Empl.: 82; *Sls. Mgr.:* Susan M. Cuevas

ELECTRONIC SPECIALISTS, 171 South Main St., Natick, MA 01760, Tel: 617-655-1532, 800-225-4876, Telex: 955-329 ATTN: ESP; Empl.: 42; *Sls. Mgr.:* Alice Brown

ELECTRONIC SPECIALTY DIV., ElecSpec Corp., 14511 N.E. 13th Ave., Vancouver, WA 98668-3501, Tel: 206-574-5000, Telex: 360-453, TWX: 910-469-8782; FSC No.: 98927;Multiple; Empl.: 250; *Sls. Mgr.:* L. Fuller ..... **B•1346-1347**

Local Sales Offices & Reps

CA	Anaheim, Gabriel & Assocs.	713-666-0660
CA	San Jose, Ruppert Sls. & Engrg.	408-998-8717
CT	Bethel, Livera-Polk Assocs.	203-744-1426
FL	Lighthouse Point, Jack Krutek & Assocs.	305-941-6544
KS	Wichita, BAKA Corp.	316-682-8411
MD	Timonium, Eastern Comp.	301-561-5811
MN	Hopkins, The Kits Co.	612-933-1888
NJ	Madison, Livera-Polk Assocs.	201-377-3239
NY	Glen Head, Livera-Polk Assocs.	516-759-9300
NC	Raleigh, Eastern Comp.	919-787-3416
PA	West Conshohocken, Eastern Comp.	215-825-8610
TX	Dallas, MARCOM	214-351-4521
TX	Houston, MARCOM	713-271-5635
VA	Annandale, Eastern Comp.	703-354-0723

ELECTRONIC SYS. & PROGRAMMING, See Augat/ES)sP, Inc.

ELECTRONIC TRANSFORMER CORP., P.O. Box 188, Totowa, NJ 07511, Tel: 201-942-2222; FSC No.: 72149; Empl.: 130; *Sls. Mgr.:* Dan Rovine

ELECTRONIC TRANSISTORS, 112-15 Northern Blvd., Flushing, NY 11368, Tel: 212-651-7200, Telex: 96-0173; FSC No.: 12045; Empl.: 45; *Sls. Mgr.:* Mike Byrnes; *Dist. Mgr.:* Mike Byrnes

ELECTRONIC TREND PRODS., 10080 N. Wolfe Rd., Ste. 372, Cupertino, CA 95014, Tel: 408-996-7401, Telex: 345516; Empl.: 3; *Dist. Mgr.:* Gene Selven

ELECTRONIC WATTMETER CO., 2275 Sixth St., Sarasota, FL 33577, Tel: 813-953-5355; Empl.: 6

ELECTRONIZED CHEMICALS CO., Div. of High Voltage Engrg., 23 Industrial Way, Wilmington, MA 01887, Tel: 617-657-8030, Telex: 68-17284

ELECTRON-MACHINE CORP., Box M, Umatilla, FL 32784, Tel: 904-669-3101, Telex: 56-4300; Empl.: 55; *Sls. Mgr.:* S. K. Kemp V.P. Mktg

ELECTRON PRODUCTS, 2084 Central Ave., Duarte, CA 91010, Tel: 818-359-8281, Telex: 910-333-9810; FSC No.: 99515; Empl.: 65; *Sls. Mgr.:* Ann Meunier; *Dist. Mgr.:* Ann Meunier

ELECTRO-NUMERICS, 1811 Reynolds, Irvine, CA 92714, Tel: 714-250-1501, Telex: 68-5612; FSC No.: 51666; Empl.: 24

ELECTRO-OPTICAL INDS., Box 3770, Santa Barbara, CA 93130, Tel: 805-964-6701, Telex: 65-8427; Empl.: 130

ELECTRO-PACIFIC, 5782 Thornwood Dr., Goleta, CA 93017, Tel: 805-964-0751; FSC No.: 29853; Empl.: 60; *Sls. Mgr.:* Verne White

ELECTRO PHYSICS, 1910 West Birchwood Ave., Chicago, IL 60626, Tel: 312-274-9669; Empl.: 6; *Sls. Mgr.:* Abe Siegelman

ELECTROPHYSICS CORP., 48 Spruce St., Nutley, NJ 07110, Tel: 201-667-2262, Telex: 642277

ELECTRO-PREP, LTD., Rt 28A, P.O. Box 437, Cataumet, MA 02534, Tel: 617-563-5559; *Sls. Mgr.:* J. Anderson

ELECTRO-RACK PRODUCTS CO., 1742 S. Clementine St., Anaheim, CA 92802, Tel: 714-776-5420; FSC No.: 26073; Empl.: 25; *Sls. Mgr.:* Allen Benson

ELECTRO RENT CORP., 4209 Van Owen Place, Burbank, CA 91505, Tel: 818-843-1221, Telex: 314225, TWX: 910-498-2238; Empl.: 350; *Sls. Mgr.:* R. Tarullo

ELECTRO SCIENTIFIC INDS., 13900 N.W. Science Pk. Dr., Portland, OR 97229, Tel: 503-641-4141, Telex: 474-2064; FSC No.: 11837; Empl.: 1100; *Sls. Mgr.:* Dick Donaca

Local Sales Offices & Reps

Impedance Measuring Devices

CA	Anaheim, Gary Ingbretson	714-995-2141
TX	Austin, Pete Fugger	512-258-7362
PA	Sewickley, Charles Molitor	412-255-1577
NC	Cary, Gay Gasque	919-481-0058
OR	Portland, Stan Gressel	503-641-4141

Laser Trimming & Processing Systems

IN	Kokomo, Doug Goad	317-453-9293
CA	San Jose, Tom White	408-243-8700
GA	Rosewell, Jack Fedon	404-998-0545
MN	Minneapolis, Tom Goodnow	612-870-9192
NH	Nashua, Roy Johnson	603-888-7605
NJ	Mt. Laurel, John Alpaugh	609-235-2474
OR	Portland, Stan Gressel/Russ Schlager	503-641-4141
TX	Plano, Doug Dickinson	214-867-4647

ESF
Electro-Space Fabricators, Inc.

ELECTRO SPACE FABRICATORS, 300 W. High St., P.O. BOX 67, Topton, PA 19562-0067, Tel: 215-682-7181; Empl.: 205; *Sls. Mgr.:* T. Roth ..... **C•1054-1055**

Local Sales Offices & Reps

AL	Huntsville, Mackan, Smith & Assocs.	205-539-8000
CA	Irvine, Vale Assocs.	714-551-4004, 4821
CA	San Jose, Silicon Valley Sls.	408-286-7510
CA	San Jose, Silicon Valley Sls.	408-371-8814
CO	Boulder, Starsales	303-440-4193
CT	Bridgeport, Betronic Assocs.	203-374-6404
FL	Lighthouse Point, Jack Krutek & Assocs.	305-941-6544
FL	Madeira Beach, MacKay, Smith & Assocs.	813-393-7144
FL	Orlando, MacKay, Smith & Assocs.	305-277-1513
GA	Norcross, MacKay, Smith & Assocs.	404-449-7444
IL	Northbrook, Raines & Assocs.	312-498-0890
MD	Pikesville, Imagitron Sls.	301-521-2020
MD	Pikesville, Imagitron Sls. Co.	800-638-3592
MA	Waltham, Betronic Assocs.	617-894-8400
MN	Minneapolis, Jen-Ray Sys.	612-831-5060
NJ	Boonton, Winter Assocs.	201-334-3434
NY	Morrisville, Promark-Electrns.	315-662-3310
NY	Morrrisville, Promark Elctrns., Inc.	315-662-3310
NC	Charlotte, MacKay, Smith & Assocs.	704-372-1188
OH	Galion, James R. Bright	419-468-3787
OK	Tulsa, Advance Techn. Sls.	918-664-0482
PA	Doylestown, Monteiro Assocs.	215-345-5855
PA	McKean, Ecco Electrns. Sls.	814-476-1376
PA	McKean, ECCO	814-476-1376
TN	Chattanooga, MacKay, Smith & Assocs.	615-899-6951
TX	Austin, Advance Techn. Sls.	512-459-1351
TX	Dallas, Advance Techn. Sls.	214-340-1300
TX	Houston, Advance Techn. Sls.	713-440-3888
WA	Auburn, Elctrn. Sls. Northwest	206-839-5808
WA	Maple Valley, Electrn. Sls. Northwest	206-432-1002
Can	Downsview, Ont., Designtronics	1-416-747-1171

ELECTROSPACE SYS., INC., P. O. Box 831359, Richardson, TX 75083-1359, Tel: 214-783-2004, TWX: 910-867-4768; FSC No.: 33875; Empl.: 1,269

ELECTRO STANDARDS LAB., INC., P.O. Box 9144, Providence, RI 02940, Tel: 401-943-1164, Telex: 697-2057 ESLAB; Empl.: 20; *Sls. Mgr.:* R. B. Sepe; *Dist. Mgr.:* R. B. Sepe

ELECTROSTATIC CONSLTG. ASSOCS., 556 Lowell Rd., Groton, MA 01450, Tel: 617-448-5485; Empl.: 5; *Sls. Mgr.:* Paul Malinaric

ELECTROSTATICS, 7718 Clairemont Mesa Blvd., San Diego, CA 92111, Tel: 619-279-1414; FSC No.: 34538; Empl.: 17

ELECTRO STYLUS, 31 Cheyenne Blvd., Colorado Springs, CO 80906, Tel: 303-633-5969; Empl.: 10; *Sls. Mgr.:* L. F. Murray; *Dist. Mgr.:* M. L. Murray

ELECTRO SWITCH, King Ave., Weymouth, MA 02188, Tel: 617-335-5200, TWX: 710-388-0377; FSC No.: 82121; Empl.: 260; *Sls. Mgr.:* H. F. Peters ..... **B•1564-1565**

Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Los Angeles, Wiley	213-666-1611
CA	Moraga, W. Nott & Co.	415-376-1922
CA	San Diego, Wiley Co.	619-571-2881
CO	Boulder, Comp. Prods. Sls.	303-530-2800
FL	Winter Park, Floritronics	305-886-4818
GA	Atlanta, Holman-Gillespie	404-992-8820
IL	Elk Grove Village, Electro Switch	312-593-2225
IA	Bettendorf, H. J. Weisler & Assocs.	319-344-0566
MD	Gathersburg, Naudain Assocs.	301-258-5040
MI	Ferndale, Hilltronics	313-398-5556
MN	St. Paul, Kencotronics	612-645-7717
MO	Ellisville, H. J. Weisler & Assocs.	314-394-4543
MO	No. Kansas City, H.J. Weisler & Assocs.	816-421-1679
NJ	Fairfield, Electro Switch	201-227-6559
NJ	Marlton, Naudain Assocs.	609-983-5300
NY	Rochester, Sweetco Assocs.	716-225-2383
NY	Utica, Sweetco Assocs.	315-797-6721
NC	Winston-Salem, L. G. White Southern, Inc.	
NC	Winston-Salem, L.G. White Southern	919-725-3612
OH	Dayton, Rockford Controls	513-898-5452
OH	Euclid, Rockford Controls	216-731-5250
OH	Reynoldsburg, Rockford Controls	614-868-5577
PA	Pittsburgh, R. F. Clark	412-242-9500
SC	Greenville, L.G. White Southern	803-271-0630
TX	Bellaire, Brice Co.	713-666-1788
TX	Dallas, Brice Co.	214-233-9808
UT	Woodscross, Comp. Prods. Sls.	801-292-8882
VA	Richmond, L.G. White Southern	804-740-7093
WA	Seattle, C.B. Parsons & Co.	206-762-7373
WI	Wauwatosa, Larsen Assocs.	414-258-0529

Local Distributors

CA	Concord, Omega	415-671-7796
CA	Los Angeles, Electric Switches	213-660-1310
CO	Denver, Wesco	303-573-7550
FL	Ft. Lauderdale, Peerless Radio Corp. of Fla.	305-973-4141
GA	Atlanta, Georgia Control Ctr.	404-876-8833
IL	Bridgeview, Midco Comp. Sls.	312-599-7777
MD	Kensington, Marine Air Supp.	301-949-9560
MA	Sharon, Adcour	617-784-8123
MI	Grand Rapids, S-F Elctrn. Supp.	616-459-0216
MN	St. Paul, K. D. I.	612-645-7717
MO	St. Louis, Industrial Svc. Labs	314-535-5760
NY	Hempstead, Electronic Equip. Co.	516-538-5510
NC	Winston-Salem, General Prods. Co.	919-725-3612
OH	Euclid, Rockford Controls Ohio	216-731-5250
OK	Tulsa, Nelson Elec. Supp.	918-583-1212
PA	Conshohocken, I/O Elec. Supp. Corp.	215-825-4610
TX	Bellaire, Barclay Whls.	713-666-1788
WA	Seattle, C.B. Parsons Co.	206-762-7373
WI	Milwaukee, I/O Elec. Supp. Corp.	414-963-9050

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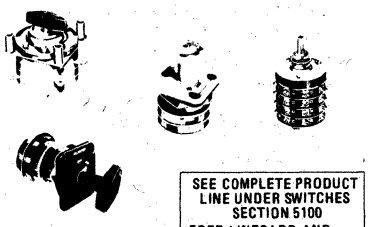

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ELECTRO-TECH SYS., INC., 115 E. Glenside Ave., Glenside, PA 19038, Tel: 215-887-2196, Telex: 831449; *Sls. Mgr.:* Sharon Sandy; *Dist. Mgr.:* Stanley Weitz

ELECTRO VECTOR, INC., 6555 Covey Rd., Forestville, CA 95436, Tel: 707-887-2292, TWX: 510-746-6024; *Sls. Mgr.:* Wayne Brigden

ELECTROVERT INC., 399 Executive Blvd., Elmsford, NY 10523, Tel: 914-592-7322, Telex: 646186; *Sls. Mgr.:* Steve Vineis

ELECTROVERT USA CORP., 10969 Shady Trail, # 101, Dallas, TX 75220, Tel: 214-353-9950, Telex: 4630186; FSC No.: 1-214-350-4991; Empl.: 175; *Sls. Mgr.:* Tom Gill

Local Sales Offices & Reps

CA	Santa Ana	714-835-2033
CA	Santa Clara	408-739-6015
CO	Denver	303-423-5598
GA	Norcross	404-441-3644
IL	Rosemont	312-678-5557
NH	Manchester	603-625-5877
NY	Elmsford	914-592-7322
TX	Dallas	214-353-9950

ELECTRO WEAVE, 425 Shrewsbury St., Worcester, MA 01604, Tel: 617-752-8932, TWX: 710-340-0635; FSC No.: 54207; Empl.: 18; *Sls. Mgr.:* C. J. Nowasacki

ELFAB CORP., 1097 Yates Street, Lewisville, TX 75067, Tel: 214-221-8776, 214-233-3033, TWX: 910-860-5460; Empl.: 350; *Sls. Mgr.:* Kermit Dye; *Dist. Mgr.:* Bud Addington ..... **C•1190-1191**

Local Sales Offices & Reps

AL	Brownsboro, J.H.U. Assocs.	205-536-7455
AZ	Tempe, Delta Elec.	602-224-1601
CA	Escondido, Cirolia Elctrn. Sls.	619-743-3015
CA	Los Alamitos, Reed Elctrns. Sls.	714-821-9600
CA	Santa Clara, Elfab Corp.	408-988-1716
CA	Tustin, Elfab Corp.	714-731-2515
CO	Littleton, Lange Sls., Inc.	303-795-3600
FL	Goldenrod, Sunland Assocs.	305-365-9533
FL	Winter Park, Elfab Corp.	305-678-7759
GA	Atlanta, J.H.U. Assocs.	404-662-0792
IL	Arlington Heights, Brainard-Wilson Mktg.	312-437-2700
IL	Crystal Lake, E. S. Healy & Assocs.	815-459-4386
MD	Hunt Valley, Phoenix Elctrn. Sls.	301-628-2066
MA	Hopkinton, Marathon Sls., Ltd.	617-875-3566
MI	Grand Rapids, R. P. Urban Assocs.	616-245-0511
MN	Edina, Mel Foster Tech Sls.	612-941-9790
MO	St. Charles, Microtronics	314-946-8500
NJ	Cherry Hill, Elfab Corp.	609-795-6262
NY	N. Syracuse, Advanced Comps.	315-699-2671
NC	Raleigh, Rick Burns Assoc., Inc.	919-876-2224
OH	Dayton, Duane Thompson & Assocs.	513-237-9422
OK	Oklahoma City, Ammon & Rizos Co.	405-942-2552
TX	Austin, Ammon & Rizos Co.	512-454-5131
TX	Dallas, Ammon & Rizos Co.	214-644-5591
TX	Houston, Ammon & Rizos Co.	713-781-6240
UT	Salt Lake City, Lange Sls., Inc.	910-925-4006
WA	Seattle, Blum & Assocs.	206-285-2590
PR	Rio Piedras, D. K. Mktg.	809-765-5380

Local Distributors

CA	Santa Clara, Cetec Elctrns.	408-748-8550

ELFORM, INC., 521 Dunn Circle, Sparks, NV 89431, Tel: 702-356-1734, Telex: 170037; *Sls. Mgr.:* Roger R. Reinke

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ELGAR CORP, An Onan McGraw Edison Co., 9250 Brown Deer Rd., San Diego, CA 92121, Tel: 619-450-0085, Telex: 211063 ELSD UR, TWX: 910-335-1246; FSC No.: 25965; Empl.: 375; *Dist. Mgr.:* Steve Larson ..... **D•1918-1922**

Local Sales Offices & Reps

AL	Huntsville, Pen-Tech Assocs.	205-881-9298
AZ	Tempe, Trembly Assoc.	602-967-2058
CA	Costa Mesa, Ward Davis Assocs.	714-556-0755
CA	Pasadena, A & F Sls.	213-681-5631
CA	Redondo Beach, Ward/Davis Assocs.	213-973-7772
CA	San Diego, Ward/Davis Assocs.	619-292-1000
CA	San Jose, D.P. Assocs.	408-296-1492
CA	Santa Clara, Ward Davis Assocs.	408-245-3700
CO	Wheat Ridge, Trembly Assocs.	303-421-8900
FL	Casselberry, Pen-Tech Assocs.	305-645-3444
FL	Deerfield Beach, Pen-Tech Assocs.	305-421-4989
GA	Marietta, Pen-Tech Assocs.	404-424-1931
IL	Arlington Heights, Dytec/Central	312-394-3380
IL	Hoffman Estates, Carvel Engrg.	312-885-8800
IN	Indianapolis, Dytec/Central	317-247-1316
KS	Lenexa, Dytec/South	913-888-0215
MD	Rockville, Elctrn. Mktg. Assocs.	301-881-5300
MA	Woburn, P. Jenks Assocs.	617-938-0488
MI	Madison Heights, WKM Assocs.	313-588-2300
MN	Edina, Carvel Engrg.	612-835-7929
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	Maryland Hgts., Dytec/South	314-569-2990
NV	Las Vegas, Trembly Assocs.	702-739-9770
NJ	Fairfield, G & A Sls.	201-575-8080
NM	Albuquerque, Trembly Assoc.	505-266-8616
NY	Fairport, NACO Elctrns. Corp.	716-223-4490
NY	Great Neck, RTI	516-829-3770
NY	North Syracuse, NACO Elctrns. Corp.	315-699-2651
NY	Utica, NACO Elctrns. Corp.	315-732-1801
NC	Greenboro, Pen Tech Assocs.	919-852-6000
OH	Dayton, WKM Assocs.	513-434-7500
OH	Independence, WKM Assocs.	216-524-5930
OK	Edmond, Data Aids Assocs.	405-478-5000
OR	Beaverton, Northwest Test & Meas.	503-646-9966
OR	Portland, Topp Engrg.	503-244-7265
PA	Pittsburgh, WKM Assocs.	412-892-2953
PA	Plymouth Meeting, Elctrn. Mktg. Assocs.	215-828-7400
TX	Austin, Data Aids Assocs.	512-327-8600
TX	Dallas, Data Aids Assocs.	214-620-1551
TX	Woodlands, Data Aids Assocs.	713-363-3838
UT	Salt Lake City, Trembly Assocs.	801-486-5292
WA	Bellevue, Topp Engrg.	206-747-5400
WA	Redmond, Northwest Test & Meas.	206-881-8857
WI	Elm Grove, Dytec Central Inc.	414-784-9686
WI	New Berlin, Carvel Engrg.	414-784-7007
EXP	CA, San Diego, Elgar Intl. Corp.	619-565-1155

Local Distributors

CA	Inglewood, Cal. Micro	213-671-6075
IL	Arlington Heights, Peak Distrs., Inc.	312-394-3380
MN	St. Paul, Dytec North, Inc.	612-645-5816
MO	Maryland Heights, Dytec Distrs.	314-569-2990
NJ	Hackensack, Logon, Inc.	201-646-9222
NY	North Syracuse, Naco Elctrns. Corp.	315-699-2651
NC	Greensboro, Pen-Tech Sls.	919-852-6000
OH	Dayton, National Distrs., Inc.	513-434-7500
PA	Penllyn, Promark Distrs., Inc.	215-643-3400
TX	Woodlands, Data Aids Assocs.	713-363-3838
WA	Bellevue, Topp Engrg. Sls. Corp.	206-747-5400

ELGENCO, INC., Box 460, Hurricane, UT 84737, Tel: 801-635-4954; FSC No.: 15455; *Sls. Mgr.:* Duane Beecher ..... **D•1218-1223**

Local Sales Offices & Reps

CA	Sherman Oaks, Windsor Dynamics	818-990-4173
CA	Woodside, N-S Assocs.	415-851-2703
CT	Hamden, Polytek Assoc.	203-288-5246
MA	Waban, Polytek Assoc.	617-881-4741

NJ Marmore, Holdsworth & Co. 609-398-4340
NM Albuquerque, Technology Mktg. Assoc. 505-345-8921
PA Newtown Square, Holdsworth & Co. .. 215-356-8550

ELGIN ELECTRONICS, Combustion Engineering, 5533 New Perry Hwy., Erie, PA 16509-3570, Tel: 814-864-4921, TWX: 510-699-6870; Empl.: 500; *Sls. Mgr.:* C. G. Searles

Local Sales Offices & Reps
CA Chatsworth, Elgin Elctrns. 818-700-0299
GA Atlanta, Elgin Elctrns. 404-925-2572
IN Redkey 317-369-2012
PA Wayne 215-687-6100
TX Fort Worth, Elgin Elctrns. 817-429-7331

ELIN DIV., California Instrs. Co., Div. of Norlin Ind., 5150 Convoy St., San Diego, CA 92111, Tel: 619-279-8620, Telex: 695-047; FSC No.: 16067; Empl.: 90; *Sls. Mgr.:* W.W. Hanford

ELITE ELECTRONICS, INC., 1408 Summit - Suite #5, Plano, TX 75074, Tel: 214-881-0026; Empl.: 3

ELITE SOFTWARE DEVELOPMENT, INC., P.O. Drawer 1194, Bryan, TX 77806, Tel: 409-846-2340, Telex: 910-997-6760; Empl.: 4; *Sls. Mgr.:* Terri J. King

ELMA ENGRG., 1066 E. Meadow Circle, Palo Alto, CA 94303, Tel: 415-494-7303, Telex: 345-560; FSC No.: 59810; Empl.: 50

ELMAG, 54 Clark St., Newark, NJ 07104, Tel: 201-481-1600; FSC No.: 23160; Empl.: 25

ELM SYSTEMS, 1101 Brown St., Wauconda, IL 60084, Tel: 312-526-5003; *Sls. Mgr.:* T. A. McCollum

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ELMWOOD SENSORS, 500 Narragansett Park Drive, Pawtucket, RI 02861, Tel: 401-727-1300, Telex: 6814066 ELMWOOD, TWX: 710-381-6413; Empl.: 700; *Sls. Mgr.:* Gary Polkow ..... **B•1750**

Local Sales Offices & Reps
AL Decatur, Tenn. Tech. Sls. 205-350-0630
AZ Phoenix, O'Donnell SW 602-944-9542
AR Hot Springs, Ion Assoc.-Arkla 918-664-018
CA San Diego, O'Donnell Assocs. 619-578-1645
CA San Jose, O'Donnell Assocs. 408-263-6500
CA Torrance, O'Donnell Assocs. 213-539-9664
CO Boulder, Front Range Mktg. 303-443-4780
FL Coral Springs, CBC Electronics 305-755-1111
GA Atlanta, Tenn. Tech. Sls. 404-622-5784
IL Arlington Heights, Thermek 312-577-6900
IN Fort Wayne, O. Bromberg 219-456-6010
KY Louisville, O. Bromberg 502-245-8916
MA Danvers, C. H. Burnham Assoc. 617-774-0111
MI Brooklyn, Engineered Comps. 517-592-3236
MN Minneapolis, C. Listug Sls. 612-537-6740
MO Creve Coeur, Hill & Co. 314-432-1136
MO St. Louis, Hill & Co. 314-432-1136
NH Durham, C. H. Burnham Assoc. 603-868-2282
NY Fairport, Bastian Sls. 716-223-0237
NY Larchmont, G. M. Moch Co. 914-834-3530
NY Syracuse, Canavan-Scanlon 315-437-1271
NC Charlotte, Tenn-Tech Sls. 704-525-6295
NC Raleigh, Tenn-Tech 919-226-3610
OH Cincinnati, O. Bromberg 513-771-9333
OH Cleveland, Allied Entprs. 216-779-0080
OK Tulsa, Ion Assoc. 918-664-0186
OR Hillsboro, Temco-Northwest 503-648-8171
PA Huntington Valley, Omega Elctrns. Sls. 215-947-4135
PA Murrysville, Allied Entprs. 412-325-3200
RI Johnston, C. H. Burnham Assoc. 401-231-7475
TX Austin, Ion Assocs. 512-331-7252
TX Grand Prairie, Ion Assocs. 214-647-8225
TX Houston, Ion Assocs. 713-977-4354
UT Salt Lake City, Front Range Mktg. 801-364-6481
VA Midlothian, Daniel E. Boehling Assocs. 804-794-5879
WA Bellevue, Lehr Assocs. 206-453-9993
WA Bothell, Temco Northwest 206-821-5434
WI Milwaukee, R. Zingler 414-351-5005
Can Mississauga, Ont., Andy Baumen Assocs. 416-828-2600

ELNA AMERICA, INC., 153 E. Savarona Way, Carson, CA 90746, Tel: 213-327-6090, Telex: 68-6427, TWX: 910-346-6730; *Sls. Mgr.:* Don L. Bilsing; *Dist. Mgr.:* Isao Kikuchi

ELNETIC ELCTRNS., 1730 21st St., Santa Monica, CA 90404, Tel: 213-828-9541; FSC No.: 98460; Empl.: 25; *Sls. Mgr.:* Ernest H. Carlson, Jr.

ELNIK INSTRS., 3 Edison Place, Fairfield, NJ 07006, Tel: 201-882-8033, Telex: 13-0567; Empl.: 8; *Sls. Mgr.:* Claus J. Joens

ELOGRAPHICS, 105 Randolph Rd., Oak Ridge, TN 37830, Tel: 615-482-4100; *Sls. Mgr.:* R. Highfill

ELPAC COMPS., 3131 S. Standard Ave., Santa Ana, CA 92705, Tel: 714-979-4440, TWX: 910-595-1513; Empl.: 130; *Sls. Mgr.:* Rod Bolton ..... **A•1078-1079**

Local Sales Offices & Reps
AZ Tempe, Sunwest Mktg. Assocs. 602-838-7586
CA San Diego, Wes-K Assocs. 619-578-2040
CA Santa Clara, Westrep 408-988-8833
CA Van Nuys, Wes-K Assocs. 213-989-3070
CO Arvada, Wescom Mktg. 303-422-7619
CT Milford, Todino Engr. Sls. 203-874-6643
FL Orlando, OEM Mktg. Corp. 305-299-1000
IL Highland Park, Bransky Sls. 312-433-2375
MA Needham Heights, Todino Engr. Sls. .. 617-444-7925
MN Bloomington, Smiley-Scott Assocs. ... 612-888-5551
NJ Englewood, Harold Gray Assocs. 201-894-0894
OH Dayton, J. C. Hofstetter Co. 513-296-1010
OH Medina, J. C. Hofstetter Co. 216-241-4880
OR Beaverton, Caruso & Northcutt. 503-646-4973
PA Hickord, J. C. Hofstetter Co. 412-356-2305
TX Richardson, Mech-Tron 214-437-4833
UT Salt Lake City, Wescom Mktg. 801-466-9594
WA Bellevue, Caruso & Northcutt. 206-454-9699
WI Cedarburg, Bransky Sls. 414-377-8507

Local Distributors
AZ Phoenix, T.T.I. 602-861-0222
CA Chatsworth, Mil-Comm 213-998-3111
CA Garden Grove, Megacap 714-891-5176
CA Irvine, Kelex 714-863-1230
CA San Jose, T.T.I. 408-943-9155
FL Orlando, T.T.I. Florida 305-859-1000
IL Northbrook, Classic Components 312-272-9650
IL Skokie, Kellner Elctrns. 312-677-1120
MA Wilmington, Aved Elctrns. 617-657-8311
MA Woburn, T.T.I., Inc. NE 617-938-8800
MO Maryland Heights, Ensco Distribg., Inc. 314-423-3935
NJ S. Hackensack, Waltech 201-641-7300
NY Bohemia, T.T.I. 516-567-1500
NY Elmsford, Ancar 914-592-7100
OK Tulsa, Altair Co. 918-252-5781
TX Austin, Captronics 512-459-4328
TX Dallas, Captronics 214-340-3592
TX Ft. Worth, T.T.I. 817-429-1440
TX Houston, Altair Co. 713-462-3029
WI Mequon, Taylor Elec. Dists. 800-558-8921
WI Racine, Badger Elctrns. 414-637-1256, 414-933-6685

ELPAC POWER SYS., 3131 S. Standard Ave., Santa Ana, CA 92705, Tel: 714-979-4440, TWX: 910-595-1513; Empl.: 270; *Sls. Mgr.:* Randy Bilsley; *Dist. Mgr.:* Randy Bilsley ..... **D•1626-1631**

Local Sales Offices & Reps
AL Huntsville, K&E Assoc. 205-883-9720
AZ Phoenix, Westrep 602-997-8899
CA Anaheim, Westrep 714-527-2822
CA San Diego, Westrep 619-276-0751
CA Santa Clara, Westrep 408-988-8833
CO Parker, A-5 Co. 303-841-3651
CT Yalesville, The Newscott Co. 203-269-2654
FL Casselberry, Semi 305-831-2822
GA Doraville, K&E Assoc. 404-448-7025
IL Highland Park, Bransky Sls. 312-433-2375
IN Ft. Wayne, F. J. Campisano 219-747-2633
IN Indianapolis, F. J. Campisano 317-253-7651
KS Overland Park, Electri-Rep 913-649-2168
MD Pikesville, Imagitron Sls. 301-521-2020
MA Needham Hgts., Newscott Co. 617-444-1923
MI Brighton, Michigan Mktg. 313-229-6218
NJ Cedar Knolls, TAM 201-285-9094
NY S. Hauppauge, TAM 516-348-0800
NC Greenboro, Imagitron Sls. 919-292-5474
OH Cincinnati, F. J. Campisano 513-574-7111
OH Cleveland, F. J. Campisano 216-749-5550
OK Tulsa, ION Assocs. 918-664-0186
OR Beaverton, Caruso & Northcutt 503-646-4973
PA Coraopolis, F. J. Campisano 412-264-5151
TX Austin, Ion Assocs 512-346-7160
TX Grand Prairie, ION Assocs. 214-647-8225
TX Houston, Ion Assocs. 713-977-4354
UT Murray, A-5 Co. 801-483-1034
WA Bellevue, Caruso & Northcutt 206-454-9699
WI Cedarburg, Bransky Sls. 414-377-6837

Local Distributors
AL Marshall Inds.
AL Birmingham, ACK Radio Supp. 205-322-0588
AL Huntsville, Powell Elec. 205-539-2731
AL Huntsville, RM Elctrns. 205-852-1550
AZ Phoenix, Heilind Elec. 602-437-1060
AZ Tempe, Marshall Inds. 602-968-6181
CA Costa Mesa, Powell Elec. 714-754-1717
CA El Monte, Marshall Inds. 213-442-7204
CA San Jose, Powell Elec. 408-943-9020
CO Denver, Marshall Inds. 303-427-1818
CT Bethel, Heilind Elec. 203-797-8600
CT Wallingford, Marshall Inds. 203-265-3822
CT Wallingford, Sager Elctrns. 203-265-4600
FL Ft. Lauderdale, Powell Elec. 305-979-5000
FL Orlando, Marshall Inds. 305-841-1878
GA Atlanta, ACK Radio Supp. 404-351-6340
GA Norcross, Marshall Inds. 404-923-5750
IL Chicago, Newark Elctrns. 312-638-5100
IL Northbrook, Classic Comps. 312-272-9650
IL Schaumburg, Marshall Inds. 312-490-0155
IN Indianapolis, RM Elctrns. 317-291-7110
MD Gaithersburg, Marshall Inds. 301-840-9450
MA Burlington, Marshall Inds. 617-272-8200
MA Burlington, QPL Elctrns. 617-229-2424
MA Hingham, Sager Elctrns. 617-749-6700
MI Grand Rapids, RM Elec. 616-531-9300
MI Livonia, Marshall Inds. 313-525-5850
MN Plymouth, Marshall Inds. 612-559-2211
MO St. Charles, Finnigan Elec. 314-946-6201
NH Hudson, Heilind Elec. 603-883-9536
NJ Cranford, Garden State Indl. 201-272-6400
NJ Fairfield, Marshall Inds. 201-882-0320
NJ Mt. Laurel, Marshall Inds. 609-234-9100
NY Hauppauge, Broadline Elctrns. 212-895-6232
NY Hauppauge, Marshall Inds. 516-273-2424
NY Johnson City, Marshall Inds. 607-798-1611
NY Rochester, Marshall Inds. 716-235-7620
NC Greensboro, Hammond 919-275-6391
OH Dayton, Marshall Inds. 513-236-8088
PA Philadelphia, Shap Elctrns. 215-969-3300
SC Greenville, Hammond Elctrns. 803-233-4121
TN Austin, Marshall Inds. 512-458-5654
TX Dallas, Heilind Elec. 214-351-2050
TX Dallas, Marshall Inds. 214-233-5200
TX Dallas, RM Elctrns. 214-235-3100
TX Houston, Heilind Elec. 713-988-2711
TX Houston, Marshall Inds. 713-789-6600
TX Houston, Newark Elctrns. 713-782-4800
WA Bellevue, Marshall Inds. 206-747-9100
WI New Berlin, Classic Comps. 414-786-5300
WI New Berlin, RM Elctrns. 414-784-4420

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Local Sales Offices & Reps
AZ Phoenix, Shefler-Kahn 602-257-9015
CA Hayward, Pacific Mktg. 415-887-1620
CO Denver, Moss Mktg. 303-455-7205
CT Milford, Todino Engrg. Sls. Co. 203-874-6643
GA Norcross, Hollingsworth & Still 404-447-1700
IL Chicago, G. Mcl. Cole Co. 312-774-3535

IN Indianapolis, Elctrn. Mktg. Consits. 317-253-1668
KS Overland Park, Thomas L. Dowell & Assocs. 913-648-7373
MA Needham Heights, Todino Engrg. 617-444-7925
MI Livonia, Electronic Salesmasters 800-321-1848
MN Edina, Restronics 612-941-9135
MO St. Louis, Thomas L. Dowell & Assoc. 314-849-4234
NJ Englewood Cliffs, Masin Esco 201-569-8868
NJ Marlton, Twin Sls. 609-966-4070
NY Chappaqua, Masin Esco 914-238-8337
NY East Syracuse, Nycom, Inc. 315-437-8343
NY Hauppauge, Masin Esco 516-273-3500
OH Beachwood, Electronic Salesmasters 216-831-9555
PA Bensalem, Twin Sls. 215-638-4850
TX Dallas, R. E. Nesbitt Co. 214-357-4601
VA Herndon, Stinson Assocs. 703-620-0088
WA Seattle, Northmar 206-524-5170

Local Distributors

AL Huntsville, Components Distrs. 205-883-7501
CA Cerritos, El Com 213-404-2961
CA Fremont, Terminal Sls. 415-656-7722
CA Gardena, Culver Elctrn. Sls. 213-538-2811
CA Mountain View, Energy Sls. 415-969-0800
CO Denver, Hensley Battery 303-455-3643
CT Middletown, Mid-State Elctrns. 203-347-5638
FL Ft. Lauderdale, Component Dist. 305-971-4950
GA Atlanta, Custom Alarm Prods. 404-458-0990
IL Downers Grove, Telecommunication Dvcs. 312-971-3460
IL Palatine, Ohm Elctrns. 312-359-5500
IN Indianapolis, Graham Elctrns. 317-634-8202
LA New Orleans, Allen Supp. Corp. 504-525-8222
MD Savage, Pyttronic 301-792-0780
MI Livonia, Alarm Supp. Co. 313-591-9100
MN Burnsville, Power Trust Grp. 612-890-1360
MO St. Louis, Olive Elctrns. 314-426-4500
MO St. Louis, Van Sickle Radio 314-621-5000
NJ Hanover, State Elctrns Pts. 201-887-2550
NY Jackson Hgts., A-1 Alarmatic 212-639-8300
OR Portland, Radar Elec. 503-232-3404
PA Allentown, A. A. Peters 215-434-5237
UT Salt Lake City, Standard Supp. 801-486-3371
VA Richmond, AVCC Elctrns. 804-359-6071
WA Seattle, Radar Elec. 206-282-2511

EL-RAD MFG., 2800 W. Cullom Ave., Chicago, IL 60618, Tel: 312-478-7300, TWX: 910-221-0104; FSC No.: 11253; Empl.: 225; *Sls. Mgr.:* Marvin S. Christ

Local Sales Offices & Reps

J. J. Riley Assocs.
AZ Scottsdale, Memco Sls. 602-241-2254
AR Little Rock, Jaro Electro Sls. 214-231-6654
CA Huntington Beach, J. J. Riley Assoc. 714-841-1411
CA Mountain View, Westech Sls. 415-961-1422
FL Pompano Beach, Cole-Tek 305-781-8110
IL Elk Grove Village, I R O Co. 312-593-0644
MD Glen Burnie, Faion Lott & Co. 301-744-4611
MD St. Louis, Abrams & Assocs. 314-569-0447
MI Benton Harbor, Mc Nabb & Assocs. 616-925-2166
NJ Baltimore, Faion Lott & Co. 301-744-4611
NM Phoenix, Memco Sls. 602-952-2254
TX Richardson, Jaro Electro Sls. 214-231-6654

ELTEC INSTRUMENTS INC., P.O. Box 9610, Daytona Bch., FL 32020, Tel: 904-253-5328, TWX: 810-832-6294; Empl.: 120; *Sls. Mgr.:* Douglas S. Armstrong

EMCA, Sub. Rohm and Haas Advanced Matls. Co., 605 Center Ave., Mamaroneck, NY 10543, Tel: 914-698-8434, TWX: 710-566-1128; Empl.: 70; *Sls. Mgr.:* Dennis Hanley

EMCO HIGH VOLTAGE CO., 11126 Ridge Road, Sutter Creek, CA 95685, Tel: 209-223-3626; Empl.: 38 .... **D•1632**

EMCON INC., Sub. of Kyocera Intl., 11620 Sorrento Valley Rd., San Diego, CA 92138, Tel: 619-459-4355, TWX: 910-322-1130; Empl.: 500; *Sls. Mgr.:* Bob Goodman; *Dist. Mgr.:* George Maines

EMCOR PRODUCTS, Crenlo, Inc., 1600 Fourth Ave. NW, Rochester, MN 55901, Tel: 507-289-3371, TWX: 910-565-2374; *Sls. Mgr.:* John Horton .... **C•1057**

EMC TECHNOLOGY INC, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034, Tel: 609-429-7800, Telex: 710 896 0193; FSC No.: 24602; Empl.: 75; *Sls. Mgr.:* Peter Semitschew

Local Distributors

CA Los Altos, SIDCO, Inc. 415-949-0440
CA Malibu, RL Comp., Inc. 213-456-9021
NJ E. Windsor, Micro-Lambda, Inc. 609-443-3113

EMERGENCY BEACON CORP., 15 River St., New Rochelle, NY 10801, Tel: 914-235-9400; Empl.: 25; *Sls. Mgr.:* Judith L. Weber

EMERGENCY POWER ENGINEERING INC., 3580 Cadillac Ave., Costa Mesa, CA 92606, Tel: 714-557-1636, Telex: 183535; Empl.: 356; *Sls. Mgr.:* Warren Caves

EMERSON, INDL. CONTROLS DIV., 3300 Standard St., Santa Ana, CA 92702, Tel: 714-545-5581, Telex: 67-8460; Empl.: 800; *Sls. Mgr.:* R. L. Calvin

Please call factory for sales offices and nearest rep.

EMERSON & CUMING, W. R. Grace & Co., 59 Walpole St., Canton, MA 02021, Tel: 617-828-3300, TWX: 710-348-1324; Empl.: + 500

EMHART CANADA, LTD., See Mallory Components Div.

EMICO INC., Box 368, Dublin, PA 18917, Tel: 215-249-9330, TWX: 510-665-9583; FSC No.: 85925; Empl.: 170; *Sls. Mgr.:* R. Jones .... **D•1352-1353**

Local Sales Offices & Reps

AZ Scottsdale, Luscombe 602-949-9333
CA Campbell, Luscombe Engrg. 408-370-2020
CA Pasadena, Luscombe 213-684-2000
CO Arvada, Arrowhead Sls. Co. 303-423-5556
FL Semenole, Chaco Sls. 813-397-4843
IL Chicago, Ropek & Cahill 312-631-0070
IN Carmel, S T B & Assocs. 317-844-9227
KS Shawnee Mission, Robinson & Assocs. 913-262-1374
MD Silver Spring, H.R. Sieber Co. 301-681-3770
MA Braintree, Anderson Sls. Co. 617-848-9194
MN Minneapolis, H.M.R., Inc. 612-888-2122
NJ Marlton, B.G.R. Assocs. 609-428-2440
NY Syracuse, Nycom, Inc. 315-437-8343
NY Yonkers, Sonkin Assoc. 914-968-8282
NC Charlotte, Electro-Rep. Assocs. 704-527-2530
OH Rocky River, Loesch Assocs. 216-333-0077
TX Rowlett, Campion Sls. 214-475-8313
WA Redmond, Eclipse Mktg. 206-885-6991
WI Colgate, Rep I and Assocs. 414-628-4016

EMI GENCOM INC., See THORN EMI Gencom Inc.

EMI TECHNOLOGY INC., See THORN EMI Technology Inc.

E/M LUBRICANTS, INC., Div. of Great Lakes Chemical Corp., Highway 52 NW, W. Lafayette, IN 47906, Tel: 317-463-2511, Telex: 27-9428; FSC No.: 11770

Local Sales Offices & Reps

CA Mt. View 415-961-5865
CA North Hollywood 213-875-0101
CO Denver 303-371-6771
CT New Britain, E/M Lubricants, Inc. 203-224-9148
GA Atlanta 404-361-2550
IL Lombard 312-620-6808
MA Auburn 617-792-6919
MI Roseville 313-779-6460
MN New Brighton 612-780-3202
OH Dayton 513-254-8481
PA Sharon Hill 215-461-1015
TX Ft. Worth 817-834-8817

EMM SEMI, SUB OF EM & M, See GTE Microcircuits

EMM/SESCO, 20630 Plummer St., Chatsworth, CA 91311, Tel: 213-998-9090, Telex: 691404, TWX: 910-494-4990; *Sls. Mgr.:* Russ Summers

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Local Sales Offices & Reps

CA La Canada, Lew Brooks Co. 213-790-8358
CA Santa Ana, Lew Brooks Co. 714-544-8900
GA Atlanta, Brownell Electro Inc. 404-762-5181
IL Chicago, Best Rep Co. 312-992-1055
MA Burlington, E.I.L. Instr.-Mancib Div. 617-272-9450
NJ Belleville, D. F. Tobias & Co. 201-751-8680
OH Cleveland, Weschler Elec. Corp. 216-238-2550
PA Philadelphia, Sunshine Sci. Instr. Inc. 215-673-5600
TX Houston, Ev Smith Sls. 713-649-5756

EMR DATA SYSTEMS, DIV. SANGAMO- WESTON, Box 3041, Sarasota, FL 33578, Tel: 813-371-0811, Telex: 052-890, TWX: 810-864-0406; Empl.: 1100; *Sls. Mgr.:* F. V. Hinkel

E M S DEVELOPMENT CORP., 200 Allen Blvd., Farmingdale, NY 11735, Tel: 516-694-2886, TWX: 510-224-6480; FSC No.: 51435; Empl.: 115; *Sls. Mgr.:* Ed Simkovich

EMULOGIC, 3 Technology Way, Norwood, MA 02062, Tel: 617-329-1031; *Sls. Mgr.:* Robert Smith

ENCLOSURE CORP., 4529 Adams Circle, Cornwells Hts., PA 19020, Tel: 215-638-9550; FSC No.: 32360; Empl.: 106; *Sls. Mgr.:* Gene Goldner

ENCODER DIV., LITTON SYSTEMS, INC., See Litton Encoder Div.

ENCODER PRODS., 1601B Dover Rd., Sandpoint, ID 83864, Tel: 208-263-8541, TWX: 510-776-1595; Empl.: 70; *Sls. Mgr.:* Vance Conner

ENDEVCO, 30700 Rancho Viejo Rd., San Juan Capistrano, CA 92675, Tel: 714-493-8181, Telex: 68-5608, TWX: 910-596-1415; FSC No.: 95411; Empl.: 400; *Sls. Mgr.:* C. Bowes

Local Sales Offices & Reps

AL Huntsville, & 205-536-4454
CA Anaheim 714-831-9200
CA San Francisco, & 415-552-1763
CT West Mystic 203-572-0571
FL Orlando, & 305-855-4535
IL Chicago 312-754-3888
MD Annapolis, & 301-269-8800
NJ Lambertville, & 201-254-9600
TX Dallas 214-458-7720

Local Distributors

MI Charlotte, RDP Assocs. 517-543-6212
OH Cleveland, RDP Assocs. 216-659-3138
OH Dayton, RDP Assocs. 513-253-6175

ENDICOTT COIL, 22 E. Charlotte St., Binghamton, NY 13905, Tel: 607-797-1263, Telex: 932411; Empl.: 140; *Sls. Mgr.:* Norman Aprile .... **A•1239, 2135**

ERC™ Endicott Research Group, Inc.

ENDICOTT RESCH. GRP., INC., 2601 Wayne St., P.O. Box 269, Endicott, NY 13760, Tel: 607-754-9187, TWX: 510-252-0155; FSC No.: 63312; Empl.: 102 .... **B•1047-1049; D•1633**

Local Sales Offices & Reps

CA Laguna Hills, Component Mktg. Assocs. 714-951-6046
CA Lomita, Component Mktg. Assoc. 213-326-1460
CA Saratoga, Testco 408-253-1900
CO Denver, West Incorporated 303-773-5150
CT Bloomfield, SIR Assocs. 203-243-9343
FL Pompano Beach, Cole-Tek Assocs. 305-781-8110
GA Atlanta, Wallace Electronics 404-471-6297
IL Elk Grove Village, Carlson Elctrn. Sls. 312-956-8240
IN Indianapolis, J & W Sls. 317-842-3740
IA Cedar Rapids, Carlson Elctrn. Sls. 319-377-6341
KS Wichita, PMR, Inc. 316-684-4141
MA Bedford, SIR Assocs. 617-275-5550
MI West Bloomfield, Granneman & Assocs. 313-661-4891
MN Minneapolis, Jos-Col Melius 612-861-3343
MO Maryland Hts., PMR, Inc. 314-569-1220
NE Overland Park, PMR, Inc. 913-381-0004
NJ Livingston, Eagle Sls. Co. 201-992-2030
NY Albany, H. C. Johnson Agencies 716-632-7880
NY Buffalo, H. C. Johnson Agencies 716-632-7880
NY Jericho, Metro-Tech 516-935-3330
NY Rochester, H. C. Johnson Agencies 716-482-3000
NC Kernersville, Wallace Electronics 919-996-2742
OH Dayton, Dynel Co. 513-434-6467
PA Glenshaw, H. C. Johnson Agencies 412-487-1246
PA King of Prussia, Freedman-Malta Assocs. 215-337-9211
TX Austin, Mil-Rep Associates 512-258-2828
TX Houston, Mil-Rep Associates 713-937-0127
TX Richardson, Mil-Rep Associates 214-644-6731
UT Salt Lake City, West Inc. 303-773-8180
WA Bellevue, Testco 206-454-7422
WI Milwaukee, Carlson Elctrn. Sls. 414-476-2790

Can Toronto, Norgay Entprs., Ltd. 416-239-3025

ENERCO, INC., 9615 W. Marginal Way S., Seattle, WA 98108, Tel: 206-762-1422; Empl.: 5; *Sls. Mgr.:* Lee Rabie

ENERGETEC SYSTEMS, INC., 130 E. St. Charles Rd., Carol Stream, IL 60188, Tel: 312-653-1920, Telex: 910-380-8574; Empl.: 40

ENERGY CONCEPTS, PO Box 128, Carlsbad, CA 92008, Tel: 619-942-3144; FSC No.: 01830; Empl.: 6; *Sls. Mgr.:* Marilyn Decarlo

ENERGY, LTD., 4714 Upshur Street, Bladensburg, MD 20710, Tel: 301-699-1144; FSC No.: Easylink 62837736; Empl.: 6 ..... **D•1923**

ENGELHARD CORP., 70 Wood Ave. S., Iselin, NJ 08830, Tel: 201-321-5900, Telex: 83-3147; Empl.: 8500

ENGELMANN MICROWAVE CO., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981, Tel: 201-887-5700, TWX: 710-986-8220; *Sls. Mgr.:* Carl Schraufnagl

ENGINEERED COMPS. CO., P. O. Box 8121, San Luis Obispo, CA 93403-8121, Tel: 805-544-3800; FSC No.: 32440; Empl.: 250

ENGD. PROD., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727, Tel: 716-968-2400, Telex: 91-6451, TWX: 510-245-2700; Empl.: 850; *Sls. Mgr.:* Dick Milne

ENGINEERING & ELCTRN. DEVICES, 1024 N. McCadden Pl., Los Angeles, CA 90038, Tel: 213-463-4175; Empl.: 4; *Sls. Mgr.:* John H. Aulbach, Jr.; *Dist. Mgr.:* Henry C. Lerner

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ENGINEERING SOFTWARE CO., Infotech Mgmt, Inc., Three Northpark East, # 901, 8800 N. Central Expwy., Dallas, TX 75041, Tel: 214-361-2431

ENGLER INSTRUMENTS OPERATION, Stemco Truck Products Division, 250 Culver Ave., Jersey City, NJ 07305, Tel: 201-332-5353, TWX: 710-730-5236; FSC No.: 07446; Empl.: 1200; *Sls. Mgr.:* Bob Halpin

ENI, INC., See Electronic Navigation Inds., Inc.

ENI POWER SYS., 3000 Winton Rd. S., Rochester, NY 14623, Tel: 716-473-7330, Telex: 97-8283; FSC No.: 10226; Empl.: 200; *Sls. Mgr.:* L. A. Benedict

ENTECH SYSTEMS, INC., 15 Herman Dr., Simsbury, CT 06070, Tel: 203-651-9557; *Sls. Mgr.:* A. D. Jorczak

ENTER COMPUTER, INC., 6867 Nancy Ridge Drive, San Diego, CA 92121, Tel: 619-450-0601, Telex: 181740; *Sls. Mgr.:* Robert Curtis

ENTERPRISE SYS. CORP., P.O. Box 698, Dover, NH 03820, Tel: 603-742-7363; Empl.: 20; *Sls. Mgr.:* G. E. Perrine

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ENTRAN DEVICES, 10 Washington Ave., Fairfield, NJ 07006, Tel: 201-227-1002, Telex: 130-361; *Sls. Mgr.:* John W. G. Budd ..... **B•1794-1795**

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AZ	Phoenix, J. Smith & Assocs.	602-267-0981
CA	Long Beach, Saber Entprs.	213-595-5646
CA	Pleasanton, Secco Assocs.	415-484-1030
CA	San Diego, Saber Entprs.	619-271-1523
CO	Colorado Springs, J. Smith & Assoc.	303-597-5343
CT	Hamden, Pond Tech. Sls.	203-281-0005
GA	Atlanta, Quantum Meas.	404-351-3531
IN	Plainfield, Stress Analysis Svcs.	317-839-8235
MI	Brighton, Stress Analysis Svcs.	313-632-6110
NJ	Hopatcong, Measurements, Inc.	201-770-1281
NM	Albuquerque, J. Smith & Assocs.	505-265-3406
NY	Clarence, Trott Electrns.	716-634-8500
NY	Pittsford, Trott lectrns.	716-586-8251
NC	Chapel Hill, Quantum Meas.	919-933-7408
OH	Dayton, Stress Analysis Svcs.	513-263-8036
OH	Medina, Stress Analysis Svc.	216-725-7733
PA	Frazer, Measurements, Inc.	215-644-7142
VA	Fredericksburg, Measurements, Inc.	703-373-5520
Can	Ontario, Intertechnology	416-445-5500

ENTRELEC DIV., See Cogenel, Inc./Entrelec Div.

ENVIRONMENTAL COMM., 3150 Pullman St., Costa Mesa, CA 92627, Tel: 714-557-7800, TWX: 910-595-1781; FSC No.: 16450; Empl.: 65; *Sls. Mgr.:* Joseph Hughes

ENVIRONMENTAL CONTAINER SYS., INC., 3560 Rogue River Hwy., Box 188, Grants Pass, OR 97526, Tel: 503-476-8871, TWX: 510-755-0777; FSC No.: 24995; Empl.: 135

Local Sales Offices & Reps

AR	Little Rock, Advance Tech. Sls.	501-794-1618
CA	Santa Clara, Ross Mktg. Assocs.	408-988-8111
CO	Englewood, Electronic Comp. Sls., Inc.	303-781-5904
CT	Wallingford, Apex Assocs.	203-269-8401
FL	Clearwater, Brennan Assocs., Inc.	813-446-5006
GA	Atlanta, Brennan Assocs., Inc.	404-395-7527
MA	Westwood, Apex Assocs.	617-326-5042
NJ	Teaneck, Noreast Tech. Sls.	201-833-2044
OK	Tulsa, Advance Tech. Sls.	918-664-0482
TX	Austin, Advance Tech. Sls.	512-459-1351
TX	Dallas, Advance Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888

EOTEC CORP., 420 Frontage Road, W. Haven, CT 06516, Tel: 203-934-7961, Telex: 358190; Empl.: 24; *Sls. Mgr.:* Robert L. Belard

EOTEC CORPORATION, Fiber Optic Interconnect Group, 420 Frontage Road, West Haven, CT 06516, Tel: 203-934-7961, Telex: 358190; Empl.: 24; *Sls. Mgr.:* Lou Maiolo

E.P.E. CORP., P.O. Box 5238, Manchester, NH 03108, Tel: 603-669-9181, Telex: 943536; Empl.: 65; *Sls. Mgr.:* James D. Bell; *Dist. Mgr.:* Thomas S. Bell

EPIC, INC., 150 Nassau St., New York, NY 10038, Tel: 212-349-2470, Telex: 12-6531; Empl.: 8; *Sls. Mgr.:* Peter Letica

EPICOM, INC., 411 Josiane Court, Altamonte Springs, FL 32701, Tel: 305-331-1640; Empl.: 15; *Sls. Mgr.:* W. R. Adams; *Dist. Mgr.:* W. R. Adams

EPOCH ENTERPRISES, LTD., 3541 N. Olive Rd., Tucson, AZ 85719, Tel: 602-887-1970, 888-5167, Telex: 4995542; Empl.: 2

EPOXYLITE CORP., 9400 Toledo Way, P.O. Box 19671, Irvine, CA 92713, Tel: 714-951-3231; Empl.: 60

EPOXY TECHNOLOGY, INC., 14 Fortune Dr., P.O. Box 567, Billerica, MA 01821, Tel: 800-227-2201, Telex: 94-7140; FSC No.: 33246; Empl.: 18

Local Sales Offices & Reps

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CA	Hacienda Heights, Wadsworth/Bryant	818-330-5592
CO	Boulder, Specialty Sales Co.	303-444-0954
FL	Fort Pierce, Hyber-Sem	305-464-0461
IL	Chicago, E. Przechera Sls. Co.	312-725-1933
MA	Newton, Normell Assoc.	617-969-5478
MI	Royal Oak, Murray A. Percival Co.	313-548-1971
NJ	Clinton, Price-Tech Inc.	201-735-9797
NY	Fair Haven, Feikert Assoc.	315-652-5577
OH	Dayton, Berberich Assoc.	513-433-0342
OR	Beaverton, Demarest Assoc.	503-643-0141
TX	Arlington, Whitehead & Assoc.	817-261-5794
UT	West Jordan, Specialty Sales Co.	801-561-0222
WA	Seattle, Demarest Assoc.	206-523-3210

EPSCO, 920 Westwood Ave., Addison, IL 60101, Tel: 312-543-0410; FSC No.: 53003; Empl.: 8 ..... **D•1634**

Local Distributors

AR	Little Rock, Carlton-Bates Co.	501-562-9100
CA	Garden Grove, Allied Elctrns.	714-554-0731
CA	San Francisco, VWR Scientific Inc.	415-468-7150
CO	Denver, Newark Elctrns.	303-757-3351
FL	Marathon, Marathon Wholesale Electric Supply	305-743-2262
FL	Miami, Aero Quality Sls.	305-592-5055
GA	Warner Robbins, Omnia Supp.	912-929-2948
HI	Honolulu, Honolulu Elctrn.	808-949-5564
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Elgin, Allied Elctrns.	312-697-8200
IL	Elmhurst, McMaster-Carr Supp.	312-834-9600
IL	Skokie, Sargent-Welch Sci.	312-677-0600
IN	Evansville, Hutch & Son	812-425-7201
IN	Indianapolis, Electro Prods.	317-298-8255
LA	New Orleans, Radio Parts	504-581-5959
MA	Lynn, Land Elctrns.	617-592-2220
MI	Flint, Shand Elctrns.	313-743-8940
MI	Lansing, Fulton Radio	517-394-5020
MO	Kansas City, Walters Radio Supp.	816-531-7015
NJ	Bridgeport, VWR Scientific Corp.	609-467-2600
NM	Albuquerque, Walker Radio	505-247-2288
NY	New York, Colonial Hardware Corp.	212-741-8989
OH	Dayton, The John A. Becker Co.	513-226-1341
OH	Warren, Rem Elctrns. Supp.	216-373-1300
PA	Pittsburgh, Fischer Scientific Co.	412-562-8300
SC	Charleston, Wholesale Inds. Elec.	803-722-2634
TX	Dallas, Wholesale Elctrns.	214-824-3001
TX	Ft. Worth, Allied Elctrns.	817-336-5401
UT	Salt Lake City, Newark Elctrns.	801-486-1048
VA	Norfolk, Avec Elctrns.	804-627-3502
WI	Milwaukee, Industrial Elctrns. Supp.	414-276-1212

EPSCO MICROWAVE, 411 Providence Hwy., Westwood, MA 02090, Tel: 617-329-1500, TWX: 710-348-0484; FSC No.: 15894; Empl.: 185; *Sls. Mgr.:* John M. Shalhoub

EPSILON-LAMBDA ELCTRNS. CORP., 427 Stevens St., Geneva, IL 60134, Tel: 312-232-9611, TWX: 910-237-1684; Empl.: 30; *Sls. Mgr.:* Robert Knox

EQUIPTO, 225 S. Highland Ave., Aurora, IL 60507, Tel: 312-859-1000, TWX: 910-232 0845; Empl.: 300; *Sls. Mgr.:* Ralph Zettinger

EQUIPTO ELCTRNS. CORP., 351 Woodlawn Ave., Aurora, IL 60507, Tel: 312-897-4691; FSC No.: 14002;Multiple; *Sls. Mgr.:* Larry Suggett ..... **C•1059**

Local Sales Offices & Reps

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AZ	Tempe, Burland Assoc.	602-894-5564
CA	Anaheim, Spectrum Assocs.	714-630-6977
CA	Milpitas, Ward Elctrn. Packaging Sls.	408-945-0420
CO	Littleton, Grifco	303-795-1989
CT	Bridgeport, Technical Instrs.	203-368-4582
FL	Ft. Lauderdale, Hollingsworth & Still	800-241-5712
FL	Tampa, Hollingsworth & Still	800-241-5712
GA	Norcross, Hollingsworth & Still	404-447-1700
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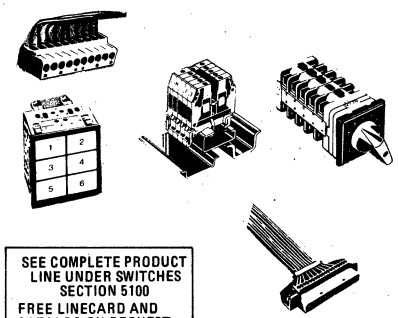

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MD Silver Spring, Sel-Tronics 301-589-3391
MA Wilmington, Technical Instrs. 617-944-3930
MO Florissant, Midtec Assocs., Inc. 314-837-5200
NJ Englewood, Tecnimat 201-569-4200
NM Albuquerque, R.L.S. Instr. 505-265-4187
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PA Pittsburg, Scott Elctrns., Inc. 412-963-6116
PA Valley Forge, J. E. Cuesta & Co. 215-265-5800
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TX Houston, ION Assocs., Inc. 713-977-4354
WA Seattle, S.J.I. Corp. 206-763-8981

ERA POLY-PLANAR DIV., 311 E. Park St., Moonachie, NJ 07074, Tel: 201-641-3650, TWX: 710-990-5064; Empl.: 100; *Sls. Mgr.:* John Apelian

ERA TRANSPAC DIV., Sub. Elctrn. Research Assocs., 50 Graphic Place, Moonachie, NJ 07074, Tel: 201-641-3650, TWX: 710-990-5064; FSC No.: 96762; Empl.: 100; *Sls. Mgr.:* John Apelian ..... **D•1635-1637**

Local Sales Offices & Reps
CA Los Angeles, Astralonics 213-706-0488
CA Orange County, Astralonics 213-691-6123
CA San Diego, Astralonics 619-789-2256
CA Westlake Village, Astralonics 818-706-3936
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GA Smyrna, B-C Elctrn. Sls., Inc. 404-436-5169
MA Needham Heights, Todino Engrg. Sls. 617-444-7925
NJ Perth Amboy, Astrorep, Inc. 201-826-8050
NY Babylon, Astrorep, Inc. 516-422-2500
PA Pittsburgh, Covert & Newman Co. 412-531-2002
TX Austin, Beacon 512-331-5115
TX Dallas, Beacon 214-437-1505
VA Front Royal, Eltron Sls., Ltd. 703-635-7201

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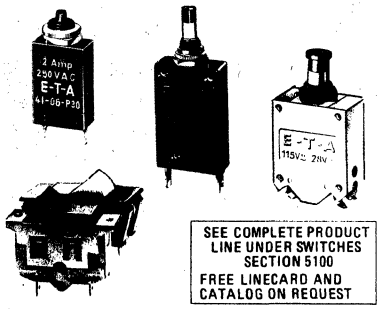

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FREE LINECARD AND CATALOG ON REQUEST

WA Seattle, Datacom Assocs., Inc. 206-285-2525
Can Pointe Claire, Que., Elcom GBM, Inc. 514-626-4039,514-697-4556

ERASER CO., Box 4961, Syracuse, NY 13221, Tel: 315-454-3237, Telex: 93-7442; Empl.: 45; *Sls. Mgr.:* Linda S. Cahill

ERBTEC ENGINEERING, INC., 5680 Valmont Rd., Boulder, CO 80301, Tel: 303-447-8750; Empl.: 16; *Sls. Mgr.:* Harvey Girard

ERC, See Electronic Research Co.

ERCONA, 125 Wilbur Pl., Bohemia, NY 11716, Tel: 516-567-3399, Telex: 961449; Empl.: 10; *Sls. Mgr.:* M. Kandell; *Dist. Mgr.:* J. Curley

EREM CORP., 3740 Skypark Dr., Torrance, CA 90505, Tel: 213-772-0751; Empl.: 25; *Sls. Mgr.:* G. Johnson; *Dist. Mgr.:* C. Johnson

ERGOTRON, INC., 1621 E. 79th Street, Minneapolis, MN 55420, Tel: 612-854-9116, 800-328-9839, Telex: 290766; Empl.: 8; *Sls. Mgr.:* Keith A. Jentoft

ERICSON MFG. CO., 4215 Hamann Pkwy., Willoughby, OH 44094, Tel: 216-951-8000, Telex: 98-5390; *Sls. Mgr.:* J. E. (Jay) Ericson, Jr.

ERIE TECHN. PRODS., See Murata Erie No. Amer., Inc.

ERIE TECHNOLOGICAL PRODUCTS, 645 West 11th St., Erie, PA 16512, Tel: 814-453-5611

ERM, 27 Water St., Wakefield, MA 01880, Tel: 617-246-3550

ERNI COMPS. CORP., Erni Elektroapparate GMBH, 1235 E. Davis St., Arlington Heights, IL 60005, Tel: 312-577-8620, TWX: 910-687-0260; *Sls. Mgr.:* J. Garratt; *Dist. Mgr.:* G. F. Zib

ESC

ESC ELCTRNS. CORP., 534 Bergen Blvd., Palisades Pk., NJ 07650, Tel: 201-947-0400, TWX: 710-991-9780; Empl.: 120 ..... **A•1508-1521, 1604-1605**

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AZ Tucson, Sedco Sls., Inc. 602-298-1758
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CO Westminster, D/Z Assocs. 303-429-9369
CT Bridgeport, Betronic Assocs. 203-374-6404
FL St. Petersburg, QXI, Inc. 813-821-2281
FL Tamarac, QXI, Inc. 305-392-2626
GA Norcross, Interep Assocs., Inc. 404-449-8680
IL Elk Grove, Carlson Elctrn. Sls. Co. 312-956-8240
IN Indianapolis, J & W Sls. 317-842-3740
IA Cedar Rapids, Carlson Elctrn. Sls. Co. 319-377-6341
KS Merriam, Midwest Tech. Sls. 913-236-8555
MA Waltham, Betronic Assocs. 617-894-8400
MN Minneapolis, R-J, Inc. 612-866-3661
MO St. Charles, Midwest Tech. Sls. 314-441-1012
NY New York City, Robert Smith Assocs. 212-541-4885
NY Plainview, Robert Smith Assocs. 516-681-3155
OH Cincinnati, Makin Assocs. 513-871-2424
OR Beaverton, Ravencraft 503-646-9261
NJ Marlton, BGR Assocs. 609-983-1020
TN Greeneville, Interep Assocs., Inc. 615-639-3491
TX Plano, Zeus Engrg. 214-423-2027
UT Salt Lake City, D/Z Assocs. 801-268-2876
VA Reston, Tytronics Tech. Sls. 703-471-0440
WI Milwaukee, Carlson Elctrn. Sls. Co. 414-476-2790
EXP NJ, Palisades Pk., ESC Elctrns. Corp. 201-947-0400

ESE, 142 Sierra St., El Segundo, CA 90245, Tel: 213-322-2136; FSC No.: 58525; Empl.: 25; *Sls. Mgr.:* R. Mayers; *Dist. Mgr.:* R. Mayers

ESICO, INC., Box 247, Deep River, CT 06417, Tel: 203-526-5361; Empl.: 45; *Sls. Mgr.:* Robert W. Mead

ESNA DIV., 2330 Vauxhall Rd., Union, NJ 07083, Tel: 201-686-6000, Telex: 1-38243, TWX: 710-985-4677; Empl.: 700

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ESPEY MFG. & ELECTRONICS CORP., 223-239 Ballston Ave., Saratoga Springs, NY 12866, Tel: 518-584-4100

E² TECHNOLOGY CORP., 4475 Dupont Ct # 9, Ventura, CA 93003, Tel: 805-644-9544, Telex: 887971 E Sq. Tech. UD; Empl.: 15; *Sls. Mgr.:* Larry D. Emery

ESSCO INDS., P.O. Box 515, Sierra Madre, CA 91024-0515, Tel: 818-355-8315; Empl.: 33

ESSEX CONTROLS, See Stancor Products

ESSEX CONTROLS DIV., ESSEX GRP., See Essex Controls, United Technologies

ESSEX GROUP, 9933 13th St., Ft. Wayne, IN. 46809, Tel: 219-478-1521; Empl.: 300-500; *Sls. Mgr.:* J. Scott

ESSEX GRP., ESSEX TERMINALS/CONNECTORS, See United Technologies, Comps. Div. Terminals

ESSEX GRP., Power Conductor Div., 2601 S. Adams, Marion, IN 46953, Tel: 317-664-6211, TWX: 317-667-6972; Empl.: 700; *Sls. Mgr.:* J. Burdick

ESTERLINE ANGUS INSTR. CORP., Box 24000, Indianapolis, IN 46224, Tel: 317-244-7611, Telex: 027-419; FSC No.: 72264; Empl.: 250 +; *Sls. Mgr.:* James Banks

ESTES ENGRG. CO., 930 Marine Dr., Port Angeles, WA 98362, Tel: 206-457-0904; FSC No.: 22590; Empl.: 28

E-SYSTEMS, Garland Div., Box 226118, Dallas, TX 75266, Tel: 214-272-0515, TWX: 910-860-5187; Empl.: 1927

E-SYSTEMS, Greenville Div., P.O. Box 1056, Greenville, TX 75401, Tel: 214-457-4694, Telex: 73-2392; *Sls. Mgr.:* C. L. Byrom

E-SYSTEMS, Melpar Div., 7700 Arlington Blvd., Falls Church, VA 22046

E-SYSTEMS, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750, Tel: 219-356-4300, TWX: 810-333-1530; FSC No.: 24681; Empl.: 450; *Sls. Mgr.:* Ray Vanderspool ..... **A•1869, 2015**

Local Sales Offices & Reps
AL Huntsville, Murcota 205-539-8476
CA Santa Ana, Cal-Tronic Sls. 714-979-4863
CA Santa Clara, D.H. Ross 408-988-8111
CO Denver, West, Inc. 303-692-0131
FL Indialantic, Raycom 305-727-8860
GA Atlanta, Murcota 404-875-2525
IL Chicago, D. Dolin Sls. 312-286-6200
IN Ft. Wayne, Menze Sls. 219-747-5616
MI St. Clair Shores, J.M. Thorpe 313-779-6363
MO Blue Springs, Chesco 816-229-1404
MO St. Charles, Chesco 314-946-6677
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NJ Englewood Cliffs, Masin Esco 201-569-8868
NY Hauppauge, Masin Esco 516-273-3500
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NC Burlington, Murcota 919-585-1577
NC Winston-Salem, Murcota 919-723-1001
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PA Newtown Square, G.M. Conneen 215-353-2241
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TX Houston, SW Elctrn. Ind. 713-729-1670
UT Salt Lake City, West, Inc. 801-966-0171
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E-T-A CIRCUIT BREAKERS, 7400 N. Croname Rd., Chicago, IL 60648, Tel: 312-647-8303, Telex: 253780; Empl.: 20; *Sls. Mgr.:* John J. Palsir

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CO Denver, Challenge Sls. 303-450-2402
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FL Orlando, EAB Inc. 305-898-7444
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IN Ft. Wayne, Needler Sls. Co. 219-447-2123
IN Indianapolis, Needler Sls. Co. 317-255-8056

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VA Fairfax, Beacon North 703-591-1300
WA Seattle, Temco Northwest 206-488-1254
WI Milwaukee, Star Engineering 414-645-3680

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ETI SYSTEMS

ETI SYSTEMS, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, Tel: 619-757-7770, TWX: 910-322-1396; FSC No.: 952 762672; *Sls. Mgr.:* Bill Tice; *Dist. Mgr.:* Bill Tice ..... **A•2016-2017; B•1150-1152; D•1120-1121**

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CT Washington, Tri-Com Assocs. 203-563-2241
IL Arlington Heights, Brainard-Wilson Mktg. 312-437-2700
IN Carmel, Brainard-Wilson Mktg. 317-844-2800
LA Covington, HBT Assocs. 504-892-4045
MA Burlington, Tri-Com Assocs. 617-272-8163
MA Newburyport, Tri-Com Assocs. 617-465-3205
MI Livonia, Lowell Wenot 313-464-2722
MN Minneapolis, Intl. Elctrns. 612-571-0000
NJ Morristown, Andrews & Andrews 201-569-8800
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OH Cleveland, Baehr Greenleaf & Assocs. 216-221-9030
OH Columbus, Baehr Greenleaf & Assocs. 614-486-4046
OH Dayton, Baehr Greenleaf & Assocs. ... 513-439-0724
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TX Dallas, Allied Comp., Inc. 214-238-0408
TX Houston, Allied Comp., Inc. 713-988-1600
TX Hurst, Allied Comp., Inc. 817-589-0456
TX Round Rock, Allied Comp., Inc. 512-244-1166
VA Roanoke, Homersmith, Inc. 703-774-7411
WA Kent, Rhode Sls. Corp. 206-251-5396
WI Waukesha, Brainard-Wilson 414-797-7940

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CA Anaheim, A To Z Elctrns. 714-634-3620
CA Canoga Park, Tim-Co. Sls. 213-992-5040
CA Garden Grove, Allied Elctrns. 714-544-0731
CA Hayward, Allied Elctrns. 415-487-5250
CA Los Angeles, Allied Elctrns. 213-725-7111
CA San Jose, Allied Elctrns. 408-727-1690
CA San Jose, Vader Elec. 408-971-0288
CO Wheatridge, Allied Elctrns. 303-425-7144
CT Hamden, Allied Elctrns. 203-248-8900
FL Ft. Lauderdale, Allied Elctrns. 305-486-0500
FL Jupitor, Brosey Entprs. 305-746-2439
GA Atlanta, Allied Elctrns. 404-237-3366
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IL Lisle, Components, Inc. 312-852-7707
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MA Wilmington, Allied Elctrns. 617-942-0150
MA Woburn, Mac Bearing Co. 617-933-2110
NY Mineola, Allied Elctrns. 516-248-2360
NY Port Washington, Connector Concepts Corp. 516-883-3800
NC Raleigh, Allied Elctrns. 919-467-0720
OH Cleveland, Allied Elctrns.
OH Cleveland, Specialized Comp. Sls. 216-464-0405
OK Oklahoma City, Trice Wholesales Elec. 405-524-4411
OK Tulsa, Allied Elctrns. 918-663-7630
OR Beaverton, Shannon, Ltd. 503-644-8077
PA Bala Cynwyd, Allied Elctrns. 215-667-6940
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Houston, Lenert Co. 713-225-1465
TX Humble, Allied Elctrns. 713-852-3730
WA Kent, Shannon, Ltd. 206-763-0545
WA Seattle, Allied Elctrns. 206-767-5772
WI Milwaukee, Allied Elctrns. 414-355-8866
WI Oshkosh, Electronic Inds. 414-235-8930

ETM ELECTROMATIC INCORPORATED

ETM ELECTROMATIC, 470 San Antonio Ave., Palo Alto, CA 94306, Tel: 415-494-1505; *Sls. Mgr.:* Wes Henderson ..... **D•1226-1227, 1638**

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ETRI, INC., 608 Broome St., P.O. Box 5006, Monroe, NC 28110, Tel: 704-289-5423, TWX: 810-649-1352; FSC No.: FAX 704-283-7170; *Sls. Mgr.:* G. Wolf ... **C•1638-1640**

Local Sales Offices & Reps

AL Huntsville, Montgomery Mktg. 205-830-0498
AZ Scottsdale, Luscombe Engrg. 602-949-9333
CA Los Gatos, Nor-West Elctrns. 408-395-1190
CA Pasadena, Luscombe Engrg. 213-684-2000
CA San Diego, Bestronics 619-693-1111
CO Boulder, Comp. Prods. Sls. 303-530-2800
FL Altamonte Springs, Semitronics Assocs. 305-831-8233
FL Clearwater, Semtronics Assocs. 813-461-4675
FL Ft. Lauderdale, Semtronics Assocs. ... 305-731-2484
GA Norcross, Montgomery Mktg. 404-447-6124
IL Des Plaines, Lincoln, Hodges & Assocs. 312-297-3810
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IN Indianapolis, Advanced Comp. Sls. 317-545-6441
IA Cedar Rapids, PMR, Inc. 319-362-9177
KS Overland Park, PMR, Inc. 913-381-0004
MA Lexington, John E. Boeing Co., Inc. 617-862-2500
MI Birmingham, Favco Techn. Reps. 313-644-0173
MN Minneapolis, Milt Westlund Assocs. ... 612-866-5002
MO Maryland Heights, PMR, Inc. 314-569-1220
NJ Cherry Hill, Trinkle Sls., Inc. 609-795-4200
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NY Manhasset, Win-Cor Elctrns. 516-627-9474
NY Pittsford, Noeth-Honsinger 716-586-9002
NC Cary, Montgomery Mktg. 919-467-6319
OH Cincinnati, Makin & Assocs., Inc. 513-871-2424
OR Wilsonville, RTS, Inc. 503-638-5670
TX Austin, Nova Mktg. 512-343-2321
TX Dallas, Nova Mktg. 214-750-6082
TX Houston, Nova Mktg. 713-988-6082
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WI Waukesha, Lincoln, Hodges & Assocs. 414-542-3087
PR Santurce, John E. Boeing Co., Inc. 809-722-6942
Can Monroe, NC, ETRI, Inc. 704-289-5423

Local Distributors

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CA Alhambra, Fisher-Brownell 818-289-0255
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CA San Diego, Acacia Sls., Inc. 619-565-4365
CA San Diego, Fisher Brownell 619-560-8545
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CT Orange, Milgray Elctrns. 203-795-0711
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FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
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GA Atlanta, Milgray Elctrns. 404-393-9666
IL Addison, L-Comp 312-628-1400
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IL Elk Grove Village, RM Elctrns. 312-364-6622
IL Itasca, Voyager Elctrns. 312-773-4900
IL Palatine, OHM Elctrns. 312-359-5500
IN Indianapolis, Advent Elctrns. 317-872-4910
IN Indianapolis, RM Elctrns. 317-291-7110
KS Overland Park, Milgray Elctrns. 913-236-8800
KS Wichita, L-Comp 316-265-5100
MD Gaithersburgh, MS Elctrns. 301-921-0200
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MA Wilmington, R C Comps. Inc. 617-273-1860
MI Grand Rapids, RM Elctrns. 616-531-9300
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MN Minneapolis, Industrial Comps. 612-831-2666
MN Minneapolis, Stark Elctrns. 612-332-1325
MO Kansas City, L-Comp 816-221-2400
MO Maryland Heights, L-Comp 314-291-6200
NH Hudson, C & H Elctrns. 603-882-1133
NJ Marlton, Milgray Elctrns. 609-983-5010
NY Bohemia, Key Comps. 516-567-7500
NY Buffalo, Summit Distrs. 716-884-3450
NY Farmingdale, Milgray Elctrns. 516-420-9800
NY Pittsford, Milgray Elctrns. 716-385-9330
NY Rochester, Summit Elctrns. 716-334-8110
NC Charlotte, Electronic Mktg. Corp. 714-394-6195
NC Greensboro, Hammond Elctrns. 919-275-6391
OH Cleveland, Alpha Distrs. 216-526-3716
OH Cleveland, Milgray Elctrns. 216-447-1520
OH Columbus, Electronic Mktg. Corp. 614-299-4161
OH Dayton, Electronic Mktg. Corp. 513-439-4711
OH Highland Heights, Electronic Mktg. Corp. 216-442-3441
OK Tulsa, Norvell Elctrns. 918-663-1247
OR Beaverton, Acacia Sls., Inc. 503-646-3377
PA Allentown, P.A. Peters 215-434-5237
PA Montgomeryville, Pyttronics Inds. 215-643-2850
SC Greenville, Hammond Elctrns. 803-233-4121
TX Austin, Norvell Elctrns. 512-458-8106
TX Dallas, Milgray Elctrns. 214-248-1603
TX Dallas, Norvell Elctrns. 214-233-0020
TX Houston, Force Elctrns. of TX 713-561-8644
TX Houston, Norvell Elctrns. 713-777-1666
TX Irving, Force Elctrns. of TX 214-438-5700
TX Richardson, Components Ctr. 214-644-3444
TX Richardson, Fisher-Brownell 214-235-3177
UT Salt Lake City, Bell Indus. 801-972-6969
VA Charlottesville, Virginia Radio & Supp. 804-296-4184
WI Milwaukee, Indl. Elctrns. 414-276-1212
WI New Berlin, RM Elctrns. 414-784-4420
Can Markham, Ont., International Rectifier 416-475-1897
Can Vancouver B.C., Intek Elctrns. 604-324-6831

E-TRONICS, 16774 Schoenborn, Sepulveda, CA 91343, Tel: 213-892-7279; Empl.: 28

EUBANKS ENGRG., 1307 So. Myrtle Ave., Monrovia, CA 91016, Tel: 818-357-7011, Telex: 675403; Empl.: 90; *Sls. Mgr.:* J. Reed

EVANS & SUTHERLAND COMPUTER CORP., P.O. Box 8700, 580 Arapeen Dr., Salt Lake City, UT 84108, Tel: 801-582-5847, Telex: 389492, TWX: 910-925-5818; Empl.: 850; *Sls. Mgr.:* William Elstun

EVANS ELECTRONICS, Box 5055, Berkeley, CA 94705, Tel: 415-653-3083

EVAPORATED COATINGS, P.O. Box 160, Huntingdon Valley, PA 19006, Tel: 215-947-1465; Empl.: 24; *Sls. Mgr.:* Stephen L. Schaffer

EVENTIDE, INC., One Alsan Way, Little Ferry, NJ 07643, Tel: 201-641-1200, TWX: 710-991-8715; Empl.: 38; *Sls. Mgr.:* Michele Natter; *Dist. Mgr.:* Michele Natter

EVEREADY-ENERGIZER, See Union Carbide Battery Prods. Div.

EVEREST INTERSCIENCE, INC., P.O. Box 345, Tustin, CA 92681, Tel: 714-992-4461, 714-730-0747, Telex: 295368 EVER OR; Empl.: 11; *Sls. Mgr.:* Steve A. Giffin

Local Sales Offices & Reps

AL Huntsville, Newcomb Assocs. 205-837-3233
CA Gardena, Instrument Lab. 213-327-3282
CO Littleton, Radco Elctrns. 303-794-4279
IL Decatur, Mueller Sls. 217-442-6379
IA Cedar Rapids, Mueller Sls. 319-365-1196
LA Baton Rouge, Allesco 504-928-1571
MN Golden Valley, Mueller Sls. 612-544-8888
NE Omahab 402-571-3033
NY Buffalo, Seelbach & Schmitt Inc. 716-839-2300
OH Cincinnati, Pro-Con Analytical 513-272-3300
OR Portland, Fairman B. Lee Co. 503-283-9442
PA Havertown, Shelby Jones Co. 215-446-6600
TX Dallas, Allesco 817-261-3966

TX Houston, Allesco 713-771-0115
WA Seattle, Fairman B. Lee Co.
WI Brookfield, Mueller Sls. 414-781-5310

EVERETT/CHARLES AUTOMATION SYS. INC., 6101 Cherry Ave., Fontana, CA 92335, Tel: 714-899-2411, TWX: 4720716; *Sls. Mgr.:* Jim Meadville

EVERETT/CHARLES CONTACT PRODS. INC., 700 E. Harrison Ave., Pomona, CA 91767, Tel: 714-625-5551, Telex: 67-55-78, TWX: 910-581-1210; Empl.: 100; *Sls. Mgr.:* Bud Fabian

EVERETT/CHARLES TEST EQUIP. INC., 2887 N. Towne Ave., Pomona, CA 91767, Tel: 714-621-9511, TWX: 910-581-3838; Empl.: 200; *Sls. Mgr.:* Jim Malloy

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EV-GAME INC., See EVG, Inc.

EVI, INC., 8970 F Route 108, Columbia, MD 21045, Tel: 301-964-1660; Empl.: 4 ..... **D•1639**

EWALD INSTRS., Rte. 7R, Kent, CT 06757, Tel: 203-927-3278

EWC, INC., 725 Federal Ave., Kenilworth, NJ 07033, Tel: 201-245-3200, 800-526-4048, TWX: 710-996-5993; FSC No.: 15387;MIL-T-27D; Empl.: 210; *Sls. Mgr.:* C. G. Hiotis; *Dist. Mgr.:* C. G. Hiotis ..... **A•2136-2148**

Local Sales Offices & Reps

AZ Mesa, Cummings & Assoc. 602-994-9027
CA Canoga Park, Cummings & Assocs. ... 818-340-6035
CA Santa Clara, Cummings & Assocs. 408-247-8656
CO Denver, Cummings & Assocs., Mktg. Inc. 303-455-6860
CT Ridgefield, Phoenix Sales 203-438-9644
FL Apopka, Tech-Rep Assoc. 813-577-2779
FL Greenacres City, Tech-Rep. Assoc. ... 813-577-2779
FL St. Petersberg, Tech-Rep. Assoc. 813-577-2779
FL Winter Park, Tech-Rep Assoc. 813-577-2779
IL Pallatine, T-Squared Assoc. 312-991-2144
IN Fort Wayne, Giesting & Assoc. 219-486-1912
IA Cedar Rapids, Lorenz Sales 319-377-4666
KS Overland Park, Lorenz Sales 913-649-5556
MI Coloma, Geisting & Assoc. 616-468-4200
MI Farmington Hills, Giesting & Assoc. ... 313-478-8106
MN St. Paul, Proud Inds. 612-646-9428
NE Lincoln, Lorenz Sales 402-475-4660
NJ E. Brunswick, Winch Assoc. 201-828-4615
NY Cortland, Net Sales 607-756-6592
NY Roslyn Heights, Winch Assoc. 516-621-6378
NY Troy, Net Sls. Co. 518-274-4758
NY Webster, Net Sales 716-467-4538
OH Cincinnati, Giesting & Assoc. 513-385-1105
OH Cleveland, Giesting & Assoc. 216-261-9705
OH Dayton, Giesting & Assoc. 513-433-5832
OR Portland, DHS Sales 503-285-9790
PA Bensalem, Stemler Assoc. 215-638-4850
PA Greensberg, Pro-Mark 412-832-3800
RI Worwick, Cal-Greg Comps. 401-738-6170
RI Worwick, Monette Eng. & Assoc. 401-885-2205
TX Irving, Impaq Sales 214-257-3677
UT Salt Lake City, Cummings & Assocs., Mktg. Inc. 801-263-8131
VA Reston, Stinson Assoc. 703-471-0723, 703-620-0088
VA Troutville, Stinson Assoc. 703-992-5459
Can Montreal, Solid State Engrg. 514-481-3313

Local Distributors

CA Mountain View, Abacus Elctrns. 415-961-1500
CA San Diego, Park-West Inc. 619-277-8433
CA Woodland Hills, C & A Elctrns. 213-340-6036
CT Norwalk, Park Dist. 203-853-2010
FL West Palm Beach, Nurmi Elctrn. Supp. 305-686-8553
IL Arlington Heights, Reptron Elctrns. 312-593-7070
MD Baltimore, Whitney Dist. 301-944-8080
OR Portland, Dunn Elctrns. 503-285-0214
OR Portland, Radar Elec. 503-233-3691
PA McKean, Advocom Elctrns. 814-476-7774
WA Seattle, Radar Elec. 206-282-2511

EXACT ELECTRONICS, Div. of Dynatech Nevada Inc., Box 1925, 2000 Arrowhead Dr., Carson City, NV 89701, Tel: 702-883-3400, 800-648-7952, Telex: 170054; FSC No.: 34511; Empl.: 60; *Sls. Mgr.:* Joe Foster

EXAR CORP., P. O. Box 62229, 750 Palomar Ave., Sunnyvale, CA 94086, Tel: 408-732-7970, TWX: 910-339-9233; Empl.: 550; *Dist. Mgr.:* Jack Hanoka ..... **A•1668-1669**

Local Sales Offices & Reps

AZ Scottsdale, Summit Sls. 602-998-4850
CA Los Angeles, Landa/Minyard, Inc. 213-879-0770
CA San Diego, Harvey Kinc 619-566-5252
CA Santa Clara, Criterion Sls. 408-988-6300
CO Golden, Candal, Inc. 303-233-0155
CT Ridgefield, Phoenix Sls 203-438-9644
FL Orlando, Donato & Assocs. 305-352-0727
GA Tucker, Rep Inc. 404-938-4358
IL Des Plaines, Janus, Inc. 312-298-9330
MD Baltimore, Comp. Sls. 301-484-3647
MA Westwood, Mass Tech Sales 617-329-8820
MN Minneapolis, Dan'l Engrg. 612-854-7550
MO St. Louis, KKB & Co. 314-647-2400
NM Albuquerque, Syntech 505-266-7951
NY Buffalo, Quality Comps. 716-837-5430
NY Great Neck, Trionic Assocs. 516-466-2300
NC Raleigh, Zucker Assocs. 919-782-8433
OH Columbus, McFadden Sls. 614-459-1280
OR Tigard, Comps. West 503-684-1671
TN Jefferson City, Rep Inc. 615-475-4105
TX Carrollton, Technical Mktg. 214-387-3601
WA Redmond, Comps. West 206-885-5880
WI Milwaukee, Janus, Inc. 414-476-9104

Local Distributors

AL Huntsville, Pioneer Elctrns. 205-837-9300
CA Anaheim, Zeus Comps. 714-632-6880
CA Irvine, IEC/Jaco 714-660-1055
CA Sunnyvale, Bell Indus. 408-734-8570
CA Tustin, A.V.E.D. 213-770-0871
CT East Haven, J.V. Elctrns. 203-469-2321
FL Clearwater, Future Elctns. 813-596-8295
GA Comming, Pan American 404-577-2144
IL Arlington Hgts., Reptron 312-593-7070
IN Indianapolis, Graham Elctrns. 317-634-8202
IA Cedar Rapids, Deeco 319-377-5795
MA Norwood, Gerber Elctrns. 617-329-2400
MI Grand Rapids, R.M. Elctrns. 616-531-9300
MN Minneapolis, Merit Elctrns. 612-546-5583
NJ Berlin, GCI 609-768-6767
NY Melville, Diplomat Elctrns. 516-454-6400
OH Columbus, Reptron Elctrns. 614-436-6675
OK Tulsa, Quality Comps. 918-664-8812
OR Beaverton, Western Microtechnology 503-641-9312
PA Philadelphia, Almo Elctrns. 215-698-4000
TX Dallas, Act/ Diplomat Elctrns. 214-980-1818
WA Seattle, Radar Elec. Co., Inc. 206-282-2511
WI Berlin, RM Elctrns., Inc. 414-784-4420
Can Pt. Claire, Que., Future Elctrns. 514-694-7710

EXATRON AUTOMATIC TEST EQUIP., 3513 Ryder St., Santa Clara, CA 95051, Tel: 408-737-7111, 800-EXA-TRON, Telex: 172-090; Empl.: 14; *Sls. Mgr.:* Kathryn Henderson

Local Sales Offices & Reps

AL Huntsville, Pen-Tech Assocs. 205-881-9298
AZ Phoenix, Zeus Elctrns. 602-263-6022
CA Covina, Romar Intl. 213-332-8548
CA Sunnyvale, C.C.L.M. 408-578-6119
CO Denver, Zeus Elctrns. 303-321-4246
FL Casselberry, Pen Tech Assocs. 305-678-6809
FL Deerfield Beach, Pen Tech Assocs. ... 305-421-4989
GA Marietta, Pen Tech Assocs. 404-424-1931
IL Chicago, Solid St. Elctrns. of IL 312-889-8033
MA Tyngsboro, J. R. Sls. 617-649-3449
MN Edina, P.E.C./Levi 612-944-8540
NJ Vincentown, JRM Elctrns. 609-859-2106
NM Albuquerque, Zeus Elctrns. 505-842-6633
NC Greensboro, Pen Tech Assocs. 919-852-6000
OH Hudson, Technical Sls. 216-656-3978
OR Beaverton, Northwest Test & Meas. 503-646-9966
TX Dallas, Elctrn. Prod. Spec. 214-985-1932
UT Salt Lake City, Zeus Elctrns. 801-534-0500
WA Redmond, Northwest Test & Meas. ... 206-881-8857
Can Burlington, Ont., Arbell, Inc. 416-632-9494

EXCELLON AUTOMATION, 24215 Garnier St., Torrance, CA 90505, Tel: 213-325-8000, Telex: 67-4562; Empl.: 570; *Sls. Mgr.:* R. Schreuders

EXCEL PRODS., 401 Joyce Kilmer Ave., New Brunswick, NJ 08903, Tel: 201-249-6600, TWX: 710-480-6255; Empl.: 360; *Sls. Mgr.:* Jack Luch; *Dist. Mgr.:* Jack Luch

EXCEL SPECIALTY CORP., 6335 N. Broadway, Chicago, IL 60660, Tel: 312-262-4781; Empl.: 50

EXCEL TECHNOLOGY INTL. CORP., 4-5 Stryker La., Hillsborough Indl. Pk., Belle Mead, NJ 08502, Tel: 201-874-4747, TWX: 910-333-9588; *Sls. Mgr.:* Michi Chen ..... **B•1050-1052**

Local Sales Offices & Reps

CA Marina Del Ray, Electro-Optical Mktg. 213-822-0702
CA San Diego, Uni-Rep 619-746-5131
CA San Jose, Cerco 408-298-1918
FL Coral Springs, HAI Elctrns. 305-752-7520
GA Norcross, Mountain Electro Prods., Inc. 404-469-0603
IL Westchester, W. G. Brouillette & Assocs., Inc. 312-345-6500
MO Independence, Engrg. Svcs. Co. 816-254-3600
MO St. Louis, Engrg. Svcs. Co. 314-997-1515
NJ E. Brunswick, Kong Sys. 201-390-8523
NM Azcapotzaico, Dicopel 561-32-11
OR Portland, Frank Jackson, Assoc. 503-292-2638
TX Dallas, Southwest Elctrn. Inds. 214-690-9881
TX Houston, Dunkel Elctrn. Assocs. 713-729-1670

EXERGETIC SYS., INC., 1499 Franklin St., Oakland, CA 94612, Tel: 415-763-3460; *Sls. Mgr.:* R. W. Beckwith

EXIDE CORP., 101 Gibraltar Rd., Horsham, PA 19044, Tel: 215-674-9500, TWX: 215-725-7397; Empl.: 2200

EXIDE ELCTRNS., P.O. Box 58189, Raleigh, NC 27658, Tel: 919-872-3020, TWX: 510-928-0598; FSC No.: 31795; Empl.: 900; *Sls. Mgr.:* Richard King

EXPRESS TEST CORP., 239 Commercial Street, Sunnyvale, CA 94086, Tel: 408-732-9999, Telex: 4942091; *Sls. Mgr.:* Frank S. Gavin

EXTECH INTERNATIONAL CORP., 150 Bear Hill Rd., Waltham, MA 02154, Tel: 617-890-7440, Telex: 940913; *Sls. Mgr.:* Neal DeWitt

EYRING RESEARCH INST., INC., 1455 W. 820 N., Provo, UT 84601, Tel: 801-375-2434, TWX: 882000; FSC No.: 801-374-8339; Empl.: 350

E-Z-HOOK, Div. Tektest Inc., Box 450 - 225 N. Second Ave., Arcadia, CA 91006, Tel: 818-446-6175, TWX: 910-582-1614; FSC No.: 08505; Empl.: 23; *Sls. Mgr.:* C. Haskin; *Dist. Mgr.:* P. Wood

FABRICAST, 2517 Seaman Ave., P.O. Box 3176, S. El Monte, CA 91733, Tel: 818-443-3247; FSC No.: 13345; Empl.: 8 ..... **B•1154-1159**

FABRI-TEK CIRCUITS, INC., Circuits Division, 1560 Tenth Ave., Baldwin, WI 54002, Tel: 715-684-3381

Refer to CTS Corp., Elkhart, IN, for sales offices and representatives and for distributor listings.

FAB-TEK INC., 68 Morgan Ave., Danbury, CT 06810, Tel: 203-743-3312; Empl.: 5

FACET ENTERPRISES, INC., Elmira, NY 14903, Tel: 607-737-8011, Telex: 93-2490, TWX: 510-252-1594; Empl.: 400; *Sls. Mgr.:* Gary Packard

FACIT, INC., 9 Executive Park Dr., Merrimack, NH 03054, Tel: 603-424-8000

FAIRCHILD CAMERA & INSTR. CORP., 464 Ellis St., 20-2271, Mountain View, CA 94042, Tel: 415-962-5011, Telex: CORPHQ. MVAC; Empl.: 16,000; *Sls. Mgr.:* David Miller

FAIRCHILD CAMERA & INSTR. CORP., Digital Div., 333 Western Avenue, So. Portland, ME 04106, Tel: 207-775-8700, Telex: 710-221-1980; *Sls. Mgr.:* Dan Bongatti; *Dist. Mgr.:* Brigid O'Rourke

FAIRCHILD CAMERA & INSTR. CORP., Linear Div., 313 Fairchild Dr., Mountain View, CA 94139, Tel: 415-962-4011, Telex: MVLD

FAIRCHILD CAMERA & INSTR. CORP., Memory & High Speed Logic Div., P. O. Box 5000, Puyallup, WA 98373, Tel: 206-841-6000, TWX: 310-449-4425; *Sls. Mgr.:* Jim Brye

FAIRCHILD MICROCONTROLLER DIV., Fairchild Camera & Instr. Corp., 450 National Ave., Mountain View, CA 94042, Tel: 415-962-3838, TWX: 910-379-5091

FACTRON/SCHLUMBERGER, Titusville, 1400 White Dr., Titusville, FL 32780, Tel: 305-267-7212, TWX: 510-950-3043; Empl.: 103; *Sls. Mgr.:* Becki Rubin

FAIRCHILD WESTON, DATA RECORDERS, P.O. Box 3041, Sarasota, FL 33578, Tel: 813-371-0811, Telex: 4991610, TWX: 810-864-0406; FSC No.: GS-00K-8301-S0078; Empl.: 750; *Sls. Mgr.:* Steve Hoff ..... **D•1228**

Local Sales Offices & Reps

AZ	Mesa, Vic Myers Assocs.	602-897-7378
CA	Cupertino, Fairchild Weston	408-257-1813
CA	Laguna Hills, Elotek Sys.	714-830-4856
CA	Westlake, Fairchild Weston	213-889-1057
CO	Fort Collins, Vic Myers Assocs.	303-223-8907
CT	Higganum, Intersell	203-528-5357
FL	Fort Walton Beach, RAM-Z Assocs.	904-862-2700
FL	Maitland, Wade H. Boggs	305-647-2226
ID	Rathdrum, Hood Engrg. Sls., Inc.	208-772-7235
IL	Des Plaines, Marsland Assocs.	312-298-2620
IN	Indianapolis, Marsland Assocs.	317-293-5437
IA	Cedar Rapids, Marsland Assocs.	319-396-8030
MD	Silver Spring, Sel-Tronics	301-589-3391
MA	Burlington, Intersell	617-273-3844
MI	Madison Heights, WKM Assocs.	313-588-2300
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Lovis, Marsland Assocs.	314-991-1399
NJ	Cedar Grove, KLS Assocs.	201-785-4450
NM	Albuquerque, Vic Myers Assocs.	505-884-6878
NY	Rochester, Scientific Dvcs. NY	716-334-2445
OH	Dayton, WKM Assocs.	513-434-7500
OH	Independence, WKM Assocs.	216-524-5930
PA	Devon, Fairchild Weston	215-687-3220
TX	Conroe, Fairchild Weston	713-539-1315
WA	Bellevue, D.P.M., Inc.	206-747-3309
WI	New Berlin, Marsland Assocs.	414-786-6611

FAIRCHILD WESTON, See Weston Controls, Div. Fairchild

FAIRCHILD - WESTON - TELEMETRY, P.O. Box 3041, Sarasota, FL 33578, Tel: 813-377-5566, Telex: 052-890, TWX: 810-864-0406; FSC No.: 06141; Empl.: 825; *Sls. Mgr.:* Wyatt Bishop

FAIR-RITE PRODS., PO Box J, Wallkill, NY 12589, Tel: 914-895-2055, TWX: 510-249-4819; FSC No.: 34899; Empl.: 200 + ; *Sls. Mgr.:* B. G. Tolen

Local Sales Offices & Reps

AL	Huntsville, Macro-Mktg. Assocs.	205-883-9630
CA	Anaheim, Micrometals	714-630-7420
CA	Sunnyvale, Schwerin & Merrill Assocs.	408-735-7900
CO	Aurora, A-G Elctrns.	303-690-0964
CT	W. Hartford, R. S. Pettigrew & Assocs.	203-236-5891
FL	New Smyrna Beach, J. Wetzel	904-423-5707
IL	Marshall, Fair-Rite Prods.	618-584-2944
IN	Indianapolis, Frank J. Campisano Co.	317-253-7651
MI	Southfield, J. L. Montgomery Assocs.	313-358-2616
MN	Bloomington, Holmes & Ladky Assocs. of Minn.	612-884-2125
NY	Hempstead, Kahgan Sls.	516-538-2300
OH	Cincinnati, F. J. Campisano & Assocs.	513-574-7111
OR	Portland, Freed Assocs.	503-289-5320
PA	Easton, Kendon Co.	215-253-3100
TX	Dallas, S.E.I., Inc.	214-690-9881
VA	Front Royal, Eltron Sls., Ltd.	703-635-7201
VA	Roanoke, A. B. Kreger & Co.	703-989-4738
WI	Milwaukee, Frank W. Ladky Assocs.	414-351-2112

FANCORT INDUSTRIES, INC., 31 Fairfield Place, W. Caldwell, NJ 07006, Tel: 201-575-0610; Empl.: 10; *Sls. Mgr.:* Ron Corey; *Dist. Mgr.:* Ron Corey

F & M SYSTEMS CO., See Texas Controls

FAN-S CORP., 7158 Industrial Pk. Blvd., Mentor, OH 44060, Tel: 216-951-3300, Telex: 985319; Empl.: 75; *Sls. Mgr.:* John Hallums; *Dist. Mgr.:* William Forkins

FARADAY ELECTRONICS, 743 Pastoria, Sunnyvale, CA 94086, Tel: 408-749-1900, Telex: 706738; Empl.: 41; *Sls. Mgr.:* Lou Panetta

FARIA, THOMAS G., CORP., P.O. Box 0983, Uncasville, CT 06382, Tel: 203-848-9271; Empl.: 225; *Sls. Mgr.:* A. Knupp

FARINON DIV., Harris Corp., 1691 Bayport, San Carlos, CA 94070, Tel: 415-594-3000, Telex: 34-8491; *Sls. Mgr.:* Jan Graaf

FARRAND CONTROLS, Div. of Farrand Industries, Inc., 99 Wall St., Valhalla, NY 10595, Tel: 914-RO1-2600, Telex: 646-640; Empl.: 120; *Sls. Mgr.:* George A. Quinn; *Dist. Mgr.:* George A. Quinn ...**B•1796**

FASCO INDUSTRIES, INC., Div. of Hawker Siddeley Grp. Plc., 601 North Federal Highway, Boca Raton, FL 33432, Tel: 305-368-0600, Telex: 51-5612; *Sls. Mgr.:* O. J. Binnette; *Dist. Mgr.:* Paul R. Reid

FASTEX, 195 Algonquin Rd., Des Plaines, IL 60016, Tel: 312-299-2222, TWX: 910-233-2786; FSC No.: 02768

FAST FEEDBACK TECHNOLOGIES, 1505 Aviation Blvd., Redoudo Beach, CA 90278, Tel: 213-379-6100; Empl.: 4; *Sls. Mgr.:* M. Lacas

FCM PLASTICS, Plastics Technologies Inc., 2555 Oak Industrial Dr. NE, Grand Rapids, MI 49505, Tel: 616-451-4502, TWX: 810-273-6038; *Sls. Mgr.:* Patrick K. Parsons

F-DYNE ELCTRNS., 449 Howard Ave., Bridgeport, CT 06605, Tel: 203-367-6431, TWX: 710-453-0087; Empl.: 175; *Sls. Mgr.:* Robert Furst

FEDERAL PACIFIC, Reliance Electric, P. O. Box 99502, Cleveland, OH 44199, Tel: 800-245-4501, in OH 800-245-4497

FEEDBACK, 620 Springfield Ave., Berkeley Hghts., NJ 07922, Tel: 201-464-5181; Empl.: 28; *Sls. Mgr.:* M. J. Lawson

FEMA ELCTRNS. CORP., 12-6 Edgeboro Rd., E. Brunswick, NJ 08816, Tel: 201-238-1223, Telex: 299425 FEMA UR; Empl.: 10 to 20; *Sls. Mgr.:* Bob Cheng

FEMCO, INC., P.O. Box 26710 Parkmoor Sta., San Jose, CA 95159, Tel: 408-946-1188, Telex: 17-1618, TWX: 910-338-2290

FENWAL, INC., 400 Main St., Ashland, MA 01721, Tel: 617-881-2000; Empl.: 1000; *Sls. Mgr.:* John W. Rice

FENWAL ELCTRNS., 63 Fountain St., Framingham, MA 01701, Tel: 617-872-8841, Telex: 299550; Empl.: 500; *Sls. Mgr.:* W. M. Minnucci; *Dist. Mgr.:* Chester Tricca ..... **B•1751**

Local Sales Offices & Reps

AL	Huntsville, Conley & Assocs., Inc.	205-882-0316
AZ	Phoenix, Dorton Entprs., Inc.	602-944-2957
CA	Cupertino, Codella Mktg. Grp., Inc.	408-257-2561
CA	Los Angeles, Landa/Minyard, Inc.	213-879-0770
CO	Denver, Elcom, Inc.	303-337-2300
CT	Southington, Andrews Airtronics, Inc.	203-621-6158
FL	Deerfield Beach, Conley & Assocs., Inc.	305-421-7180
FL	Oviedo, Conley & Assocs., Inc.	305-365-3283
FL	Tampa, Conley & Assocs., Inc.	813-885-7658
GA	Doraville, Conley & Assocs., Inc.	404-447-6992
IL	Chicago, Century Elctrns. Corp.	312-777-9700
IN	Noblesville, Century Elctrns. Corp.	317-849-2026
IA	Cedar Rapids, Palatine Engrg. & Sls., Inc.	319-365-8071
KS	Mission, Palatine Engrg. & Sls., Inc.	913-831-0555
MD	Woodbine, Naudain Assoc. So., Inc.	301-442-2270
MA	Danvers, Andrews Airtronics, Inc.	617-246-2450
MI	Ferndale, Hilltronics, Inc.	313-398-5556
MN	So. St. Paul, Northport Engrg., Inc.	612-457-8000
MO	Hazelwood, Palatine Engrg. & Sls., Inc.	314-839-0800
NY	Huntington, CDB Entprs.	516-692-5200
NY	Kingston, R. P. Kennedy Co., Inc.	914-876-2700
NY	Rochester, R. P. Kennedy Co., Inc.	716-271-6322
NY	Rochester, R. P. Kennedy Co., Inc.	716-271-1910
NC	Raleigh, Conley & Assocs., Inc.	919-876-9862
OH	Cleveland, Arthur H. Baier Co.	216-461-6161
OH	Dayton, Arthur H. Baier Co.	513-276-4128
OR	Portland, Jas. J. Backer Co.	503-297-8744
OR	Salem, Jas. J. Backer Co.	503-362-0717
PA	Pittsburgh, Covert & Newman Co.	412-531-2002
PA	Wynnewood, Metz-Benham Assoc., Inc.	215-896-7300
TX	Austin, W. Pat Fralia Co. & Assoc., Inc.	512-835-7911
TX	Bedford, W. Pat Fralia Co. & Assoc., Inc.	817-267-3577
TX	Houston, W. Pat Fralia Co. & Assoc., Inc.	713-772-1572
UT	Salt Lake City, Elcom, Inc.	801-485-7415
WA	Seattle, Jas. J. Backer Co.	206-285-1300
WI	Milwaukee, Century Elctrns. Corp.	414-645-3680
EXP	MA, Framingham, Fenwal Elctrns.	617-872-8841

Local Distributors

CA	Burlingame, Rose Elctrn. Distr.	408-263-9700
CA	Chatsworth, Mil-Comm Distr.	213-998-3111
CO	Denver, Newark-Denver Elctrn. Supp.	303-757-3351
CO	Englewood, Indl. Elctrns. Corp.	303-694-9444
FL	Ft. Lauderdale, Newark Elctrns.	305-587-2372
GA	Norcross, Newark Elctrns.	404-321-0413
IL	Chicago, Newark Elctrns. Corp.	312-638-4411
IN	Indianapolis, Graham Elctrns. Supp.	317-634-8202
MD	Beltsville, Newark Elctrns.	301-937-5085
MA	Woburn, Newark Elctrns.	617-935-8350
MI	Grand Rapids, Newark Elctrns.	616-241-6681
MI	Oak Park, Newark Elctrns.	313-967-0600
MN	Minneapolis, Stark Elec.	612-332-1325
NJ	Springfield, Newark Elctrns.	201-376-9500
NY	Buffalo, Summit Dists.	716-887-2800
NY	Huntington, CDB Dev. Corp.	516-692-5200
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Warrensville Heights, Newark Elctrns.	216-587-1700
OK	Tulsa, Radio, Inc.	918-587-9123
PA	Wynnewood, Metz-Benham Assoc., Inc.	215-896-7300
TX	Fort Worth, Patco Supply	817-429-8596
UT	Salt Lake City, Standard Supp.	801-486-3371

FERNO-SALESMAKER, Ferno-Washington, Inc., 70 Well Way, Wilmington, OH 45177, Tel: 513-382-1451, Telex: 214282; Empl.: 300; *Sls. Mgr.:* Gary Hiles

FERRANTI ELEC., 87 Modula Ave., Commack, NY 11725, Tel: 516-543-0200, TWX: 510-226-1490; *Sls. Mgr.:* Mike Kennett

FERRETEC INC., 1701A Fortune Dr., San Jose, CA 95131, Tel: 408-263-1216, TWX: 910-338-2353; *Sls. Mgr.:* Allen E. Rosenzweig

Local Sales Offices & Reps

AZ	Mesa, P.C.L. Elctrns.	602-892-9329
CA	San Jose, MCH Assocs.	408-246-7330
CA	Torrance, DeTomasi & Grupp Inc.	213-327-1775
FL	Mebourne Beach, Millett Assocs.	305-725-5055
IL	Wauconda, Cudahy Sls. Co.	312-526-2484
MD	Severna Park, Delmarva Engrg. Assocs.	301-647-8007
MA	Chelmsford, BBC	617-452-7211
MO	Leasburg, EIR Co.	314-245-6860
NY	Great Neck, Phase Four Inc.	516-482-1790
NY	Utica, B. D. Hummel Co.	315-736-7821
PA	Elkins Park, Snow Assocs.	215-379-4700
TX	Dallas, Tritex Technical Sls., Inc.	214-247-3041

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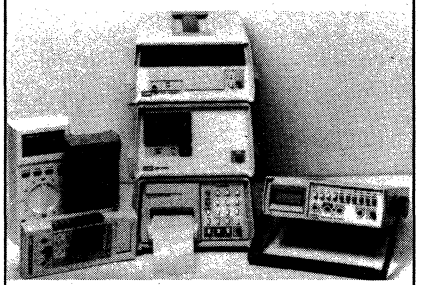

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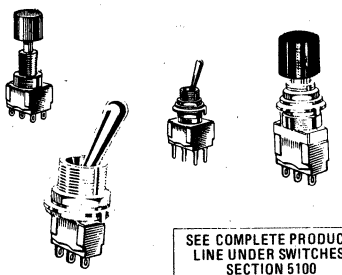

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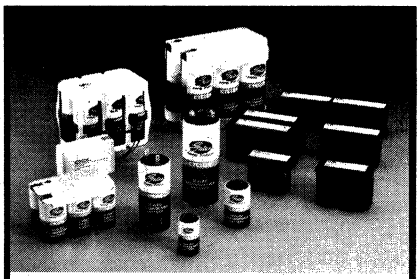

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- Cells rated at 2V in 2.5Ah, 5Ah, 12.5Ah and 25Ah. Monoblocs rated at 4V & 6V in 2.5Ah and 5Ah. All offer a wealth of configurations.

Gates Energy Products

P.O. Box 5887
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Denver, CO 80217 U.S.A.
303/744-4806
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Local Sales Offices & Reps

CA	San Gabriel, R. G. Moye Co.	213-283-1669
CO	Denver, Nelson Co.	303-573-1516
CT	Marlborough, Precision Sls.	203-295-0580
GA	Smyrna, B-C. Elctrn. Sls.	404-436-5169
MD	Baltimore, B. White & Co.	301-484-5400
NY	Pittsford, Noeth-Honsinger Assoc.	716-586-9002
NY	White Plains, QED Elctrns.	914-946-3424
OH	Cleveland, Scott Elctrns.	216-473-5050
OH	Trotwood, I. Atkind & Assoc.	513-837-4750
PA	King of Prussia, Freedman-Malta Assoc.	215-337-9211
EXP	NY, Plainview, Morhan Exp.	516-293-5582

FTS • FREQUENCY AND TIME SYSTEMS, INC.

FREQUENCY AND TIME SYSTEMS, INC., DATUM, INC., 34 Tozer Rd., Beverly, MA 01915, Tel: 617-927-8220, Telex: 94-0518 FTS BVLY; FSC No.: 56219; Empl.: 126; *Sls. Mgr.:* Richard Kelley **A• 1364 -1365; D• 1230**

Local Sales Offices & Reps

AL	Huntsville, Lee Assocs.	205-533-5896
AZ	Tempe, Mar Tech Assocs., Inc.	602-968-4944
CA	Anaheim, Datum Timing	714-533-6333
CA	Santa Clara, Ward-Davis Assocs.	408-245-3700
FL	Coral Springs, Electrocraft	305-753-8666
FL	Largo, Electrocraft	813-530-4749
FL	Winter Park, Electrocraft	305-628-4705
IL	Park Ridge, Electronic Instr. Assocs.	312-298-2290
IN	Indianapolis, Electronic Instr. Assocs.	317-257-7231
IA	Hiawatha, Gassner & Clark Co.	319-393-5763
MD	Burtonsville, Eastern Instrmn.	301-384-8500
MA	Lexington, Del-Con Sls.	617-862-1118
MN	Minneapolis, Electronic Instr. Assocs.	612-374-5628
NJ	Haddonfield, G. L. Williams Assocs.	609-428-6060
NY	Bayside, Robert Diamond, Inc.	718-423-7330
NY	Liverpool, R & D Assocs.	315-457-0100
NC	Burlington, P.J. Nahser Co., Inc.	919-226-8053
OH	Centerville, Micro Sls. Corp.	513-433-8171
TX	Houston, Lear Assocs., Inc.	713-488-7893
TX	Richardson, Lear Assocs., Inc.	214-231-5388
WA	Kirkland, Manon Engrg.	206-827-7449
Can	St. Laurent, Que., RF Microwave, Ltd.	514-335-2335

FREQUENCY CONTROL PRODS., INC., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377, Tel: 212-458-5811, TWX: 710-582-2637; FSC No.: 59559;03040; *Sls. Mgr.:* Sanford Cohen - Crystals, Ed Cohen - Oscillators Servo, John Murray - Electro Optic

FREQUENCY DEVICES™

FREQUENCY DEVICES, INC., 25 Locust St., Haverhill, MA 01830, Tel: 617-374-0761, TWX: 710-347-0314; Empl.: 60; *Sls. Mgr.:* Warren Munroe **A•1609; D•1231**

Local Sales Offices & Reps

AL	Huntsville, Lee Assocs. Mid-South, Inc.	205-533-5896
CA	San Jose, Texel North	408-272-6836
CA	Seal Beach, Texel	213-596-9411
IL	Palatine, Kingston Comps., Inc.	312-359-7990
MA	Holbrook, McLellan Assocs.	617-767-4771
NJ	East Brunswick, Winch Sls. Assocs.	201-828-4615
NY	Roslyn Heights, Winch Sls. Assocs.	516-621-6376
TX	Houston, TCI Elctrns.	713-774-5019
Can	Don Mills, Ontario, R. D. Assocs.	416-444-0959

FREQUENCY ELCTRNS., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, Tel: 516-794-4500, TWX: 510-223-0418; Empl.: 350; *Sls. Mgr.:* A. Lazar **A•1366-1367**

Local Sales Offices & Reps

CA	Mountainview, Disman-Baker	415-969-3010
FL	Orlando, Truex Assoc.	305-859-2160
MD	Hunt Valley, Marktron	301-628-1111
MD	Rockville, Marktron	301-251-8990
MA	Cochituate, High-Tech Sls.	617-653-3838
NJ	East Windsor, Micro Lambda	609-443-3113
NJ	W. Orange, E-F Techn. Sls.	201-731-7203
NY	Huntington Sta., E-F Techn. Sls.	516-549-1818
OH	Cleveland, Tiby Co.	216-371-5335
TX	Houston, Spectra Sls. Corp.	713-783-8333
TX	Richardson, Spectra Sls. Corp.	214-234-3600
VA	Charlottesville, Marktron	804-973-5874
EXP	NY, New York, Henley Elctrns.	212-986-5544

FREQUENCY SELECTIVE NETWORKS, INC., 69-20 Garfield Ave., Woodside, NY 11377, Tel: 718-424-7500; FSC No.: 56662; Empl.: 30; *Sls. Mgr.:* Michael L. Izzolo **A•1369**

Local Sales Offices & Reps

FL	Ft. Lauderdale, Donato Assoc.	305-733-3450
MN	Bloomington, 2M Sls.	612-888-7414
NY	Huntington, Carnes Assocs.	516-694-1600
OH	Dayton, Aschbacher Assocs.	513-252-7785

FREQUENCY SOURCES, KSW Semiconductor Div., 16 Maple Rd., Chelmsford, MA 01824, Tel: 617-256-8101, TWX: 710-343-0404; FSC No.: 50101; Empl.: 80

FREQUENCY WEST, INC., 3140 Alfred St., Santa Clara, CA 95054, Tel: 408-727-8500, TWX: 910-338-0163; FSC No.: 8F150; Empl.: 158; *Sls. Mgr.:* James K. McGuinness

FRESNEL OPTICS, Div. of Alliance Tool Corp., 1300 Mt. Read Blvd., Rochester, NY 14606, Tel: 716-647-1140, Telex: 97-8322; *Sls. Mgr.:* Helmut Walter

FRONT PANEL DEVICES, INC., 530 Burnside Ave., Inwood, NY 11696, Tel: 212-471-9800, Telex: 645-580; Empl.: 20; *Sls. Mgr.:* Michael Geller

FSI/FORK STANDARDS INC., 666 Western Ave., Lombard, IL 60148, Tel: 312-231-3511, 312-932-9380; FSC No.: 14986; Empl.: 20; *Sls. Mgr.:* A. E. Toht; *Dist. Mgr.:* A. E. Toht

FTS SYS., POB 158, Stone Ridge, NY 12484, Tel: 800-824-0400, TWX: 510-247-0547; Empl.: 100; *Sls. Mgr.:* T. N. Thompson, Jr.

FUJI-SVEA, P.O. Box 3375, Torrance, CA 90510, Tel: 213-533-1221, Telex: 182-392

FUJITSU

FUJITSU AMERICA, INC., 918 Sherwood Dr., Lake Bluff, IL 60044, Tel: 312-295-2610, Telex: 206196, TWX: 910-651-2259; Empl.: 40 **B•1349-1368; C•1104, 1195-1224**

Local Sales Offices & Reps

AZ	Phoenix, Sanford Sls.	602-957-3570
CA	San Diego, Earle Assocs., Inc.	619-278-5441
CA	San Jose, Applied Elctrn. Mktg.	408-971-9377
CA	Thousand Oaks, SC Cubed	805-496-7307
CA	Tustin, SC Cubed	714-731-9206
CO	Denver, Donohue Sls.	303-455-1719
FL	Altamonte Springs, 'C' Assocs.	305-831-1717
FL	Pompano Beach, 'C' Assocs.	305-972-9200
IA	Cedar Rapids, R. W. Kunz & Assocs.	319-396-5386
GA	Lawrenceville, Tek-Rep Mktg.	404-963-1600
IL	Elk Grove Vl., John G. Twist	312-593-0200
IL	Highland Park, Bransky Sls.	312-433-2375
KS	Prairie Village, R. W. Kunz & Assocs., Inc.	913-648-3535
ME	E. Sabago, Electrical Comps. Inc.	207-787-3145
MD	Baltimore, Component Sls., Inc.	301-484-3647
MA	Fall River, Elec. Comps.	617-674-0064
MA	Longmeadow, Elec. Comps.	413-567-0153
MA	Natick, Elec. Comps.	617-655-2225
MI	Warren, DEM Elctrn. Sls.	313-575-9444
MN	Bloomington, John G. Twist	612-835-2120
MO	St. Louis, R. W. Kunz & Assocs., Inc.	314-966-4977
NJ	Bellmawr, TAI Corp.	609-933-2600
NJ	Parlin, JMR Sls.	201-254-8484
NY	E. Setauket, JMR Sls.	516-689-8871
NY	E. Syracuse, Nycom, Inc.	315-437-8343
NC	Charlotte, Robert W. Chapman Co.	704-525-2421
NC	Greensboro, Robert W. Chapman	919-275-0003
NC	Raleigh, Robert W. Chapman	919-782-2624
OH	Columbus, McFadden Sls.	614-459-1280
OR	Aloha, Whisler Sls. Co.	503-649-9078
PA	Greensburg, Pro-Mark	412-832-3800
TX	Garland, Savarese & Assocs.	214-475-8360
UT	Bountiful, Anderson Assocs.	801-292-8991
VA	Richmond, Component Sls., Inc.	804-741-4072
WA	Bellevue, Whisler Sls. Co.	206-643-1463
WI	Brookfield, John G. Twist	414-782-2670
WI	Cedarburg, Bransky Sls.	414-377-6837
Can	Concord, Ont., Votran Elctrns., Inc.	416-669-9870, 416-661-5190

Local Distributors

CA	Brisbane, Automated Process Controls	415-467-6162
CA	Buena Park, Control Design Supp.	714-521-5040
CA	San Carlos, Control Design Supp.	415-592-4808
CA	San Jose, Cypress Elctrns.	408-945-8400
CA	Santa Ana, Pacesetter Elctrns.	714-557-7131, 213-233-5800
CA	Santa Monica, Distr. Specialists	213-393-9666
CA	Torrance, Cypress Elctrns.	213-533-6005, 714-761-3366
CO	Denver, CSID	303-292-9594
CO	Wheat Ridge, Cypress Elctrns.	303-431-2622
CT	Orange, Milgray Elctrns.	203-795-0711
FL	Altamonte Springs, Control Design Supp.	305-788-3220
FL	Lakeland, A-A Elec.	813-665-6941
FL	Winter Park, Milgray Elctrns.	305-647-5747
GA	Atlanta, Milgray Elctrns.	404-393-9666
GA	Atlanta, Prehler Elctrns., Inc.	404-447-5540
GA	Stone Mountain, Control Design Supp.	404-979-3500
IL	Addison, L Comp.	312-628-1400
IL	Bensenville, Milgray Elctrns., Inc.	312-350-0490
IL	Carol Stream, Lectro Comps.	312-690-0520
IL	Chicago, Prehler Elctrns., Inc.	312-384-6100
IL	Genoa, Control Design Supp.	815-784-6519
IL	Northbrook, Classic Comp. Supp.	312-272-9650
IL	Wheeling, Hawk Elctrns.	312-459-4030
IN	Indianapolis, Classic Comps. Supp., Inc.	317-872-4777
IN	Indianapolis, Control Design Supp.	317-788-0551
IA	Cedar Rapids, Bergquist	910-525-1335
IA	Marian, Control Design Supply, Inc.	319-373-2923
KS	Wichita, L Comp.	316-265-5100
ME	Gray, Longhill Electro-Tech	207-657-2183
MD	Rockville, Milgray Elctrns.	301-468-6400
MA	Burlington, Milgray Elctrns.	617-272-6800
MA	Burlington, Q.P.L. Elctrns.	617-947-2424
MA	Middleboro, Glynn Electronics	617-947-4262
MA	Natick, Tec-Con Elctrns.	617-655-9333
MA	Somerville, Electro Sls.	617-666-0500
MI	Farmington Hills, Prehler Elctrns., Inc.	313-473-7200
MN	Burnsville, Custom Connections	612-894-4090
MN	Minneapolis, Bergquist	612-835-2322
MN	Minneapolis, Control Design Supp.	612-721-1628
MO	Kansas City, L Comp.	816-221-2400
MO	Maryland Heights, L Comp.	314-291-6200
MO	St. Louis, Control Design Supp.	314-426-3160
MO	St. Louis, Interstate Industrial Elctrns.	314-423-4322

NE Omaha, Radio Equip. 402-341-7700
NJ Marlton, Milgray Elctrns. 609-983-5010
NJ Nutley, Vantage Comps. 201-667-1840
NY Buffalo, Summit Distrs., Inc. 716-887-2800
NY Farmingdale, Milgray Elctrns. 516-420-9800
NY Farmingdale, Pride Elctrns. 516-293-4020
NY Pittsford, Milgray Elctrns. 716-385-9330
NC Charlotte, Control Design Supp. 704-588-4410
NC Raleigh, Prehler Elctrns., Inc. 919-876-9111
OH Cleveland, Milgray Elctrns. 216-447-1520
OH Middleburg Heights, Prehler Elctrns., Inc. 216-243-5510
OH Solon, Repco 216-248-8900
OK Tulsa, Altair Co. 918-252-5781
PA Harrisburg, Cumberland Elctrns. 717-232-5999
PA Malvern, Control Design Supp. 215-296-0150
PA McKean, Advacom, Inc. 814-476-7774
TX Austin, Altair Co. 512-837-4490
TX Dallas, Control Design Supp. 214-358-1441
TX Dallas, Cypress Elctrns. 214-869-1435
TX Dallas, Milgray Elctrns. 214-248-1603
TX Houston, Altair Co. 713-462-3029
TX Richardson, Altair Co. 214-231-5166
UT Salt Lake City, ACT/Diplomat 801-486-4134
WA Bellevue, Integrated Elctrns., Inc. 206-455-2727
WI Milwaukee, Indl. Elctrns. 414-276-1212
WI New Berlin, Classic Comp. Supp. 414-786-5300
WI New Berlin, Control Design Supp. 414-784-1016
WI New Berlin, NEP Elctrns. 414-785-9100
WI Racine, Badger Elctrn. Parts Co. 414-637-1256

FURMAN SOUND, INC., 30 Rich St., Greenbrae, CA 94904, Tel: 415-927-1225, Telex: 172029 SPXSRFL; *Sls. Mgr.:* Diane Poole; *Dist. Mgr.:* Diane Poole

FURNAS ELEC., 1197 McKee St., Batavia, IL 60510, Tel: 312-879-6000, Telex: 72-0458; Empl.: 1360; *Sls. Mgr.:* T. W. Thornton; *Dist. Mgr.:* R. Lanser

FUSECOM, 14864 NE 95th St., Redmond, WA 98052, Tel: 206-881-2442; *Sls. Mgr.:* Bruce Barndt

Distributor

FUSES UNLIMITED, 9300 Mason Av., Chatsworth, CA 91311, Tel: 818-882-1515 ..... **B•1234**

FUSION INC., 4658 E. 355th. St., Willoughby, OH 44094, Tel: 216-946-3300, Telex: 98-0445; Empl.: 85; *Sls. Mgr.:* Raymond C. Yuhasz

GABRIEL ELCTRNS., Box 70, Scarborough Indl. Pk., Scarborough, ME 04074, Tel: 207-883-5161, Telex: 95-0113; Empl.: 135; *Sls. Mgr.:* D. B. Crisman

GALILEO ELECTRO-OPTICS CORP., Galileo Pk., Sturbridge, MA 01518, Tel: 617-347-9191, TWX: 710-347-1190; FSC No.: 28719; Empl.: 330; *Sls. Mgr.:* L. P. Thompson

GALITE, 2 Tower Dr., Wallingford, CT 06492, Tel: 203-265-7126, TWX: 710-476-0764; FSC No.: 56447; *Sls. Mgr.:* James W. Campbell, Jr.

GAMBLE, CHARLES T., INDS., 605 Perkins La., Delanco, NJ 08075, Tel: 609-461-1900; Empl.: 150; *Sls. Mgr.:* W. Snyder

GAMMA HIGH VOLTAGE RESCH. INC., 152 S. MacQuesten Pkwy., Mt. Vernon, NY 10550, Tel: 914-667-5050 ..... **D•1644-1645**

Local Sales Offices & Reps

IL Chicago, Ropek, Cahill & Vogt 312-631-0070
MD Timonium, Eastern Comps. 301-561-5811
NJ Nutley, Irwin Brill Sls. 201-667-0653
NM Albuquerque, Cleveland Entprs. 505-265-7893
NC Raleigh, Eastern Comps. 800-223-3850
PA W. Conshocken, Eastern Comps. 215-825-8610

GAMMA SCIENTIFIC INC., 3777 Ruffin Rd., San Diego, CA 92123, Tel: 619-279-8034, Telex: 69-7938; Empl.: 65; *Sls. Mgr.:* G.C. Unangst

GANDALF DATA, INC., 1019 S. Noel Ave., Wheeling, IL 60090, Tel: 312-541-6060, TWX: 910-651-4951; Empl.: 350; *Sls. Mgr.:* Ken Charbauski

GANDALF TECHNOLOGIES, INC., 350 E Dundee Rd., Suite 301, Wheeling, IL 60090, Tel: 312-459-6630, TWX: 910-651-4951

GAP INSTR., 40 Oser Ave., Hauppauge, NY 11787, Tel: 516-273-0909, TWX: 510-227-6237; FSC No.: 00607; Empl.: 50

GARDINER ELCTRNS., 4729 North 7th Ave., Phoenix, AZ 85013, Tel: 602-274-9681

GARDINER SOLDER CO., Div. of Gardiner Metal Co., 4820 S. Campbell Ave., Chicago, IL 60632, Tel: 312-847-0100, TWX: 910-221-2510; Empl.: 100; *Sls. Mgr.:* John A. Seyda ..... **C•1738**

Local Sales Offices & Reps

AZ Phoenix, Astro Prods. 602-268-2948
AZ Phoenix, Tooltronics, Inc. 602-257-0768
CA Glendale, Tooltronics, Inc. 818-240-4000
CA La Mirada, Gardiner Solder 714-994-6350
CA Santa Clara, Tooltronics, Inc. 408-496-6000
CO Littleton, West Mark Denver, Inc. 303-979-3720
FL Merritt Island, James A. Kennedy Assocs. 305-452-9821
GA Tucker, Electrical Concepts, Inc. 404-491-3154
IA Princeton, Johnson Mfg. 319-289-5123
MA Woburn, Yankee Tech Sls. 617-935-6278
MI East Detroit, Fred Harris & Assocs. ... 313-776-5430
MO St. Charles, Phillips & Assocs. 314-441-0148
NJ Norwood, Wilson Inds. 201-767-7060
NJ Scotch Plains, Gardiner Solder Co. ... 201-232-1965
NC Charlotte, Electro-Rep Assocs., Inc. ... 704-527-2530
OH Cleveland, Jim Finnegan & Co. 216-238-5905
PA Carnegie, Lloyd K. Lombardi 412-279-2017
TX Dallas, Elctrn. Production Specialists .. 214-422-5476
TX El Paso, Aztec Microelectronics 915-581-6130
WA Bellevue, Doland Co. 206-454-4952
PR Rio Tiedras, Electronic Sls. Assocs. ... 809-762-6459

Local Distributors

CA So. San Francisco, Electrical Specialty Co. 415-589-9611
AL Birmingham, E.I.S., Inc. 205-252-9046
AZ Phoenix, Elctrl. Specialty Co. 602-275-5736
CA Anaheim, Advance Electrical Sls., Inc. 714-870-0300
CA Anaheim, Elctrl. Specialty Co. 714-630-7050
CA Belmont, Advance Elctrl. Sls. 415-592-4550
CA Chino, Tracy Elctrns. 714-591-4736
CA Fawnskin, Pat Dooley 714-866-3413
CA Glendale, Mac Donald & Co. 818-241-1101
CA Lakeside, CASCO 619-560-9319
CA Los Angeles, Elctrl. Specialty Co. 213-724-9600
CA Los Angeles, John Cameron Supply Co. 213-870-7403
CA San Diego, Casco 619-560-9319
CA San Diego, Elctrl. Specialty Co. 619-560-1800
CA San Diego, Hi-Tech Metals Co. 619-270-8081
CA Santa Clara, RGB Electro Indl. Tool ... 408-980-1300
CA Simi Valley, Cal-Pacific Suppliers 213-998-4982
CO Denver, Advance Elctrl. Sls. 303-388-0923
CO Denver, Elctrl. Specialty Co. 303-321-0226
CO Denver, Integrated Elec. 303-292-6121
CT Wallingford, ASTECH 203-265-4241
FL Boca Raton, KIMCO 305-994-0590
FL Clearwater, Your Production Cupboard 813-447-2581
FL Orlando, E.I.S., Inc. 305-855-7100
FL Orlando, Mavidon Entprs. 305-298-7324
FL Palm Bay, Enstice Tool Grinding 305-734-2100
GA Atlanta, E.I.S., Inc. 404-355-1651
IL Addison, International Soldering Supplies 312-628-8083
IL Bensenville, MASTCO 312-595-0414
IL Chicago, Fay Elec. Wire Corp. 312-267-9222
IL Hillside, Complete-Reading Electric Co. 312-547-5400
IN Indianapolis, Complete-Reading Electric Co. 317-872-3710
IA Princeton, Johnson Mfg. Co. 319-289-5123
KS Louisburg, Ambrose Sls. Co. 913-541-8476
KY Louisville, E.I.S., Inc. 502-636-0384
LA New Orleans, Complete-Reading Elec. Co. 504-733-9435
MD Baltimore, Complete-Reading Elec. Co. 301-646-1330
MA Leominster, Elctrn. Tool Specialists ... 617-534-3324
MA Woburn, Pacer Elctrns. 617-935-8330
MI Warren, Complete-Reading Elec. Co. .. 313-755-6020
MN Edina, Complete-Reading Elec. Co. ... 612-831-8145
MN Minneapolis, W. D. Forbes Co., Inc. 612-378-1917
MN New Brighton, Chris Elctrns. 612-631-2647
MN St. Paul, Nordic Elctrns. 612-228-9027
MO Kansas City, Complete-Reading Elec. Co. 816-471-5966
MO Maryland Heights, Complete-Reading Elec. Co. 314-569-1611
MO St. Charles, Finnigan Wire & Cable 314-946-6201
NV Carson City, Gibson Tool Co. 702-883-3566
NH Manchester, E.P.E. Corp. 603-669-9181
NJ Livingston, Robert McKeown Co., Inc. 201-992-0700
NJ Stirling, Janel 201-647-5600
NY Fairport, Pacer Elctrns. 716-377-0462
NY Farmingdale, S.A.I. 516-293-2710
NY Liverpool, Complete-Reading Elec. Co. 315-457-1350
NY Sidney, Wingate & Assocs. 607-563-2113
NC Charlotte, E.I.S., Inc. 704-392-7366
NC Raleigh, E.I.S., Inc. 919-781-4750
OH Cincinnati, E.I.S., Inc. 513-771-4073
OH Cleveland, Complete-Reading Elec. Co. 216-827-8891
OH Mentor, Kimco 216-255-1992
OK Tulsa, Complete-Reading Elec. Co. ... 918-664-4000
OR Portland, Elctrl. Specialty Co. 503-227-3601
PA Pittsburgh, Complete-Reading Elec. Co. 412-788-1580
RI Warwick, Bayside Tech Inds. 401-737-5366
TN Memphis, E.I.S., Inc. 901-947-4176
TN Nashville, E.I.S., Inc. 612-883-0862
TX Beaumont, Complete-Reading Elec. Co. 713-842-2117
TX Dallas, Complete-Reading Elec. Co. ... 214-827-8891
TX El Paso, Elctrl. Specialty Co. 915-594-8251
TX Garland, Complete Reading Elec. Co. 214-840-6000
TX Houston, Complete-Reading Elec. Co. 713-691-0080
TX Houston, Fay Elec. Wire Corp. 713-923-2825
TX Plano, Fay Elec. Wire Corp. 214-422-2797
UT Salt Lake City, Electrical Specialty Co. 801-972-4184
VA Bluefield, Complete-Reading Elec. Co. 703-322-5424
VA Richmond, E.I.S., Inc. 804-649-9221
WA Kirkland, R G B Electro Indl. Tool 800-958-5811
WA Seattle, Advanced Elctrl. Sls., Inc. 206-575-4323
WA Tukwila, Electrical Specialty Co. 206-241-1010
WV Bluefield, E. I. S. 703-322-5424
WI Mequon, Complete-Reading Elec. Co. 414-241-3880
WI Oshkosh, Fay Elec. Wire Corp. 414-426-0792
EXP PR, Carolina, E. I. S. 809-757-6565
PR San Juan, Distributronics, Inc. 809-781-0631

GAR ENTERPRISES, 2029 N. Lincoln Ave., Pasadena, CA 91103, Tel: 818-798-0785; Empl.: 25

GARNER GLASS CO., 177 S. Indian Hill Blvd., Claremont, CA 91711, Tel: 714-624-5071; Empl.: 50; *Sls. Mgr.:* Joseph C. Hyatt

GARRY MFG. CO., DIV. OF BRAND-REX CO., 9 Queen Anne Ct., Laghorne, PA 19047, Tel: 215-949-2300; Empl.: 250; *Sls. Mgr.:* Tom Malek; *Dist. Mgr.:* Bob D'Autrachy

GASKET INTL. INC., 49 Ackerman St., Bloomfield, NJ 07003, Tel: 201-338-6814; Empl.: 5; *Sls. Mgr.:* Russell L. Steinman

GATES, GEO. W., & CO., INC., Hempstead Tpke. & Lucille Ave., Franklin Sq., NY 11010, Tel: 516-352-2904; Empl.: 10; *Sls. Mgr.:* T. E. Schulz, Jr

GATES DATA PRODUCTS, Gates Corporation, 2455 Executive Circle, Colorado Springs, CO 80906, Tel: 303-579-0330; *Sls. Mgr.:* Donald D. Stucker; *Dist. Mgr.:* Gregory D. Easton

GATES ENERGY PRODS., 1050 S. Broadway, Denver, CO 80217, Tel: 303-744-4806, Telex: 045-511, TWX: 910-931-2658; Empl.: 500; *Sls. Mgr.:* R. O. Hammel; *Dist. Mgr.:* M. R. Harrison

GATEWAY COMMUNICATIONS INC., 16782 Redhill Ave., Irvine, CA 92714, Tel: 714-261-0762; *Sls. Mgr.:* David S. McMaster

GAVITT WIRE & CABLE, Brookfield, MA 01506, Tel: 617-867-6476; Empl.: 75

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Can Markham, Ont., Avotronics, Ltd. 416-475-2024

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GENTEX, Box 315, Carbondale, PA 18407, Tel: 603-434-0311, Telex: 831-883; FSC No.: 97427; *Sls. Mgr.:* Ture Heline

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TX Fort Worth, Allied Elctrns. 817-336-5401
WI Milwaukee, Seaker Elctrns. 414-878-3727

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CT Guilford, Rosenbaum Elctrns. 203-453-5424
MN Minneapolis, Loren Green Assoc. 612-571-6666
NY Cooperstown, Lloyd Hart Assoc. 607-547-9333
NY Rochester, Lloyd Hart Assoc. 716-244-3253
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TX Richardson, Scientific Sls. Co. 214-231-6541

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GIC THERMODYNAMICS, 2611 Parmenter, Royal Oak, MI 48073, Tel: 313-280-1648, Telex: 23-5714; Empl.: 7

GIDDINGS & LEWIS ELCTRNS., A Unit of AMCA Intl., 666 S. Military Rd., P.O. Box 1658, Fond du Lac, WI 54935, Tel: 414-921-7100, Telex: 26-2722, TWX: 910-275-1100; Empl.: 200; *Sls. Mgr.:* Tom Bullock

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GLATZER INDUSTRY CORP., 15 River St., New Rochelle, NY 10801, Tel: 914-576-2700; Empl.: 15

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GLENMARC MFG., 330 Melvin Dr., Northbrook, IL 60062, Tel: 312-272-9030, Telex: 28-3499; Empl.: 13; *Sls. Mgr.:* David Greenwood

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GA Marietta, Adams & Assocs. 404-973-0853
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GORDON, L., PACKAGING, 1050 S. Paca St., Baltimore, MD 21230, Tel: 301-539-6537; Empl.: 150

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OR	Aloha, Micro Sls.	503-642-1818
WA	Bellevue, Micro Sls.	206-451-0568
WI	Milwaukee, Bill Swanson	414-543-2727

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AL	Huntsville, RM	205-852-1550
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AZ	Phoenix, Newark	602-957-0085
AZ	Tempe, Bell Inds.	602-966-7800
AZ	Tempe, Time	602-967-2000
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CA	Inglewood, Newark	213-671-7066
CA	Los Angeles, Elec. Switches	213-660-1310
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CA	San Diego, Elctrn. Supp.	619-693-8222
CA	Santa Clara, Manco	408-496-6611
CA	Sunnyvale, Time	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
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CO	Denver, Newark	303-757-3351
CO	Wheatridge, Bell Inds.	303-424-1985
CO	Wheatridge, Hannah Hill	303-424-0108
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7130
FL	Ft. Lauderdale, Newark	305-587-2372
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FL	Ft. Lauderdale, Power Comps.	305-565-1614
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GA	Norcross, Newark	404-448-1300
GA	Norcross, Pioneer	404-448-1711
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IL	Elk Grove Village, Pioneer	312-437-9680
IL	Genoa, Control Design	815-784-6515
IL	Lombard, RM	312-364-6622
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IN	Indianapolis, Control Design	317-788-4559
IN	Indianapolis, Pioneer	317-849-7300
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MA	Woburn, Time	617-935-8080
MI	Grand Rapids, RM Elctrns.	616-531-9300
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MO	St. Louis, L Comp	314-291-6200
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NJ	East Rutherford, A. A. Elec.	201-777-5477
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NM	Albuquerque, Elctrn. Dvcs.	505-884-2950
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NC	Pineville, Control Design	704-588-4410
NC	Shelby, Dixie Indl. Supply	704-482-5641
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PA	King of Prussia, Time Elctrns.	215-337-0900
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TX	Dallas, Pioneer	214-386-7300
TX	Dallas, RM Elctrns.	214-263-8361
TX	Garland, Newark	214-494-5911
TX	Houston, Newark	713-782-4800
TX	Houston, Pioneer	713-988-5555
TX	Richardson, JACO	214-235-9575
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UT	Salt Lake City, Bell Inds.	801-972-6969
VA	Chester, Virginia Control Equip. Co.	804-796-3001
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WA	Bellevue, IEC	206-455-2727
WA	Bellevue, Newark	206-641-9800
WA	Kirtland, Cascade Data Mktg.	206-747-6190
WI	Milwaukee, Indl. Elctrns.	414-276-1212
WI	New Berlin, Control Design	414-784-1015
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Can	Vancouver, L. A. Varah	604-873-3211
Can	Winnepeg, L. A. Varah	204-633-6190

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CT	Orange, R. F. Duffy Assocs.	203-795-3678
MA	Braintree, R. F. Duffy Assocs.	617-848-3550
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NY	Pittsford, Noeth-Honsinger	716-586-9002
NC	Peachland, D.P. McDonald	704-272-8474
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CA	Redondo Beach, Ward/Davis Assocs., Inc.	213-643-6977
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CA	Santa Clara, Ward/Davis Assocs.	408-245-3700
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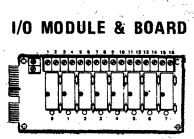

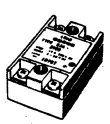

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GOULD INC., Programmable Control Div., Box 83, S.V.S., Andover, MA 01810, Tel: 617-475-4700, Telex: 947-402, TWX: 710-347-6610; *Sls. Mgr.:* George Dannecker; *Dist. Mgr.:* Richard Bell

GOULD INC., Recording Systems Div., 3631 Perkins Ave., Cleveland, OH 44114, Tel: 216-361-3315, Telex: 196113GLD RS UT; FSC No.: 96795; Empl.: 550; *Sls. Mgr.:* David Friggle ..... **D•1400, 1404**

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CA Cerritos, Gould Inc., Recording Sys. Div. 213-404-1919
CA Hayward, Gould Inc., Recording Sys. Div. 415-782-0852
CO Englewood, Gould Inc., Recording Sys. Div. 303-781-4473
FL Altamonte Springs, Gould Inc., Recording Sys. Div. 305-830-0695
GA Atlanta, Gould Inc., Recording Sys. Div. 404-441-5556
HI Honolulu, Hawaiian Industrial Instr. 808-523-3676
IL Elk Grove Village, Gould Inc., Recording Sys. Div. 312-640-4135
IN Indianapolis, Gould Inc., Recording Sys. Div. 317-842-4484
MD Greenbelt, Gould Inc., Recording Sys. Div. 301-345-0050
MA Burlington, Gould Inc., Recording Sys. Div. 617-272-0750
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NC Greensboro, Gould Inc., Recording Sys. Div. 919-275-1978
OH Centerville, Gould Inc., Recording Sys. Div. 513-433-9586
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PA Malvern, Gould Inc., Recording Sys. Div. 215-647-2214
PA Pittsburgh, Gould Inc., Recording Sys. Div. 412-838-7700
TN Hermitage, Gould Inc., Recording Sys. Div. 615-754-7100
TX Dallas, Gould Inc., Recording Sys. Div. 214-634-2131
TX Houston, Gould Inc., Recording Sys. Div. 713-680-1121
VA Richmond, Gould Inc., Recording Sys. Div. 804-282-5533
WA Bellevue, Gould Inc., Recording Sys. Div. 206-453-2461

GOULD DATAMETRICS, See Datametrics Inc.

GOWANDA ELCTRNS., 1 Industrial Pl., Gowanda, NY 14070, Tel: 716-532-2234, TWX: 710-529-1211; FSC No.: 24226;15305; Empl.: 250; *Sls. Mgr.:* K. Strohmeyer ..... **A•1240**

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GA Atlanta, L & D, Inc. 404-455-3483
IL Chicago, W. F. Hamilton Co. 312-867-5030
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KS Overland Park, Barnes MidWest Sls. .. 913-341-9317
MD Baltimore, Mech-Elec. Sls. 301-342-1984
MA Reading, Lincoln Assocs. 617-944-9020
MI Southfield, Fred H. Gehrke & Assocs. 313-559-5363
MN Chanhassen, Barnes Sls. Assocs. 612-934-2907
NJ Medford, Mech Elec. Sls. 609-654-8209
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NY Kew Gardens, Robert Smith Assocs. .. 212-780-0097
NY New York, Robert Smith Assocs. 212-541-4885
NY Plainview, Robert Smith Assocs. 516-681-3155
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NC Raleigh, L & D, Inc. 919-876-5301
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VA Richmond, L & D, Inc. 804-359-0125
WA Olympia, Bergford & Assocs. 206-866-2001

GOW-MAC INSTR. CO., P.O. Box 32, Bound Brook, NJ 08805, Tel: 201-560-0600, Telex: 833-174; Empl.: 40; *Sls. Mgr.:* R. J. Mathieu

GRADO LABS., 4614 Seventh Ave., Brooklyn, NY 11220, Tel: 718-435-5340

GRALEX INDS., 295 Community Dr., Great Neck, NY 11021, Tel: 516-487-7289, 800-645-6535; FSC No.: 11332; Empl.: 15; *Sls. Mgr.:* Gene Belgard ..... **D•1354-1356**

GRA-MAR INC., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803, Tel: 305-894-3351, TWX: 810-850-0125; FSC No.: 58-12-31006-40

GRAND TRANSFORMERS, Box 188, Grand Haven, MI 49417, Tel: 616-842-5430; Empl.: 125; *Sls. Mgr.:* G. V. Retzlaff

GRANGER ASSOCS., 3101 Scott Blvd., Santa Clara, CA 95051, Tel: 408-727-3101, Telex: 34-8380; Empl.: 750; *Sls. Mgr.:* Rick Green

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GRANT HARDWARE CO., Div. of Grant Inds. Inc., 7 Hoover Ave, Haverstraw, NY 10927-1092, Tel: 914-EL8-4400, TWX: 914-358-3541; FSC No.: 83508; Empl.: 490; *Sls. Mgr.:* F. Centrillo

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MI Farmington, Carter, McCormic & Peirce 313-477-7700
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NJ Ridgefield, M - D Inds. 201-941-3113
NY Liverpool, Precision Sls. 315-451-3480
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OH Cincinnati, Tri State Mktg. 513-761-7993
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GRAPHTEC SERVICES, INC., 1600 N.W. Madrid Way, Boca Raton, FL 33432, Tel: 305-392-3373; Empl.: 12

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GRAYHILL INC., 569 Hillgrove Ave., La Grange, IL 60525, Tel: 312-354-1040, Telex: 6871375 GHLG UW, TWX: 910-683-1850; FSC No.: 5930; Empl.: 1000; *Sls. Mgr.:* Richard K. Neumann; *Dist. Mgr.:* Robert J. Ferrel
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FL	Deerfield Beach, Newell-Hynes	305-429-3207
GA	Tucker, Rep, Inc.	404-938-4358
IL	La Grange, Grayhill, Inc.	312-354-1040
IN	Ft. Wayne, Menze Sls.	219-747-5616
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
KS	Overland Park, PMR, Inc.	913-381-0004
KS	Wichita, PMR, Inc.	316-684-4141
MD	Gaithersburg, Naudain Assocs. Southern	301-258-5040
MA	Needham Hgts., Newscott Co.	617-444-1923
MI	Troy, C. B. Jensen & Assocs.	313-643-0506
MN	S. St. Paul, Northport Engrg.	612-457-8000
MO	St. Louis, PMR Corp.	314-569-1220
NJ	Marlton, Naudain Assocs.	609-983-5300
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Great Neck, Tylinski Assocs.	516-466-9070
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NC	Charlotte, R. W. Chapman & Co.	704-525-2421
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NC	Raleigh, R. W. Chapman	919-782-2624
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PA	Pittsburgh, Covert & Newman Co.	412-531-2002
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TX	Bedford, W. Pat Fralia Co.	817-267-3577
TX	Houston, W. Pat Fralia Co.	713-772-1572
UT	Salt Lake City, Lindberg Co.	801-467-1794
WA	Bellevue, Eltech, Inc.	206-643-4330
WI	Mequon, Badgerep	414-241-9200

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CA	Los Angeles, Electric Switches	213-660-1310
CA	Los Angeles, Richey/Western	213-820-3777
CA	Riverside, Electronic Supp.	714-683-7300
CA	San Diego, Fisher/Brownell	619-560-8545
CA	San Diego, Richey/Western Electrns.	619-271-4511
CA	San Jose, Powell Elctrns.	408-943-9020
CA	Santa Clara, Fisher/Brownell	408-988-6041
CA	Santa Clara, Richey/Western Electrns.	408-727-7411
CO	Denver, CSID, Inc.	303-292-9594
CO	Denver, Newark Elctrns.	303-757-3351
CO	Denver, Ragon Elctrns.	303-777-9430
CT	Bethel, Heilind Elctrns.	203-797-8600
CT	Wallingford, Midan Elctrns.	203-265-2077
CT	Wallingford, Sager	203-265-4600
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FL	Orlando, Hammond Elctrns.	305-849-6060
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GA	Norcross, A-A Elec.	404-449-8670
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IL	Elk Grove, GBL	312-593-3220
IL	Northbrook, Classic Comp. Supp.	312-272-9650
IL	Palatine, Ohm Elctrn.	312-359-5500
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IN	Evansville, Hutch & Son	812-425-7201
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IN	Indianapolis, Genesis Elctrns.	317-637-5571
IN	Indianapolis, Graham Elctrns.	317-634-8202
IA	Cedar Rapids, Deeco, Inc.	319-365-7551
KS	Wichita, LComp, Inc.	316-265-5100
MD	Baltimore, Resco	301-529-0500
MD	Columbia, Powell Elctrns.	301-621-4070
MD	Gaithersburg, Pioneer/Wash.	301-921-0660
MD	Kensington, Marine Air Supp.	301-949-9560
MA	Burlington, Heilind Elctrns.	617-272-5610
MA	Hingham, Sager Elctrns.	617-749-6700
MA	North Adams, Elctrn. Supp. Ctr.	413-663-6828
MA	Norwood, Gerber Elctrns.	617-329-2400
MA	Worcester, R M Elctrns.	617-791-7861
MI	Livonia, Pioneer Mich	313-525-1800
MI	Livonia, R.S. Elctrns.	313-525-1155
MI	Oak Park, Newark Detroit Elctrns.	313-967-0600
MI	St. Clair Shores, Spemco	313-771-2700
MN	Minneapolis, Newark Elec.	612-331-6350
MN	Minneapolis, Stark Elctrns.	612-332-1325
MN	St. Paul, Gopher Elctrns.	612-483-3322
MS	Jackson, Ellington Elctrn. Supp.	601-355-0561
MO	Kansas City, LComp, Inc.	816-221-2400
MO	Maryland Hgts., LComp, Inc.	314-291-6200
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NE	Lincoln, Scott Elctrns.	402-466-8221
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NJ	Englewood, Powell Elec.	201-894-8900
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NJ	Mt. Laurel, Jerseyswitch, Inc.	609-778-8190
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NY	Bohemia, Car-Lac Elctrns.	516-567-4200
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NY	Rome, Rome Elctrns.	315-337-5400
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NC	Greensboro, Hammond Elctrns.	919-275-6391
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OH	Cincinnati, URI Elctrns.	513-761-4030
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TX	El Paso, Intl. Elctrns.	915-598-3406
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TX	Stafford, Harrison Equip.	713-879-2600
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WI	Milwaukee, Marsh Elctrns.	414-475-6000

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GREGG ELEC., 608 W. Emporia, Ontario, CA 91761, Tel: 714-983-1794; FSC No.: 53014; Empl.: 8

GREIBACH INSTRS. DIV., 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717; FSC No.: 32590; Empl.: 35

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GRIES/DYNACAST, Div. Coats & Clark Inc., 162 Beechwood Ave., New Rochelle, NY 10801, Tel: 914-633-8600, TWX: 914-235-2188; Empl.: 600

GRIM CORPORATION, Box 67, Medford, NJ 08055, Tel: 609-267-7950, TWX: 510-683-9392; FSC No.: 21870; Empl.: 125; *Sls. Mgr.:* Eileen Muzina ..... **D•1051**

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GROVER PATENT PRODUCTS, 339 W. Arden Ave., Glendale, CA 91203, Tel: 213-245-4400; Empl.: 4

GRUENBERG OVEN CO., INC., P.O. Box 3246, 2121 Reach Rd., Williamsport, PA 17701, Tel: 717-326-1755, Telex: 350079; Empl.: 90; *Sls. Mgr.:* James Polk

GSE, 23640 Research Dr., Farmington Hills, MI 48024, Tel: 313-476-7875, Telex: 23-0738; Empl.: 105; *Sls. Mgr.:* Harold G. Munn

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GSI CORP., 1917 Greenspring Dr., Timonium, MD 21093, Tel: 301-252-1768, Telex: 292319 GSIC UR; FSC No.: 60990; Empl.: 28; *Sls. Mgr.:* R. A. Higgins ..... **C•1840**

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AL	Huntsville, Montgomery Mktg., Inc.	205-830-0498
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GA	Norcross, Montgomery Mktg., Inc.	404-447-6124
NC	Cary, Montgomery Mktg., Inc.	919-467-6319
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GTE CORP., Sylvania Emissive Prods./Process Heat, Portsmouth Ave., Exeter, NH 03833, Tel: 603-772-4331, TWX: 510-294-4471; Empl.: 200000

GTEK, INC., 307 Coleman Ave., Waveland, MS 39576, Tel: 601-467-8048, Telex: 315814; Empl.: 8; *Sls. Mgr.:* Bill Groves; *Dist. Mgr.:* Bill Groves

GTE METAL LAMINATES, 1704 Barnes St., Reidsville, NC 27320, Tel: 918-342-2381; Empl.: 260; *Sls. Mgr.:* J. W. Leone

GTE MICROCIRCUITS, 2000 W. 14th. St., Tempe, AZ 85281, Tel: 602-968-4431, TWX: 910-951-1383; FSC No.: 16766; Empl.: 432; *Sls. Mgr.:* David Thompson

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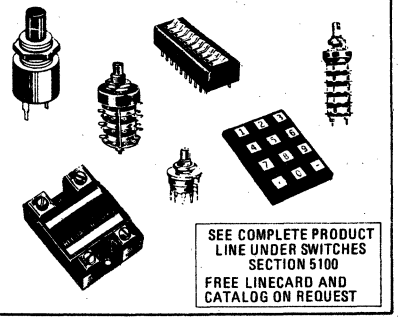
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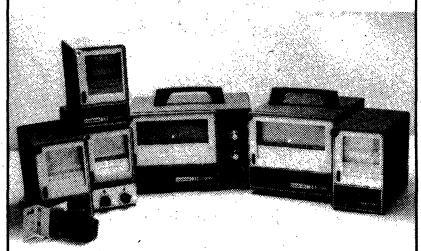

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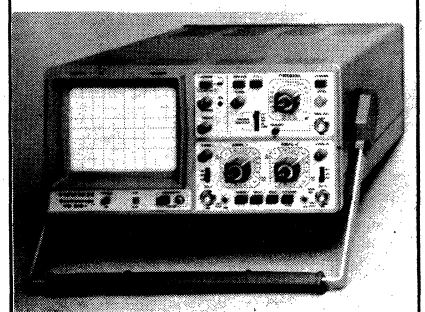

Model 203

GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116, Tel: 801-537-5237, TWX: 910-925-4081; Empl.: 500; *Sls. Mgr.:* J. E. Murphy

GTE SWITCHING & TELEPHONE PRODUCTS, 400 N. Wolf Rd., Northlake, IL 60164, Tel: 312-681-7100

GTE SYLVANIA, INC., CHEM. & METAL. DIV., See Sylvania Chemicals/Metals

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HANKSCRAFT MOTORS, Div. of Gerber Prods. Co., P.O. Box 120, Reedsburg, WI 53959, Tel: 608-524-4341; Empl.: 550

HANSCOM, H. F., CO., INC., 225 Chapman St., Providence, RI 02905, Tel: 401-941-1455, Telex: 952107; Empl.: 50; *Sls. Mgr.:* William E. Taplin

HAPCO, Box 1205, Boulder, CO 80302, Tel: 303-447-0441; Empl.: 8; *Sls. Mgr.:* Allen Lopez

HARBISON INDL. PRODS., Sub. of Polymer Corp., 7205 Hibbs La., Levittown, PA 19057, Tel: 215-943-9000; Empl.: 65

HARDIGG INDS., INC., North Main St., South Deerfield, MA 01373, Tel: 413-665-2163, Telex: 955431; FSC No.: 11214; *Dist. Mgr.:* Warren H. Bickford

HARDMAN INC., 600 Cortlandt St., Belleville, NJ 07109, Tel: 201-751-3000, TWX: 710-995-4940; Empl.: 105; *Sls. Mgr.:* Carl T. Sanford

HAROWE SERVO CONTROLS, Bowmar Inst. Corp., Westtown Rd. at West Chester Pike, W. Chester, PA 19380, Tel: 215-692-2700, Telex: 83-5486, TWX: 510-663-0335; FSC No.: 06989; Empl.: 329; *Sls. Mgr.:* Dennis B. Daisy/Chuck Burgess

HARREL, INC., 16 Fitch St., E. Norwalk, CT 06855, Tel: 203-866-2573; *Sls. Mgr.:* W. Becker ..... **D•1122**

Local Sales Offices & Reps

CA Sherman Oaks, Windsor Dynamics 213-990-4173
CA Walnut Creek, Viking Instr. 415-946-1226
NY Cazenovia, P. M. Decew, Inc. 315-655-8602
NC Pineville, Beck Sls. 704-542-9329
OH Medina, Odessa Instr. Co. 216-725-0575
PA Elkins Park, Edwin F. Gregg 215-635-0450
TN Knoxville, Robert Olsen Co. 615-688-4038

HARRIS CALORIFIC, Emerson Electric Co., 400 Clark St., Elyria, OH 44036, Tel: 216-961-5700; *Sls. Mgr.:* Phil Preuninger

HARRIS CIRCUITS MFG., 2706 Colley Ave., Norfolk, VA. 23517, Tel: 804-467-1116; Empl.: 15

HARRIS CORP., Computer Systems Div., 2101 W. Cypress Creek Rd., Ft. Lauderdale, FL 33309, Tel: 305-974-1700, TWX: 510-956-3096; FSC No.: 29436; Empl.: 1000; *Sls. Mgr.:* Frank P. Carollo

HARRIS CORP., Dracon Div., 809 Calle Plano, Camarillo, CA 93010, Tel: 805-987-9511, Telex: 182327; Empl.: 400; *Sls. Mgr.:* Tom Erdmann; *Dist. Mgr.:* Keith Boutillier

Local Sales Offices & Reps

CA Anaheim, Marlene Chase 714-921-1156
CA Cypress, Keith Boutillier 714-892-1439
CA Fremont, Dave Buechner 415-490-2816
CO Denver, Richard Jones 303-337-7779
FL Eustis, Jeff Hearsey 904-589-4412
IL Rantoul, Howard Darnell 217-897-6666
MO Lake Ozark, Gary Foster 314-365-5055
NJ Oak Ridge, J. B. Behan 201-697-5222

HARRIS CORP., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791, Tel: 516-364-0400, TWX: 510-222-4494; FSC No.: 77327; Empl.: 1,850; *Sls. Mgr.:* R. A. Lebowitz

HARRIS MICROWAVE SEMICONDUCTOR, 1530 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-262-2222, TWX: 910-338-2247

HARRIS SEMICONDUCTOR, Box 883, Melbourne, FL 32901, Tel: 305-724-7400, TWX: 510-959-6259; FSC No.: 34371; Empl.: 2300; *Sls. Mgr.:* Dan McCranie; *Dist. Mgr.:* Charles H. Beaty

HARSHAW FILTROL PARTNERSHIP, 1945 E. 97th St., Cleveland, OH 44106, Tel: 216-721-8300; *Sls. Mgr.:* Robert Anfang

HARTLEY PRODS., 620 Island Rd., Ramsey, NJ 07446, Tel: 201-327-4443; *Sls. Mgr.:* R. Schmetterer

HARTMAN SYSTEMS, Figgie Intl., 360 Wolf Hill Rd., Huntington Sta., NY 11746, Tel: 516-427-7500, TWX: 510-226-6982; FSC No.: 92220; Empl.: 310; *Sls. Mgr.:* Robert Griffith

HARTWELL CORP., 900 S. Richfield Rd., Placentia, CA 92670, Tel: 714-993-4200, Telex: 683-485, TWX: 910-596-1294; FSC No.: 83014; Empl.: 425

HARWIL, 1548 17th St., Santa Monica, CA 90404, Tel: 213-829-2310; Empl.: 8

HASCO COMPONENTS, INC., 247-40 Jericho Tpke., Bellrose Village, NY 11001, Tel: 516-328-9292, TWX: 710-582-5750; Empl.: 6; *Sls. Mgr.:* Tab Hauser ..... **B•1390-1396, 1589-1591**

HAVERLY SYSTEMS, INC., 78 Broadway, Denville, NJ 07834, Tel: 201-627-1424, Telex: 710-987-8402; Empl.: 33; *Sls. Mgr.:* Wm. Parkins

HAYDON SWITCH & INSTR., 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705, Tel: 203-756-7441, Telex: 643852 - HSIINTLWBY; FSC No.: 02005; Empl.: 350; *Sls. Mgr.:* Scott Moulton

HAZELTINE CORP., 500 Commack Rd., Commack, NY 11725, Tel: 516-462-5100, Telex: 64-0525, TWX: 510-226-0239; Empl.: 2,500

H-A-Z LABORATORIES, Brass Castle Rd., P.O. Box 67-M, Washington, NJ 07882, Tel: 201-689-0110; *Sls. Mgr.:* Henry Zajac

HBS EQUIPMENT DIV., 3000 Supply Ave., Los Angeles, CA 90040, Tel: 213-726-3033, TWX: 910-580-3179; Empl.: 40; *Sls. Mgr.:* K. Lowery

HDR POWER SYS., INC., 600 Oakland Park Ave., Columbus, OH 43214, Tel: 614-262-6832, Telex: 246524; Empl.: 41; *Sls. Mgr.:* Harlan W. Bates

HDS INC., 12310 Pinecrest Rd., Reston, VA 22091, Tel: 703-620-6200, Telex: 64585; Empl.: 65

HEADWAY RESCH., INC., 3713 Forest La., Garland, TX 75042, Tel: 214-272-5431, Telex: 73-0257; Empl.: 50; *Sls. Mgr.:* Mina Kelly

Local Sales Offices & Reps

CA Santa Clara, California Tech. Serv. 408-496-1156, 408-496-1157
CA Tarzana, California Tech. Serv. 818-343-3131
PA Haverford, Blason Ent., Inc. 609-767-6733

HEATH CO., Benton Harbor, MI 49022, Tel: 616-982-3886, Telex: 72-9421

HEAT SYSTEMS-ULTRASONICS, INC., 1938 New Hwy., Farmingdale, NY 11735, Tel: 516-694-9555, Telex: 14-3101; *Sls. Mgr.:* Irwin Leibson

HECON CORP., 31 Park Rd., Tinton Falls, NJ 07724, Tel: 201-542-9200, Telex: 13-2457; Empl.: 200; *Sls. Mgr.:* P. Shine; *Dist. Mgr.:* R. Drum

HEI CORPORATION, 290 S. Main Place, Carol Stream, IL 60188, Tel: 312-665-5500; Empl.: 8

HEI, INC., 1495 Steiger Lake La., Victoria, MN 55386, Tel: 612-443-2500, TWX: 910-578-3961; Empl.: 175; *Sls. Mgr.:* R. D. Young ..... **B•1211**

Local Sales Offices & Reps

AL Huntsville, REP, Inc. 205-881-9270
AZ Phoneix, Toward Engrg. 602-955-3193
CA Brea, MASCO 714-529-0866
CA Mountain View, Leddy Assocs. 415-969-6313
CA Vista, MASCO 619-758-5562
CO Denver, Ausco Sls. 303-750-3846
FL Coral Springs, CBC Elctrns. 305-755-1111
FL Longwood, CBC Elctrns. 305-831-5380
GA Tucker, REP, Inc. 404-938-4358
IL Schaumburg, Micro-Tex 312-885-1131
KS De Soto, Midtec Assocs. 913-441-6565
MI Grand Rapids, Miltimore Sls. 616-942-9721
MI Novi, Miltimore Sls. 313-349-0260
NH Salem, Sls. Engrg. 603-893-5521
NJ Pitman, Colrud Corp. 609-589-5866
NY Kingston, D. L. Eiss Assocs. 914-338-7588
NY Massapequa, Coughlin Assoc. 516-799-7743
NY Rochester, D. L. Eiss Assocs. 716-328-3000
NC Raleigh, REP, Inc. 919-851-3007
OH Rocky River, Norm Case Assocs. 216-333-0400
TN Jefferson City, REP, Inc. 615-475-9012
TX Austin, Quad State Mktg. 512-282-2046
TX Dallas, Quad State Mktg. 214-680-0411
VA Reston, Colrud Corp. South 703-620-6612
WA Bellevue, Comtec 206-453-1188
WI Waukesha, Micro-Tex 414-542-5352
Can Oakville, Ont., Haltronics, Ltd. 416-844-2121

HEINEMANN ELEC. CO., Brunswick Pike, Alt. Rte. #1, P.O.Box 6800, Lawrenceville, NJ 08648-0800, Tel: 609-882-4800, Telex: 843431; FSC No.: 74193; Empl.: 625; *Sls. Mgr.:* N. J. Alzamora ..... **B•1236-1237**

Local Sales Offices & Reps

AL	Birmingham, Austin Brown Assocs. Inc.	205-822-6198
AL	Mobile, Austin Brown Assocs., Inc.	205-344-0728
AZ	Phoenix, O'Donnell Assocs. SW	602-944-9542
CA	Chatsworth, Porter Co.	818-700-0808
CA	San Diego, Porter Co.	619-275-0641
CA	San Jose, O'Donnell Assocs. No.	408-263-6500
FL	Deerfield Beach, Conley & Assoc.	305-421-7180
FL	Oviedo, Conley & Assocs.	305-365-3283
FL	Tampa, Conley & Assocs.	813-885-7658
GA	Atlanta, Austin Brown Assocs. Inc.	404-457-6381
IL	Chicago, D. Dolin Sls.	312-498-6770
IN	Ft. Wayne, O.H. Bromberg & Assocs.	219-456-6010
KY	Louisville, O.H. Bromberg & Assocs.	502-245-8916
MD	Pikesville, Imagitron Sls. Co.	301-521-2020
MA	Framingham, Sullivan Tech. Sls.	617-620-0195
MI	Southfield, L. H. Dickelman Co.	313-353-8210
MN	Minneapolis, Furber Sls. Co., Inc.	612-881-3620
MO	Creve Coeur, Hill & Co.	314-432-1136
NJ	Ridgewood, Ballou, Inc.	201-444-6990
NY	Rochester, Canavan-Scanlon	716-424-1830
NY	Syracuse, Canavan-Scanlon	315-437-1271
NC	Charlotte, J. Rudisill Assocs.	704-377-6901
OH	Cincinnati, O.H. Bromberg & Assocs.	513-771-9333
OH	Cleveland, Brown Elect. Prod.	216-331-2072
OH	Dayton, KW Elctrn. Sls.	513-890-2150
OH	Dayton, O. H. Bromberg & Assocs.	513-434-8788
PA	Allison Park, KW Electrn. Sls.	412-487-4300
PA	Washington Crossing, DVS Co.	215-493-4642
TN	Brentwood, Austin Brown Assocs. Inc.	615-373-2068
TX	Dallas, Glidden Electro Equip.	214-341-0610
TX	Houston, Glidden Electro Equip.	713-681-1415
WA	Mercer Island, Andersen Assocs.	206-232-0484
WI	Elm Grove, Key Entpr.	414-784-3390

Local Distributors

AL	Montgomery, Southern Controls	205-277-5030
CA	Burlingame, Campbell & George	415-697-2965
CA	Chatsworth, POCO Sls.	818-700-8727
CA	San Jose, Cazco Sls.	408-263-6503
CO	Denver, CSID Inc.	303-292-9594
CT	Hartford, L. E. Whelan Co.	203-246-5694
CT	New Haven, Green Shaw Co.	203-397-0710
FL	Oviedo, Dixie Sls.	305-365-5211
IL	Chicago, Nedco Elctrns.	312-286-5565
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Northbrook, Classic Comps. Supp.	312-272-9650
IN	Indianapolis, Graham Elctrns.	317-634-8202
KS	Edwardville, C. Tennant & Sons	913-441-1801
MA	Boston, Apparatus Svc.	617-787-1300
MA	Newton, Green Shaw Co.	617-969-8900
MI	Southfield, Michigan Lectrols Corp.	313-353-1350
MN	Minneapolis, Northland Elec. Supp.	612-341-6100
NH	Hudson, C & H Elctrns.	603-882-1133
NY	Syracuse, Baldwin Hall	315-463-9251
NY	Whitestone, Power Electro Supp. Co.	212-767-1447
NC	Charlotte, Joyce Sls. Co.	704-377-1555
OH	Cincinnati, Cartessa Corp.	513-385-7700
OH	Dayton, Duellman Elec.	513-461-5010
OH	Dayton, Stotts Friedman Co.	513-298-5555
OH	Solon, REH Electrns.	216-248-1636
OH	Valley View, Newark Elctrns.	216-447-8860
OR	Portland, Taylor Elec.	503-233-5321
PA	Washington Crossing, Riverside Comps.	215-493-5228
PA	West Chester, West Chester Elec. & Electrn.	215-696-7500
TN	Chattanooga, Techni-Tronics	615-875-5449
TX	Dallas, Geeco Sls. Co.	214-341-2626
VA	Charlottesville, Va. Radio Supp. Co. Inc.	804-296-4184
VA	Richmond, General Elec. Supp.	804-358-4941

HEINEMANN ELECTRIC CO., P.O. Box 6800, Lawrenceville, NJ 08648-0800, Tel: 609-882-4800

HEITZ, KARL, INC., P.O. Box 427, Woodside, NY 11377, Tel: 718-565-0004; Empl.: 15

HELICAL PRODS. CO., INC., Box 1069, Santa Maria, CA 93456, Tel: 805-928-3851, TWX: 910-351-5856; FSC No.: 13201; Empl.: 55

HELIONETICS, INC., DECC Div., 17312 Eastman St., Irvine, CA 92714, Tel: 714-546-4731, 800-421-7915, TWX: 910-595-2829; *Sls. Mgr.:* R. S. Tullock

HELLESENS BATTERY ENGRG., INC., A/S Hellesens, 1636 Hyde Park Ave., Hyde Park, MA 02136, Tel: 617-361-7555, Telex: 294116 BOSTELEX; FSC No.: 617-361-1835; *Sls. Mgr.:* James Epstein

HELM INSTR. CO., INC., 1387 Dussel Drive, Maumee, OH 43537, Tel: 419-893-4356, Telex: 28-6078

HENES PRODS., 4301 E. Madison St., Phoenix, AZ 85034, Tel: 602-275-4126; Empl.: 25

HENSCHEL, General Signal Corp., 9 Hoyt Drive, P.O. Box 30, Newburyport, MA 01950, Tel: 617-462-2400, Telex: (RCA) 294074; FSC No.: 28199; Multiple; Empl.: 190

HERAEUS-VOLKERT INC., 222-34 96th Ave., Queens Village, NY 11429, Tel: 212-464-8400, Telex: 142338; Empl.: 250

HERBERT PRODS. INC., 180 Linden Ave., Westbury, NY 11590-0384, Tel: 516-334-6500, TWX: 510-222-5963; Empl.: 98; *Sls. Mgr.:* L. C. Peshkin

HERMETIC SEAL, 4232 Temple City Blvd., Rosemead, CA 91770, Tel: 818-283-0411, TWX: 910-587-3352; FSC No.: 04820; Empl.: 220

HERMETIC SWITCH, Box 1325, Hwy. 92, Chickasha, OK 73018, Tel: 405-224-4046, Telex: 796125 Hermetic CKSA; Empl.: 150; *Sls. Mgr.:* E. R. Andrus ..... **B•1592**

Local Sales Offices & Reps

CA	Arcadia, V. Gott & Assocs.	818-445-9728
CA	San Diego, V. Gott & Assocs.	612-272-8452
GA	Atlanta, Electro Technlg. Prods.	404-458-4427
MD	Timonium, Heller Sls.	301-252-4780
MA	Canton, New England Elctrn. Sls.	617-828-4835
MN	Minneapolis, Peterson Sls. & Assocs.	612-944-0030
NY	Oceanside, Current Inds.	516-678-3895
NY	Rochester, Electronic Mktg. Assocs.	716-427-8115
OR	Beaverton, LD Elctrns.	503-649-8556
PA	Furlong, Avenir	215-348-8290
TX	Austin, R. F. Kimball Co.	800-442-4506
TX	Houston, R. F. Kimball Co.	713-840-0590
TX	Richardson, R. F. Kimball Co.	214-231-3447
WA	Snohomish, LD Elctrns.	206-568-0511
WA	Spokane, LD Elctrns. (Boise, ID #)	208-343-2741

HERTNER DIV., 12690 Elmwood Ave., Cleveland, OH 44111, Tel: 216-252-4242, Telex: 98-5552; Empl.: 125; *Sls. Mgr.:* S. Steven

HERTZ FILTER, 3 Aerial Way, Syosset, NY 11791, Tel: 516-822-4770; Empl.: 22

HEURIKON CORPORATION, 3201 Latham Dr., Madison, WI 53713, Tel: 800-356-9602, 608-271-8700, Telex: 469532; Empl.: 80; *Sls. Mgr.:* Ed DeWitt ..... **D•1091**

Local Sales Offices & Reps

AL	Huntsville, Magaro & Assocs.	205-882-0827
AZ	Tempe, Mar Tech Assocs.	602-968-4944
CA	Concord, Qualtech	415-680-1800
CA	N. Hollywood, Qualtech	818-765-1419
CA	Orange, Qualtech	714-639-9820
CA	Palo Alto, Qualtech	415-494-9060
CA	San Diego, Mesa Engrg. & Sls.	619-278-8021
CA	Sunnyvale, Qualtech	408-732-4800
CO	Aurora, Par Assocs.	303-363-6636
CO	Denver, PAR Assocs.	303-371-4140
GA	Atlanta, Magaro & Assocs.	404-451-8862
IN	Indianapolis, CMP, Inc.	317-844-4175
KS	Kansas City, Panatek	913-362-3349
KS	Prairie Village, Panatek	913-362-3349
MD	Rockville, Spectro Assocs.	301-294-9770
MA	Brockton, Daner-Hayes, Inc.	617-538-0598
MA	Canton, Daner-Hayes, Inc.	617-828-1997
MA	Concord, Daner-Hayes, Inc.	617-828-1997
MA	Waltham, Daner-Hayes	617-894-7290
MA	Wayland, Daner-Hayes, Inc.	617-655-0888
MA	Weston, Daner-Hayes, Inc.	617-891-5548
MI	Detroit, CMP, Inc.	313-477-7700
MN	Minneapolis, Micro Resources Corp.	612-830-1454
NJ	Glen Gardner, Daner-Hayes, Inc.	201-537-4534
NJ	Scotch Plains, Daner-Hayes, Inc.	201-889-4515
NM	Albuquerque, Mar Tech Assocs.	505-821-2775
NY	Brewster, Daner-Hayes, Inc.	914-279-2168
NY	Rochester, Daner-Hayes, Inc.	716-288-0921
NC	Greensboro, Magaro & Assocs.	919-294-4783
OH	Cincinnati, Applied Data Mgmt.	513-579-8108
OH	Cleveland, CMP, Inc.	216-779-5100
OH	Dayton, CMP, Inc.	513-836-0951
OK	Stillwater, Acudata, Inc.	405-743-1886
PA	Doylestown, Daner-Hayes, Inc.	215-345-6056
PA	Pittsburgh, CMP, Inc.	412-372-4415
TX	Dallas, Acudate, Inc.	214-424-3567
TX	Houston, Acudata, Inc.	713-580-2451
TX	Plano, Acudata	214-424-3567
TX	Austin, Acudata, Inc.	512-478-1018
UT	Centerville, PAR Assocs.	801-292-8145
UT	Salt Lake City, Par Assocs.	801-537-1900
VT	White River Junction, Daner-Hayes, Inc.	802-295-5260
WI	Madison, Heurikon Corp.	608-271-8700
Intl	Japan, Tokyo, NPS, Inc.	Telex-781/27832
Intl	UK, Thame, Oxon, Thame Sys. Lt.	011-44-84-421-5471
Intl	W. Germany, Munchen, Tekelec Airtronic	011-49-89-59-4621
Can	Nepean, Ont., Multilek, Inc.	800-267-1070
Can	Ottawa, Multilek, Inc.	613-226-2365

HEWLETT-PACKARD CO., P.O. Box 301, 815 Southwest 14th St., Loveland, CO 80537, Tel: 303-667-5000

HEWLETT-PACKARD CO., 1820 Embarcadero Rd., Palo Alto, CA 94303, Tel: Call Local Sls. Off.; Empl.: 68,000 ..... **D•1653-1656**

Local Sales Offices & Reps

AL	Birmingham	205-881-6802
AL	Huntsville	205-830-2000
AZ	Phoenix	602-273-8000
AZ	Tucson	602-573-7400
CA	Brisbane	415-330-2500
CA	Fresno	209-252-9652
CA	Fullerton	714-999-6700
CA	Goleta	805-967-3405
CA	Lawndale	213-970-7500
CA	Los Angeles	213-643-7500
CA	Palo Alto	415-857-8000
CA	Sacramento	916-929-7222
CA	San Diego	714-279-3200
CA	San Ramon	415-838-5900
CA	Santa Ana	714-641-0977
CA	Santa Clara	408-988-7000
CA	Westlake Village	213-706-6800
CO	Englewood	303-649-5000
CT	Bridgeport	203-371-6454
CT	Wallingford	203-265-7801
FL	Ft. Lauderdale	305-973-2600
FL	Jacksonville	904-398-0663
FL	Orlando	305-859-2900
FL	Pensacola	904-476-8422
FL	Tampa	813-884-3282
GA	Atlanta	404-955-1500
HI	Honolulu	808-526-1555
IL	Bloomington	309-662-9411
IL	Chicago	312-930-0010
IL	Naperville	312-357-8800
IL	Rolling Meadows	312-255-9800
IN	Carmel	317-844-4100
IA	Cedar Rapids	319-390-4250
IA	West Des Moines	515-224-1435
KY	Louisville	502-426-0100
LA	Kenner	504-467-4100
MD	Baltimore	301-644-5800
MD	Rockville	301-948-6370
MA	Andover	617-682-1500
MA	Lexington	617-861-8960
MI	Grand Rapids	616-957-1970
MI	Novi	313-349-9200
MI	Troy	313-643-6474
MN	St. Paul	612-644-1100
MO	Bridgeton	314-344-5100
MO	Kansas City	816-941-0411
NE	Omaha	402-334-1813
NJ	Paramus	201-265-5000
NJ	Piscataway	201-981-1199
NM	Albuquerque	505-292-1330
NY	Albany	518-458-1550
NY	Clarence	716-759-8621
NY	Fairport	716-223-9950
NY	Liverpool	315-451-1820
NY	Manhattan	212-971-0800
NY	Syracuse	315-455-2486
NY	White Plains	914-684-6100
NY	Woodbury	516-921-0300
NC	Cary	919-467-6600
NC	Charlotte	704-527-8780
NC	Greensboro	919-852-1800
OH	Cincinnati	513-891-9870
OH	Cleveland	216-243-7300
OH	Miamiburg	513-859-8202
OH	Westerville	614-436-1041
OK	Oklahoma City	405-446-9499
OK	Tulsa	918-665-3300
OR	Wilsonville	503-682-8000
PA	Harrisburg	717-657-5900
PA	Pittsburgh	412-782-0400
PA	Valley Forge	215-666-9000
SC	Columbia	803-732-0400
SC	Greenville	803-297-4120
TN	Knoxville	615-966-4747
TN	Memphis	901-346-8370

TN Nashville 615-255-1271
TX Austin 512-835-6771
TX El Paso 915-833-4400
TX Fort Worth 817-232-9500
TX Houston 713-776-6400
TX Irvine 214-556-1950
TX Richardson 214-231-6101
TX San Antonio 512-494-9336
UT Salt Lake City 801-974-1700
VA Richmond 804-747-7750
WA Bellevue 206-643-4000
WA Spokane 509-922-7000
WV Charleston 304-925-0492
WI Brookfield 414-784-8800

HEXACON ELEC., 161 W. Clay Ave., Roselle Park, NJ 07204, Tel: 201-245-6200, Telex: 13-8812; Empl.: 150; *Sls. Mgr.:* Robert L. Miller ..... **C•1739**

Local Sales Offices & Reps

AL Huntsville, BJR Mfrs. Reps. 205-881-3569
AZ Tucson, Ross IV Assocs. 602-299-1425
CA Newport Beach, Ross IV Assocs. 714-650-5542
CA Sunnyvale, J. F. Pell Co. 408-730-5869
CO Littleton, Production Equip. Sls. 303-795-5022
CT E. Woodstock, H & M Assocs. 203-928-9442
FL Merritt Island, J. A. Kennedy Co. 305-452-9821
IL Elk Grove Village, Bradley Reps. 312-228-8450
IN Indianapolis, Bradley Reps, Ind. 317-631-3106
MD Phoenix, B&W Mktg. 301-592-8907
MN Edina, Pec/Levi 612-944-8540
NJ Jersey City, Dunn & Bryan 201-963-4478
NY New Hartford, V. Clair 315-735-8122
OH Solon, KDF Co. 216-248-8010
OR Gladstone, Northcoast Mfrs. Agy. II 503-657-9427
PA West Chester, B&W Mktg. 215-692-7155
TX Dallas, P. J. Scanlon 214-231-4661
WA Seattle, Northcoast Mfrs. Agy. 206-284-5024
EXP NY, New York, W. D. Blood & Co. 212-344-0210

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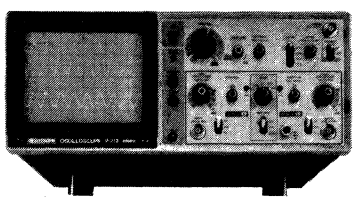

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CA	San Jose, Cypress Elctrns.	408-945-8400
CA	Santa Clara, El-Com Sls.	408-496-0800
CA	Santa Clara, Peters-De-Laet	415-980-9243
CO	Denver, CSID Elctrns.	303-292-9594
CO	Englewood, Industrial Elctrns.	303-694-9444
CT	Yalesville, Schaal Assocs.	203-269-3779
FL	Ft. Lauderdale, K.S.M. Elctrns.	305-971-5900
FL	Longwood, Intertec Comps., Inc.	305-834-7777
FL	Winter Park, Deanco	305-671-5100
GA	Atlanta, K.S.M. Elctrns.	404-458-2013
GA	Cumming, Pan American	404-577-2113, 800-554-9796
GA	Marietta, Deanco	404-429-0126
IL	Addison, K.S.M.	312-953-9473
IL	Arlington Heights, Lodan Elctrns.	312-398-5311
IL	Lisle, Components, Inc.	312-852-7707
IN	Indianapolis, RM Indiana, Inc.	317-291-7110
IA	Cedar Rapids, Bergquist Co.	319-366-8733
MD	Baltimore, Whitney Distrs.	301-944-8080
MD	Beltsville, Resco/Baltimore	301-937-9100
MD	Gaithersburg, Deanco	301-948-5444
MD	White Marsh, Resco/Baltimore	301-529-0500
MA	Burlington, Deanco, Inc.	617-272-1506
MA	Burlington, Schaal Assocs.	617-272-7940
MA	Natick, Tec-Con Elctrns., Inc.	617-655-9333
MI	Farmington Hills, Prehler	313-473-7200, 800-321-5982
MN	Bloomington, Prehler	612-854-6780
MN	Minneapolis, Bergquist Co.	612-835-2322
MO	Kansas City, Finnigan Elctrns.	816-421-4277
NJ	Fairfield, Deanco	201-575-7960
NJ	Rockaway, Tonar Inds.	201-884-1400
NY	Farmingdale, Tri-Start Elctrns.	516-293-0400
NY	Hauppauge, Schaal Assocs.	516-434-7100
NY	Ithaca, Deanco	607-257-4444
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Mt. Vernon, QAR Inds. Elctrn. Sls., Inc.	914-699-2224
NY	Rome, Rome Elctrns.	315-337-5400, 315-735-2249
NC	Raleigh, Century Elctrns.	919-872-2203
NC	Raleigh, Deanco	919-851-2065
OH	Dayton, Televox, Inc.	513-294-4499
OH	Middleburg Hts., Prehler	216-243-5510, 800-824-0178
OR	Beaverton, Murphy Elctrns.	503-642-2001
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	McKean, Advacom, Inc.	814-476-7774
PA	Montgomeryville, Pytronic Inds., Inc.	215-643-2850
PA	Norristown, Century Elctrn. Comps.	215-631-5400
TX	Addison, Connec/Tek, Inc.	214-733-4411
TX	Corpus Christi, Douglas Elctrns.	512-883-5103
TX	Fort Worth, Texas Connector Corp.	817-246-0109
UT	Salt Lake City, Diplomat	800-453-5503
VA	Virginia Beach, Deanco	804-460-3558
WA	Bellevue, Bell Inds.	206-747-1515
WA	Redmond, Murphy Elctrns.	206-881-1234
WI	Hartland, G.W. Elctrns.	414-367-6003
WI	New Berlin, RM Elctrns.	414-784-4420
EXP	CA, Irvine, Product Supp. Co.	714-250-0622
Can	London, Ont., C.M. Peterson Co., Ltd.	519-434-3204
Can	Scarborough, Ont., Carsten-Elctrns., Ltd.	416-495-7705, 416-495-9999
Can	Vancouver, L.A. Varah, Ltd.	604-873-3211

HOLT INC., 9351 Jeronimo Rd., Irvine, CA 92718, Tel: 714-859-8800, Telex: 753307; Empl.: 77; *Sls. Mgr.:* Ed Fernandez

HOLUB INDUSTRIES, 1701 W. Bethany Rd., Sycamore, IL 60178, Tel: 815-895-6501, Telex: 25-7359; Empl.: 90; *Sls. Mgr.:* R. J. Morrison

HONEYWELL INC., Aerospace & Defense Grp., Honeywell Plaza, Minneapolis, MN 55408, Tel: 612-870-5186, TWX: 910-576-2692; Empl.: 15,000

HONEYWELL INC., Commercial Div., MN 27-7246, Honeywell Plaza, Minneapolis, MN 55408, Tel: 612-870-5357; Empl.: 3000; *Sls. Mgr.:* Doyle G. Adams

HONEYWELL INFO. SYS., 200 Smith St., MS 440, Waltham, MA 02154, Tel: 617-895-6000

HONEYWELL MICRO SWITCH DIV., See Micro Switch, a Honeywell Division

HONEYWELL OPTOELECTRONICS, 830 E. Arapaho Dr., Richardson, TX 75080, Tel: 214-234-4271, Telex: 73-0890; Empl.: 300; *Sls. Mgr.:* Joe Tucker; *Dist. Mgr.:* Joe Tucker

HONEYWELL, Process Control Div., 1100 Virginia Dr., Ft. Washington, PA 19034, Tel: 800-321-5111, Ext. 596; Empl.: 2500

HONEYWELL, Test Instrs. Div., P.O. Box 5227, Denver, CO 80217, Tel: 303-773-4700, Telex: 45793 DVR; Empl.: 850; *Sls. Mgr.:* Frank Doherty

THE HOOSIER MAGNETICS GROUP, Hoosier of Ohio, Inc., 700 North Wheeling Street, Toledo, OH 43607, Tel: 419-698-8087; Empl.: 90

HOOSIER MAGNETICS, INC., 520 E. Van Trees St., P.O. Box 753, Washington, IN 47501, Tel: 812-254-1901; Empl.: 90

HOOSIER OF NEW YORK, INC., Lower Denny Street, P.O. Box 372, Ogdensburg, NY 13669, Tel: 315-393-2293; Empl.: 90

HOPKINS ENGRG., 12900 Foothill Blvd., San Fernando, CA 91342, Tel: 213-361-8691, TWX: 910-496-1531; FSC No.: 02777; Empl.: 100; *Sls. Mgr.:* Gary M. Smith; *Dist. Mgr.:* Clyde M. Salisbury

HOPT, KARL, CO., 118 First Ave., Atlantic Highlands, NJ 07716, Tel: 201-291-0633, Telex: 132496; Empl.: 400; *Sls. Mgr.:* G.C. Ellis

HOTPACK CORP., Heinicke Instrs., 10940 Dutton Rd., Philadelphia, PA 19154, Tel: 215-824-1700, 800-523-3608, TWX: 710-670-1694; FSC No.: 66; Empl.: 100; *Sls. Mgr.:* Tim Fitzgerald

Hotpack is a manufacturer and is sold direct. To contact the salesman in your area call 800-523-3608 or 215-824-1700.

HOTTINGER BALDWIN MEASUREMENTS, 139 Newbury St., Framingham, MA 01701, Tel: 617-875-8282, Telex: 94-8499; Empl.: 179; *Sls. Mgr.:* Robert Haggerson

HOUSE OF METAL ENCLOSURES, 500 W. 9th St., Box 225, Hermann, MO 65041, Tel: 314-486-3111; Empl.: 100; *Sls. Mgr.:* Richard L. Kastel

HOUSTON INSTRUMENT, 8500 Cameron Rd., Austin, TX 78753, Tel: 512-835-0900, TWX: 910-874-2022; Empl.: 450; *Dist. Mgr.:* Rod Schaffner

HOWARD INDUSTRIES, MSL Ind., Inc., Box 287, Milford, IL 60953, Tel: 815-889-4105, TWX: 910-642-2950; FSC No.: 815-889-4105; Empl.: 500; *Sls. Mgr.:* Ralph Young; *Dist. Mgr.:* Alan Mancuso

HOWELL INSTRS., 3479 W. Vickery Blvd., Ft. Worth, TX 76107, Tel: 817-336-7411, Telex: 75-8233; FSC No.: 98869; Empl.: 180; *Sls. Mgr.:* Bruce Pike

HTL ELECTRO KINETICS, 402 E. Gutierrez St., Santa Barbara, CA 93101, Tel: 805-963-2055, TWX: 910-334-1177; Empl.: 180; *Sls. Mgr.:* Robert E. Lynch

HUDSON TOOL & DIE CO., INC., 18 Malvern St., Newark, NJ 07105, Tel: 201-589-1800, TWX: 710-995-4445; FSC No.: 02875; Empl.: 300; *Sls. Mgr.:* William Miller

HUGHES AIRCRAFT CO., 6155 El Camino Real, Carlsbad, CA 92008, Tel: 619-931-3000, TWX: 910-322-1393; Empl.: 1000

HUGHES AIRCRAFT CO, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009, Tel: 213-670-1515, Telex: 67222, TWX: 213-871-5210; *Sls. Mgr.:* W. L. Pemberton

HUGHES AIRCRAFT CO., Connecting Devices Div., 17150 Von Karman Ave., Irvine, CA 92714, Tel: 714-660-5701, TWX: 910-595-2523; FSC No.: 53669; *Sls. Mgr.:* Bill Strobel

HUGHES AIRCRAFT CO., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509-2999, Tel: 213-517-6000, Telex: 67-7064, TWX: 910-347-7321; Empl.: 2,200; *Sls. Mgr.:* Robert L. Woods

HUGHES AIRCRAFT CO., Indl. Prods. Div. FACT Sys., 6155 El Camino Real, Carlsbad, CA 92008, Tel: 619-931-3000, TWX: 910-332-1393

HUGHES AIRCRAFT CO., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715, Tel: 714-752-3800, TWX: 910-595-2435; *Sls. Mgr.:* J. L. Waters

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HUGHES AIRCRAFT COMPANY

HUGHES SOLID STATE PRODUCTS, 500 Superior Ave., Dept. E8, Newport Bch., CA 92658-8903, Tel: 714-759-2411, TWX: 910-596-1374 ..... **A•1370-1373**

Local Sales Offices & Reps

AL	Huntsville, L & D Inc.	205-837-1469
AZ	Phoenix, Toward Engrg. Assocs.	602-955-3193
CA	Mountain View, Weseloh/Swanson	415-961-0565
CA	San Diego, Wes-K Assocs.	619-295-3501
CA	Van Nuys, Wes-K Assocs.	213-989-3070
CT	Ansonia, R. H. Sturdy Co.	203-734-2186
CT	Rocky Hill, R. H. Sturdy Co.	203-563-8455
FL	Clearwater, Delmac Sls.	813-447-5192
FL	Orlando, Delmac Sls.	305-898-4688
FL	Tamarac, Delmac Sls.	305-726-1330
GA	Atlanta, L & D Inc.	404-455-3483
IL	Elk Grove Village, Carlson Elctrn. Sls.	312-956-8240
IN	Indianapolis, J & W Sales	317-842-3740
IA	Cedar Rapids, Carlson Elctrn. Sls.	319-377-6341
KS	Shawnee Mission, Technical Sls. Assocs.	913-888-3330
MD	Glen Burnie, Faion Lott & Co.	301-744-4611
MA	Salisbury, R. H. Sturdy Co.	617-465-1505
MA	Wellesley Hills, R. H. Sturdy Co.	617-235-2330
MI	Livonia, Luebbe Sls.	313-477-3131
MN	Minneapolis, Deming (Bill) & Assocs.	612-888-5000
MO	Ferguson, Technical Sls. Assocs.	314-725-5361
NY	Endwell, Tri-Tech Elctrns.	607-754-1094
NY	Fairport, Tri-Tech Elctrns.	716-223-5720
NY	Fayetteville, Tri-Tech Elctrns.	315-446-2881
NY	Great Neck, Cooper-Simon & Co.	516-487-1142
NY	Poughkeepsie, Tri-Tech Elctrns.	914-473-3880
NC	Greensboro, L & D Inc.	919-292-3201
NC	Raleigh, L & D Inc.	919-876-5301
OH	Cincinnati, Luebbe Sls.	513-891-5770
OH	Cleveland, Luebbe Sls.	216-333-0425
OH	Columbus, Luebbe Sls.	614-431-0474
OH	Dayton, Luebbe Sls.	513-294-0426
PA	Bala Cynwyd, Electro-Comp Sls.	215-667-9360
PA	Pittsburgh, Luebbe Sls.	412-931-0414
TX	Dallas, Southern States Mktg.	214-248-8600
TX	Houston, Southern States Mktg.	713-988-0991
WI	Milwaukee, Carlson Elctrn. Sls.	414-476-2790

HUGHEY & PHILLIPS, INC., 3050 N. California St., Burbank, CA 91504, Tel: 818-849-1104, TWX: 910-498-2252; FSC No.: 94295; Empl.: 38; *Sls. Mgr.:* C.L. Phillis; *Dist. Mgr.:* C.L. Phillis

HUGIN INDS. INC., 745 Distel Dr., Los Altos, CA 94022, Tel: 415-961-2950, Telex: 348 399; Empl.: 4; *Sls. Mgr.:* Peter Hugin

Local Sales Offices & Reps

IL	Chicago, Patton Sls.	312-325-2170
NJ	Tenafly, D&D Engrg.	201-568-5032
NY	Rochester, Irondequoit Inds.	716-544-6257
NC	Fayetteville, Zim-Tek	919-488-4101
OH	Dover, AJ Assocs.	216-343-2224

HULL CORP., Davisville Rd., Hatboro, PA 19040, Tel: 215-672-7800, TWX: 510-665-6822; Empl.: 200; *Sls. Mgr.:* Eldon Avery

HUMISEAL DIV., Columbia Chase Corp., 26-60 Bklyn.-Queens Expwy., Woodside, NY 11377, Tel: 718-932-0800, TWX: 710-582-2141; FSC No.: 99109;46058; Empl.: 150

HUMPHREY, INC., 9212 Balboa Ave., San Diego, CA 92123, Tel: 619-565-6631, TWX: 910-335-2001; Empl.: 220

HUNTER STANLEY ELEC., 1813 Church St., Nashville, TN 37203, Tel: 615-321-0500; FSC No.: 21675; Empl.: 10; *Sls. Mgr.:* W. D. Stanley

HUNTER TOOLS, 6721 Baymeadow Dr., Glen Burnie, MD 21061, Tel: 301-760-2200; Empl.: 450

HUNTINGTON ELECTRIC INC., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750, Tel: 219-356-0778; *Sls. Mgr.:* Robert Smith ..... **A•1871**

Local Sales Offices & Reps

CA	Chino, Tracy Elctrns. Sls.	714-591-4736
FL	Lighthouse Point, Mr. Jack Krutek & Assocs., Inc.	305-941-6544
IL	Arlington Heights, Rozner Sls.	312-577-0067
IN	Huntington, HEI	219-356-0756
MA	Burlington, Tri-Com Assocs., Inc.	617-272-8163
MN	St. Louis Park, Parq Sls.	612-920-3643
MO	St. Louis, Rep-Tronics	314-576-9816
NJ	Medford, Champion Elctrns. Sls. Co.	609-983-0932
OK	Tulsa, Genzel Sls. & Assocs., Inc.	918-622-7744
PA	Greensberg, Pro-Mark	412-832-3800
TX	Fort Worth, Component Concepts, Inc.	817-292-5803

Local Distributors

AZ	Phoenix, Camco Elctrn. Comps.	602-269-6201
CA	Burbank, Welco Elctrns.	213-840-9020
CA	Costa Mesa, Orange County Comps., Inc.	714-979-3597
CA	Los Angeles, Cal State Elctrns.	213-933-8187
CA	Tustin, Cal-Tronic Sls., Inc.	714-730-0350
CA	Van Nuys, EW Elctrns.	818-782-9020
FL	Fort Lauderdale, NRC Elctrns., Inc.	305-772-4500
IN	Huntington, HEI	219-356-0756
MI	St. Clair Shores, Spemco	313-771-2700
NY	Valley Stream, L & S Elctrns., Inc.	516-561-2474
OK	Oklahoma City, She Elctrns., Inc.	405-843-5941

HUNTRON INSTRS., INC., 15123 Highway 99, Lynnwood, WA 98036, Tel: 206-743-3171, 800-426-9265, Telex: 152951 Hunt Inst, TWX: Lywd; FSC No.: 57705; *Sls. Mgr.:* Jim Crosson; *Dist. Mgr.:* Jim Crosson

HURRICANE ELECTRNS. LAB, P.O. Box 1280, Hurricane, UT 84737, Tel: 801-635-2003; FSC No.: 64109; Empl.: 11; *Sls. Mgr.:* C. R. Reeve

HURST MFG. CORP., Emerson Elec. Co., Box 326, Princeton, IN 47670, Tel: 812-385-2564; Empl.: 200; *Sls. Mgr.:* Jac Diano

HUTSON INDS., 1000 Hutson Cir., Frisco, TX 75034, Tel: 214-377-3557, TWX: 910-860-5051; *Sls. Mgr.:* Bill Giles

Hybricon Corporation

HYBRICON CORP., 410 Great Rd., Littleton, MA 01460, Tel: 617-486-0311, TWX: 710-347-0654; Empl.: 74; *Sls. Mgr.:* Richard W. Palmer ..... **C•1710**

Local Sales Offices & Reps

AZ	Phoenix, Cristee-Meade Co.	602-867-6000
CA	Inglewood, Basic Sys. Corp.	213-673-4300
CA	San Diego, Basic Sys. Corp.	619-268-8000
CA	Santa Clara, Basic Sys. Corp.	408-727-1800
CO	Lakewood, Cristee-Meade Co.	303-232-0287
MN	Minneapolis, Mark Co.	612-933-3026
NH	Salem, OEM Mktg. & Sls.	603-893-0009
NY	New Hartford, PDQ Assocs.	315-768-8167
OH	Cincinnati, Applied Data Mgmt.	513-579-8108
OR	Beaverton, Elctrns. Tech. Sls. Assoc.	503-641-5180
PA	Huntingdon Valley, Lynbar Grp. Inc.	215-947-3554
TX	Houston, System Tech. Assocs.	713-440-8340
VA	Alexandria, Scott Corp.	703-765-7901
WA	Kirkland, Elctrns. Tech. Sls. Assoc.	206-827-8086

HYBRID ELCTRNS., 142 Adams St., Newton, MA 02158, Tel: 617-527-2711; Empl.: 28; *Sls. Mgr.:* D. Kates

HYBRID SVCS. INC., 38 Main St., North Reading, MA 01864, Tel: 617-664-5500; Empl.: 45; *Sls. Mgr.:* Richard A. Vogel

HYBRID SYSTEMS CORP., 22 Linnell Circle, Billerica, MA 01821, Tel: 617-667-8700, TWX: 710-347-1575; Empl.: 250; *Sls. Mgr.:* H. Diamond

HYBRILONICS, INC., P.O. Box 217, Lasalle Sta., Niagara Falls, NY 14304, Tel: 716-731-9080, TWX: 910-333-0624; Empl.: 20

Local Sales Offices & Reps

AZ	Tempe, Wm. Brierton & Assocs.	602-839-9107
CA	Torrance, Basic Trade, Inc.	213-214-4677
CT	Avon, Martech	203-673-5132
GA	Norcross, Mountain Electro Prods.	404-448-5594
IL	Woodridge, Trend-Tronics	312-985-0626
KS	Overland Park, Lorenz Sls. Co.	913-649-5556
MA	Peabody, OEM Sls. of New England	617-535-2521
MN	Wayzata, White Sls. Co.	612-920-3558
NY	Buffalo, Antil-Thrasher Assocs.	716-652-0423
NY	Manhasset, Martech	516-627-1151
NY	Syracuse, Antil-Thrasher Assocs.	315-468-2370
NC	Raleigh, Mountain Electro Prods.	919-846-1514
OH	Cincinnati, Bill Teplitz Assocs.	513-481-1648
OH	Cleveland, Bill Teplitz Assocs.	216-439-3265
PA	Langhorne, Spiral Sls.	215-968-9250
TX	Arlington, Electronic Prods. Rep.	817-467-0377
VA	Front Royal, Eltron Sls.	703-635-7201
WI	Waukesha, Trend-Tronics	414-542-4919
Can	Markham, Ont., Avotronics, Ltd.	416-475-2024

HY-CAL ENGRG., 9650 Telstar Ave., El Monte, CA 91731, Tel: 213-444-4000, Telex: 67-5548; FSC No.: 12199; Empl.: 120

HyComp, Inc.

HYCOMP INC., 75 Union Ave., Box 377, Sudbury, MA 01776, Tel: 617-443-4631, TWX: 710-347-0385; FSC No.: 34707; Empl.: 60; *Sls. Mgr.:* James Chacharone ..... **A•1670, 1872-1873**

Local Sales Offices & Reps

AL	Huntsville, Magaro & Assocs.	205-882-0827
AZ	Mesa, SEDCO Sls.	602-835-6281
CA	Mountain View, Leddy Assocs.	415-969-6313
CA	Santa Ana, Calif. Elctrn. Mktg.	714-835-2701
CT	Collinsville, Dynamic Sls. of New Eng.	203-693-6567
FL	Clearwater, Cherith Sls.	813-797-3004
GA	Atlanta, Magaro & Assocs.	404-451-8862
IL	Palatine, T-Squared Assocs.	312-991-2144
IN	Ft. Wayne, Scott Elctrns.	219-484-7865
IN	Indianapolis, Scott Elctrns.	317-897-9976
KS	Kansas City, BC Elctrns.	913-342-1211
KS	Wichita, BC Elctrns.	316-942-9840
KY	Louisville, Scott Elctrns.	502-964-0640
MD	Lutherville, Walker-Houck Assocs.	301-296-6021
MA	Burlington, Dynamic Sls. of New Eng.	617-272-5676
MN	Minnetonka, S.A.I. Mktg. Corp.	612-935-0777
MO	Bridgeton, BC Elctrns.	314-291-1101
NY	Lynbrook, HLJ Comp-Tech	516-599-2999
NY	Rochester, Murcan Sls. Corp.	716-586-4450
NY	Syracuse, Murcan Sls. Corp.	315-437-0734
NC	Greensboro, Magaro & Assocs.	919-294-4783
OH	Cincinnati, Scott Elctrns.	513-791-2513
OH	Cleveland, Scott Elctrns.	216-473-5050
OH	Kettering, Scott Elctrns.	513-294-0539
OH	Reynoldsburg, Scott Elctrns.	614-863-1281
PA	Norristown, Rivco January	215-631-1414
PA	Pittsburgh, Scott Elctrns.	412-963-6116
TX	Austin, Dyna Mktg.	512-454-3114
TX	Dallas, Dyna Mktg.	214-438-6528
TX	Houston, Dyna Mktg.	713-460-0314
VA	Moneta, Walker-Houck Assocs.	703-297-4496
WI	Racine, T-Squared Assocs.	414-633-9456

HYDRA-ELECTRIC CO., 3151 Kenwood St., Burbank, CA 91503, Tel: 213-843-6211

HYDROCAP CORP., 975 N.W. 95 St., Miami, FL 33150, Tel: 305-696-2504; Empl.: 5

HYDROSTATICS, INC., 2005 Industrial Dr., Bethlehem, PA 18017, Tel: 215-694-0121, 1-800-441-7301 Outside PA., TWX: 510-662-3306

HYLETRONICS, Newtown Rd., Littleton, MA 01460, Tel: 617-486-8911, TWX: 710-347-0656; FSC No.: 22534; Empl.: 82; *Sls. Mgr.:* Norman Hill

HYPERTRONICS CORP., 16 Brent Dr., Hudson, MA 01749, Tel: 617-568-0451, 800-225-9228, Telex: 95-1152; FSC No.: 50541; Empl.: 100; *Sls. Mgr.:* E. Dalrymple ..... **C•1271**

Local Sales Offices & Reps

AL	Brownsboro, JHU Assoc.	205-536-7455
AZ	Scottsdale, Western Tech. Sls.	602-991-7306
CA	Mountain View, Leddy Assocs.	415-969-6313
CA	N. Hollywood, Jewett Co.	213-789-8103
CO	Commerce City, Williams Assocs.	303-289-5647
CT	Bethany, Reps. Corp.	203-393-0024
DC	Washington, Tyler Griffin Co.	EN1-4821
FL	Orlando, Design Mktg.	305-291-8208
GA	Atlanta, Design Mktg.	404-457-5621
IL	Downers Grove, Momak Sls.	312-936-6400
IN	Indianapolis, CC Elctrns.	317-255-1508
KS	Merriam, Midwest Tech. Sls.	913-236-8557
MD	Baltimore, Tyler Griffin Co.	EN9-4821
MA	Wellesley, Reps. Corp.	617-237-6476
MI	Lake Orion, CC Elctrns.	313-338-7400
MN	St. Paul, Murnco, Inc.	612-484-8200

NJ Wayne, G.T. Assocs. 201-694-6040
NM Albuquerque, Williams Assocs. 505-255-0622
NY Fayetteville, R. D. Sherman 315-637-9861
NC Greensboro, JHU Assoc. 919-852-9097
OH Centerville, Dolfuss-Root & Co. 513-433-6776
PA Paoli, Tyler Griffin Co. 215-647-1550
TN Talbot, JHU Assoc. 615-581-4141
TX Freeport, Marathon Assoc. 409-233-7026
TX Lewisville, Marathon Assoc. 214-436-8882
UT Salt Lake City, Williams Assocs. 801-532-7701
WA Bellevue, A.I.E. Inc. 206-455-4697

HYSOL, 15051 E. Don Julian, City of Industry, CA 91746, Tel: 818-968-6511, TWX: 910-584-1342; *Sls. Mgr.:* Hugh Dotson

HY-TEC INDUSTRIES, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786, Tel: 516-744-5062; *Sls. Mgr.:* Tom Poole

hytek

HYTEK MICROSYSTEMS, 980 University Ave., Los Gatos, CA 95030, Tel: 408-395-2300, TWX: 910-597-5393; FSC No.: 57474; Empl.: 340; *Sls. Mgr.:* Greg Kizik; *Dist. Mgr.:* Richard Fryhoff ..... **A•1522-1527, 1671**

Local Sales Offices & Reps

AL Huntsville, Reynolds & Assocs. 305-259-7000
AZ Tempe, Cantec Sls. 602-829-0191
CA Del Mar, Chapman & Chapman 619-755-0412
CA Irvine, Centaur Corp. 714-261-2123
CA Los Gatos, Pro Assocs. 408-358-3861
CO Englewood, Dynatech, Inc. 303-773-2830
CO Englewood, Dynatech, Inc. 705-773-2830
FL Melbourne, Reynolds & Assocs. 305-259-7000
FL St. Petersburg, Reynolds & Assocs. 305-259-7000
MA Tyngsboro, Comtech, Inc. 617-649-3030
MN Minneapolis, Components Grp. 612-374-1250
MN Minneapolis, Comps. Grp. 612-374-1250
MN Roseville, Components Grp. 612-636-5060
NV Carson City, Hytek Microsystems 702-883-0820
NM Albuquerque, Power Entprs. 505-298-1918
NY Rochester, L-Mar Assocs., Inc. 716-323-1000
NY Wantagh, Tri-Tek 516-221-7600
NC Raleigh, Reynolds & Assocs. 305-259-7000
TX El Paso, Power Entprs. 915-533-9902
TX Grapevine, Elctrns. Mktg. Assocs. 817-481-7502
TX Grapevine, Electronics Mktg. Assocs. 817-488-6583
TX Houston, Electronics Mktg. Assocs. 713-498-8120
Can Burnaby, B.C., GNT 604-430-3302
Can Toronto, Que., Cantec Reps. 613-725-3704

ICCI, 196 Broadway, Cambridge, MA 02139, Tel: 617-864-3270, Telex: 95-1106; *Sls. Mgr.:* Jeremiah Snow

ICI, 570 W. Lambert, Ste. C, Brea, CA 92621, Tel: 714-990-1707; Empl.: 10

I.C. INDS., Box 104, Altamonte Springs, FL 32701, Tel: 305-339-8298, Telex: 56-4303; *Sls. Mgr.:* William S. Hodges

INTERNATIONAL CONTROLS AND MEASUREMENTS CORP., P. O. Box 2578, Syracuse, NY 13220, Tel: 315-699-5262, TWX: 710-545-0235; FSC No.: 52516; Empl.: 45; *Sls. Mgr.:* Frederick W. Schulze; *Dist. Mgr.:* Robert Ford

ICON, 156 Sixth St., Cambridge, MA 02142, Tel: 617-868-5400, TWX: 710-321-1883; Empl.: 81; *Sls. Mgr.:* Irvin L. McKittrick

ICO-RALLY, 2575 E. Bayshore Rd., Palo Alto, CA 94303, Tel: 415-856-9900, Telex: 34-8335; FSC No.: 51705; Empl.: 45; *Dist. Mgr.:* Barbara Enad

ICS ELECTRONICS CORP., 2185 Old Oakland Rd., San Jose, CA 95131, Tel: 408-263-4844, TWX: 910-338-7810; *Sls. Mgr.:* Robert H. Prosin; *Dist. Mgr.:* Robert H. Prosin

ICS, INC., 520 Interstate Rd., Addison, IL 60101, Tel: 312-543-6200, TWX: 910-991-5945; Empl.: 50; *Sls. Mgr.:* Marion Servos; *Dist. Mgr.:* Susan Earnest

IDEAL INDUSTRIES, 4450 Becker Pl., Sycamore, IL 60178, Tel: 815-895-5181, TWX: 910-639-0613; Empl.: 700

IDEAL PRECISION METER, 214 Franklin St., Brooklyn, NY 11222, Tel: 212-383-6904, TWX: 710-584-2160; FSC No.: 11707;10304-41; Empl.: 150; *Sls. Mgr.:* T. Bell

IDE ASSOCIATES, INC., 35 Dunham Rd., Billerica, MA 01821, Tel: 617-663-6878; Empl.: 40; *Sls. Mgr.:* James Bender

iDEC

IDEC SYSTEMS & CONTROLS CORP., 1213 Elko Drive, Sunnyvale, CA 94089-2211, Tel: 408-747-0550, Telex: 34-0601, TWX: 910-339-9383; Empl.: 60; *Sls. Mgr.:* D.J. Synnott; *Dist. Mgr.:* James Young ..... **B•1056, 1408-1412**

Local Sales Offices & Reps

AL Decatur, El Tech, Inc. 205-353-7899
AZ Phoenix, Neal-Miller Sls. 602-274-0898
AR Jonesboro, Electro-Tech, Inc. 501-932-0366
CA Fremont, Thebrege Sls. Reps. 415-651-8775
CA Santa Fe Springs, J. H. Grace Co. 213-868-6771
CO Lakewood, T.M.M.I. 303-232-1516
FL Oldmar, Boggs & Assocs. 813-855-1812
FL Sarasota, Boggs & Assocs. 813-351-3338
GA Grayson, El Tech, Inc. 404-466-2997
IL Hoffman Estates, Bu-Nell Engrg. 312-843-8600
IN Indianapolis, Gurney Indl. Sls. 317-293-2333
KS Overland Park, TMW 913-383-1818
MA Norwood, Hyland Assocs. 617-762-0345
MI Southfield, Component Assocs. 313-557-3232
MN Minnetonka, S. J. Collins & Assocs. 612-933-7661
NJ W. Long Branch, Eastern Indl. Sls. 201-544-0600
NM Albuquerque, T.M.M.I. 505-298-6893
NY Syracuse, WM Stamp Co. 315-463-4390
NC Kernersville, Heritage Sls. Assocs. 919-996-4374
OH Cincinnati, James Murray & Assocs. 513-574-8500
OH Cleveland, Matthew Haley Co. 216-892-1820
OH Toledo, Matthew Haley Co. 419-382-9588
OK Tulsa, Associated Sls. Agy. 918-838-8930
OR Portland, SPS Elctrns. 503-297-6919
PA Ingomar, RW Moulton Assocs. 412-935-3333
PA Philadelphia, Fite-El Tech 215-248-3171
SC Taylors, Heritage Sls. Assocs. 803-292-1723
TN Knoxville, Tubbs Agy. 615-577-0689
TX Dallas, SW Mktg. Assocs. 214-341-8631
TX Houston, SW Mktg. Assocs. 713-864-6281
UT Salt Lake City, T.M.M.I. 801-487-7676
VA Alexandria, T.D.I. 703-971-8982
VA Richmond, Dunnington & Assocs. 804-282-8383
WA Redmond, SPS Elctrns. 206-323-4140
WV Bluefield, RW Moulton Assocs. 304-327-6421
WI Appleton, Bu-Nell Engrg. 414-733-4242
WI Waukesha, Bu-Nell Engrg. 414-784-0994

IDENTATRONICS, INC., 425 Lively Blvd., Elk Grove, IL 60007, Tel: 312-437-2654, 1-800-323-5403, Telex: 254708; *Sls. Mgr.:* Gregg Powell

VERTEX INDUSTRIES, INC., Indenticon Div., 23 Carol St., P. O. Box 1123, Clifton, NJ 07014, Tel: 201-472-2121, TWX: 710-989-7021 VER TOT CLIF; Empl.: 85; *Sls. Mgr.:* Ronald Byer

Local Sales Offices & Reps

AZ Tempe, Burland Assocs. 602-894-5564
CA Santa Ana, California Elec. Mktg. 714-835-2702
FL Melbourne, Reynolds & Assocs. 305-259-7000
IL Elk Grove Village, Quad Data 312-228-1722
KS Shawnee Mission, Panatek Tech. Sls. 913-362-3349
MA Wayland, Daner Hayes, Inc. 617-655-0888
MI Farmington Hills, Carter, McCormic & Pierce 313-477-7700
MO Rockville, Spectro Assocs. 301-294-9770
TX Dallas, IBL Engrg. & Sls. 214-363-2921
WA Seattle, SJI Corp. 206-763-8981

IEC CORPORATION, 3100 Longhorn Blvd., Austin, TX 78759, Tel: 512-836-0547, Telex: 757025; FSC No.: 16071; Empl.: 23; *Sls. Mgr.:* Florencio Canizales, Jr.

IEC ELCTRNS., 105 Norton St., Newark, NY 14513, Tel: 315-331-7742, TWX: 510-250-2515; Empl.: 650; *Sls. Mgr.:* Russ Stingel; *Dist. Mgr.:* Steve Hotchkiss

IEE, See Industrial Elctrn. Engrs., Inc.

IEI-ISKRA

IEI-ISKRA ELECTRONICS, INC., 222 Sherwood Ave., Farmingdale, NY 11735, Tel: 516-753-0400, Telex: 645127; *Sls. Mgr.:* Tom Juliano ..... **A•1080-1083, 1875, 2020, 2072-2073; B•1413**

Local Sales Offices & Reps

AZ Tempe, Sunwest Mktg. 602-838-7586
CA San Diego, C. K. Assocs. 619-279-0420
CA San Jose, K-Lectron 408-942-9177
IL Chicago, Berndt Assocs., Inc. 312-283-0713
IN Indianapolis, Electronic Reps. 317-894-1414
KS Shawnee Mission, K & M Sls. 913-262-1444
MD Pikesville, Muncy Sls. 301-484-6376
NY Macedon, M. M. Hare Co. 315-986-3742
NY West Hempstead, Schmitt Indl. Mktg. 516-486-3510
PA Philadelphia, Paragon Sls. 215-563-7060
SC Easley, R A Sls. 803-859-1859
TX El Paso, EPEC Elctrns., Inc. 915-593-8481
UT South Jordan, MAC III 801-566-3781
WA Bellevue, Communication Comp. Sls. 206-643-0500

Local Distributors

GA Tucker, Shamrock Comps. 404-939-9198
NY West Islip, Shamrock Comps. 516-669-2027
TX El Paso, Shamrock Comps. 915-593-8554

IERC, 135 W. Magnolia Blvd., Burbank, CA 91502, Tel: 818-849-2481, 818-786-1182, TWX: 910-498-2206; *Sls. Mgr.:* Richard Schuckman ..... **C•1643**

Local Sales Offices & Reps

AL Huntsville, Murcota Corp. 205-539-8476
AZ scottsdale, SMS & Assocs. 602-998-0831
CA Burlingame, Jack Logan & Assocs. 415-348-8822
CA Burlingame, Mollard Mktg., Inc. 415-961-0456
CA Los Angeles, Ed Landa Co. 213-879-0770
CO Denver, Elcom, Inc. 303-337-2300
FL Boca Raton, Lawrence & Assocs. 305-368-7373
IL Mt. Prospect, Magnuson & Assocs. 312-956-0700
IN Indianapolis, Magnuson & Assocs. 317-247-5108
KS Leawood, Thunderbird Tech. Sls. & Svcs., Inc. 913-642-7220
KS Wichita, Thunderbird Tech. Sls. & Svcs., Inc. 316-684-3941
MA Lexington, Hathaway Elctrns., Inc. 617-861-7010
MI Ferndale, Shalco, Inc. 313-547-4771
MO Maryland Heights, Thunderbird Tech. Sls. & Svcs., Inc. 314-567-6488
NJ Wayne, G. T. Assocs., Inc. 201-694-6040
NY Rochester, Ossman Comp. Sls. Corp. 716-424-4460
NY Syracuse, Ossman Comp. Sls. Corp. 315-455-6611
NC Winston-Salem, Murcota Corp. 919-722-9445
OH Cleveland, Norm Case & Assocs. 216-333-0400
OR Portland, Frank Jackson & Assocs. 503-292-2638
PA Philadelphia, Kenneth B. Erdman Co. 215-224-1833
PA Pittsburgh, Russell F. Clark Co., Inc. 412-242-9500
TX Houston, Barry Sls., Inc. 713-784-5860
TX Richardson (Dallas), Barry Sls., Inc. 214-234-0255
UT Salt Lake City, Elcom, Inc. 801-532-7940
WA Redmond, Frank Jackson Assocs. 206-881-7277
Can Burlington, Ont., White Radio Ltd. 416-632-6894
Can Montreal, Que., White Radio Ltd. 514-481-0158

Local Distributors

CA Burlingame, Rose Elctrns. 415-348-2740
CA Chatsworth, Mil-Comm Distrs. 213-998-3111
CA San Diego, Deco Elctrns. 619-693-1595
CO Denver, Integrated Elctrns. 303-292-6121
CO Englewood, Industrial Elctrns., Inc. 303-694-9444
CT Norwalk, Park Distrs., Inc. 203-853-2011
FL Clearwater, Lynch Gentry Assocs. 813-433-2697
GA Atlanta, Ack Radio Supp. Co. 404-351-6340
IL Mt.Prospect, Magnuson & Assocs. 312-956-0700
MD Towson, Jones-Maryland Elctrns. 301-823-5721
MA Billerica, A. W. Mayer Co., Inc. 617-667-6900
MA Waltham, Sterling Elctrns. 617-894-6200
NH Hudson, C & H Elctrns., Inc. 603-882-1133
NY Bohemia, Car-Lac Elctrn. Indl. Sls. 516-567-4200
NY Rochester, Modutex Corp. 716-424-1620
NY West Hempstead, March Elctrns. 516-486-6511
OH Englewood, Argent Inds., Inc. 513-836-8633
PA McKeesport, Barno Radio 412-751-5966
RI Providence, William Dandreta & Co. 401-861-2800
TX Fort Worth, C & W Supp. 817-831-0395
TX Houston, Lenert Co. 713-225-1465
UT Provo, Omega Elctrns. 801-375-4664
UT Salt Lake City, Kimball Elctrns., Inc. 801-328-2075
WA Redmond, Elwood Inds. 206-881-7277

IET LABS, INC.

IET LABS, INC., 534 Main St., Westbury, NY 11590, Tel: 516-334-5959; FSC No.: 62015; *Sls. Mgr.:* Sam Sheena ..... **D•1242-1245**

ILC DATA DEVICE CORPORATION

ILC DATA DEVICE CORP., 105 Wilbur Pl., Bohemia, NY 11716, Tel: 516-567-5600, TWX: 510-228-7324; FSC No.: 19645; Empl.: 850; *Sls. Mgr.:* J. P. Sheahan; *Dist. Mgr.:* Mort Lux ..... **D•1150-1151**

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg.	205-830-0498
AZ	Scottsdale, Fred Board Assocs.	602-994-9388
AZ	Tuscon, Fred Board Assocs.	602-299-1508
CA	Santa Clara, ILC Data Dev.	408-244-0831
CA	Woodland Hills, ILC Data Dev.	818-992-1772
CO	Englewood, Western Sls., Inc.	303-798-0945
CT	Canton Center, Dynamic Sls. of New Eng.	203-693-6567
FL	Boca Raton, Perrott Assocs.	813-443-5214
FL	Clearwater Beach, Perrott Assocs.	813-443-5214
FL	Orlando, Perrott Assocs.	305-298-7748
GA	Norcross, Montgomery Mktg., Inc.	404-447-6124
HI	Kihea, Aloha Assocs.	808-879-5296
IL	Chicago, John Alexander & Assocs.	312-233-7788
IL	Des Plaines, Elctrn. Mktg.	312-298-2330
IN	Carmel, Giesting & Assocs.	317-844-5222
IN	Fort Wayne, Giesting & Assocs.	219-486-1912
KS	Lenexa, Dytec/South	913-888-0215
MA	Burlington, Dynamic Sls. of New Eng.	617-272-5676
MI	Coloma, Giesting & Assocs.	616-468-4200
MI	Farmington Hills, Giesting & Assocs.	313-478-8106
MN	Minneapolis, Comprehensive Techn.	612-888-7011
MO	Maryland Hgts., Dytec/South	314-569-2990
NJ	Totowa, ILC Data Dev. Corp.	201-785-1734
NM	Albuquerque, Vermillion Co.	505-883-3668
NY	E. Rochester, Tri Tech Elctrns.	716-385-6500
NY	Endwell, Tri Tech Elctrns.	607-754-1094
NY	Fayetteville, Tri Tech Elctrns.	315-446-2881
NY	Fishkill, Tri Tech Elctrns.	914-897-5611
NC	Cary, Montgomery Mktg., Inc.	919-467-6319
OH	Cincinnati, Giesting & Assocs.	513-385-1105
OH	Cleveland, Giesting & Assocs.	216-261-9705
OH	Dayton, Giesting & Assocs.	513-433-5832
OH	Dayton, Lionel Fedotin	513-275-9345
OK	Tulsa, Bonser-Philhower Sls.	918-744-9964
OR	Aloha, Venture Elctrns.	503-642-9090
PA	Glenside, Koebert Assocs.	215-887-2310
PA	New Kensington, Bobar Instr.	412-339-3565
PA	Pittsburgh, Giesting & Assocs.	412-963-0727
TX	Austin, Bonser-Philhower Sls.	512-346-9186
TX	Houston, Bonser-Philhower Sls.	713-531-4144
TX	Richardson, Bonser-Philhower Sls.	214-234-8438
VT	Burlington, Dynamic Sls. of New Eng.	802-863-6665
VA	Vienna, ILC Data Dev.	201-785-1734
WA	Bellevue, Venture Elctrns.	206-454-4594
WI	Milwaukee, JM Sls.	414-546-0040
WI	Waukesha, Electron Mktg.	414-547-1505
Can	Montreal, Repco Engrg.	514-694-1877

ILC TECHNOLOGY, INC., 399 Java Dr., Sunnyvale, CA 94089, Tel: 408-745-7900, TWX: 910-339-9389; *Sls. Mgr.:* Robert Turner

ILLINOIS CAPACITOR, INC.

ILLINOIS CAPACITOR, INC., 3757 W. Touhy Ave., Lincolnwood, IL 60645, Tel: 312-675-1760, Telex: 72-4361; Empl.: 44; *Sls. Mgr.:* C. Kurland .... **A•1084-1085**

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech. Sls.	205-533-2100
AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	El Cajon, KCE Corp.	619-588-1198
CA	Palo Alto, Mollard Mktg.	415-961-0456
CA	Woodland Hills, Illinois Capacitor, Inc.	800-323-3652
CO	Denver, Elcom	303-337-2300
CT	Bristol, Technology Prods. Grp.	617-731-0858
FL	Miami Beach, Ben Goldner	305-932-2782
GA	Norcross, Electro-Mech. Sls.	404-447-6478
IN	Indianapolis, Fred Dorsey Assoc.	317-842-0060
KY	Louisville, Fred Dorsey Assoc.	502-426-3540
MA	Brookline, Technology Prods. Grp.	617-731-0858
MI	Warren, Dem Elctrns. Sls.	313-575-9444
MN	Golden Valley, Highland Elctrn. Sls. Co.	612-545-4028
MS	Jackson, IL Capacitor	312-675-1760
MO	Hazelwood, Jim Moore & Assocs.	314-731-2240
MO	Overland Park, Guernsey-Moore Assocs.	913-381-2225
NY	Commack, ERA	516-543-0510
NY	De Ruyter, Net Sales, Inc.	315-662-7996
NY	Fairport, Net Sls.	716-467-4538
NY	Webster, Net Sales, Inc.	716-671-0022
NC	Raleigh, Electro-Mech. Sls.	919-851-8165
OR	Beaverton, Caruso-Northcutt	503-646-4973
PA	Narberth, J. Bresson Assocs.	215-664-6460
TN	Jonesboro, Electro-Mech. Sls.	615-753-2964
TX	Austin, Mil-Rep	512-459-8602
TX	El Paso, EPEC, Inc.	915-593-8481
TX	Houston, Mil-Rep	713-444-2557
TX	Richardson, Mil-Rep Assocs.	214-664-6731
UT	Salt Lake City, Elcom	801-532-7940
WA	Bellevue, Caruso-Northcutt	206-454-9699
WI	Milwaukee, Erdman Sls. Co.	414-281-1330
Can	Downsview, Ont., Designtronics	416-747-1171

Local Distributors

CA	Anaheim, A to Z Elctrns.	714-634-3620
CA	Canoga Pk., Myco/Vickers Elctrn. Supp.	213-340-2025
CA	Irvine, Hi-Rel Distr. Sls.	714-768-6656
CA	Santa Ana, Projections Unltd.	714-641-1472
CA	Santa Clara, California Capacitor	408-980-8495
CO	Englewood, Industrial Elctrns.	303-694-9444
IL	Northbrook, Classic Comps.	312-272-9650
IN	Carmel, Altex Elctrns.	317-848-1323
IA	Cedar Rapids, Bergquist Co.	319-366-8733
LA	Harvey, AFG Electrn. Supp.	504-368-9696
MD	Columbia, General Radio Supp.	301-997-6337
MA	Wakefield, Lorcor	617-246-1903
MA	Woburn, Semtex	617-935-2150
MI	Grand Rapids, R M Elctrns.	616-531-9300
MN	Minneapolis, Bergquist Co.	612-835-2322
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NJ	Camden, General Radio Supp. Co.	609-964-8560
NJ	Roselle, Lectron Ind.	201-245-5859
NY	Buffalo, Genesee Radio & Parts Co.	716-873-9661
NY	Buffalo, Summit Distrbg.	716-887-2890
NY	E. Syracuse, Add Elctrns.	315-437-0300
NY	Freeport, Semtex Ind. Corp.	800-645-3960
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Troy, Trojan Elctrn. Supp.	518-274-4481
NC	Greensboro, Hammond Elctrns.	919-275-6391
OH	Dayton, Semtex Ind. Corp.	513-435-6600
OK	Tulsa, Altair Elctrns.	918-252-5781
SC	Greenville, Hammond Elctrns.	803-233-4121
TX	Austin, Altair Elctrns.	512-837-4490
TX	Channelview, Henry Elctrns.	713-452-4451
TX	Houston, Altair Elctrns.	713-462-3029
TX	Richardson, Altair Elctrns.	214-231-5166
WI	Milwaukee, Badger Capacitor Sls.	414-281-1330
EXP	Rexdale, ON, Electrn. Supp., Inc.	416-741-4000

ILLINOIS LOCK CO., The Eastern Co., 301 W. Hintz Rd., Wheeling, IL 60090, Tel: 312-537-1800; *Sls. Mgr.:* Kim Palmer ..... **B•1593-1595**

Local Sales Offices & Reps

AZ	Tempe, Desert-West Technical Sls.	602-244-0735
CA	Los Angeles, Spectrum Assocs.	213-641-4255
CA	San Rafael, Wright Assoc.	415-457-9940
FL	New Port Richey, Lobo Mktg. Assocs.	813-848-8578
IN	Carmel, TMC	317-844-8462
IN	Fort Wayne, TMC	219-432-5553
KY	Louisville, TMC	502-499-7808
MN	Minneapolis, Jos. Co/Melius	612-861-3343
NJ	Haddonfield, Gray Assocs.	
VA	Front Royal, Eltron Sls.	

Local Distributors

CA	Gardena, California Switch & Signal	213-770-2330
CA	San Leandro, Electro-Components	415-352-5210

IMAGE GRAPHICS, INC., 107 Ardmore Street, Fairfield, CT 06430, Tel: 203-259-1394; FSC No.: 5M867; Empl.: 35; *Sls. Mgr.:* J. P. Whitley

IMAGE MAKERS OF PITTSFORD, 6 Wood Gate, Pittsford, NY 14534, Tel: 716-385-4567; *Sls. Mgr.:* Richard H. Roberts; *Dist. Mgr.:* Richard H. Roberts

IMAGE TECHNOLOGY METHODS CORP., 103 Moody St., Waltham, MA 02154, Tel: 617-894-1720

IMAGING TECHNOLOGY, INC., 600 W. Cummings Park, Woburn, MA 01801, Tel: 617-938-8444, Telex: 948263; Empl.: 70; *Sls. Mgr.:* Ronald A. Massa

imc

IMC MAGNETICS CORP., Exec. Off., 100 Jericho Quadrangle, Ste. 221, Jericho, NY 11753, Tel: 516-938-0800, TWX: 510-221-2126; *Sls. Mgr.:* E. Egan ..... **B•1161; C•1644-1645, 1647**

IMC MAGNETICS CORP., Arizona Div., 1900 East Fifth St., Tempe, AZ 85281, Tel: 602-968-4441, Telex: 910-951-0001; *Sls. Mgr.:* Alex Lazutin

IMC MAGNETICS CORP., Eastern Div., 570 Main St., Westbury, NY 11590, Tel: 516-334-7070, TWX: 510-222-4469; *Sls. Mgr.:* A. Chillemi .... **B•1161; C•1644-1645**

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Tempe, Gassner & Clark	602-968-9037
CA	Cerritos, El-Com, Inc.	213-404-2961
CA	Los Altos, Recht Assocs.	415-964-6321
CA	San Diego, El-Com, Inc.	619-578-0900
CO	Englewood, Thorson Rocky Mtn.	303-779-0666
CT	Middletown, Gerber Sls. Corp.	203-347-3000
FL	Coral Springs, HAI Elctrns.	404-256-9640
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Chicago, Industrial Reps., Inc.	312-647-7755
MD	Mt. Airy, Beacon N.	800-336-3747
MA	Monson, Gerber Sls. Corp.	413-267-5051
MA	Newton Upper, Gerber Sls. Corp.	617-969-2620
MN	Minneapolis, Holmgren Assocs.	612-786-7641
MO	Grandview, Harris-Hanson Co.	816-763-6200
MO	St. Louis, Harris-Hanson	314-432-3611
MO	St. Louis, Harris-Hanson Co.	314-432-3611
NJ	Haddonfield, Mesa Tech Assoc.	609-429-9531
NJ	Haddonfield, Mesa Tech. Assoc.	609-429-9531
NY	Fairport, Net Sales Co.	716-467-4538
NY	Great Neck, Trionics Assocs.	516-466-2300
NY	Syracuse, Electra Sls. Corp.	315-463-1248
NC	Greensboro, Beacon Elctrns.	919-275-9997
NC	Raleigh, Beacon Elctrns.	919-787-0330
OH	Dayton, Electrical Sys. Co.	513-434-9822
OH	Dayton, Electrical Systems Co.	513-434-9822
OH	Westlake, Electrical Sys. Co.	216-835-8672
OR	Alhoa, Huntley Assocs.	503-649-5388
OR	Lake Oswego, Huntley Assocs.	503-636-7558
TX	Dallas, Kruvand Assocs.	214-691-4592
TX	Dallas, Kruvand Assocs.	801-973-7969
UT	Valley City, Thorson Rocky Mtn.	214-437-3355
VA	Fairfax, Beacon N.	703-591-1300
VA	Falls Church, Beacon North	703-534-7200
WA	Everett, Huntley Assocs.	206-353-1833
PR	San Juan, Jorge Donato Assocs.	809-790-1300
Can	Markham, Ont., Lenbrook Elctrns.	416-477-7722
Can	Surrey, B.C., Lenbrook Elctrns.	604-585-9599

IMC/HANSEN, Box 23, Princeton, IN 47670, Tel: 812-385-3415, Telex: 27-8458 HANSON PEON; Empl.: 350; *Sls. Mgr.:* George A. Gilbert

IMC MAGNETICS CORP., New Hampshire Div., Rte. 16B, Rochester, NH 03867, Tel: 603-332-5300, TWX: 510-297-4466; *Sls. Mgr.:* William Beaulieu; *Dist. Mgr.:* Dave Flanagan ..... **C•1647**

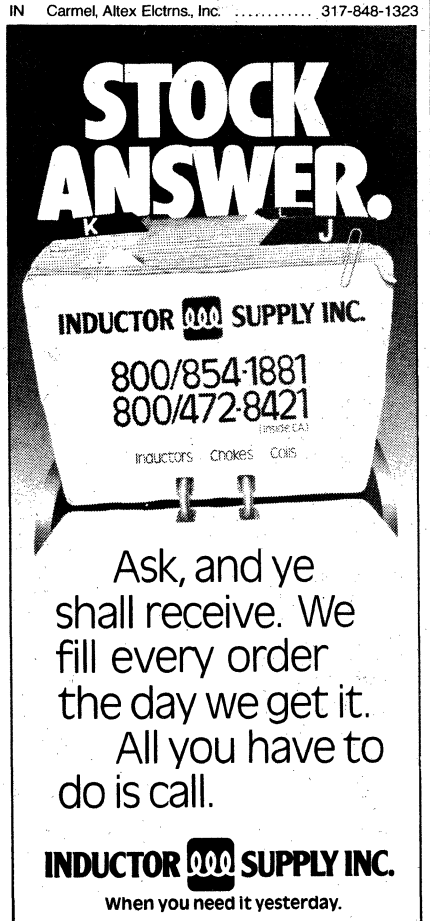
Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Tempe, Gassner & Clark	602-968-9037
CA	Cerritos, El-Com, Inc.	213-404-2961
CA	Los Altos, Recht Assocs.	415-964-6321
CA	San Diego, El-Com, Inc.	619-578-0900
CO	Englewood, Thorson Rocky Mtn.	303-779-0666
CT	Middletown, Gerber Sls. Corp.	203-347-3000
FL	Coral Springs, HAI Elctrns.	404-256-9640
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Chicago, Industrial Reps., Inc.	312-647-7755
MD	Mt. Airy, Beacon N.	800-336-3747
MA	Monson, Gerber Sls. Corp.	413-267-5051
MA	Newton Upper, Gerber Sls. Corp.	617-969-2620
MN	Minneapolis, Holmgren Assocs.	612-786-7641

MO Grandview, Harris-Hanson Co. 816-763-6200
MO St. Louis, Harris-Hanson Co. 314-432-3611
NJ Haddonfield, Mesa Tech Assoc. 609-429-9631
NY Great Neck, Trionics Assocs. 516-466-2300
NY Syracuse, Electra Sls. Corp. 315-463-1248
NC Raleigh, Beacon Elctrns. 919-787-0330
OH Dayton, Electrical Sys. Co. 513-434-9822
OH Westlake, Electrical Sys. Co. 216-835-8672
OR Alhoa, Huntley Assocs. 503-649-5388
TX Dallas, Kruvand Assocs. 214-437-3355
UT Valley City, Thorson Rocky Mtn. 801-973-7969
VA Fairfax, Beacon N. 703-591-1300
WA Everett, Huntley Assocs. 206-353-1833
PR San Juan, Jorge Donato Assocs. 809-790-1300
Can Markham, Ont., Lenbrook Elctrns. 416-477-7722
Can Surrey, B. C., Lenbrook Elctrns. 604-585-9599

Local Distributors

AL Huntsville, C.D.I. 205-883-7501
AK Little Rock, C.D.I. 501-227-6278
AZ Phoenix, Sterling Elctrns. 602-268-2121
AZ Tempe, Bell Inds. 602-966-7800
AZ Tuscon, Southwest Sls. 602-325-4087
CA Cerritos, El-Com 213-404-2961
CA Garden Grove, Bell Inds. 714-220-0681
CA Gardena, Bell Inds. 213-515-1800
CA Inglewood, Newark Elctrns. 213-671-7387
CA Roseville, Graham Elctrns. 916-969-3100
CA San Diego, Bell Inds. 619-268-1277
CA San Diego, El-Com 619-578-0900
CA Santa Clara, El-Com 408-496-0880
CA Sunnyvale, Bell Inds. 408-734-8570
CA Thousand Oaks, Bell Inds. 805-499-6821
CO Denver, Newark Denver Elctrnd. 303-757-3351
CO Ravada, Denver Wintronics 303-431-7161
CO Wheatridge, Bell Inds. 303-424-1985
CT East Haven, J. V. Elctrns. 203-469-2321
CT Wallingford, Sager Elctrl. Supp. Co. 203-265-4600
CT Wallingford, Sterling Elctrns. 203-265-9535
FL Ft. Lauderdale, C.D.I. 305-971-4950
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Largo, Graham Elctrns. 813-541-4434
FL Orlando, Hammond Elctrns. 305-849-6060
GA Norcross, C.D.I. 404-441-3320
IL Chicago, Bell Inds. 312-982-9210
IL Chicago, Newark Elctrns. 312-638-4411
IL Northbrook, Classic Comps. 312-272-9650
IN Carmel, Altex Elctrns., Inc. 317-848-1323



IN Ft. Wayne, Graham Elctrns. 219-423-3422
IN Indianapolis, Graham Elctrns. 317-634-8202
IN Lafayette, Graham Elctrns. 317-423-5564
IA Cedar Rapids, Bell Inds. 319-395-0730
KS Wichita, RSC Elctrns., Inc. 316-267-5213
MD Columbia, Lionex Corp. 301-964-0040
MD Savage, Pyttronic Inds. 301-792-0780
MA Hingham, Sager Elctrl. Sup. Co. 617-749-6700
MA Norwood, Gerber Elctrns. 617-769-6000
MA Somerville, Electro Sls. 617-666-0500
MA Waltham, Sterling Elctrns. 617-894-6200
MA Wilmington, Lionex Corp. 617-657-5170
MI Adrian, Wedemeyer Elctrn. Supp. Co. 517-263-2925
MI Ann Arbor, Graham Elctrns. 313-884-4725
MI Ann Arbor, Wedemeyer Elctrn. Supp. Co. 313-665-8611
MI Lansing, Wedemeyer Ecltrn. Supp. Co. 517-484-9009
MN Minneapolis, Aero-Space Computer Supps., Inc. 612-884-4725
MO St. Louis, Olive Elctrns., Inc. 314-426-4500
NJ Bellmawr, Mid-Atlantic 609-931-5303
NJ Fairfield, Lionex Corp. 201-227-7960
NJ Perth Amboy, Sterling Elctrns. 201-442-8000
NM Albuquerque, Bell Inds. 505-292-2700
NM Albuquerque, International Elctrns. 505-345-8127
NM Albuquerque, Sterling Elctrns. 505-884-1900
NY Buffalo, Summit Distrs. 716-884-3450
NY Endwell, A.S.I. Elctrns. 607-754-3823
NY Hauppauge, Lionex Corp. 516-273-1660
NY Mt. Vernon, Q.A.R. Indl. Sls. 914-699-2224
NY Plainview, Progress Elctrns. 516-433-1700
NY Rochester, Summit Elctrns. 716-334-8110
NC Greensboro, Hammond Elctrns. 919-275-6391
NC Raleigh, C.D.I. 919-834-9465
OH Cincinnati, Graham Elctrns. 513-772-1661
OH Columbus, Graham Elctrns. 614-895-1590
OH Columbus, Wedemeyer Elctrn. Supp. Co. 614-436-2410
OH Dayton, Bell Inds. 513-434-8231
OH Dayton, Esco Elctrons. 513-293-1133
OH Dayton, Stotts-Friedman 513-298-5555
OH Youngstown, Newark Elctrns. 216-793-6134
OR Lake Oswego, Bell Inds. 503-241-4115
PA Braddock, Leff Elctrns. 412-351-5000
PA Horsham, Lionex Corp. 215-443-5150
PA McKean, Advacom, Inc. 814-476-7774
PA Montgomeryville, Pyttronic Inds. 215-643-2850
PA Reading, Barbey Elctrns. 215-376-6116
RI Providence, William Dandreta Co. 401-861-2800
SC Greenville, Hammond Elctrns. 803-233-4121
TN Nashville, Electra Distrbg. Co. 615-329-3971
TN Nashville, Graham Elctrns. 615-242-2682
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TX Dallas, Heilind Elctrns. 214-351-2050
TX Dallas, Sterling Elctrns. 213-243-1600, 800-225-9618
TX El Paso, International Elctrns. 915-598-3406
TX Houston, Sterling Elctrns. 713-623-6600
UT Salt Lake City, Bell Inds. 801-972-6969
UT Salt Lake City, Standard Supp. 801-486-3371
VA Richmond, Sterling Elctrns. 804-226-2190
WA Bellevue, Bell Inds. 206-747-1515
WI New Berlin, Classic Comps. 414-786-5300
WI Waukesha, Bell Inds. 414-547-8879
Can Downsview, Ont., Westburne Indl. Entprs., Ltd. 416-635-2950
Can Montreal, Que., Electronic Whls., Ltd. 514-769-8851/61
Can Ottawa, Ont., Electronic Whls., Ltd. 613-746-4413
Can Ottawa, Ont., Wackid Radio 613-728-1821
Can Pointe Claire, Que., Future Elctrns. 514-694-7710

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AZ Tucson, W.J.M. Sales 602-888-4847
CA Orange, E.T.A. 714-998-9241
CA San Diego, Savage Assocs. 619-457-2644
CA Santa Clara, M2 Mktg. Grp. 408-986-0676
CO Sedalia, Jensen Reps. 303-688-4154
FL Casselberry, Southern Elctrn. Mktg. 305-695-3334
IL Chicago, Electro-Tech Mktg. 312-672-3151
MD Silver Springs, Mid Atlantic Sls. 301-583-7749
MA Framingham, Sullivan Tech. Sls. 617-620-0195
MN Minnetonka, Frank Anthony Mktg. 612-934-0773
MO Clayton, Mertens Co. 314-993-6600
MO Silver Springs, Mid Atlantic Sls. 301-593-7749
NJ Mountainside, Henry G. Richter 201-233-4615
NY Rochester, Henry G. Richter 716-436-0300
NC Research Triangle Park, Naylor Assocs. 919-286-7007
OH Columbus, Micro-Tec 614-888-9761
OR Portland, Power Sources, Unltd. 503-292-0820
PA Pittsburgh, Micro-Tec 412-931-3380
SC Greenville, Naylor Assocs. 803-297-9969
TX Dallas, Milco Mktg. 214-783-2716
TX Houston, Milco Mktg. 713-723-5003
WA Lynnwood, Power Sources, Unltd. 206-743-6641
WI Brookfield, Electro-Tech Mktg. 414-785-9554
Can Pointe Claire, Que., A. R. Gray & Assocs. 514-694-6378

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AZ Phoenix, Tri Tek, Inc. 602-995-9352
CA Costa Mesa, Escot 714-557-3252
CA Fullerton, Pyramid Elctrns. 714-773-0781
CA San Diego, Lauber Elctrns. 619-274-7242
CA San Jose, Compumech 408-289-9171
CA Santa Ana, C. R. Elctrns. 714-556-2040
CA Santa Clara, Escot 408-988-4991
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CA Sunnyvale, Sierra West 408-747-1188
CO Broomfield, Escot 303-465-2346
FL Longwood, Cam RPC 305-834-2031
GA Norcross, Cam RPC 404-441-1188
IL Wheeling, Escot 312-459-5750
MD Aberdeen, Harco Elctrns. 301-575-6885
MD Beltsville, Treeko Sls. 301-937-8260
MD Towson, Cam RPC 301-337-5545
MA Newton, Greene-Shaw Co. 617-969-8900
MN Bloomington, N.W.R. Elctrns. 612-854-7329
NJ East Brunswick, Brothers Elec. 201-238-2200
NY Henrietta, Cam RPC 716-334-5600
OH Cleveland, Cam RPC 216-461-4700
OH Dayton, Micro-Mil/Bell 513-434-8231
PA Philadelphia, Cam RPC 215-739-4095
PA Pittsburgh, Cam RPC 412-782-3770
TX Dallas, Cam RPC 214-644-4325
VA Annandale, Arcade Elctrns. 703-256-4610
WA Kent, Pyramid Elctrns. 206-872-5800

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INDUCTOR SUPPLY, 15204 Transistor Lane, Huntington Beach, CA 92649, Tel: 714-891-4524 ..... p. 700

INDUSTRIAL COMPUTER DESIGNS, INC., 31264 La Baya Drive, Westlake Village, CA 91362, Tel: 818-889-3179; Empl.: 33; *Sls. Mgr.:* David J. Knight

INDUSTRIAL CONTROL CO., 3100 Pineda Ave., Rockledge, FL 32955, Tel: 305-259-7105; Empl.: 15; *Sls. Mgr.:* I. Nobilio ..... **D•1988**

INDUSTRIAL DEVICES, INC., 7 Hudson St., Edgewater, NJ 07020, Tel: 201-224-4700, Telex: 12-7459; FSC No.: 91802; Empl.: 200; *Sls. Mgr.:* Michael Dicleglie ..... **B•1014, 1017, 1057-1077**

Local Sales Offices & Reps

AL	Huntsville, E.M.A., Inc.	205-837-7363
AZ	Scottsdale, Bill Earl Assocs., Inc.	602-994-3813
CA	Los Angeles, Universal Comps.	213-641-4255
CA	Mountain View, Westech Sls.	415-961-1422
CO	Aurora, Sage Sls.	303-750-3501
FL	Casselberry, Southern Elctrn. Mktg.	305-831-2822
GA	Atlanta, E.M.A., Inc.	404-448-1215
IL	Chicago, K. D. Engle	312-539-1820
IN	Indianapolis, Elctrn. Mktg. Consits.	317-253-1668
KS	Shawnee Mission, Lowell-Kangas Assocs.	913-631-3515
MD	Towson, Ernie Stefkovic Assocs.	301-321-6008
MA	Newton Upper Falls, Anchor Engrg.	617-964-6205
MI	Oak Pk., W. Spenser	313-967-0808
MN	Minneapolis, Elec. Comp. Sls.	612-933-2594
MO	St. Louis, Lowell-Kangas Assocs.	314-821-4050
NJ	Cherry Hill, Ernie Stefkovic Assocs.	609-667-4066
NJ	Manville, Dyno Rep	201-685-0135
NY	Rochester, Apex Assocs.	716-254-6050
NC	Raleigh, E.M.A., Inc.	919-847-8800
OH	Cleveland, Marlow Assocs.	216-991-6500
OH	Columbus, Marlow Assocs.	800-362-2265
OR	Portland, Earl & Brown	503-245-2283
PA	Pittsburgh, Marlow Assocs.	412-367-8886
SC	Greenville, E.M.A., Inc.	803-233-4637
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Houston, R. F. Kimball Co.	713-890-8810
TX	Richardson, R. F. Kimball Co.	214-231-3447
UT	Salt Lake City, Sage Sls.	801-467-5451
WA	Seattle, Earl & Brown	206-284-1121
EXP	NY, Jericho, E.T.I., Inc.	516-931-3434

Local Distributors

AZ	Phoenix, Dalis Elctrn. Supp.	602-275-2885
CA	Gardena, Calif. Switch & Signal	213-770-2330
CA	Los Angeles, Elec. Switches	213-664-1141
CA	Palo Alto, Zack Elctrns.	415-326-5432
CA	Pasadena, Empire Elctrn. Distr.	213-681-2711
CA	S. San Francisco, Steven Engrg.	415-588-9200
CA	San Diego, Shanks & Wright	619-239-0176
CA	San Diego, Sigma Elctrns.	714-565-2000
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	San Jose, Quement Elctrns.	408-998-5900
CA	Santa Monica, Master Distrs.	213-452-1229
CO	Arvada, Denver Wintronics	303-431-7161
CT	Norwalk, Park Distrs.	800-243-5006
CT	Stratford, Utronics, Inc.	203-378-4201
CT	Wallingford, Sager Electrical Supp.	203-265-4600
FL	Longwood, Inter Tec	800-432-1654
FL	Miami, Electro Standard Lab (ESL)	305-593-6060
FL	Tampa, Leader Elctrns.	813-870-3315
FL	W. Palm Beach, Nurmi Elctrn.	305-686-8553
GA	Atlanta, Wholesale Indl. Elec.	800-282-1857
IL	Villa Park, Melvin Elctrns.	312-279-5015
IL	Wood Dale, Electro-Kinetics	312-595-6700
IN	East Chicago, ACRO Elctrns.	312-375-1269
IN	Evansville, Hutch & Son	812-425-7201
IN	Fort Wayne, Graham Elctrs.	219-423-3422
IN	Indianapolis, Graham Elctrns.	317-634-8202
IN	South Bend, Genesis Elctrns.	219-287-2911
IA	Cedar Rapids, Bergquist Co.	319-366-8733
IA	Cedar Rapids, Iowa Radio Supp.	319-393-4510
KY	Bowling Green, Crescent Elctrns.	502-842-2444
LA	Lafayette, Ralph's	318-234-4507
LA	New Orleans, Wm. B. Allen Supp. Co.	800-462-9520
MD	Rockville, Capitol Radio Whlsrs.	301-881-2270
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	N. Wilbraham, Indl. Comps.	413-596-3854
MA	Norwood, Gerber Elctrns.	617-329-2400
MA	Worcester, RM Elctrns.	617-756-8311
MI	Flint, Shand Elctrns.	313-743-8940
MN	Minneapolis, Bergquist Co.	612-835-2322
MN	Minneapolis, Elctrn. Center	612-371-5200
MN	Minneapolis, Stark Elctrns.	612-332-1325
MO	Kansas City, Olive Indl. Elect.	816-842-8556
MO	St. Louis, Olive Indl. Elctrns.	314-426-4500
MO	St. Louis, Van Sickle Radio-Elec.	314-621-5000
NE	Lincoln, Scott Elctrn. Supp.	402-466-8221
NV	Las Vegas, Kiesub Elctrns.	702-733-3888
NJ	Fair Lawn, Relay Spec.	201-797-3313
NJ	Hanover, State Elctrns. Parts	201-887-2550
NJ	Springfield, Route Elctrns.	201-379-7710
NY	Albany, E. E. Taylor Co.	518-438-7811
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	Hempstead, Elctrn. Equip.	800-645-1605
NY	Mt. Vernon, Q.A.R. Indl. Elctrn. Sls.	914-699-2224
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Raleigh, Southeastern Radio Supp.	919-828-2311
OH	Cincinatti, Hughes-Peters	513-351-2000
OH	Cincinnati, United Radio	513-761-4030
OH	Cleveland, Roberts Elctrns.	216-238-1711
OH	Columbus, Hughes Peters	614-294-5351
OH	Dayton, Stotts-Friedman Co.	513-298-5555
OH	Toledo, Warren Radio	419-248-3364
OK	Oklahoma City, Trice Whls. Elctrns.	405-524-4411
OK	Tulsa, Oil Capitol Elctrns.	918-622-8520
OR	Eugene, United Radio Supp.	503-342-3381
OR	Portland, United Radio Supp.	503-233-7151
PA	Erie, Rem/Mace Elctrns.	814-453-5626
PA	Harrisburg, Cumberland Elctrns.	717-233-5883
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
TN	Memphis, Bluff City Elctrns.	901-345-9500
TN	Nashville, Randolph & Rice	615-255-5601
TX	Fort Worth, Swieco	817-335-6521
TX	Ft. Worth, Allied Elctrns.	817-336-5401
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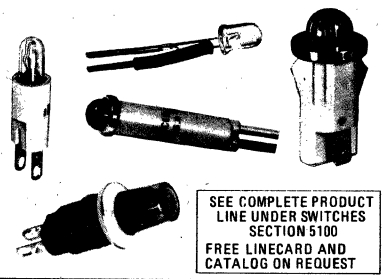

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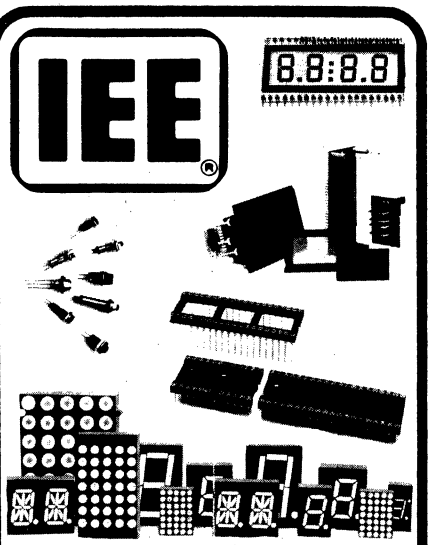

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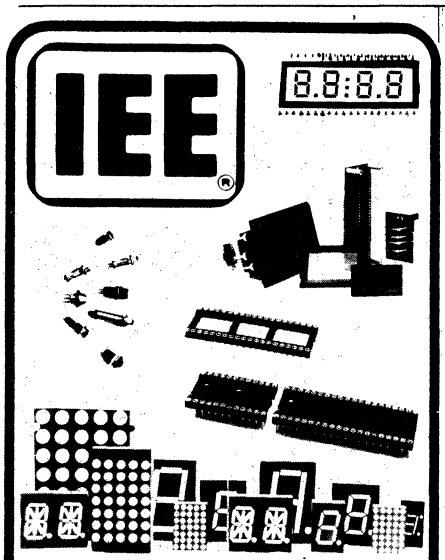

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Circuit Specialist Co.
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Ital Elctrn. Sls., Inc.
Philadelphia Elctrns., Inc.
AL Huntsville, TMA Technlg. Mktg. Assocs. 205-883-7893
AZ Phoenix, Gramer & Co. 602-995-9455, 602-942-1415
CA Brea, Masco Elctrns., Inc. 714-529-0866
CA Campbell, LCO Tech. Sls. 408-378-9900
CA Los Angeles, Masco Elctrns., Inc. 714-529-0866
CA Vista, Masco Elctrns., Inc. 619-758-5562
CO Lakewood, Cristee-Meade Co. 303-232-0287
CA San Jose, Class One Elctrns. 408-297-8666
CT North Haven, Kitchen & Kutchin, Inc. .. 203-239-0212
FL Melbourne, TMA Tech. Mktg. Assocs. 305-676-3776
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ID Boise, Huntley Assocs. 208-343-3753
IL Highland Park, Bransky Sls. 312-433-2375
IN Carmel, TMC Tech. Mktg. Corp. 317-844-8462
IN Ft. Wayne, TMC Techng. Mktg. Corp. .. 219-432-5553
KS De Soto, Midtec 913-441-6565
KY Louisville, TMC Tech. Mktg. Corp. 502-499-7808
MD Hunt Valley, Marktron, Inc. 301-628-1111
MD Rockville, Marktron, Inc. 301-251-8990
MA Burlington, Kitchen & Kutchin, Inc. 617-229-2660
MI Southfield, L. H. Dickelman Co. 313-353-8210
NJ Englewood, ABS 201-871-0020,212-594-4090
MN Burnsville, 2M Sales, Inc. 612-890-7774
MO Florissant, Midtec 314-837-5200
NC Raleigh, DHR Mktg, Inc. 919-876-5450
OH Cleveland, Geotronix, Inc. 216-526-2535
OH Trotwood, Geotronix, Inc. 513-252-6700
OR Aloha, Huntley Assocs. 503-649-5388
PA Norristown, RJI 215-631-1414
SC Greenville, DHR Mktg., Inc. 803-235-3594
TX Dallas, MGR Elctrns., Inc. 214-238-5246, 713-759-0187
UT Sandy, Cristee-Meade/GTM Assocs. 801-483-4103
VA Charlottesville, Marktron, Inc. 804-973-5874
WA Everett, Huntley Assocs. 206-353-1833
WI Cedarburg, Bransky Sls. 414-377-6837

Local Distributors

AL Huntsville, C.D.I. 205-883-7501
AZ Phoenix, Tri-Tek, Inc. 602-995-9352
AZ Tempe, Circuit Specialist Co. 602-966-0764
AR Little Rock, C.D.I. 501-227-6278
CA Cerritos, El-Com, Inc. 213-404-2961
CA Gardena, California Switch & Signal Co. 213-538-9830
CA Industry, Ital Elctrn. Sls., Inc. 818-968-8515, 714-990-0922
CA Lakeside, Mouser Elctrn. Corp. 619-449-2229
CA San Diego, El-Com, Inc. 619-578-0900
CA San Diego, Richey/Western Elctrns. ... 619-565-4444
CA San Jose, Richey/Western Elctrns. ... 408-946-6611
CA Santa Clara, Waltronic Sls. 408-727-1200
CA Sun Valley, Richey/Western Elctrns. .. 818-768-3800
CO Denver, Integrated Elctrns. 303-292-6121
CT East Haven, J. V. Elctrns. 203-469-2321
FL Alamonte Springs, Pioneer/Orlando ... 305-834-9090, 800-432-6094
FL Ft. Lauderdale, C.D.I. 305-971-4950
FL Miami, Elctrn. Equip. Co., Inc. 305-871-3500
GA Norcross, C.D.I. 404-441-3320
IL Chicago, Bell Inds. 312-982-9210
IL Chicago, Newark Elctrns. 312-638-4411
IL Elgin, Allied Elctrns. 312-697-8200
IL Elmhurst, Semiconductor Specialists, Inc. 312-279-1005
IL Northbrook, Classic Comps. 312-272-9650
IN Carmel, Altex Elctrns., Inc. 317-848-1323, 800-692-6039
KS Wichita, R.S.C. 316-267-5213
MD Beltsville, Treeko Sls. 301-937-8260
MD Gaithersburg, Pioneer/Washington ... 301-948-0710
MA Billerica, A. W. Mayer Co., Inc. 617-667-6900
MA Danvers, Criterion Elctrns. 617-777-4725
MA Needham, Cronin Elctrns., Inc. 617-449-5000
MI Grand Rapids, S-F Elctrn. Supp. Inc. .. 616-459-0216
MI Southfield, Michigan Lectrols Corp. ... 313-353-1350
MN Minneapolis, Stark Elctrns. 612-332-1325
MO Kansas City, Semiconductor Specialists, Inc. 816-452-3900
MO St. Louis, Olive Indl. Elctrns. 314-426-4500
NM Albuquerque, Betatron Elctrns. 505-344-2381
NM Albuquerque, Intl. Elctrns. 505-345-8127
NY Farmingdale, Pride Elctrns. 516-293-4020
NY Farmingdale, S.A.I. 516-293-2710
NY Mamaroneck, Logicomp Elctrns. 914-698-9332
NY Rochester, Masline Elctrns. 716-647-9700
NY Rochester, Modutex Corp. 716-647-9700
NC Greensboro, Hammond Elec. 919-275-6391
NC Raleigh, So. Eastern. Elctrns. 919-828-2311
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Cleveland, Alpha Distr. Corp. 216-526-3716
OH Dayton, The Stotts-Friedman Co. 513-298-5555
OK Oklahoma City, Electro Entrs., Inc. 405-427-6591
PA Philadelphia, Herbach & Rademan, Inc. 215-426-1700
PA Philadelphia, Philadelphia Elctrns., Inc. 215-568-7400
SC Taylors, Cantrell Whls. 803-268-1194
TX Austin, Southwest Elctrns. 512-837-8971
TX Austin, The Altair Co. 512-837-4490
TX Fort Worth, Allied Elctrns. 817-336-5401
TX Houston, Solid State Elctrns. 713-772-8483
TX Houston, The Altair Co. 713-462-3029
TX Irving, Solid State Elctrns. 214-438-5700
TX Richardson, Southwest Elctrns. 214-234-3050
TX Richardson, The Altair Co. 214-231-5166
TX Stafford, Southwest Elctrns. 713-491-4900
WA Kent, Shannon Ltd. 206-763-0545
WI Mequon, Taylor Elec. Co. 414-241-4321
WI Milwaukee, Marsh Elctrns. 414-475-6000

IEH

INDUSTRIAL ELCTRN. HARDWARE CORP., 109 Prince St., New York, NY 10012, Tel: 212-677-1881, TWX: 710-581-4338; FSC No.: 97913; Empl.: 430; *Sls. Mgr.:* Louis Roberts; *Dist. Mgr.:* Louis Roberts ..... **C•1272**

Local Sales Offices & Reps

AL Huntsville, Beacon Elctrns. 205-881-5031
AZ Phoenix, Knight Co. 602-582-8506
CA Los Angeles, Knight Co 213-670-2833
CA San Diego, Knight Co. 619-743-5136
CA Sunnyvale, M2 Mktg. Grp. 408-986-0676
FL Maitland, Ellis Assocs. 305-645-1101
GA Atlanta, Beacon Elctrns. 404-256-9640
KS Wichita, Thunderbird Tech. Sls. 316-684-3941
MD Ellicot City, Techn. Sls. 301-461-2400
MA Lowell, Todino Engrg. 617-444-7925
MN St. Paul, Countryman 612-645-9151
NJ Fort Lee, FJK Assocs., Inc. 201-592-1002
NJ Haddonfield, Brown Assocs. 609-429-1005
NY Buffalo, Franklin Sls. 716-248-8251
NY Pittsford, Franklin Sls. 716-248-8251
NY Ronkonkoma; PMR 516-467-8200
NC Raleigh, Beacon Elctrns. 919-787-0330
OH Beachwood, Elctrn. Salesmasters, Inc. 216-831-9555
OR Beaverton, Eclipse Mktg. 206-885-6991
TX Dallas, Pro-Mark 214-644-0497
WA Redmond, Eclipse Mktg. 206-885-6991

Local Distributors

AL Huntsville, Powell Elctrns. 205-539-2731
CA San Jose, Powell Elctrns. 408-943-9020
CA Sunnyvale, Time Elctrns. 408-734-9888
FL Ft. Lauderdale, Time Elctrns. 305-974-4800
MA Westborough, Powell Elctrns. 617-366-6100
MA Woburn, Time Elctrns. 617-935-8080
NY Hauppauge, Time Elctrns. 516-273-0100
PA Philadelphia, Powell Elctrns. 215-365-1900
TX Dallas, Time Elctrns. 214-385-0566
TX Los Colinas, Powell Elctrns. 214-258-6841

INDUSTRIAL FABRICATING CO., 820 Woodend Ave., Stratford, CT 06497, Tel: 203-375-5853; Empl.: 30; *Sls. Mgr.:* Ray Peterson

INDUSTRIAL INDEXING SYS., INC., 626 Fishers Run, Victor, NY 14564, Tel: 716-924-9181; Empl.: 30; *Sls. Mgr.:* Raymond F. Coller

Local Sales Offices & Reps

CA	San Carlos, Cymatix	415-592-8076
IN	Fort Wayne, Aktron Corp.	219-747-3650
MA	Bedford, AID Engrg. Sls.	203-663-2225
MI	Grand Rapids, Ackerman Elec. Supp.	616-459-8327
MI	Walled Lake, Static Controls	313-363-4500
NY	East Rochester, A & D Dvcs.	716-385-2778
NY	Sidney, A & D Dvcs.	603-563-8488
OH	Medina, Cygnus Corp.	216-725-1663
PA	Media, Homersmith, Inc.	215-543-2434
WI	Milwaukee, KMA Sls. Co.	414-259-1771

INDUSTRIAL MIDWEC CAPACITORS, 4902 Tollview Dr., Rolling Meadows, IL 60008, Tel: 312-577-0120, TWX: 910-687-3375; Empl.: 800; *Sls. Mgr.:* Andy Kaluski

Powertron

INDUSTRIAL TEST EQUIP., 21 Yennicock Ave., Port Washington, NY 11050, Tel: 516-883-1700; FSC No.: 99074; *Sls. Mgr.:* Robert Loiacono **D•1247, 1938-1941**

INERTIAL MOTORS, 280 N. Broad St., Doylestown, PA 18901, Tel: 215-345-1010, Telex: 83-1633; Empl.: 49; *Sls. Mgr.:* Lori Clarkin

INFICON LEYBOLD-HERAEUS, INC., 6500 Fly Rd, E. Syracuse, NY 13057, Tel: 315-437-0377, TWX: 710-541-0594; Empl.: 165; *Sls. Mgr.:* D. A. DiRenzo

INFINETICS INC., Friskem Div., 201 Vandever Ave., Wilmington, DE 19802, Tel: 302-658-2471, TWX: 510-632-2332; *Sls. Mgr.:* M. Schwartz

INFOCAP, INC., 31119 Via Colinas #502, Westlake Village, CA 91362, Tel: 818-991-1410; *Sls. Mgr.:* David Knight

INFODEX

INFODEX, INC., 395 W. Main St., Waterbury, CT 06702, Tel: 203-757-9291, Telex: 178702 IFDX; FSC No.: 09087; Empl.: 45; *Sls. Mgr.:* E. H. Ulm .. **B•1080-1081; D•1410**

Local Sales Offices & Reps

CA	Pasadena, A-F Sales Engrg.	818-681-5631
MA	Boston, Nortech Engrg. Sls.	617-359-6063
MA	Concord, Nortech Engrg. Sls.	617-259-0032

INFOLINK CORP., 1925 Hoiste Rd., Northbrook, IL 60062, Tel: 312-291-2900; Empl.: 200; *Sls. Mgr.:* Joseph F. Guzman; *Dist. Mgr.:* Joseph F. Guzman

INFO-LITE CORP., See Dio-Rey and Crosspoint

INFO-PROS INC., 2102 Business Center Dr., Irvine, CA 92715, Tel: 714-851-8975

INFORMATION CONTROL, Dept. EM7 9610 Bellanca Ave., Los Angeles, CA 90045, Tel: 213-641-8520, TWX: 910-328-7234; Empl.: 55; *Sls. Mgr.:* Carol J. Smith

INFORMATION CONTROL CORP., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045, Tel: 213-641-8520, TWX: 910-328-7234; Empl.: 50

INFORMATION CONTROL CORP., 9610 Bellanca Ave., Los Angeles, CA 90045, Tel: 213-641-8520, TWX: 910-328-7234; Empl.: 30; *Sls. Mgr.:* J. M. Boyle

INFORMATION TECHNOLGOY A.D.S.C., P.O. Box 470, College Park, MD 20740, Tel: 301-779-5110; *Sls. Mgr.:* Daniel Akers

INFORMATION TERMINALS, See Verbatim Corp.

iiti THE SWITCHING COMPANY

INFORMATION TRANSFER INDL., Box 357, Holcomb, NY 14469, Tel: 716-657-7074; FSC No.: 55137; Empl.: 70; *Sls. Mgr.:* J. E. Wiseman .... **D•1152-1154, 1248-1249**

Local Sales Offices & Reps

AZ	Scottsdale, Luscombe Engrg.	602-949-9333
CA	Campbell, Luscombe Engrg.	408-370-2020
CA	Pasadena, Luscombe Engrg.	213-684-2000
CA	San Diego, Luscombe Engrg.	714-295-4300
CO	Littleton, Pond Assocs., Inc.	303-798-2904
CT	Marion, Polytek Assocs.	203-621-4542
IL	Schaumburg, Kenneth W. Meyers Co.	312-882-4808
IN	Indianapolis, Kenneth W. Meyers Co.	317-783-1030
IA	Cedar Rapids, Kenneth W. Meyers Co.	319-363-8987
MD	Clarksville, Riffe Assocs.	301-953-2811
MA	Ashland, Polytek Assocs.	617-881-4741
MN	Minneapolis, Kenneth W. Meyers Co.	612-920-7080
NJ	Oxford, Malin Assocs.	201-689-7398
NY	Albany, R. F. Lamb Co.	518-869-3355
NY	Buffalo, R. F. Lamb Co.	716-874-4900
NY	Rochester, R. F. Lamb Co.	716-323-1250
NY	Syracuse, R. F. Lamb Co.	315-454-2469
OR	Portland, Tasco	503-245-8168
PA	Melrose Park, Robert Meyers Assocs.	215-224-1663
TX	Houston, Sci. Sls. Co.	713-460-9170
TX	Richardson, Sci. Sls. Co.	214-231-6541
WA	Bellevue, Tasco	206-453-1414
WI	Brookfield, Kenneth W. Meyers Co.	414-784-3790
EXP	Brampton, Ontario, Misner Mktg. Ltd.	416-456-3777

INFOSPHERE, INC., 4730 S.W. Macadam Ave., Portland, OR 97201, Tel: 503-226-3515, Telex: 360312; *Sls. Mgr.:* Wm. David Sharon; *Dist. Mgr.:* Wm. David Sharon

INFRARED INDS., INC., P.O. Box 14200, Orlando, FL 32857, Tel: 305-282-7700, Telex: 568908; Empl.: 80; *Sls. Mgr.:* Thomas Chisholm

INJECTORALL ELCTRNS., 98-100 Glen St., Glen Cove, NY 11542, Tel: 516-671-6010 ..... **C•1101**

Local Sales Offices & Reps

AL	Birmingham, John F. Russell Co.	205-822-2196
CA	Burlingame, Carelli-Ema	415-342-4514
CA	Long Beach, Ross Sls.	213-424-9818
FL	Miami Beach, Everett Wollman Sls.	305-932-1790
MA	Northboro, W. B. Pray Co.	617-393-3434
MI	Livonia, Harvey Sales Co.	313-476-1974
NY	Brooklyn, Moet Maltz & Co.	212-252-1139
WA	Edmonds, McLaughlin Mktg. Inc.	206-743-1161

Local Distributors

AL	Huntsville, Mock	205-539-2401
AZ	Tucson, Electronic City	602-622-1173
CA	Los Angeles, ITC	213-388-0621
CA	San Jose, Quement	408-998-5900
CA	San Rafael, Elctrns. Plus	415-457-0466
CA	Sunnyvale, Halted Specialties	408-732-1573
FL	Pensacola, Pensacola Elctrns.	904-478-3771
GA	Atlanta, Delta	404-458-4690
IL	Chicago, Tron Elctrns.	312-640-8822
IN	East Chicago, Acro	219-397-8681
KY	Louisville, P.I. Burkes	502-589-3960
MA	Needham, Y.D.I.	617-449-1005
MI	Bay City, KDC	517-892-1594
MI	Port Huron, Main	313-985-5103
NJ	Vineland, Laraco	609-691-2900
NY	Elmsford, Ancar	914-592-7100
NY	Levittown, Edlies Elctrns.	516-735-3330
NY	New York City, Taft	212-575-5194
NY	Richmond Hill, Anchor	212-846-2420
OR	Beaverton, Norvac	503-644-1025
PA	Norristown, Philadelphia Elctrns.	215-275-5550
TX	Fort Worth, Sweico	817-335-6521
WA	Seattle, Elctrn. Supermart	206-575-1093
WA	Seattle, Radar	206-282-2511

INLAND MOTOR DIV. KOLLMORGEN, INDL DRIVES GRP., See Kollmorgen Corp.

INLAND MOTOR DIVISION, Kollmorgen Corp., 4020 E. Inland Rd., Sierra Vista, AZ 85635, Tel: 602-459-1150, Telex: 62858, TWX: 910-973-9869; *Sls. Mgr.:* Mike Malcoun

INLAND MOTOR KOLLMORGEN CORPORATION

INLAND MOTOR, Kollmorgen Corp., 501 First St., Radford, VA 24141, Tel: 703-639-9045, TWX: 710-875-3740; FSC No.: 11384; Empl.: 450

Local Sales Offices & Reps

PA	Media, Homersmith, Inc.	215-543-2434
FL	Melbourne, Technology Mktg. Assocs.	305-676-3776
FL	Orlando, Technology Mktg. Assocs.	305-857-3760
FL	Pampano Beach, Technology Mktg. Assocs.	305-942-0774
FL	Winter Park, Magna Engrg. Sls.	305-671-8716
OH	Medina, Cygnus	216-725-1663
PA	Doylestown, Magna Engrg. Sls.	215-345-5111

Specialty/Instrument/Industrial Drive Group

AL	Huntsville, Technology Mktg. Assocs.	205-883-7893
AZ	Phoenix, Thor Engrg. Mfrs. Reps.	602-437-1463
AZ	Sierra Vista, Inland Motor	602-459-1150
CA	Alhambra, Thorson Co. of Southern CA	818-281-2280
CA	Goleta, Thorson Co. of Southern CA	805-964-8751
CA	Mountain View, Thorson Co. of Southern CA	415-964-9300
CA	San Diego, Thorson Co. of San Diego	619-292-8525
CA	Signal Hill, Thorson Co. of Southern CA	213-595-0361
CO	Englewood, Thorson Rocky Mt., Inc.	303-779-0666
CT	Wolcott, Vanguard Elctrns. Corp.	203-879-9310
GA	Atlanta, Technology Mktg. Assocs.	404-257-0374
IL	Collinsville, Magna Engrg. Sls.	618-345-5583
IL	Elk Grove Village, Carlson Elctrn. Sls.	312-956-8240
IN	Indianapolis, J & W Sls.	317-842-3740
IA	Cedar Rapids, Carlson Elctrn. Sls.	319-377-6341
KS	Wichita, Magna Engrg. Sls.	316-744-0851
MD	Baltimore, Rep-Tron, Inc.	301-799-7490
MA	Needham Heights, Vanguard Elctrns. Corp.	617-449-5578
MI	Grand Rapids, R. P. Urban & Assocs.	616-245-0511
MI	Redford, R. P. Urban & Assocs.	313-535-2355
MN	St. Paul, John J. Exon Co.	612-636-5533
NJ	Wayne, SHL Assocs., Inc.	201-790-1714
NY	E. Rochester, A & D Dvcs.	716-385-2778
OR	Beaverton, Thorson Co. Northwest	503-644-5900
TX	Dallas, Magna Engrg. Sls.	214-349-6171
UT	W. Valley City, Thorson Rocky Mt, Inc.	801-973-7969
WA	Bellevue, Thorson Co. Northwest	206-455-9180
WI	Milwaukee, Carlson Elctrn. Sls.	414-476-2790

INMAC, 2465 Augustine Dr., Santa Clara, CA 95054, Tel: 408-727-1970, TWX: 910-338-2091; Empl.: 500

INMARK CORP., 147 West Cedar St., Norwalk, CT 06854, Tel: 203-866-8474, Telex: 99-6419; *Sls. Mgr.:* Lars Giers

INMOS CORP., P.O. Box 16000, Colorado Springs, CO 80935, Tel: 303-630-4000 Ext. 4454, TWX: 910-920-4904; Empl.: 1500; *Sls. Mgr.:* Peter Fowler; *Dist. Mgr.:* Jim O'Sullivan

INNOTRONICS, Brooks Rd., Lincoln, MA 01773, Tel: 617-678-8720; *Dist. Mgr.:* Stephen Scheuer

INNOVATEK MICROSYSTEMS, INC., Smithfield Rd., R1 Box 104, Millerton, NY 12546-9720, Tel: 914-373-9003, Telex: 750120; Empl.: 8; *Sls. Mgr.:* Paul F. Fitts

INNOVATIVE DATA TECHNOLOGY, 5340 Eastgate Mall, San Diego, CA 92121, Tel: 619-587-0555, TWX: 910-335-1610 IDT SDG; Empl.: 80; *Sls. Mgr.:* Robert G. Christy

INNOVATIVE ELECTRONICS, INC., 4714 N.W. 165th St., Miami, FL 33014, Tel: 305-624-1644, Telex: 80-7121; Empl.: 28; *Sls. Mgr.:* Tom Wullen; *Dist. Mgr.:* Tom Wullen

INRECO, See Ransco Industries

INRESCO, INC., 654 Ocean Road, Pt. Pleasant, NJ 08742, Tel: 201-892-5881, Telex: WUD, TWX: 844228; Empl.: 16; *Sls. Mgr.:* G. L. Martin

INSERVCO, INC., Box 106, La Grange, OH 44050

INSTRON CORP., 100 Royall St., Canton, MA 02021, Tel: 617-828-2500, Telex: 924434; Empl.: 1000; *Sls. Mgr.:* S. J. Vinciguerra; *Dist. Mgr.:* Lawrence Frost

INSTRULAB, P.O. B. 98, Dayton, OH 45404, Tel: 513-223-2241; Empl.: 22; *Sls. Mgr.:* Philip C. Alderton

INSTRU-LEC, 44 Old State Rd, #18, New Milford, CT 06776, Tel: 203-355-3717; FSC No.: 13782; Empl.: 4

INSTRUMENTATION & CONTROL SYS., 520 Interstate Rd, Addison, IL 60101, Tel: 312-543-6200, TWX: 910-991-5945; Empl.: 50; *Sls. Mgr.:* Ken Horning ..... **B•1318-1319; D•1933**

Local Sales Offices & Reps

Industrial Control Component Reps.

CA	Arcadia, HMC, Inc.	818-447-0958
FL	Miami, Hummel Indl. Sls.	305-651-0196
IL	Elmhurst, Hill-Gray Assocs.	312-832-4101
NY	Rochester, J. G. Welch Assocs., Inc.	716-244-1100
IN	Indianapolis, Fred A. Dorsey & Assocs.	317-842-0060
KS	Shawnee Mission, Microtronics	913-262-1444
MI	Brooklyn, ECI	517-592-3236
MN	Minneapolis, R. W. Marshall Co.	612-929-0457
CO	Denver, West Incorporated	303-477-8180
NH	Durham, C. H. Burnham Assocs.	603-868-2282
NY	Plainview, R. Smith Assocs.	516-681-3155
NY	Tonwanda, Ronco Power Sys.	716-873-0760
VA	Warrenton, Mid-Atlantic Power Specialists	703-442-8249

Power Conditioning Reps.

AL	Birmingham, C. S. Phillips Co.	205-870-0640
CA	San Ramon, Synergy	415-838-8300
CO	Englewood, Data Specialties	303-761-5763
FL	Newport Richey, R. C. Todd	813-849-6067
GA	Atlanta, Fincannon Assocs.	404-451-7841
IL	Chicago, Ropek-Cahill & Vogt	312-631-0070
LA	Lake Charles, Devitt Pancoast Controls Co., Inc.	318-439-1255
LA	Baton Rouge, Devitt Pancoast Controls Co., Inc.	318-439-1255
NJ	Franklin Lakes, Lambert Assocs.	201-891-7154
NM	Albuquerque, E.E.R.	505-265-7148
LA	Metairie, Devitt Pancoast Controls Co., Inc.	504-835-1713
NY	Rochester, RG Engrg.	716-424-7492
TX	Houston, Gettys-Eads-Adair	713-781-3005

Local Distributors

CA	Canoga Park, C & A Elctrns.	818-340-6022
CA	Garden Grove, Allied Elctrns.	714-554-0731
CA	Hayward, Allied Elctrns.	415-487-5250
CA	San Jose, Allied Elctrns.	408-995-0470
CO	Denver, Colorado Bus.	303-759-4589
MA	Wilmington, Allied Elctrns.	617-942-0150
FL	Ft. Lauderdale, Allied Elctrns.	305-486-0500
FL	Miami, Hummel Indl. Sls.	305-651-0196
GA	Atlanta, Automatic Controls Co.	404-266-0130
IL	Berwyn, B-B & W, Inc.	312-749-1710
IL	Elgin, Allied Elctrns.	312-697-8200
IL	Rosemont, Advent Elctrns.	312-297-6200
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
IA	Indianapolis, Advent Elctrns.	317-872-4910
MD	Marlow Hgts., Allied Elctrns.	301-423-0161
MI	Farmington Hills, Advent Elctrns.	313-447-1650
MN	St. Paul, Powermation	612-645-0781
NY	Bay Shore, Soundview Instrs.	516-666-1000
NY	Mineola, Allied Elctrns.	516-248-2360
OH	Chagrin Falls, Neptune	216-247-7030
OH	Warren, REM Elctrn. Supp. Co., Inc.	216-373-1300
TX	Brownsville, Garden Indl. Grp.	512-546-1612
TX	Ft. Worth, Allied Elctrns.	817-336-5401, 214-265-9341
TX	Ft. Worth, Allied Export Svcs.	817-336-5401
TX	Garland, Powertronics	214-272-4640
WA	Seattle, Allied Elctrns.	206-767-2827
WI	Fond du Lac, Fedco Elctrns.	414-922-6490
WI	Waukesha, Powermation	414-542-2868

INSTRUMENTATION MEAS. LAB., Div. of Lockheed Electronics Co., Inc., 1501 Rt. 22, Plainfield, NJ 07061, Tel: 201-757-3730; *Sls. Mgr.:* P. Murray Grinnell

INSTRUMENTATION PRODS., 3M Co., 300 S. Lewis Rd., Camarillo, CA 93010, Tel: 805-482-1911, TWX: 910-336-1676; Empl.: 500

INSTRUMENTATION SERVICES, INC., 957 Winnetka Ave. N., Minneapolis, MN 55427, Tel: 612-544-8916, Telex: 29-0101; Empl.: 30; *Sls. Mgr.:* G. Ryan

INSTRUMENT ENCLOSURES, 9767 Glenoaks Blvd., Sun Valley, CA 91352, Tel: 818-768-4622, Telex: 66-2442; FSC No.: 62012; Empl.: 28; *Sls. Mgr.:* William B. Taylor

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INTERNATIONAL MICROELECTRONIC PRODS., 2830 North First Street, San Jose, CA 95134, Tel: 408-262-9100, Telex: 499-1041, TWX: 910-338-2274; FSC No.: 408-262-3981 (Manual); Empl.: 380; *Sls. Mgr.:* Robert Kromer ..... **A•1674-1676**

Local Sales Offices & Reps

AL	Huntsville, The Novus Grp.	205-881-2207
AZ	Scottsdale, Summit Sls.	602-998-4850
CA	Los Alamitos, Santana Sls.	213-431-3533
CA	San Diego, SR Elctrns.	619-560-8330
CA	San Jose, IMP West. Area Sls. Off.	408-262-9100
CA	San Jose, Quadrep	408-946-4000
CT	Orange, Access Sys. Corp.	203-795-0201
FL	Orlando, Perrott Assocs., Inc.	305-298-7748
GA	Norcross, The Novus Grp.	404-939-1135
IL	Schaumburg, Gassner & Clark	312-882-8608
IN	Indianapolis, CC Elctrns.	317-225-1508
MD	Towson, DG Reps.	301-583-1360
MN	St. Paul, Northport Engrg., Inc.	612-457-8000
NH	Nashua, Access Sys. Corp.	603-888-8160
NY	Melville, IMP East. Area Sls. Off.	516-752-1166
NC	Greensboro, United Sls.	919-674-9849
OH	Cincinnati, Applied Data Mgmt.	513-579-8108
TX	Plano, Texas Sls. Co.	214-867-0644
WA	Redmond, Quadra, Sls. Corp.	206-883-3550

INTERNATIONAL MICROSYSTEMS, 11554 C Ave., Auburn, CA 95603, Tel: 800-325-6028; Empl.: 12; *Sls. Mgr.:* Stan Burmich

INTERNATIONAL MICROTRONICS CORP., 4016 E. Tennessee St., Tucson, AZ 85714, Tel: 602-748-7900, TWX: 910-952-1170; Empl.: 30; *Sls. Mgr.:* Tommy Follis; *Dist. Mgr.:* Tommy Follis

INTERNATIONAL POWER, 350 N. Lantana, Ste. 710, Camarillo, CA 93010, Tel: 805-987-7900 ..... **D•1670-1675**

INTERNATIONAL POWER MACHINES, 11534 Pagemill Rd., Dallas, TX 75243, Tel: 214-343-6076; *Sls. Mgr.:* Jack Conn

INTERNATIONAL RECTIFIER CORP., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245, Tel: 213-772-2000, Telex: 472-0403, TWX: 910-348-6291; Empl.: 1200; *Sls. Mgr.:* W. Lewis; *Dist. Mgr.:* D. Coppinger

INTERNATIONAL RESOURCE SVCS., 7343 N.W. 79th Terr., Miami, FL 33166, Tel: 305-884-2924, Telex: 522261 MIA DEPT 343; Empl.: 5; *Sls. Mgr.:* Richard L. Winn

INTERNATIONAL SENSOR SYSTEMS, INC., Aurora Industrial Pk., Box 345, Aurora, NE 68818, Tel: 402-694-6111; Empl.: 45; *Sls. Mgr.:* Michael E. Fattig ..... **A•1677**

Local Sales Offices & Reps

AZ	Tempe, Spectrum Assoc. SW	602-966-1788
CA	Palo Alto, Tri-Rep	415-965-1822
CT	Branford, LJM Assocs.	203-488-4244
IL	Chicago, Esco Assocs.	312-763-0800
MN	Minneapolis, R-J Inc.	612-866-3661
PA	Southampton, Campbell Assocs.	215-322-6630
TX	El Paso, Nokomis Consumer Prods.	915-778-2801
TX	Euless, Andy Byles Intl.	817-267-4099

Local Distributors

CA	Arcadia, Van Gott & Assocs. Inc.	818-445-9728
FL	Jupiter, Southern Elctrn. Sls., Inc.	305-744-0028
IL	Des Plaines, Esco Assocs., Inc.	312-298-5310
IN	Indianapolis, Electronic Sls. & Engrg., Inc.	317-849-4260
MD	Lutherville, Quarterback Sls., Inc.	301-252-6167
NE	Omaha, IONEB	402-895-4431
NJ	Wayne, Ramapo Mfrs. Agt., Inc.	201-839-6767
NY	Liverpool, Syronics, Inc.	315-451-0968
NC	Charlotte, Over and Over	704-527-3070
OH	Brecksville, WRR Assocs., Inc.	216-526-2023
TX	El Paso, Nokomis of El Paso, Inc.	925-778-2801

INTERNATIONAL TRANSDUCER CORP., Channel Technologies, Inc., 93 Castilian Dr., Goleta, CA 93117, Tel: 805-685-1441, Telex: 658 495; FSC No.: ID 532; Empl.: 65; *Sls. Mgr.:* Roland 'Fred' Dutton

INTERNATIONAL WIRE PRODUCTS CO., 500 W. Main St., Wyckoff, NJ 07481, Tel: 201-891-5800, Telex: 642580; Empl.: 700; *Sls. Mgr.:* C. D. Abbott

INTEROPTICS, Purdy Group, 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-7727

INTERPRETATION SYS., INC., A DBA Systems Company, 420 S. Fairview Ave., Goleta, CA 93117, Tel: 805-967-2383, Telex: 658336; *Sls. Mgr.:* Stan Schlosser

INTERSIL, 10710 N. Tantau Ave., Cupertino, CA 95014, Tel: 408-996-5000, TWX: 910-338-0583; FSC No.: 32293; Empl.: 4102; *Dist. Mgr.:* Bruce Mattern

INTERSTATE ELECTRONICS CORP., Box 3117, 1001 E. Ball Rd., Anaheim, CA 92803, Tel: 714-635-7210, Telex: 655443, TWX: 910-591-1197; FSC No.: 6625, 5985; Empl.: 1500; *Sls. Mgr.:* Darryl Watanabe; *Dist. Mgr.:* R. Sorenson

INTERSWITCH, 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-8217, TWX: 910-374-2353; Empl.: 30; *Sls. Mgr.:* Ray G. Vorce

The Inter-Technical Group Inc. WIMA Division

INTER-TECHNICAL GRP., Box 23, Irvington, NY 10533, Tel: 914-591-8822, TWX: 710-564-0802; Empl.: 21; *Sls. Mgr.:* T. A. Galgano ..... **A•1087-1092**

Local Sales Offices & Reps

AL	Huntsville, J. R. Assocs.	205-830-2130
AZ	Scottsdale, Semper Fi Sls., Inc.	602-991-4606
CA	Santa Clara, Engineering Assocs. Corp.	408-988-5001
CO	Lakewood, Palmer Assocs.	303-233-9423
CT	Colchester, Normell Assocs.	203-537-5555/3758
FL	Altamonte Springs, 'C' Assocs., Inc.	305-831-1717
GA	Dunwoody, J. R. Assocs.	404-399-1831
IL	Westchester, W. G. Brouillette & Assocs.	312-345-6500
IN	Noblesville, W. G. Brouillette & Assocs.	317-877-4508
MA	Newton, Normell Assocs.	617-969-5478
MN	Minneapolis, Intl. Sls. Co.	612-831-8423
NJ	Colonia, H. B. Heft Assocs.	201-381-5193
NJ	Colonia, Heft & Ficarra Assocs.	201-381-5193
NY	Lynbrook, H. B. Heft Assocs.	516-LY 9-3351
NY	Rochester, BKT Assocs., Inc.	716-586-5814
NC	Winston Salem, J. R. Assocs.	919-768-7738
OH	Dayton, Markus Barnett Assocs., Inc.	513-293-6778
OR	Portland, Harry Levinson Co.	503-245-1902
PA	King of Prussia, R. D. Freedman Assocs.	215-279-5767
PA	W. Conshohocken, Eastern Comps. Sls. Corp.	215-825-8610
TN	Chattanooga, J. R. Assocs.	615-892-7630
TX	Carrollton, Paulsen Elctrn. Sls.	214-386-4785
TX	Richardson, Lelko-Paulsen Sls.	214-475-8052
UT	Salt Lake City, Alpine Entprs.	801-278-5081
VA	Front Royal, Eltron Sls., Ltd.	703-635-7201
VA	Manassas, Eastern Comps. Sls.	800-223-3850
WA	Seattle, Harry Levinson Co.	206-382-1300
PR	Ponce, Burke Assocs., Inc.	809-840-2444

Local Distributors

CA	Santa Clara, ISC	408-496-0411
FL	Ft. Lauderdale, NRC Elctrns., Inc.	305-772-4500
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NJ	East Brunswick, Brothers Elctrns., Inc.	201-238-2200
NY	Port Chester, MKM Elctrn. Comps., Inc.	914-382-3940
PA	Exton, VSH Elctrns.	215-363-2250
TX	Allen, Prime Distrbg. Co.	214-231-0170
WA	Seattle, Kam Elctrns. Div.	206-382-1300

INTEX MICRO SYSTEMS CORP., 725 S. Adams Rd., Suite L-8, Birmingham, MI 48011, Tel: 313-540-7601, Telex: 230254 WUPUBTLX; *Sls. Mgr.:* R. Thielman

INTRA-COMPUTER, 101 W. 31st St., New York, NY 10001, Tel: 212-947-5533, Telex: 64-5067; Empl.: 9; *Sls. Mgr.:* Art Yaglian

INTRONICS, INC., 57 Chapel St., Newton, MA 02158, Tel: 617-964-4000, Telex: 200095, TWX: 710-335-6835; Empl.: 130; *Sls. Mgr.:* J. Swartz ..... **D•1676-1677**

Local Sales Offices & Reps

AL Huntsville, Over & Over, Inc. 205-837-7105
AZ Tempe, Delta Elctrns. 602-224-1601
CA Los Alamitos, Power Specialists 213-594-9418
FL Melbourne, Reynolds & Assocs. 305-259-7000
GA Norcross, Over & Over, Inc. 404-449-6205
IL Palatine, Kingston Comps. 312-359-7990
IN Fort Wayne, Domino Unltd. 219-747-5621
IA Cedar Rapids, Technical Elctrns. 319-362-4116
KS De Soto, Midtec Assocs. 913-441-6565
MI Grand Rapids, KRW Sls. 616-363-2925
MN Minneapolis, Dan'l. Engrg. 612-854-7550
MO Florissant, Midtec Assocs. 314-837-5200
NY Canandaigua, Bensman/Upstate Assocs. 716-396-2498
NY Hicksville, J-Square Mktg. 516-935-3200
NC Raleigh, Over & Over, Inc. 919-872-2262
OH Dayton, Del Steffen & Assocs. 513-293-3145
PA Montgomeryville, Eastern Sci. Mktg. ... 215-368-4570
TX Houston, Scientific Sls. Co. 713-460-9170
TX Richardson, Scientific Sls. Co. 214-231-6541
UT Bountiful, Anderson Assocs. 801-292-8991
WA Seattle, Data Com. Assoc. 206-285-2525
Can Mississauga, Ont., Giden-Morton Assocs. 416-671-8111

ION PHYSICS CO., 323 Andover St., Wilmington, MA 01887, Tel: 617-658-6030, Telex: 951733 ..... **D•1123**

IPAC GRP., 3047 Indl. Blvd., Bethel Pk., PA 15102, Tel: 412-831-9200, TWX: 510-697-3935; Empl.: 50; *Sls. Mgr.:* D. T. Cusack

IQ SYSTEMS, Applied Circuit Tech., 2931 La Jolla St., Anaheim, CA 92806, Tel: 714-630-6834; *Sls. Mgr.:* Jim Stedt

IR SCIENTIFIC, Box 110, Carlisle, MA 01741, Tel: 617-369-7118; Empl.: 10; *Sls. Mgr.:* S. J. Sommer

ISC MAGNETICS DIV., See Aeroflex Labs., Inc., Magnetic Prods. Div.

ISL PRODUCTS INT'L, LTD., 235 P Robbins Lane, Syosset, NY 11791-6093, Tel: 516-822-9601, TWX: 510-221-2109; Empl.: 25,000; *Sls. Mgr.:* Ken Kawaller ..... **A•1094-1095, 1877, 2075, 2159**

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IL Chicago, Rendell Sls. 312-528-9025
IN Noblesville, Newton & Assoc. 317-845-8157
MD Pikesville, Muncy Sls. 301-484-6376
MA Topsfield, RFC Assocs. 617-887-8545
MN Edina, Components Rep. Grp. 612-944-1160

ISOCHEM PRODUCTS CO., A Sub. of Rohm and Haas Adv. Matls., 99 Cook St., Lincoln, RI 02865, Tel: 401-723-2100, Telex: 845-247, TWX: 710-670-5335; Empl.: 26; *Sls. Mgr.:* W. Lott

ISOLATION PRODUCTS, INC., 157 San Lazaro Ave., Sunnyvale, CA 94086, Tel: 408-730-4672; Empl.: 5

ISOREG CORP., 410 Great Rd., P.O. Box 486, Littleton, MA 01460, Tel: 617-486-9483, TWX: 710-347-6974 ISOREG LTTN; Empl.: 75; *Sls. Mgr.:* Paul Foss; *Dist. Mgr.:* Paul Foss

ISOTEMP RESEARCH, INC, Box 3389, Charlottesville, VA 22901, Tel: 804-295-3101; FSC No.: 031785; Empl.: 30 ..... **A•1374-1375**

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AZ Scottsdale, Faser Technical Sls. 602-948-4404
CA Fremont, Wm. Parks & Assocs. 415-796-0875
CA Irvine, EBA Microwave 714-857-6079
CA San Diego, Qualtronics 619-695-0118
IL Woodridge, Trend-Tronics 312-985-0626
IN Fort Wayne, Given Corp. 219-432-5585
NC Raleigh, Godwin Assocs. 919-847-3006

ISOTRONICS, Industrial Park, New Bedford, MA 02745, Tel: 617-998-2000, TWX: 710-344-1961; *Sls. Mgr.:* Dennis T. Hanley

I² INTERFACE, INC., 21101 Osborne St., Canoga Park, CA 91304, Tel: 818-341-7014, TWX: 662 949 CNPK; Empl.: 40; *Sls. Mgr.:* Gilbert Gautereaux

ITC SYSTEMS, INC., 3739 Meru Lane, Santa Barbara, CA 93105, Tel: 805-682-8122, Telex: 295-298 INTERTEL SNC; *Sls. Mgr.:* W. Schulz

ITEK MEASUREMENT SYS., Div. Litton Inds., 27 Christina St., Newton, MA 02161, Tel: 617-969-7300, TWX: 710-335-6783; Empl.: 100 ..... **B•1797**

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IL Des Plaines, Marsland Assocs. 312-298-2620
IN Indianapolis, Marsland Assocs. 317-293-5437
IA Cedar Rapids, Marsland Assocs. 319-396-8030
MN Minneapolis, Marsland Assocs. 612-545-4481
NJ Metuchen, Measurement Sys. Div. 201-548-1500
NM Las Cruces, BFA Corp. 505-524-9693

Local Distributors

FL Orlando, Kenneth S. Chaney 305-423-9465
IL Des Plaines, Marsland Assocs. 312-298-2620
IN Indianapolis, Marsland Assocs. 317-293-5437
MN Minneapolis, Marsland Assocs. 612-545-4481
NM Las Cruces, BFA Corp. 505-524-9693
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Intl France, Paris, Sedeme 580.72.000
Intl Germany, Munich, Weltronic GmbH 089-49 20 66
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Intl Norway, Oslo, Ole A. Nordby A/S 02 55 07 50
Intl Sweden, Waxholm, Saven AB 764-315 80
Intl Switz., Zurich, Litton Prec. Prods. Intl. 01/48 35 44

ITHACO, INC., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437, Tel: 607-272-7640, TWX: 510-255-9307; Empl.: 120; *Sls. Mgr.:* E. W. Seymour

ITOH ELECTRONICS, INC. (C.), 5301 Beethoven St., Los Angeles, CA 90066, Tel: 212-682-0420, Telex: 12-5059; Empl.: 100; *Sls. Mgr.:* F.I. Makstein, VP Mktg.

ITT CANNON, 666 E. Dyer Road, Santa Ana, CA 92705-5684, Tel: 714-557-4700, Telex: 75-3917, TWX: 910-997-0523; FSC No.: 71468;Multiple; Empl.: 2500; *Sls. Mgr.:* Joel Urban; *Dist. Mgr.:* Richard Torson ..... **C•1274-1288**

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AL Huntsville, Brandel-Stephens & Co. ... 205-833-0445
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CA Fountain Valley, ITT Cannon 714-964-7400
CA San Diego, ITT Cannon 619-560-0917
CA Santa Ana, ITT Cannon 714-557-4700
CO Franktown, ITT Cannon 505-293-0457
CO Littleton, ITT Cannon 303-973-8766
CT New Fairfied, ITT Cannon 203-746-7160
FL Deerfield Beach, Brandel-Stephens & Co. 305-427-8558
FL Orlando, Brandel-Stephens & Co. 305-425-3202
IL Des Plaines, ITT Cannon 312-297-3150
IN Fort Wayne, ITT Cannon 219-484-6447
IA Swisher, ITT Cannon 319-369-9107
KS Wichita, ITT Cannon 316-681-2029
MD Baltimore, ITT Cannon 301-882-4760
MD Baltimore, ITT Cannon 301-254-3707
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NY Rochester, L-Mar Assocs. 716-323-1000
NC Greensboro, Brandel-Stephens & Co. 919-274-6952
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TX Houston, ITT Cannon 713-777-1177
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WI Waukesha, ITT Cannon 414-544-1018

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CA Anaheim, Time Elctrns. 714-937-0911
CA Chatsworth, Arrow Elctrns., Inc. 818-701-7500
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CA Hayward, Arrow Elctrns., Inc. 415-487-4600
CA Orange, Richey/Western Elec., Inc. ... 714-634-2811
CA Sacramento, Arrow Elctrns., Inc. 916-925-7456
CA San Diego, Arrow Elctrns., Inc. 619-565-4800
CA San Diego, Richey/Western 619-271-4511
CA San Diego, Time Elctrns. 619-586-1331
CA Santa Clara, Richey/Western Elec., Inc. 408-727-7411
CA Sun Valley, Richey Elctrns. 213-875-2862
CA Sunnyvale, Arrow Elctrns., Inc. 408-745-6600
CA Sunnyvale, Time Elctrns. 408-734-9888
CA Torrance, Time Elctrns. 213-320-0880
CA Tustin, Arrow Elctrns., Inc. 714-838-5422
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CO Englewood, Time Elctrns. of CO 303-850-7701
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GA Norcross, Time Elctrns. 404-448-4448
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NY Hauppauge, Arrow Elctrns., Inc. 516-231-1000
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WA Bellevue, Almac Elctrns. 206-643-9992
WA Bellevue, Arrow Elctrns., Inc. 206-643-4800
WA Bellevue, Time Elctrns. 206-641-3640
WA Spokane, Almac Elctrns. 509-924-9500
WI Oak Creek, Arrow Elctrns., Inc. 414-764-6600

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CA Laguna Hills, English Damco 714-837-3801
CA Los Angeles, English Damco 213-598-6146
CA Mountain View, Caltron Comps. Corp. 415-964-3244
CA San Diego, English Damco 619-942-8282
CO Denver, I. W. Strong & Assocs. 303-292-6900
CT Guilford, Data Mark, Inc. 203-453-0575
FL Deerfield Beach, Brandel-Stephens & Co. 305-427-8558
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GA Atlanta, Brandel-Stephens & Co. 404-261-7579
IL Rolling Meadows, Heartland Tech. Sls. 312-577-9222
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OH Dayton, Thompson & Assocs. 513-435-7733
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OR Portland, Jas. J. Backer Co. 503-297-8744
PA Prospect Park, Elf Sls. 215-534-3340
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TX Dallas, Norcom 214-386-4888
TX Houston, Norcom 713-778-0392
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VA Lynchburg, Trimark 804-528-0681
WA Seattle, Jas. J. Backer Co. 206-285-1300
WI Milwaukee, Heartland Tech. Mktg. 414-931-0606

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AZ Tempe, Richey Western Elctrns. 602-894-9251
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CA Chatsworth, Integrated Elctrns. 818-998-2200
CA Chatsworth, Q.C. Comps. 818-700-2622
CA Chatsworth, Time Elctrns. 818-998-7200
CA Irvine, Integrated Elctrns. 714-660-1055
CA Los Angeles, Master Distrs. 213-452-1229
CA Los Angeles, Richey Western Elctrns. 213-820-3777
CA Los Angeles, Time Elctrns. 213-477-1251
CA Orange, Richey Western Elctrns. 714-634-2811
CA Sacramento, Integrated Elctrns. 916-424-5297
CA San Diego, Richey Western Elctrns. 619-271-4511
CA San Diego, Time Elctrns. 619-586-1331
CA San Jose, Integrated Elctrns. 408-263-1100
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CA Santa Clara, RM Elctrns. 408-496-0411
CA Santa Monica, Distr. Specialists 213-393-9666
CA Sunnyvale, TIME Elctrns. 408-734-9888
CA Torrance, TIME Elctrns. 213-320-0880
CO Denver, Integrated Elctrns. 303-292-6121
CO Englewood, NEP Elctrns. 303-799-9898
CO Englewood, TIME Elctrns. 303-850-7701
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CT New Haven, Greene Shaw Co. 203-397-0710
FL Davie, ARCO Distrs. 305-473-2550
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FL Fort Lauderdale, TIME Elctrns. 305-974-4800
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FL Tampa, Reptron 810-876-0671
GA Atlanta, Prehler Elctrns. 404-447-5540
GA Norcross, Time Elctrns. 404-448-4448
IL Arlington Heights, Reptron Elctrns. 312-593-7070
IL Chicago, NEP Elctrns. 312-625-8400
IL Chicago, Prehler Elctrns. 312-384-6100
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MD Beltsville, RESCO-Washington 301-937-9100
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MA Woburn, TIME Elctrns. 617-935-8080
MI Farmington Hills, Prehler Elctrns. 313-473-7200
MI Grand Rapids, RM Elctrns. 616-531-9300
MI Livonia, Reptron Elctrns. 313-525-2700
MN Bloomington, Time Elctrns. 612-944-9192
MN Minneapolis, Industrial Comps. 612-831-2666
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NV Las Vegas, Kiesub Elctrns. 702-733-3888
NJ Whippany, Tonar Inds. 201-586-9000
NM Albuquerque, Betatron Elctrns. 505-344-2381
NM Albuquerque, International Elctrns. 505-345-8127
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TX El Paso, International Elctrns. 915-598-3406
TX Sugarland, Quality Comps. 713-491-2255
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CA Laguna Hills, English Damco 714-837-3801
CA Mountain View, Caltron Comp. Corp. .. 415-964-3244
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CT Guilford, Data Mark 203-453-0575
GA Atlanta, Brandel-Stephens & Co. 404-261-7579
IL Rolling Meadows, Heartland Tech. Mktg., Inc. 312-577-9222
IN Fort Wayne, M/S Sls. & Assoc. 219-483-4520
IN Indianapolis, SAI Mktg. 317-241-9276
KS Leawood, Thunderbird Tech. Sls. 913-642-7220
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MA Southboro, KSA of New England 617-485-9432
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OH Beachwood, Thompson Assoc. 216-831-6277
OH Dayton, Thompson Assoc. 513-435-7733
OR Portland, Jas J. Backer Co. 503-297-3777
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TX Austin, Norcom 512-451-2757
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WA Seattle, Jas J. Backer Co. 206-285-1300

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AZ Tempe, Time Elctrns. 602-967-2000
CA Anaheim, Time Elctrns. 714-937-0911
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CA Sunnyvale, Time Elctrns. 408-734-9888
CA Torrance, Time Elctrns. 213-320-0880
CA Van Nuys, Nesco 213-781-0505
CO Denver, Integrated Elctrns. 303-292-6121
CO Englewood, Time Elctrns. 303-850-7701
CT East Haven, J.V. Elctrns. 203-469-2321
CT New Haven, Greene Shaw Co. 203-397-0710
FL Dania, Arco Distrs. 305-462-3370
FL Fort Lauderdale, NRC 305-772-4500
FL Fort Lauderdale, Time Elctrns. 305-974-4800
GA Atlanta, Prehler Elctrns. 404-447-5540
GA Atlanta, Time Elctrns. 404-351-3545
IL Arlington Hgts., Reptron Elctrns. 312-593-7070
IL Chicago, Integrated 312-625-8400
IL Chicago, NEP Elctrns. 312-625-8400
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IN Indianapolis, RM Elctrns. 317-247-9701
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MI Farmington Hills, Prehler elctrns. 313-473-7200
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OH Middleburg Hieghts, Prehler Elctrns. 216-243-5510
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TX Dallas, RM Elctrns. 214-263-8361
TX El Paso, International Elctrns. 915-598-3406
TX Ft. Worth, TTI, Inc. 817-831-0441
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TX Richardson, The Altair Co. 214-231-5166
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CA Culver City, DeAngelo, Rothman & Co. 213-827-2202
CA Pasadena, Paul Nurches Co. 818-681-8957, 818-796-5844
CA Santa Clara, Engrg. Assocs. Corp. 408-988-5001
CO Denver, A-E-S Inc. 303-777-8733
FL Hialeah, L. Haas Co. 305-822-2300
IL Northbrook, W. M. Linz 312-498-9600
IN Indianapolis, Blind Elctrn. Sls. Co. 317-241-3742, 317-293-6205
IN Indianapolis, Blind Elctrns. Sls. Co. 317-241-3742
IA West Des Moines, Nevco 515-225-9866
MA Sharon, A Appell Assoc. 617-784-3439
MI Kentwood, C. Geer 616-534-9449,616-243-2746
MN Minneapolis, Hei-lite Sls. 612-861-6051
MO Kansas City, Nevco 816-421-1751
OH Mentor, Perry Lohse & Co., Inc. 216-255-1992
MO North Kansas City, Nevco, Inc. 816-421-1751
NJ Belleville, D. F. Tobias & Co. 201-751-8680
OH Dayton, Lessis Assocs. 513-294-1551
OR Beaverton, Eclipse Mktg. Grp. 503-642-1661
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SC Greenville, H. C. Norman 803-244-6254
TX Dallas, Techno Assocs. 214-357-9212
WA Redmond, Eclipse Mktg. Grp. 206-885-6991
Can Whitby, ITT Canon Elec. Canada 416-668-8881

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AL Huntsville, Brandel-Stephens 205-883-0445
CA Los Angeles, Landa/Minyard 213-879-0770
CA Mountain View, Caltron Comps. 415-964-3244
CA San Diego, Landa/Minyard 619-942-1086
CO Boulder, Component Prod. Sls. 303-530-2800
CT Farmington, R. Perron & Co. 203-673-4825
FL Deerfield Beach, Brandel-Stephens 305-427-8558
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GA Atlanta, Brandel-Stephens 404-261-7579
IL Chicago, IRI 312-647-7755
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MO Maryland Heights, PMR 314-569-1220
NH Bedford, Ray Perron & Co. 603-472-3030
NH Dover, Ray Perron & Co. 603-742-2321
NM Albuquerque, Thorson Desert States 505-265-5655
NY Albany, Regan-Compar, Inc. 518-489-4777
NC Greensboro, Brandel-Stephens 919-274-6952
OH Columbus, K. W. Elctrns. 614-888-0483
OH Dayton, K. W. Elctrns. 513-890-2150
PA Philadelphia, P.S.A., Inc. 215-245-0513
TX Arlington, W. Pat Fralia Co. 817-267-3577
TX Houston, W. Pat Fralia Co. 713-772-1572
UT Salt Lake City, Comp. Prods. 801-262-0000
WA Seattle, Jas. J. Backer Co. 206-285-1300

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CA Gardena, Cal-Switch 213-770-2330
CA Los Angeles, Richey Western 213-820-3777
CA San Diego, El-Com, Inc. 619-272-4511
CA Sunnyvale, Time Elctrns. Nor/Cal 408-734-9888
CO Denver, Integrated Elctrns. 303-292-6121
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IL Bensenville, Hallmark 312-860-3800
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MD Columbia, Hallmark 301-988-9800
MA Canton, Impact Sls. Co. 617-444-3971
MA Hingham, Sager Elec. 617-749-6700
MI Kentwood, R.M. Elctrns. 616-531-9300
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MN Minneapolis, Berquist Co. 612-835-2322
MO Maryland Heights, Hallmark 314-291-5350
NY Buffalo, Summit Distr. 716-884-3450
NY Lynbrook, Peerless Radio 516-593-2121
NY Rochester, Modutex, Inc. 716-647-9700
NC Raleigh, Hallmark 919-872-0712
OH Cincinnati, Schuster Elec. 313-489-1400
OH Twinsburg, Schuster/Cleveland 216-425-8134
OH Westerville, Hallmark 614-891-4555
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TX Stafford, SW Elctrns. 713-491-4900
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IVEK CORP., 43 School St., N. Springfield, VT 05150, Tel: 802-886-8278; Empl.: 4; *Sls. Mgr.:* Gene Williams

IVERON PACIFIC, 1150 Morena Boulevard, San Diego, CA 92110-3899, Tel: 619-275-1500; Empl.: 16; *Sls. Mgr.:* Lee Kerl

IVO INDS., INC., 201 Industrial Way W., P.O. Drawer 917, Eatontown, NJ 07724, Tel: 201-542-5151, Telex: 132-414; Empl.: 10; *Sls. Mgr.:* Tom Jones ..... **B•1603**

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IL Buffalo Grove, Jim Laganowski & Assocs. 312-520-0130
NY Buffalo, Rudell-Merrifield Assoc. 716-634-4300
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PA Willow Grove, Indl. Mktg. Specialists 215-659-0444

Local Distributors

..... 818-991-3864
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CA San Carlos, Logan Elctrns. 415-594-0700
CA San Diego, Electric Power & Controls 619-483-1126
CA San Jose, Consolidated Parts 408-263-9521
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CA Garden Grove, Advanced Digital Grp. 213-598-9645
CA Sunnyvale, ICHIREP 408-249-2585
CT Old Saybrook, MJT Assocs. 203-38-5890
FL Sarasota, Ram-Z Assocs. 813-921-5561
IL Rolling Meadows, Commodore 1 312-394-5441
MN Minneapolis, Kodo Assocs. 612-881-1255
NH Nashua, MJT Assocs. 603-889-5373
NJ Parlin, J.M.R. Sls., Inc. 201-254-8484
NY Rochester, Harmony Labs. 716-458-3376
NC Pineville, TESTREPS 704-588-4624
OH North Ridgeville, TMS 216-327-3527
OK Tulsa, Spectra Sls. Corp. 918-663-7188
TX Houston, Spectra Sls. Corp. 713-747-2798

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CA Anaheim, R & D Elctrn. Supp. 714-773-0240
CA Burbank, U.S. Instr. Rentals 213-849-5861
CA Canoga Park, Rag Elctrns. 213-998-6500
CA Freemont, Rep Inc. 415-651-4131
CA Lakewood, R. D. Technology 213-595-9468
CA Oceanside, Palomar Elctrn. Prods. 619-439-7541
CA San Diego, Instrument Engrs. 619-268-8344
CA San Mateo, U.S. Instr. Rentals 415-572-6686
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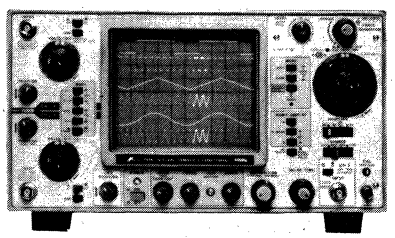
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FL W. Palm Beach, Nurmi Elctrn. Supp. 305-686-8553
IL Downers Grove, Ames Supply Co. 800-942-1596
MA Billerica, Hayes Instr. Svc. 617-663-4800
MA N. Billerica, A.S.T./Servo Sys. 617-667-8541
MA Newton, Interfax Sys., Ltd. 617-332-4621
MA Waltham, Calibron Instrs. 617-894-6440
MI Royal Oak, Programmed Learning Measures 313-549-3936
MN Minneapolis, Tonka Tech. Labs 612-593-1770
MO St. Louis, Indl. Svc. Lab. Corp. 314-535-5760
NJ North Caldwell, Hosica 201-256-7724
NM Albuquerque, Electronic Parts Co. 505-293-6161
NY Frankfort, Kapital Instr. Sls. 315-894-4245
NY Great Neck, Instrument Mart 516-487-7430
NY Melville, Exphil Calibration 516-694-5755
NY Morrisville, D.F.I. Entprs. 315-684-9693
NY Poughquag, Schmidt Elctrns. 914-724-3400
NY Rochester, Caltronix, Inc. 716-359-3780
NC Pineville, Elctrn. Measuring Instr. Svc. 704-588-4624
OK Oklahoma City, Houston De Pue Labs. 404-235-5469
OK Tulsa, Tri-State Instrs. 918-836-0286
PA Philadelphia, Jan Ind. Elctrns. 215-922-1321
PA Philadelphia, Sunshine Instrs. 215-673-5600
PA York, Y.I.S., Inc. 717-854-7804
TX Austin, Galtronics, Inc. 512-837-7470
TX Austin, Tinkertronics 512-926-4420
TX Dallas, Hutton Co. 214-484-0580
TX Garland, Tucker Elctrns. 214-348-8800
TX Houston, Houston Whls. Elctrns. 713-644-8320
TX Houston, Meters & Instrs. 713-644-1631
VA Chesterfield, Chesapeake Sys. 804-271-7725
VA Vienna, Electronic Equip. Bank 703-938-3350
WA Seattle, Vanguard Elctrn. Tool 206-284-6186
WI Madison, Schrenk Sls. 603-255-7400

IXYS CORP., 142 Charcot Ave., San Jose, CA 95131, Tel: 408-262-8800, Telex: 384928 SNJ SU; FSC No.: 408-435-1033; *Sls. Mgr.:* Yoram Hirsch

JACO MFG. CO., 468 Geiger St., Berea, OH 44017, Tel: 216-234-4000

JAE Electronics, Inc.

JAE, 1901A E. Carnegie Ave., San Ana, CA 92705, Tel: 714-250-8770, TWX: 681-438 ZEMCO SNA; Empl.: 20; *Sls. Mgr.:* James R. Clark ..... **B•1604-1607**

Local Sales Offices & Reps

CA Irvine, Angle Assocs. 714-833-0692
CA Santa Clara, M2 Mktg. Grp. 408-986-0676
FL Miami, Intro Corp. 305-387-1176
IL Downers Grove, Momak Sls. 312-963-6400
IN Indianapolis, Frank J. Campisano Co. 317-253-7651
MA Wakefield, Kentronics, Inc. 617-246-0245
MO St. Louis, Abrams & Assocs. 314-569-0447
NJ Wayne, G. T. Assocs. 201-694-6040
OH Cincinnati, Frank J. Campisano Co. 513-574-1111
OR Hillsbore, Rhodes Sls. Corp. 503-640-6666
PA Coraopolis, Frank J. Campisano Co. 412-264-5151

JAIDINGER MFG., 1921 W. Hubbard St., Chicago, IL 60622, Tel: 312-421-1090; Empl.: 35; *Sls. Mgr.:* John S. Jaidinger

JAMB INDS., Box 281, Rockaway Valley Rd., Boonton, NJ 07005, Tel: 201-263-9295; Empl.: 3

JAMESBURY CORP., Div. of Combustion Engineering, Inc., 640 Lincoln St., Worcester, MA 01605, Tel: 617-852-0200, Telex: 92-0448, TWX: 710-240-1268; Empl.: 1000; *Sls. Mgr.:* C. A. Richardson

JAMES ELECTRONICS, 4050 N. Rockwell, Chicago, IL 60618, Tel: 312-463-6500, TWX: 910-221-5034; *Sls. Mgr.:* J. R. Ther; *Dist. Mgr.:* J. R. Ther

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JANCO CORP., Box 3038-Glenoaks Sta., Burbank, CA 91504, Tel: 818-846-1800, TWX: 910-498-2701; FSC No.: 91812; Empl.: 185; *Sls. Mgr.:* Sam Kay, Jr. ..... **B•1608-1609**

Local Sales Offices & Reps

AZ Tempe, Piper Sls. 602-949-0048
AR Dallas, Kruvand Assocs. 214-437-3355
CA Cupertino, Codella 408-257-2561
CA San Diego, Qualtronics 619-695-0118
CO Longmont, Piper Sls. 303-651-2378
FL Orlando, MacKay, Smith & Assocs. 305-423-4353
GA Atlanta, MacKay, Smith & Assocs. 404-449-7444
IL Addison, Engineered Sls. 312-832-8425
IN Ft. Wayne, Aktron Corp. 219-747-3650
KS Wichita, T-Bird Tech. Sls. & Svc. 316-684-3941
MD Silver Spring, H.R. Sieber 301-589-9110
MA Mendon, B. Caron Assocs. 617-478-4519
MN St. Paul, Cahill, Schmitz & Cahill 612-646-7217
MO Maryland Heights, T-Bird Sls. & Svc. 314-567-6488
NJ Cherry Hill, Quality Comps. 609-428-6266
NY Albertson, C.F. Ward 516-742-5561
NC Charlotte, MacKay, Smith & Assocs. 704-372-1188
OH Columbus, Tom Mulligan Company 614-457-2242
TX Dallas, Kruvand Assocs. 214-437-3355
WA Seattle, Norwest 206-827-9562

Local Distributors

CA Burbank, Merit Comp. Supp. 818-842-8162
CA Westlake Village, Tech-Cable Prods. 818-991-4697

J & S TOOL, 70 Okner Pkwy., Livingston, NJ 07039, Tel: 201-533-0700, Telex: 139229; Empl.: 50; *Sls. Mgr.:* K.F. Swenson

JAN HARDWARE MFG. CO., 47-27 36th St., Long Island City, NY 11101, Tel: 212-361-0800; FSC No.: 99813; Empl.: 60; *Sls. Mgr.:* Irwin E. Wasserman; *Dist. Mgr.:* Bob Anzalone ..... **C•1588, 1591-1611**

Local Sales Offices & Reps

AZ Phoenix, Steve Fisher Assocs. 602-247-7865
CA Menlo Park, Long Assocs. 415-327-1300
CA San Diego, Robert Scott Co. 619-420-6446
CA Thousand Oaks, S.A.R.G.E. 213-991-6706
FL Seminole, Custom Assembly 813-397-8302
IL Woodale, Croydon Elec. 312-595-2300
MD Woodbine, Naudain Assocs. South. 301-442-2270
MA Brookline, Harman Assocs., Inc. 617-232-6687
MA Lee, Harman Assocs., Inc. 413-243-1158
MN Golden Valley, A.I.M. 612-542-8437
MO Crestwood, Nevco 314-843-7406
MO Kansas City, Nevco 816-421-1751
NJ Englewood, H. Gray Assocs. 201-894-0894
NJ Marlton, Naudain Assocs. 609-983-5808
OH Dayton, F. L. Ohmer & Assocs. 513-434-1454
TX Richardson, AGM Sls. 214-644-1475

JAPANESE PRODS. CORP., 31368 Via Colinas, Ste. 103-104, West Lake Village, CA 91362, Tel: 818-991-6111

JARO COMPONENTS, INC., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883, Tel: 305-771-7000, Telex: 522-334; Empl.: 30; *Sls. Mgr.:* Robert C. Flipse; *Dist. Mgr.:* Floyd Burwell

JAY CONTROL CO., 21 Sequin Dr., Glastonbury, CT 06033, Tel: 203-633-5294; Empl.: 40; *Sls. Mgr.:* Mike Colomonico

JAYCOR, P.O. Box 85154, San Diego, CA 92138, Tel: 619-453-6580, TWX: 910-322-1064; Empl.: 300; *Sls. Mgr.:* Steven Lutjens

JAY-EL PRODS., Sub. Ducommun Inc., 1859 W. 169th St., Gardena, CA 90247, Tel: 213-323-7130, TWX: 910-346-7633; FSC No.: 08719;Multiple; Empl.: 310

JB ELCTRN. TRANSFORMERS, 2300 W. Armitage Ave., Chicago, IL 60647, Tel: 312-342-0080, TWX: 910-221-1283; FSC No.: 11700; Empl.: 150; *Sls. Mgr.:* J. M. Blacklidge

JBM ELECTRONICS, INC., 531 Front St, Manchester, NH 03102, Tel: 603-623-0222, Telex: 953134, TWX: 710-220-8978; FSC No.: 62694; Empl.: Approx. 100; *Sls. Mgr.:* Mr. Steve Glorioso; *Dist. Mgr.:* Mr. Steve Glorioso ..... **A•1528-1529**

J-B-T INSTRS., Box 1818, New Haven, CT 06508, Tel: 203-776-1111; Empl.: 25; *Sls. Mgr.:* Virginia Devitt ..... **D•1358**

Local Sales Offices & Reps

MN	Minneapolis, Hei-Lite Sls.	612-861-6051
TX	Dallas, Elcom Mktg., Inc.	214-241-2166
Can	Thornhill, Ont., R. C. Kahnert Sls., Ltd.	416-221-7755
Can	Winnipeg, Vancouver, Smith-Paterson & Assocs.	604-681-0743

Local Distributors

AL	Montgomery, Southern Controls	205-277-5030
CA	Glendale, Western Elctrns.	213-246-4861
CA	Los Angeles, Metermaster	213-685-4340
CA	San Francisco, Pacific Elctrns.	415-543-3104
CA	Wilmington, Wilmington Instrs.	213-834-1133
CO	Denver, E.I.L. Instrs.	303-534-4160
CT	New Haven, Hatry Elctrns.	203-787-5921
FL	Miami, Florida Precision	305-324-1731
GA	Augusta, Speciality Distributing	404-873-2521
IL	Bridgeview, E.I.L. Instrs.	312-430-2292
IL	Elk Grove Village, Metermaster	312-593-8650
LA	Lafayette, Ralph's Elctrns.	318-234-4507
MD	Sparks, E.I.L. Instrs.	301-771-4800
MA	Hingham, Sager Elec.	617-749-6700
MN	Minneapolis, Instrument Controls	612-871-2514
MS	Jackson, Ellington Elctrn. Supp.	601-355-0561
NJ	Belleville, Miscorp	201-751-8680
NJ	North Caldwell, Hosica Labs	201-256-7724
NY	Long Island City, Metermod	718-726-4850
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Maspeth, Harry Alter	718-366-0123
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Bluffton, Bluffton Prods.	419-358-7891
OH	Cleveland, Weschler Elec.	216-238-2550
OH	Dayton, Scott-Friedman	513-298-5555
OK	Oklahoma City, Trice Wholesale	405-524-4411
PA	Reading, Barbey Elctrns.	215-376-7451
RI	Providence, William Dandreta	401-861-2800
TN	Nashville, Electra Distributing	615-329-3971
TX	Ft. Worth, Swieco	817-335-6521
TX	Garland, Metermaster	214-271-5671
TX	Houston, Harrison Equip.	713-879-2600
TX	Houston, Quality Instrs.	713-524-0528
WA	Seattle, Eicher-Richards	206-523-7888
WV	St. Albans, Preiser Scientific	304-727-2902

J-B-T SWITCHES, CUTLER-HAMMER PRODS., EATON CORP., Box 1904, New Haven, CT 06509, Tel: 203-772-2220; FSC No.: 55459; Empl.: 160; *Sls. Mgr.:* C. A. Peffer

Refer to Eaton Corp./Cutler-Hammer Prods., Areospace/Commercial Controls Div. for distributor information.

JDK CONTROLS, INC., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, Tel: 805-499-7779; *Sls. Mgr.:* Reece Kendall ..... **A•2021**

JEFFERS ELCTRNS., Grand Plaza, 945 Grand Ave., Nogales, AZ 85621, Tel: 602-287-5851, TWX: 910-973-9794; FSC No.: 59474; Empl.: 400; *Sls. Mgr.:* Ken Shobert; *Dist. Mgr.:* Steve Morris

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, O'Donnell Assoc.	602-944-9542
CA	Garden Grove, Elsco	714-891-4621
CA	Santa Clara, I Squared	408-988-3400
CO	Boulder, R.G. Entprs.	303-447-9211
CT	Middletown, Gerber Sls.	203-347-3000
FL	Tampa, APM Assoc.	813-886-2457
GA	Atlanta, Cartwright & Bean	404-233-2939
IL	Arlington Hgts., C.L. Greenslade Sls.	312-593-3450
IN	Ft. Wayne, J.F. Kilfoil	219-436-7233
KS	Overland Park, Advanced Techn. Sls.	913-642-6675
LA	Covington, Cartwright & Bean	504-892-1780
MA	Newton Upper Falls, Gerber Sls.	617-969-2620
MI	Lathrup Village, R. C. Nordstrom	313-559-7373
MN	Edina, Grayden & Flemmer	612-941-1120
NM	Albuquerque, Power Entprs.	505-298-1918
NY	E. Rochester, Tri-Tech Elctrns.	716-385-6500
NY	Great Neck, MOS Assoc.	516-487-3966
NC	Raleigh, Cartwright & Bean	919-876-4130
OH	Cincinnati, J.F. Kilfoil Co.	513-791-6150
OR	Beaverton, Eclipse Mktg.	503-642-1661
PA	Ardmore, Wm. K. Metz	215-896-7300
TX	Lewisville, Jim Hughes	214-221-1536
WA	Puerto Rico, Hato Rey, M. Anderson Co.	809-751-2026
WA	Redmond, Eclipse Mrktg.	206-885-6991

JEFFERSON ELEC., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021, Tel: 312-691-2400, Telex: 72-8408; Empl.: 1200; *Sls. Mgr.:* Tom Hull; *Dist. Mgr.:* Frank Michalik

Local Sales Offices & Reps

AZ	Phoenix, Ross-Bloom & Assoc.	602-955-5024
CA	Los Angeles, J. G. Pomeroy	213-263-9381
CA	San Francisco, Black & Egbert Assocs.	415-282-0840
CO	Denver, Electra-Tech Sls.	303-778-1900
FL	Tampa, Clement-Kinzel, Inc.	813-839-4470
GA	Atlanta, Berry-Elsberry Co.	404-355-9296
IL	Hillside, Archibald & Hamel	312-449-0202
IL	Wood Dale, Power Prods. Co.	312-595-1142
MD	Annapolis, Peter Straaten	301-261-2831
MA	Framingham, Gerald Rosen Co.	617-879-5505
MA	Stoughton, North Coast Sls.	617-344-1007
MI	Livonia, Electric Sls. Co.	313-464-1800
MN	Minneapolis, G. L. Brusacorm	612-872-8222
MS	Jackson, Welch & Doby	601-932-5534
MO	Kansas City, Mid-States Elec. Sls.	913-621-6161
MO	St. Louis, Schaeffer Sls.	314-647-1000
NE	Omaha, Boyle & Williamson	402-553-1666
NJ	Edison, Bizzarro Elec. Sls.	201-757-7010
NJ	Gloucester City, ESA Mfgrs. Rep.	609-456-7110
OH	Westlake, Associated Elec. Comps.	216-835-9960
NY	New Hartford, F. W. Laver & Son	315-724-2304
NC	Charlotte, W. H. Lassister Sls.	704-523-2736
OH	Cincinnati, Bryan, Haley & Cunningham	513-561-0500
PA	Pittsburgh, Robert Colley Assocs.	412-331-3121
TX	Dallas, The Rich Co.	214-742-1758
TX	Houston, Gulf Elec. Mktg.	713-868-2517
WA	Seattle, Bangs Assocs.	206-762-0262
WI	Butler, J. F. Nolan & Assocs.	414-781-1140

JENNINGS, 970 McLaughlin Ave., San Jose, CA 95122, Tel: 408-292-4025, Telex: 34-6311, TWX: 910-338-0159; FSC No.: 73905; Empl.: 370; *Sls. Mgr.:* E. V. Valehrach ..... **A•1102-1103; B•1424-1425, 1610; D•1251**

Local Sales Offices & Reps

AL	Huntsville, Brandel-Stephens	205-883-0445
AZ	Phoenix, Crown Systems	602-274-3180
CA	Granada Hills, C & W Comps.	213-368-4032
CA	Santa Clara, Silicon Valley Sls.	408-371-8814
CO	Denver, Lindberg Co.	303-758-9033
FL	Deerfield Beach, Brandel-Stephens	305-427-8558
FL	Orlando, Brandel-Stephens	305-425-3202
GA	Atlanta, Brandel-Stephens	404-261-7579
IL	Chicago, Berndt Assocs.	312-283-0713
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Shawnee Mission, Lowell-Kangas & Assoc.	913-631-3515
MD	Silver Spring, Marktron	301-460-6100
MD	Timonium, Marktron	301-252-7111
MA	Haverhill, L. K. Harman, Inc.	617-373-1313
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	St. Louis, Lowell-Kangas & Assoc.	314-821-4050
NJ	Englewood, Cooper Assocs.	201-871-4985
NM	Albuquerque, Lindberg Co.	505-881-1006
NC	Greensboro, Brandel-Stephens	919-274-6952
OH	Westlake, Harry W. Applegate Co.	216-331-2960
PA	Huntingdon Valley, Omega Elctrns.	215-947-4135
PA	Pittsburgh, Covert & Newman & Co.	412-531-2022
TX	Houston, Barry Sales	713-784-5860
TX	Richardson, Barry Sales	214-234-0255
UT	Salt Lake City, Lindberg Co.	801-969-2400
VA	Charlottesville, Marktron	804-973-5874
WI	Milwaukee, Berndt Assocs.	414-545-8400

Local Distributors

CA	Oceanside, Surcom Assocs.	619-722-6162
IL	Franklin Park, Richardson Elctrns., Ltd.	312-456-0600

JENSEN TOOLS, INC., Axia, Inc., 7815 S. 46th St, Phoenix, AZ 85040, Tel: 602-968-6241, TWX: 910-950-0115; Empl.: 100; *Sls. Mgr.:* Tom Fenzel

JEROME INDUSTRIES CORP., B 730 Division St, Elizabeth, NJ 07201, Tel: 201-353-5700, Telex: 132001-JEROME, ELIZ; Empl.: 150; *Sls. Mgr.:* Anthony Di Girolamo ..... **D•1678-1679**

Local Sales Offices & Reps

MN	St. Paul, Countrymen Assocs.	612-645-9151

JEROME INDUSTRIES CORP., Transformer Div., 730 Division St, Elizabeth, NJ 07201, Tel: 201-353-5700, Telex: 132001-JEROME, ELIZ; *Sls. Mgr.:* Anthony Di Girolamo

JERSEY SPECIALTY CO., See JSC Wire & Cable

JERSEYSWITCH, INC., 129A Gaither Dr., Mt. Laurel, NJ 08054, Tel: 609-778-8190

JETTRON PRODS., P.O. Box 337, E. Hanover, NJ 07936, Tel: 201-887-0571; FSC No.: 04435; Empl.: 30; *Sls. Mgr.:* J. M. Schill ..... **C•1408-1410**

Local Sales Offices & Reps

CA	El Cajon, A-Tronics	619-444-1501
CA	Woodland Hills, A-Tronics	818-703-7212
NY	New York, Eltron Export Co.	212-944-7635

Local Distributors

Intl	England, Slough, Berks, LPPI	44-753-77788
Intl	France, Le Chesnay, LPPI	33 3 955 2104
Intl	Italy, Cinisello Balsamo (Mila, LPPI	2-6127821
Intl	Netherland, Krimpen a.d. Yssel, LPPI	31-1807-1 8555
Intl	Sweden, Stockholm, LPPI	46-8-132030
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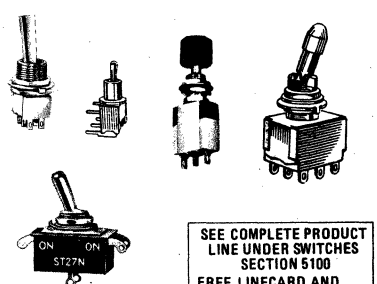

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Local Sales Offices & Reps

AL	Huntsville, Currie, Peak & Frazier	205-536-1506
AZ	Phoenix, The Knight Co.	602-582-8506
AR	Little Rock, J. Y. Schoonmaker	501-375-2168
CA	Fremont, William Parks Assocs.	415-796-0875
CA	Los Angeles, Knight Co.	213-670-2833
CA	San Diego, Knight Co.	619-571-7903
CT	Middletown, Gerber Sls.	203-347-3000
GA	Norcross, Currie, Peak & Frazier, Inc.	404-449-7662
IL	Chicago, Berndt Assocs.	312-283-0713
IN	Carmel, Berndt Assocs.	317-844-0114
IA	Cedar Rapids, Gassner & Clark Co.	319-393-5763
MA	Monson, Gerber Sls.	413-267-5051
MA	Newton Upper Falls, Gerber Sls.	617-969-2620
MI	Troy, C. B. Jensen	313-643-0506
MN	Edina, M. Foster Co.	612-941-9790
NJ	Cherry Hill, Trinkle Sls.	609-795-4200
NM	Albuquerque, C. T. Carlberg	505-888-3883
NY	Buffalo, Rudell-Merrifield Assocs.	716-634-4300
NY	Melville, Comtronics Assocs.	516-249-0505
NC	Greensboro, Currie, Peak & Frazier, Inc.	919-373-0380
NC	Raleigh, Currie, Peak & Frazier, Inc.	919-787-0808
OH	Cleveland, Marlow Assocs.	216-991-6500
OH	Columbus, Marlow Assocs.	614-885-7643
OH	Dayton, Marlow Assocs., Inc.	513-275-4147
OK	Oklahoma City, J. Y. Schoonmaker	405-685-4477
OR	Portland, Frank Jackson	503-292-2638
TX	Austin, J. Y. Schoonmaker	512-480-9257
TX	Dallas, J. Y. Schoonmaker	214-349-1650
TX	Houston, J. Y. Schoonmaker	713-738-2427
WA	Redmond, F. Jackson	206-881-7277
WI	Milwaukee, Berndt Assocs.	414-545-8400

Local Distributors

AL	Birmingham, Brownell Electro, Inc.	205-322-3374
AL	Mobile, Brownell Electro, Inc.	205-479-5404
AZ	Phoenix, Metermaster, Inc.	602-437-1425
AR	Little Rock, Brownell Electro, Inc.	501-562-2061
CA	Lamirada, Stevens Instr. Co.	714-994-5111
CA	Los Angeles, E.I.L. Instrs., Inc.	213-685-7020
CA	Los Angeles, Metermaster, Inc.	213-685-4340
CA	Palo Alto, Metermaster, Inc.	415-968-0313
CA	San Diego, Metermaster, Inc.	619-560-4844
CA	Santa Clara, Dynametron, Inc.	408-727-6531
CA	Santa Clara, E.I.L. Instrs., Inc.	408-727-0396
CA	Santa Clara, Fisher-Brownell	408-988-6041
CO	Denver, E.I.L. Instrs., Inc.	303-534-4160
CO	Denver, Metermaster Instr., Inc.	303-722-5766
CT	Middletown, E.I.L. Instrs., Inc.	203-346-6646
FL	Miami, Brownell Electro, Inc.	305-592-2636
FL	Orlando, Brownell Electro, Inc.	305-843-6770
FL	Palm Bay, E.I.L. Instrs., Inc.	305-725-8300
GA	Atlanta, Brownell Electro, Inc.	404-762-5181
IL	Bridgeview, E.I.L. Instrs., Inc.	312-430-2292
IL	Countryside, Pacific Indicator Co.	312-352-3500
IL	Itasca, Metermaster, Inc.	312-250-0606
IN	Evansville, Electro-Lab Svcs., Inc.	812-423-5211
IN	Indianapolis, E.I.L. Instrs., Inc.	317-545-1373
KY	Louisville, E.I.L. Instrs., Inc.	502-454-3420
LA	Kenner, Breard-Gardner	504-466-3401
MD	Baltimore, Sunshine Sci. Instr., Inc.	301-661-5900
MD	Gaithersburg, Pioneer/Instrmn.	301-921-0660
MD	Sparks, E.I.L. Instrs., Inc.	301-771-4800
MA	Burlington, E.I.L. Instrs., Inc.	617-272-9450
MA	Waltham, Calibron Corp.	617-894-6440
MA	Woburn, Brownell Electro, Inc.	617-935-7820
MI	Ferndale, Ram Meter, Inc.	313-398-6767
MN	Minneapolis, Instrumentation Svcs., Inc.	612-544-8916
MN	Minneapolis, Process Measurement Co.	612-544-4035
MO	St. Louis, Industrial Svc. Labs	314-535-5760
NJ	Belleville, Miscorp	201-751-1190
NJ	Edison, Brownell Electro, Inc.	201-287-2030
NJ	Pennsauken, E.I.L. Instrs., Inc.	609-488-0474
NM	Albuquerque, Walker Elctrn. Supp. Co.	505-883-2992
NY	Clarence, Trott Elctrns., Inc.	716-634-8500
NY	Hauppauge, E.I.L. Instrs., Inc.	516-231-6333
NY	New York, Brownell Electro, Inc.	212-924-6000
NY	Rochester, E.I.L. Instrs., Inc.	716-427-8000
NC	Charlotte, Brownell Electro, Inc.	704-597-1270
NC	Charlotte, Trott Electronics, Inc.	704-376-2237
NC	Raleigh, Brownell Electro, Inc.	919-876-6524
OH	Cleveland, Pioneer Instrmn.	216-587-3600
OH	Cleveland, Weschler Elec. Co.	216-237-2550
OH	Dayton, E.I.L. Instrs., Inc.	513-435-2134
OH	Dayton, Pioneer Std. Elctrn.	513-236-9900
OK	Tulsa, Combined Technlg. Co.	918-665-3002
OK	Tulsa, Genesis Elctrns. Corp.	918-622-8520
OR	Portland, Branom Instr. Co.	503-283-2555
PA	Philadelphia, Sunshine Sci. Instr.	215-673-5600
PA	Pittsburgh, C.A.M. Inst.	412-963-1885
PA	Pittsburgh, E.I.L. Instrs., Inc.	412-731-5230
SC	Columbia, Brownell Electro, Inc.	803-772-6111
TN	Knoxville, Brownell Electro, Inc.	615-966-3441
TN	Memphis, Brownell Electro, Inc.	901-795-8483
TN	Nashville, Brownell Electro, Inc.	615-885-1302
TX	Dallas, Dallas Meter-Tek Supp.	214-349-6044
TX	Dallas, E.I.L. Instrs., Inc.	214-931-1236
TX	Dallas, Ultra Instr. Lab, Inc.	214-357-0297
TX	El Paso, McNicol Elctrns.	915-566-2936
TX	Garland, Metermaster, Inc.	214-271-5671
TX	Houston, E.I.L. Instrs., Inc.	713-271-3100
TX	Houston, Quality Instr. Lab	713-524-0528
VA	Richmond, Meter Metrics	804-275-1431
WA	Richland, Branom Instr. Co.	509-943-6664
WA	Seattle, Branom Instr. Co.	206-762-6050
WA	Seattle, E.I.L. Instrs., Inc.	206-762-0880
VA	Alexandria, E.I.L. Instrs., Inc.	703-354-4330
VA	Virginia Beach, E.I.L. Instrs., Inc.	804-499-3746
WI	Milwaukee, E-M Instrs., Inc.	414-272-7799

JFD ELCTRNS., See Murata Erie No. Amer., Inc.

JF MICROSYSTEMS, 3641 Frontier Road, Pasco, WA 99301, Tel: 509-297-4294, 800-JF-CARDS; Empl.: 2; *Sls. Mgr.:* Jim Follansbee

JFW INDS., INC., 2719 E. Troy Ave., Indianapolis, IN 46203, Tel: 317-783-9875; Empl.: 30; *Sls. Mgr.:* Joetta Walker; *Dist. Mgr.:* Joetta Walker

JKL COMPS., 13343 Paxton St., Pacoima, CA 91331, Tel: 818-896-0019, Telex: 910-496-1504; FSC No.: 55335; Empl.: 18; *Sls. Mgr.:* Bob Brandt

JMJ TECHNICAL PRODS., 50 Wheeler Point Rd., Newark, NJ 07105, Tel: 201-589-4257; Empl.: 8; *Sls. Mgr.:* Kevin Kolenut ..... **C•1613**

JMK, INC., 15 Caldwell Dr., Amherst, NH 03060, Tel: 603-886-4100, Telex: 955329; Empl.: 200; *Sls. Mgr.:* J. Kennedy ..... **A•1611**

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-881-0413
CA	Santa Clara, Cummings & Assocs.	408-247-8656
CA	Woodland Hills, Cummings & Assocs.	213-340-6035
CO	Denver, Arkco Sls.	303-758-1151
FL	Lantana, Burke Assocs.	305-585-3238
FL	Largo, Burke Assocs.	813-584-5699
FL	Orlando, Burke Assocs.	305-298-4783
IL	Downers Grove, Momak Sls.	312-963-6400
IN	Indianapolis, Gorny Sls.	317-271-7504
MD	Riderwood, W.S. Warrington & Assocs.	301-823-8759
MA	Framingham, STS	617-620-0195
MI	Novi, Lektronics	313-349-3304
MN	St. Paul, Arkco Sls.	612-777-7454
NJ	Haddonfield, Gray Assocs.	609-429-5300
NJ	Ridgewood, Ballou Assocs.	201-444-6990
NY	Rochester, Elcom Sls.	716-385-1400
NY	Syracuse, Elcom Sls.	315-685-8245
NC	Charlotte, JWL Assocs.	704-523-3001
OK	Tulsa, Barry Sls.	918-749-7775
OR	Hillsboro, Temco NW	503-648-8171
OR	Portland, Cummings & Assocs.	503-761-4411
TX	Austin, Barry Sls.	512-837-3616
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255
WA	Bothell, Temco NW	206-821-5434
WA	Edmonds, Cummings & Assocs.	206-775-1421
WI	Muskego, Momak Sls.	414-363-7744

Local Distributors

CA	Woodland Hills, C & A Elctrns.	213-340-6022
MN	St. Paul, Voyager Elctrns.	612-571-7766
NH	Hudson, C & H Elctrns.	603-882-1133
Can	Toronto, Ont., RAE Elctrns.	416-736-1744

JM TRANSFORMER CO., INC., 112 Florida St., Farmingdale, NY 11735, Tel: 516-293-0475; Empl.: 13; *Sls. Mgr.:* J. Millman ..... **A•2160-2163**

JOBMASTER CORP., 9008 Liberty Rd., Randallstown, MD 21133, Tel: 301-655-1400; Empl.: 16; *Sls. Mgr.:* Wendy Goldman ..... **A•1303**

JOHANSON DIELECTRICS, 2220 Screenland Dr., Burbank, CA 91505, Tel: 818-848-4465, TWX: 910-498-2735; Empl.: 154 ..... **A•1104**

Local Sales Offices & Reps

AZ	Phoenix, Compass Mktg. & Sls.	602-266-5400
CA	Glendale, Mission Mktg.	818-247-9110
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assocs.	303-426-0890
FL	Boca Raton, Lawrence Assocs	305-368-7373
IL	Northfield, Johanson Dielectrics	312-446-8425
IL	Park Ridge, Metcom Assocs.	312-696-1490
IN	Kokomo, Schillinger Assocs.	317-452-4057
KS	Shawnee Mission, Florence & Meyer	913-722-5210
MA	Wethersfield, Compac Sls.	203-563-4784
MN	Minneapolis, Bill Deming & Assocs.	612-888-5000
NY	Babylon, Astro Rep.	516-422-2500
NY	Syracuse, Pitroncis	315-455-7346
NC	Greensboro, L & D Inc.	919-292-3201
OH	Breckville, WRR Assocs.	216-526-2023
PA	Trevose, PSA Co.	215-245-0513
TX	Arlington, W. Pat Fralia Co.	817-640-9101
WA	Seattle, Northmar Inc.	206-524-5170
Can	Hamilton, Ont., Cartwright/Southhall	416-528-0294

Local Distributors

CA	Los Alamitos, SEMI DICE	213-594-4631
CA	Santa Clara, SEMI DICE	408-980-9777
NJ	Fairfield, CHPS Inc.	201-882-0997

JOHANSON MFG. CORP., 400 Rockaway Valley Rd., Boonton, NJ 07005, Tel: 201-334-2676, TWX: 710-987-8367; FSC No.: 91293; Empl.: 200 ..... **A•1105**

Local Sales Offices & Reps

AZ	Phoenix, Compass Mktg. & Sls.	602-996-0635
CA	Los Angeles, Knight Co.	213-670-2833
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assoc., Mt. States	303-426-0890
FL	Orlando, Perrott Assocs.	305-298-7748
IL	Northfield, Johanson Mfg.	312-446-4021
IN	Kokana, Schillinger Assocs.	317-452-4057
IA	Cedar Rapids, ARD Sales Co.	319-393-6392
MA	Seekonk, J. Murphy Assocs.	617-761-7153
MN	Bloomington, Bill Deming & Assoc.	612-888-5000
NJ	Boonton, Johanson Mfg. Corp.	201-334-2676
NY	Mount Vernon, Friedman-Smith Elctrn. Sls.	914-664-4866
NY	Pittsford, NHA, Inc.	716-586-9002
NC	Winston-Salem, Murcota Corp.	919-722-9445
OH	Cleveland, Baehr, Greenleaf & Assoc.	216-221-9030
PA	Trevose, P.S.A.	215-245-0513
TX	Bedford, W. Pat Fralia Co.	817-267-3577
WA	Seattle, Northmar	206-524-5170

Local Distributors

AZ	Tempe, Bell Inds.	602-267-7774
AZ	Tempe, Shelley Elctrns.	602-894-2058
CA	Chatsworth, Shelley Elctrns.	213-998-3333
CA	Chatsworth, Shelley Elctrns.	818-998-3333
CA	Gardena, Bell Inds.	213-515-1800
CA	San Diego, Shelley Elctrns.	619-453-7133
CA	San Jose, Integrated Electronics	408-263-1100
CA	San Jose, Shelley Elctrns.	408-942-9111
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Van Nuys, CW Swift & Assocs.	818-989-1133
CO	Boulder, Shelley Elctrns.	303-442-2718
CO	Wheatridge, Bell Inds.	303-424-1985
FL	Orlando, Pelcor Co.	305-299-1541
IL	Chicago, Bell Inds.	312-982-9210
IL	Chicago, Newark Elctrns.	312-784-5100
MD	Baltimore, Radio Elec. Svc.	301-823-0070
MD	Beltsville, Radio Elec. Svc.	301-937-9100
MA	Medford, Blake Assocs.	617-391-7890
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Mt. Vernon, ASAP Elctrns.	914-699-2727
NY	Syracuse, Newark Elctrns.	315-437-6611
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
TX	Ft. Worth, PATCO Supplies	817-429-8596
UT	Salt Lake City, Bell Inds.	801-972-6969
WA	Bellevue, Bell Inds.	206-747-1515

JOHNSON, E. F., CO., 299 Johnson Ave., Waseca, MN 56093, Tel: 507-835-6222, Telex: 290470, TWX: 910-565-2161; Empl.: 1400; *Sls. Mgr.:* G. Mena

JOHNSON CONTROLS, Battery Div., 5757 N. Green Bay Ave., Milwaukee, WI 53201, Tel: 414-228-2581, Telex: 026-650; Empl.: 20,000

JOLO INDS., 13921 Nautilus Dr., Garden Grove, CA 92643, Tel: 714-554-6840, TWX: 910-595-1138; Empl.: 20; *Sls. Mgr.:* J.S. Giampiccolo, Jr.

JONARD INDUSTRIES CORP., 134 Marbledale Rd., Tuckahoe, NY 10707, Tel: 914-793-0700, Telex: 996570, TWX: 710-562-0107; Empl.: 65; *Sls. Mgr.:* R. Fersen

JONATHAN MFG., 1101 So. Acacia Ave., Fullerton, CA 92631, Tel: 714-526-4651, Telex: 910 592-1241; Empl.: 375

JONES, HIRAM, ELCTRNS. INC., See Hiram Jones Elctrns. Inc.

JORDAN ELEC., See Vishey Resistance Sys. Grp.

JORI RESOURCES, 2128 Knoll Dr., Ventura, CA 93003, Tel: 805-642-2266; Empl.: 4

JOSLYN ELCTRN. SYS., P.O. Box 817, Goleta, CA 93116, Tel: 805-968-3551, TWX: 910-334-3464; FSC No.: 23663; Empl.: 210; *Sls. Mgr.:* A. deSouza

JRW INDS., INC., 2312 N Second St., Harrisburg, PA 17110, Tel: 717-236-1418; Empl.: 4; *Sls. Mgr.:* James Thorbahn

JSC WIRE & CABLE
QUALITY WIRE AT THE RIGHT PRICE

JSC WIRE & CABLE, Box 248, Burgess Pl., Wayne, NJ 07470, Tel: 201-694-6200; Empl.: 40; *Sls. Mgr.:* R. Dulude ..... **C•1841**

Local Sales Offices & Reps

CA	Van Nuys, Art Szerlip Sls. Co.	818-782-1765
CO	Colorado Springs, Norris & Warren Assocs.	303-576-8697
CO	Denver, Norris & Warren Assocs.	303-579-1676
DE	Newark, Carmine Assocs.	302-731-0697
FL	Crystal River, Foster Sls.	904-795-7831
IL	Chicago, Ken Levy Assocs.	312-763-5000
IA	Burlington, J. S. Ridge Entprs.	319-754-8745
KY	Louisville, Mid Central Sls. Co.	502-239-5614
MA	Lynn, Keene Sls. Co.	617-595-2300
MI	Livonia, Harvey Sls.	313-591-1975
NJ	Teaneck, Steve Fisher Sls.	201-837-1200
NY	Rochester, Warren Kaufman	716-266-2728
NC	Charlotte, D. Austin Co.	704-334-0174
OH	Columbus, Benchmark	614-861-2070
OR	Portland, R. M. Minthorne	503-246-4556
TX	Dallas, Crockett Sls. Co.	214-350-3377
MN	Minneapolis, John E. M. Anderson	612-823-6459
EXP	NY, New York, Roburn Agencies	212-989-5939

J. TRONICS, Apollo Magnetics, 2720 W. Beverly Rd., Los Angeles, CA 90057, Tel: 213-381-2500, TWX: 910-321-4348; *Sls. Mgr.:* Michael Ronzon

JUDCO MFG. INC., P.O. Box 487-E84, 24030 Frampton Ave., Harbor City, CA 90710, Tel: 213-534-0959 ..... **B•1611**

Judd Wire
DIVISION OF
HIGH VOLTAGE ENGINEERING

JUDD WIRE, High Voltage Engrg., 57 Turnpike Rd., Turners Falls, MA 01376, Tel: 413-863-4357, TWX: 510-290-2147; FSC No.: 3357; Empl.: 148; *Sls. Mgr.:* Jack Allen ..... **C•1842-1843**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
CA	Los Altos, Ewing Foley	415-941-4525
CO	Denver, Duffy Assocs.	303-595-4244
FL	Coral Springs, HAI Elctrns.	305-752-7520
GA	Atlanta, Hughes Assocs.	404-252-7486
IL	Arlington Heights, Rozner Sls. Co.	312-577-0067
MA	Marlborough, O.K. Engrg.	617-481-6400
MI	Southfield, C. H. Schmidt Co.	313-353-6000
MN	Brooklyn Center, Willman Assocs.	612-566-5010
MS	Corinth, Hughes Assocs.	601-287-2915
NJ	Haddonfield, Mesa Tech. Assocs.	609-429-9531
NY	Attica, B. H. Tollefson Assocs.	716-591-1219
NY	Auburn, B. H. Tollefson Assocs.	315-253-4109
NY	Rochester, B. H. Tollefson Assocs.	716-271-4141
NC	Research Triangle Park, Naylor Assocs.	919-836-0478
OH	Worthington, Simcox Assocs.	614-885-8995
OR	Portland, Jas. J. Backer Co.	503-297-8744
SC	Greenville, Naylor Assocs.	803-297-9969
TN	Morristown, Hughes Assocs.	615-587-2433
TX	Dallas, Stevens Sls. Co.	214-350-2476
UT	Salt Lake City, Electrodyne	801-486-3801
WA	Seattle, Jas. J. Backer Co.	206-285-1300

Local Distributors

AL	Madison, Sea Wire & Cable	205-772-9616
AZ	Tempe, Pacer Elctrns.	602-267-0299
CA	Anaheim, Innovative Sys.	714-632-8800
CA	Concord, Control Master	415-939-3600
CA	Irvine, Republic Elctrns.	714-855-2222
CA	Mountain View, Sonic Wire	415-965-4646
CA	San Leandro, Anixter	415-352-3100
CA	Torrance, Blake Wire & Cable	213-515-0561
CA	Valencia, Wirenetics Co.	805-257-2400
CT	East Hartford, E. J. Stephens Co.	203-568-1927
CT	Manchester, I.M.S.	203-649-4415
FL	Altamonte Springs, Royce Elctrns.	305-869-4700
FL	Ft. Lauderdale, Pacer Elctrns.	305-462-0902
FL	Ft. Lauderdale, Simcona Elctrn.	305-485-4455
GA	Clarkston, Lance Engrg.	404-292-4404
MA	Burlington, QPL Elctrn. Dist.	617-229-2424
MA	Woburn, Pacer Elctrns.	617-935-8330
MN	Bloomington, K. L. Tannehill	612-881-6700
NH	Amherst, North Country Wire & Cable	603-889-0063
NH	Manchester, Yankee Elctrn.	603-625-9746
NJ	Dover, Electro Spec.	201-361-5079
NJ	Fairfield, Olympic Wire & Cable	201-227-7996
NJ	Red Bank, Freedom Elctrns.	201-747-4666
NY	Fairport, Pacer Elctrns.	716-377-0462
NY	Farmingdale, Weico Elctrns.	516-293-0050
NY	Rochester, Simcona Elctrn.	716-328-3230
NY	Ronkonkoma, Zenith Wire	516-585-1444
OH	Dayton, Astro Inds.	513-429-5900
PA	Harleysville, Omega Wire & Cable	215-256-6577
PA	Montgomeryville, Pyttronic Ind.	215-242-6700
TX	Dallas, Interstate Wire	214-553-1311
WA	Seattle, Anixter	206-251-5287
WI	New Berlin, Indl. Elec. Wire & Cable	414-782-2323

JUDD WIRE, High Voltage Engrg., 870 Los Vallecitos Blvd., San Marcos, CA 92069, Tel: 619-744-7720, TWX: 910-322-1149; FSC No.: 3357 ..... **C•1842-1843**

Refer to Judd Wire, Turners Falls, MA for sales office and distributor information.

JRL JULIE RESEARCH

JULIE RESCH. LABS., 211 West 61st St., New York, NY 10023, Tel: 212-245-2727, TWX: 710-581-5138; Empl.: 45; *Sls. Mgr.:* Pamela Spencer ..... **A•1878; D•1252-1256**

Local Sales Offices & Reps

Resistors

CA	Northridge, Craig Assocs.	213-993-4060

JUMBO PROCESS CONTROL, INC., 410 Garibaldi Ave., Lodi, NJ 07644, Tel: 201-779-7744, Telex: 642-406; *Sls. Mgr.:* W. F. Feiler

JUNCTION DEVICES, INC., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594, Tel: 818-889-4030, 805-497-4421, TWX: 910-336-1293; FSC No.: 60858; Empl.: 70; *Sls. Mgr.:* N. Pena

JUPITER SYSTEMS, 1100 Marina Village Parkway, Alameda, CA 94501, Tel: 415-523-9000; *Sls. Mgr.:* Richard MacElhiney

KAHGAN ELCTRNS. CORP., 605 Peninsula Blvd., Hempstead, NY 11550, Tel: 516-538-2300, TWX: 510-222-4347; Empl.: 39; *Sls. Mgr.:* Fred Strauss; *Dist. Mgr.:* Carl Clemente

Local Sales Offices & Reps

AL	Huntsville, BCI, Inc.	205-539-4411
CA	Los Angeles, Corcoran Assocs.	213-823-4589
CA	Santa Clara, Maxim Elctrn. Sls.	408-946-6001
CO	Aurora, High Tech Assocs.	303-695-1990
FL	Casselberry, Southern Elctrn. Mktg. (A/K/A Semi)	305-831-2822
IL	Palatine, Technology Sls.	312-991-6600
KS	Overland Park, J. F. Guernsey Co.	913-381-2225
MA	Lexington, Del-Con Sls.	617-938-1929
MI	Southfield, Gehrke, Fred & Assocs.	313-559-5363
MN	Minneapolis, Smiley-Scott Assocs.	612-888-5551
NY	N. Syracuse, R. F. Roux Co.	315-458-6576
OH	Cincinnati, Gilbert, Bob & Assocs.	513-574-1932
PA	King of Prussia, Emerald Elctrns.	215-265-1360
SC	Easley, RA Sls.	803-859-1859
TX	Dallas, Marcom	214-351-4532
TX	El Paso, Aztec Microelectronics	915-581-6130
VA	Reston, Tytronics Tech. Sls.	703-471-0440
WA	Vancouver, Ray Over Sls.	206-695-6179
WI	Wauseka, Techn. Sls.	414-787-5015

KAHLE ENGRG., Div. Joule Machinery Grp., 3344 Hudson Ave., P.O. Box 877, Union City, NJ 07087, Tel: 201-867-6500, Telex: 42-7757, TWX: 710-992-8835; Empl.: 50; *Sls. Mgr.:* Carl A. Napor

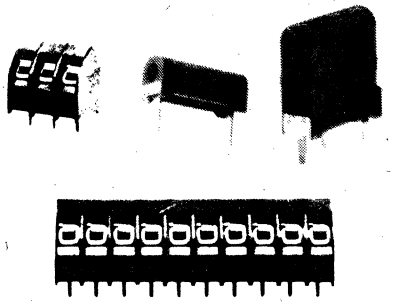
KAISER ELCTRNS., Kaiser Aerospace & Elctrns., 2701 Orchard Pkwy., San Jose, CA 95134, Tel: 408-946-3000, TWX: 910-338-0196; Empl.: 1200

KAISER ELECTROPRECISION, Kaiser Aerospace & Elctrns., 1700 S. Redhill Ave., Irvine, CA 92714, Tel: 714-250-1015, Telex: 678467; FSC No.: 86831; Empl.: 387; *Sls. Mgr.:* Gerald W. Allen

KSI Kaiser Systems, Inc.

KAISER SYSTEMS, INC., 126 Sohier Road, Beverly, MA 01915, Tel: 617-922-9300, Telex: 887159; FSC No.: 3698; Empl.: 100 ..... **D•1680-1683**

JOLO INDUSTRIES, INC
INTERCONNECTION HARDWARE



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KALAMAZOO TECHNICAL FURNITURE, P.O. Box 1165, Kalamazoo, MI 49005, Tel: 616-385-2255; Empl.: 42; *Sls. Mgr.:* B. Smith ..... **C•1068**

KALART VICTOR CORP., Hultenius St., Plainville, CT 06062, Tel: 203-747-1663; *Sls. Mgr.:* J. J. Costag

KALGLO ELCTRNS. CO., INC., 6584 Ruch Rd., E. Allen Twp., Bethlehem, PA 18017, Tel: 215-837-0700; FSC No.: 64521; *Sls. Mgr.:* Joe H. Ungerer

KALMUS & ASSOCS., INC., 2424 S. 25th Ave., Box 525, Broadview, IL 60153, Tel: 312-343-7004, TWX: 910-226-0713; Empl.: 346; *Sls. Mgr.:* William R. Blinn

Local Sales Offices & Reps

AL	Huntsville, L & D, Inc.	205-837-1469
CA	Pasadena, Black & White, Inc.	818-792-2133
CA	San Diego, Varigon Assocs.	619-576-0100
CA	San Jose, Class One Elctrns. Corp.	408-297-8666
CO	Boulder, Comp. Product Sls.	303-530-2800
FL	Plantation, Gallagher & Assocs.	305-473-2101
GA	Atlanta, L & D, Inc.	404-395-7079
IL	Arlington Heights, M. J. Petersen & Assocs.	312-577-8200
IL	Chicago, W. F. Hamilton Co.	312-867-5030
IN	Ft. Wayne, F. J. Campisano Co.	219-747-2633
IN	Indianapolis, F. J. Campisano Co.	317-253-7651
MA	Braintree, Nova Assocs.	617-848-9330
MI	Jackson, Jim Jordan Assocs.	517-750-2677
MN	Minneapolis, Northstar Comps.	612-553-1888
MS	Meridian, Alpha Mktg.	601-483-9306
MO	Independence, Engrg. Svcs. Co.	816-254-3600
MO	St. Louis, Engrg. Svcs. Co.	314-997-1515
NJ	Mountainside, Henry G. Richter Co.	201-233-4615
NY	Fayetteville, Henry G. Richter Co.	315-637-6713
NC	Greensboro, L & D, Inc.	919-292-3201
OH	Cincinnati, F. J. Campisano Co.	513-574-7111
OH	Cleveland, F. J. Campisano Co.	216-749-5550
PA	Corapolis, F. J. Campisano Co.	412-264-5151
TN	Austin, C. R. Colvin Assocs.	512-474-8698
TN	Houston, C. R. Colvin Assocs.	713-961-1262
TX	Richardson, McCoy Assocs. Co.	214-238-1017

K&L MICROWAVE, INC., 408 Coles Circle, Salisbury, MD 21801, Tel: 301-749-2424, TWX: 710-864-9683; FSC No.: 50140; Empl.: 320; *Sls. Mgr.:* Paul J. Leo

K & L QUARTZTEK, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043, Tel: 602-272-7944, TWX: 910-951-1305; FSC No.: 59492; *Sls. Mgr.:* Mark H. Story

K & M ELCTRNS., 123 Interstate Dr., W. Springfield, MA 01089, Tel: 413-781-1350, TWX: 710-350-6463; FSC No.: 6M312; Empl.: 500; *Sls. Mgr.:* Allan Mallanik ... **A•1879**

Local Sales Offices & Reps

CT	Marlborough, Precision Sls., Inc.	203-295-0580
OH	Akron, Augnat Assocs.	216-273-1211

Local Distributors

MA	West Springfield, Moldcon	413-736-0371

KANTZ ELCTRN. IND., 1804 Wall Church Rd., Wall Township, NJ 07719, Tel: 201-974-0090; Empl.: 12; *Sls. Mgr.:* L. Herold

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KAPPA NETWORKS, INC., 1443 Pinewood St., Rahway, NJ 07065, Tel: 201-541-1600, Telex: 130081 Kappa Rhwy; FSC No.: 20933; Empl.: 237; *Sls. Mgr.:* D. Pearl ..... **A•1530-1545**

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech Sls. Engrg. Co.	205-533-2100
CA	Alhambra, Kappa Networks	213-283-2048
CA	Alhambra, M. W. Riedel & Co.	213-283-7694
CA	Santa Clara, Emerging Tech. Sls.	408-727-1771
CO	Englewood, White Sls. Co.	303-694-9555
CT	Cheshire, Selmark Assocs.	203-573-9088
FL	Altamonte Springs, 'C' Assocs., Inc.	305-831-1717
GA	Norcross, Electro-Mech Sls. Engrg. Co.	404-447-6478
IA	Grandview, R.R. Burton & Assocs.	816-763-5385
MD	Columbia, Eastern Tech. Corp.	301-995-0202
MA	Millis, Selmark Assocs.	617-376-2914
MN	Osseo, Gaffney Sls. Co.	612-425-5484
MO	Grandview, R.R. Burton & Assocs.	816-763-5385
NH	Hopkinton, Selmark Assocs.	603-746-3299
NJ	Madison, Livera-Polk Assocs.	201-377-3220
NY	Glen Head, Livera-Polk Assocs.	516-759-9300
NC	Raleigh, Electro-Mech Sls. Engrg. Co.	919-851-8165
PA	Wynnewood, Metz-Benham Assocs.	215-896-7300
TN	Jonesboro, Electro-Mech Sls. Engrg. Co.	615-753-2964
TX	Dallas, Technig. Sls.	214-380-0200
TX	Houston, Technig. Sls.	713-266-2473
EXP	Carteret NJ, Kappa Networks	800-223-0603

Local Distributors

CA	Sherman Oaks, Delay Line Distrs. Co.	800-624-2617

KAPPA SCIENTIFIC CORP., Box 30585, Santa Barbara, CA 93105, Tel: 805-687-9648; Empl.: 4

KARKAR ELECTRONICS, INC., 245 Eleventh St., San Francisco, CA 94103, Tel: 415-552-1247, TWX: 910-372-7754 or 650-157-2515 MCI; FSC No.: 017857; *Sls. Mgr.:* A. Slikkerveer

KARL HOPT CO, See Hopt, Karl, Co.

KATES SCI. INSTRS., 142 Adam St., Newton, MA 02158, Tel: 614-527-2711; Empl.: 28; *Sls. Mgr.:* D. Kates

KATO ENGINEERING, Reliance Electric, P. O. Box 99502, Cleveland, OH 44199, Tel: 800-245-4501, in OH 800-245-4497

KAUFMAN DATA COMMS., INC., Orange Nassau Elctrns. Co., 145 E. Dana St., Mountain View, CA 94041, Tel: 415-962-8811, TWX: 910-379-5021

KAVLICO CORPORATION

KAVLICO CORP., 20869 Plummer St., Chatsworth, CA 91311-5096, Tel: 818-882-2400, FAX 818-998-2050, Telex: 65-1481; Empl.: 250; *Dist. Mgr.:* Rudi Kettler ..... **B•1798**

Local Sales Offices & Reps

AL	Adamsville, SouthRep	205-674-3056
CA	Dana Point, Avia-Tech	714-661-1914
CO	Lakewood, Loritz Controls	303-232-7803
IL	Lansing, Van Meter Instr.	312-474-3580
KS	Desoto, Midtec Assocs.	913-441-6565
MA	Lexington, Jodan Tech.	617-863-8898, 617-862-2354
MI	Taylor, Source Elctrns.	313-295-7790
MN	Minneapolis, Industra Co.	612-835-5535
NM	Albuquerque, Indl. Prods. Corp. (IPC)	505-256-3561
NJ	Haledon, E. A. Oliva Co.	914-457-9209
OH	Middleburgh Hgts., J. L. Finnicum	216-234-2323
PA	King of Prussia, FLW of PA	215-337-4343
SC	Greenville, E. C. Capell & Assocs.	803-297-6550
TX	Ft. Worth, UTM Engineering	817-429-2456
TX	Houston, Collinsystems Pro-Quip	713-464-9428

KAYE INSTRUMENTS, 15 De Angelo Dr., Bedford, MA 01730, Tel: 617-275-0300, Telex: 6817183; Empl.: 170

KAY ELEMETRICS CORP., 12 Maple Ave., Pine Brook, NJ 07058-9797, Tel: 201-227-2000, TWX: 710-734-4347; FSC No.: 80138; Empl.: 70; *Sls. Mgr.:* Stephen P. Crump ..... **A•1713**

KAY-TOWNES ANTENNA, P.O. Box 593, Rome, GA 30161, Tel: 404-291-9871, TWX: 810-764-4809; Empl.: 85; *Sls. Mgr.:* Charles S. Ford; *Dist. Mgr.:* James A. Sheffiled

KB ELCTRNS., 73 Wortman Ave., Brooklyn, NY 11207, Tel: 718-257-3300, TWX: 710 584 2308; Empl.: 125; *Sls. Mgr.:* A Bueller

KBI, A Div. of Cabot Corp., PO Box 1462, Reading, PA 19603, Tel: 215-371-3600, Telex: 902251, TWX: 510-651-0106; Empl.: 600; *Sls. Mgr.:* Robert J. Longenecker

KCK AMERICA INC., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018, Tel: 312-297-5435, Telex: 726481; *Sls. Mgr.:* Carl Bronder; *Dist. Mgr.:* Carl Bronder

KD COMPONENTS, INC., 3016 S. Orange Ave., Santa Ana, CA 92707, Tel: 714-545-7108, TWX: 910-595-2678; Empl.: 25

KDI ELECTRONICS, INC., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981, Tel: 201-887-8100, TWX: 710-986-8220; FSC No.: 64537; Empl.: 300; *Sls. Mgr.:* Carl Schraufnagl; *Dist. Mgr.:* Carl Schraufnagl ..... **A•1881**

Local Sales Offices & Reps

AZ	Phoenix, Toward Engrg. Assocs.	602-955-3193
CA	Los Angeles, Elsco	714-891-4621
CA	Mountain View, Gene Woempner	415-964-5454
CA	Mountain View, Gene Woempner Co., Inc.	415-964-5454
CA	Mountain View, J.L. Tech. Sls.	415-969-5552
CO	Englewood, High Plains Mktg.	303-792-2020
FL	PalmBay, Spartech Assocs., Inc.	305-727-8045
GA	Norcross, Spartech Assocs., Inc.	404-446-7300
IL	Northfield, Imex Ltd.	312-446-8934
IL	Park Ridge, Probe Elctrns.	312-698-2044
MD	Owings Mills, Neal Deoul Assocs.	301-363-4311
MA	Ashland, John O'Donnell	617-881-1380
MA	N. Andover, Torrey Assocs.	617-687-0099
MN	New Brighton, TWC Sls.	612-636-1770
MO	Grandview, Harris - Hanson	816-763-6200
MO	St. Louis, Harris - Hanson	314-432-3611
NJ	Madison, Livera-Polk Assocs.	201-377-3220
NY	Glen Head, Livera-Polk Assocs.	516-759-9300
NY	Huntington, CDB Entrps., Inc.	516-692-5200
NY	Syracuse, T-Squared Elctrns.	315-463-8592
OH	Dayton, Frederick L. Ohmer & Assocs.	513-434-1454
PA	Doylestown, Lou Adezio	215-249-9729
TX	Garland, Carey, McMahill & Zerbe Co., Inc.	214-681-1414
WA	Vancouver, Ray Over Sls.	206-695-4697

Local Distributors

CA	Chatsworth, MIL-COMM Distrs.	213-998-3111
CA	Mountain View, Target Elctrns.	415-961-1170
NJ	Englewood, Tech. Elctrn. Distrs.	201-894-0800
NY	Farmingdale, Command Elctrns.	516-293-1212
TX	Houston, Lenert Co.	713-225-1465

KEARNEY MAGNETICS, 150 Charcot Ave., San Jose, CA 95131, Tel: 408-262-4136, Telex: 910-338-2108; Empl.: 150; *Sls. Mgr.:* Carolyn Morton; *Dist. Mgr.:* Aki Fusimoto

KEC ELCTRNS., INC., 20817 Western Ave., Torrance, CA 90501, Tel: 213-320-3902, TWX: 910-349-6962; FSC No.: 213-618-1197; Empl.: 8; *Sls. Mgr.:* Frank Chase ..... **D•1685-1687**

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AZ	Tempe, Quatra	602-894-2802
CA	Cupertino, Costar	408-446-9339
CA	Los Alamitos, Power Specialists	213-594-9418
CO	Fort Collins, Vic Myers Assocs.	303-223-8907
FL	Cocoa Beach, Teqspec	305-748-9292
FL	Hobe Sound, Teqspec	305-746-4987
FL	Palm Harbor, Teqspec	813-785-2276
GA	Atlanta, Teqspec	404-455-7222
IL	Elk Grove Village, Loren Green Assocs.	312-593-0282
IN	Indianapolis, Loren Green Assocs.	317-293-9827
MA	Danvers, C. H. Burnham Assocs.	617-774-0111
MI	Jenison, R. C. Nordstrom & Co.	616-457-5762
MI	Southfield, R. C. Nordstrom & Co.	313-559-7373
MN	Minnetonka, Chris-Tek	612-934-1334
NH	Durham, C. H. Burnham Assocs.	603-868-2282
NJ	Springlake, Neville & Vespo	201-974-1520
NM	Albuquerque, Quatra Assoc. Inc.	505-821-1355
NY	Binghamton, TAE-Rep.	607-772-6952
NY	Rochester, TAE-Rep.	716-586-8710
NY	Thompson Ridge, Neville & Vespo	914-457-9209
NC	Winston Salem, Teqspec	919-723-8102
OH	Chesterland, KT/DEPCO	216-729-3588
PA	Erdenheim, Omni Sls.	215-233-4600
PA	Pittsburg, KT/Depco	412-487-8777
RI	Johnston, C. H. Burnham Assocs.	401-231-7475
TN	Morristown, Teqspec	615-587-0980
VA	Fairfax, Nine Assocs.	703-273-1803
WA	Bellevue, Elctrn. Mktg. Grp.	206-746-5915

KEENE LAMINATES, Keene Corp., 199 Amaral St., E. Providence, RI 02914, Tel: 800-556-7683, Telex: 927524; Empl.: 75

KEDMAN CO., Box 25667, Salt Lake City, UT 84125, Tel: 801-973-9112, TWX: 910-925-4116; Empl.: 100

KEENE RAY PROOF, Keene Corp., 50 Keeler Ave., Norwalk, CT 06878, Tel: 203-838-4555, Telex: 96-5812; *Sls. Mgr.:* Robert C. Barbour; *Dist. Mgr.:* Ken Makowski

KEITHLEY INSTRS., 28775 Aurora Rd., Cleveland, OH 44139, Tel: 216-248-0400, Telex: 98-5469; Empl.: 461; *Sls. Mgr.:* Ron Ruiz; *Dist. Mgr.:* T. A. Hayden

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AZ Scottsdale, BH&B Sls. 602-994-4455
CA El Toro, Kel-Am Pacific 714-859-2093
CA San Jose, Pilgrim Elctrns. 408-249-7500
CO Boulder, Component Prod. Sls. 303-530-2800
CT North Haven, Kitchen & Kutchin 203-239-0212
FL Sarasota, Phoenix Comps. 813-371-1163
GA Atlanta, Electro Sls. 404-394-1122
IN Fort Wayne, CC Elctrns. 317-255-1508
IA Davenport, Electro Tech. 319-386-1134
MD Baltimore, Faion Lott, Inc. 301-744-4611
MA Lexington, & 617-862-8230
MA Wakefield, Kentronics 617-246-0245
MI Ypsilanti, Tamco, Inc. 313-572-1950
MN Minneapolis, Electro-Tech 612-927-5878
MO N. Kansas City, Weisler & Assocs. 314-394-4543
MO St. Louis, Weisler & Assocs. 314-394-4543
NJ Clark, R. E. Breuer Co. 201-388-5045
NM Albuquerque, Nelco Elctrns. 505-293-1399
NY Port Washington, R. E. Breuer Co. 516-883-7810
NY Rochester, Tech. Comps. 716-342-2406
OR Portland, SPS Engrg. 503-297-6919
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PA Willow Grove, Meldena Sls. 215-657-7760
NC Matthews, RG Sls. 704-847-0049
TN Chattonooga, Electro Sls. 615-267-4260
TX Grapevine, Elctrn. Mktg. Assoc. 817-481-7502
TX Houston, Elctrn. Mktg. Assoc. 713-498-8120
WA Redmond, SPS Elctrns. 206-392-5264

Local Distributors

AZ Tempe, Anjon 602-894-1332
AZ Tucson, Southwest Sls. 602-628-1613
CA Belmont, LO-DAN Elctrns. 415-592-4600
CA Corona, Konex Corp. 714-371-1200
CA Costa Mesa, Ascot 714-557-3252
CA Glendale, Remco 714-558-3202
CA Mountain View, Cornett Elctrns. 415-969-5420
CA San Diego, Mann 619-578-1550
CA San Diego, R. David Miner, Inc. 619-566-9891
CA San Fernando, REMCO 213-365-1176
CA Santa Ana, Mann S.W. 714-558-3202
CA Santa Clara, Ascot 408-988-4991
CA Santa Clara, Mann Elctrns. 408-988-6061
CO Broomfield, Ascot 303-465-2346
CO Denver, CSID Intergrated Elctrns. 303-893-9594
FL Ft. Lauderdale, Intertec Comps. 305-975-8644
FL Largo, Lo Dan Elctrns. 813-586-2851
FL Longwood, Intertec Comps. 305-834-7777
IL Arlington Hgts., Lo Dan Elctrns. 312-398-5311
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KS Shawnee, Besco Elctrns. 913-631-3882
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KELTEC FLORIDA, P.O. Box 2917, Ft. Walton Bch., FL 32549, Tel: 904-651-9749, TWX: 510-730-7654; FSC No.: 09062; Empl.: 400 ..... **D•1688**

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MA Needham Hgts., O'Sullivan & Murphy 617-449-4141/4142/4144
MO Hazelwood, Palatine Sls. 314-839-0800
NJ Danville, Metro-MICS 201-625-5959
NM Albuquerque, J. Smith Assoc. 505-265-3406
NY Melville, Metro MICS 516-271-6677
OH Brunswick, Science Sls. 216-273-4429
PA Montgomerysville, VPI 215-474-3200
TX Richardson, Lear Assocs. 214-231-5388

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KELTRON CORP., 225 Crescent St., Waltham, MA 02154, Tel: 617-894-8700, Telex: 948197; Empl.: 270; *Sls. Mgr.:* Scott J. Shrier; *Dist. Mgr.:* Scott J. Shrier

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KELVIN, 5919 Noble Ave., Van Nuys, CA 91411, Tel: 818-782-6662, Telex: 65-1417; FSC No.: 19587; Empl.: 250; *Sls. Mgr.:* R. A. Featherston ..... **A•1882-1883**

Local Sales Offices & Reps

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CA Van Nuys, Wes-K Assocs. 213-989-3070
CO Boulder, R-G Entprs. 303-447-9211
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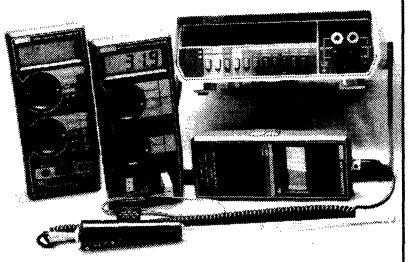

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CA Alhambra, Fisher-Brownell 818-289-0255
CA Anaheim, Time 714-937-0911
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CA Canoga Park, Schweber Elctrns. 213-999-4702
CA Chatsworth, Avnet 818-700-2600
CA Chatsworth, Hamilton Electro Sls. 818-700-6500
CA Chatsworth, Integrated Elctrns. 213-998-2200
CA Chatsworth, Time 818-998-7200
CA Citrus Heights, Hall-Mark 916-772-8600
CA Costa Mesa, Avnet Elctrns. 714-754-6111
CA Costa Mesa, Hamilton/Avnet Elctrns. 714-641-4112
CA Culver City, Hamilton Electro Sls. 213-558-2662
CA Culver City, Hamilton Electro Sls. (Corp. Off.) 213-558-2662
CA Culver City, Hamilton/Avnet 214-558-2883
CA El Segundo, Hall-Mark 213-643-9101
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CA Gardena, Bell Inds. 213-515-1800
CA Irvine, Integrated 714-660-1055
CA Irvine, Schweber Elctrns. 714-863-0256
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CO Englewood, Time 303-799-8851
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CT Danbury, Schweber Elctrns. 203-748-7080
CT Wallingford, Hall-Mark 203-269-0100
FL Altamonte Springs, Schweber Elctrns. 305-331-7555
FL Clearwater, Hall-Mark 815-530-4543
FL Ft. Lauderdale, Hamilton/Avnet Elctrns. 305-971-2900
FL Ft. Lauderdale, Time 305-974-4800
FL Hollywood, Schweber Elctrns. 305-927-0511
FL Largo, Bell/Graham 813-541-4434
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GA Norcross, Hamilton/Avnet Elctrns. 404-447-7500
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NH Manchester, Hamilton/Avnet 603-624-9400
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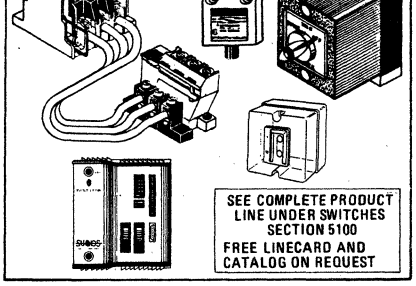

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NY Binghamton, Tae-Rep 607-722-9265
NY Rochester, Tae-Rep 716-586-8710
UT Salt Lake City, Williams Assocs. 801-532-7701
WA Portland, Westcon 503-283-0132
WI New Berlin, Marsland Assocs. 414-786-6611

KOGYOSHA, 179 Riveredge Rd., Tenafly, NJ 07670, Tel: 201-569-8769; Empl.: 3; *Sls. Mgr.:* Mark Nakanishi; *Dist. Mgr.:* Mark Nakanishi

KOLE IND., 3553 N.W. 50th St., Miami, FL 33102-0152, Tel: 305-633-2556, 800-327-6085; Empl.: 45; *Sls. Mgr.:* B. J. Neelands

KOLIN INDS., Box 300, Pound Ridge, NY 10576, Tel: 914-764-5775, Telex: 137453; Empl.: 30; *Sls. Mgr.:* J. Kolinsky

KOLLMORGEN
INDUSTRIAL DRIVES

KOLLMORGEN CORP., Industrial Drives Div., 201 Rock Rd., Radford, VA 24141, Tel: 703-639-2495, TWX: 710-875-3743; FSC No.: 11384; Empl.: 343; *Sls. Mgr.:* Sandor L. Tako/G. Wayne Coleman ..... **B•1163-1165; C•1483**

Local Sales Offices & Reps
AL Huntsville, Techn. Mktg. Assoc. 205-883-7893
AZ Phoenix, Thor Engr. 602-437-1463
CA Alhambra, Thorson 818-281-2280
CA Goleta, Thorson 805-964-8751
CA Mountain View, Thorson 415-964-9300
CA Signal Hill, Thorson 213-595-0361
CT Meriden, Whitehead Assocs., Inc. 203-634-1280
CT Tolland, Whitehead Assocs., Inc.
FL Melbourne, Technlg. Mktg. Assocs. ... 305-676-3776
FL Orlando, Techn. Mktg. Assoc. 305-857-3760
FL Pompano Beach, Techn. Mktg. Assoc. 305-942-0774
GA Atlanta, Technlg. Mktg. Assocs. 404-257-0374
IL Schaumburg, Industrial Drives 312-893-8886
MA Wakefield, Whitehead Assocs., Inc. 617-246-5155
MI Farmington Hills, Electro-Matics Prods., Inc. 313-478-1182
MN St. Paul, John J. Exon Co. 612-636-5533
MO Raytown, Cadon Techn. Sls. 816-356-7685
MO St. Louis, Cadon Techn. Sls. 314-645-8670
NJ Wayne, S. Howard Lagerveld & Assocs. 201-790-1714
NY Rochester, A & D Devices 716-385-2778
NY Sydney, A & D Dvcs. 607-563-8488
NC Matthews, Industrial Drives Div. 704-821-9875
OH Chagrin Falls, Jerry Kilroy Corp. 216-543-3370
OH Kettering, Kilroy Corp. 513-294-1235
OR Beaverton, Thorson NW 503-644-5900
PA Downingtown, Homersmith, Inc. 215-269-3637
PA Media, Homer Smith Engr. Prods. Rep. 215-543-2434
TX Austin, P.J. Scanlon Co. 512-255-2664
TX Dallas, P. J. Scanlon Co., Inc. 214-231-4661
VA Salem, Homersmith, Inc. 703-774-7411
WA Bellevue, Thorson 206-455-9180
WI Wauwatosa, Industrial Drives 414-475-5985

KOLLSMAN INSTR., 220 Daniel Webster Hwy., Merrimack, NH 03054, Tel: 603-889-2500, Telex: 94-3537, TWX: 710-366-6883; Empl.: 2200

KONTES, Kimble Div. of Owens/IL, 1001 Spruce St., Vineland, NJ 08360, Tel: 609-692-8500, TWX: 510-687-8967; *Sls. Mgr.:* Peter Davenport

KONTRON ELCTRNS., 1230 Charleston Rd., Mountain View, CA 94039-7230, Tel: 415-965-7020, TWX: 910-378-5207; Empl.: 200; *Sls. Mgr.:* Dick Ridas

KOOLTRONIC, Hamilton Ave., Hopewell, NJ 08525, Tel: 609-466-3400, Telex: 84-3345; Empl.: 150; *Sls. Mgr.:* Gerald H. Freedman

KORRY ELECTRONICS, INC., 223 8th Ave. N., Seattle, WA 98109, Tel: 206-223-5400, TWX: 910-444-2295; Empl.: 410; *Sls. Mgr.:* Woody Hertzog

KRECKMAN, HERB, CO., Cresco, PA 18326, Tel: 717-595-2212; Empl.: 4

KR ELECTRONICS, INC., 91 Avenel St., Avenel, NJ 07001, Tel: 201-636-1900; Empl.: 15 ..... **A•1613**

KRL ELCTRNS., 160 Bouchard St., Manchester, NH 03103, Tel: 603-668-3210, 800-257-3300, TWX: 710-220-1662; Empl.: 65; *Sls. Mgr.:* Bert A. Spiller

KROHN CERAMICS, INC, See Centerflex Techn.

KROHN-HITE CORP., Avon Indl. Pk., Bodwell St., Avon, MA 02322, Tel: 617-580-1660, TWX: 710-345-0831; Empl.: 100; *Sls. Mgr.:* Craig S. Dunbar ..... **D•1258-1259**

Local Sales Offices & Reps
AL Huntsville, Gentry Assocs. 205-837-0692
AZ Phoenix, Odyssey 1 602-246-8846
AR Eldorado, Kemp Engrg. 501-826-5869
CA Inglewood, L & M Engrg. Assocs. 213-674-6850
CA San Jose, MCH Assocs. 408-246-7330
CO Englewood, Odyssey 1 303-773-8176
CT New Haven, McBar Assocs. 203-865-4376
FL Ft. Lauderdale, Gentry Assocs. 305-791-8405
FL Orlando, Gentry Assocs. 305-859-7450
FL Tampa, Gentry Assocs. 813-886-0720
GA Atlanta, Gentry Assocs. 404-998-2828
IL Chicago, Berndt Assocs. 312-283-0713
IN Carmel, Berndt Assocs. 317-844-0114
KS Overland Park, Ramsey Assocs. 913-649-6996
LA Gretna, Gentry Assocs. 504-367-3975
MD Baltimore, Sci-Rep 703-385-0600
MA Waltham, McBar 617-890-0233
MI Detroit, EQS Sys. 313-961-3042
MN Minneapolis, Berndt Assocs. 612-546-2021
MO St. Louis, Ramsey Assocs. 314-878-5042
NJ Englewood, Sci. Devices E. 201-871-3916
NM Albuquerque, Odyssey 1 505-265-6645
NY Syracuse, Labtronics 315-455-7314
OH Chesterland, EQS Sys. 216-729-2222
OH Columbus, EQS Sys. 614-228-3453
OK Tulsa, Kemp Engrg. 918-663-4501
OR Portland, McLaren 503-297-2248
PA Pittsburgh, EQS Sys. 216-729-2222
PA Spring House, Scientific Devices East 215-643-3335
SC Columbia, Gentry Assocs. 803-772-6786
TN Knoxville, Gentry Assocs. 615-584-0281
TX Dallas, Kemp Engrg. 214-931-7100
TX Houston, Kemp Engrg. 713-466-1465
VA Fairfax, Sci-Rep 703-385-0600
WA Bellevue, McLaren 206-454-3400
WI Milwaukee, Berndt Assocs. 414-545-8400

KRYSTINEL CORP., 126 Pennsylvania Ave., Paterson, NJ 07503, Tel: 201-345-8900, TWX: 710-988-5931; Empl.: 200; *Sls. Mgr.:* Joseph Barreca ..... **A•1304-1306**

Local Sales Offices & Reps
AZ Phoenix, Charles T. Fink & Assoc. 602-992-9884

Local Distributors
CA Los Alamitos, Permag Pacific Corp. ... 213-594-6515
CA Sunnyvale, Permag Sierra Corp. 408-738-1080
CO Aurora, Permag Corp. 303-693-6612
GA Norcross, Permag Dixie Corp. 404-448-5661
IL Elk Grove Vl., Permag Cen. Corp. 312-956-1140
MA Billerica, Permag NE Corp. 617-273-2890
MN Eden Prairie, Permag Minn. Corp. 612-934-4635
NY Hicksville, Permag Corp. 516-822-3311
OH Toledo, Permag Magnetics Corp. 419-385-4621
OR Portland, Permag Corp, Sierra Div. 503-252-9610
TX Richardson, Permag S.W. Corp. 214-699-1121

KSI, See Kaiser Systems, Inc.

KSW ELCTRNS. CORP., See Frequency Sources, KSW Semicond. Div.

K-SYSTEMS, INC., 3902 Lilac, Las Cruces, NM 88005, Tel: 505-526-3209, Telex: 910-380-3378; Empl.: 2; *Sls. Mgr.:* Alice Furphy

H. KUHNKE, INC., 26 W. Highland Ave., Atlantic Highlands, NJ 07716, Tel: 201-291-3334, 800-221-0714, Telex: 854041; Empl.: 12; *Sls. Mgr.:* John Chapski

kulite

KULITE SEMICONDUCTOR PRODS., INC., 1039 Hoyt Ave., Ridgefield, NJ 07657, Tel: 201-945-3000, Telex: 13-5458; Empl.: 300 ..... **B•1799**

Local Sales Offices & Reps
AL Huntsville, Lee Assocs. 205-533-5896
AZ Scottsdale, Dave Menegey Assocs. ... 602-994-9519
CA Hollywood, B. J. Wolfe Entprs. 213-877-5518
CA Walnut Creek, Dale-Dahl Assocs. 415-933-9595
CO Boulder, Measurement Cnslts. 303-449-7506
DC Baltimore, Reptron, Inc. 301-799-7490
FL Osprey, Dick Ridgewell Co. 813-484-2020
IN Indianapolis, EIA, Inc. 317-257-7231
MD Baltimore, Reptron 301-799-7490
MA Wayland, Daner-Hayes 617-655-0888
MI Madison Heights, WKM Assocs. 313-588-2300
MN Minneapolis, Trask Engrg. 612-537-2434
MO St. Louis, Ozark Elctrn. Mktg. 314-423-7200
NH Wilton, Daner-Hayes, Inc. 800-225-8760
NJ Glen Gardner, Daner-Hayes, Inc. 800-225-8760
NM Albuquerque, Amonette Entprs. 505-344-4143
NY Brewster, Daner-Hayes, Inc. 800-225-8760
NY Rochester, Daner-Hayes, Inc. 800-225-8760
OH Dayton, WKM Assocs 513-434-7500
OH Pittsburgh, WKM Assocs. 412-892-2953
OK Edmond, Data Aids Assocs. 405-478-5000/01
PA Doylestown, Daner-Hayes, Inc. 800-225-8760
PA Pittsburgh, WKM Assocs. 412-892-2953
TX Austin, Data Aids 512-327-8600/01
TX Dallas, Data Aids 214-620-1551
UT Salt Lake City, Measurement Cnslts. .. 801-364-3174
VT White River Junction, Daner-Hayes, Inc. 800-225-8760
WA Seattle, Brett Assocs. 206-431-8090

Kulka Smith
A NORTH AMERICAN PHILIPS COMPANY

KULKA SMITH, INC., 1913 Atlantic Ave., Manasquan, NJ 08736, Tel: 201-223-9400, TWX: 244536; Empl.: 500; *Sls. Mgr.:* John Chirico ..... **C•1424-1429**

Local Sales Offices & Reps

AZ Phoenix, Shefler-Kahn Co. 602-257-9015
CA Los Angeles, E E Strassner 818-242-8823
CA Santa Clara, Ross Mktg. Assocs. 408-988-8111
CO Denver, Lindberg Co. 303-758-9033
CT North Haven, Coakley, Boyd & Abbett 800-225-8402
FL Orlando, Hollingsworth & Still, Inc. 305-859-9423
GA Norcross, Hollingsworth & Still, Inc. ... 404-447-1700
IL Lombard, RMP/McBride Corp. 312-932-9090
IL Northbrook, Dolin Sls. 312-498-6770
IN Indianapolis, Electronic Reps., Inc. 317-894-7414
KS Shawnee Mission, Lowell-Kangas & Assocs. 913-631-3515
MA Needham Hgts., Coakley, Boyd & Abbett 617-444-5470
MI Southfield, R. C. Nordstrom & Co. 313-559-7373
MN Minneapolis, Electronic Comp. Sls. 612-933-2594
MO St. Louis, Lowell-Kangas & Assocs. ... 314-821-4050
NH Plaistow, Coakley, Boyd & Abbett 617-444-5470
NJ Clifton, R.O.I. Sls. Co. 201-340-1515
NY Syracuse, Allen, Leonard D., Inc. 315-437-8387
NC Kenersville, Hollingsworth & Still, Inc. 800-241-5712
OH Richfield, Bear Mktg. 216-659-3131
OR Portland, Dale J Weber Co. 503-234-7671
PA Trevose, P.S.A., Inc. 215-245-0513
TX Dallas, Schoonmaker, J. Y. Co. 214-349-1650
WI Milwaukee, D. Dolin Sls. 414-482-1111
Can Rexdale, Ont., Frank Eakin Sls. 416-245-3600

Local Distributors

AZ Tempe, Fisher/Brownell 602-967-1464
CA Alhambra, Fisher/Brownell 818-289-0255
CA Buena Park, Control Design 213-802-1371
CA Buena Park, RPS Elctrns. 714-521-5040
CA Mountain View, Cornett Elctrns. 415-969-5420
CA San Carlos, Control Design 415-592-4808
CA San Diego, Fisher/Brownell 619-560-8545
CA Santa Clara, El-Com Comps. 408-496-0880
CA Santa Clara, Fisher/Brownell 408-988-6041
CO Arvada, Denver Wintronics 303-431-7161
CO Englewood, Industrial Elctrns. 303-694-9444
CT Stratford, Utronics 203-378-4201
CT Wallingford, Midan 203-265-2077
FL Altamonte Springs, Control Design Supp. 305-788-3220
FL Clearwater, Electronic Precepts 813-530-9781
FL Ft. Lauderdale, Peerless Radio/Fla. ... 305-973-4141
FL Miami, Electronic Equip. Co. 305-871-3500
GA Stone Mountain, Control Design Supp., Inc. 404-979-3500
IL Addison, Lectro Comps. 312-543-1680
IL Chicago, Newark Elctrns. 312-784-5100
IL Genoa, Control Design Supp., Inc. 815-784-6515
IL Palatine, OHM Elctrns. 312-359-5500
IL Peoria, Klaus Radio 309-691-4840
IN Indianapolis, Control Design 317-788-4559
IN Indianapolis, Graham Elctrn. Supp. 317-634-8202
IA Cedar Rapids, Deeco, Inc. 319-365-7551
IA Cedar Rapids, Vrbik-Berquist 319-366-8733
IA Marion, Control Design 313-373-2923
KS Wichita, RSC Elctrns. 316-267-5213
KY Louisville, Peerless Elctrn. Equip. 502-637-7677
LA New Orleans, Radio Parts 504-581-5959
LA New Orleans, W. B. Allen Supp. 504-525-8222
MD Baltimore, Resco/Baltimore 301-529-0500
MA Newton, Greene Shaw Co. 617-969-8900
MA Norwood, Gerber Elctrns. 617-769-6000
MI Battle Creek, Great Lakes Elctrns. 616-731-4156
MI Grand Rapids, S. F. Elctrns. 616-459-0216
MN Minneapolis, Control Design 612-721-6555
MN St. Paul, Ragon Elctrns. 612-642-2828
MO Kansas City, Walter Radio Supp. Co. .. 816-531-7015
MO Maryland Hgts., L-Comp., Inc. 314-291-6200
MO St. Louis, Control Design Supp. 314-426-3150
NE Lincoln, Scott Elctrns. Supp. 402-466-8221
NJ Prospect Park, Kappe Electrical Distrs. 201-790-1999
NM Albuquerque, Walker Elctrl. 505-883-2992
NY Bohemia, Key Comps., Inc. 516-567-7500
NY Buffalo, Summit Distrs. 716-884-3450
NY Elmsford, Ancar Elctrns. 914-592-7100
NY Lynbrook, Peerless Radio 516-593-2121
NY Mt. Vernon, Qar Indl. Elctrns. 914-699-2224
NY Rochester, Simcona Elctrns. 716-328-3230
NY Rochester, Summit Distrs. 716-334-8110
NY Rockville Center, Midway Indl. 516-293-6800
NC Charlotte, Control Design Supp. 704-588-4410
NC Raleigh, Southeastern Radio Supp. ... 919-828-2311
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Cincinnati, URI Elctrns. 513-761-4030
OH Cleveland, Roberts Elctrns. 216-238-1711
OH Cleveland, W. M. Pattison Supp. 216-441-3000
OH Columbus, Electronics Mktg. 614-299-4161
OH Dayton, John A. Becker Co. 513-226-1341
OH Dayton, Stotts-Friedman 513-298-5555
OH Warren, Rem Elctrns. 800-262-9050
OK Oklahoma City, Electro Entprs. 405-427-6591
OR Portland, Radar Elec. 503-232-3404
PA Altoona, Allegheny Elctrns. 814-946-0871
PA Harrisburg, Pyttronics 215-643-2850
PA Malverne, Control Design 215-296-0150
PA McKean, Advacom 814-476-7774
PA Philadelphia, Almo Elctrns. 215-698-4000
PA Philadelphia, Shap Elctrns. 215-969-3300
PA Pittsburgh, CAM/RPC Co. 412-782-3770
PA Reading, Barbey Elctrns. 215-376-1451
TN Knoxville, Industrial Elctrns. 615-573-7135
TX Dallas, Force Elctrns. 214-438-5700
TX Fort Worth, Allied Elctrns. 817-336-5401
TX Ft. Worth, Industrial Elctrns. 817-731-7321
TX Houston, Altair Corp. 214-231-5176
TX Houston, Sterling Elctrns. 713-627-9800
TX Richardson, Altair Corp. 214-231-5166
UT Salt Lake City, Ra-Elco 801-487-7749
VA Charlottesville, Virginia Radio Supp. 804-296-4184
WA Seattle, Pacific Elctrns. 206-575-1050
WA Seattle, Radar Elec. 206-282-2515
WI New Berlin, Control Design 414-784-1015
WI New Berlin, RM Wisconsin 414-784-4420
Can Pte. Claire, Que., Future Elctrns. 514-694-7710

KURZ INSTRUMENTS INC.

KURZ INSTRUMENTS, INC., P.O. Box 849, Carmel Valley, CA 93924, Tel: 800-424-7356, Telex: 172275; FSC No.: 94-24-11681; Empl.: 45; *Sls. Mgr.:* Phil Hickerson ..... **B•1800**

Local Sales Offices & Reps

FL Jacksonville, Hile Controls Of Florida 904-268-4880
GA Woodstock, Hile Controls Of Georgia 404-928-6844
IL South Holland, Carrier-Oehler Co. 312-339-8200
KS Mission, Vertec Assocs. 913-677-3200
KY Ft. Mitchell, Giangarlo Sci. Co. 606-341-9570
LA Baton Rouge, Desselle-Maggard Corp. 504-293-3290
MA Newton, ETA Assocs. 617-527-4544
MI Kalamazoo, Giangarlo Sci. Co. 616-345-9182
MN Cedar, Bican Co. 612-434-7733
MO Manchester, Vertec Assocs. 314-394-6242
NJ Clifton, I.R.I. 201-471-2614
NM Albuquerque, A-Tek Co. 505-265-8325
NY Hamilton, Giangarlo Sci. Co. 315-824-1883
NC Matthews, W. K. Hile Co. 704-847-9125
OR Portland, Extech, LTD. 503-292-9219
PA Pittsburgh, Giancarlo Sci., Co. 412-584-0208
TX Houston, Stringer Assocs. 713-469-9209
TN Knoxville, Hile Controls of Tennessee 615-584-0208
UT Salt Lake City, MC2 801-364-3174
VA Chester, Hile Controls Of Virginia 804-796-3001
WA Enumclaw, Extech, LTD. 206-825-2308
WI Milwaukee, Jensen Reynolds Corp. ... 414-351-1100
Can Toronto, Safety Supply Canada 416-364-3234

KURZ-KASCH, Knob Div., 711 Hunter Dr., Wilmington, OH 45177, Tel: 513-382-0966; Empl.: 250; *Sls. Mgr.:* J. McGeady, M. Krystofik

KYOCERA INTL., INC., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138, Tel: 619-454-1800, TWX: 910-322-1130; *Sls. Mgr.:* Clif Nehlsen; *Dist. Mgr.:* Bill McKelvy

LAAKMANN ELECTRO-OPTICS, INC., 33052 Calle Aviador, San Juan Capistrano, CA 92675, Tel: 714-493-6624, Telex: 681335; *Sls. Mgr.:* John Wheeler

LAB-LINE INSTRS., 15th & Bloomingdale, Melrose Park, IL 60160, Tel: 312-450-2600, Telex: 270-312; Empl.: 225

LABORATORY PRODUCTS, INC., 57 Cornwall St., P. O. Box 1750, Jamaica Plain, MA 02130, Tel: 617-522-7800; FSC No.: 04-2593524; Empl.: 9; *Sls. Mgr.:* R. J. Toronto

LAFRANCE CORP., Entprs & Exec Aves, Philadelphia, PA 19153, Tel: 215-365-8000, Telex: 83-1732; *Sls. Mgr.:* James Craig

LAFRANCE CORP., PACTEC DIV., See PacTec Div., LaFrance Corp.

LA MARCHE MFG., 106 Bradrock Dr., Des Plaines, IL 60018, Tel: 312-299-1188, Telex: 28-2526; FSC No.: ;15736; Empl.: 225

LAMBDA ELECTRONICS, Veeco Instr., Inc., 515 Broad Hollow Rd., Melville, NY 11747, Tel: 516-694-4200, TWX: 510-224-6484; Empl.: 1200; *Sls. Mgr.:* R. Koslow

LAMBDA SEMICONDUCTORS, Veeco Instr., 121 International Dr., Corpus Christi, TX 78410, Tel: 512-289-0403, 800-255-9606, TWX: 910-876-1404; Empl.: 200; *Sls. Mgr.:* Derek Roberts

LAMP TECHNOLOGY, INC., 141A Central Ave., Farmingdale, NY 11735, Tel: 516-454-6464, Telex: 645543; Empl.: 10; *Sls. Mgr.:* Edith Reuter

LAMPTRONIX CO., LTD., 85 N. Williams St., Crystal Lake, IL 60014, Tel: 815-455-0400, Telex: 280191; FSC No.: 61342; *Sls. Mgr.:* Nancy E. Towe

Local Sales Offices & Reps

FL Orlando, Over & Over Florida, Inc. 305-857-4057
IL Addison, Engineered Sls. 312-832-8425
IN Noblesville, W.G. Brouillette & Assocs. 317-345-6500
KS Wichita, D & O Engrg. 316-686-2802
NJ Haddonfield, Gray Assocs. 609-429-5300
TN Antioch, Over & Over, Inc. 615-834-0140
WA Lynwood, Blum & Assocs. 206-775-6656

LAMTECH ELECTRONICS, 620 Easy Street, Garland, TX 75042, Tel: 214-272-3504; Empl.: 100; *Sls. Mgr.:* Phillip Rasor; *Dist. Mgr.:* Phillip Rasor ..... **C•1845**

Local Sales Offices & Reps

TX Dallas, Zonk & Assocs. 214-238-7651
TX Houston, Zonk & Assocs. 713-895-9131

LANCE INDS., P.O. Box 4156, Sylmar, CA 91342-0156, Tel: 818-367-1811, Telex: 66-2443; *Sls. Mgr.:* Jerry Updyke; *Dist. Mgr.:* Joe Barris

LANCE WIRE & CABLE, INC., 1010 Sherman Ave., Hamden, CT 06514, Tel: 203-288-5571; Empl.: 50; *Sls. Mgr.:* Bill Kahler

LANCORE TECHNOLOGIES, INC., 31324 Via Colinas, Westlake Village, CA 91362, Tel: 818-991-5100, Telex: 532044

LANDIS & GYR, INC., 4 Westchester Plaza, Elmsford, NY 10523, Tel: 914-592-4400, Telex: 137345; FSC No.: 914-592-1179; Empl.: 65; *Sls. Mgr.:* Joe Depaola; *Dist. Mgr.:* R. W. Strohm

L & L SPECIAL FURNACE, 166 Kent Rd., Aston, PA 19014, Tel: 215-459-9216, Telex: 753264; Empl.: 20; *Sls. Mgr.:* Greg Lewicki; *Dist. Mgr.:* Stephen Lewicki

L & R MFG. CO., 577 Elm St., Kearny, NJ 07032, Tel: 201-991-5330, Telex: 642078 Ellanar Krny.; Empl.: 220; *Sls. Mgr.:* Bruce Bernardo

LANGLEY, P.O. Box 2911, San Diego, CA 92112, Tel: 619-264-3181; FSC No.: 83549; Empl.: 140; *Sls. Mgr.:* A. Kremm

LANSING

LANSING RESEARCH CORP., 705 Willow Ave., Ithaca, NY 14850, Tel: 607-272-3265, 800-847-3535; *Sls. Mgr.:* Fred B. Widding ..... **C•1069**

LA POINTE INDUSTRIES, INC., Electronics Products Div., 155 W. Main St., Rockville, CT 06066, Tel: 203-872-8581, TWX: 710-435-1663; FSC No.: 70117; Empl.: 650

LARK ELECTRONICS, INC., Box 390, New York, NY 10040, Tel: 212-569-0430; FSC No.: 52682

LARK ENGINEERING CO., 26401 Calle Rolando, San Juan Capistrano, CA 92675, Tel: 714-493-9501, TWX: 910-596-1411; FSC No.: 33175; Empl.: 40

LARSON INSTR., Greenbush Rd., Orangeburg, NY 10962, Tel: 914-359-3800; Empl.: 18; *Sls. Mgr.:* A. D. Stephens

LASER APPLICATIONS, 91 Carver Ave., Westwood, NJ 07675, Tel: 201-664-7636; Empl.: 5

LASER CONCEPTS, Omega Organization Intl., P.O. Box 687, Mercer Island, WA 98040, Tel: 206-232-6256; *Sls. Mgr.:* Sheila Chatelaine

LASER DIODE LABS, 1130 Somerset St., New Brunswick, NJ 08901, Tel: 201-249-7000, TWX: 710-998-0597; *Sls. Mgr.:* Steve Klunk

LASER INC., Laser Lane, Box 537, Sturbridge, MA 01566, Tel: 617-347-7314, Telex: 95-1806; Empl.: 110; *Sls. Mgr.:* William H. Shiner

LASER PRECISION CORP., 1231 Hart St., Utica, NY 13502, Tel: 315-797-4449, Telex: 646803; Empl.: 110; *Sls. Mgr.:* Don Sypek

LASERSONICS POWER SUPPLY OPERATION, 177 N. Wolfe Rd., Sunnyvale, CA 94086, Tel: 408-732-9880 ..... **D•1719**

LASER TECHN., 10624 Ventura Blvd., N. Hollywood, CA 91604, Tel: 818-763-7091; Empl.: 18; *Sls. Mgr.:* H. B. McLaughlin

LATTIN RADIO LABS., 1431 Sweeney, P.O. Box 44, Owensboro, KY 42302, Tel: 502-683-2868; Empl.: 3; *Sls. Mgr.:* Wm J. Lattin

LAWRENCE-CROW ELCTRNS. INC., 2100 Stemmons, Dallas, TX 75207, Tel: 214-749-5440, Telex: 730213; *Sls. Mgr.:* Jesse Hall; *Dist. Mgr.:* Michael T. McAndrews

L-COM INC., 1755 Osgood St., Unit 11EM, N. Andover, MA 01845, Tel: 617-682-6936, Telex: 882157; Empl.: 14; *Sls. Mgr.:* Mark W. Tomkins; *Dist. Mgr.:* Mark W. Tomkins ..... **C•1846-1847**

Local Sales Offices & Reps

CA	Anaheim, Galaxie Sls. Intl.	714-937-5622
CT	Middletown, Gerber Sls.	203-347-3000
FL	Apopka, G. F. Bohman Assoc., Inc.	305-886-1882
IL	Chicago, Ed Joyner & Co.	512-320-1200
KS	Kansas City, BC Elctrns. Sls.	913-342-1211
MA	Newton Upper Falls, Gerber Sls.	617-969-2620
MO	Bridgeton, BC Elctrns. Sls.	314-291-1101
NJ	Marlton, Naudain Assoc.	609-983-5300
NY	Great Neck, F & F Metro, Inc.	516-482-4080
NY	Rochester, Lamb Comps., Inc.	716-323-1250
NY	Syracuse, Lamb Comps., Inc.	315-455-2469
TX	Houston, Repmasters-Houston	713-692-8204
TX	Sherman, Repmasters-Dallas	214-247-6236

Local Distributors

CA	Los Angeles, Electric Switches	213-660-1310
GA	Atlanta, A.P. Sales	800-624-5496
IL	Chicago, Classic Comp. Supp.	800-842-5149
MA	Canton, Impact Sls.	617-821-1500
MA	Newton Upper Falls, In-Stock Prods.	617-964-6200
MI	Brighton, A.P. Sls.	313-229-6550
NY	Victor, Add Elctrns.	716-924-4760
OH	Dayton, Televox	513-294-4499
TN	Knoxville, Mac-One	615-690-6221

LDJ INCORPORATED, 2200 Stephenson Hwy., P.O. Box 219, Troy, MI 48099-0219, Tel: 313-528-2202, TWX: 810-232-1509 LDJ TRMI; Empl.: 63; *Sls. Mgr.:* Jim Ling ..... **D•1260**

LEACH®
CONTROL PRODUCTS DIVISION

LEACH CORP., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620, Tel: 714-739-0770, TWX: 910-596-2867; Empl.: 220; *Sls. Mgr.:* Ron Zimmerman; *Dist. Mgr.:* Ron Zimmerman ..... **A•1378-1379, 1678-1679; B•1428-1429**

Local Sales Offices & Reps

AL	Huntsville, Brandel-Stephens & Co., Inc.	205-883-0445
AZ	Tempe, ELEC-COM Assocs.	602-967-8644
CA	Granada Hills, C & W Comps. Sls.	213-368-4032
CA	San Mateo, Halbar Assocs.	415-349-4700
FL	Orlando, Donato & Assocs.	305-352-0727
GA	Atlanta, Brandel-Stephens & Co., Inc.	404-261-7579
IN	Carmel, Giesting & Assocs.	317-844-5222
KS	Wichita, BAKA Corp.	316-682-8411
MD	Hunt Valley, Marktron	301-628-1111
MD	Rockville, Marktron	301-251-8990
MA	Woburn, Comp. Techn.	617-933-5390
MI	Farmington Hills, Giesting & Assocs.	313-478-8106
MN	Minneapolis, Comprehensive Tech. Sls.	612-888-7011
NJ	Englewood Cliffs, Leach Corp.	201-567-6795
NY	Fayetteville, R. D. Sherman	315-637-9861
NC	Greensboro, Brandel-Stephens & Co., Inc.	919-275-9059
OH	Cincinnati, Giesting & Assocs.	513-521-8800
PA	Trevose, PSA, Inc.	215-245-0513
TX	Dallas, Caton Sls.	214-661-5792
VA	Charlottesville, Marktron	804-973-5874
VA	Charlottesville, Marktron	301-251-8990
WA	Bellevue, Leach Corp.	206-746-7263
Can	Kirkland, Que., Robin Aerospace Prods., Ltd.	514-694-1315

Local Distributors

AZ	Tempe, Time Elctrns.	602-967-2000
CA	Anaheim, Time Elctrns.	714-937-0911
CA	Sunnyvale, Time/Nor-Cal.	408-734-9888
CA	Torrance, Time Elctrns. West	213-320-0880
FL	Ft. Lauderdale, Time Elctrns. - FL	305-974-4800
GA	Atlanta, Electro Air Corp.	404-351-3545
MD	Columbia, Time Elctrns.	301-964-3090
MA	Woburn, Time/New Eng.	617-935-8080
MO	St. Louis, Time Midwest	314-391-6444
NY	Hauppauge, Time Elctrn. Sls.	516-273-0100
PA	Broomall, Time/Mid-Atlantic	215-359-1200
TX	Dallas, Electro Air Corp.	214-385-0566
WA	Bellevue, Electro-Air/NW	206-641-3640
WA	Redmond, Pan Pacific Elctrns.	206-881-7252

LEACH®
RELAY DIVISION

LEACH CORP., Relay Div., 5915 Avalon Blvd., Los Angeles, CA 90003, Tel: 213-232-8221, TWX: 910-321-2303; FSC No.: 35344; Empl.: 630; *Sls. Mgr.:* S. Whitcomb; *Dist. Mgr.:* D. Robinson ..... **B•1430-1435**

Local Sales Offices & Reps

AZ	Tempe, Elec-Com Assocs.	602-967-8644
CA	San Mateo, Halbar Assocs.	415-349-4700
CO	Denver, Quorum 3	303-696-8480
FL	Orlando, Donato & Assocs.	305-352-0727
FL	Palm Harbor, Donato & Assocs., Inc.	813-785-3327
GA	Atlanta, Craft Assocs.	404-256-0420
IN	Fort Wayne, Denton Mktg.	219-627-5525
KS	Wichita, BAKA Corp.	316-682-8411
MD	Hunt Valley, Marktron	301-628-1111
MD	Rockville, Marktron	301-251-8990
MA	Woburn, Comp. Techn.	617-933-5390
MN	Minneapolis, Comprehensive Tech. Sls.	612-888-7011
MO	Ferguson, Leach Corp.	314-524-2880
NJ	Englewood Cliffs, Leach Corp.	201-567-6795
NY	Fayetteville, R. D. Sherman	315-637-9861
OH	Dayton, Leach Corp.	513-434-8151
PA	Trevose, PSA, Inc.	215-245-0513
TX	Dallas, Caton Sls.	214-243-4716
UT	Sandy, Quorum 3: Sls. Grp., Inc.	801-943-9227
VA	Charlottesville, Marktron	804-973-5874
WA	Bellevue, Leach Corp.	206-746-7263
Can	Kirkland, Que., Robin Aerospace Prods.	514-694-1315
Can	Mississauga, Ont., Robin Aerospace Prods.	416-673-1666

Local Distributors

AZ	Tempe, Time Elctrns.	602-967-2000
CA	Anaheim, Time Elctrns.	714-937-0911
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	San Diego, Time Elctrns.	619-586-1331
CA	Sunnyvale, Time/Nor-Cal	408-734-9888
CA	Torrance, Time Elctrns. West	213-320-0880
CO	Englewood, Time Elctrns.	303-850-7701
CT	Cheshire, Time Elctrns.	203-271-3200
FL	Ft. Lauderdale, Time Elctrns.-Fla.	305-974-4800
FL	Orlando, Time Elctrns.	305-841-6565
GA	Atlanta, Electro Air Corp.	404-351-3545
MD	Columbia, Time Elctrns.	301-964-3090
MA	Woburn, Time/New Eng.	617-935-8080
MN	Bloomington, Time Elctrns.	612-944-9192
MO	St. Louis, Time/Midwest	314-391-6444
NY	Hauppauge, Time Elctrn. Sls.	516-273-0100
OR	Portland, Time Elctrns.	503-664-3780
PA	King of Prussia, Time/Mid-Atlantic	215-337-0900
TX	Dallas, Time Elctrns.	214-385-0566
WA	Bellevue, Time Elctrns.	206-641-3640
WA	Redmond, Pan Pacific	206-881-7252

LEADER INSTRS. CORP., 380 Oser Ave., Hauppauge, NY 11788-3694, Tel: 516-231-6900, TWX: 510-227-9669; Empl.: 42; *Sls. Mgr.:* B. Storch; *Dist. Mgr.:* A. Ambrosio

LEA DYNATECH, INC., 12516 Lakeland Rd., Santa Fe Springs, CA 90670-9990, Tel: 213-944-0916, TWX: 910-586-1381; FSC No.: 57499; Empl.: 35

Local Sales Offices & Reps

AL	Huntsville, FM Assocs. Ltd.	205-882-0689
AZ	Phoenix, Indl. Prods. Corp.	602-954-7300
CA	Burbank, Biztek Co., Inc.	213-766-4890
CA	Mountain View, Leddy Assocs.	415-969-6313
CO	Boulder, Abco, Inc.	303-444-1173
CT	Hamden, Applied Meas.	203-288-5288
DC	Washington, Instrucom	202-223-1759
FL	Jupiter, FM Assocs. Ltd.	305-746-2996
GA	Atlanta, FM Assocs. Ltd.	404-451-2293
HI	Honolulu, Nustate Aircon	808-839-1212
IN	Fort Wayne, Century Dynamics, Inc.	219-486-2681
KS	Lenexa, C & C Sls.	913-888-6200
LA	Baton Rouge, Fogarty Engrg. Co.	504-928-3372
ME	Waterville, Kentrol	207-873-7741
MI	Birmingham, Thibodeau Engrg.	313-642-6620
MN	St. Paul, Knox Assocs.	612-488-5402
MO	Bridgeton, Electro Mech. Assocs.	314-291-7661
NM	Albuquerque, Industrial Prods. Corp.	505-256-3561
NY	Lynbrook, Puleo Elctrns., Inc.	516-599-4875
NC	Ramseur, FM Assocs., Ltd.	919-824-2196
OH	Wickliffe, Walter J. Brauer & Assocs.	216-943-0601
PA	Warminster, Multi-Meas., Inc.	25-675-3082
TX	Houston, Texas Tech. Prods. Co.	713-526-0656
TX	Midland, Total Flow Meas.	915-694-1567
VT	Bennington, Applied Meas., Inc.	802-422-2222
WA	Seattle, R. W. Campbell, Inc.	206-622-3403
WY	Casper, ABCO, Inc.	307-577-1851

LEAR SIEGLER, INC., 2850 Ocean Park Blvd., P.O. Box 2158, Santa Monica, CA 90406, Tel: 213-452-5444, TWX: 910-343-6463; Empl.: 30,860

LEAR SIEGLER, INC., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, CA 92803, Tel: 714-774-1010, TWX: 910-591-1157; Empl.: 256; *Sls. Mgr.:* J. Horgan ..... **C•1430**

Local Sales Offices & Reps

CA	San Diego, Qualtronics	619-695-0118
GA	Atlanta, Grady Duckett	404-451-3529
IL	Chicago, Mauer Co.	312-677-4771
IN	Indianapolis, Elctrn. Sls. & Engrg.	317-849-4260
MA	Haverhill, L.K. Harmon	617-373-1313
MI	Detroit, Hummon Assocs.	313-474-0661
MN	Minneapolis, Paul Ericson & Assocs., Inc.	612-884-1969
NJ	Bellmawr, Mid Atlantic Corp.	609-931-5303
NY	Syracuse, C. W. Floring & Assocs.	315-478-2149
NY	Williston Park, ABC Elec.	516-747-6610
OH	Cleveland, Geotronix	216-526-2535
TX	Austin, Alphatech, Inc.	512-458-9179

Local Distributors

CA	Placentia, Local Sls., Inc.	714-993-1800
IL	Evanston, Mauer Co.	312-677-4771
Intl	Eng., Eastleigh Hants, BICC Vero Elctrns.	TWX 851-47-551
Intl	Japan, Tokyo, Hakuto Co.	TWX 78-12-2912
Can	Kingston, Ont., Elctrn. Pkg. Sys.	613-549-5152

LEASAMETRIC, INC., 1164 Triton Dr., Foster City, CA 94404, Tel: 415-574-4441; *Sls. Mgr.:* David Sobo

LEBOW CO., 5960 Mandarin Ave., Goleta, CA 93117, Tel: 805-964-7117; *Sls. Mgr.:* Sharon J. Neiman

LEBOW PRODUCTS, Eaton Corp., 1728 Maplelawn Rd., Troy, MI 48084, Tel: 313-643-0220, TWX: 810-232-4818; Empl.: 110; *Sls. Mgr.:* Michael J. Parker

LECROY RESCH. SYS. CORP., 700 S. Main St., Spring Vly., NY 10977, Tel: 914-425-2000, TWX: 710-577-2832; Empl.: 300; *Sls. Mgr.:* Henry Bickel

LECROY RESCH. SYS. CORP. (CAL.), 1806 Embarcadero Rd., Palo Alto, CA 94303, Tel: 415-856-1800, TWX: 910-373-1791; *Sls. Mgr.:* Andy Keyser

LECTROHM DIV. OF CAPCO, INC., Box 1028, Grand Junction, CO 81502, Tel: 303-243-8480, TWX: 910-929-6989; Empl.: 110

LECTRO MAGNETICS, INC., 6056 W. Jefferson Blvd., Los Angeles, CA 90016, Tel: 800-325-9814, 213-870-9383; FSC No.: 29098; Empl.: 60; *Sls. Mgr.:* Bill DeSalle

LECTROTECH, INC., 5810 N. Western Ave., Chicago, IL 60659, Tel: 312-769-6262; Empl.: 42

LEDCO DIV., 240 Plato Blvd., St. Paul, MN 55107, Tel: 612-222-2791, TWX: 910-563-3679; FSC No.: 55292; Empl.: 300; *Sls. Mgr.:* Laurie Wilbrecht

LEDEX INC., P.O. Box 427, Vandalia, OH 45377, Tel: 513-898-3621, Telex: 28-8228, TWX: 810-450-2526; FSC No.: 81840; Empl.: 500; *Sls. Mgr.:* T. C. Ristoff ..... **B•1462, 1468-1470, 1612-1614**

Local Sales Offices & Reps

AL Huntsville, A. B. Andrews & Co. 205-539-6817
AZ Scottsdale, Arcom Sls. 602-947-5745
CA San Diego, Interstate Mktg. Assoc. 619-292-8117
CA Saratoga, Testco Co. 408-253-1900
CA Woodland Hills, Interstate Mktg. Assocs. 818-883-7606
CO Boulder, Front Range Mktg. 303-443-4780
CT Bloomfield, SIR Assoc. 203-243-9343
FL Largo, Techn. Mktg. Assocs. 813-536-3796
FL Melbourne, Techn. Mktg. Assocs. 305-676-3776
FL Orlando, Techn. Mktg. Assocs. 305-857-3760
FL Pompano Beach, Techn. Mktg. Assocs. 305-942-0774
IL Elk Grove Village, Control Sls. 312-595-2110
IN Greenwood, Valentine & Assoc. 317-888-2260
IN South Bend, Valentine & Assoc. 219-288-7070
KS Leawood, Thunderbird Tech. Sls. & Svcs. 913-642-7220
KS Wichita, Thunderbird Tech. Sls. & Svcs. 316-684-3941
MA Bedford, SIR Assocs. 617-275-5550
MN Bloomington, Merrill Franklin Co. 612-854-9446
MO Maryland Heights, Thunderbird Tech. Sls. & Svcs. 314-567-6488
NY Clark Mills, KLM-Garner Co. 315-853-6126
NY N. Syracuse, KLM-Garner Co. 315-458-6214
NY Oceanside, Bittan Assocs. 516-678-6222
NY Pittsford, KLM-Garner Co. 716-381-8350
NC Research Triangle Park, A. B. Andrews & Co. 919-544-1762
OH Cleveland, Del Steffen & Assoc. 216-461-8333
OH Dayton, Del Steffen & Assoc. 513-293-3145
OH Lexington, Del Steffen & Assoc. 419-884-2313
OK Tulsa, ION Assocs., Inc. 918-664-0186
PA Carnegie, Del Steffen & Assocs., Inc. 412-276-7366
PA King of Prussia, Freedman-Malta Assoc. 215-337-9211
PA Pittsburgh, Del Steffen & Assoc. 412-276-7366
TX Austin, ION Assocs., Inc. 512-331-7251
TX Grand Prairie, ION Assocs., Inc. 214-647-8225
TX Houston, ION Assocs., Inc. 713-977-4354
UT Salt Lake City, Front Range Mktg. 801-364-6481
VA Vinton, A. B. Andrews & Co. 703-890-1128
WA Bellevue, Testco 206-454-7422
WI Thiensville, Control Sls. 414-242-4580

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LEDTRONICS, INC., 4009 Pacific Coast Hwy., Torrance, CA 90505, Tel: 213-534-1505, Telex: 4945454; FSC No.: 8Z410; Empl.: 10; *Sls. Mgr.:* Pervaiz Lodhie .... **B•1083**

Local Sales Offices & Reps

CA Santa Clara, Cummings & Assocs. 408-247-8656
CA Woodland Hills, Cummings & Assocs. 818-340-6035
CO Aurora, Butler Tech. Sls. 303-842-3787
IN Indianapolis, Shank Elctrn. Mktg. Assocs. 317-842-6204
NE Lincoln, Creative Concepts 402-474-2033
WI Brookfield, Electro Tech. Mktg. Assocs. 414-785-9554

LEECRAFT MFG., 21-02 44th Rd., Long Island City, NY 11101, Tel: 718-392-8800, TWX: 710-582-2897; Empl.: 250; *Sls. Mgr.:* Jeff Heller; *Dist. Mgr.:* Harvey Shankman ..... **B•1085-1087**

Local Sales Offices & Reps

AL Huntsville, Ultra Sls. 205-539-7911
AZ Phoenix, Dodds & Co., Inc. 602-482-9330
CA Freemont, Hartfield, Kennan, Freytag .. 415-863-2200
CA Los Angeles, Hartfield-Kennan-Freytag 213-225-1318
CA Union City, Hartfield, Kennan, Freytag 415-471-2493
CT Ansonia, Zaslow Sls. Co. 203-735-9851
CT Bloomfield, Zaslow Sls. 203-242-7781
DE Washington, Dus Co. 215-493-4642
FL Maitland, D.J. Ellis & Assocs., Inc. 305-645-1101
GA Decatur, Tenn Tech, Inc. 205-350-0630
IL Naperville, Electra Sls. Assocs. 312-369-8240
IN Fort Wayne, Needler Sls. Co., Inc. 219-447-2123
IN Indianapolis, Needler Sls. Co. 317-255-8056
IA Cedar Rapids, PMR Corp. 319-362-9177
KS Overland Park, PMR Corp. 913-381-0004
KS Wichita, PMR 316-684-4141
KY Nicholasville, Summers & Mathews ... 606-885-4943
MA Westboro, Zaslow Sls. 617-393-8150
MI Livonia, Electronic Salesmasters 313-591-2433
MN Minneapolis, Boerger & Assocs. 612-560-3425
MO St. Louis, PMR Corp. 314-569-1220
NH Londonderry, Zaslow Sls. 603-432-8907
NY New York, T.J. Marine 718-392-8800
NC Charlotte, Robert W. Chapman Co. 704-525-2421
OH Beachwood, Elctrn. Sls. Masters 216-831-9555
OR Forest Grove, Doran Sls. Assocs. 503-357-3333
PA Philadelphia, Naudain Assocs. 609-235-1801
PA Pittsburgh, Covert & Newman 412-531-2002
RI Providence, Zaslow Sls. 401-351-0070
TN Hixson, Shiles & Assocs. 615-877-7725
TX Bedford, Fralia & Assocs. 817-354-1144
TX Houston, Fralia & Assocs. 713-772-1572
WA Redmond, Doran Sls. Assocs. 206-885-1885
WI Milwaukee, R.F. Kitchern Co., Inc. 414-327-7300
EXP NY, Long Island City, Leecraft Intl. Corp. 718-392-8800
Can Scarborough, Leecraft Inds., Ltd. 416-439-6320

Local Distributors

AZ Phoenix, Aero-Space Southwest, Inc. 602-861-1785
CA Alhambra, Fisher Brownell 213-289-0255
CA El Monte, Kimball & Stark 213-444-2594
CA Los Angeles, Richey Western Elctrns. 213-820-3777
CA Sacramento, Sacramento Elec. 916-441-4821
CA San Diego, Richey Western Elctrns. ... 714-271-4511
CA Santa Ana, Sunray Lighting, Inc. 714-556-3630
CA Santa Clara, Fisher Brownell 408-988-6041
CO Arvada, Denver Wintronics 303-431-7161
CT Shelton, Century Elec. Supp. 203-736-2684
FL Miami, Electronic Equip. 305-871-3500
GA Atlanta, Specialty Dist. 404-873-2521
IL Champaign, Klaus Radio 217-356-1896
IL Chicago, Newark Elctrns. 312-784-5100
IL Niles, Industribution 312-966-5630
IL Northbrook, Classic Comps. 312-272-9650
IN Fort Wayne, Graham Elect. 219-423-3422
KS Wichita, RSC Electronics 316-267-5213
KY Louisville, P. I. Burks 502-589-3960
LA New Orleans, Southern Radio 504-524-2343
MI Ann Arbor, Wedemeyer Elect. Supp. ... 313-665-8611
MI Grand Rapids, SF Elctrns. 616-459-0216
MI Livonia, LWC Distrs. 313-464-7700
MI Livonia, RS Elctrns. 313-525-1155
MN Minneapolis, Aero-Space Computer Supps. 612-884-4725
MN Minneapolis, Newark Elect. 612-331-6350
MO Kansas City, Electronics Supp. 816-931-0250
MO Maryland Hgts., LCOMP 314-291-6200
NH Hudson, C & H Elect. 603-882-1133
NJ E. Hanover, State Elctrn. Parts 201-887-2550
NJ Kenilworth, Federated Purchasers 201-272-0505
NJ Pennsauken, Resco Elctrns. 609-662-4000
NY Buffalo, Genesee Radio 716-873-9661
NY Buffalo, Summit Distrs. 716-884-3450
NY Elmsford, Ancar Elctrns. 914-592-7100
NY Endwell, ASI Electronics 607-754-3823
NY Farmingdale, Midway Ind. Elctrns. 516-293-6800
NY Hempstead, Electronic Equip. 516-538-5510
NY New York, City Elec. 212-564-5454
NC Greensboro, Hammond Elctrns. 919-275-6391
OH Akron, Akron Elctrn. Supp. 216-762-8818
OH Akron, Sun Radio 216-434-2171
OH Cincinnati, Hughes-Peters 513-351-2000
OH Cincinnati, United Radio 513-761-4030
OH Cincinnatti, Stotts-Friedman 513-574-7701
OH Cleveland, Roberts Elctrns. 216-238-1711
OH Solon, Repco Elctrns. 216-248-8900
OH Warren, REM Elect. 216-373-1300
PA McKeesport, Barno Radio 412-462-7574
PA Philadelphia, Herbach & Rademan 215-426-1700
PA Philadelphia, PEI/Genesis 215-568-7400
PA Reading, Barbey Elctrns. 215-376-7451
RI Providence, Wm. Dandreta 401-861-2800
TN Kingsport, Radio Elec. Supp. 615-247-8111
TN Nashville, Electra Distributing 615-329-3971
TX McKinney, Prime Distributing 214-231-0170
TX Richardson, Fisher Brownell 214-235-3177
WA Seattle, Pacific Elctrns. 206-575-1050
WI Milwaukee, Indl. Elctrns. 414-276-1212

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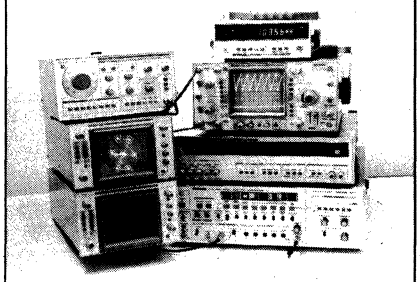

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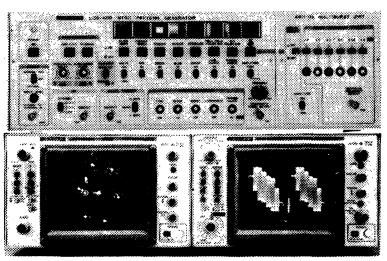

LEE DATA CORPORATION, 7075 Flying Cloud Drive, Minneapolis, MN 55344, Tel: 612-828-0300, TWX: 910-576-1690; Empl.: Approx. 1025; *Sls. Mgr.:* Frederic H. Sweeny

LEEDS & NORTHRUP INSTRS., A Unit of General Signal Corp., Sumneytown Pike, North Wales, PA 19454, Tel: 215-643-2000; Empl.: 4800; *Sls. Mgr.:* R. L. Snyder

Local Sales Offices & Reps

AL	Birmingham, Leeds & Northrup	205-823-2610
AL	Mobile, Leeds & Northrup	205-342-8929
AK	Anchorage, Artic Techology, Inc.	907-276-7110
CA	Orange, Leeds & Northrup	714-937-1647
CA	San Francisco, Leeds & Northrup	415-349-6656
CO	Denver, Leeds & Northrup	303-759-2701
CT	Avon, Leeds & Northrup	203-678-0270
FL	Lakeland, Leeds & Northrup	813-646-5014
GA	Atlanta, Leeds & Northrup	404-938-8946
HI	Honolulu, Applied Tech. Svcs.	808-261-4000
IL	Chicago, Leeds & Northrup	312-430-1130
IL	South Holland, Leeds & Northrup	312-596-8480
IN	Indianapolis, Leeds & Northrup	317-259-7161
IA	Bettandorf, Leeds & Northrup	319-355-6481
KY	Louisville, Leeds & Northrup	502-897-0631
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ME	Portland, Leen Co.	207-774-6266
MD	Columbia, Leeds & Northrup	301-995-0494
MA	Boston, Leeds & Northrup	617-326-8816
MA	Dedham, Leeds & Northrup	617-326-8816
MI	Farmington Hills, Leeds & Northrup	313-851-7171
MI	Grand Rapids, Leeds & Northrup	313-455-7070
MN	Minneapolis, Leeds & Northrup	612-933-7372
MO	St. Louis, Leeds & Northrup	314-965-9200
NJ	Union, Leeds & Northrup	201-686-5200
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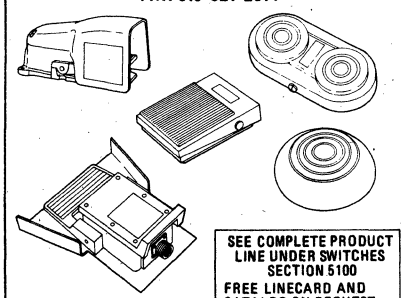

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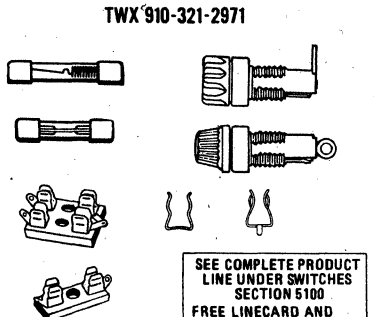

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TX	Dallas, Norcom	214-386-4888
TX	Houston, Norcom	713-933-6021
WA	Redmond, Halber Assocs.	206-882-0990

MAGNETIKA, INC., 4254 Glencoe Ave., Venice, CA 90292, Tel: 213-391-0391

MAGNETOELASTIC DEVICES, 326 Springside Ave., Box 625, Pittsfield, MA 01201, Tel: 413-445-5608

MAGNETRAN CORP., 5701 Savoy Lane, Houston, TX 77036, Tel: 713-785-4202; Empl.: 15

MAGNET SALES & MFG. CO. INC., 11250 Playa Court, Culver City, CA 90230-6127, Tel: 213-391-7213, 800-421-6692; FSC No.: 95-2916141; Empl.: 25; *Sls. Mgr.:* Anil Nanji; *Dist. Mgr.:* Anil Nanji ..... **A•1307**

MAGNOS, Old School House Rd., Harvard, MA 01451, Tel: 617-456-8880; Empl.: 5

MAGNUM ELEC., 6385 Dixie Hwy., Erie, MI 48133, Tel: 313-848-2555, TWX: 810-231-7160; Empl.: 150; *Sls. Mgr.:* Ronald Pitchford; *Dist. Mgr.:* Ronald Pitchford ..... **C•1440-1444**

Local Sales Offices & Reps

AZ	Tempe, Delta Elctrns.	602-224-1601
CA	Pleasanton, Moulthrop Sls.	415-463-0450
CA	Westminster, West Elctrn. Sls.	714-898-0120
CO	Englewood, Frontier Representatives	303-799-6063
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Pompano Beach, Hutto-Hawkins-Peregoy	305-971-5750
GA	Atlanta, Effective Mktg. Force	404-948-6023
IL	Elk Grove Village, Control Sls.	312-595-2110
IN	Indianapolis, Marketing Engrs.	317-872-5665
KS	Overland Park, Thomas L. Dowell & Assocs.	913-648-7373
MD	Pikesville, Imagitron Sls. Co.	301-521-2020
MA	Burlington, Kitchen & Kutchin	617-229-2660
MN	Brooklyn Center, Willman Assocs.	612-566-5010
MO	St. Louis, Thomas L. Dowell & Assocs.	314-849-4234
NJ	Perth Amboy, Astrorep, Inc.	201-826-8050
NY	Babylon, Astrorep	516-422-2500
NY	Rochester, Marchese Marsey & Barden	716-544-4300
OH	Beachwood, ESI	216-831-9555
OH	Cleveland, Baehr, Greenleaf & Assocs.	216-221-9030
OH	Columbus, Baehr, Greenleaf & Assocs.	614-486-4046
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OR	Portland, Jos. V. Belusko Co.	503-222-4279
PA	Huntingdon Valley, Inacker Sls.	215-947-5660
TX	Richardson, Barry Sls.	214-234-0255
WI	Thiensville, Control Sls.	414-242-4580

MAGNUM MICROWAVE CORP., 365 Ravendale Dr., Mountain View, CA 94043, Tel: 415-968-9281, Telex: 171596; FSC No.: 59277; *Sls. Mgr.:* David N. Fealkoff

MAGNUM OPUS CUSTOM ELCTRN. ENGRG., 284 Kennedy St., Iselin, NJ 08830, Tel: 201-283-4925; *Sls. Mgr.:* R. Galanty ..... **D•1093**

MAGNUSONIC DEVICES, 290 Duffy Ave., Hicksville, NY 11801, Tel: 516-938-4700, TWX: 510-221-1850; Empl.: 275; *Sls. Mgr.:* M. Stamouli

MAIDA DEVELOPMENT CO., 20 Libby St., Hampton, VA 23663, Tel: 804-723-0785, Telex: 82-3443; Empl.: 299; *Sls. Mgr.:* Edward T. Maida, Frank Thompson ..... **A•1109-1113**

Local Sales Offices & Reps

CA	Los Angeles, High Voltage Sls.	213-881-9194
CA	Mountain View, West/Mark Assocs.	415-969-1700
FL	Vero Beach, John Hansen & Assocs.	305-562-2328
MA	Burlington, Conti-Younger	617-273-1582
NC	Cary, FBD Sls.	919-467-7595
SC	Mauldin, FBD Sls.	803-828-2323
VA	Portsmouth, FBD Sls.	804-484-3162
WA	Seattle, ECCO Mktg.	206-364-0200

MALCO, Div. Microdot Electronic Components Group, 12 Progress Dr., Montgomeryville, PA 18936, Tel: 215-699-5373, Telex: 510-661-8260, TWX: 910-588-3768; *Dist. Mgr.:* J. McLaughlin ..... **C•1446-1449, 1859**

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg.	205-830-0498
AZ	Mesa, Sedco Sls.	602-835-6281
CA	Anaheim, Libratronix	714-534-7073
CA	Santa Clara, Thresum Assocs.	408-249-7400
CO	Longmont, Todd & Fry Assocs.	303-776-7331
CT	West Hartford, Pettigrew Co.	203-236-5891
FL	Clearwater, WMM Assocs.	813-461-7074
GA	Norcross, Montgomery Mktg.	404-447-6124
IL	Elk Grove Village, John G. Twist Co.	312-593-0222
IN	Greenwood, Valentine & Assocs.	317-888-2260
IA	Cedar Rapids, S & O Sls.	319-393-1845
MA	Woburn, Component Tech.	617-933-5390
MN	Bloomington, John G. Twist	612-835-2120
NM	Albuquerque, Reptronix	505-292-1718
NY	Rochester, Ossman Comps.	716-424-4460
NY	Yonkers, Sonkin Assocs.	914-968-8282
NC	Cary, Montgomery Mktg.	919-467-6319
OR	Beaverton, Blair Hirsch Co.	503-641-1875
PA	Hatboro, Jacobsen Assocs.	215-674-2937
TX	Dallas, Kruvand Assocs.	214-437-3355
VA	Fairfax, Beacon North	703-591-1300
WA	Lynwood, Blair Hirsh Co.	206-774-8151
WI	Brookfield, John G. Twist Co.	414-782-2670
Can	Montreal, Que., Kaytronics, Ltd.	514-367-0101

Local Distributors

AL	Huntsville, Hamilton Avnet	205-837-7210
AZ	Tempe, Hamilton Avnet	602-231-5100
CA	Casta Mesa, Hamilton Avnet	714-754-6111
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CA	Sunnyvale, Hamilton Avnet	408-743-3355
CT	Danbury, Hamilton Avnet	203-797-2800
GA	Norcross, Hamilton Avnet	404-447-7507
IL	Bensenville, Hamilton Avnet	312-860-7700
MD	Columbia, Hamilton Avnet	301-995-3500
MA	Woburn, Hamilton Avnet	617-273-7500
MI	Livonia, Hamilton Avnet	313-522-4700
MO	Earth City, Hamilton Avnet	314-344-1200
NH	Manchester, Yankee Elctrn. Supp.	603-625-9746
NJ	Fairfield, Hamilton Avnet	201-575-3390
NJ	Old Bridge, BTC Elctrn. Comps.	800-526-2828
NY	Hauppauge, Hamilton Avnet	516-231-9800
NY	Plainview, Progress Elctrns.	516-443-1700
NY	Rochester, Hamilton Avnet	716-474-9130
NY	Syracuse, Hamilton Avnet	315-437-2641
OH	Cleveland, Hamilton Avnet	216-831-3500
PA	Wayne, Peak Elctrn. Corp.	215-293-9000
TX	Irving, Hamilton Avnet	214-659-4111
TX	Richardson, Southwest Elctrns.	214-234-3050
UT	Salt Lake City, Hamilton Avnet	801-972-2800
WA	Bellevue, Hamilton Avnet	206-643-3950

MALLORY BATTERY, See Duracell Intl.

MALLORY CAPACITOR CO., Mallory Comps. Grp., 3029 E. Washington St., Indianapolis, IN 46201, Tel: 317-636-5353, Telex: 27-2155, TWX: 687-6015; FSC No.: 317-261-1581; Empl.: 1900; *Sls. Mgr.:* A. E. Irwin; *Dist. Mgr.:* Frank Vendely ..... **A•1114-1115**

Local Sales Offices & Reps

AZ	Scottsdale	602-949-7788
CA	Los Angeles	714-523-7992
CA	San Francisco	415-856-1136
CO	Denver	303-457-9373
FL	Orlando	305-855-6353
IL	Chicago	312-364-5750
IN	Indianapolis	317-636-5353
KS	Shawnee Mission	913-362-7099
MA	Boston	617-872-7776
MI	Detroit	313-524-0015
MN	Minneapolis	612-884-2881
MO	St. Louis	314-291-8223
NJ	Hillsdale	201-666-3600
NY	Syracuse	315-425-9800
NC	Raleigh	919-836-0401
OH	Dayton	513-299-5505
OR	Portland	503-643-1203
PA	Carnegie	412-279-4248
PA	Willow Grove	215-657-4250
TN	Nashville	615-889-1174
TX	Dallas	214-324-2448

MALLORY COMPONENTS DIVISION, Emhart Elec./Elctrn. Grp., 3029 E. Washington St., Indianapolis, IN 46201, Tel: 317-261-1361, Telex: 27-2155; *Sls. Mgr.:* Steve Leykauf; *Dist. Mgr.:* Mike Bland ..... **A•2022**

MALLORY TIMERS, Emhart Elec./Elctrn. Grp., 3029 E. Washington St., Indianapolis, IN 46201, Tel: 317-636-5353, TWX: 317-634-4214; Empl.: 2,000; *Sls. Mgr.:* Bill Miller

MANAGE, INC., Fibre Optics Elctrns. Sys. Grp., P.O. Box 175, 40 Nichols Rd., Chicopee, MA 01014, Tel: 413-598-8204, 592-3834; Empl.: 30; *Sls. Mgr.:* David Menard

M&T CHEMICALS, INC., Woodbridge Rd. & Randolph Ave., Rahway, NJ 07065, Tel: 201-499-0200, Telex: 710-996-5841, TWX: 710-996-5842; Empl.: 1650

MANGER ELEC. CO., INC., W. Henry St., Stamford, CT 06902, Tel: 203-348-7761; Empl.: 100; *Sls. Mgr.:* J. V. Judge

MANHATTAN ELECTRIC CABLE, 225 Passaic St., Passaic, NJ 07055, Tel: 201-779-8900, Telex: 137-387; Empl.: 125; *Sls. Mgr.:* Ed Harvey; *Dist. Mgr.:* Allan Marconi

MANHATTAN ELEC. CABLE CORP., 1 Station Plaza, Rye, NY 10580, Tel: 914-967-8000, Telex: 137-387; Empl.: 125; *Sls. Mgr.:* Edward J. Harvey

MANN, HENRY, INC., 3983 Mann Road, Huntingdon Valley, PA 19006, Tel: 215-355-7200, Telex: 6851160; FSC No.: 215-355-5134; Empl.: 105; *Sls. Mgr.:* Carol Mann; *Dist. Mgr.:* James P. Massi

MANNESMANN TALLY CORP., 8301 S. 180th St., Kent, WA 98032, Tel: 206-251-5500, Telex: 32-0200; Empl.: 450; *Sls. Mgr.:* John Cooper

MANTEX CORP., 1800 Metamora Rd., P.O. Box 15E, Oxford, MI 48051, Tel: 313-628-9711; Empl.: 100; *Sls. Mgr.:* Dennis J. Stepien ..... **B•1727**

Local Sales Offices & Reps

AZ	Phoenix, Cristee-Meade Co.	602-267-7197
CA	Glendale, Halbar Assocs.	213-246-8263
CA	San Diego, Mesa Engr. Sls. Assoc.	619-278-8021
CA	San Mateo, Halbar Assocs.	415-349-4700
CO	Lakewood, Christee-Meade Co.	303-232-0287
IL	Highland Park, Thomas B. Hunter Assoc.	312-433-7000
IN	Indianapolis, S.A.I. Mktg. Corp.	317-241-9276
KS	Leawood, Thunderbird	913-642-7220
KS	Wichita, Thunderbird	316-684-3941
MD	Baltimore, Muncy Sls. Assocs.	301-484-6376
MI	Brighton, S.A.I. Mktg. Corp.	313-227-1786
MN	St. Louis Park, Lestronix	612-926-8466
MO	Leawood, Thunderbird	913-642-7220
MO	Maryland Hgts., Thunderbird	314-567-6488
NH	Salem, Sales Engrg.	603-893-5521
OH	Columbus, S.A.I. Mktg. Corp.	614-454-8942
OH	Dayton, S.A.I. Mktg. Corp.	513-435-3181
OH	Shaker Hgts., S.A.I. Mktg. Corp.	216-751-3633
PA	Pittsburgh, S.A.I. Mktg. Corp.	412-261-0482
TX	Richardson, Thunderbird	214-690-0763
VA	Richmond, Muncy Sales Assoc.	804-288-5720

MANUFACTURING SYS., Div. LeDoux Inds., Inc., 2022-C S. Grand Ave., Santa Ana, CA 92705, Tel: 714-540-6630; Empl.: 6; *Sls. Mgr.:* Larry LeDoux

MARATHON BATTERY CO., 8301 Imperial Dr., Waco, TX 76714, Tel: 817-776-0650, TWX: 910-894-5203 MARATHON WAC; *Sls. Mgr.:* Walter H. Harder

MARATHON FLITE-TRONICS COMPANY, A Marathon Power Technologies Co., 2525 N. Naomi St., Burbank, CA 91504, Tel: 818-841-3210, Telex: 69-1487; Empl.: 65

MARATHON SPECIAL PRODS., 13300 Van Camp Rd., Bowling Green, OH 43402, Tel: 419-352-8441, TWX: 810-499-2988; Empl.: 150; *Sls. Mgr.:* J. Campisi

MARCON AMERICA CORP., 310 Era Drive, Northbrook, IL 60062, Tel: 312-564-2820; FSC No.: 564-1150; Empl.: 9; *Dist. Mgr.:* Helen A. Stubbs ..... **A•1116-1117, 1887**

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech Sls.	205-533-2100
AZ	Tucson, Clemick & Assocs.	602-749-4003
CA	San Jose, K-Lectron	408-942-9177
CO	Denver, Lindberg Co.	303-758-9033
FL	Altamonte Springs, Electro-Comp Assocs.	303-331-0173
FL	Deerfield Beach, Electro-Comp Assocs.	305-429-0802
FL	Melbourne, Electro-Comp Assocs.	305-242-0621
FL	St. Petersburg, Electro-Comp Assocs.	813-327-9677
GA	Norcross, Electro-Mech Sls.	404-447-6478
IL	Des Plaines, Electron Mktg.	312-298-2330
IN	Indianapolis, Insul-Reps	317-251-1994
IA	Marion, M-S-B Assocs.	319-377-6261
KS	Shawnee Mission, M-S-B Assocs.	913-432-2131
MD	Baltimore, Mech-Elec Sls.	301-342-1984
MA	Canton, D. Taggart Assocs.	617-828-6064
MI	Farmington, R. C. Merchant Co.	313-476-4600
MI	St. Joseph, R. C. Merchant Co.	616-983-7378
MN	Eden Prairie, Rockmore Sls.	612-941-1390
MO	St. Charles, M-S-B Assocs.	314-946-5577
NJ	Medford, Mech-Elec Sls.	609-654-8209
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Kingston, R. P. Kennedy Co.	914-331-0755
NY	Melville, L.I., Comtronic Assocs.	516-249-0606
NY	Rochester, R. P. Kennedy Co.	716-271-1910
NY	Rochester, R. P. Kennedy Co.	716-271-6322
NC	Raleigh, Electro-Mech Sls.	919-851-8165
OH	Cincinnati, Jayenbee Mktg.	513-531-3320
OH	Grafton, Jayenbee Mktg.	216-458-8468
OR	Portland, Harry Levinson Co.	503-245-0902
PA	McLean, E.C.C.O. Elctrn. Sls.	814-476-1376
TN	Knoxville, Insul-Reps	615-691-7586
TN	Nashville, Electro-Mech Sls.	615-885-0073
TX	Austin, Sundance Sls.	512-339-6611
TX	Houston, Sundance Sls.	713-772-4988
TX	Plano, Sundance Sls.	214-867-0592
UT	Salt Lake City, Lindberg Co.	801-467-1794
WA	Seattle, Harry Levinson Co.	206-382-1300

MARCONI INSTRUMENTS, 3 Pearl Court, Allendale, NJ 07401, Tel: 201-934-9050, TWX: 710-991-9752; *Sls. Mgr.:* William E. Bean ..... **D•1262-1264**

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns. Assocs.	205-881-5031
CA	Huntington Beach, Scientific Dvcs. West	714-840-3501
CA	San Jose, Scientific Dvcs. West	408-554-0455
CA	Westminster, Marconi	714-895-7182
FL	Boca Raton, Beacon Electrns. Assocs.	305-392-3500
GA	Atlanta, Beacon Electrns. Assocs.	404-256-9640
IL	Chicago, K.W. Meyers	312-882-4808
IN	Indianapolis, K. Meyers	317-783-1030
MD	Burtonsville, Bekr Inds.	301-421-1200
MA	Stoneham, Ken Corp.	617-926-5525
MN	Minneapolis, K.W. Meyers	612-920-7080
NJ	Elmwood Park, L & M Assocs.	201-797-0441
NM	Albuquerque, Scientific Dvcs.	505-883-3668
NY	New York City, L & M Assocs.	212-243-6155
NY	Whitney Point, Tae-Rep	607-692-3705
NC	Raleigh, Beacon Electrns. Assoc.	919-787-0330
OH	Chesterland, EQS Systems	216-729-2222
PA	Andalusia, L & M	215-245-6658
TX	Dallas, Bradenco	214-243-7261
WA	Marysville, The Western Rep	206-653-6031

MAREL INSTR. CO., 907 South East 13th Pl., Cape Coral, FL 33904, Tel: 813-574-8788; Empl.: 14; *Sls. Mgr.:* T. Swift

MARINE ELECTRIC RPD, INC., See CML Macarr Div. Marine Electric RPD, Inc.

MARINE INDUSTRIAL CABLE CORP., P.O. Box 29207, New Orleans, LA 70189, Tel: 504-254-0754

WILD OATS

MARKAT DIV., Wild Oats Corp., 3 Country Dr., Plainview, NY 11803, Tel: 516-549-9272; Empl.: 228; *Sls. Mgr.:* K. L. Campbell; *Dist. Mgr.:* W. B. Heather

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Local Sales Offices & Reps

AZ	Scottsdale, Southworth Sls.	602-945-3464
IN	Carmel, Hoosier Sls.	317-844-4535
NY	Massapequa Park, Systems Design & Engrg.	516-598-1270
OH	Centerville, Grimm & Co.	513-433-1717

MARKEL CORPORATION

MARKEL CORP., P.O. Box 752, Norristown, PA 19404, Tel: 215-272-8960, TWX: 510-660-0929; FSC No.: 03890; Empl.: 267; *Dist. Mgr.:* E. J. Barth ..... **C•1689**

Local Sales Offices & Reps

AZ	Phoenix, K. Jahn Co.	602-956-9060
AR	Hot Springs, MYA, Inc.	501-262-1365
CA	Anaheim, Indl. Dielectrics	714-776-7411
CA	Berkeley, Riggs/LaMoree	415-841-0601
CA	L.A., Natl. Wire & Cable	213-225-5611
CA	Torrance, Insulation Supp.	213-320-9400
CO	Denver, Ward Elec. Supp.	303-572-3541
FL	Lighthouse Point, Jack Krutek & Assoc.	305-941-6544
IL	Naperville, J.J. Glenn	312-961-1902
KS	Overland Park, Mathews	913-642-9063
MD	Glen Burnie, F. Lott	301-744-4611
MA	Waltham, Datcom	617-891-4600
MI	Farmington, L. George & Assoc.	313-474-1505
MN	Edina, PWC	612-933-3393
NJ	Colonia, Heft & Ficarra	201-381-5193
NY	Lynbrook, Heft & Ficarra	516-599-3351
NY	Rochester, Gislason	716-454-4741
OH	Chagrin Falls, Electrolock	216-543-5125
PA	Flourtown, C. Newson	215-248-3377
SC	Greenville, Electrolock Inc.	803-297-9830
TN	Chattanooga, Jackson	615-267-4260
TX	Richardson, C.J. Garvey	214-234-3371
WA	Mercer Is., Electronic Component	206-232-9301
WI	Mequon, Wm. R. Bolles	414-241-3320
EXP	Philadelphia, Markel Corp., Exp. Dept.	215-665-2300

Local Distributors

CA	Berkeley, Riggs/LaMoree	415-841-0601
CA	Los Angeles, Natl. Wire & Cable	213-225-5611
CA	Torrance, Insulation Supp.	213-320-9400
IL	Naperville, J. J. Glenn	312-961-1902
OH	Chagrin Falls, Electrolock	216-543-5125
Can	Mississauga, Ont., Marflex	416-828-0220

MARKEM CORP., 1000 Congress St., Keene, NH 03431, Tel: 603-352-1130, TWX: 710-366-1800; Empl.: 1200; *Sls. Mgr.:* Jack Lyman

MARKENRICH CORP., 14946-A Shoemaker Ave., Santa Fe Springs, CA 90670, Tel: 213-921-0250, Telex: 298727 MARK UR; Empl.: 7

Local Sales Offices & Reps

CA	North Hollywood, Crown Elctrns.	213-877-3550
FL	Melbourne, Electro Mech. Standards	305-724-1027
FL	Sarasota, Electro Mech. Sls.	813-923-2804
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Palatine, Somers-Reagan	312-991-1108
IA	Coralville, EPA, Inc.	612-835-9022
MD	Timonium, Heller Sls. Co.	301-252-4780
MA	Reading, Lincoln Tech. Sls.	617-944-9594
MN	Edina, EPA, Inc.	612-835-9022
NJ	Vincentown, Eastern Sci. Mktg.	609-268-0250
NY	Syracuse, I. A. Hotze Assocs.	315-479-6641
OR	Hillsboro, CompRepco	503-796-1350
PA	Chalfont, Eastern Sci. Mktg.	215-822-6503
PA	Montgomeryville, Eastern Sci. Mktg.	215-368-4570
TX	Houston, Spectra Sls.	713-747-2798
TX	Richardson, Spectra Sls.	214-234-3600
VA	Vienna, Eastern Sci. Mktg.	703-281-0778

MARKETING ENGINEERS, INC., 9860 Michigan Rd., Carmel, IN 46032

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MARLEE SWITCH CO., 933-D N. Central Ave., Upland, CA 91786, Tel: 714-982-8988; *Sls. Mgr.:* LeRoy Tichy

MARLOW INDS., 10451 Vista Park Rd., Dallas, TX 75238, Tel: 214-340-4900, TWX: 910-860-5161; FSC No.: 55686; Empl.: 150; *Sls. Mgr.:* Richard J. Buist; *Dist. Mgr.:* David Marlow

MARQUARDT SWITCHES INC., Route 20 East, P.O. Box 465 EEM, Cazenovia, NY 13035, Tel: 315-655-8050, Telex: 703-287-40; FSC No.: 315-655-8042; *Sls. Mgr.:* J. J. Kennedy; *Dist. Mgr.:* R. A. Philipchik ..... **B•1622**

Local Sales Offices & Reps

AL	Huntsville, Electro Sls. Co.	205-830-2715
CA	Los Angeles, Universal Components, Inc.	213-641-4255

CA Santa Clara, M-2 Marketing Group 408-986-0676
CO Lakewood, Cristee Meade Co. 303-232-0287
FL Orlando, Stettner Elctrns., Inc. 305-291-7756
GA Atlanta, Electro Sls. Co. 404-394-1122
IL Rosemont, Stettner Central, Inc. 312-671-4208
IN Fort Wayne, J & B Engrg. 219-483-2813
KS Shawnee Mission, M-S-B Assocs. 913-432-2131
MI Grand Blanc, Inter-Comm 313-695-0665
MN St. Paul, Arkco Sls Co. 612-777-7454
MO St. Louis, M-S-B Assocs. 314-946-5577
NH Nashua, Bell Controls, Inc. 603-882-6984
NJ Freehold, Ballou, Inc. 201-431-0514
NJ Ridgewood, Ballou, Inc. 201-444-6990
NY Cazenovia, S.T./Woolard Co. 315-655-8145
NY Syosset, Ballou, Inc. 516-681-3068
NY Whitestone, Ballou, Inc. 212-352-9233
OK Tulsa, Rem-Air Comps. Corp. 918-742-2559
PA Phoenixville, Gil-Tronics, Inc. 215-933-8525
SC Easley, R-A Sls. Co. 803-859-1859
TN Chattanooga, Electro Sls. 615-267-4260
TX Dallas, Rem-Air Comps. 214-234-1069
UT Sandy, G-M Assocs. 801-532-7501
WA Kirkland, Manon Engrg. 206-827-7449
WI Elm Grove, Key Entpr., Inc. 414-784-3390

Local Distributors
CA Covina, Selecta Switch 213-967-4123
CA Gardena, California Switch & Signal .. 213-770-2330
CA Sunnyvale, Sierra West 408-747-1188
CO Denver, CSID 303-292-9564
FL Lakewood, Switch Controls 813-644-7564
FL West Palm Beach, Nurmi Electrns. 305-686-8553
IL Itasca, Voyager Elctrns. 312-773-4900
IL Rosemont, Central Comps. 312-671-4208
KS Wichita, Radio, Inc 316-264-2798
MI Grand Rapids, S.F. Elctrns. 616-459-0216
MI St.Claire Shores, Spemco 313-771-2700
MN Minneapolis, Control Design Supp. 612-721-1628
MO Maryland Heights, L-Comp 314-291-6200
NJ Garfield, B & R Electronics 201-470-0700
NJ Mt. Laurel, Jersey Switch 609-778-8190
NJ Warwick, Cal-Greg Comp. Inc. 401-738-6170
NC Gastonia, J.M.T. Electronics 704-867-4401
OK Oklahoma City, Radio, Inc. 405-789-0741
OK Tulsa, Radio, Inc. 918-587-9123
OR Beaverton, Murphy Electrns,Inc. 503-642-2001
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TX Richardson, Southwest Electrns. 214-234-3050
TX Stafford, Southwest Electrns. 713-240-4000
WA Redmond, Murphy Electrns. 206-881-1234

MARTEL ELCTRNS. CORP., 13 Heritage Hill Rd., Windham, NH 03087, Tel: 800-821-0023, 617-275-5970, Telex: 95-1232; *Sls. Mgr.:* David DeVries

MARTIN SOUND PRODS., 28 Alpha Park, Cleveland, OH 44143-2297, Tel: 216-442-2286; Empl.: 2; *Sls. Mgr.:* DeWayne (Bud) Martin; *Dist. Mgr.:* DeWayne (Bud) Martin

MARWAY PRODS. INC., 311 N. Clara St., Santa Ana, CA 92703, Tel: 714-973-1800; FSC No.: 60955; *Sls. Mgr.:* Wayne Whitney ..... **D•1944-1945**

MASTER APPLIANCE CORP., 2420 18th St., Box 68, Racine, WI 53403, Tel: 414-633-7791, Telex: 269-505; FSC No.: 83284; Empl.: 50; *Sls. Mgr.:* G. E. Mertins; *Dist. Mgr.:* G. E. Mertins

MASTER BOND, P.O. Box 522, Teaneck, NJ 07666, Tel: 201-343-8983; FSC No.: 59504; Empl.: 16; *Sls. Mgr.:* James Brenner

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MASTER ELCTRN. CONTROLS, P.O. Box 25905, Los Angeles, CA 90025, Tel: 213-452-1336, Telex: 182041; Empl.: 64; *Sls. Mgr.:* I. Nizam; *Dist. Mgr.:* Bob Kent

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MATERIALS RESCH., Route 303, Orangeburg, NY 10962, Tel: 914-359-4200, Telex: 221862 MRC UR; Empl.: 1,000; *Sls. Mgr.:* Mel Lipton

MATH ASSOCS., 2200 Shames Dr., Westbury, NY 11590, Tel: 516-334-6800; FSC No.: 60373; Empl.: 37; *Sls. Mgr.:* Robert DeLia ..... **B•1124**

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CA Huntington Beach, Seevid 714-898-6100
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NC Charlotte, SFI Elctrns. 704-333-0157
TX Houston, Q-Max Mktg. 713-474-2233

Local Distributors
NY Farmingdale, Universal Video 516-420-0224
NY Hempstead, Global Computer Supps. 800-645-6393
PA Uniontown, Allegheney Teleconn Sys. 412-438-0451

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MATHEMATICAL SYSTEMS DESIGN, INC., 2850 Ocean Park Blvd., Ste. 300, Santa Monica, CA 90405, Tel: 213-450-9851; *Sls. Mgr.:* William E. Schaff

MATRA DESIGN SYSTEMS, 2840-100 Sam Tomas Expressway, Santa Clara, CA 95051, Tel: 408-986-9000, Telex: 299-656; *Sls. Mgr.:* David T. Fletcher; *Dist. Mgr.:* Rex Brooks of Brooks Tech. Grp.

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MATRIX CORP., 1639 Green St., Raleigh, NC 27603, Tel: 919-833-2837; Empl.: 30; *Sls. Mgr.:* Ray Alderman

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MATRIX SCIENCE CORP., 435 Maple Ave., Torrance, CA 90503, Tel: 213-328-0271

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Local Sales Offices & Reps
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CA N. Hollywood, Crown Elctrns. 213-877-3550
CO Broomfield, Sci. Dvcs. 303-449-9466
CO Broomfield, Scientific Dvcs. 303-469-5145
CT Marion, Poly Tek Assocs. 203-621-7000
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IN Indianapolis, Comtel Midwest 317-253-1681
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KS Shawnee Mission, Comtel Midwest ... 913-722-1030
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MA Falmouth Heights, RJC Assocs. 617-540-8832
MI Southfield, Comtel-Instr. 313-358-2505
MN Wayzata, Comtel Midwest 612-476-1551
MO St. Louis, Comtel Midwest 314-991-5363
NY Mamaroneck, Bassin Tech. Sls. Co. ... 914-698-9358
NC Raleigh, Reynolds Assoc. 800-255-1965
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OH Dayton, Comtel Instr. 513-298-7573
OH Hillard, Comtel Instr. 614-876-8305
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PA Pittsburgh, Comtel Instr. 412-922-5720
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VA Fairfax, Schibley Assocs. 703-591-3008
WA Bellevue, Topp Engrg. Sls. 206-747-5400
WI New Berlin, Comtel Midwest 414-544-6042

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AZ Tempe, Quatra Assocs. 602-820-7050
CA Santa Clara, Logan Sls. 408-496-0660
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KS Mission, Palatine Sls. 913-831-0555
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NY Fairport, Net Sls. 716-467-4538
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OH Cleveland, Marlow Assocs. 216-991-6500
OH Dayton, Marlow Assocs. 513-435-5673
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PA Pittsburgh, Marlow Assocs. 412-367-8886
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CA Mountain View, USI Intl. 415-969-5420
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CA San Jose, TTI 408-943-9155
CA Santa Ana, Projection Unltd. 714-261-2323
CA Santee, TTI 619-449-2220
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NY Rochester, Masline Elctrns. 716-546-5373
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NY Ronkonkoma, Prime Comps. 516-737-1730
OH Cleveland, Robert Elctrns. 216-238-1711
PA Norristown, Century Elctrn. Comps. ... 215-631-5400
PA York, Elctr. Comps. for Ind. 717-846-5334
TX El Paso, Era Elctrns. 915-592-4126
TX Ft. Worth, TTI 817-831-0441
WA Kent, Shannon, Ltd. 206-763-0545
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CA Los Altos, Recht Assocs. 415-964-6321
CA Pomona, Cook Entprs. 818-443-5147
CA San Diego, Power Assocs. 619-275-0641
CO Denver, Williams Assocs. 303-373-4730
FL Altamonte Springs, V.G. Sls. 305-831-8688
FL Pompano, V.G. Sls. 305-971-0900
GA Norcross, Montgomery Mktg. 404-447-6124
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IA Cedar Rapids, Harris Hanson 800-231-4343
MD Woodbine, Naudain Assocs. 301-442-2270
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NC Cary, Montgomery Mktg. 919-467-6319
OH Dayton, Thompson Assocs. 513-435-7733
OR Beaverton, Quest Mktg., Inc. 503-641-7377
PA Huntington Valley, Omega Elex 215-947-4135
TX Austin, West & Assoc 512-441-6973
TX Dallas, West & Assoc 214-661-9400
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NY New Rochelle, Ascor Elctrns. 914-235-8838
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EXP NJ, Oradell, Sylvan Ginsbury Ltd. 201-261-3200

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MCFADDEN SYS., INC., 8953 S. Atlantic Ave., South Gate, CA 90280-9990, Tel: 213-564-5958, Telex: 677161; FSC No.: 25750; Empl.: 42

MCG ELECTRONICS INC.

MCG ELCTRNS., 12 Burt Dr., Deer Park, NY 11729, Tel: 516-586-5125, Telex: 645518; FSC No.: 29779; Empl.: 45; *Sls. Mgr.:* Cecilia Long ..... **B•1248-1253**

Local Sales Offices & Reps

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LA Covington, Svc. Elctrl. Sls. 504-893-2830
MA Woburn, EMS 617-229-6686
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MO St. Louis, Engrg. Svc. Co. 314-997-1515
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NC Greensboro, The Saylor Assocs. 919-292-0452

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MD Baltimore, R. A. Wafer Assocs. 301-744-1133
MA Needham, Hgts. Newscott Co. 617-444-1923
MI W. Bloomfield, OBE, Inc. 313-332-4900
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NY N. Syracuse, Advanced Comp. Corp. .. 315-699-2671
OH Cleveland, Allied Entprs. 216-779-0080
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UT Salt Lake City, Sage Sls. 801-467-5451
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CT Canton, Motoreps, Inc. 800-243-1978
FL Ft. Lauderdale, R.I. Smith Assocs. 305-772-5100
FL Orlando, R.I. Smith Assocs. 305-365-8077
GA Atlanta, Beacon Elctrns. 404-256-9640
IL Elmhurst, Scott Assocs. 312-279-5681
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MD Hunt Valley, Marktron 301-628-1111
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NY Rochester, Reagan/Compar 716-271-2230
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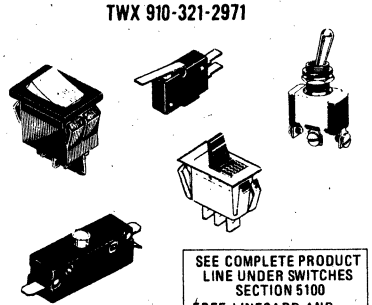
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NC High Point 919-889-7181
OH Cincinnati 513-482-3100
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CT New Canaan, Impact Sls. Co. 203-972-1458
CT Yalesville, Schaal Assocs./Deanco ... 203-269-3779
FL Ft. Lauderdale, Powell Elctrns. 305-979-5000
FL Winter Park, Deanco 305-671-5100
GA Atlanta, A.C. Equip. Co. 404-451-2747
GA Atlanta, Prehler Elctrns. 404-447-5540
GA Marietta, Deanco 404-429-0126
IL Chicago, Prehler Elctrns. 312-328-6100
IL Elk Grove, RM Illinois 312-364-6622
IL Mt. Prospect, Magnuson Elctrns. 312-956-0700
IN Indianapolis, Graham Elctrns. 517-634-8202
MD Columbia, Aztech Elctrns. ..... 301-995-1760, 301-621-4070 in
MD Columbia, Powell Elctrns. ..... 301-995-0410, 301-621-4070 in
MD Gaithersburg, Deanco 301-948-5444
MA Burlington, Schaal Assocs./Deanco ... 617-272-1506
MA Canton, Impact Sls. 617-821-1500
MA Westboro, Powell Elctrns. 617-366-6100
MI Grand Rapids, RM Michigan 616-531-9300
MN St. Paul, Ragon Elctrns. 612-642-2828
MO Independence, Ragon Elctrns. 816-254-3410
MO St. Charles, Lectronix 314-946-6424
NJ Clifton, J-Mar Elctrns. 201-772-6400
NJ Englewood, Powell Elctrns. 201-894-0800
NJ Fairfield, Deanco 201-575-7960
NY Farmingdale, Addem Distrs. 516-752-9303
NY Hauppauge, Schaal Assocs./Deanco 516-434-4600
NY Ithaca, Deanco 607-257-4444
NY Ronkonkoma, Zenith Wire & Cable ... 516-585-1444
NC Cary, Powell Elctrns. 919-467-1212
NC Charlotte, Elctrns. Mktg. Corp. 704-394-6195
NC Raleigh, Prehler Elctrns. 919-876-9111
OH Columbus, Elctrns. Mktg. Corp. 614-299-4161
OH Highland Heights, Elctrns. Mktg. Corp. 216-442-3441
OH Middleburg Heights, Prehler 216-243-5510
OK Tulsa, Norvell Elctrns. 918-663-1247
OR Beaverton, Acacia Sls. 503-646-3377
OR Lake Oswego, Moore Elctrns., Inc. 503-684-3100
OR Wilsonville, Ragon Elctrns. 503-682-2929
PA Malvern, Transtek Inds. 215-296-4400
PA Philadelphia, Powell Elctrns. 215-365-1900
TX Austin, Kent Elctrns. 512-834-1900
TX Austin, Norvell Elctrns. 512-458-8106
TX Dallas, Norvell Elctrns. 214-233-0020
TX El Paso, ERA Elctrns. 915-592-4126
TX Houston, Kent Elctrns. 713-780-7770
TX Houston, Norvell Elctrns. 713-777-1666
TX Richardson, Kent Elctrns. 214-669-2600
UT Midvale, Ratel Elctrns./Xytec 801-562-2600
WA Bellevue, Powell Elctrns. 206-641-4446
WA Seattle, Ragon Elctrns. 206-241-1980
Can London, Ont., 3M 519-451-2500

3M CO., STATIC CONTROL SYS. DIV., P. O. Box 2963, Austin, TX 78769-2963, Tel: 800-328-1368; Empl.: 300; *Sls. Mgr.:* Mike Martin ..... **D•1980-1981**

Local Sales Offices & Reps

AZ Phoenix 602-934-7413,800-221-1046
CA Los Angeles 800-221-1045
CA San Francisco 415-761-1155
CO Denver 303-321-3873
DC Washington 800-241-3669
FL Orlando 800-241-3669
GA Atlanta 800-241-3670
IL Chicago 312-496-6553
MA Boston 617-449-0300
MI Detroit 800-323-4087
MN St. Paul 800-392-0312
MO St. Louis 314-997-8500
NJ Newark 800-221-1454
NJ West Caldwell 800-221-1454
NY Syracuse 800-221-1455
NC High Point 919-889-7181
OH Cincinnati 800-241-3669
OH Cleveland 216-362-1700
PA Philadelphia 215-728-5300
TX Dallas 800-442-8046
TX Houston 800-442-8046
WA Seattle 206-244-7200,206-241-2250

3M CO., TECH CERAMIC RESOURCES, 3M Center 225-4W, St. Paul, MN. 55101, Tel: 617-736-0601, Telex: 29-7023, TWX: 910-563-3712; Empl.: 83000

3M CO. VISUAL PRODS./INDUS. OPTICS., See 3M Co. Carbonless Related Prods. Div.

MDB SYS., 1995 N Batavia St., Orange, CA 92665, Tel: 714-998-6900, TWX: 910-593-1339; Empl.: 200; *Sls. Mgr.:* William Wollam

MDF PRODUCTS INC., 7 Johnson Dr., Danbury, CT 06811, Tel: 203-743-3579, Telex: 499-8051; FSC No.: 60628; Empl.: 5 ..... **D•1265**

MEA DIV., See Mechanized Elctrn. Assembly Div., Universal Instrs. Corp.

MEASUREMENTS GROUP, INC., Box 27777, Raleigh, NC 27611, Tel: 919-365-3800, Telex: 802-502, TWX: 510-920-0770; *Sls. Mgr.:* Stephen R. Katz

MS

MEASUREMENT SYS., INC., 121 Water St., Norwalk, CT 06854, Tel: 203-838-5561, Telex: 6813573, TWX: 710-468-2185; Empl.: 97; *Sls. Mgr.:* John Cronan ... **D•1126**

Local Sales Offices & Reps

IA Cedar Rapids, S & O Sls. 319-393-1845
MD Columbia, Robert Elctrn. Sls. 301-995-1900
MA Hudson, Data Rep. 617-481-0333
PA Melrose Park, R. Meyers Assocs. 215-224-1663
TX Richardson, OM Sls.,Inc 214-690-6746
VA Richmond, Robert Elctrn. Sls. 804-276-3979

MEC A/S, Industriparken 23, Ballerup, Denmark DK-2750, Tel: 452-973366

Local Sales Offices & Reps

AL Huntsville, Beacon Elctrns. 205-881-5031
AZ Phoenix, Eltron 602-266-2164
AZ Scottsdale, SMS & Assocs. 602-998-0831
AR Little Rock, Beacon Elctrns. 501-224-5449
CA Brea, Masco 714-529-0867
CA Curpertino, F & F Assocs. 408-446-2349
CA Mountain View, Switches, Inc. 415-962-8649
CA Orange County, Pacific Switch Controls, Inc. 714-953-1254
CA Van Nuys, Pacific Switch Controls, Inc. 213-873-4802
CO Aurora, Mountain View Mktg. 303-360-9641
CO Englewood, Electronic Comps. Sys. ... 303-781-5904
FL Boca Raton, Beacon Elctrns. 305-392-3500
FL Clearwater, Beacon Elctrns. 813-796-2378
FL Fort Lauderdale, KSM Elctrns., Inc. 305-971-5900
FL Maitland, Beacon Elctrns. 305-647-3498
FL Melbourne, Beacon Elctrns. 305-724-8010
GA Atlanta, Beacon Elctrns. 404-256-9640
GA Atlanta, KSM Elctrns., Inc. 404-458-2013
IL Downers Grove, Richmar Elctrns. 312-968-0118
IN Indianapolis, Insul Reps 317-251-1994
IA Cedar Rapids, Palatine Engrg. & Sls. .. 319-365-8071
KS Mission, Palatine Engrg. & Sls. 913-831-0550
MA Needham, A&M Elctrns. 617-444-8170
MA Plainville, Enterprise Tech., Inc. 617-695-4700
MI Bloomfield, Obe, Inc. 313-332-4900
MI Brighton, AP Assocs. 313-229-6550
MI Grand Rapids, Obe, Inc. 616-458-8993
MI St. Joseph, Obe, Inc. 616-429-1160
MN Minneapolis, Components Rep. Grp. .. 612-944-0800
MN Minneapolis, Elctrn. Comps. Grp. 612-559-0720
MO Hazelwood, Palatine Engrg. & Sls. 314-839-0800
NJ Ho-Ho-Kus, D. J. Fisher Co., Inc. 201-652-0090
NM Albuquerque, Syntech 505-266-7051
NY Fairport, TAC Sls. 716-425-1070
NY Great Neck, M.O.S. Assocs. 516-487-3966
NC Raleigh, Beacon Elctrns. 919-787-0330
OH Cleveland, Components, Inc. 216-243-9020
OK Bixby, Southern Sts. Mktg. 918-369-3233
PA Glenside, Wyncote Instrmn. 215-572-6500
TX Austin, Southern Sts. Mktg. 512-473-2741
TX Houston, Southern Sts. Mktg. 713-558-4900
TX Richardson, Southern Sts. Mktg. 214-238-7500
TX Richardson, Southern Sts. Mktg. 915-238-7500
UT Salt Lake City, Quality Comps. Sls. 801-268-8000
VA Fairfax, Beacon North 703-591-1300
VA Forest, Beacon North 804-239-8486
WA Kirby, A/D Elctrns. 206-821-3208
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301
WI Butler, Richmar Elctrns. 414-781-1730

Local Distributors

CA Hollywood, Yale Elec. 213-465-3186
CA Manhattan Beach, Prime Electro 213-379-3642
CA Mountain View, Target Elctrns. 415-962-8649
CA Orange County, Pacific Switch Controls 714-953-1254
CA San Carlos, Logan Elctrns. 415-594-0700
CA San Diego, Pacific Switch Controls 619-264-6117
CA Santa Monica, Master Distrs. 213-452-1229
CA Van Nuys, Pacific Switch Controls 213-873-4802
CO Englewood, Industrial Supp. 303-694-9444
CT Hartford, Atlantic Switch Controls 203-527-7705
CT Shelton, Century Elec. 203-736-208
FL Lakeland, Switch Controls, Inc. 813-644-7564
IL Carol Stream, Conectrix 312-653-1460
MD Beltsville, P.S.I. 301-937-4960
MD Columbia, D.K. Elctrns. 301-995-1950
MA Needham, 'You Do It' 617-449-1005
MN Minneapolis, Glen Mark 612-941-4825
NH Nashua, Atlantic Switch 603-880-1971
NJ Mt. Laurel, Jersey Switch 609-778-8190
OH Columbus, Ohio Switch 613-885-0391
OR Portland, Component Resources 503-641-8488
TX Dallas, TexaSwitch 214-357-1768
TX Hurst, Alectron Corp. 817-280-0313
WA Seattle, Component Resources 206-454-8666
WA Seattle, Radar Elctrns. 507-747-3053
Can Toronto, Ont., Deskin Sls. 416-475-1412

MECHANICAL ENGRAVING, 4500 Bullard Ave, Bronx, NY 10470, Tel: 212-324-4455; FSC No.: 99040; Empl.: 35; *Sls. Mgr.:* Bernard W. Mandel

MECHANICAL ENTPRS., 461 Carlisle Dr., Herndon, VA 22070, Tel: 703-435-9496, TWX: 710-832-0942; Empl.: 25; *Sls. Mgr.:* R.H. Twyford ..... **B•1624, 1728-1729**

Local Sales Offices & Reps

CA Irvine, Vale Electrn. Assocs. 714-551-4821, 619-693-0113
CA Santa Clara, Eastec Corp. 408-720-1807
CT Bristol, Technlg. Prod. Grp. 203-583-0703
FL Casselberry, Semi 305-831-2822
FL Ft. Lauderdale, SEMI 305-475-3686
FL Melbourne, Semi 305-831-2822
FL Palm Harbor, SEMI 813-441-3902
IL Arlington Heights, Coombs Assocs., Inc. 312-439-9810
IN Ft. Wayne, Coombs Assocs., Inc. 219-747-7661
IN Ft.Waynee, Coombs Assoc., Inc. 219-747-7661
IA Cedar Rapids, Coombs Assocs., Inc. .. 319-362-4116

MA Brookline, Technlg. Prods. 617-731-0858
MA Brookline, Technology Prod. Grp. 617-731-0858
MI Jackson, Norwood Scroggs Co. 517-750-1170
NY Cooperstown, Fitzelle Assoc. 607-547-9333
NY Cooperstown, Fitzelle Assocs. 607-547-9333
NY Rochester, Lloyd Hart Assocs. 716-225-4455
TX Dallas, Stasco 214-239-4517
WI Milwaukee, Coombs Assocs., Inc. 414-351-6123
Can Concord, Ont., Delco Electerns.,Inc. ... 416-738-1090

Local Distributors

CA Los Angeles, Electric Switches, Inc. ... 213-660-1310
CA San Diego, Sigma Electrns. 619-292-1523
IL Wheeling, Hawk Elctrns., Inc. 312-459-4030
NY Yonkers, Kintronics, Inc. 914-968-7736, 800-431-1658
Can Burnaby, B.C., Rae Ind. Electrns.,LTD .. 604-291-8866

MECHANICAL PRODUCTS, Amstar, 1824 River St. P. O. Box 729E, Jackson, MI 49204, Tel: 517-782-0391, TWX: 810-253-0827; *Sls. Mgr.:* Bob Vangermeersch

MECHANICAL TECHN., 968 Albany Shaker Rd., Latham, NY 12110, Tel: 518-785-2353, TWX: 710-443-8150; Empl.: 1000; *Sls. Mgr.:* David W. Bender; *Dist. Mgr.:* David W. Bender

MECHANIZED ELECTRONIC ASSEMBLY DIV., Universal Instrs. Corp., P.O. Box 825, Binghamton, NY 13902, Tel: 607-772-7522, TWX: 510-252-1990; *Sls. Mgr.:* Gene Exley ..... **D•1982**

Local Sales Offices & Reps

NH Bedford, Universal Instrs. Corp. 603-625-9600
NY Binghamton, Universal Instrs. Corp. ... 607-772-7472
PA Paoli, Universal Instrs. Corp. 215-296-8811

MEDA, INC., MacIntyre Electronics Design Assocs., Inc., 1930 Isaac Newton Sq., Reston, VA 22090, Tel: 703-471-1445, Telex: 910-350-0132; Empl.: 5

MEDIA RECOVERY INC., Box 1407, Graham, TX 76046, Tel: 800-527-9497, 214-630-9625 (Texas), Telex: 73-2561; Empl.: 130; *Sls. Mgr.:* J. Ricciardi

Local Sales Offices & Reps

CA San Francisco, Media Recovery 415-572-0167
CT Hartford, Media Recovery of N.J. 203-528-9776
MA Boston, Media Recovery Inc. 617-843-8400
MI Livonia, Media Recovery 313-421-4244
TX Dallas, Media Recovery of Tex 214-630-9625
TX Houston, Media Recovery of Tex 713-681-5464
TX San Antonio, Media Recovery of Texas 512-349-5854

MEGA LOGIC, 9659 Natl. Rd., Brookville, OH 45309, Tel: 513-833-5222

MEGATEK CORP., 9645 Scranton Road, San Diego, CA 92121, Tel: 619-455-5590, TWX: 910-335-2056; Empl.: 500; *Sls. Mgr.:* Robert A. Becker; *Dist. Mgr.:* Michel Schwab, Dir., International Sls.

MEGATEST, 880 Fox La., San Jose, CA 95131, Tel: 408-998-7110, TWX: 910-338-0259; Empl.: 225; *Sls. Mgr.:* Rick Carmichael

MEGATRAN ELECTRONIC POWER, Rising Sun Rd., Bordentown, NJ 08505, Tel: 609-298-7300, TWX: 510-685-3645; Empl.: 25; *Sls. Mgr.:* C. W. Harrison

MEISSNER INDS., 551 Rte. 10, Dover, NJ 07801, Tel: 201-366-1700; Empl.: 10 ..... **A•1889**

MELCHER, INC., 6290 Sunset Blvd., # 1126, Los Angeles, CA 90028, Tel: 213-463-5617, TWX: 910-321-2903; *Sls. Mgr.:* Norman R. Sutherland

melcor

MELCOR/MATERIALS ELCTRN. PRODS., 994 Spruce St., Trenton, NJ 08648, Tel: 609-393-4178, Telex: 84-3314; FSC No.: 32333; Empl.: 175; *Sls. Mgr.:* M.A. Levine ..... **C•1652-1653**

MELCO SLS., See Mitsubishi Elctrns.

MELLES GRIOT, 1770 Kettering St., Irvine, CA 92714, Tel: 714-261-5600, Telex: 678447; Empl.: 90; *Sls. Mgr.:* Paul H. Shirley

MEL-RAIN CONTROLS, 42974 M-43 Hwy., Paw Paw, MI 49079, Tel: 616-657-2527; FSC No.: 639; Empl.: 20; *Sls. Mgr.:* Howard F. Walter

MEL TEC, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090, Tel: 617-329-1508, Telex: 95-1110, TWX: 710-348-0484; Empl.: 180

MEMODYNE, 220 Reservoir St., Needham Hgts., MA 02194, Tel: 617-444-7000, Telex: 92-2537; Empl.: 50; *Sls. Mgr.:* Joseph K. McEttrick ..... **D•1068**

Local Sales Offices & Reps

AZ Tempe, Mar Tech Assocs., Inc. 602-968-4944
CA Fullerton, Elctrn. Comp. Mktg. 714-879-9460
CA Santa Clara, Nelson Elctrns. Sls. 408-980-1950
CO Englewood, F. G. Mktg. Co. 303-795-9176
CT Hamden, Burton Forrester Associates 203-248-4380
GA Atlanta, Magaro & Assoc. 404-451-8862
HI Honolulu, Aloha Assocs. 808-941-1574
IL Elmhurst, Scott Assocs. 312-279-5681
KS DeSoto, Midtec Assocs. 910-743-6565
MA Braintree, Burton Forrester Assocs. ... 617-848-7234
MI Detroit, EQS Sys. 313-961-3042
MO Florissant, Midtec Assocs. 313-837-5200
NY Clark Mills, KLM Assocs. 315-853-6126
NY Elmont, Crane & Egert Corp. 516-872-0800
NY North Syracuse, KLM Assocs. 315-458-6214
NY Pittsford, KLM Assocs. 716-381-8350
NC Greensboro, Magaro & Assocs. 919-294-4783
OH Chesterland, EQS Sys. 216-729-2222
OH Columbus, EQS Sys. 614-228-3453
OR Portland, Topp Engrg. Sls. 503-244-7265
PA Pittsburgh, EQS Sys. 412-261-2604
TX Houston, Acudata 713-488-8195
TX Plano, Acudata 214-424-3567
UT Englewood, F. G. Mktg. Co. 303-795-9176
WA Bellevue, Topp Engrg. Sls. 206-747-5400

MEMOREX CORP., San Thomas at Central Expwy., Santa Clara, CA 95052, Tel: 408-987-1000; Empl.: 12,284

MEMORY PROTECTION DEVICES INC., 320 Broad Hollow Rd., Farmingdale, NY 11735, Tel: 516-454-0340, 516-454-0341, Telex: 219801; *Sls. Mgr.:* Lou Asighieri/Charlotte Stalker; *Dist. Mgr.:* Sandy Silvani ..... **C•1451-1453**

Local Sales Offices & Reps

AL Huntsville, REP Inc. 205-881-9270
CA Pleasonton, Moulthrop Sls. 415-463-0450
CA San Diego, Tauber Assocs. 619-274-7242
GA Tucker, Rep., Inc. 404-938-4358
IN Indianapolis, Marketing Engrg. 317-872-5665
KS Olathe, Rush & West 913-764-2700
MA Burlington, Conti Younger 617-273-1582
MO Ballwin, Rush West 314-394-7271
NJ Mt. Laurel, Comtek 609-235-8505
NY Pittsford, Andres Comp. 716-381-3818
NC Raleigh, Rep., Inc. 919-851-3007
OR Tigard, Electronic Sources 503-684-0040
TN Jefferson City, Rep., Inc. 615-475-9012
TX Dallas, Dunbar 214-239-7151
UT Salt Lake City, Comp. Sls. 801-268-8440
WA Bellevue, Elctrn. Sources 206-451-3500

Local Distributors

AL Huntsville, Resistacap, Inc. 205-883-4270
CA Burlingame, Rose Elec. 415-348-0483
CA San Diego, Tauber Elec. 619-272-7242
CA San Jose, Cypress Elec. 408-945-8400
CA Van Nuys, Nesco 213-781-0505
FL Dania, Summit Distr. 305-920-6253
FL Pompano Beach, Component South .. 305-971-0350
IL Chicago, Prehler Elec. 312-384-6100
IN Indianapolis, Graham Elec. 317-634-8202
MA Sharon, Adcour 617-784-8123
MI Brighton, A. P. Sls. 313-229-6550
MI Farmington Hills, Prehler Elec. 313-473-7200
MN Burnsville, Power Grp. 612-890-1360
MN Thief River Falls, Digi Key 218-681-6674
NJ Bellmawr, Mid-Atlantic 609-931-5303
NJ Plainfield, Mars Elec. 201-757-4332
NY Buffalo, Summit Dist. 716-887-2800
OH Cincinnati, Hughes Peters 513-351-2000
OH Columbus, Hughes Peters 614-294-5351
PA Allentown, Lehigh Elec. 215-433-3045
TX Dallas, Computer Comps. 214-239-0271
WA Bellevue, Almac Elec. 206-643-9992

MEMTRON TECHNOLOGIES, INC., 1400 Weiss St., Frankenmuth, MI 48734, Tel: 517-652-2652, TWX: 910-380-9153; FSC No.: 6 V 417; Empl.: 53; *Sls. Mgr.:* Daniel T. Ortner ..... **B•1731**

Local Sales Offices & Reps

AZ Scottsdale, Semi-Systems Arizona, Inc. 602-991-1151
CO Englewood, Martec Assocs. 303-741-3322
FL Maitland, EIR, Inc. 305-660-9600
GA Lawrenceville, Tek-Rep Mktg., Inc. 404-963-1600
IL Wheaton, Chadra-Schilke & Assocs., Inc. 312-653-8126
IN Indianapolis, EMCI, Inc. 317-253-1668
MA Framington, Stone Comp. Sls. Corp. ... 617-875-3266
MO Saint Charles, Buckman & Assocs. 314-946-6201
NY Fairport, Net Sls., Inc. 716-467-4538
NY Smithtown, T & K Sls. 516-724-3456
OH Columbus, Tom Mulligan Co. 614-457-2242
PA Southampton, Campbell Assocs. 215-322-6630
TX Richardson, Lonk & Assocs. 214-238-7651
VA Martinsville, Engineering Sls. Corp. 703-632-2365
Can Rexdale, Ont., Bestec Elctrns., Ltd. 416-674-1330

Mepco//Electra
A NORTH AMERICAN PHILIPS COMPANY

MEPCO//ELECTRA, INC., North American Philips Corp., Columbia Rd., Morristown, NJ 07960, Tel: 201-539-2000, Telex: 136461, TWX: 710-986-7437; *Sls. Mgr.:* Michael F. Kirkowski; *Dist. Mgr.:* Robert G. Elko ..... **A•1124-1126, 1890-1891, 2029; B•1008**

MEPCO//ELECTRA, INC., North American Philips Corp., 11468 Sorrento Valley Rd., San Diego, CA 92121, Tel: 619-453-0332, Telex: 820534, TWX: 910-337-1120 ..... **A•2029; B•1008**

Potentiometers (Cermet, Carbon) Industrial & Military

MEPCO//ELECTRA, INC., North American Philips Corp., 5900 Australian Ave., West Palm Beach, FL 33407, Tel: 305-842-3201, Telex: 387217, TWX: 510-952-7618 ..... **A•1124; B•1009**

Tantalum Capacitors (Solid, Wet Slug, Chip) Military & Industrial

MEPCO//ELECTRA, INC., North American Philips Corp., Columbia Rd., Morristown, NJ 07960, Tel: 201-539-2000, Telex: 136461, TWX: 710-986-4737 ..... **A•1126, 1890-1891**

Metal Film Resistors (Established Reliability-Hermetic) Thick Film Chips, Thick Film Networks, Non-Linear Resistors, Film Trimmer Capacitors

MEPCO//ELECTRA, INC., North American Philips Corp., 6071 St. Andrews Rd., Columbia, SC 29210, Tel: 803-772-2500, Telex: 820676, TWX: 810-666-2662 ..... **A•1124-1126; B•1009**

DC Aluminum Electrolytic Capacitors (Computer Grade, Axial, Radial) Military, Industrial & Consumer, AC Motor Starts, Film Capacitors (Film/Foil, Metallized), Tantalum Capacitors (Foil)

MEPCO//ELECTRA, INC., Airport Road, P.O. Box 760, Mineral Wells, TX 76067, Tel: 817-325-7871, Telex: G.P.R.-881857/S.P.R.-820545 ..... **A•1890**

Metal Film Resistors (General Purpose, Standard Precision, Ultra Precision, Standard Military, Established Reliability) Carbon Film Resistors, Precision Matched Sets

Local Sales Offices & Reps

AL Huntsville, Macro-Mktg. Assocs. 205-883-9630
AZ Tempe, Mepco/Electra 602-968-9573
CA Anaheim, Mepco/Electra 714-441-0385
CA Harbor City, Refrigeration Comp. 213-325-3420
CA Milpitas, Mepco/Electra 408-945-1020
CA San Diego, The Rep Co. 619-292-9001
CA Santa Clara, I-Squared 408-988-3400
CA Sherman Oaks, Mepco//Electra 818-986-4892
CO Englewood, Thorson Rocky Mnt. 303-779-0666
CO Westminster, Mepco//Electra 303-460-0051
FL Altamonte Springs, Mepco/Electra 305-339-5073
FL Ft. Lauderdale, Mepco/Electra 305-485-0115
GA Norcross, Over & Over, Inc. 404-449-6205
IL Bannockburn, Heth 312-295-8440
IL Elk Grove Village, Oasis Sls. 312-640-1850
IL Itasca, Mepco/Electra 312-773-3399
IN Fort Wayne, Corrao Marsh, Inc. 219-637-5548
IN Greenfield, Corrao Marsh, Inc. 317-894-0377
IN Indianapolis, Corrao Marsh, Inc. 317-872-7157
IN Indianapolis, Leslie M. Devoe Co. 317-842-3245
IA Cedar Rapids, Lorenz Sls. 319-377-4666

KS Overland Park, PMR Corp. 913-381-0004
MD Columbia, Delta III Assoc. 301-730-4700
MA Woburn, Mepco/Electra 617-935-6920
MI Grand Rapids, Miltimore Sls. 616-942-9721
MI Novi, Miltimore Sls. 313-349-0260
MN Minneapolis, Electric Comps. Sls., Inc. 612-933-2594
MO Maryland Heights, PMR Corp. 314-569-1220
NE Lincoln, Lorenz Sls. 402-475-4660
NJ Englewood Cliffs, Ed Glass Assocs. ... 201-592-0200
NJ Marlton, B.G.R. Assocs. 609-983-1020
NJ Morristown, Mepco/Electra 201-539-2000
NJ Springfield, Gebhardt Mktg. 201-376-4415
NY Rochester, Electra Sls. Corp. 716-427-7860
NY Syracuse, Electra Sls. Corp. 315-463-1248
NC Charlotte, Over & Over, Inc. 704-527-3070
NC Raleigh, Over & Over 919-872-2262
OH Dayton, Mepco/Electra 513-278-5842
OR Beaverton, Mepco/Electra 503-643-5516
PA Greensburg, Pro Mark 412-832-3800
TX Richardson, Mepco/Electra 214-231-8274
UT West Valley City, Thorson Rocky Mountain 801-973-7969
WA Bellevue, Mepco/Electra 206-643-4555
WI Wauwatosa, Larsen Assoc. 414-258-0529

Local Distributors

AL Huntsville, Hamilton/Avnet 205-837-7210
AZ Phoenix, T.T.I. 602-966-1616
AZ Tempe, Hamilton/Avnet 602-231-5100
AZ Tempe, Shelley Elctrns., Inc. 602-894-2058
CA Chatsworth, Avnet Elctrns. 818-700-8668
CA Chatsworth, Hamilton Electro Sls. 818-700-1222
CA Chatsworth, QC Comps., Inc. 818-700-2622
CA Chatsworth, Shelley Elctrns., Inc. 213-998-3333
CA Chatsworth, TTI 818-709-1010
CA Compton, Harper, S.I.D. 213-979-5090
CA Costa Mesa, Avnet Elctrns. 714-754-6077
CA Costa Mesa, Hamilton Electro Sls. 714-641-4100
CA Culver City, Hamilton Electro Sls. 213-558-2131
CA Culver City, Hamilton/Avnet 213-558-2020
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CA Ontario, Hamilton/Avnet 714-989-4602
CA Sacramento, Hamilton/Avnet 916-920-3120
CA San Diego, Hamilton/Avnet 619-571-7500
CA San Diego, Shelley Elctrns. 619-453-7133
CA San Jose, Ratel Elctrns. 408-946-4300
CA San Jose, Shelley Elctrns., Inc. 408-942-9111
CA San Jose, TTI, Inc. 408-943-9155
CA Sunnyvale, Hamilton/Avnet 408-743-3355
CO Boulder, Shelley Elctrns., Inc. 303-442-2718
CO Denver, Ragon Elctrns. 303-774-1992
CO Englewood, Hamilton/Avnet 303-740-1000
CO Englewood, NEP Elctrns. 303-799-9898
CT Danbury, Hamilton/Avnet 203-797-2800
CT New Haven, Greene Shaw Co. 203-397-0710
CT Stratford, TTI 203-375-1400
FL Ft. Lauderdale, Dielco 305-973-8700
FL Ft. Lauderdale, Hamilton/Avnet 305-971-2900
FL Orlando, T.T.I. 305-859-1000
FL St. Petersburg, Hamilton/Avnet 813-576-3930
FL Tampa, Impala Elctrns. 813-885-4747
FL Tampa, Shelley Elctrns., Inc. 813-884-0946
FL Winter Park, Hamilton/Avnet 305-628-3888
GA Norcross, Hamilton/Avnet 404-447-7507
GA Norcross, TTI 404-662-0911
IL Bensenville, Hamilton/Avnet 312-860-7700
IL Chicago, Nep Elctrns. 312-625-8400
IL Rosemont, Advent Elctrns. 312-298-4210
IN Carmel, Hamilton/Avnet 317-844-9603
IN Indianapolis, Advent Elctrns. 317-872-4910
IN Indianapolis, RM Elctrns., Inc. 317-291-7110
IA Cedar Rapids, Advent Elctrns. 319-363-0221
KS Overland Park, Hamilton/Avnet 913-888-8900
MD Beltsville, Resco/Washington 301-937-9100
MD Columbia, Aztech Elctrns. 301-995-1760
MD Columbia, Hamilton/Avnet 301-995-3500
MD White Marsh, Resco/Baltimore 301-529-0500
MA Burlington, TLC Elctrns. 617-273-0140
MA Newton, Greene-Shaw Co. 617-969-8900
MA Woburn, Hamilton/Avnet 617-935-9700
MA Woburn, Jaco Elctrns. 617-933-7760
MA Woburn, T.T.I. 617-938-8800
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MO St. Louis, Olive Elctrns. 314-426-4500
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NY Central Islip, Semi-Cap Elctrns. 516-582-4400
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NY Hauppauge, Hamilton/Avnet 516-231-9800
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NY Hempstead, Kahgan Comps. 516-538-2300
NY Henrietta, CAM RPC Elctrns. 716-334-5600
NY Rochester, Hamilton/Avnet 716-475-9130
NY Rochester, Summit Distrs. 716-334-8110
NY Rome, Rome Elctrns. 315-337-5400
NY Sodus, Pace Elctrn. Prods. 315-483-9122
NC Greensboro, Hammond Elctrns. 919-275-6391
NC Raleigh, Hamilton/Avnet 919-829-8030
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OH Cleveland, Hamilton/Avnet 216-831-3500
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TX Austin, Hamilton/Avnet 512-837-8911
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TX El Paso, Era Elctrns. 915-592-4126
TX Ft. Worth, T.T.I. Inc. 817-429-1440
TX Houston, Altair Co. 713-462-3029
TX Houston, Hamilton/Avnet 713-780-1771
TX Irving, Hamilton/Avnet 214-659-4111
TX Richardson, Altair Co. 214-231-5166
TX Richardson, Jaco Elctrns. 214-235-9575
UT Salt Lake City, Hamilton/Avnet 801-972-2800
VA Arlington, Arlington Elctrns. 703-524-2412
VA Charlottesville, Virginia Radio Supp. Co. 804-296-4184
WA Bellevue, Almac Elctrns. Corp. 206-643-9992
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WI Milwaukee, Marsh Elctrns. 414-475-6000
WI New Berlin, Hamilton/Avnet 414-784-4510
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WI New Berlin, R.M. Elctrns. 414-784-4420

MERCURY PLASTICS, A UNIT OF ZERO CORP., 672 Fuller Rd., Chicopee, MA 01020, Tel: 413-267-5561, TWX: 710-354-1450; Empl.: 100; *Sls. Mgr.:* Douglas W. Griffith

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NY White Plains, Metro-Tek Assocs. 914-631-4758
UT Salt Lake City, Global Tek., Inc. 801-972-0999
VA Fairfax, Schibley Assocs.,Inc. 703-591-3008

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METAVAC, INC., 45-68 162nd St., Flushing, NY 11358, Tel: 212-HI5-0400; Empl.: 52; *Sls. Mgr.:* Clifford E. Sisler

METEREX CORP., 25 Industrial Park Rd., Hingham, MA 02043, Tel: 617-749-8100; Empl.: 4; *Sls. Mgr.:* K. Sharples

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METERMASTER, 5646 Jullson St., Los Angeles, CA 90040, Tel: 213-685-4340 ..... pgs. **612, 680, 701, 781, 805, 824.**

METHODE ELCTRNS., INC., 7444 W. Wilson Ave., Chicago, IL 60656, Tel: 312-867-9600, TWX: 910-221-2468; Empl.: 900; *Sls. Mgr.:* R. Close; *Dist. Mgr.:* K. Lindsey

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METHODS RESEARCH, 54D Asbury Ave., Farmingdale, NJ 07727, Tel: 201-938-6000; *Sls. Mgr.:* J. James Mandy

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METRAPLEX CORP., Berkshire Indl. Park, Bethel, CT 06801, Tel: 203-748-0606, TWX: 710-456-3959; *Sls. Mgr.:* Charles B. Weaver

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METRON OPTICS INC., P.O. Box 690, Solana Beach, CA 92075-0690, Tel: 619-755-4477; Empl.: 15

METROPOLE PRODUCTS INC., P.O. Box 10275, Alexandria, VA 22310, Tel: 703-971-8606, 703-971-7082, Telex: 908041 BAL; FSC No.: 55908; *Sls. Mgr.:* John DePaola

METROSONICS, INC., Box 23075, Rochester, NY 14692-3075, Tel: 716-334-7300, Telex: 853348; Empl.: 80; *Sls. Mgr.:* W. Whitford; *Dist. Mgr.:* W. Whitford

METUCHEN CAPACITORS, INC., 420 Park Ave., Perth Amboy, NJ 08861, Tel: 201-442-0500, TWX: 710-998-0892; FSC No.: 55969; Empl.: 25; *Sls. Mgr.:* George Wolter ..... **A•1128-1134, 1614-1615; C•1454-1457**

THE MEYERCORD CO., 365 E. North Ave., Carol Stream, IL 60188, Tel: 312-682-6200, Telex: 72-2449; Empl.: 500; *Sls. Mgr.:* Joseph Galloni

MFE CORP., Instr. Div., Keewaydin Dr., Bldg. #1, Salem, NH 03079, Tel: 603-893-1921, Telex: 94-7477, TWX: 710-366-1887; *Sls. Mgr.:* Peter Schwartz; *Dist. Mgr.:* Jim Muckenhoupt

MF ELCTRNS. CORP., 10 Renewal Pl., New Rochelle, NY 10801, Tel: 914-576-6570, TWX: 710-563-0643; FSC No.: 08111; Empl.: 100; *Sls. Mgr.:* Bill Braverman; *Dist. Mgr.:* Bill Braverman ..... **A•1384-1385**

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AL Huntsville, E.M.A. 205-837-7363
AZ Glendale, Southwest Elec. Mktg. Assoc. 602-278-0500

CA Irvine, J. V. Earley & Assocs. 714-833-1806
CA Sunnyvale, W. W. Posey Co. 408-746-0771
CO Denver, Matthews & Assocs. 303-450-6476
CT Meriden, Orion Group 203-621-8371
FL Altamonte Springs, APM Assocs. 305-869-6831
FL Ft. Lauderdale, APM Assocs. 305-565-0056
FL Tampa, AMP Assocs. 813-886-2457
GA Atlanta, E.M.A. 404-448-1215
IL Bensenville, Banner Tech. Sls. 312-766-4131
ME Wakefield, The Orion Group 617-245-5220
MI Brighton, A.P.J. Assocs. 313-229-6550
MN Minneapolis, Peterson Sls. & Assoc. .. 612-884-3483
NJ Perth Amboy, Astro Rep. 201-826-8050
NM Glendale, S. W. Elec. Mktg. Assoc. 602-278-0500
NY Rochester, Sweetco Assocs. 716-225-2383
NY Utica, Sweetco Assocs. 315-733-6721
NY W. Babylon, Astro Rep. 516-422-2500
NC Raleigh, E.M.A. 919-847-8800
OH Dayton, APJ Assoc. 216-356-2424
OR Portland, Controltek Sls. 503-641-0877
PA Prospect Park, ELF Sls. 215-534-3340
TX Austin, Matthews & Assocs. 512-479-0028
TX Dallas, Matthews & Assocs. 214-931-0167
WA Bellevue, Controltek Sls. 206-451-8163
WI Mukwonago, Banner Tech. Sls. 414-363-5086

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CA Burbank, Atwater Elctrns. 714-670-1426
CA Sunnyvale, Pacesetter 408-734-5470
NJ Northtown, Aztec Engrg. 215-539-8200
PA Northtown, Aztec Engrg. 215-539-8200

MG ELECTRONICS

MG ELECTRONICS, 32 Ranick Rd., Hauppauge, NY 11788, Tel: 516-582-3400, Telex: 645113; Empl.: 14; *Sls. Mgr.:* John Kibbit; *Dist. Mgr.:* Stan Grey ..... **D•1027**

MHOTRONICS., INC., 444 Lake Cook Rd., Ste. 8, Deerfield, IL 60015, Tel: 312-948-5600, TWX: 910-686-0630 ..... **C•1459-1461**

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AZ Phoenix, J. F. Hurlbutt Co. 602-952-2029
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CA Santa Clara, Context Engrg. 408-748-8676
CO Golden, J. F. Hurlbutt 303-279-7796
FL Deerfield Beach, Cartwright & Bean ... 305-429-3400
FL Orlando, Cartwright & Bean 305-422-4531
GA Atlanta, Cartwright & Bean 404-233-2939
IL Elk Grove Village, Memetron 312-595-2828
IL Mt. Prospect, The Dombrow Co. 312-253-3326
LA Covington, Cartwright & Bean 504-892-1780
MA Framingham, Marathon Sls., Ltd. 617-875-3566
NY Hauppauge, Masin-Esco, Inc. 516-273-3500
NY Syracuse, Northeastern Elctrns. Co., Inc. 315-455-7561
NC Charlotte, Cartwright & Bean 704-377-5673
NC Raleigh, Cartwright & Bean 919-876-4130
OR Portland, SPS Elctrns. 503-297-6919
TN Knoxville, Cartwright & Bean 615-693-7450
TN Memphis, Cartwright & Bean 901-276-4442
TX Austin, Swearingen Sls. 512-339-8663
WA Redmond, SPS Elctrns. 206-323-4140

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MICA CORPORATION, 8536 National Blvd., Culver City, CA 90232, Tel: 213-837-8100, Telex: WU 664336, ITT 4720769; FSC No.: 06216;Multiple; Empl.: 300

MICHIGAN MAGNETICS, 203 W. Third St., Vermontville, MI 49096, Tel: 517-726-0590; Empl.: 95; *Sls. Mgr.:* B. L. Killinger

MICOM SYSTEMS, INC., 4100 Los Angeles Ave, P.O. Box 8100, Simi Valley, CA 93062-8100, Tel: 805-583-8600, Telex: 687-497, TWX: 910-494-4910; *Sls. Mgr.:* M. Winters; *Dist. Mgr.:* A. Yilmaz

MICRA CORP., 120 Ricefield Lane, Hauppauge, NY 11788, Tel: 516-231-8600, TWX: 882633 MICRA US; FSC No.: 63071; Empl.: 200; *Sls. Mgr.:* Richard S. Davis

MICREL, INC., 1235 Midas Way, Sunnyvale, CA 94086, Tel: 408-245-2500, TWX: 910-379-0007; Empl.: 120

MICRO ASSOCIATES INC., 2349 Memorial Blvd., Port Arthur, TX 77640, Tel: 409-983-2051

MICROAVIONICS CORP., 3198-K Airport Loop Dr., Costa Mesa, CA 92626, Tel: 714-957-6904; Empl.: 15; *Sls. Mgr.:* B. H. Corzine

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MICROBOND DIV., PO Box 689, Altamonte Springs, FL 32701, Tel: 305-339-8298, Telex: 56-4303; *Sls. Mgr.:* William S. Hodges

MICROCAP, INC., 11120 Roselle St, San Diego, CA 92121, Tel: 619-452-9812; Empl.: 23; *Sls. Mgr.:* Denise Kelly

MICRO-CIRCUIT ENGRG., See MCE Semiconductor

MICRO-CIRCUITS CO., INC., Route 1 - Box 518, New Buffalo, MI 49117, Tel: 616-469-2727

MICRO-COAX COMPONENTS, INC., a UTI Company, Box E, Collegeville, PA 19426, Tel: 215-489-3700, Telex: 84-6428, TWX: 510-660-6107; FSC No.: 215-489-1103; Empl.: 50; *Sls. Mgr.:* Lloyd Deery

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Microcomputer Power, Inc.

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MD Baltimore, Stemler Assocs. 301-944-8262
MA Andover, Richard Porinton, Inc. 617-475-7055
NJ Cherry Hill, Stemler Assocs. 609-966-0470
NY Plainview, Alto Assocs. 516-681-3163
PA Feasterville, Stemler Assocs. 215-638-1850
EXP CA, Santa Clara, Prima Intl. 408-496-0722

Local Distributors
AZ Glendale, Aspen Power 602-937-4784
CA Hayward, K E A Electronics 415-887-2900
CA Inglewood, Basic Sys. 213-673-4300
FL Orlando, G M I Distrs. 305-894-3354
NM Albuquerque, Walker Elctrns. 505-883-2992

MICRO COMPUTER RENTALS, 742D Hampshire Rd., Westlake Village, CA 91361, Tel: 213-991-1704

MICRODATA CORP., 17481 Red Hill Ave., Irvine, CA 92705, Tel: 714-540-6730, TWX: 910-595-1764; Empl.: 375

MICRO DEVICES PRODUCT GROUP, Therm-O-Disc, Inc., 1320 South Main Street, P.O. Box 3538, Mansfield, OH 44907, Tel: 419-756-5005, Telex: 987455; *Sls. Mgr.:* J. A. Kight ..... **B•1775**

MICRO DIGITAL ASSOCS., INC., 12791 Western Ave., Unit C, Garden Grove, CA 92641, Tel: 714-891-2363; *Sls. Mgr.:* Ralph Moore; *Dist. Mgr.:* Ralph Moore

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MICROELECTRONIC RELAYS, INC., 1300 S. Beacon St., San Pedro, CA 90731, Tel: 213-831-2331, Telex: 297340; Empl.: 25; *Sls. Mgr.:* C. D. Stalker ..... **B•1439**

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IL La Grange Park, Bierhaus Sls. 312-354-5100
MD Baltimore, Callas Elctrns. 301-744-7711
MA Peabody, OEM Sls. 617-535-2521
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NY Commack, R. C. Engrg. 516-543-3325
NY Syracuse, L. D. Allen 315-437-8387
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UT Layton, Dynatech 801-546-4837
WI Milwaukee, Bierhaus Sls. 414-963-0318
Can Ontario, Intrade 613-727-1272

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MICRO-ETCH PRODUCTS, INC., 94 Dodge Ave., P.O. Box 9712, Stratford, CT 06497, Tel: 203-378-8610; FSC No.: 24846; Empl.: 42; *Sls. Mgr.:* Frank Dichiara; *Dist. Mgr.:* Frank Dichiara

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MICROLOGIC, INC., 108 Water St., Watertown, MA 02172, Tel: 617-923-1700; *Sls. Mgr.:* Eric Kapust

MICROMETALS, 1190 N. Hawk, Anaheim, CA 92807, Tel: 714-630-7420, TWX: 910-591-1690; FSC No.: 12856; Empl.: 70; *Sls. Mgr.:* K. Baker, Jr.

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MICRO MO ELECTRONICS, INC., 742 2nd Ave. S., St. Petersburg, FL 33701, Tel: 813-822-2529, Telex: 807-982; Empl.: 25; *Sls. Mgr.:* S. J. O'Neil ..... **B•1172-1175**

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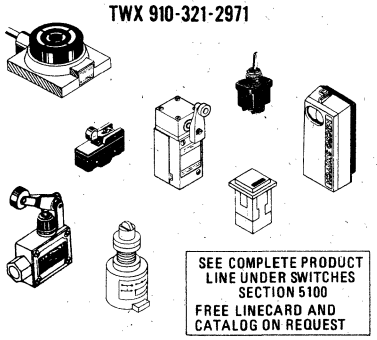

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IL Rosemont, Advent Elctrns. 312-297-6200
IL Skokie, Mar-Con Assocs. 312-675-6450
IN Indianapolis, Advent Elctrns. 317-872-4910
IN Indianapolis, Classic Comp. Supp. 319-363-0221
IA Cedar Rapids, Advent Elctrns. 319-363-0221
IA Cedar Rapids, Bergquist 319-366-8733
MD Beltsville, Treeko Sls. 301-792-0112
MD Rockville, All American 301-792-0112
MA Billerica, A. W. Mayer Co. 617-229-2255
MI Farmington Hills, Advent Elctrns. 313-477-1650
MN Edina, Diplomat/ACT 612-559-2500
MN Minneapolis, Bergquist Co. 612-835-2322
NY Buffalo, Genesee Radio 716-546-5373
NY Rochester, Masline Elctrns., Inc. 716-546-5373
NY Stony Brook, Dove Elctrn. Comp., Inc. 516-689-7733
NC Raleigh, Prehler Elctrns. 919-876-9111
OH Cincinnati, Schuster Elec. Co. 800-543-4973
OH Englewood, Argent Electra 513-836-8633
OH Solon, Repco Elctrns. 216-248-8900
OK Tulsa, Altair Co. 918-252-5781
OR Tigard, Integrated Elctrns. 503-639-9661
PA Pittsburgh, Alder-Tronics 412-821-5565
TX Austin, Altair Co. 512-837-4970
TX Austin, Diplomat/ACT 512-452-5254
TX Dallas, Diplomat/ACT 214-980-1888
TX Houston, Altair Co. 713-462-3029
TX Houston, Diplomat/ACT 713-496-4000
TX Richardson, Altair Co. 214-231-5166
UT Salt Lake City, Diplomat/ACT 801-487-8131
UT Salt Lake City, Integrated Elctrns. 801-298-1868
WA Bellevue, Integrated Elctrns. 206-455-2727
WI Mequon, Taylor Elec. 800-242-8914
WI New Berlin, Classic Comps. Supp. 800-242-7408
EXP WI, Burlington, Midland-Ross Corp. 414-763-3591
Can Brampton, Ont., Midland-Ross of Can., Ltd. 416-453-4200

MIDLAND STANDARD, INC., 603 E. Chicago St., Box 38, Elgin, IL 60120, Tel: 312-741-6600; Empl.: 38

MIDWAY MFR. CO., 10750 W. Grand Ave., Franklin Park, IL 60131, Tel: 312-451-1360, Telex: 72-1596; Empl.: 2000; *Dist. Mgr.:* Allan Stearns

MIDWEC, See Industrial Midwec Capacitors

MCI

MIDWEST COMPS., 1981 Port City Blvd., Muskegon, MI 49443, Tel: 616-777-2602, TWX: 510-394-4130; FSC No.: 50157; Empl.: 125; *Sls. Mgr.:* J. E. Saling ..... **B•1740, 1758-1765**

Local Sales Offices & Reps

AL Huntsville, Glen White Assoc. 205-883-7938
CA Saratoga, Testco 408-253-1900
FL Light House Pt., R. C. Simon 305-941-2757
GA Norcross, Glen White Assoc. 404-441-1447
IL Chicago, D. Dolin Sls. 312-286-6200
IN Ft. Wayne, TMC Corp. 219-432-5553
MD Timonium, Glen White Assoc. 301-252-6360
MN St. Paul, R. G. Ragon 612-488-0201
NJ Burlington, Mallon Sls. 609-387-4044
NJ Ft. Lee, Necco 201-461-2789
NY New York, Necco 201-461-2789
NC Raleigh, Glen White Assoc. 919-787-7023
OH Dayton, Jay Engrg. 513-253-2151
OH N. Royalton, Jay Engrg. 216-237-4235
OK Tulsa, Norcom 918-664-9526
TN Gray, Glen White Assoc. 615-477-8850
TX Dallas, Norcom 214-386-4888
TX Houston, Norcom 713-988-0022
VA Lynchburg, Glen White Assoc. 804-237-6291
WA Bellevue, Testco 206-454-7422
WI Milwaukee, D. Dolin Sls. 414-482-1111

MIKRON INSTR., Box 211, Ridgewood, NJ 07451, Tel: 201-891-7330, TWX: 710-988-5821; Empl.: 40; *Sls. Mgr.:* K. Irani

Distributor

MIL-COMM DISTRIBUTORS, INC., 9400 Lurline Ave. # C, Chatsworth, CA 91311, Tel: 818-998-3111 ..... **D•1421**

MIL ELECTRONICS, INC., 1 Mill st., Dracut, MA 01826, Tel: 617-453-8000; FSC No.: 07862; Empl.: 40; *Sls. Mgr.:* Mark Ryan

MILFORD RIVET & MACH., 857 Bridgeport Ave., Milford, CT 06460, Tel: 203-878-4631, Telex: 964363, TWX: 710-462-0538; Empl.: 400; *Sls. Mgr.:* Robert E. Kranz, Jr.

MILLEN COMPONENTS, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180, Tel: 617-438-6951, Telex: 948-025; FSC No.: 57285; Empl.: 50; *Sls. Mgr.:* R. A. Boisseau; *Dist. Mgr.:* Gardner Gray

MILLER DIAL CORP., 4400 N. Temple City Blvd., El Monte, CA 91734, Tel: 818-283-5111, TWX: 910-587-3438; *Sls. Mgr.:* Doug Hazelip

MILLER, J.W., CO., See Bell Inds.

MILLER, L.C., CO., 717 Monterey Pass Rd., Monterey Pk., CA 91754, Tel: 213-268-3611; Empl.: 45

MILLER, SANFORD, CORP., See Sanford-Miller Corp.

MILLER, W. A., CO., Mingo Loop, P.O. Box 337, Oquossoc, ME 04964, Tel: 207-864-3344; Empl.: 18; *Sls. Mgr.:* D. Hunger

MILLER-STEPHENSON CHEM. CO., INC., George Washington Hwy., Danbury, CT 06810, Tel: 203-743-4447, Telex: 643-711

MILLIFLECT, 7752 Enterprise Dr., Newark, CA 94560, Tel: 415-791-5188; Empl.: 22; *Sls. Mgr.:* J. F. Rutschow

MILLI-SWITCH CORP., Box 67, Gladwyne, PA 19035, Tel: 215-MI2-9222; Empl.: 15

MILLIVAC INSTRS., Box 997, Curry Rd. Ext., Schenectady, NY 12301, Tel: 518-355-8300; FSC No.: 85711; Empl.: 30; *Sls. Mgr.:* (Mrs.) Pola Metzger ..... **D•1266**

Local Sales Offices & Reps

CA San Diego, Jan B. Metzger 619-571-8406
MA Needham, Addelco Corp. 617-444-4754
NY Fayetteville, Martin P. Andrews 315-637-5291
NY Melville, Paul W. Steen Assocs. 516-427-1114
PA Media, S & S Div. of Klinetics 215-565-5388
TX Houston, Scientific Sls. 713-460-9170
TX Richardson, Scientific Sls. 214-231-6541
Can Downsview, Ont., Tradeport Elctrns. Grp. 416-736-0866

MILL-MAX MFG. CORP., P.O. Box 300, Oyster Bay, NY 11771, Tel: 516-922-6000, TWX: 510-221-1820; *Sls. Mgr.:* Therese Malhame

MILLS RESISTOR CO., 3840 Catalina St., Los Alamitos, CA 90720, Tel: 213-598-2454; FSC No.: 34238; Empl.: 50 ..... **A•1899**

Local Sales Offices & Reps

AZ Scottsdale, Verein Corp. 602-948-3571
CA Los Altos, Frauman Assocs. 415-941-0660
CA Sacramento, Mills Resistor Co. 916-422-5461
CT Rocky Hill, Jim McPhail 203-721-1802
KS Leawood, James Dick Co. 913-649-0805
MA Waltham, Dynasel Assocs. 617-890-6777
OH Chagrin Falls, ARL Co. 216-543-9124
OR Gaston, SPS Elctrns. 206-323-4140
TX Houston, Ev Smith Co. 713-649-5756
WA Seattle, SPS Elctrns. 206-323-4140

Local Distributors

AZ Phoenix, Fiesta Elctrns. 602-861-1141
FL Ft. Lauderdale, Jaro Elctrns. 800-327-5551

MILPOWER SOURCE, INC., 49 Range Rd., Windham, NH 03087, Tel: 603-893-2834; Empl.: 150

Local Sales Offices & Reps

MD Baltimore, Micro Comp., Inc. 301-247-0400

MILTON ROSS CO., 511 Second St. Pike, Southampton, PA 18966, Tel: 215-355-0200, TWX: 510-667-1702; Empl.: 165; *Sls. Mgr.:* M. I. Ross

MILTOPE CORP., 1770 Walt Whitman Rd., Melville, NY 11747, Tel: 516-420-0200, TWX: 510-221-1803; Empl.: 500; *Sls. Mgr.:* Robert Ceonzo; *Dist. Mgr.:* William Jennings

MRC

MILWAUKEE RESISTOR CORP., 700 W. Virginia St., Milwaukee, WI 53204, Tel: 414-271-9900; FSC No.: 82807;15109; Empl.: 100; *Sls. Mgr.:* W. R. Pollock; *Dist. Mgr.:* W. R. Pollock ..... **A•1900-1905**

Local Sales Offices & Reps

CA San Carlos, Electro Pacific 415-592-3114
IL La Grange, PVA Co. 312-579-9300
NY Rochester, Gislason Sls. 716-328-7400

MILWAUKEE TRANSFORMER CO., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223, Tel: 414-358-5300; *Sls. Mgr.:* Richard T. Armantrout; *Dist. Mgr.:* Richard T. Armantrout

MIMIC, INC., P.O. Box 921, Acton, MA 01720, Tel: 617-263-2101; Empl.: 5; *Sls. Mgr.:* S. Thurston

MINCO PRODS., 7300 Commerce La., Minneapolis, MN 55432, Tel: 612-571-3121, TWX: 910-576-2848; FSC No.: 09359; Empl.: 400; *Sls. Mgr.:* J. Anderson

MIN-E-CON, 1791 Reynolds, Irvine, CA 92714, Tel: 714-250-0474, TWX: 910-595-1144; *Sls. Mgr.:* Wendell Jacob

MINELCO INC. - A TALLEY IND., 135 S. Main St., Thomaston, CT 06787-0459, Tel: 203-283-8261, TWX: 710-475-1091; FSC No.: 07479; Empl.: 61; *Sls. Mgr.:* John Pfingsten

Local Sales Offices & Reps

AL Huntsville, L & D Inc. 205-837-1469
AZ Phoenix, Dood & Co. Inc 602-482-9330
CA Alhambra, M.W. Riedel & Co. 213-283-7694
CA Hayward, Liaison, Inc. 415-783-1131
CO Denver, West Inc. 303-477-8180
CT Old Saybrook, FJS Assocs. 203-388-5374
FL Orlando, Delmac 305-898-4688

GA Atlanta, L & D, Inc. 404-395-7079
IL Elk Grove Village, Midwest Meridian .. 312-640-9540
IA Cedar Rapids, J.R. Sls. Engrg. 319-393-2232
MD Severna Park, DelMarva Eng. Assoc. .. 301-647-8007
MA Winchester, F.J.S. Assocs. 617-729-3135
MN New Brighton, TWC Sls. 612-636-1770
MO Maryland Heights, Midwest Meridian .. 314-878-4441
NJ Hasbrouck Hgts., Comp-Tech Sls. 201-288-7400
NY Syracuse, J. R. Costello 315-472-0322
NC Greensboro, L & D, Inc. 919-292-3201
OH Cleveland, Jim Finnegan & Co. 216-238-5905
OR Beaverton, Caruso-Northcutt 503-646-4973
PA Downingtown, McCoy, Inc. 215-363-0350
TX Fort Worth, Midwest Meridian 817-654-2132
WA Bellevue, Caruso-Northcutt 206-454-9699

MINIATURE METAL FORMING DIV., 4819 Emerald St, P.O. Box 2962, Torrance, CA 90509, Tel: 213-370-3679, Telex: 75-7989; *Sls. Mgr.:* William Kramer

MINIATURE PRECISION BEARINGS, MPB Corp., Precision Park, Keene, NH 03431, Tel: 603-352-0310, TWX: 710-366-1801; *Sls. Mgr.:* Thomas A. Rudziensky; *Dist. Mgr.:* Jack E. Barker

Mini-Circuits

MINI-CIRCUITS LAB., 2625 E. 14th St., P.O. Box 166, Brooklyn, NY 11235, Tel: 718-934-4500, Telex: 125460, 620156 (Intl.); FSC No.: 15542 .... **A•1700, 1716-1779**

Local Sales Offices & Reps
AL Huntsville, Beacon Elctrns. 205-881-5031
AZ Phoenix, Crown Elctrns. 602-944-3721
AR Little Rock, Beacon Elctrns. 501-224-5449
CA Los Altos, Cain-White & Co. 415-948-6533
CA N. Hollywood, Crown Elctrns. 213-877-3550
FL Clearwater, Beacon Elctrns. 813-796-2378
FL Ft. Lauderdale, Beacon Elctrns. 305-491-1054
FL Maitland, Beacon Elctrns. 305-647-3498
FL Melbourne, Beacon Elctrns. 305-724-8010
GA Atlanta, Beacon Elctrns. 404-256-9640
IL Mount Prospect, Cain Forlaw Co. 312-253-3578
MD Columbia, M. Lader & Co. 301-730-1550
MD Conowingo, M. Lader & Co. 301-378-3449
MA Waltham, Scientific Devices 617-890-2252
NY Hartsdale, Spectrum Sales 914-997-1166
NY Skaneateles, Robtron 315-685-5731
NC Greensboro, Beacon Elctrns. 919-275-9997
OH Lancaster, Cain Forlaw Co. 614-654-4800
PA Lafayette Hill, M. Lader & Co. 215-825-3177
TX Dallas, Cain & Co. 214-233-6809

Local Distributors
AL Huntsville, Components Distrs. 205-883-7501
AR Little Rock, Components Distrs. 501-227-6278
CA Los Altos, Pen Stock 415-948-6552
CA N. Hollywood, Crown Elctrns. 213-877-3550
FL Ft. Lauderdale, Components Distrs. ... 305-971-4950
IL Mt. Prospect, CFC Distributors 312-253-3578
NC Raleigh, Components Distrs. 919-781-0262
PA Lafayette Hill, MLC Distrs. 215-825-3177

MINI COMPUTER TECHNLG., 696 E. Trimble Rd., San Jose, CA 95131, Tel: 408-942-1616, TWX: 910-338-2281; Empl.: 30; *Sls. Mgr.:* Doug Vincent; *Dist. Mgr.:* Ed Hagenbuch

MINI-SYSTEMS, INC., 20 David Rd., North Attleboro, MA 02761, Tel: 617-695-0203, TWX: 710-348-0564; FSC No.: 50316; Empl.: 150 ..... **A•1906**

Local Sales Offices & Reps
FL Coral Springs, Marks Tech. Sls. Assocs. 305-753-3830
MA Newton, Normell Assocs. 617-969-5478
TX Lewisville, C & J Assocs. 214-539-0140

MINI-SYSTEMS, INC., Electronic Package Div., 168 E. Bacon St., P.O. Box 1597, Plainville, MA 02762, Tel: 617-695-2000, TWX: 710-348-0564 ..... **A•1681**

MINNTRONICS CORPORATION, 2599 White Bear Ave., St. Paul, MN 55109, Tel: 612-770-5247

MITEC ELCTRNS., 15 Commerce St., Williston, VT 05495, Tel: 802-864-0064, TWX: 610-421-3572; *Sls. Mgr.:* Elayne Bernstein

MITEL SEMICONDUCTOR, P.O. Box 13089, Kanata, ON, Canada K2K 1X3, Tel: 613-592-5280, Telex: 053-3221, TWX: 610-562-8529; Empl.: 200

MITEQ INC., 125 Ricefield Lane, Hauppauge, NY 11788, Tel: 516-543-8873, TWX: 510-226-3781; Empl.: 185

MITRONICS, 2908 Oregon Court - Bldg. I-2, Torrance, CA 90503, Tel: 213-320-7011

MITSUBISHI ELCTRNS. AMERICA, Computer Peripheral Div., 991 Knox St., Torrance, CA 90502, Tel: 213-515-3993; *Sls. Mgr.:* Mike Foster

MITSUBISHI ELCTRNS., Industrial Electronics Div., 991 Knox Street, Torrance, CA 90502, Tel: 213-515-3993, Telex: 06-4703-M USA LSA, TWX: 66-4787-MELA TRNC; *Sls. Mgr.:* Don Aarons

MITSUBISHI ELCTRNS. AMERICA, INC., Semiconductor Div., 1050 East Arques Ave., Sunnyvale, CA 94086, Tel: 408-730-5900, Telex: 172296, TWX: 910-339-9549; FSC No.: 408-749-0453; *Sls. Mgr.:* John Zucker

MITSUMI ELEC. CO., LTD., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan, Tel: 489-5333, Telex: J28846/J24935; Empl.: 1700; *Sls. Mgr.:* H. Sato; *Dist. Mgr.:* U. Nishimura

MIZAR INC.

MIZAR, INC., 302 Chester St., St. Paul, MN 55107, Tel: 612-224-8941, Telex: 469542; Empl.: 17; *Sls. Mgr.:* Susan Roth ..... **D•1094-1096, 1106**

Local Sales Offices & Reps
AZ Tempe, Foley, Tallent & Lee Inc. 602-894-2345
CA Long Beach, B. K. & Associates 213-596-1233
CA Los Gatos, Data-Rep 408-279-1212
CA San Jose, Data-Rep Inc. 408-279-1212
FL Melbourne, Reynolds & Assocs. 305-259-7000
FL Melbourne, Star-Tec Co. 305-727-2247
IL North Brook, Epstein & Assocs. 312-564-9292
MA Waltham, Com-Sls. Inc. 617-890-0011
MN Minneapolis, D. A. Case & Assoc. 612-888-8666
MO Ellisville, Advanced Indl. Sys. 314-391-0366
NJ Nashua, Bell Controls 603-882-6984
NJ Springfield, Gebhardt Mktg. Inc. 201-376-4415
OH Cuyahoga Falls, Micrographics, Inc. ... 216-923-3915
OH Strongsville, Dolfuss Root & Co. 216-238-0300
PA Hatboro, Electro-Rep Engrg. 215-674-4421
PA Ivyland, Technico 215-322-5966
TX Austin, Acudata, Inc. 512-346-4033
TX Houston, Acudata, Inc. 713-580-2451
TX Plano, Acudata, Inc. 214-424-3567
WA Bellevue, Tasco, Inc. 216-923-3915
Can Edmonton, Alb., 4.M. Mottl. Mktg., Ltd. 403-486-0091

MKS ELECTRONICS CORP., 454 E. Donovan Rd., Kansas City, KS 66115, Tel: 913-371-1351; Empl.: 26

MKS INSTRS., INC., 22 Third Ave., Burlington, MA 01803, Tel: 617-272-9255, Telex: 94-9375; Empl.: 130

MOBILE-TRONICS CO., INC., Box 1022, Tustin, CA 92680, Tel: 714-546-0884; Empl.: 2

MODERN CONTROLS CORP., 4636 Hidden Forest Dr., Sarasota, FL 33580, Tel: 813-351-3042; Empl.: 4

MODICON PROGRAMMABLE CONTROL DIV., Gould Inc., P.O. Box 83 S.V.S., Andover, MA 01810, Tel: 617-475-4700, Telex: 94-7402, TWX: 710-347-6610; *Sls. Mgr.:* Steven Mader (PC's); *Dist. Mgr.:* George Dannecker (Micro 84)

MODULAR COMPUTER SYSTEMS, P.O. Box 6099, Ft. Lauderdale, FL 33310, Tel: 305-974-1380, Telex: 52-2564, TWX: 510-956-9414; Empl.: 950

MODULAR AUDIO PRODS., Modular Devices Inc., 50 Orville Dr., Bohemia, NY 11716, Tel: 516-567-9620; *Sls. Mgr.:* C. Liptman

MODULAR DEVICES, 50 Orville Dr., Bohemia, NY 11716, Tel: 516-567-9620; FSC No.: 52202; Empl.: 50; *Sls. Mgr.:* C. Liptman ..... **D•1011, 1727**

Local Sales Offices & Reps
FL Enterprise, DJE Assocs. 305-321-6623
NH Manchester, Northeast Comps. 603-627-7242
NY Rochester, T.T.A. North-Div. Tri-Tek Assocs. 716-271-6764
NY Wantagh, Tri-Tek Assocs. 516-221-7600
EXP CA, San Diego, Total Elctrns. Int'l. 619-224-3291

PHOTON SOURCES, INC., 12163 Globe Rd., Livonia, MI 48150, Tel: 313-591-0101, TWX: 810-242-3270; Empl.: 140; *Sls. Mgr.:* Pete Seamans

MODULAR POWER SYS. INC., P.O. Box 180579, Austin, TX 78718-0579, Tel: 512-834-9262, Telex: 752-890; FSC No.: 58480; Empl.: 86; *Sls. Mgr.:* Manard Overall; *Dist. Mgr.:* Manard Overall

MODULAR SYSTEMS, INC., 905 Albemarle St., Charlottesville, VA 22901, Tel: 804-295-7882; Empl.: 9; *Sls. Mgr.:* G. L. Blencowe

MODUTEC, 18 Marshall St., Norwalk, CT 06854, Tel: 203-853-3636, TWX: 710-468-2039; Empl.: 300; *Sls. Mgr.:* Lester A. Velez; *Dist. Mgr.:* William J. Betz ..... **D•1362-1363**

Local Sales Offices & Reps
AL Huntsville, Beacon Elctrns. Assocs. ... 205-881-5031
AK Anchorage, Denali Indl. Sls. 907-243-6283
AZ Scottsdale, Luscombe Engrg. Co. 602-949-9333
AR Little Rock, Beacon Elec. Assoc. 501-224-5449
CA Campbell, Luscombe Engrg. Co. 408-370-2020
CA Pasadena, Luscombe Engrg. Co. 213-684-2000
CO Arvada, Arrowhead Sls. Co. 303-423-5556
FL Clearwater, Beacon Elec. Assoc. 813-796-2378
FL Ft. Lauderdale, Beacon Elctrn. Assoc. 305-491-1054
FL Maitland, Beacon Elctrn. Assocs. 305-647-3498
FL Melbourne, Beacon Elec. Assoc. 305-724-8010
GA Atlanta, Beacon Elctrn. Assocs. 404-256-9640
HI Honolulu, Aloha Assocs. 808-941-1574
IL Arlington Hgts., Brainard-Wilson Mktg. 312-437-2700
IN Carmel, Brainard-Wilson Mktg. 317-844-2800
IN Carmel, Carter, McCormic & Peirce ... 317-844-4175
IA Marion, M-S-B Assocs. 319-377-6261
KS Shawnee Mission, M-S-B Assocs. 913-432-2131
MD Randallstown, Beacon Elec. 703-534-7200
MA Canton, New England Elctrn. Sls. Corp. 617-828-4835
MI Farmington, Carter, McCormic & Peirce 313-477-7700
MN Minneapolis, R.J. Inc. 612-866-3661
MO St. Charles, M-S-B Assocs. 314-946-5577
NJ Englewood, Sprung/Nussbaum 201-569-5666
NJ Marmora, Holdsworth & Co. 609-398-4340
NM Albuquerque, Amonette Entprs. 505-344-4143
NY Bainbridge, R. W. Mitscher 607-697-7192
NY Buffalo, R. W. Mitscher 716-633-7970
NY N. Syracuse, R. W. Mitscher 315-458-1321
NY Pittsford, R. W. Mitscher 716-586-4012
NY Red Hook, R. W. Mitscher 914-758-8375
NY Rochester, R. W. Mitscher 716-227-0839
NC Greensboro, Beacon Elctrn. Assoc. ... 919-275-9997
NC Raleigh, Beacon Elctrn. 919-787-0330
OH Cleveland, Carter, McCormic & Peirce 216-779-5100
OH Englewood, Carter, McCormic & Peirce 513-836-0951
OR Beaverton, Barrett-Squibb & Assoc. ... 503-644-2550
PA Monroeville, Carter, McCormic & Peirce 412-372-4415
PA Newtown Square, Holdsworth & Co.-SWR 215-356-8550
TX Houston, Scientific Sls. Co. 713-460-9170
TX Richardson, Scientific Sls. Co. 214-231-6541
UT Salt Lake City, Arrowhead Sls. 801-261-1661
VA Fairfax, Beacon Elctrns. 703-591-1300
VA Forrest, Beacon North 804-239-8486
WA Redmond, Barrett Squibb, Inc. 206-885-6991
WI Colgate, Rep-1 Assoc. 414-628-4016
EXP Freeport, Minthorne 516-546-4700

Local Distributors
AL Birmingham, Brownell Electro 205-322-3374
AL Huntsville, Component Distrs. 205-883-7501
AL Mobile, Brownell Electro 205-479-8581
AR Little Rock, Component Distrs. 501-227-6278
CA Inglewood, Force Elctrns. 213-776-1324
CA Los Angeles, Erlanger Sls. 213-731-2238
CA Los Angeles, Erlanger Sls. Co. 213-731-2238
CA Santa Clara, Fisher-Brownell 408-988-6041
FL Ft. Lauderdale, Component Distrs. 305-971-4950
FL Miami, Brownell Electro 305-591-3215
FL Orlando, Brownell Electro 305-843-6770
GA Hapeville, Brownell Electro 404-762-5181
IL Chicago, Newark Elctrns. 312-638-4411
IL Elk Grove Village, Meter Master 312-593-8650
IN Ft. Wayne, Graham Elctrns. 219-423-3422

IN Indianapolis, Graham Elctrns. 317-634-8202
MD Gaithersburg, Pioneer Instrumentation 301-921-0660
MA Woburn, Brownell Electro 617-935-7820
MI Ferndale, RAM Meter 313-398-6767
MO St. Louis, Olive Elctrns. 314-426-4500
NJ Belleville, Miscorp 201-751-1190
NJ Fairfield, Ampower Elctrn. Instr. 201-227-7720
NJ S. Plainfield, Brownell Electro 201-753-4600
NY Clarence, Trott Elctrns. 716-634-8500
NY New York, Brownell Electro 212-691-1171
NY Pittsford, Trott Elctrns. 716-586-8251
NC Charlotte, Brownell Electro 704-597-1270
NC Raleigh, Brownell Electro 919-876-6524
NC Raleigh, Component Distrs. 919-781-0262
OH Cleveland, Pioneer Instrumentation 216-587-3600
OH Cleveland, Weschler Elec. Co. 216-238-2550
OH Dayton, Pioneer Instrumentation 513-236-9900
PA Norristown, Kimberly-James Co. 215-666-7286
SC Columbia, Brownell Electro 803-772-6111
TN Chattanooga, Techni-Tronics 615-875-5449
TN Knoxville, Brownell Electro 615-966-3441
TN Memphis, Brownell Electro 901-795-8483
TN Nashville, Brownell Electro 615-889-8230
TX Dallas, Inotek Corp. 214-243-7000
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Ft. Worth, Inotek Corp. 817-831-2126
TX Houston, American Analog 713-941-7265
TX Houston, Brownell Electro 713-699-1981
TX Houston, Inotek Corp. 713-688-4494
WA Seattle, Eicher-Richards Co. 206-523-7888
WI Milwaukee, E-M Instrs. 414-272-7799
WI Milwaukee, Marsh Elctrns. 414-475-6000

MODU-TEL CORP., 1429 N. Halstead, Hutchinson, KS 67501, Tel: 316-662-3302, Telex: 469331 COMTRON CI; Empl.: 5; *Sls. Mgr.:* Paul Bascom

MOHAWK DATA SCIENCES, MDS Center, Herkimer, NY 13350, Tel: 315-866-5300, Telex: (71)662032; Empl.: 4500

MOHAWK WIRE & CABLE CORP., 9 Mohawk Drive, Leominister, MA 01453, Tel: 617-537-9961

MOLDCON CORP., 221 Interstate Dr., W. Springfield, MA 01089, Tel: 413-736-0371, TWX: 710-350-6463; *Sls. Mgr.:* Robert Krzynowck

MOLDING TECHNOLOGY INC., See MTI

MOLDTRONICS, INC., 703 Rogers St., Downers Grove, IL 60515, Tel: 312-968-7000, TWX: 910-695-3537; Empl.: 140; *Sls. Mgr.:* Jim Arnold

Local Sales Offices & Reps

CA Topanga, S-J-N Sales 213-455-1813
FL Winter Springs, Martinet Assocs. 305-699-0392
IL Cary, Ecro Inc. 312-639-1162
IN Indianapolis, Butler Comps. 317-253-5143
MN St. Paul, PDQ Comps 612-690-5215
OH Dayton, H. G. Lake Co. 513-277-8181
PA Lancaster, Thomas G. Armstrong Assoc. 717-397-2942
RI Wickford, R. P. Morrison Co. 401-295-5692

MOLECU-WIRE, P.O. Box 495, Farmingdale, NJ 07727, Tel: 201-938-9473, TWX: 710-723-6943; Empl.: 175 ..... **C•1860-1862**

Local Sales Offices & Reps

CA Montrose, Roger D. Dahl 213-245-3817
CT Orange, KLS Sls. 203-795-6210
IL Northbrook, Jack Norlie Assocs. 312-498-3657
KS Shawnee Mission, B.C. Elctrn. Sls. 913-342-1211
NC Charlotte, QED 704-525-3053
PA Ligonier, Patterson Elec. 412-238-6238
WA Seattle, Comptronics 206-284-4842
WI Mequon, Robco 414-241-3348

molex®

MOLEX, INC., 2222 Wellington Ct., Lisle, IL 60532, Tel: 312-969-4550, TWX: 910-695-3227; Empl.: 4,100; *Sls. Mgr.:* Gregg Johnson; *Dist. Mgr.:* Bill Hyslop ... **B•1671; C•1463-1467**

Local Sales Offices & Reps

AL Huntsville, Dennis Andrew 404-396-6120
CA Costa Mesa, Molex 714-241-8588
CA Encino, Dow Lebowski 714-241-8588
CA Mission Viejo, Tony Scutetta 714-241-8588
CA San Diego, Al Batza 619-241-8588
CA Sunnyvale, Molex 408-773-0505
CT West Hartford, Randy Stone 617-935-8983
FL North Palm Beach, Chuck Vincent 404-396-6120
FL St. Petersburg, Molex 404-396-6120
GA Atlanta, Molex 404-396-6120
IN Connersville, George Allen 317-844-8986
IN Indianapolis, Steve Byrne 317-844-8986
KY Taylorsville, Jim Lieb 404-396-6120
MD Bethesda, Molex 404-396-6120
MA Mansfield, Paul Hansen 617-935-8983
MA Marblehead, Pete Evans 617-935-8983
MA Woburn, Molex 617-935-8983
MI Grand Rapids, Mark Fluga 616-957-1205
MI Royal Oak, Schwegman & Assocs. 313-542-6767
MN Edina, Mark Boe 612-893-9029
MO Gladstone, Mark Rider 818-737-9427
MO Independence, Dy-Tronix, Inc. 816-373-6600
NJ Washington, Oscar Cobian 201-267-8014
NY Webster, Joe Schmitt 716-223-6899
NC Raleigh, Molex, Inc. 404-396-6120
OR Lake Oswego, Gary Rohde 503-636-7558
PA Rosemont, Ed M. Sullivan 617-935-8983
TN Knoxville, Insul Reps. 615-691-7586
TX Austin, Daniel Daneff 512-453-1398
TX Dallas, Dale Otten 214-247-7117
TX Manchaca, Max Bassler 512-453-1398
UT West Valley, Thorson Rocky Mountain 801-973-7969
WA Redmond, Molex 206-881-2042
PR Hato Rey, Max Anderson Co. 809-751-2202

Local Distributors

AL Huntsville, Hamilton/Avnet 205-837-7210
AZ Tempe, Fisher Brownell 602-967-1464
AZ Tempe, Hamilton/Avnet 602-231-5100
AZ Tempe, Time Elctrns. Arizona 602-967-2000
AR Little Rock, Carlton-Bates 501-666-0206
CA Alhambra, Fisher Brownell 213-289-0255
CA Chatsworth, Diplomat 213-341-4411
CA Costa Mesa, Avnet Elctrns. 714-754-6111
CA Costa Mesa, Diplomat 714-549-8401
CA Costa Mesa, Hamilton Electro Sls. 714-641-4100
CA Culver City, Hamilton Electro Sls. 213-558-2121
CA Inglewood, Force Elctrns. 213-776-1324
CA Los Angeles, Richley/Western Elctrns. 213-820-3777
CA S. San Francisco, Peters-delaet 415-873-9595
CA San Diego, Diplomat 619-292-5693
CA San Diego, Fisher Brownell 619-560-8545
CA San Diego, Hamilton/Avnet 619-571-7510
CA San Diego, Richley/Western Elctrns. 619-271-4511
CA Santa Clara, Fisher Brownell 408-988-6041
CA Santa Clara, Force Elctrns. 408-739-1324
CA Santa Clara, Peters-de Laet 408-727-9440
CA Sunnyvale, Diplomat 415-964-1700
CA Sunnyvale, Hamilton/Avnet 408-743-3355
CA Sunnyvale, Time Northern Calif. 408-734-9888
CA Torrance, Time Elctrns. West 213-320-0880
CO Denver, Integrated Elctrns. 303-534-6121
CO Englewood, Hamilton/Avnet 303-740-1000
CO Wheat Ridge, Bell Inds. 303-424-1985
CT Bethel, Heilind Elctrns. 203-797-8600
CT Danbury, Hamilton/Avnet 203-797-2800
FL Ft. Lauderdale, Hamilton/Avnet 305-971-2900
FL Ft. Lauderdale, Time Elctrns. 305-974-4800
FL Pompano Beach, Comps. South 305-971-0350
GA Atlanta, Electro-Air Corp. 404-351-3545
GA Norcross, Hamilton/Avnet 404-447-7507
IL Bensenville, Hamilton/Avnet 312-860-7700
IL Chicago, Waldom Elctrns. 312-585-1212
IL Crystal Lake, Sub-Sem Elctrns. 815-459-4139
IL Mount Prospect, Magnuson Elctrns. 312-956-0700
IN Carmel, Hamilton/Avnet 317-844-9333
KS Overland Park, Hamilton/Avnet 913-888-8900
MD Columbia, Hamilton/Avnet 301-995-3500
MD Savage, Pyttronic Inds. 301-953-9650
MA Burlington, Heilind Elctrns. 617-272-5610
MA Canton, Impact Elctrns. 617-821-1500
MA Wilmington, RC Comps. 617-273-1860
MA Woburn, Hamilton/Avnet 617-273-7500
MA Woburn, Time New England 617-935-8080
MI Clawson, Empire Elctrns. 313-435-0460
MI Grand Rapids, Hamilton/Avnet 616-243-8805
MI Livonia, Hamilton/Avnet 313-522-4700
MI Wyoming, R-M Elctrns. Co. 616-531-9300
MN Minneapolis, Indl. Comps. 612-831-2666
MN Minnetonka, Hamilton/Avnet 612-932-0600
MO Earth City, Hamilton/Avnet 314-344-1200
MO St. Charles, Lectronix 800-325-3348
MO St. Louis, Time Elctrn./Midwest 314-391-6444
NE Lincoln, Scott Elctrns. 402-466-8221
NH Hudson, Heilind Elctrns. 603-883-9536
NJ Camden, Genral Radio Supp. Co. 609-964-8560
NJ Cherry Hill, Hamilton/Avnet 609-424-0100
NJ Clifton, J-Mar Elctrns. 201-772-6400
NJ Fairfield, Hamilton/Avnet 201-575-3390
NM Albuquerque, Hamilton/Avnet 505-765-1500
NY Buffalo, Summit Distrs. 716-884-3450
NY E. Syracuse, Hamilton/Avnet 315-437-2641
NY Hauppauge, Time Elctrns. Sls. 516-273-0100
NY Melville, Hamilton/Avnet 516-454-6060
NY Plainview, Progress Elctrns. 516-433-1700
NY Rochester, Hamilton/Avnet 716-475-9130
NC Raleigh, Hamilton/Avnet 919-829-8030
NC Raleigh, Resco 919-781-5700
OH Cleveland, Hamilton/Avnet 216-831-3500
OH Columbus, Camelot/Ohio 614-252-0728
OH Dayton, Hamilton/Avnet 513-433-0610
OH Dayton, Stotts-Friedman 513-298-5555
OH Wickliffe, Gateway Megatech 216-944-8565
OR Lake Oswego, Hamilton/Avnet 503-635-8157
PA Broomall, Time Mid-Atlantic 215-359-1200
PA McKean, Advacom 814-476-7774
PA Montgomeryville, Pyttronic Inds. 215-643-2850
TN Chattanooga, Techni-Tronics 615-875-5449
TX Austin, Hamilton/Avnet 512-837-8911
TX Houston, Hamilton/Avnet 713-780-1771
TX Irving, Hamilton/Avnet 214-659-4111
TX Richardson, Fisher Brownell 214-235-3177
UT Salt Lake City, Bell Inds. 801-972-6969
UT Salt Lake City, Hamilton/Avnet 801-972-2800
VA Lynchburg, Comps., United. 804-237-6286
WA Bellevue, Electro-Air NW 206-641-3640
WA Bellevue, Hamilton/Avnet 206-643-3950
WA Seattle, Radar Elec. 206-282-2511
WI New Berlin, Hamilton/Avnet 414-784-4510

MOLON MOTOR & COIL CORP., 3737 Industrial Ave., Rolling Meadows, IL 60008, Tel: 312-259-8700, TWX: 910-687-0428; Empl.: 350; *Sls. Mgr.:* J. Bailey

MONITOR LABS, INC., 10180 Scripps Ranch Blvd., San Diego, CA 92131, Tel: 619-578-5060, Telex: 182794

MONITOR PC

MONITOR PRODS. CO., INC., Post Office Box 1966, Oceanside, CA 92054, Tel: 619-433-4510, TWX: 910-322-1381; FSC No.: 54331; Empl.: 65; *Sls. Mgr.:* Patricia Courington ..... **A•1388-1391**

Local Sales Offices & Reps

AL Huntsville, CSR Elctrns. 205-533-2444
AZ Phoenix, Eltron 602-266-2164
CA Encino, Great American Rep Co. 818-990-4870
CA Los Altos, Elrepco 415-962-0660
CA San Diego, Rep Co. 619-292-9001
CA Tustin, Great American Rep. Co. 714-954-0371
CO Aurora, Electrodyne 303-695-8903
CT Southbury, Lindco Assocs. 203-264-7200
FL Apopka, Tech Rep Assocs. 305-889-2286
FL Ft. Lauderdale, Tech Rep Assocs. 305-476-7637
FL Lake Worth, Tech-Rep Assocs. 305-968-7792
FL St. Petersburg, Tech-Rep Assocs. 813-577-2779
GA Atlanta, CSR Elctrns. 404-396-3720
IL Downers Grove, Momak Sls. 312-963-6400
IA Davenport, Ensco Rep 319-386-6600
KS Overland Park, Ensco Rep 913-381-7557
KS Wichita, Ensco Rep 316-683-1070
MA Stow, Today Comps. Sls. 617-897-7500
MN Eden Prairie, Elctrn. Innovators 612-941-0830
MO Maryland Heights, Ensco Rep 314-423-3935
NY Melville, Parallax 516-351-1000
NC Matthews, CSR Elctrns. 704-847-1927
NC Raleigh, CSR Elctrns. 919-878-9200
OH Dayton, Berberich & Assocs. 512-433-0342
OR Hillsboro, Western Tech. Sls. 503-640-4621
PA Pittsburgh, Covert & Newman Co. 412-531-2002
TX Austin, Mil-Rep Assocs. 512-459-8602
TX Houston, Mil-Rep Assocs. 713-937-0127
TX Richardson, Mil-Rep Assocs. 214-644-6731
UT Salt Lake City, Electrodyne 801-486-3801
UT Salt Lake City, Electrodyne, Inc. 801-486-3801
VA Fairfax, Beacon North 703-591-1300
VA Forest, Beacon North 804-239-8486
WA Bellevue, Western Tech. Sls. 206-641-3900
WA Spokane, Western Tech. Sls. 509-922-7600
WI Mukwonago, Momak Sls. 414-363-7744

MONOLITHIC COMPONENTS CORP., 6828 Nancy Ridge Drive, San Diego, CA 92121, Tel: 619-457-1727

MONOLITHIC SYS., 84 Inverness Circle E., Englewood, CO 80112, Tel: 303-790-7400, Telex: 45-4498; Empl.: 100; *Sls. Mgr.:* Mike Hart

MONSANTO CO., 800 N. Lindbergh Blvd., St. Louis, MO 63167, Tel: 314-694-1000, Telex: 44-7282

MONSANTO-ELECTRONICS DIV., See General Instr., Optoelctrns. Div.

MONTEK MICROSYSTEMS, P.O. Box 1845, Huntsville, AL 35807, Tel: 205-723-2927; *Sls. Mgr.:* Paul Rainosek; *Dist. Mgr.:* Paul Rainosek

MOODY TOOLS, 43 Crompton Ave., E. Greenwich, RI 02818, Tel: 401-885-0911; Empl.: 11; *Sls. Mgr.:* J. H. Moody; *Dist. Mgr.:* D .H. Moody

Local Sales Offices & Reps

CA	Alamo, Magliano-Dodds-Evans-Hall	415-820-6395
CO	Denver, A-E-S	303-777-8733
FL	Winter Park, Floritronics	305-886-4818
IL	Palatine, Witz-Knight, Inc.	312-438-9030
MD	Baltimore, Coastline Sls. Co.	301-828-8520
NY	New York, Lane-Mizner Assocs.	212-8[illegible]-9711
NY	Orchard Park, S & B Indl. Sls.	716-662-5988
OH	St. Marys, Thomas Shelby & Co.	419-394-3377
RI	Barrington, Kilburn Assocs.	401-437-1839
EXP	IL, Northbrook, Vaco/Intl.	312-564-3300
Can	Islington, Ontario, Toolquip Agy. Ltd.	416-274-4918

MORRIS, J. I., CO., 372 Elm St., Southbridge, MA 01550, Tel: 617-764-4394; Empl.: 45

MORRIS ENTPRS., 16799 Schoenborn St, Sepulveda, CA 91343, Tel: 818-894-9103, Telex: 6-74681, TWX: 910-496-1525; FSC No.: 5491[illegible]; Empl.: 50; *Sls. Mgr.:* J. Dumpert

MOSS CO., See Electron General

MOTION CONTROL DEVICES, INC., 80 Stedman St., Lowell, MA 01851, Tel: 617-454-3407, Telex: 955318-INTL-DIV-ATTEN-MCD-I; Empl.: 25; *Sls. Mgr.:* Joe Laliberte

MOTOROLA INC., Auto. & Indl. Elctrns. Grp., 1299 E. Algonquin Rd., Schaumburg, IL 60196, Tel: 312-576-4850, Telex: 722443; *Sls. Mgr.:* Jay A. Bonk

MOTOROLA INC.

Component Products

MOTOROLA, INC., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, Tel: 312-451-1000, TWX: 910-227-0799; Empl.: 1400; *Sls. Mgr.:* Barnie Ill; *Dist. Mgr.:* Ted Hoffman ... **A•1392-1393**

Local Sales Offices & Reps

AL	Huntsville, R. O. Whitesell	205-883-5110
AZ	Scottsdale, Thorson Desert States	602-998-2444
AR	Ft. Smith, Electra Reps.	501-452-4030
CA	Campbell, Kottmeier Assocs.	408-866-5153
CA	Fullerton, Groh Assoc.	714-837-9871
CO	Englewood, Thorsen Co.	303-779-0666
FL	Clearwater, Perrott Assocs.	813-443-5414
FL	Orlando, Perrott Assocs.	305-298-7748
FL	Sunrise, Perrott Assocs.	305-792-2211
GA	Norcross, Glen White Assoc.	404-441-1447
IN	Fort Wayne, R. O. Whitesell	219-432-5591
IN	Indianapolis, R. O. Whitesell	317-359-9283
IA	Cedar Rapids, Comstrand	319-377-1575
MD	Timonium, Glen White Assoc.	301-252-6360
MA	Natick, Wayland Engrg. Sls.	617-655-6080
MI	Southfield, R. O. Whitesell Assoc.	313-559-5454
MI	St. Joseph, R. O. Whitesell Assoc.	616-983-7337
MN	Minneapolis, Comstrand	612-788-9234
MO	St. Louis, Abrams Assoc.	314-569-0447
NM	Albuquerque, Thorsen Desert States	505-293-8555
NY	Great Neck, Trionic Assoc.	516-466-2300
NY	Rochester, Ossmann Comp. Sls.	716-442-4460
NY	Syracuse, Ossmann Comp. Sls.	315-455-6611
NC	Raleigh, Glen White Assoc.	919-787-7016
OH	Cincinnati, R. O. Whitesell	513-521-2290
OH	Cleveland, R.O. Whitesell & Assoc.	216-447-9020
OH	Columbus, R. O. Whitesell	614-888-9396
OH	Dayton, R. O. Whitesell	513-298-9546
OK	Tulsa, H. J. Daly Co.	918-494-7711
OR	Tigard, Elctrn. Sources	503-684-0040
PA	Glenside, Koebert Assoc.	215-887-2310
PA	Pittsburgh, R. O. Whitesell	412-963-6161
TN	Gray, Glen White Assoc.	615-477-8850
TX	Dallas, Electra Reps.	214-387-3594
TX	Houston, Electra Reps.	713-530-2208
UT	West Valley City, Thorsen Co.	801-973-7969
VA	Colonial Beach, Glen White Assoc.	804-224-7764
VA	Lynchburg, Glen White Assoc.	804-237-6291
WA	Bellevue, Electronic Sources	206-451-2530
WI	Milwaukee, KMA Sls. & Co.	414-259-1771
EXP	IL, Franklin Pk., Motorola	312-451-1000

MOTOROLA INC.

MOTOROLA SEMICONDUCTOR PRODS. SECTOR, Adv. 72, Box 20912, Phoenix, AZ 85036, Tel: 602-244-6900, TWX: 910-951-1334; FSC No.: 04713; *Sls. Mgr.:* Brian Hilton; *Dist. Mgr.:* John Dunleavy ..... **A•1682-1692, 2066, 2077-2087; D•1098-1101**

Local Sales Offices & Reps

AL	Huntsville	205-830-1050
AZ	Phoenix	602-244-7100
CA	Agoura Hills	213-872-1505,818-706-1929
CA	Los Angeles	818-706-1929
CA	Orange	213-417-8848
CA	Sacramento	916-922-7152
CA	San Diego	619-560-4644
CA	San Jose	408-985-0510
CO	Colorado Springs	303-599-7404
CO	Denver	303-337-3434
CT	Wallingford	203-284-0810
DC	Washington	301-577-2600
FL	Casselberry/Maitland	305-831-3422
FL	Pompano Bch./Ft. Lauderdale	305-486-9775
FL	St. Petersburg	813-576-6030
GA	Atlanta	404-256-0222
IL	Chicago/Schaumburg	312-576-7800
IN	Ft. Wayne	219-484-0436
IN	Indianapolis	317-849-7060
IN	Kokomo	317-457-6634
IA	Cedar Rapids	319-373-1328
KS	Kansas City/Mission	913-384-3050
MD	Hyattsville	301-577-2600
MA	Berlin	617-562-3856
MA	Burlington	617-273-5020
MI	Detroit/Westland	313-261-6200
MN	Minneapolis	612-941-6800
MO	St. Louis	314-872-7681
NJ	Hackensack	201-488-1200
NY	Fairport	716-425-4000
NY	Hauppauge	516-361-7000
NY	Poughkeepsie/Fishkill	914-473-8102
NC	Raleigh	919-876-6025
OH	Cleveland	216-461-3160
OH	Columbus/Worthington	614-846-9460
OH	Dayton	513-294-2231
OR	Portland	503-641-3681
PA	Philadelphia/Horsham	215-443-9400
TN	Knoxville	615-690-5592
TX	Austin	512-452-7673
TX	Dallas	214-699-3900
TX	Houston	713-783-6400
UT	Salt Lake City	801-539-1190
VA	Charlottesville	804-977-3691
WA	Bellevue	206-454-4160
WA	Seattle Access	206-622-9960
WI	Milwaukee/Wauwatosa	414-476-5554

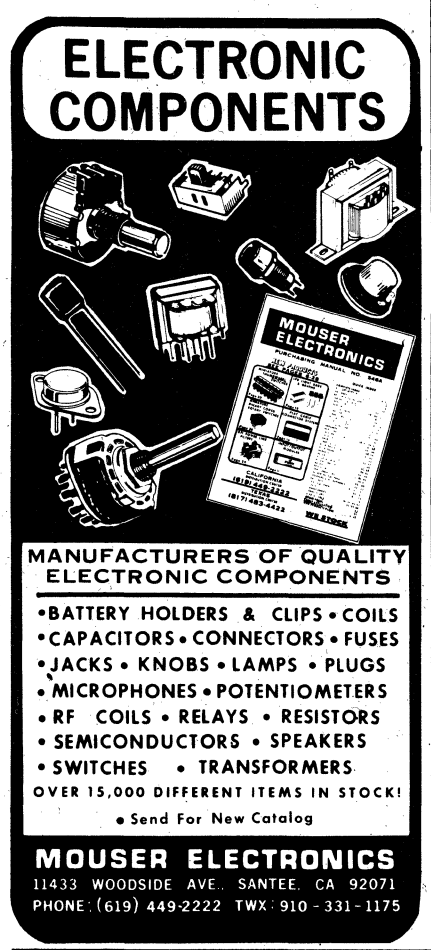
Motorola Systems Reps.

AL	Huntsville, EMA	205-830-4030
CT	Torrington, Northern Computer Sls.	203-482-3007
GA	Atlanta, EMA	404-329-0530
MA	Westwood, Northern Computer Sls.	617-326-3454
MN	Minneapolis, P.S.I. Co.	612-944-8545
NC	Raleigh, EMA	919-781-9369
OR	Beaverton, Thorson Co. Northwest	503-644-5900
PA	King of Prussia, K.S.I.	215-783-6440
WA	Bellevue, Thorson Co. Northwest	206-455-9180

Local Distributors

AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AL	Huntsville, Hamilton/Avnet Elctrns.	205-837-7210
AL	Huntsville, Pioneer/Huntsville	205-837-9300
AL	Huntsville, Schweber Elctrns.	205-882-2200
AZ	Phoenix, Hall-Mark Elctrns.	602-437-1200
AZ	Phoenix, Kierulff Elctrns.	602-437-0750
AZ	Phoenix, Schweber Elctrns.	602-997-4874
AZ	Tempe, Anthem Elctrns.	602-966-6600
AZ	Tempe, Hamilton/Avnet Elctrns.	602-231-5100
CA	Anaheim, Zeus Comps. West	714-632-6880
CA	Canoga Park, Hall-Mark Elctrns.	818-716-7300
CA	Canoga Park, Schweber Elctrns.	213-999-4702
CA	Chatsworth, Anthem Elctrns.	818-700-1000
CA	Chatsworth, Avnet Elctrns.	818-700-2600
CA	Chatsworth, Hamilton Electro Sls.	818-700-6500
CA	Chatsworth, Kierulff Elctrns.	213-341-2211
CA	Costa Mesa, Avnet	714-754-6111
CA	Costa Mesa, Hamilton Electro Sls.	714-641-4100
CA	Culver City, Hamilton Electro Sls./L.A.	213-558-2501
CA	Culver City, Hamilton/Avnet	213-558-2323
CA	Cypress, Kierulff Elctrns.	714-220-6300
CA	El Segundo, Hall-Mark Elctrns.	213-643-9101
CA	Irvine, Schweber Elctrns.	213-537-4321
CA	Irvine, Schweber Elctrns.	213-537-4321, 714-863-0200
CA	Los Angeles, Kierulff Elctrns.	213-725-0325
CA	Ontario, Hamilton/Avnet Elctrns.	714-989-4602
CA	Roseville, Bell Inds.	916-969-3100
CA	Sacramento, Hamilton/Avnet Elctrns.	916-925-2216
CA	Sacramento, Schweber Elctrns.	916-929-9732
CA	San Diego, Anthem Elctrns.	619-270-5200
CA	San Diego, Hall-Mark Elctrns.	619-268-1201
CA	San Diego, Hamilton/Avnet Elctrns.	619-571-7510
CA	San Diego, Kierulff Elctrns.	619-278-2112
CA	San Diego, Schweber Elctrns.	619-450-0454
CA	San Jose, Anthem Elctrns.	408-946-8000
CA	San Jose, Future Elctrns.	408-945-9100
CA	San Jose, Hall-Mark Elctrns.	408-773-9990
CA	San Jose, Kierulff Elctrns.	408-971-2600
CA	Santa Clara, Schweber Elctrns.	408-748-4700
CA	Santa Clara, Zeus Comps.	408-727-0714
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Sunnyvale, Hamilton/Avnet Elctrns.	408-743-3360
CA	Torrance, Hamilton/Avnet Elctrns.	213-615-3900
CA	Tustin, Anthem Elctrns.	714-730-8000
CA	Tustin, Hall-Mark Elctrns.	714-586-9346
CA	Tustin, Kierulff Elctrns.	714-731-5711
CA	Woodland Hills, Hamilton/Avnet Elctrns.	818-887-2353
CO	Denver, Kierulff Elctrns.	303-790-4444
CO	Englewood, Anthem Elctrns.	303-790-4500
CO	Englewood, Hall-Mark Elctrns.	303-694-1662
CO	Englewood, Hamilton/Avnet Elctrns.	303-740-1000
CO	Westminster, Future Elctrns.	303-650-0123
CO	Wheatridge, Bell Inds.	303-424-1985
CT	Danbury, Future Elctrns.	203-743-9594
CT	Danbury, Hamilton/Avnet Elctrns.	203-797-2800
CT	Danbury, Schweber Elctrns.	203-792-3500
CT	Norwalk, Pioneer-Harvey/Norwalk	203-853-1515
CT	Wallingford, Kierulff Elctrns.	203-265-1115
CT	West Hartford, Hartford Elec. Supp. Co.	203-236-6171
FL	Altamonte Springs, Pioneer/Florida	305-834-9090
FL	Altamonte Springs, Schweber Elctrns.	305-331-7555
FL	Bradenton, Zeus Comps.	813-748-3125
FL	Clearwater, Future Elctrns.	813-441-4771
FL	Ft. Lauderdale, Hamilton/Avnet Elctrns.	305-971-2900
FL	Ft. Lauderdale, Kierulff Elctrns.	305-486-4004
FL	Ft. Lauderdale, Pioneer/Ft. Lauderdale	305-428-8877
FL	Hollywood, Schweber Elctrns.	305-927-0511
FL	Orlando, Hall-Mark Elctrns.	305-855-4020
FL	Orlando, Hamilton/Avnet Elctrns.	305-628-3888
FL	Pompano Beach, Hall-Mark Elctrns.	305-971-9280
FL	St. Petersburg, Hall-Mark Elctrns.	813-530-4543
FL	St. Petersburg, Hamilton/Avnet Elctrns.	813-576-3930
FL	St. Petersburg, Kierulff Elctrns.	813-576-1966
FL	Winter Park, Hall-Mark Elctrns.	305-628-3888
GA	Norcross, Hall-Mark Elctrns.	404-447-8000
GA	Norcross, Hamilton/Avnet Elctrns.	404-447-7507
GA	Norcross, Kierulff Elctrns.	404-447-5252
GA	Norcross, Pioneer/Atlanta	404-448-1711
GA	Norcross, Schweber Elctrns.	404-449-9170
IL	Schaumburg, Future Elctrns.	312-882-1255
IL	Bensenville, Hall-Mark Elctrns.	312-860-3800
IL	Bensenville, Hamilton/Avnet Elctrns.	312-860-7700
IL	Chicago, Bell Inds.	312-982-9210
IL	Chicago, Newark Elctrns. Corp.	312-784-5100
IL	Elk Grove Village, Kierulff Elctrns.	312-640-0200
IL	Elk Grove Village, Pioneer/Chicago	312-437-9680
IL	Elk Grove Village, Schweber Elctrns.	312-364-3750
IN	Indianapolis, Graham Elctrns. Supp.	317-634-8208
IN	Indianapolis, Hamilton/Avnet Elctrns.	317-844-9333
IN	Indianapolis, Pioneer/Indiana	317-849-7300
IA	Cedar Rapids, Bell Elctrns.	319-395-0730
IA	Cedar Rapids, Hamilton/Avnet Elctrns.	319-362-4757
IA	Cedar Rapids, Schweber Elctrns.	319-373-1417
KS	Lexena, Hall-Mark Elctrns.	913-888-4747
KS	Overland Park, Schweber Elctrns.	913-492-2921
KS	Overland Pk., Hamilton/Avnet Elctrns.	913-888-8900
LA	New Orleans, Reily Elctrl. Supp.	504-897-2211
MD	Baltimore, Hall-Mark Elctrns.	301-796-9300
MD	Baltimore, Kierulff Elctrns.	301-636-5800
MD	Columbia, Future Elctrns.	301-995-1222
MD	Columbia, Hall-Mark Elctrns.	301-988-9800
MD	Columbia, Hamilton/Avnet Elctrns.	301-995-3500
MD	Gaithersburg, Pioneer/Washington	301-921-0660
MD	Gaithersburg, Schweber Elctrns.	301-840-5900
MA	Bedford, Schweber Elctrns.	617-275-5100
MA	Billerica, Hall-Mark Elctrns.	617-935-9777
MA	Billerica, Kierulff Elctrns.	617-667-8331
MA	Burlington, Lionex Corp.	617-272-9400
MA	Lexington, Pioneer	617-861-9200
MA	Lexington, Zeus Comps.	617-273-0750
MA	Westborough, Future Elctrns.	617-366-2400
MA	Wilmington, Lionex Corp.	617-657-5170
MA	Woburn, Hamilton/Avnet Elctrns.	617-273-7500
MI	Grand Rapids, Hamilton/Avnet Elctrns.	616-243-8805
MI	Livonia, Hamilton/Avnet Elctrns.	313-522-4700
MI	Livonia, Pioneer/Michigan	313-525-1800
MI	Livonia, RS Elctrns.	313-525-1155
MI	Livonia, Schweber Elctrns.	313-525-8100
MI	Madison Hgts., McNaughton-McKay Elec. Co.	313-399-7500
MN	Bloomington, Hall-Mark Elctrns.	612-854-3223
MN	Edina, Kierulff Elctrns.	612-941-7500
MN	Edina, Schweber Elctrns.	612-941-5280
MN	Minnetonka, Hamilton/Avnet Elctrns.	612-932-0600
MN	Minnetonka, Pioneer/Twin Cities	612-935-5444
MO	Earth City, Hall-Mark Elctrns.	314-291-5350

MO Earth City, Hamilton/Avnet Elctrns. ... 314-344-1200
MO Earth City, Schweber Elctrns. ... 314-739-0526
MO Maryland Hgts., Kierulff Elctrns. ... 314-739-0855
NH Manchester, Hamilton/Avnet Elctrns.... 603-624-9400
NJ Cherry Hill, Hall-Mark Elctrns. ... 609-424-7300
NJ Cherry Hill, Hamilton/Avnet Elctrns. ... 609-424-0110
NJ Fairfield, Hall-Mark Elctrns. ... 201-575-4415
NJ Fairfield, Hamilton/Avnet Elctrns. ... 201-575-3390
NJ Fairfield, Kierulff Elctrns. ... 201-575-6750
NJ Fairfield, Schweber Elctrns. ... 201-227-7880
NJ Mount Laurel, Future Elctrns. ... 609-778-7600
NJ Pinebrook, Pioneer-Harvey/Pinebrook . 201-575-3510
NM Albuquerque, Alliance Elctrns. ... 505-292-3360
NM Albuquerque, Bells Inds. ... 505-292-2700
NM Albuquerque, Hamilton/Avnet Elctrns.. 505-765-1500
NY Binghamton, Pioneer-Harvey/Binghamton ... 607-748-8211
NY E. Syracuse, Hamilton/Avnet Elctrns. .. 315-437-2641
NY Fairport, Pioneer-Harvey/Rochester .. 716-381-7070
NY Hauppauge, Lionex Corp. ... 516-273-1660
NY Hauppauge, Pioneer/Military ... 516-231-9800
NY Liverpool, Future Elctrns. ... 315-451-2371
NY Port Chester, Zeus Comps. ... 914-937-7400
NY Rochester, Hamilton/Avnet Elctrns. ... 716-475-9130
NY Rochester, Schweber Elctrns. ... 716-424-2222
NY Vestal, Pioneer Elctrns. ... 607-748-8211
NY Westbury, Schweber Elctrns. ... 516-334-7474
NY Woodbury, Pioneer-Harvey/Woodbury. 516-921-8700
NC Charlotte, Pioneer/Carolina ... 704-526-8188
NC Raleigh, Hall-Mark Elctrns. ... 919-872-0712
NC Raleigh, Hamilton/Avnet Elctrns. ... 919-878-0810
NC Raleigh, Kierulff Elctrns. ... 919-872-8410
NC Raleigh, Schweber Elctrns. ... 919-876-0000
OH Beachwood, Schweber Elctrns. ... 216-464-2970
OH Centerville, Hamilton/Avnet Elctrns. ... 513-439-6700
OH Cincinnati, Graham Elctrns. ... 513-772-1661
OH Cincinnati, Hall-Mark Elctrns. ... 513-563-5980
OH Cleveland, Hall-Mark Elctrns. ... 216-349-4632
OH Cleveland, Hamilton/Avnet Elctrns. ... 216-831-3500
OH Cleveland, Kierulff Elctrns. ... 216-587-6558
OH Cleveland, Pioneer/Cleveland ... 216-587-3600
OH Columbus, Hamilton/Avnet Elctrns. ... 614-882-7004
OH Dayton, Pioneer/Dayton ... 513-236-9900
OH Dayton, Schweber Elctrns. ... 513-439-1800
OH Westerville, Hall-Mark Elctrns. ... 614-891-4555
OH Westerville, Hamilton/Avnet Elctrns. .. 614-882-7004
OK Tulsa, Hall-Mark Elctrns. ... 918-665-3200
OK Tulsa, Kierulff Elctrns. ... 918-252-7537
OK Tulsa, Schweber Elctrns. ... 918-622-8000
OR Beaverton, Almac Elctrns. Corp. ... 503-641-9070
OR Lake Oswego, Anthem Elctrns. ... 503-684-2661
OR Lake Oswego, Hamilton/Avnet Elctrns.. 503-635-8831
OR Portland, Kierulff Elctrns. ... 503-641-9150
PA Horsham, Lionex Corp. ... 215-442-5150
PA Horsham, Pioneer/Delaware Valley ... 215-674-4000
PA Horsham, Schweber Elctrns. ... 215-441-0600
PA Pittsburgh, Hamilton/Avnet Elctrns. ... 412-281-4150
PA Pittsburgh, Pioneer/Pittsburgh ... 412-782-2300
PA Pittsburgh, Schweber Elctrns. ... 412-782-1600
TX Austin, Hall-Mark Elctrns. ... 512-258-8848
TX Austin, Hamilton/Avnet Elctrns. ... 512-837-8911
TX Austin, Kierulff Elctrns. ... 512-835-2090
TX Austin, Pioneer/Austin ... 512-835-4000
TX Austin, Schweber Elctrns. ... 512-458-8253
TX Dallas, Hall-Mark Corp. ... 214-343-5000
TX Dallas, Hall-Mark Elctrns. ... 214-341-1147
TX Dallas, Kierulff Elctrns. ... 214-343-2400
TX Dallas, Pioneer/Dallas ... 214-386-7300
TX Dallas, Schweber Elctrns. ... 214-661-5010
TX Houston, Hall-Mark Elctrns. ... 713-781-6100
TX Houston, Hamilton/Avnet Elctrns. ... 713-780-1771
TX Houston, Kierulff Elctrns. ... 713-530-7030
TX Houston, Pioneer/Houston ... 713-988-5555
TX Houston, Schweber Elctrns. ... 713-784-3600
TX Irving, Hamilton/Avnet Elctrns. ... 214-659-4111
UT Salt Lake City, Anthem Elctrns. ... 801-973-8555
UT Salt Lake City, Bell Inds. ... 801-972-6969
UT Salt Lake City, Hamilton/Avnet Elctrns. 801-972-2800
UT Salt Lake City, Kierulff Elctrns. ... 801-973-6913
WA Bellevue, Almac Elctrns. Corp. ... 206-643-9992
WA Bellevue, Hamilton/Avnet Elctrns. ... 206-643-3950
WA Redmond, Anthem Elctrns. ... 206-881-0850
WA Tukwila, Kierulff Elctrns. ... 206-575-4420
WI Brookfield, Schweber Elctrns. ... 414-784-9020
WI New Berlin, Hamilton/Avnet Elctrns. .. 414-784-4510
WI Oak Creek, Hall-Mark Elctrns. ... 414-761-3000
WI Waukesha, Bell Inds. ... 414-784-0235
WI Waukesha, Kierulff Elctrns. ... 414-784-8160



MOTOR-TRONICS, INC., 2142 Industrial Ct., Bldg. 'F', Vista, CA 92083, Tel: 619-727-7430; *Sls. Mgr.:* Bill Linko ... **B•1176-1177**

MOTRONICS CORP., Riverside Indl. Pk., Little Falls, NY 13365, Tel: 315-823-4050; Empl.: 90; *Sls. Mgr.:* Otto Demuth

Local Sales Offices & Reps

CA Chatsworth, Motion Tech., Inc. ... 818-993-3762
CO Englewood, Integrated Motion Sys. ... 303-762-1817
IL Schaumburg, Gassner & Clark Co. ... 312-882-8608
IN Beech Grove, Control Sls. ... 317-353-6094
KS Shawnee Mission, L.S.C., Inc. ... 913-362-2121
MA Southborough, Motion Engrg. ... 617-485-2144
MI Livonia, Electrolines ... 313-591-2428
MN St. Paul, Northstar Motion & Cont. Co... 612-770-5311
NY Clark Mills, KLM Garner ... 315-853-6126
OH Cleveland, KT/Depco ... 216-442-6200
PA Audubon, Holmes Assocs. ... 215-666-0636
PA Pittsburgh, Greye Glass Assocs. ... 412-366-6664
TX Dallas, Blackburn Assocs., Inc. ... 214-692-8885
VA Roanoke, Engrg. & Mktg. Corp. of Vir. .. 703-986-1410
WA Bellevue, Al Smith Co. ... 206-746-6770
WI Milwaukee, Schreiber-Arterburn ... 414-545-7800

MOUSER ELECTRONICS, 11433 Woodside Ave., Santee, CA 92071, Tel: 619-449-2222, TWX: 910-331-1175; Empl.: 200; *Sls. Mgr.:* Jerry Tallent

MOUSER ELECTRONICS, 2401 Hwy. 287 North, Mansfield, TX 76063, Tel: 817-483-4422

MOUSE SYS. CORP., 2336H Walsh Ave., Santa Clara, CA 95051, Tel: 408-988-0211, Telex: 467848; *Sls. Mgr.:* Evelyn Boyd; *Dist. Mgr.:* Barbara Marsh-Wetherell

moxness products, inc.

MOXNESS PRODUCTS, INC., Versa Technologies, 1914 Indiana St., Racine, WI 53405, Tel: 414-554-5050, 800-558-5706; Empl.: 300; *Sls. Mgr.:* Thomas D. Hynes; *Dist. Mgr.:* Thomas D. Hynes ... **B•1734**

Local Sales Offices & Reps

CA Clayton, Moxness Prods., Inc. ... 415-672-9213
CA Escondido, Estco Entprs ... 619-489-8746
FL Clearwater, Frisby, Inc. ... 813-461-6055
GA Lilburn, R. L. Panyik & Assocs. ... 404-923-3703
IN Indianapolis, Elctrn. Sls. & Engrg. ... 317-849-4260
MA Framington, Petri & Jones ... 617-877-4233
NY Rochester, Empire Indl. Sls. Co., Inc. .. 716-244-9540
NC Cary, Moxness Prods., Inc. ... 919-467-2042
OH Xenia, Moxness Prods., Inc. ... 513-372-7334
WI Racine, Moxness Prods., Inc. ... 414-554-5050

MOXON INC., See Kode

MPB CORP., Precision Park, Keene, NH 03431, Tel: 603-352-0310, TWX: 710-366-1801; Empl.: 1600; *Dist. Mgr.:* Jack E. Barker

MPC SYS., Div. of Consulting Systems, RFD Box 441, Fremont, NH 03044, Tel: 603-642-5913; *Sls. Mgr.:* W. Morse

MPH ELCTRNS., 2660 Loma Ave., S. El Monte, CA 91733, Tel: 213-442-7818; *Sls. Mgr.:* A. Pastecci

MPI, 4426 S. Century Dr., Salt Lake City, UT 84107, Tel: 800-821-8848; *Sls. Mgr.:* Jamie Johnston

MPS CO., 8 N. Grant Dr., Addison, IL 60101, Tel: 312-543-1748; Empl.: 2; *Sls. Mgr.:* M. C. Mitchell

MSC PRODS./EATON CORP., 1640 Monrovia St., Costa Mesa, CA 92627, Tel: 714-642-2427, Telex: 67-8433; Empl.: 350 + ; *Sls. Mgr.:* J. McDorough

MSI DATA CORP., 340 Fischer Ave., Costa Mesa, CA 92626, Tel: 714-549-6000, TWX: 910-595-1719; Empl.: 700; *Sls. Mgr.:* J. Falvey; *Dist. Mgr.:* S. Altice

MSI ELECTRONICS, INC., 34-32 57th St., Woodside, NY 11377, Tel: 212-672-6500, Telex: 426407; FSC No.: 18518; Empl.: 26; *Sls. Mgr.:* A. Lederman

MSS/MACINTOSH SOFTWARE, 170 West 73rd St. Ste 12C, New York, NY 10023, Tel: 212-799-8195; *Sls. Mgr.:* David H. M. Spector

MTE CORP., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, Tel: 414-358-5300, 800-558-4332 ... **A•2199**

Local Sales Offices & Reps

AZ Tempe, EDS ... 602-438-1547
CA Danville, Bontrol Sys. ... 415-838-8540
CA San Diego, OMNI ... 619-268-9606
CA Santa Ana, El-Mar ... 714-547-8933
CO Englewood, C. M. Mktg. ... 303-850-9841
CT Avon, Tom Maguire Assocs. ... 203-673-3019
FL Casselberry, Southern Elctrn. Mktg. ... 305-831-2822
FL Ft. Lauderdale, Southern Elctrn. Mktg. ... 305-475-3686
FL Palm Harbor, Southern Elctrn. Mktg. .. 813-441-3902
GA Atlanta, Grady-Duckett ... 404-451-3529
IL Glencoe, Howard Benjamin Assocs. .. 312-835-0150
IN Carmel, Technology Mktg. ... 317-844-8462
IN Ft. Wayne, Technology Mktg. ... 219-432-5553
IA Cedar Rapids, Palatine Engrg. ... 319-365-8071
KY Louisville, Technology Mktg. ... 502-499-7808
MD Glen Arm, Rick Volk, Inc. ... 301-592-7154
MA Wellesley, Tom Maguire Assocs. ... 617-431-1120
MI Birmingham, Favco ... 313-644-0173
MI Grand Rapids, Favco ... 616-459-4425
MN Bloomington, Kettner & Assocs. ... 612-884-4343
MO Hazelwood, Palatine Engrg. ... 314-839-0800
MT Blue Springs, Palatine Engrg. ... 816-229-4007
NH Windham, Tom Maguire Assocs. ... 603-432-0363
NJ Marlton, BGR Assocs. ... 609-983-1020
NY Ridgewood, Ballou, Inc. ... 201-444-6990
OH Dayton, Electro-Com ... 513-898-5140
OK Tulsa, Components, Inc. ... 918-583-9149
TX Austin, R. F. Kimball Co., Inc. ... 512-443-5284
TX Houston, R. F. Kimball Co., Inc. ... 713-840-0590
TX Richardson, R. F. Kimball Co., Inc. ... 214-231-3447
WA Mukilteo, Robert Krippner ... 206-743-3579
WI Milwaukee, Kettner & Assocs. ... 414-351-3584

M-TRON INDS., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, Tel: 605-665-9321, TWX: 910-668-3603; Empl.: 125; *Sls. Mgr.:* Mike Huennekens; *Dist. Mgr.:* Karen Hansen ... **A•1395**

Local Sales Offices & Reps

AL Huntsville, 20th Century Mktg. ... 205-533-9281
AZ Tempe, SSA Sales ... 602-829-9338
CA Mountain View, Taarcom ... 415-960-1550
CA San Diego, Bestronics ... 619-693-1111
CA Thousand Oaks, SC Cubed ... 805-496-7307
CA Tustin, SC Cubed ... 714-731-9206
CO Littleton, Simpson Assoc. ... 303-794-8381
CT Ridgefield, Phoenix Sls. ... 203-438-9644
FL Apopka, G.F. Bohman ... 305-886-1882
FL Ft. Lauderdale, Bohman Assoc. ... 305-979-0008
FL St. Petersburg, G F Bohman ... 813-522-6120
GA Athens, ADI ... 404-548-0788

GA Norcross, 20th Century 404-446-1999
IL Arlington Hgts., Micro Sls. 312-956-1000
IN Fort Wayne, Given Corp. 219-432-5585
IA West Des Moines, SPS Assoc. 515-225-0607
KS Olathe, SPS Assoc. 913-764-4460
MD Ellicott City, Marketing Tech Inc. 301-465-5944
MA Needham Heights, Kanan 617-449-7400
MI Detroit, Rathsburg Assoc. 313-882-1717
MN Bloomington, Com-Tek Sls. 612-888-7011
MO St. Ann, SPS Assoc. 314-739-4468
NE Panama, SPS Assoc. 913-764-4460
NJ Englewood, Sprung/Nussbaum 201-569-5666
NJ Marlton, BGR 609-983-1020
NM Albuquerque, SSA 505-881-8877
NY Rochester, Ontec Sales 716-464-8636
NC Smithfield, ADI 919-934-8136
OH Dayton, Lyons Corp. 513-278-0714
OH Richfield, Lyons Corp. 216-659-9224
SC Fort Mill, ADI 803-547-2115
TN Knoxville, 20th Century 615-966-3608
TN Memphis, 20th Century 901-756-4681
TX Austin, Mech-Tron Mktg. 512-459-0802
TX Houston, Mech-Tron Mktg. 713-462-1432
TX Richardson, Mech-Tron Mktg. 214-437-4833
UT Midvale, Simpson Assoc. 801-566-3691
VA Lynchburg, Marketing Tech Inc. 804-384-6459
WA Redmond, Quadra Sls. 206-883-3550
WI Menominee, Micro Sales Inc. 414-251-0151
Can Mississaqua, Ontario, John Weiss Co. 416-673-0011
Can Nepean, Ontario, John Weiss Co. 613-726-1436
Can St. Laurent, Quebec, John Weiss Co. 154-337-5022
Can Winnipeg, Manitoba, John Weiss Co. 204-774-2119

Local Distributors

AL Huntsville, Pioneer Elctrns. 205-837-9300
AZ Phoenix, Sterling Elect. 602-268-2121
AZ Phoenix, Wyle Distr. Grp. 602-249-2232
AZ Tempe, Bell Inds. 602-966-7800
AR Little Rock, Carlton-Bates 501-562-9100
CA Aquara, Wyle 818-880-9000
CA Fullerton, Pyramid Elctrns. 714-773-0781
CA Irvine, Ryno Elctrns. 714-261-2500
CA Irvine, Wyle 714-863-9953
CA Rancho Cordova, Wyle 916-638-5282
CA San Diego, Ryno Elctrns. 619-453-8430
CA San Diego, Wyle 619-565-9171
CA San Jose, Capacitors Unltd. 408-946-7676
CA Santa Clara, Pyramid 408-727-9810
CA Santa Clara, Wyle Distr. Grp. 408-727-2500
CA Tustin, Image Elctrns. 714-730-0303
CO Thornton, Wyle Distr. Grp. 303-457-9953
CO Wheatridge, Bell Inds. 303-424-1985
CT E. Haven, J. V. Elctrns. 203-469-2321
CT Norwalk, Pioneer Elctrns. 203-853-1515
CT Orange, Milgray Elctrns. 203-795-0711
CT Wallingford, Mid-State Elect. 203-265-9900
FL Altamonte Springs, Pioneer 305-834-9090
FL Deerfield Beach, Pioneer Elctrns. 305-428-8877
FL Winter Park, Milgray Elctrns. 305-647-5747
GA Atlanta, Milgray 404-393-9666
GA Norcross, Pioneer Elctrns. 404-448-1711
IL Elk Grove, Pioneer Elctrns. 312-437-9680
IL Hoffman Estates, Inter Comp 312-843-2040
IN Indianapolis, Advent 317-872-4910
IN Indianapolis, Pioneer/IN 317-849-7300
IA Cedar Rapids, Advent 319-363-0221
KS Overland Park, Milgray Elctrns. 913-236-8800
MD Beltsville, Resco/Wash. 301-937-9100
MD Gaithersburg, Pioneer 301-921-0660
MD Rockville, Milgray Elctrns. 301-468-6400
MD White Marsh, Resco Washington 301-529-0500
MA Burlington, Milgray Elctrns. 617-272-6800
MA Lexington, Pioneer Elctrns. 617-861-9200
MA Wilmington, J.V. Elctrns. 617-273-4300
MA Woburn, 1st Frequency 617-935-3885
MI Farmington Hills, Advent Elec. 313-477-1650
MI Livonia, Pioneer Elctrns. 313-525-1800
MI Livonia, RS Elctrns. 313-525-1155
MN Bloomington, NWR 612-854-7329
MN Hibbing, NWR Elec. 218-262-5228
MN Minneapolis, Stark Elec. 612-332-1325
MN Minnetonka, Pioneer 612-935-5444
MO St Louis, Ric-tronics 314-576-9816
MO St. Louis, Olive Elctrns. 314-426-4500
NJ Berlin, GCI 609-768-6767
NJ Marlton, Milgray Elctrns. 609-983-5010
NJ Mt. Laurel, P.A.C. Elctrns. 609-387-3549
NJ Pinebrook, Pioneer Elctrns. 201-575-3510
NM Albuquerque, Sterling Elect. 505-884-1900
NY Binghamton, Pioneer Elctrns. 607-748-8211
NY Fairport, Pioneer 716-381-7070
NY Farmingdale, Milgray Elctrns. 516-420-9800
NY Pittsford, Milgray 716-385-9330
NY Woodbury, Pioneer Elctrns. 516-921-8700
NC Charlotte, Pioneer Elctrns. 704-527-8188
NC Raleigh, Century Elctrns. 918-872-2203
OH Cleveland, Milgray Elctrns. 216-447-1520
OH Cleveland, Pioneer Elctrns. 216-587-3600
OH Dayton, Pioneer Elctrns. 513-236-9900
OH Maumee, RS Elec. 419-893-0721
OK Oklahoma City, Radio Inc. 405-789-0741
OK Tulsa, Altair 918-252-5781
OK Tulsa, Radio Inc. 918-587-9123
OR Hillsboro, Wyle Distr. Grp. 503-640-6000
PA Horsham, Pioneer Elctrns. 215-674-4000
PA Norristown, Century Elec. 215-631-5400
PA Pittsburgh, Pioneer Elctrns. 412-782-2300
TX Austin, Altair 512-837-4970
TX Austin, Pioneer 512-835-4000
TX Austin, Wyle Distr. 512-834-9957
TX Dallas, Pioneer Elctrns. 214-386-7300
TX Houston, Altair 713-462-3029
TX Houston, Force Elec. 713-561-8644
TX Houston, Pioneer 713-988-5555
TX Houston, Wyle Laboratories 713-879-9953
TX Irving, Force Elec. 214-438-5700
TX Richardson, Altair 214-231-5166
TX Richardson, Wyle Electric 214-235-9953
UT Salt Lake City, Standard Supp. 801-486-3371
UT Salt Lake City, Wyle Distr. Grp. 801-974-9953
VT Richmond, Sterling Elect. 804-226-2190
WA Bellevue, Wyle Distr. Grp. 206-453-8300
WA Kent, Pyramid Elec. 206-872-5800
WI Milwaukee, Marsh Elect. 414-475-6000
Can Burnaby, BC, R-A-E Ltd / Camgaard 604-291-8866
Can Edmonton, ALB., Cardinal Elec. 403-483-6266
Can Montreal, PQ, Prelco Ltd. 514-389-8051
Can Oakville, ONT., L.A. Varah Ltd. 416-842-8484
Can Willowdale, Ontario, Electro Sonic 416-494-1666

MTS SYS., Box 24012, Minneapolis, MN 55424, Tel: 612-937-4000, Telex: 29-0521; Empl.: 1100; *Sls. Mgr.:* J. Beal

MU-DEL ELECTRONICS, INC., 2426 Linden Lane, Silver Spring, MD 20910-1288, Tel: 301-587-6087, Telex: 292038; FSC No.: 31563; Empl.: 8; *Sls. Mgr.:* Heinz E. Blum

MUELLER ELEC. CO., 1583 E 31st St., Dept. 20, Cleveland, OH 44114, Tel: 216-771-5225; Empl.: 156; *Sls. Mgr.:* J. E. Wisneski ..... **C•1468-1472**

Local Sales Offices & Reps

AZ Phoenix, The Health Grp. 602-247-9091
CA Cambell, Olsheski & Assoc. Inc. 408-378-6003
CA Downey, Ungar Sls. Assoc. 213-923-1467
CA Gardena, Ungar Sls. Assoc. 213-538-2811
CA W. Covina, Ungar Sls. Assoc. 213-339-1052
CO Colorado Springs, Norris & Warren 303-576-8697
FL Tampa, Palm State Mktg. Inc. 813-888-6316
GA Stone Mountain, Mfg. Sls. & Mktg. Serv. 404-469-5862
IL Libertyville, Raymond Klipp Assoc. 312-367-4676
IN Indianapolis, John Sukup, Inc. 317-253-5501
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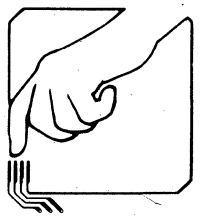

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IN	Kokomo, Jack Harvey & Assocs.	317-453-4260
KY	Prospect, Jack Harvey & Assocs.	502-228-4100
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MI	Southfield, Jack Harvey & Assocs.	313-569-4477
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CA	San Diego, Diplomat Elctrns.	619-292-5693
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NATIONAL SEMICONDUCTOR OPTOELECTRONICS, 365 Jordan Road, Troy, NY 12180-8396, Tel: 518-271-2100, TWX: 710-444-4962; *Dist. Mgr.:* Donna McLaughlin

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CA San Diego, Nicolet Instr. 619-454-6274
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CT Ansonia, R. H. Sturdy Co. 203-734-2186
FL Coral Springs, CBC Elctrns. 305-755-1111
FL Longwood, CBC Elctrns. 301-831-5380
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IA Davenport, Ensco-Rep, Inc. 319-386-6600
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KS Wichita, Ensco-Rep, Inc. 316-683-1070
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OH Englewood, Allen Nace Co. 513-836-0931
OH Richfield, Allen Nace Co. 216-659-7178
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TX Dallas, Electra Reps 214-248-3842
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WA Vancouver, Underwood-Hanify 503-224-0583

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AZ Scottsdale, Mahaffey & Assocs. 602-991-9790
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GA Norcross, Over & Over, Inc. 404-449-6205
IL Rolling Meadows, KMA Sales 312-398-5300
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KS Merriam, Midwest Tech. Sls. 913-236-8557
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MA Needham Hgts., Newscott Co. 617-444-1923
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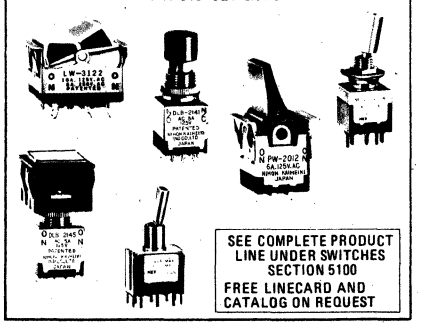

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CA San Diego, Metermaster 619-560-4841
CA San Jose, Allied Elctrns. 408-727-1690
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CT Middletown, E. I. L. 203-346-6646
FL Ft. Lauderdale, Allied Elctrns. 305-486-0550
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WI Milwaukee, Pat Lind Elctrns. 414-224-0146

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EXP Hayden Int'l. Corp.
Can Lachine Quebec, Electro Design 513-636-4838

NOVA TRAN, 100 Deposition Dr., Clear Lake, WI 54005, Tel: 715-263-2333; FSC No.: 56643; Empl.: 45; *Sls. Mgr.:* R. Schley

NOVATRONICS, Box 878, Pompano Beach, FL 33061, Tel: 305-942-5200, TWX: 510-956-9878; Empl.: 225; *Sls. Mgr.:* W. G. Peters

NRD

NRD, Mark IV Ind., Inc., 2937 Alt Blvd. N., Grand Island, NY 14072, Tel: 716-773-7634, Telex: 91578 NRD GRDI; *Sls. Mgr.:* James R. Curtis; *Dist. Mgr.:* Larry Keating ..... **D•1983**

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CA Mountain View, Tech-Ser, Inc. 415-969-9020
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FL Orlando, Delmac Sls. 305-898-4688
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Can Montreal, Que., Prelco Elctrns. 514-389-8051
Can Nepean, Prelco Elctrns. 613-726-1800

NSD, 10936 Portal Dr., Los Alamitos, CA 90720, Tel: 714-527-4896; *Sls. Mgr.:* Paul Pomerantz; *Dist. Mgr.:* Paul Pomerantz

NTK TECHNICAL CERAMICS, NGK Spark Plugs (U.S.A.), Inc., 1701 N. Greenville Ave. #205, Richardson, TX 75081, Tel: 214-235-8332; FSC No.: 95-246-1286; *Sls. Mgr.:* K. C. Ogawa; *Dist. Mgr.:* Mark Ota ..... **A•1398-1399; B•1805; D•1029**

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WA Seattle, Northmar Inc. 206-524-5170

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SC Georgetown, Nuclear Research 803-546-1724

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NU DATA, 32 Fairview Ave., Little Silver, NJ 07739, Tel: 201-842-5757, Telex: 132405, TWX: 710-722-5754; Empl.: 20; *Sls. Mgr.:* Keith Taylor

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NYE, WILLIAM F., INC., P.O. Box G-927, New Bedford, MA 02742-0927, Tel: 617-996-6721, Telex: 940807; Empl.: 15

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NYTRONICS COMPONENTS GRP., INC., Orange St., Darlington, SC 29532, Tel: 803-393-5421, TWX: 810-665-2182; FSC No.: 83125; Empl.: 502; *Sls. Mgr.:* Mack W. Windham ..... **A•1142-1155, 1204, 1244-1263, 1550-1554, 1911**

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TX Dallas, Design Mktg. 214-680-9767
TX Round Rock, Design Mktg. 512-255-9896
UT Salt Lake City, Component Sls. 801-466-8623

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CA Walnut, A. C. L. 213-331-0735
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IN Indianapolis, Graham Elect. 317-634-8202
IA Cedar Rapids, Newark Elect. 312-362-1171
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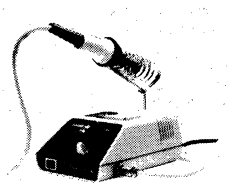
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OAK SWITCH SYS., 100 S. Main St., Crystal Lake, IL 60014, Tel: 815-459-5000, Telex: 72-2447, TWX: 910-634-3353; FSC No.: 76854; Empl.: 1200

OAKTRON INDS., 1000 30th St., Monroe, WI 53566, Tel: 608-328-5560; FSC No.: 07109; Empl.: 250; *Sls. Mgr.:* J. F. Disch; *Dist. Mgr.:* J. F. Disch ..... **D•1030**

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IL Elmhurst, E.S.I. 312-941-0710
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MN Minneapolis, Kodo Assoc. 612-881-1255
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MO St. Louis, Nevco 314-843-7406
NY Rochester, Warren Kaufman Assoc. 716-266-2728
NY Whitestone, J. Brown Elctrl. Sls. 718-767-1977
NC Raleigh, Millar Elctrl. 919-787-9564
OH Akron, Shamrock Elctrl. 614-888-7638
OH Dayton, Shamrock Elctrl. 513-298-1227
TX Richardson, Campion Sls. 214-238-8145
VA Great Falls, Kendall & Assoc. 703-759-3128
WA Seattle, Vector/RMC 206-322-4343
EXP IL, Chicago, Magnus Elctrl. 312-679-6070

OAL ASSOCS., P.O. Box J, Escondido, CA 92025, Tel: 619-743-7143; Empl.: 10; *Sls. Mgr.:* Mark Lohkemper

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CA Costa Mesa, Pat Dooley Co. 714-548-2232
NY Great Neck, W&A Holland 516-487-8877

OAR CORP., A CompuDyne Co., 10447 Roselle St., San Diego, CA 92121, Tel: 619-453-4013, Telex: 697852; *Sls. Mgr.:* Michael A. Duke

OAS INC., See Optimum Applied Systems

OCEAN MARINE INSTRUMENT, 629 Terminal Way # 15, Costa Mesa, CA 92627, Tel: 714-548-9569 ..... **D•1947**

OCEAN RESCH. EQUIP., INC., Box 709, Falmouth, MA 02541, Tel: 617-548-5800, Telex: 94-0859; Empl.: 125; *Sls. Mgr.:* J. Angell

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ODELL, M. P., CO., 1620 Chesapeake Dr., Hoffman Estates, IL 60195, Tel: 312-991-2828; *Sls. Mgr.:* Maria McClurkin

OECO CORP., 712 S.E. Hawthorne Blvd., Portland, OR 97214, Tel: 503-238-2440, Telex: 36-0350; FSC No.: 95266; Empl.: 559; *Sls. Mgr.:* Bob Bunker

OGALLALA ELCTRNS., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153, Tel: 308-284-4093; Empl.: 37; *Sls. Mgr.:* H. L. Harrington

O'HANLON COMPUTER SYSTEMS, INC., 8383-158th Ave NE, Seattle, WA 98052, Tel: 206-885-2502; Empl.: 32; *Sls. Mgr.:* Dennis Sullivan; *Dist. Mgr.:* Dennis Sullivan

OSI

OHIO SEMITRONICS, INC., 1205 Chesapeake Ave., Columbus, OH 43212, Tel: 614-486-9561, TWX: 810-482-1630; FSC No.: 12066; Empl.: 58; *Sls. Mgr.:* G. Clagett ..... **B•1776, 1806-1819; D•1284-1289**

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CA Hayward, FLW, Inc. 415-786-9070
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IL Park Ridge, Elctrn. Instr. Assocs. 312-298-2290
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TN Memphis, Jordan/Marlar/Hale, Inc. 901-452-7441
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WA Bellevue, Topp Engrg. Sls. Corp. 206-747-5400

OHIOSWITCH, INC., 6534 Singletree Dr., Columbus, OH 43229, Tel: 614-885-0319

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FL Orlando, Cartwright & Bean 305-422-4531
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LA Covington, Cartwright & Bean 504-892-1780
MA Needham Hgts., Coakley, Boyd & Abbett 617-444-5470
MI Grosse Pointe Park, Greiner Assocs. 313-499-0188
MN St. Paul, Northport Engrg. 612-457-8000
MS Jackson, Cartwright & Bean 601-981-1170
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MA Shrewsbury, Compatible Comps. 617-422-7641
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OH Cincinnati, John F. Kilfoil Co. 513-791-6150
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TX Lewisville, Jim Hughes Co. 214-221-1536

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MO	Frontenac	314-997-2320
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NJ	Cherry Hill	215-567-5739
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NY	Caledonia, E. F. Sls.	716-538-4754
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ONSET COMPUTER CORP., 199 Main St., PO Box 1030, N. Falmouth, MA 02556, Tel: 617-563-2267, Telex: 469915; Empl.: 8; *Sls. Mgr.:* Elaine Boyd

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OPAMP LABS, INC., 1033 N. Sycamore Ave., Los Angeles, CA 90038, Tel: 213-934-3566; FSC No.: 24699; Empl.: 18 ..... **D•1014**

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OPTELECOM, 15940 Luanne Dr., Gaithersburg, MD 20877, Tel: 301-840-2121; FSC No.: 59338; Empl.: 50; *Sls. Mgr.:* F. C. Eggleston

OPTICAL & CONDUCTIVE COATINGS, Meridian Inds., Inc., 428 N. Buchanan Cir., # 8, Pacheco, CA 94553, Tel: 415-798-6066, Telex: 171309 HQ WNCK; FSC No.: 9U775; Empl.: 8; *Sls. Mgr.:* Glenn G. Grupe

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CA	Santa Clara, Comtronics	408-773-9800
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MA	Burlington, Tritek, Inc.	617-272-4550
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OPTICAL PUBLISHING CO., INC., Berkshire Common, Pittsfield, MA 01201, Tel: 413-499-0514, Telex: 232-005-ASAS Attention: Optical; *Sls. Mgr.:* George Cominsky

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OPTICS FOR RESEARCH, INC., P.O. Box 82, Caldwell, NJ 07006, Tel: 201-228-4480, Telex: 130-224; *Sls. Mgr.:* Donald K. Wilson

OPTICS INTERNATIONAL, Box 101, Tenafly, NJ 07670, Tel: 201-567-4799; Empl.: 10

OPTIMA ENCLOSURES, 2166 Mountain Indl. Blvd., Tucker, GA 30084, Tel: 404-939-6340, TWX: 810-766-3967; FSC No.: 10110; Empl.: 250; *Sls. Mgr.:* Al Waters

OPTIMATION, See Julie Research Labs

OPTIMIZED DEVICES, INC., 220 Marble Ave., Pleasantville, NY 10570, Tel: 914-769-6100; Empl.: 30

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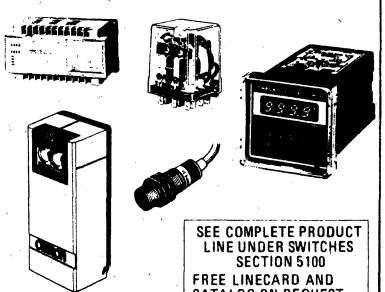

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OH Dayton, Hamilton Avnet Elctrns. 513-439-6700
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TX Houston, Pioneer/Houston 713-988-5555
TX Houston, Quality Comps. 713-240-2255
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TX Irving, Hamilton Avnet Elctrns. 214-659-4111
TX Richardson, Wyle Labs. 214-235-9953
UT Salt Lake City, Hamilton Avnet Elctrns. 801-972-2800
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ORAM ELCTRNS., Rte. 22, Putnam Business Park, Brewster, NY 10509-9587, Tel: 914-279-2966, Telex: ORAM 628-382-40; Empl.: 25; *Sls. Mgr.:* Vincent A. Gianguzzi

ORAM ELECTRONICS, 12 Cranston Rd., Pittsford, NY 14534, Tel: 716-381-4673; Empl.: 150; *Sls. Mgr.:* M. I. Mindell ..... **D•1740**

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ORBIT INSTRUMENT CORP., 80 Cabot Ct., Hauppauge, NY 11788, Tel: 516-435-8300, TWX: 510-221-2122; FSC No.: 11263; *Sls. Mgr.:* Bruce Reissman, Dennis Sunshine ..... **B•1735; D•1129**

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CA San Diego, Orbit Instr. Corp. 619-566-3437

ORBIT INSTRUMENT OF CAL., 6431 Global Dr., Cypress, CA 90630, Tel: 714-527-0561, TWX: 510-221-2122; FSC No.: 11263; *Sls. Mgr.:* Bruce Reissman

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FL Longwood, CBC Elctrns. 305-831-5380
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MI Grosse Pointe Park, Greiner Assocs. .. 313-499-0188
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OH	Dayton, Electro-Com	513-898-5140
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WA	Bellevue, James Findlay Co.	206-455-9597

Local Distributors

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PACIFIC ELECTRICORD, 747 W. Redondo Bch. Blvd., Gardena, CA 90247, Tel: 213-532-6600, TWX: 910-346-7619; Empl.: 600; *Sls. Mgr.:* W. A. Fiechtner; *Dist. Mgr.:* Gary M. Payne

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PACIFIC INSTRS. INC., 215 Mason Circle, Concord, CA 94518, Tel: 415-827-9010, TWX: 910-481-9977; Empl.: 45 ..... **D•1015**

Local Sales Offices & Reps

AL	Huntsville, Lee Assocs.-Mid South, Inc.	205-533-5896
CA	Alhambra, Dale-Dahl Assocs.	213-682-3417
CA	Walnut Creek, Dale/Dahl Assocs.	415-933-9595
CT	Hamden, JBL Assocs.	203-281-3161
FL	Maitland, Wade H. Boggs, Inc.	305-647-2226
IL	Park Ridge, EIA, Inc.	312-298-2290
MA	Acton, Applied Measurements	617-263-2766
MI	Farmington Hill, Anderson Elctrns., Inc.	313-553-7600
NJ	Elizabeth, Instrumentation Prods., Inc.	201-351-1155
NM	Albuquerque, Vic Myers Assocs.	505-884-6878
NY	Latham, L-Tron Corp.	518-785-5332
OH	Dayton, RDP Corp.	513-253-6171
PA	Pittsburgh, Wainwright Tech. Sls., Inc.	412-487-5055
PA	Radnor, Roberts Engrg.	215-688-6525
TX	Arlington, John T. Houston Assocs., Inc.	817-265-2931
VA	Arlington, Gans & Pugh Assocs.	703-527-3262
WA	Bellevue, Tasco, Inc.	206-453-1414
Can	Rexdale, Ont., SRP Control Sys., Ltd.	416-746-0117

PACIFIC MAGNETICS CORP., 2602 Transportation Ave., Ste. F, National City, CA 92050, Tel: 619-474-8216; *Sls. Mgr.:* Mary Hill

PACIFIC MEAS., INC., 488 Tasman Drive, Sunnyvale, CA 94086, Tel: 408-734-5780, TWX: 910-339-9273; Empl.: 100; *Sls. Mgr.:* Ed Mendel

PACIFIC MICROCOMPUTERS, INC., 160 Chesterfield Dr., Cardiff, CA 92007, Tel: 619-436-8649, Telex: 701-578; Empl.: 34; *Sls. Mgr.:* Phyllis Maloy

PACIFIC MICRO SYS., INC., 160 Gate 5 Rd., Sausalito, CA 94965, Tel: 415-331-2525; Empl.: 12; *Sls. Mgr.:* Donald Shipley; *Dist. Mgr.:* Donald Shipley

PACIFIC
POWER SOURCE CORP.

PACIFIC POWER SOURCE CORP., 15122 Bolsa Chica St., Huntington Bch., CA 92649, Tel: 714-898-2691, 800-854-2433; Empl.: 49; *Sls. Mgr.:* A. F. Hatlestad ..... **D•1949-1953**

Local Sales Offices & Reps

KS	Overland Park, Ramsey Assocs.	913-649-6996
MA	Burlington, Intersell, Inc.	617-273-3844
MN	Minneapolis, Loren Green Assocs.	612-571-6666
MO	Maryland Heights, Ramsey Assocs.	314-878-5042
NY	Dewitt, D. B. Assocs. Inc.	315-446-0220
NY	Wantagh, Bytec Reps.	516-781-7400
WA	Bellevue, Al Smith	206-746-6770
WA	Vancouver, Al Smith	206-892-9912

Local Distributors

EXP	Los Angeles, CA, Trans World Trade	213-476-8406

PACIFIC RESISTOR CO.

PACIFIC RESISTOR CO., 18300 Oxnard St., Tarzana, CA 91356, Tel: 818-345-7811, Telex: 06416; *Sls. Mgr.:* Douglas Trewhitt ..... **A•1926-1927**

Local Sales Offices & Reps

CA	San Jose, Silcon Valley	408-286-7510
MN	St. Paul	612-642-2828

PACIFIC SCIENTIFIC CO., 4301 Kishwaukee, Rockford, IL 61105, Tel: 815-966-3600, Telex: 257-315; Empl.: 400

PACIFIC SWITCH CONTROLS, INC., 16116 Leadwell St., Van Nuys, CA 91406, Tel: 213-873-4802

PACIFIC TIMER INC., 21739 N.E. 18th Way, Redmond, WA 98052, Tel: 206-881-1785; *Sls. Mgr.:* Karen A. Pettyjohn

PACIFIC TRANSDUCER, 2301 Federal, Los Angeles, CA 90064, Tel: 213-478-1134; Empl.: 23

PACTEC DIV., LaFrance Corp., Enterprise & Executive Avenues, Philadelphia, PA 19153, Tel: 215-365-8400, Telex: 83-1732; *Dist. Mgr.:* Edward Fitzpatrick ..... **C•1002, 1070-1071**

Local Sales Offices & Reps

AZ	Phoenix, Gramer & Co.	602-995-9455
CA	Buena Park, PAC-TEC CORP.	714-522-6410
CA	Fallbrook, Martronix	619-728-7678
CA	Santa Clara, Warren Assoc.	408-988-7762
CO	Englewood, High Plains Mktg.	303-792-2020
FL	Key Largo, Jerrold Helbein & Assocs., Inc.	305-367-3025
IL	Arlington, Brainard-Wilson Mktg.	312-437-2700
IN	Indianapolis, STB & Assocs., Inc.	317-844-9227
MD	Columbia, Snowden Center	301-964-0225
MA	Newton, Gerber Sls.	617-969-2620
MI	Warren, Burcaw Co.	313-573-4605
MN	Excelsior, Lestronix	612-474-1935
MN	St. Louis Park, Lestronix	612-926-8466
MO	Grandview, Harris Hanson Co.	816-763-6200
MO	St. Louis, Harris Hanson Co.	314-432-3611
NJ	Broomall, L. D. Lowery, Inc.	215-528-5170
NJ	Woodcliff Lake, Joe Freid & Assoc.	201-391-6792
NY	Great Neck, F & F Metro	516-482-4080
NY	Mendon, Tech-Mark	716-624-3840
OH	Richfield, Bear Mktg.	216-659-3131
OR	Portland, James J. Backer Co.	503-297-8744
PA	Broomall, L.D. Lowery, Inc.	215-528-5170
TX	Dallas, MGR Elctrn.	214-238-5246
UT	Salt Lake City, High Plains Mktg.	801-968-9456
WA	Seattle, James J. Backer Co.	206-285-1300
WI	Colgate, Rep 1 & Assocs.	414-628-4016
Can	Markham, Ont., Avotronics, LTD	416-475-2024
Can	Ottawa, Ont., Avotronics, LTD	613-233-5527
Can	Pointe Claire, Que., Avotronics, LTD	514-697-2135

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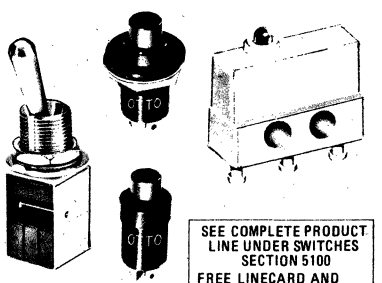

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Local Distributors

AL Birmingham, American Elctrns. Supp. 205-942-4656
AL Birmingham, Forbes Distrbg. 205-251-4105
AL Decatur, Forbes Distrs. 205-353-4762
AL Huntsville, Forbes Distrbg. 205-533-4150
AZ Phoenix, Lion Elctrns. 602-869-9611
AZ Phoenix, R. V. Weatherford 602-272-7144
AZ Phoenix, Tri-Tek 602-995-9352
AZ Tempe, Circut Specialists, Inc. 602-966-0764
AZ Tucson, Anatech Corp. 602-881-2348
AZ Tucson, Elliot Elctrns. 602-884-7394
CA Anaheim, A-Z Elctrns. 714-634-3620
CA Burbank, Electronic City 213-842-5275
CA Canoga Park, Sandy's Elctrns. Supp. 213-346-8353
CA Costa Mesa, Marvac 714-540-3280
CA Cucamonga, Abletronics 714-987-7606
CA El Segundo, Force Elctrns. 213-772-1324
CA El Toro, R-Vac 714-586-1210
CA Freemont, Terminal Sls, Corp. 415-656-7722
CA Gardena, California Switch & Signal 714-522-8600
CA Glendale, R. V. Weatherford 213-849-3451
CA Goleta, Bill's Stereo 805-967-8280
CA Monterey, Zackit (Monterey) 408-375-3144
CA Palo Alto, Zack Elctrns. 415-326-5432
CA Redding, North Valley Elec. Distr. 916-222-1500
CA Sacramento, Zackit/Sacramento 916-446-3131
CA San Diego, R. V. Weatherford 619-695-1700
CA San Diego, Southland Comps. 619-578-6630
CA San Jose, Quement Elctrns. 408-998-5900
CA San Jose, Rose Elctrns. 408-263-2934
CA San Rafael, Electronics Plus 415-457-0456
CA Santa Anna, C. R. Elctrns., Inc. 714-556-2040
CA Valleyo, Zackit (Valleyo) 707-644-6676
CO Denver, Gateway Elctrns. 303-458-5444
CO Denver, Intergrated Elctrns. 303-292-5337
CO Denver, R. V. Weatherford 303-428-6900
CO Greeley, Greely Walker 303-353-3241
CT New Haven, Hatry Elctrns. 203-527-1881
CT New London, Jan Elctrns. 203-442-4386
CT Stratford, Utronics 203-378-4201
CT Wallingford, Midstate Elctrns. 203-265-9900
DE Wilmington, Wholesale Elctrns. 302-656-9988
FL Clearwater, Electronic Precepts of FL 813-530-9781
FL Dania, Summit Distrs. 305-920-6253
FL Longwood, Interec Comps. 305-834-7777
FL Miami, Electronic Equip. Co. 305-871-3500
FL Orlando, EMSCO 305-849-6362
FL St. Petersburg, Knapp of Florida 813-392-0406
FL Tampa, Dow Elctrns. 813-626-5195
FL Tampa, Leader Elctrns. 813-870-3315
FL Tampa, Sunex Elctrns. 813-885-4074
FL West Palm Beach, Nurmi Elctrns. 305-686-8553
GA Atlanta, Ack Radio 404-351-6340
GA Atlanta, Specialty Distr. Co. 404-873-2521
IL Berwyn, BB & W Inc. 312-242-1533
IL Chicago, Electronic Distrs. 312-283-4800
IL Chicago, R. W. Elctrns. 312-248-2480
IL Elk Grove, Martec Assocs. 312-956-8090
IL Geneva, Melvin Elctrns. 312-279-5015
IL Mt. Prospect, Tri State Elctrns. 312-255-0600
IL Niles, Joseph Elctrns. 312-297-4200
IL Peoria, Klaus Radio 309-691-4840
IL Rosemont, Advent Elctrns. 312-298-4210
IN Bloomington, Stansifer Radio Co. 812-336-6339
IN Gary, Calumet Elctrns. 317-887-4961
IN Indianapolis, Advent Elctrns. 317-872-4910
IN Indianapolis, Electronic Service Parts 317-635-7822
IN Indianapolis, Prehler Elctrns. 800-228-5839
IN Jasper, Elex Mart 812-482-4101
IA Cedar Rapids, Iowa Radio Supply 319-393-4510
KS Overland Park, Burnstein & Assocs. 913-642-6444
KS Salina, Electronics, Inc. 913-827-7377
KY Bowling Green, Randolph, Hale & Meredith 502-781-1460
KY Louisville, Peerless Elctrns. 502-637-7674
MD Aberdeen, Harco Elctrns. 301-838-7990
MD Beltsville, Mark Elctrns. 301-595-5040
MD Beltsville, P.S.I. 301-937-4960
MD Gaithersburg, Almo Elctrns. 301-792-9197
MD Glen Burnie, Revacto of Maryland 301-766-3400
MD Rockville, Capitol Radio 301-881-2270
MD Towson, Baynesville Elctrns. 301-823-0082
MA Hingham, Sager Elec. Supp. 617-749-6700
MA Newton Upper Falls, In Stock Products Co. 617-964-6200
MI Battle Creek, Great Lakes Elctrns. 616-731-4156
MI Berrien Springs, Data Comms. 616-471-2119
MI Clawson, Radio Supp. & Engrg. 313-435-6420
MI Farmington Hills, Prehler Elctrns 800-336-1406
MI Grand Rapids, S. F. Elctrns. 616-459-0216
MI Lansing, Fulton Radio 517-394-5020
MI Livonia, RS Elctrns. 313-525-1155
MN Minneapolis, Aero-Space-Computer Supp. 612-884-4725
MN Minneapolis, Northern Elctrns. 612-944-1167
MO St. Louis, Gateway Elctrns. 314-427-6116
NE Lincoln, Scott Elctrns. 402-466-8221
NJ Frenchtown, Sintec/Aries 201-996-4093
NJ Pine Brook, Parts Masters 201-227-7797
NM Albuquerque, Walker Radio Co. 505-883-2992
NY Buffalo, Summit Distr. 716-887-2800
NY Farmingdale, Midway Indl. Electro 516-293-6800
NY Freeport, KRP Elctrns. 516-623-3346
NY New York, Advance Elctrns. 212-730-7030
NY Rochester, Rochester Radio Supp. 716-454-7800
NY Rochester, Summit Distr. 716-334-8110
NY Troy, Trojan Elctrn. Supp. 518-274-4481
NC Burlington, Womack Elctrns. 919-227-7486
NC Greensboro, Hammond Elctrns. 919-275-6391
NC Raleigh, Southeastern Elctrns. 919-828-2311
OH Cincinnati, Hughes-Peters 513-351-2000
OH Cincinnati, R. S. Elctrns. 513-793-2450
OH Columbus, Hughes-Peters 614-294-5351
OH Strongsville, Roberts Elctrns. 216-238-1711
OK Oklahoma City, She Elctrns. 405-843-5941
OK Tulsa, Radio Inc. 918-587-9123
OR Beaverton, Norvac Elctrns. 503-644-1025
OR Beaverton, Rose Elctrns 503-629-9288
OR Portland, Radar Elec. 503-232-3404
PA Allentown, A.A. Peter, Inc. 215-434-5237
PA Coatesville, County Supply 215-384-4585
PA Marcus Hook, Linwood Wholesalers 215-485-0777
PA Philadelphia, Almo Elctrns. 215-698-4000
PA Willow Grove, Resco Elctrns. 215-659-4575
PA York, Rosen Elctrns. 717-843-7881
RI Pawtucket, Jabbour Elctrns. 401-944-2570
SC Columbia, Dixie Elctrns. 803-779-5332
TN Chattanooga, Curle Elctrns. Supp. 615-266-4729
TN Chattanooga, Techni-Tronics 615-842-0514
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TN Nashville, Randolph & Rice 615-255-5602
TN Tullahoma, Randolph & Vandergriff 615-455-4531
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TX Austin, Galtronics 512-837-7470
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TX Irving, Force Elctrns. 214-438-5700
TX San Antonio, Altex Elctrns. 512-828-0503
UT Salt Lake City, Standard Supp. 801-486-3371
VA Charlottesville, Virginia Radio 804-296-4184
VA Richmond, Meter Metrics Div./Tr. 804-275-2675
VA Springfield, Crossroads Elctrns. 703-931-0600
WA Bellevue, Almac Elctrns. DKM Co. 206-643-9992
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WA Seattle, Zephyr Elctrn. Sls. 206-241-1980
WI Milwaukee, Industrial Elctrns., Inc. 414-276-1212
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI Oshkosh, Electronic Inds., Inc. 414-235-8930
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Can Pointe Claire, Que., Future Elctrns. 514-694-7710

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PAINE INSTRS., 2401 S. Bayview St., Seattle, WA 98144, Tel: 800-426-0366, TWX: 910-444-2164; FSC No.: 13624; Empl.: 69; *Sls. Mgr.:* R. E. Helmick ..... **B•1823**

Local Sales Offices & Reps

CA Laguna Hills, Elotek Sys., Inc. 714-830-4856
CO Boulder, A. Bissell Co. Indl. Sls. 303-444-1173
FL Orlando, Physimetrics, Inc. 305-894-8081
GA Atlanta, Physimetrics, Inc. 404-955-0155
IL Lansing, Van Meter Instrs., Inc. 312-474-3580
IN Indianapolis, Carter, McCormic & Peirce, Inc. 317-844-4175
MD Rockville, Electronic Mktg. Assocs., Inc. 301-744-7700
MI Farmington Hills, W. R. Hummon & Assocs., Inc. 313-474-0661
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NM Albuquerque, Burt Dieruf Assocs. 505-299-0989
NY Clark Mills, KLM-Garner 315-853-6126
NY N. Syracuse, KLM-Garner 315-458-6214
NY Pittsford, KLM-Garner 716-381-8350
NC Concord, Physimetrics, Inc. 704-788-1317
OH Englewood, Carter, McCormic & Peirce, Inc. 513-836-0951
OH Fairview, Carter, McCormic & Peirce, Inc. 216-799-5100
PA Monroeville, Carter, McCormic & Peirce, Inc. 412-372-4415
TX Houston, Scientific Sls. Co. 713-460-9170
TX Richardson, Scientific Sls. Co. 214-231-6541
WA Seattle, Paine Instrs., Inc. 206-723-1705
Can Burlington, Ont., Panacon Control Sys., Inc. 416-336-7139
Can Richmond, B.C., Maxwell Morton Assocs., Ltd. 604-273-1337

PAK-TRONIC, See Tracor Paktronics

PALADIN, 3543 Old Conejo Rd., Newbury Park, CA 91320, Tel: 805-499-0318, Telex: 910-494-2799; Empl.: 9; *Sls. Mgr.:* Ronald Vogel

PALL ULTRAFINE FILTRATION CORP., 2200 Northern Blvd., East Hills, NY 11548, Tel: 516-484-5400, Telex: 968855, TWX: 510-223-0606; Empl.: 3500; *Sls. Mgr.:* Alison Ray; *Dist. Mgr.:* Fred Nordhauser

PALOMAR ENGRS., Box 455, Escondido, CA 92025, Tel: 619-747-3343; Empl.: 9

PAMOTOR, 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-1203, TWX: 910-374-2353; Empl.: 35; *Sls. Mgr.:* F. L. Nelson; *Dist. Mgr.:* F. L. Nelson

PAMRAN, 1101 Cedar Creek, Racine, WI 53402, Tel: 414-639-9076; Empl.: 28; *Sls. Mgr.:* R. C. Pfeil

PANAMETRICS, 221 Cresent St., Waltham, MA 02254, Tel: 617-899-2740, Telex: 6817337, 951006; Empl.: 200; *Sls. Mgr.:* Bob Mel

PANASONIC, IND'L. ELCTRN. COMPS., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094, Tel: 201-348-7000, Telex: 701 992-8920; Empl.: 25 ..... **D•1422-1427**

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AZ Phoenix, Dar-C 602-991-0110
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MI Brighton, A.P. Assocs. 313-229-6550
MI Holland, AP Assocs. 800-624-5496
OH Dublin, AP Assocs. 800-624-5496
OH Fairview Park, AP Assocs. 800-624-5496
OH Lorain, AP Assocs. 800-624-5496
PA Eastern PA, Comtek 609-235-8505
PA Western PA, AP Assocs. 800-624-5496

Local Distributors

AZ Scottsdale, Electro Mktg. 602-991-0110
CO Colorado Springs, C.M.T. 303-598-6888
NJ Clifton, Engineered Assem. 201-340-0600
OR Wilsonville, Micro Power 503-694-2888

PANAVISE PRODS., 2850 E. 29th St., Long Beach, CA 90806, Tel: 213-595-7621, Telex: 18-2135; Empl.: 29; *Sls. Mgr.:* Michael Steffen; *Dist. Mgr.:* Michael Steffen

PANDUIT CORP., 17301 Ridgeland Ave., Tinley Park, IL 60477-0981, Tel: 312-532-1800, Telex: 25-4560; FSC No.: ;06383; Empl.: 1200 ..... **C•1474-1476, 1888-1891**

Local Sales Offices & Reps

AL Birmingham, Frank Parker & Assocs. 205-853-3152
AK Anchorage, Bar Elec. Agt. 907-345-7281
AZ Phoenix, Panduit Corp. 602-861-3969
AR Little Rock, Byron Carson Co. 501-568-6798
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CA San Diego, Tak Sls. Co. 619-287-6141
CA Santa Ana, Panduit Corp. 714-546-5700
FL Lakeland, Panduit Corp. 813-665-5850
GA Atlanta, Panduit Corp. 404-256-5940
HI Honolulu, Agencies Co./Pacific 808-359-8343
IN Fort Wayne, Panduit Corp. 219-424-4082
IN Indianapolis, Panduit Corp. 317-251-8332
IA Des Moines, Panduit Corp. 515-280-8343
KS Kansas City, Panduit Corp. 913-764-7170
KY Louisville, A. L. Pickens Co. 502-491-4215
LA New Orleans, Wells-Keown & Assocs. 504-244-0330
MD Landover, Agency Group, Inc. 301-773-9292
MI Fraser, Panduit Corp. 313-791-1700
MI Grand Rapids, Panduit Corp. 616-942-0420
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MO St. Louis, Panduit Corp. 314-894-7800
NH Salem, Sales Eng. Co. 603-893-5521
NY Niagara Falls, Panduit Corp. 800-532-4439
NC Winston-Salem, L. G. White Southern 919-725-3612

OH Cincinnati, Panduit Corp. 513-874-0660
OH Cleveland, Panduit Corp. 216-835-2050
OH Columbus, Panduit Corp. 614-262-6052
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OR Portland, Panduit Corp. 503-654-9455
PA Carnegie, Myles F. Smith & Assoc. 412-276-5363
PA Erie, Myles F. Smith & Assocs. 814-459-7464
PA Glenside, Kunz, Powell & Assoc. 215-224-2434
SC Greenville, L. G. White Southern 803-271-0630
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WI Appleton, H. Mercer Co. 414-739-6223
PR Santurce, L. Gandia & Assocs. 809-725-3473

PANEL COMPONENTS CORP., P.O. Box 6626M, Santa Rosa, CA 95406, Tel: 707-523-0600, Telex: 176-747; Empl.: 18 ..... **B•1254-1255; C•1478-1482, 1892-1893**

Local Sales Offices & Reps
AL Huntsville, DHR Mktg. Inc. 205-533-5165
CA Santa Clara, Ross Mktg. Assoc. 408-988-8111
CA Tustin, Schoenbachler-Dobson Co. ... 714-544-1888
CO Englewood, Omega Ltd. 303-762-1921
GA Atlanta, DHR Mktg., Inc. 404-451-9848
IL Northbrook, Raines & Assocs. 312-498-0890
IA Marion, M-S-B Assocs., Inc. 319-377-6261
KS Shawnee Mission, M-S-B Assocs., Inc. 913-432-2131
MA Lexington, Zieco 617-861-8300
MN St. Paul, Arkco Sls. 612-777-7454
MO St. Charles, M-S-B Assocs., Inc. 314-946-5577
NY Great Neck, Tylinski Assocs. 516-466-9070
NY Rochester, Lloyd Hart Assocs. 716-244-3253
NC Raleigh, DHR Mktg., Inc. 919-876-5450
OH Cleveland, K-T Depco 216-442-6200
OR Portland, Earl & Brown Co. 503-245-2283
PA Doylestown, T.O.E. Sls. 215-348-2212
PA Pittsburgh, K-T Depco 412-367-1011
SC Greenville, DHR Mktg. Inc. 803-235-3594
TX Lewisville, Jim Hughes Co. 214-221-1536
TX Stafford, Jim Hughes Co. 713-343-0673
WA Seattle, Earl & Brown Co. 206-284-1121
Can Ottawa, Ont., Lloyd Ellam Assocs. 613-224-1720

PANEL CONTROLS, 1000 Mt. Elliott Ave., Detroit, MI 48207, Tel: 313-568-2400; Empl.: 24

PANELGRAPHIC CORP., 10 Henderson Dr., W. Caldwell, NJ 07006, Tel: 201-227-1500, TWX: 710-734-4367; FSC No.: 52657; Empl.: 100

PAN-MAG

PAN-MAGNETICS INTL., INC., 455-A Carson Plaza Dr., Carson, CA 90746, Tel: 213-532-1790, Telex: 664-759; *Sls. Mgr.:* W. Dull ... **A•1265, 2213-2220; D•1742-1743**

Local Sales Offices & Reps
AZ Scottsdale, E.D.P. & Assocs. 602-991-6119
CT Marlborough, Precision Sls. 203-295-0580
GA Norcross, Dixie Tech. Mktg., Inc. 404-447-6832
IN Kokomo, Schillinger Assocs., Inc. 317-452-4057
KS Overland Park, Electri-Rep 913-649-2168
MD Towson, Electronic Comp. Mktg. 301-321-8611
MA Newton, Precision Sls. 617-969-0594
MN Minneapolis, DeBeck-Hays Assocs. 612-835-3610
MO Maryland Heights, Electri-Rep, Inc. 314-878-8209
NC Raleigh, Dixie Tech. Mktg., Inc. 919-878-0909
OR Tigard, Electronic Sources 503-684-0040
WA Bellevue, Electronic Sources 206-643-0400

PANNIER CORP., Graphics Div., John Fitch Industrial Park, Warminster, PA 18974, Tel: 215-672-3600; Empl.: 45; *Sls. Mgr.:* Barry Stefaniw

PAPST MECHATRONIC CORP., Aquidneck Indl. Pk., Newport, RI 02840, Tel: 401-849-5930, Telex: 952092; *Sls. Mgr.:* Emanuel V. Lauria

PARABAM, INC., 3017 E. Las Hermanas St., Rancho Dominguez, CA 90221, Tel: 213-537-1771; Empl.: 85

PARAGON ELECT., 606 Parkway Blvd., Two Rivers, WI 54241, Tel: 414-793-1161, Telex: 26-3450; Empl.: 1000; *Sls. Mgr.:* Don Karman

PARALINE
TRANSFORMER SPECIALISTS

PARALINE TRANSFORMER CORP., 511 South Palm Ave., Alhambra, CA 91803, Tel: 818-281-0222; FSC No.: 59465; Empl.: 52 ..... **A•2221-2225**

PARAMOUNT TUBE, INC., 1430 Progress Rd., Ft. Wayne, IN 46808, Tel: 219-484-4111; Empl.: 46; *Sls. Mgr.:* D. L. Gibson

PARKER HANNIFIN CORP., 17325 Euclid Ave., Cleveland, OH 44112, Tel: 216-531-3000, Telex: 980636

PARKER MCCRORY MFG. CO., 2000 Forest Ave., Kansas City, MO 64108, Tel: 816-221-2000; *Sls. Mgr.:* Ken Turner; *Dist. Mgr.:* Ken Turner

PARKER SEAL GRP., P.O. Box 11751, Lexington, KY 40512, Tel: 606-269-2351; Empl.: 2,200; *Sls. Mgr.:* Frank Chesnik

PARLEX CORP., 145 Milk St., Methuen, MA 01844, Tel: 617-685-4341, ext. 325, TWX: 710-342-1528; Empl.: 600; *Sls. Mgr.:* Valerie Mickalide

PARSONS MFG., 1055 O'Brien Dr., Menlo Park, CA 94025, Tel: 415-324-4726, TWX: 910-373-2106; Empl.: 85; *Sls. Mgr.:* C. E. Plummer

PASO SOUND PRODS., 14 First St, Pelham, NY 10803, Tel: 914-738-4800, Telex: 646783 Paso Pelm; Empl.: 50; *Sls. Mgr.:* David Moore

Local Sales Offices & Reps
CA West Covina, Don Forth Assocs. 818-919-2322
CT Greenwich, Miller Assoc. 203-869-7793
FL Hialeah, Miguel A. Lopez 305-822-6853
FL Pembrook Pines, World Wide Prods., Inc. 1-800-223-5651
GA Marietta, Dewitt Austin Co. 404-926-4943
IL Arlington Heights, Brainard Wilson Mktg. 312-437-2700
IN Carmel, Brainard Wilson Mktg. 317-844-2800
MA Braintree, Anderson Sls. Assocs. 617-848-9194
MN Moorhead, Northland Assocs. 218-233-4616
NJ Moorestown, Piper Mktg. 609-235-8006
NY Liverpool, Jack Mesnick Sls. 315-622-3211
NC Charlotte, De Witt Austen Co. 704-334-0174
OH Medina, J. H. Podolny Co. 216-725-8814
PA Pittsburgh, James Podolny Co. 412-353-5877
TN Memphis, Electronic Sls. Co. 901-682-2281
VA Ashland, Piper Mktg. 804-798-9299
WI Waukesha, Brainard Wilson Mktg. 414-255-3400
Can Toronto, Paco Elctrns. 416-475-0740

PASS & SEYMOUR, INC., P.O. Box 4822, Syracuse, NY 13221, Tel: 315-468-6211, Telex: 93-7232; *Sls. Mgr.:* Kenneth Hooper

PATHCOM, INC., Pace Two-Way Radio Prods., 24105 S. Frampton Ave., Harbor City, CA 90710, Tel: 213-325-1290; Empl.: 600

PATTON-MACGUYER INC., 17 Virginia Ave., Providence, RI 02905, Tel: 401-941-6000; FSC No.: 77147; Empl.: 55; *Sls. Mgr.:* J. Allen

Local Sales Offices & Reps
CA Mission Viejo, Coastline Connectors .. 714-859-7878
GA Cumming, Reno Ivy & Assocs. 404-887-4533
MI Farmington, Lloyd George & Assocs. 313-474-1505
MO Lee's Summit, MYA Midwest Inc. 816-525-1290
NC Greensboro, Manufacturers Sales 919-274-2474
OH Chesterland, P.M.S. Associates 216-729-2248
RI Providence, Patton-MacGuyer Inc. 401-941-6000

PAYNE ENGRG., Box 70, Scott Depot, WV 25560, Tel: 304-757-7353, Telex: 88-5452; Empl.: 40; *Sls. Mgr.:* Matthew J. Gilberto; *Dist. Mgr.:* Diane Nelson

PCA ELECTRONICS INC.
28 SMD 3/85

PCA ELCTRNS., 16799 Schoenborn St., Sepulveda, CA 91343, Tel: 818-892-0761, Telex: 67-4681, TWX: 910-496-1525; FSC No.: 97722; Empl.: 45; *Sls. Mgr.:* Ben Weinberg ..... **A•1556-1566**

Local Sales Offices & Reps
AZ Phoenix, Toward Engrg. Assocs. 602-955-3193
CA San Diego, Littlefield & Smith Assoc. .. 619-455-0055
CA Santa Clara, Fahrner-Miller Assocs. ... 408-727-9800
FL Boca Raton, Lawrence Assocs. 305-368-7373
FL Clearwater, Lawrence Assocs. 813-584-8110
IL Westchester, W. G. Brouillette & Assocs. 312-345-6500
MA Southboro, KSA of New England 617-485-9432
MN Minneapolis, Bill Deming and Assocs. 612-888-5000
NJ Wayne, Howard Kagan Assocs. 201-694-1115
OH Cleveland, Weschler Elec. Corp. 216-238-2550
OR Portland, Elctrn. Comp. Sls. 503-245-2342
TX Dallas, Blackburn Assocs. 214-692-8885
TX Houston, Blackburn Assocs. 713-463-1354
UT Salt Lake City, Sage Sls. 801-467-5451
VA Front Royal, Eltron Sls., Ltd. 702-635-7201
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301
WA Seattle, Elctrn. Comp. Sls. 206-232-9301

PCB
PIEZOTRONICS

PCB PIEZOTRONICS, 3425 Walden Ave., Depew, NY 14043-2495, Tel: 716-684-0001, TWX: 710-263-1371; Empl.: 110; *Sls. Mgr.:* Roy Maines

Local Sales Offices & Reps
CA Alhambra, Dale-Dahl Assocs. 213-682-3417
CA Walnut Creek, Dale-Dahl Assocs. 415-933-9595
CT Hamden, Northeast Engrg. 203-248-4481
FL Orlando, Microspec, Inc. 305-299-6508
GA Lilburn, Microspec, Inc. 404-921-3840
IL Crystal Lake, ITI Systems 815-455-1411
MD Dayton, Gans-Pugh Assocs. 703-527-3262
MA Danvers, Northeast Engrg. 617-774-3010
MI Farmington, Carter, McCormic & Peirce 313-477-7700
MO St. Louis, Adelphi, Inc. 314-821-1232
NM Albuquerque, Rustco Entprs. 505-292-2741
NY Manhasset, Northeast Engrg. 516-365-9633
NY Syracuse, Labtronics, Inc. 315-455-7314
OH Englewood, Carter, McCormic & Peirce 513-836-0951
OH Fairview Pk, Carter, McCormic & Peirce 216-779-5100
PA Chester Springs, Letronix 215-458-8977
PA Monroeville, Carter, McCormic & Peirce 412-372-4415
SC Rock Hill, Microspec, Inc. 803-366-3015
TN Nashville, Microspec, Inc. 615-383-4064
TX Dallas, Techn. Prods. 214-357-9603
TX Houston, Techn. Prods. 713-493-6520
UT Logan, Western Mktg. Assocs. 801-753-0073
VA Arlington, Gans-Pugh Assocs. 703-527-3262
WA Seattle, Brett Assocs. 206-431-8090

PC INTERNATIONAL, 4400 MacArthur Blvd., Newport Beach, CA 92660, Tel: 714-476-1020

PCK ELASTOMERICS, INC., Kollmorgen Corporation, 333 Byberry Road, Hatboro, PA 19040, Tel: 215-672-0787, 215-672-4741, TWX: 510-387-236; FSC No.: 64914; *Sls. Mgr.:* Thomas G. Campbell; *Dist. Mgr.:* John Seibert ..... **C•1483**

Local Sales Offices & Reps
AZ Scottsdale, TC Elctrn. Sls., Inc. 602-994-5153
CA Fullerton, Libratronix 714-871-1513
CA Mountain View, Marquez & Assocs. ... 415-966-1012
CT South Dartmouth, Kentronics 617-999-2188
FL Coral Springs, Janco Resch. & Sls. Co. 305-755-0631
ID Spokane, L. D. Elctrns. 509-922-0883
IL Arlington Heights, Coombs Assocs., Inc. 312-439-9810
IN Ft. Wayne, Coombs Assocs., Inc. 219-747-4017
IA Cedar Rapids, Coombs Assocs., Inc. .. 319-362-4116

MA Wakefield, Kentronics 617-246-0245
MI Troy, C. B. Jensen & Assocs. 313-643-0506
MN Brooklyn Center, William Assocs. 612-566-5010
NJ Madison, Livera-Polk Assocs., Inc. 201-377-3220
NY Glen Head, Livera-Polk Assocs., Inc. 516-759-9300
OR Beaverton, L. D. Elctrns. 503-649-8556
WA Snohomish, L. D. Elctrns. 206-568-0511
WI Milwaukee, Coombs Assocs., Inc. 414-351-6123

PCK TECHNOLOGY DIV., Kollmorgen Corp., 322 South Service Rd., Melville, NY 11747, Tel: 516-454-4400, Telex: 6852163, TWX:; Empl.: 250; *Sls. Mgr.:* J. F. Dennis-Browne

PCM-PAC CYBER-METRIC, 6800 Sierra Ct., Dublin, CA 94568, Tel: 415-829-8700, TWX: 910-389-6890; Empl.: 19; *Sls. Mgr.:* T. J. Netoff

PC TRANSFORMER CORP., 64 D Nancy St., West Babylon, NY 11704, Tel: 516-491-3300; FSC No.: 62281; Empl.: 11; *Sls. Mgr.:* Stanley L. Goldstein ..... **A•2226-2229**

PEARSON ELCTRNS., 1860 Embarcadero Rd., Palo Alto, CA 94303, Tel: 415-494-6444, Telex: 171-412; FSC No.: 05280; Empl.: 23; *Sls. Mgr.:* Patricia L. Pearson ..... **A•2230**

PECA, INC., 592 Winks Lane, Bensalem, PA 19020, Tel: 215-245-1550; Empl.: 30; *Sls. Mgr.:* Jean Douglass

PENFIELD, INC., West & W. Main Sts., Plantsville, CT 06479, Tel: 203-621-9141; Empl.: 25

PENN AIRBORNE PRODS., Industrial Hwy., Southampton, PA 18966, Tel: 215-355-3400, Telex: 834759; FSC No.: 25805; Empl.: 25; *Sls. Mgr.:* W. Williams

PENN ENGRG. & MFG., P.O. Box 1000, Danboro, PA 18916, Tel: 215-766-8853; FSC No.: 46384; Empl.: 480; *Sls. Mgr.:* John E. O'Brien

PENN FIBRE & SPEC., 4343 "G" St., P.O. Box 4890A, Philadelphia, PA 19124, Tel: 215-288-7366; Empl.: 66; *Sls. Mgr.:* L. C. Jones

PENN KEYSTONE CORP., Unimax Switch Corp., Ives Rd., P.O. Box 152, Wallingford, CT 06492, Tel: 203-269-8701, Telex: 96-3485, TWX: 710-476-1397; FSC No.: 03034; *Sls. Mgr.:* Jack Fitzgerald

PENN RESCH. CORP. (PRC), 2652 South Main St., P.O. Box 3357, Kennesaw, GA 30144, Tel: 404-429-9061, Telex: 753010; *Sls. Mgr.:* Wallace Hundley

PENN-TRAN

PENN-TRAN CORP., Box 1321, Rte. 144N, Wingate, PA 16880, Tel: 814-355-1521, Telex: 706473; FSC No.: 50783; Empl.: 115; *Sls. Mgr.:* William Holt ..... **A•1266, 2231; D•1741**

Local Sales Offices & Reps
AZ Tempe, Systems Sls. of Arizona 602-829-9338
CA Los Altos, Cain-White & Co. 415-948-6533
CA Pasadena, A-F Sls. Engrg., Inc. 213-681-5631
CO Englewood, Dynatech, Inc. 303-773-2830
CT Madison, United Comp. 203-245-4810
IN Ft. Wayne, Aktron 219-747-3650
MN Minneapolis, International Sls. Co. 612-831-8423
NM Albuquerque, Systems Sls. of New Mexico 505-881-8877
NY Mendon, Tech-Mark, Inc. 716-624-3840
NC Raleigh, DHR Mktg., INc. 919-876-5450
OR Portland, Intertech Sls. 503-775-3390
PA Glenside, Koebert Assocs., Inc. 215-887-2310
UT Layton, Dynatech, Inc. 801-546-4837
VA Front Royal, Eltron Sls., Ltd. 703-635-7201

PENNTUBE PLASTICS, Madison Ave. & Holly St., Clifton Heights, PA 19018, Tel: 215-622-2300, Telex: 845-212; Empl.: 145

PENN VIDEO INC., 929 Sweitzer Ave., Akron, OH 44311, Tel: 216-762-4840, Telex: 98-6327 PVI-AKR; Empl.: 40; *Sls. Mgr.:* Sandra Donaldson; *Dist. Mgr.:* Chris Abrams

PENNWALT CORP., Three Pkwy., Philadelphia, PA 19102, Tel: 215-587-7520, TWX: 215-569-9748

PENRIL DATACOMM, Penril Corp., 207 Perry Parkway, Gaithersburg, MD 20877, Tel: 301-921-8600, TWX: 710-828-0522; Empl.: 250; *Sls. Mgr.:* David L. Johnson

PERCON, 2190 W. 11th, Eugene, OR 97402, Tel: 503-344-1189; Empl.: 9; *Sls. Mgr.:* Peter Harnack; *Dist. Mgr.:* Peter Harnack

PERFECT GEAR & INSTR., 2101 Jericho Tpk., New Hyde Park, NY 11040, Tel: 516-328-3300, TWX: 510-223-0642; Empl.: 210; *Sls. Mgr.:* Murray Ores

PERFECTION MICA CO., see Magnetic Shield Div.

PERFORMANCE CONTROLS INC., 333-E Byberry Rd., Hatboro, PA 19040, Tel: 215-675-6500, Telex: 881478; FSC No.: 61773; Empl.: 30; *Sls. Mgr.:* M. Edward Wokulich ..... **B•1178**

PERIPHERALS, 3001 Red Hill, Bldg. 6, Ste. 107, Costa Mesa, CA 92626, Tel: 714-540-4925

PERITEK CORP., 5550 Redwood Rd., Oakland, CA 94619, Tel: 415-531-6500, TWX: 910-366-2029; *Sls. Mgr.:* John Brogan

PERKIN-ELMER

PERKIN-ELMER CORP., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856, Tel: 203-762-4786, TWX: 710-468-3213; Empl.: 70; *Sls. Mgr.:* D. P. Duggan ...**A•2232**

Local Sales Offices & Reps
CA Encino, C.D.H. Assocs. 213-707-1970

PERMAG, 400 Karin La., Hicksville, NY 11801, Tel: 516-822-3311, TWX: 710-581-5264; Empl.: 50

PERMAGILE-SALMON LTD., Insulcast Div., 101 Commercial St., Plainview, NY 11803, Tel: 516-349-1100, Telex: 221720 PERM UR; *Dist. Mgr.:* Edward R. Salmon

Local Sales Offices & Reps
FL Boca Raton, Olson Assocs. 305-368-1845
IL Chicago, Karl D. Engle Co., Inc. 312-539-1820
NC Raleigh, DHR Mktg., Inc. 919-781-1961

Local Distributors
AZ Phoenix, The Advance Grp. 602-437-1334
CA Anaheim, The Advance Grp. 714-870-0300
CA Belmont, The Advance Grp. 415-592-4550
CO Denver, The Advance Grp. 303-388-0923
FL Boca Raton, Olson Assocs. 305-368-1845
NC Raleigh, Southeastern Elctrns. 919-828-2311
OH Canal Winchester, Rudolph Bros. 614-833-0707
OH Dayton, Electro Supp. 513-299-5020
TX Houston, The Advance Grp. 713-956-5436
WA Seattle, The Advance Grp. 206-575-4323

PERMALUSTER, INC., 1844 N. Keystone St., Burbank, CA 91504, Tel: 213-849-4543; Empl.: 9; *Sls. Mgr.:* J. Ross

PERMANENT MAGNET, 4437 Bragdon St., Indianapolis, IN 46226, Tel: 317-547-1336; Empl.: 85; *Sls. Mgr.:* Jack Amigh

PERMA POWER ELCTRNS., 5615 W. Howard Ave., Chicago, IL 60648, Tel: 312-647-9414; Empl.: 52; *Sls. Mgr.:* Michael Shatz; *Dist. Mgr.:* Michael Shatz ..... **B•1256; C•1690-1691**

Local Sales Offices & Reps
AR El Dorado, D. Bellew Sls. 214-373-4590
CA San Francisco, Techn. Sls. 415-467-1434
CA Sun Valley, Tegni-Rep 213-768-4223
CO Denver, Stan Sliz & Assoc. 303-666-4760
MA Wolburn, W & D Mktg. 617-935-5610
IN Indianapolis, Green-Wissler 317-872-9981
MI Plymouth, J. Malcolm Flora 313-453-4296
MN St. Paul, R. W. Sls. 612-646-2710
MO Jefferson City, C. A. Vignola 314-636-3121
NJ Marlton, Fahy Mktg. 609-983-2366
NY Phelps, L. S. M. Assocs. 315-548-4891
NY Plainview, Landau & Mack 516-293-3310
NC Greensboro, Adams & Assocs. 919-272-6838
OH Stow, J. Lehner Co. 216-686-1965
TX Dallas, Berthold Sls. 214-328-0067
WA Seattle, Northmar, Inc. 206-524-5170
EXP N.Y., Plainview, Morhan Export. 516-293-5582

PERRY AMPLIFIER, 138 Fuller St., Brookline, MA 02146, Tel: 617-734-0844; Empl.: 18; *Sls. Mgr.:* N. Geskos

PERSONAL MICRO COMPUTERS, 275 Santa Ana Ct., Sunnyvale, CA 94086, Tel: 408-737-8441, TWX: 910-379-5022

PERTEC PERIPHERALS CORP., P.O. Box 2198, Chatsworth, CA 91311, Tel: 818-882-0030, TWX: 910-494-2093; Empl.: 650; *Sls. Mgr.:* Bernie Kallai

PERVEL INDS., INC., Bemis, P.O. Box 61, Community Ave., Plainfield, CT 06374, Tel: 203-564-2741, Telex: 966450; Empl.: 350; *Sls. Mgr.:* Rick Arnold

PFC, See Southern Elctrns. Co. Inc.

PHALO CORP., Transitron Elctrn. Corp., 2 Friberg Parkway, Westborough, MA 01581, Tel: 617-366-0830, Telex: 92-0416, TWX: 710-392-1383; Empl.: 450

PHAOSTRON INSTRUMENT & ELECTRONIC CO., 151 Pasadena Ave., South Pasadena, CA 91030, Tel: 213-255-1471

PHELPS DODGE CABLE & WIRE, Box 2100, Greenwich, CT 06836, Tel: 203-625-3200, TWX: 710-560-0006; Empl.: 750; *Sls. Mgr.:* T. P. Reilly

PHELPS DODGE INTL., 2121 Ponce de Leon Blvd., Ste. 850, Coral Gables, FL 33134, Tel: 212-775-1395, 800-221-3333

PHELPS DODGE MAGNET WIRE, P.O. Box 600, Ft. Wayne, IN 46801, Tel: 219-456-4444, TWX: 810-332-1501; *Sls. Mgr.:* G. H. Guyer; *Dist. Mgr.:* W. H. Deininger

PHILADELPHIA INSULATED WIRE CO. INC., 333 New Albany Rd., Moorestown, NJ 08057, Tel: 609-235-6700, TWX: 710-897-0187; Empl.: 110; *Sls. Mgr.:* Fred Newman

PHILAMON, INC., 33 Dubon Ct., Farmingdale, NY 11735, Tel: 516-249-2700, TWX: 510-224-6512; FSC No.: 95267; Empl.: 27; *Sls. Mgr.:* B.F. Grib

PHILIPS AUDIO VIDEO SYS. CORP., See AKG Acoustics

PHILIPS ECG, See Sylvania Electronic Components

PHILIPS ECG, INC., 100 First Ave., Waltham, MA 02254, Tel: 617-890-6107; Empl.: 600; *Sls. Mgr.:* D. R. Kronenwetter; *Dist. Mgr.:* E. H. Frost

PHILIPS ELECTRONICS, LTD., Crystal Dept., 601 Milner Avenue, Scarborough, Ontario, Can. M1B 1M8, Tel: 416-292-5161, Telex: 065-25100, TWX: 610-492-0483; Empl.: 40; *Sls. Mgr.:* Mr. Jack F. Gehrels

Local Sales Offices & Reps
CA El Segundo, Fetty/Schoenduve, Inc. .. 213-322-4991
FL Pompano Beach, Technology Mktg. Assocs. 510-955-9854
NY Great Neck, Tylinski Assocs., Inc. 516-466-9070

PHILIPS ELMET, 1560 Lisbon Rd., Lewiston, ME 04240, Tel: 207-784-3591, TWX: 710-223-0675; Empl.: 250

PHILIPS TELEVISION SYS., INC., P.O. Box 618, 900 Corporate Dr., Mahway, NJ 07430, Tel: 201-529-1550, Telex: 37-62558; *Sls. Mgr.:* Warren Anderson, Dir. of Mktg.

PHILIPS TEST & MEASURING INSTRS., 85 McKee Dr., Mahwah, NJ 07430, Tel: 201-529-3800; Empl.: 70; *Sls. Mgr.:* Bob Hynes

PHILMORE MFG., 40 Inip Dr., Inwood, NY 11696, Tel: 516-239-6161; Empl.: 22

PhiTech.

PHI TECHNOLOGIES, INC., 4605 North Stiles, Oklahoma City, OK 73105, Tel: 405-521-9000, TWX: 901-831-3286; Empl.: 60; *Sls. Mgr.:* Gary Zebrowski ..... **D•1052-1054**

PHOENIX CONTACT, 1900 Greenwood St., Harrisburg, PA 17104, Tel: 717-232-0500, TWX: 510-650-4913; *Sls. Mgr.:* Howard C. Minnick, Jr.; *Dist. Mgr.:* Mark F. Gilliford ..... **C•1484-1488**

Local Sales Offices & Reps

AZ	Scottsdale, Mahaffey & Assocs. Inc.	602-991-9790
CA	Fremont, Vontek	415-651-7966
CA	Pasadena, Luscombe Engrg. Co.	213-684-2000
CA	San Diego, Luscombe Engrg. Co.	619-295-4300
CO	Denver, Spectrum Sls.	303-696-1601
CT	Bloomfield, Zaslow Sls. Co.	203-242-7781
FL	Tampa, J-R Controls	813-961-9478
GA	Atlanta, C.S.R Elctrns.	404-396-3720
IL	Mt. Prospect, Magnuson Assocs./Magnuson Elctrns.	312-956-0700
KS	Merriam, Mid-West Tech. Sls.	913-236-8557
MD	Baltimore, McCourt Co., Inc.	301-747-0044
NJ	Rockaway, R.O.I. Sls. Co.	201-627-8879
NY	North Syracuse, Lachut Electrical Sls.	315-422-2575
NC	Charlotte, Mec-Tric Control Co.	704-376-8555
OH	Medina, J. C. Hofstetter Co.	216-241-4880
PA	Carnegie, Brown-Yates Electrical Equip. Co.	412-279-1101
PA	Willow Grove, Jacobson-Rodger Assocs.	215-657-4300
TX	Dallas, Lynn Elliott Co., Inc.	214-239-8533
TX	Houston, Lynn Elliott Co., Inc.	713-499-1571
VA	Richmond, McCourt Co., Inc.	804-741-3253
WA	Bellevue, Comtec	206-453-1188

Local Distributors

AZ	Phoenix, Sterling Elctrns.	602-2121
CA	Concord, Omega Supp.	415-671-7796
CA	Duarte, Nelson West Coast, Inc.	213-303-1526
CA	Gardenia, Cal Switch	213-770-2330
CA	Riverside, Elctrn. Supply Co.	714-683-7300
CO	Englewood, E & M Sls., Inc.	303-761-6202
CT	Wallingford, Sager Electrical	203-265-4600
FL	Lakeland, A-A Elec.	813-665-6941
GA	Atlanta, A-C Equip.	404-451-2747
GA	Norcross, Mayer Elec. Supp. Co.	404-447-6800
IL	Lombard, MacGregor & Co. Inc.	312-629-5752
IN	Carmel, Altex Elctrns.	317-848-1323
LA	Baton Rouge, Ralph's Indl. Elctrns.	504-344-3761
LA	Lafayette, Ralph's Indl. Elctrns.	318-234-4507
MD	Baltimore, A.I.C.	301-747-0044
MA	Hingham, Sager Electrical	617-749-6700
MI	Roseville, Madison Elec.	313-778-7640
MO	St. Charles, Lectronix Inc.	314-946-6424
NJ	East Rutherford, A-A Elec.	201-777-5477
NJ	Pennsauken, Resco Elctrns.	609-662-4000
NY	Orchard Park, Park Elec.	716-662-7070
NY	Rochester, Rochester Radio	716-454-7800
NY	Syracuse, Salmon Motor Repair	315-455-7924
NC	Charlotte, Dixie Elctrns.	704-377-5413
NC	Gastonia, JMT Elctrns. & Controls, Inc.	704-867-4401
OH	Cincinnati, Schuster Elctrns.	513-489-1400
OH	Cleveland, Adcon Engrg.	216-238-3915
OH	Twinsburg, Schuster Elctrns.	216-425-8134
OR	Portland, North Coast Elec.	503-228-5111
OR	Portland, United Radio Supp.	503-233-7151
PA	Bradford, B-B Elec. Supp. Co.	814-368-4173
PA	Pittsburgh, Grant Industrial Controls	412-787-9770
PA	Reading, R.A.M. Motors and Controls	215-376-7102
SC	Columbia, Dixie Elctrns.	803-779-5332
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Houston, General Elec. Supp. Co.	713-939-5100
TX	Houston, Sterling Elctrns.	713-627-9800
TX	Houston, Timers & Controls, Inc.	713-894-0714
UT	Salt Lake City, Standard Supp. Co.	810-486-3371
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Spokane, North Coast Controls	509-922-1317
WI	Cedarburg, A-A Elec.	414-377-8000

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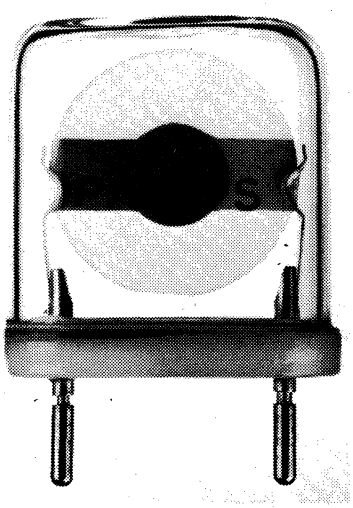

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NJ	Medford, Component Conslts.	609-654-5300
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OH	Miamisburg, Components, Inc.	513-866-0661
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WA	Mercer Island, Electronic Comp. Sls.	206-232-9301

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TX	Austin, Potter Co.	512-451-5721
TX	Richardson, Potter Co.	214-644-0575

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CA	San Diego, El-Com, Inc.	619-578-0900
CA	San Diego, Fischer-Brownell	619-560-8545
CA	San Francisco, KEA Elctrn. Distributing	415-887-2900
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CT	New Haven, Cronin Elctrns.	203-265-3134
CT	Orange, Milgray Elctrns.	203-795-0711
FL	Orlando, Intertec Comps.	305-834-7777
FL	Winter Park, Milgray Elctrns.	305-647-5747
GA	Atlanta, Milgray Elctrns.	404-393-9666
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IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
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POWER CONTROLS, P.O. Box 5860, San Antonio, TX 78201, Tel: 512-734-7155, Telex: 767222; Empl.: 90; *Sls. Mgr.:* Robert A. McAlister

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NM	Albuquerque, Electro-Tek Sls.	505-883-4871
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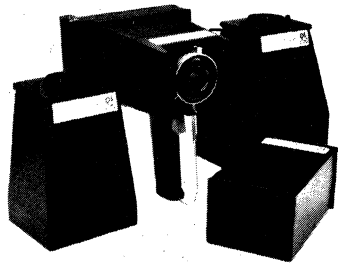

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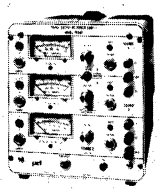

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MN Minneapolis, Loren Green Assocs. 612-571-6666
MO St. Louis, Atech 314-428-7447
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OH Solon, Arrow Elctrns. 216-248-3990
OK Tulsa, Sterling Elctrns. 918-663-2410
OR Portland, Radar Elec. 503-232-3404
PA Horsham, Pioneer/Delaware Valley ... 215-674-4000
PA Lancaster, CAM/RPC Elctrns. 717-392-8141
PA Monroeville, Arrow Elctrns. 412-856-7000
PA Pittsburgh, Alder Tronics 412-821-5565
PA Pittsburgh, CAM/RPC Elctrns. 412-782-3770
PA Wayne, Peak Elctrns. 215-293-9000
RI Warwick, Major Edwards Elctrns. 401-781-3000
TX Dallas, Arrow Elctrns. 214-386-7500
TX Dallas, Force Elctrnd. 214-438-5700
TX Dallas, Pioneer/Dallas 214-386-7300
TX Dallas, Sterling Elctrns. 214-243-1600
TX Houston, Force Elctrns. 713-772-8483
TX Houston, Sterling Elctrns. 713-627-9800
TX Stafford, Arrow Elctrns. 713-491-4100
UT Salt Lake City, Arrow Elctrns. 801-539-1135
UT Salt Lake City, Diplomat Elctrns. 801-486-4135
VA Richmond, Arrow Elctrns. 804-282-0413
VA Richmond, Sterling Elctrns. 804-226-2190
WA Bellevue, Arrow Elctrns. 206-643-4800
WA Seattle, Radar Electric 206-282-2511
WI Oak Creek, Arrow Elctrns. 414-764-6600
EXP CA, Los Angeles, Hanex, Inc. 213-556-3807

POWER-ONE, INC., Power-One Switching Products, 833 Flynn Rd., Camarillo, CA 93010, Tel: 805-482-0757, Telex: 752083; FSC No.: 54407; Empl.: 214

POWER PAC INC.

POWER PAC, 32 Meadow St, S. Norwalk, CT 06856, Tel: 203-866-4484; FSC No.: 53998; Empl.: 175; *Sls. Mgr.:* Abe Partner ..... **D•1774-1778**

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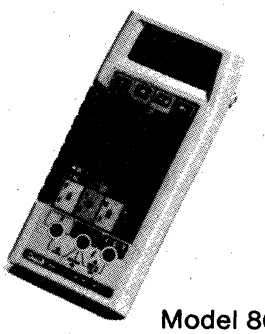

Model 8060a

Local Sales Offices & Reps

AL	Huntsville, BCI	205-539-4411
CA	Los Altos, AARD Engr.	415-948-5740
CA	Westlake Village, Powerdyne Inc.	213-991-0632
CT	Hamden, Digital Sls. Assoc.	203-248-3641
GA	Chamblee, BCI	403-455-0405
MD	Seabrook, W. A. Brown-Equip. Co.	301-577-6105
MA	Waltham, Digital Sls. Assoc.	617-899-4300
MN	Minneapolis, R.J. Inc.	612-866-3661
NJ	E. Hanover, Emtec	201-428-0600
NJ	Princeton, Murtronics	609-394-3737
NJ	Teaneck, SGL Sls.	201-837-2352
NY	Cazenovia, S.T. Woolard	315-655-8145
NY	Melville, Emtec	516-752-1630
NC	Raleigh, BCI	919-781-9426
PA	Harrisburg, Beil & Whitaker	717-564-6900
TX	Houston, Scientific Sls.	713-666-5318
TX	Richardson, Scientific Sls.	214-231-6541

Local Distributors

CT	Hamden, Digital Sls. Assoc.	203-248-3641
MA	Waltham, Digital Sls. Assoc.	617-899-4300

POWER-PAK, INC., 6216 Oakton St, Morton Grove, IL 60053, Tel: 312-966-6000; Empl.: 16; *Sls. Mgr.:* Robert Villari

POWER PRODUCTS DIV., COMPUTER PRODS., INC., See Power Products Group

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POWER PRODUCTS DIV., Computer Products, Inc., 2981 Gateway Drive, Pompano Beach, FL 33069, Tel: 305-974-2442, TWX: 510-956-3098; FSC No.: 62125; Empl.: 180
D•1446, 1552-1553, 1559-1572, 1584-1585

Refer to Computer Prods., Inc., Pompano Beach, FL, for sales offices & representatives & distributors.

POWER-SCIENCE, 7667 Vickers St, San Diego, CA 92111, Tel: 619-292-4322; Empl.: 6; *Sls. Mgr.:* E. Cooper

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POWER-SONIC, Box 5242, 3106 Spring St, Redwood City, CA 94063, Tel: 415-364-5001, Telex: 348400; Empl.: 30; *Sls. Mgr.:* B. A. Ender; *Dist. Mgr.:* B. A. Ender
D•1431

Local Sales Offices & Reps

CA	Irvine, English/Damco	714-837-3801
FL	Tampa, SRT Mktg.	813-884-4805
IL	River Forest, Pete Collins	312-366-7076
MA	Natick, Steve Dworkin	617-653-7188
MS	Jackson, Welch & Doby	601-932-5534
NY	Wantagh, Dony Tech. Sls.	516-826-5550
NC	Raleigh, DHR Mktg.	919-876-5450
PA	Media, W. Reeves Assocs.	215-566-6709
SC	Greenville, DHR Mktg.	803-235-3594
TX	Dallas, Power Connection	214-357-8207

Local Distributors

CA	Chatsworth, Mil-Comm Distr.	213-998-3111
CA	Fountain Valley, Components Center	714-979-0433
CA	Santa Clara, Components Center	408-988-3751
CO	Denver, Hensley Battery	303-455-3643
CT	Waterbury, Lighting Svcs., Inc.	203-756-8148
FL	Miami, ESL Elctrn. Distr.	305-633-6973
FL	Tampa, Leader Elctrns.	813-870-3315
GA	Atlanta, Allied Elctrns.	404-237-3366
GA	Atlanta, Security Wherehouse	404-955-1006
IL	Chicago, Allied Elctrns.	312-697-8200
IL	Villa Park, Melvin Elctrns.	312-378-7741
LA	Lafayette, Ralph's Elctrns.	318-234-4507
MA	Sharon, Adcour	617-784-3996
MI	Detroit, Alarm Supp.	313-425-2500
MO	St. Louis, Olive Elctrns.	314-426-4500
NM	Albuquerque, Betatron, Inc.	505-344-2381
NY	Ridgewood, J.A. McDermott Corp.	212-456-3606
OK	Tulsa, Radio, Inc.	918-587-9123
PA	Pittsburgh, Triangle Elctrns.	412-441-9659
TX	Austin, Harrison Indl. Elctrns.	512-458-3555
TX	Ft. Worth, Allied Elctrns.	817-265-9341
TX	Houston, Harrison Equip.	713-652-4700
TX	San Antonio, Sherman Elctrns.	512-224-1001
VA	Richmond, Sterling Elctrns.	804-226-2190

POWER SYSTEMS, 12 Tobey Rd., Bloomfield, CT 06002, Tel: 203-243-0357, TWX: 710-425-8778; FSC No.: 50463; Empl.: 375; *Sls. Mgr.:* Richard Milne
D•1780-1781

Local Sales Offices & Reps

AZ	Phoenix, Tech Sls./Powerhouse	602-246-1614
CA	San Jose, Powerhouse	408-748-1555
CA	Santa Ana, Powerhouse	714-549-9599
CT	Westbrook, Comptech, Inc.	203-399-9704
MA	Tyngsboro, Comptech	617-649-3030

POWER SYSTEMS & CONTROLS, INC., 3206 Lanvale Ave., Richmond, VA 23230, Tel: 804-355-2803; Empl.: 40

POWER SYS. GRP., Rantec Div., Emerson Elec., 9401 Oso Ave., Chatsworth, CA 91311, Tel: 818-885-8223, TWX: 910-493-1247; FSC No.: 04971; Empl.: 265; *Sls. Mgr.:* Daniel L. Esau

POWERTEC, INC.

POWERTEC, INC., 20550 Nordhoff St, Chatsworth, CA 91311, Tel: 818-882-0004, TWX: 910-494-2092; Empl.: 349; *Sls. Mgr.:* Royston A. Allman
D•1782-1799

POWERTECH, INC., 0-02 Fairlawn Ave., Fairlawn, NJ 07410, Tel: 201-791-5050, Telex: 353970; FSC No.: 32953; Empl.: 49; *Sls. Mgr.:* Alan J. Melnyk

Power Technology Inc.

POWER TECHNOLOGY, INC., P.O. Box 9769, Little Rock, AR 72219, Tel: 501-568-1995, TWX: 910-722-7313; Empl.: 69; *Sls. Mgr.:* John Webb
B•1125

POWERTREND, INC., 3139-G Los Feliz Dr., Thousand Oaks, CA 91362, Tel: 805-496-2945; *Sls. Mgr.:* R. Jones

POWER TEN, INC., 486 Mercury Dr., Sunnyvale, CA 94086, Tel: 408-738-5959, Telex: 172588 SNLO; FSC No.: 61987; *Sls. Mgr.:* Vince Mutascio
D•1779

Local Sales Offices & Reps

AZ	Mesa, Insight	602-820-4955
AZ	Phoenix, Jayson Co., Inc.	602-867-1964
IA	Cedar Rapids, Palatine Engrg. & Sls.	319-365-8071
KS	Mission, Palatine Engrg. & Sls.	913-831-0555
MO	Hazelwood, Palatine Engrg. & Sls.	314-839-0800
NJ	Wayne, Ramapo	201-839-6767
NY	Rochester, Scientific Dvcs.	716-334-2445
OR	Portland, Westcon	503-283-0132
PA	Glenside, Koebert	215-887-2310
TX	Austin, Eberts Elctrns. Sls.	512-258-1067
TX	Latexo, Eberts Elctrns. Sls.	409-687-4342

POWERTRON, See Industrial Test Equipment Co., Inc.

POWERTRON, Contraves Goerz Corp., 3821 Barranger Dr., Charlotte, NC 28210, Tel: 704-525-8962, Telex: 572-444; *Sls. Mgr.:* Sam LoBue

POWR-UPS CORP., 50 Orville Drive, Bohemia, NY 11716, Tel: 516-589-3602; Empl.: 50; *Sls. Mgr.:* Alon Kopstein
B•1182-1183

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CA	Fullerton, ESCO	714-879-7260
CA	San Diego, Total Elctrns. Int'l.	619-224-3291
IL	Oak Brook, A.G. Erickson	312-323-1367
KS	Shawnee Mission, LSC, Inc.	913-362-2121
MA	Southborough, Motion Engrg.	617-485-2144
NY	Pittsford, Magna Prod. Corp.	716-586-8621
OH	Dover, AJ Assocs.	216-343-2224
PA	Audubon, Holmes Assocs.	215-666-0636

PPC PRODS., 7516 Central Industrial Dr., Riviera Beach, FL 33404, Tel: 305-848-9606, TWX: 510-952-7611; FSC No.: 33178; Empl.: 50; *Sls. Mgr.:* Nick Ernick

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PPD, INC., Hwy. 70W, Resco Ct., P.O. Box 31347, Raleigh, NC 27612, Tel: 919-781-3955
A•1157-1165

PPM, INC., 4521 Emery Ind. Pkwy., Cleveland, OH 44128, Tel: 216-292-6006; Empl.: 20; *Sls. Mgr.:* A. L. Bletcher
D•1291

Local Sales Offices & Reps

AZ	Phoenix, J. Smith & Assocs.	602-267-0981
CO	Denver, J. Smith & Assocs.	303-597-5343
MI	Ferndale, Tiby Co.	313-547-3550
NM	Albuquerque, J. Smith & Assocs.	505-265-3406
NC	Charlotte, Binco	704-366-5092
OH	Cleveland, Tiby Co.	216-371-5335
OH	Dayton, Tiby Co.	513-277-3822

PRACTICAL AUTOMATION, Trap Falls Rd., Shelton, CT 06484, Tel: 203-929-5381, Telex: 6813310; Empl.: 150; *Sls. Mgr.:* R. M. Banzaca

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Mfr. Agts., Inc.	205-830-4030
CA	Los Alamitos, Gemini Assocs.	213-594-9618
CA	Mountain View, Thorson West	415-964-9300
CA	North Hollywood, Gemini Assocs.	818-846-2633
CA	San Diego, Gemini Assocs.	619-268-1181
CT	Ellington, J. J. Wild, Inc.	800-223-9456
FL	St. Petersburg, Elctrn. Mfr. Agts., Inc.	813-894-1171
IL	Elk Grove Village, Martec Assocs.	312-956-8090
MD	Rockville, JH Computer	301-424-0700
MA	Needham, J. J. Wild	617-449-5600
MI	Grand Rapids, R. P. Urban & Assocs.	616-245-0511
MN	Minneapolis, Chris & Assocs.	612-861-1634
NJ	Pompton Lakes, Wild & Rutkowski	201-839-0071
NY	Clark Mills, KLM-Garner	315-853-6126
NY	Jericho, Wild & Rutkowski	516-935-6600
NY	Pittsford, KLM-Garner	716-381-8350
NC	Winston Salem, Elctrn. Mfr. Agts.	919-784-7304
OH	Cleveland, Electro Sls. Assoc.	216-261-5440
OH	Dayton, Electro Sls. Assoc.	513-426-5551
PA	Willow Grove, QED Elctrns.	215-657-5600
TX	Houston, Barry Sls. Inc.	713-784-5860
TX	Richardson, Barry Sls. Inc.	214-234-0255
WA	Bellevue, Tasco Inc.	206-453-1414

PRACTICAL TECHNOLOGY, 12 Village Ctr., Box 449, Carmel Valley, CA 93924, Tel: 408-659-3128; FSC No.: 59089; Empl.: 7; *Sls. Mgr.:* Keith Rosburg

PRAGMATIC DESIGNS, INC., 950 Benicia Ave., Sunnyvale, CA 94086, Tel: 408-736-8670, Telex: 17-1627, TWX: Nanet D Suvl; FSC No.: 94-2543110; Empl.: 45

PRD ELCTRNS., DIV. OF HARRIS CORP., see Harris Corp., PRD Electronics Div.

Precontact, inc.

PRECICONTACT, INC., 835 Wheeler Way, Langhorne, PA 19047, Tel: 215-757-1202, Telex: 83-4253; FSC No.: 60197; *Sls. Mgr.:* Joseph Carroll
C•1494-1495

Local Sales Offices & Reps

AL	Huntsville, Electro Sls., Inc.	205-830-2715
AZ	Litchfield Park, G. B. Elctrns.	602-935-3984
AZ	Tuscon, G.B. Elctrns.	602-297-9759
CA	Mountain View, The Gene Woempner Co.	415-964-5454
CA	Orange, Elctrn. Tech. Assocs.	714-998-2901
CO	Englewood, White Sls. Co.	303-694-9555
GA	Atlanta, Electro Sls., Inc.	404-394-1122
IL	Rolling Meadows, Heartland Tech. Mktg.	312-577-9222
IN	Greenwood, Valentine & Assocs.	317-888-2260
IN	South Bend, Valentine & Assocs.	219-288-7070
MD	Rockville, Mechtronics Sls., Inc.	301-340-2130
MA	Norwood, The Mac Innis Co.	617-762-8090
NJ	Mountain Lakes, Components for Elctrns.	201-334-2921

NY Courtland, Net Sls. Co. 607-756-6592
NY DeRuyter, Net Sls. Co. 315-662-7996
NY East Northport, Components For Elctrns. 516-266-5020
NY Fairport, Net Sls. Co. 716-467-4538
NY Troy, Net Sls. Co. 518-274-4758
NY Webster, Net Sls. Co. 716-467-4538
NC Raleigh, Tingen Tech. Sls., Inc. 919-781-1100
OH Cincinnati, Makin & Assocs. 513-871-2424
OR Portland, Electronic Mktg. Grp. 503-289-5320
PA Hatboro, Jacobsen Assocs. 215-674-2937
PA Lebanon, Jacobsen Assocs. 717-273-9746
PA Pittsburgh, Kneip Sls. 412-823-0169
TN Chattanooga, Electro Sls., Inc. 615-267-4260
TX Plano, Sundance Sls. 214-867-0592
UT Salt Lake City, Charles Fields & Assocs. 801-531-6177
WA Redmond, Electronic Mktg. Grp. 206-882-0962
WI Milwaukee, Heartland Tech. Mktg. 414-931-0606
Can Rexdale, Ont., Electro Source, Inc. 416-675-4490
Can Vancouver, B.C., Davetek Mktg. 604-430-3680

Local Distributors

AZ Litchfield Park, GB Elctrns. 602-935-3984
CA Orange, Electronic Connexions Corp. 714-998-2901
CA San Diego, Park West 619-277-8433
CA San Jose, Cypress Elctrns. 408-945-8400
CA Santa Clara, DC Elctrns. Supp. 408-980-1199
CA Sunnyvale, Future Elctrns. 408-745-6570
CA Torrance, Cypress Elctrns. 213-533-6005
CO Denver, CSID, Inc. 303-292-9594
CO Westminster, Future Elctrns. 303-650-0123
CO Wheatridge, Cypress Elctrns. 303-431-2622
CT Danbury, Future Elctrns. 203-743-9594
CT Norwalk, Park Distrs. 203-853-2010
CT Wallingford, Cronin Elctrns., Inc. 203-265-3134
FL Clearwater, Electronic Precepts of FL 813-530-9781
FL Clearwater, Future Elctrns. 813-441-4771
FL Lake Park, Park/South, Inc. 305-863-7275
FL Pompano Beach, Components South 305-971-0350
IL Lisle, Components, Inc. 312-852-7707
IL Palatine, OHM Elctrns., Inc. 312-359-5500
IN Indianapolis, Mar Elctrns. 317-875-4510
MD Columbia, Future Elctrns. 301-995-1222
MD Rockville, Wire Tech., Inc. 301-340-1445
MA Needham, Cronin Elctrns. 617-449-5000
MA Norwood, Emtel Elctrns. 617-769-9500
MA Westborough, Future Elctrns. 617-366-2400
MA Westford, Electronic Specialty Intl. 617-486-8495
MA Wilmington, Aved Elctrns. 617-657-8310
NH Nashua, Brevan Elctrns. 603-889-7230
NJ Bellmawr, Mid-Atlantic Elctrns. 609-931-5303
NJ Berlin, GCI Corp. 609-768-6767
NJ Englewood, Powell 201-894-0800
NJ Mt. Laurel, Future Elctrns. 609-778-7600
NJ Springfield, Route Elctrns. 201-379-7710
NM Albuquerque, Connecting Comps. Div. 505-345-8921
NY Bohemia, Norelcom Elctrns. Corp. 516-567-8866
NY Brooklyn, Beryl Elctrns. 718-383-2208
NY Brooklyn, Connector Resources 718-383-2208
NY East Syracuse, Future Elctrns. 315-453-6633
NY Farmingdale, Resources for Elctrns. 516-420-8555
NY Hauppauge, Jaco Elctrns. 516-273-5500
NY Liverpool, Future Elctrns. 315-451-2371
OH Dayton, Televox, Inc. 513-294-4499
OH Mansfield, Rush Elctrns. Distrs., Inc. 419-756-2311
OR Beaverton, Component Resources 503-641-8488
PA Wayne, Peak Elctrns. 215-293-9000
PA York, E.C.I. 717-843-8971
TX Allen, Prime Distrbg. Co. 214-231-0170
TX Grand Prairie, Dial Supp. 214-647-2371
TX Richardson, Jaco Elctrns. 214-235-9575
TX Richardson, Southwest Elctrns. 214-234-3050
TX Stafford, Southwest Elctrns. 713-240-4000
UT Salt Lake City, Future Elctrns. 801-972-8489
WA Bellevue, Future Elctrns. 206-624-9609
WA Bellevue, Integrated Elctrns. 206-455-2727
WA Seattle, Pacific Elctrns. 206-575-1050
WI Brooklyn Center, Willman Assocs. 612-566-5010
Can Calgary, Alb., Future Elctrns. 403-259-6408
Can Downsview, Ont., Future Elctrns. 416-663-5563
Can Edmonton, Alb., Future Elctrns. 403-486-0974
Can Ottawa, Ont., Future Elctrns. 613-820-8313
Can Pointe Claire, Que., Future Elctrns. 514-694-7710
Can Vancouver, B.C., Future Elctrns. 604-438-5545

PRECISION COMPONENTS, INC., 1110 W. National Ave., Addison, IL 60101, Tel: 312-543-6400

PRECISION ELCTRN. COMPS. LTD., 1919 Hafis Rd., Toronto, ON, Canada M6M 2V6, Tel: 416-249-7103, Telex: 06-969671

PRECISION ELCTRNS., 9101 King Ave., Franklin Park, IL 60131, Tel: 312-678-5350; Empl.: 25; *Sls. Mgr.:* William Stow

PRECISION EXTRUSIONS, INC., Box 120, Bensenville, IL 60106, Tel: 312-766-0340; *Sls. Mgr.:* Jim Achen

PRECISION FILTERS, INC.

PRECISION FILTERS, 240 Cherry St., Ithaca, NY 14850, Tel: 607-277-3550, Telex: 646846; FSC No.: 66-II-F & 66-II-I; Empl.: 49; *Sls. Mgr.:* D. F. Chandler ..... **A•1624-1627; D•1017**

Local Sales Offices & Reps

AZ Tempe, Cleveland Entprs. 602-820-1127
CA La Crescenta, Beckrep 818-957-1111
CA San Jose, Synergistic Sls. 408-292-6573
CO Colorado Springs, Cleveland Entprs. of Colorado 303-597-8872
DC Arlington, Gans & Pugh 703-527-3262
FL Osprey, Dick Ridgewell Co. 813-484-2020
MD Dayton, Gans & Pugh Assocs. 301-596-9094
MN Chanhassen, Electronic Instr. Conslts. 612-445-7056
NJ Midland Park, Langstrom Instrs. 201-891-2829
NM Albuquerque, Cleveland Entprs. 505-265-7893
UT Salt Lake City, Cleveland Entprs. 801-355-8424
VA Arlington, Gans & Pugh Assocs. 703-527-3262
WA Bellevue, Topp Engrg. Sls. 206-747-5400
Can Downsview, Ont., Rayonics Scientific 416-736-1600

PRECISION LAMP, INC., 480 Aaron Dr., Cotati, CA 94928, Tel: 707-792-0333, Telex: 348498; Empl.: 25

PRECISION LEVEL VIAL CO., Warren Industries Inc., 1800-D Mearns Rd., Warminster, PA 18974, Tel: 215-675-2355; Empl.: 12; *Sls. Mgr.:* Christopher Beyer; *Dist. Mgr.:* Christopher Beyer

PRECISION MECHANISMS, 44 Brooklyn Ave., Westbury, NY 11590, Tel: 516-ED3-5955; FSC No.: 08127; Empl.: 26; *Sls. Mgr.:* Leon N. Canick

PRECISION METAL PRODS. CO., Centennial Indl. Pk, Peabody, MA 01960, Tel: 617-532-5500, TWX: 710-347-0123; FSC No.: 86577; Empl.: 54; *Sls. Mgr.:* Robert H. Degnan

Local Sales Offices & Reps

AZ Phoenix, J. Osborn Assocs. 602-996-1291
CA Corte Madera, P. Oneal & Assocs. 415-924-1691
CA Garden Grove, Impact Elctrns., Inc. 213-431-3581
CO Arvada, Challenge Sls. 303-427-3149
FL Clearwater, Chaco Sls. 813-536-9503
IL Hinsdale, Hill-Gray Assocs. 312-325-4810
IN South Bend, Schillinger Assocs. 219-291-6258
NJ Cherry Hill, ESA Assoc. 609-667-4066
NJ Verona, L. J. Roth Assoc. 201-857-3393
NY Syracuse, C.W. Floring & Assocs. 315-478-2149
OH Dayton, Electro-Com 513-276-3993
OR Portland, Paul Oneal Assoc N/W, c/o Clyde W. Olsen 503-775-3552
SC Greenville, Component Sales Co. 803-288-1922
TX Richardson, Draper Co. 214-680-1650

PRECISION MICRO IMAGES, Box 1330, Altamonte Springs, FL 32701, Tel: 305-830-7244, Telex: 56-4303; *Sls. Mgr.:* Williams S. Hodges

PRECISION MONOLITHICS, INC., 1500 Space Dr., Santa Clara, CA 95054, Tel: 408-727-9222, TWX: 910-338-0218; FSC No.: 06665; Empl.: 1,000; *Sls. Mgr.:* Jo Nall; *Dist. Mgr.:* Mike Dennison

PRECISION RESISTIVE PRODS., INC., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, Tel: 319-394-9131; Empl.: 90; *Sls. Mgr.:* Oscar Cline; *Dist. Mgr.:* Oscar Cline ..... **A•1929**

Local Sales Offices & Reps

CA Anaheim, Impact Electrns. Inc. 714-533-1351
CA Los Altos, Frauman Assoc. 415-941-0660
CA San Diego, KCE 619-278-7640
CO Denver, Williams Assocs. 303-373-4730
CT Milford, Cuming Assocs. 203-878-3946
FL Cocoa Beach, Reynolds & Assocs. 305-784-4700
IL Chicago, Ellinger Sls. 312-763-1570
IN Greenwood, Valentine Assocs. 317-888-2200
MD Ellicot City, Technical Sls. Inc. 301-461-2400
MA Waltham, Jesco, Inc. 617-893-0094
MI Warren, DEM Elctrns. Sls. 313-575-9444
MN Minneapolis, Intl. Sls. 617-831-8423
MO St. Charles, Chesco 314-946-6677
NY Hauppauge, Masin-Enco, Inc. 516-273-3500
NY Syracuse, C.W. Floring and Assocs., Inc 315-478-2149
OH Cincinnati, G & H Sls. Co. 513-272-0580
TX Richardson, Campion Sls. Co. 214-238-8145
WA Seattle, W3 Assocs., Inc. 206-285-2667

PRECISION RESISTOR CO., INC., 10601 75 St. N., Largo, FL 33543, Tel: 813-541-5771, Telex: 821788; FSC No.: 48615; Empl.: 45; *Sls. Mgr.:* R. L. Wright ..... **A•1930-1933; B•1770-1771**

PRECISION TECH. SEWING, 921 E. Charleston Rd., Palo Alto, CA 94303, Tel: 415-856-2128

PRECISION TUBE, Church Rd. & Wissahickon, N. Wales, PA 19454, Tel: 215-699-5801, Telex: 84-6439; FSC No.: 82413; Empl.: 240; *Sls. Mgr.:* William J. McNeil

Local Sales Offices & Reps

AZ Tempe, Walter Assocs. 602-967-1020
CA Carlsbad, Addem San Diego 619-729-9216
CA Santa Ana, RMS Assocs. 714-556-4155
CA Santa Clara, R. Donahue Assocs. 408-727-6694
CO Golden, J. F. Hurlbut Co. 303-279-7796
FL Melbourne, Hanson Assocs. 305-727-7474
IL Park Ridge, Probe Electrns. 312-696-2828
IN Indianapolis, John Sukup Inc. 317-253-5501
IA Cedar Rapids, Snider Sls. Co. 319-362-4410
MD Frederick, Applied Engrg. Prod., Inc. 301-663-4202
MA Burlington, Tri Tek 617-272-4550
MO St. Peters, D-S Sls. 314-928-5153
NJ Haddonfield, Sunday-O'Brien 609-429-4013
NY Huntington, CDB Enterprises 516-692-5200
NY Syracuse, I.A. Hotze 315-479-6641
TX McKinney, Williams Assocs. 214-548-0995
EXP Hants England, Sealectro. Ltd ... 011-44-705-373211
EXP Ramat-Gan Isreal, Elina, Ltd 03-7514129
EXP Toulo Cedex France, Sealectro, SA 011-33-947-58443
Can St. Laurent Quebec, RF Microwave, Ltd 514-931-8115

Local Distributors

CA El Cajon, Micro Mode Prods. 619-449-3844
CA Santa Clara, Waltronic Sls. 408-727-1200
CA Sunnyvale, Electronic Resources 408-745-1420
FL Stuart, Microwave Comp., Inc. 305-286-4455
MD Baltimore, Resco Baltimore 301-823-0070
MD Beltsville, Resco Washington 301-937-9100
MA Woburn, Pacer Electrns. 617-935-8330
NY Freeport, Mil Spec Wire & Cable 516-546-5454
NY New Rochelle, Compucon Dists. 914-576-2888
Can St. Laurent Quebec, Omniconnect, Inc. 514-335-2337

PREFERRED ELCTRNS., INC., Main Line Dr, P.O. Box 954, Westfield, MA 01086, Tel: 413-568-2301, Telex: 955-339; Empl.: 250; *Sls. Mgr.:* Merton I. Rosenberg

PREH ELECTRONICS INDUSTRIES, INC.

PREH ELECTRONICS INDUSTRIES, INC., 5665 Howard Street, Niles, IL 60648, Tel: 312-647-8338, Telex: 297112; FSC No.: 36-3193682; Empl.: 7; *Sls. Mgr.:* George Zib ..... **A•2034; B•1736; C•1497**

Local Sales Offices & Reps

CA Sunnyvale, James Inds. West 408-971-6016
IL Inverness, James Inds., Inc. 312-358-8000

PREMAX PRODS. DIV., Highland & College Aves., Niagara Falls, NY 14305, Tel: 716-285-9186, Telex: 91-531; FSC No.: 74183; Empl.: 350

PREMIER METAL

PREMIER METAL PRODS. CO., 381 Canal Pl., Bronx, NY 10451, Tel: 212-993-9200; Empl.: 75; *Sls. Mgr.:* Anthony E. Bozza ..... **C•1072-1073**

Local Sales Offices & Reps

AZ	Phoenix, CPS Associates	602-246-1097
CA	City of Industry, Premier Metal	818-336-4534
CA	San Jose, Silicon Valley Sls., Inc.	408-286-7510
CA	Westmunster, West Elctrn. Sls. Co.	714-898-0120
CO	Denver, AKI Enterprises	303-338-4488
CT	East Haven, Eagle Assocs.	203-467-6542
FL	Lake Worth, Adams & Assocs.	305-588-7630
GA	Marietta, Adams & Assocs.	404-973-0853
IL	Elmhurst, Utronix Sls.	312-834-1100
KS	Overland Park, Delltron Co.	913-649-2078
MD	Burtonsville, Eastern Instrmn.	301-384-8500
MA	Needham, Eagle Assocs.	617-444-3446
MI	Brighton, Electronic Sources	313-227-3598
MN	Minneapolis, J.E.M. Anderson Co.	612-823-6459
MO	St. Louis, Delltron Co.	314-869-4779
NM	Rio Rancho, RML Associates	303-757-6654
NY	New Hyde Park, Harris & Aldrich Sls.	516-488-2622
NY	Syracuse, Lewis-Dunnigan Co.	315-446-5522
NY	Yonkers, Sonkin Assocs.	914-968-8282
NC	Greenboro, Adams & Assocs.	919-272-6838
OH	Akron, ImTech Inc.	216-666-1185
PA	Bensalem, Eastern Instrmn.	215-245-6660
TX	Bedford, W. Pat Fralia Co. Inc.	817-267-3577
TX	Houston, W. Pat Fralia Co. Inc.	713-772-1572
EXP	FL, Miami, Emec, Inc.	305-871-3124

Local Distributors

AL	Huntsville, Mock Elctrns.	205-539-2401
AL	Opelika, Southern Elctrns.	205-745-5298
AZ	Phoenix, Dalis Elctrns.	602-275-2885
CA	Burlingame, Rose Elctrns.	415-348-2740
CA	San Jose, Quement Elctrns.	408-998-5900
CT	Middletown, Midstate Elctrns.	203-347-5638
FL	Dania, Summit Elctrns.	305-920-6253
FL	Miami, Electronic Equip. Co.	305-871-3500
IL	Elk Grove Village, GBL/Gould Elctrns.	312-593-3220
IN	Fort Wayne, Graham Elctrns.	219-423-3422
LA	Baton Rouge, Menard Elctrns.	504-355-0323
MD	Baltimore, ASI Elctrns.	301-265-5100
MD	Baltimore, Resco	301-823-0070
MD	Bethesda, Empire Elctrns.	301-656-3300
MA	Hingham, Sager Electrical Supp.	617-749-6700
MA	Newton, Greene-Shaw Co.	617-969-8900
MI	Ann Arbor, Purchase Radio Supp.	313-668-8696
MO	Kansas City, Walters Radio Supp.	816-531-7015
NJ	Cranford, Garden State Indl. Elec.	201-272-6400
NJ	Green Brook, Green Brook Elctrn.	201-968-3500
NJ	Hanover, State Elctrns. PTS	201-887-2550
NJ	Kenilworth, Federated Purchaser	201-272-0505
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Hauppauge, Broadline Elec. Dist.	516-231-4100
NY	Hempstead, Davis Elctrn. Corp.	516-483-9200
NY	Lynbrook, Peerless Radio Dist. Corp.	212-523-3456
NY	LIC, H. L. Dalis Inc.	212-361-1100
NY	New York, Argil Elec. LTD	212-691-8111
NY	New York, Martin Audio/Video Corp.	212-541-5900
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Rochester, Simcona Elctrn. Corp.	716-328-3230
NY	Rochester, Summit Elctrns.	716-334-8110
NY	Yonkers, Yonkers Elec. Supp.	914-969-6044
NC	Raleigh, Southeastern Radio	919-828-2311
OH	Warren, Rem Elctrns.	814-453-5626
PA	Allentown, Federated Elctrns.	215-437-4481
PA	Braddock, Leff Elctrns.	412-271-7100
PA	Horsham, Toner Cable Equip.	215-675-2053
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
PA	Reading, Barbey Elctrns.	215-376-6116
PA	West Chester, West Chester Elec. Supp.	215-696-7500
RI	Warwick, Edwards Elctrns.	401-732-3200
SC	Charleston, Wholesale Indl. Elec.	803-722-2634
TN	Clarksville, Randolph Hale & Matthews	615-647-2325
TN	Cookeville, Randolph & Parks	615-526-6184
TN	Nashville, Randolph & Rice	615-255-5601
TN	Tullahoma, Randolph Rice & Williams	615-455-4531
TX	Farmers Branch, Summers Elec. Co.	214-748-6533
TX	Ft. Worth, Swieco Inc.	817-335-6521
TX	Houston, Lenert Co.	713-225-1465
VA	Arlington, Arlington Elctrns.	703-524-2412
WA	Seattle, Radar Elec. Co.	206-282-2511

PREMIER MICROWAVE, 35 New Broad St., Port Chester, NY 10573, Tel: 914-939-8900, TWX: 710-569-1609; FSC No.: 15870; Empl.: 70 ..... **A•1781**

Local Sales Offices & Reps

CA	Los Angeles, R.F. Assocs.	213-478-1586
GA	Smyrna, BC Elctrn. Sls.	404-436-5169
IL	Chicago, L.G.S. Elctrns. Sls.	312-456-9616
MD	Catonsville, Callas Elctrns. Dist.	301-744-7711
MA	Natick, Gerald Rosen	617-879-5505
MO	St. Louis, Boweng Tech. Rep.	314-429-7327
NY	Huntington, C.D.B. Entprs.	516-692-5220
OH	Dayton, BEK Assocs.	513-278-1343
EXP	CA, N. Hollywood, Air Frame Mfg. & Supp.	213-765-2600

Local Distributors

CA	Los Angeles, R.F. Assocs.	213-478-1586
FL	Cleatwater, Brennan Assocs., Inc.	813-446-5006
GA	Smyrna, B-C Electrns. of Geroria	404-436-5169
IL	Chicago, L.G.S. Electrns.	312-456-9616
MD	Catonsville, Callas Electrns.	301-744-7711
MA	Framingham, Gerald Rosen Co.,Inc.	617-879-5505
MO	St. Louis, Boweng Technical Reps., Inc.	314-429-7327
NY	Fayetteville, R.D. Sherman, Inc.	315-637-9861
NY	Huntington, GDB Enterprises	516-692-5200
OH	Dayton, KW Electrns., Sls.	513-890-2150
TX	McKinney, Williams Assoc.	214-548-0995
EXP	Shantinagar, Hyderabad, Kashinath & Co.	346-353-6942
Can	Lachine, Quebec, Electrodesign Ltd	514-636-4838

PREM MAGNETICS, 3521 N. Chapel Hill Rd., McHenry, IL 60050, Tel: 815-385-2700, TWX: 910-642-3763; Empl.: 300; *Sls. Mgr.:* D. Hertel ..... **A•2265-2267**

PRES-AIR-TROL CORP., 1009 Boston Post Rd., Mamaroneck, NY 10543, Tel: 914-698-2026-800-431-2625 (outside NY) ..... **B•1690**

PRESIDIO COMPONENTS, INC., 7185 Construction Ct., San Diego, CA 92121, Tel: 619-578-9390, TWX: 910-335-1254; FSC No.: 60212

Local Distributors

TX	Richardson, Central States Comps.	214-644-2070

PRESS-ON PRODS., 39 Factory Rd., Addison, IL 60101, Tel: 312-628-2255; Empl.: 40; *Sls. Mgr.:* T. Cummins

PRESSURE CONTROLS, INC., 406 Cortlandt St., Belleville, NJ 07109, Tel: 201-751-5003; Empl.: 15; *Sls. Mgr.:* P. Emmarco

PRESSURE SYSTEMS, INC., 15 Research Dr., Hampton, VA 23666, Tel: 804-865-1243, Telex: 901406; Empl.: 45; *Sls. Mgr.:* J. S. Yakshe

PRESTOLITE WIRE DIV., 3529 24th St., Port Huron, MI 48060, Tel: 313-987-6300

PRESTON SCIENTIFIC, 805 E. Cerritos Ave., Anaheim, CA 92805, Tel: 714-776-6400, Telex: 655-321; Empl.: 61; *Sls. Mgr.:* Charles J. McGuire ..... **D•1161**

Local Sales Offices & Reps

AL	Huntsville, Mo-Co	205-881-5968
AZ	Scottsdale, Williams Assocs.	602-947-4297
CA	Laguna Hills, Elotek	714-830-4856
CA	Santa Clara, PBC Assocs.	408-727-7244
CO	Denver, Williams Assocs.	303-289-5647
CT	Avon, Power Mark	203-678-0123
FL	Orlando, Truex Assocs.	305-859-2160
IL	Arlington Heights, Coombs Assocs.	312-439-9810
IN	Ft. Wayne, Coombs Assocs.	219-747-7661
KS	Shawnee Mission, Techn. Sls. Assocs.	913-888-3330
MD	Clarkesville, Riffe Assocs.	301-953-2811
MA	Falmouth, RJC Assocs.	617-540-8832
MN	St. Paul, Vikeland Sls.	612-645-4647
MO	Ferguson, Techn. Sls. Assocs.	314-725-5361
NJ	Franklin, Hansen/Hughes	201-848-8900
NM	Albuquerque, Williams Assocs.	505-255-1638
NC	Winston-Salem, Radco	919-722-9671
OH	Dayton, Hocker Assocs.	513-298-8638
OR	Portland, Sci. Dvcs.	503-292-6934
PA	Cheltenham, Stein Instrmn.	215-379-1990
TX	Houston, Lear Assocs.	713-488-7893
TX	Spring, Lear Assocs.	713-370-7449
UT	Salt Lake City, Williams Assocs.	801-485-6511
WA	Bellevue, Sci. Dvcs.	206-747-5169
WI	Milwaukee, Coombs Assocs.	414-351-6123

PRIMELINE-SOLTEC DISTBN., Soltec Corp., P.O. Box 818, Sun Valley, CA 91353-0818, Tel: 800-525-5554, 818-764-5400, Telex: 494-3094 SOLTEC UI; *Sls. Mgr.:* Phillip Braden; *Dist. Mgr.:* Byron G. McIntire

PRIME/POWER

PRIME POWER, INC., Prime Technology Co., Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092; *Sls. Mgr.:* J. L. Jamieson ..... **D•1801**

Local Sales Offices & Reps

CA	Buena Park, Chuck Cooper Co.	714-739-8526
CO	Denver, WEST High-Tech, J.V.	303-477-8180
CT	Washington, Tri-Com Assocs.	2-3-563-2241
NJ	Fort Lee, FJK Assocs., Inc.	201-592-1002

PRIME TECHNOLOGY, See General Risistance, Inc., Transducers and Systems, Inc. Prime Power, Inc., AND INTERNATIONAL INSTRUMENTS, INC.

PRIMO, 25-1, 6-Chome, Mure, Mitakashi, Tokyo, Japan, Tel: 0422-43-3121, Telex: 2822-326; Empl.: 350; *Sls. Mgr.:* S. Shirota

PRINCETON CASE CO., INC., 667 Lehigh Ave., Union, NJ 07083, Tel: 201-687-1750; Empl.: 60; *Sls. Mgr.:* S. E. Parker

PRINCETON ELCTRN. PRODS., Box 101, North Brunswick, NJ 08902, Tel: 201-297-4448, TWX: 710-380-3832; Empl.: 70; *Sls. Mgr.:* R. Shermister; *Dist. Mgr.:* R. Shermister

PRINCO INSTRS., INC., 1020 Industrial Hwy., Southampton, PA 18966, Tel: 215-355-1500; FSC No.: 48620; Empl.: 66; *Sls. Mgr.:* S. A. Clayton

PRINTER PRODUCTS, Capitol Circuits Corporation, 25 Denby Road, Boston, MA 02134, Tel: 617-254-1200; Empl.: 200; *Sls. Mgr.:* John Callanan

PROBE MASTER, INC., 4898 Ronson Ct., San Diego, CA 92111, Tel: 619-560-9676, 800-854-1519, 800-772-1519; *Sls. Mgr.:* Dick Press ..... **D•1397**

PROBE-RITE, INC., 2725 Lafayette St., Santa Clara, CA 95050, Tel: 408-727-0100, TWX: 910-338-0260; *Sls. Mgr.:* Marilyn Bailey

PROCESS ANALYZERS, INC., 3 Headley Pl., Fallsington Ind'l Pk, Fallsington, PA 19054, Tel: 609-921-7330, TWX: 510-685-9254

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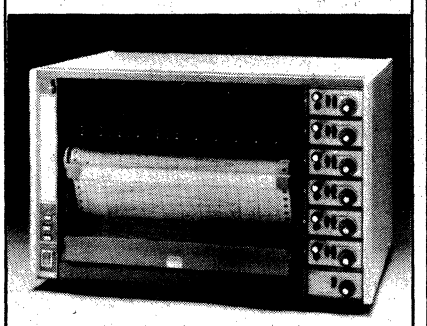

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PRODUCTION INDUSTRIES, INC., 12880-E Pierce Street, Pacoima, CA 91331, Tel: 818-896-0555, 800-423-5618; *Dist. Mgr.:* Linda Dice ... **C•1075-1077; D•1384**

PRODUCTS FOR RESCH., 88 Holten St., Danvers, MA 01923, Tel: 617-774-3250, Telex: 940-287; Empl.: 20; *Sls. Mgr.:* Harry Martin

PTS
FREQUENCY SYNTHESIZERS

PROGRAMMED TEST SOURCES, Beaver Brook Rd., Littleton, MA 01460, Tel: 617-486-3008; Empl.: 20 ..... **D•1292**

Local Sales Offices & Reps
CA La Crescenta, Beckrep, Inc. 818-957-1111

PROJECTS UNLTD., 3680 Wyse Rd., Dayton, OH 45414, Tel: 513-890-1918, TWX: 810-450-2523; Empl.: 75; *Sls. Mgr.:* Greg Kimpton

PRO-LOG, 2411 Garden Rd., Monterey, CA 93940, Tel: 408-372-4593, TWX: 910-360-7082; Empl.: 200

PROTEON, INC., 4 Tech Circle, Natick, MA 01760, Tel: 617-655-3340, Telex: PROTEON; Empl.: 75; *Sls. Mgr.:* Arthur F. Lynch

PROTO STAMPING CORP., 850 Charter St., Redwood City, CA 94063, Tel: 415-365-0498, Telex: 709241; *Sls. Mgr.:* David Duncan

PROTO SYSTEMS OF ATLANTA, 625 Sims Industrial Blvd., Alpharetta, GA 30201, Tel: 404-475-1330, Telex: 469432; *Sls. Mgr.:* John Gregory

PROTOTEK, INC., 25 Standen Dr., Hamilton, OH 45015, Tel: 513-874-5094; FSC No.: 60813 ..... **C•1714**

Local Sales Offices & Reps
CA Riverside, Cal Tech Pro, Inc. 714-682-8506
CA Santa Clara, Covington Sls. 408-241-2877
CO Denver, Matthews & Assocs., Inc. 303-450-6476
MD Gaithersburg, Simcomp, Inc. 301-258-9358
MA Tewksbury, United Sls., Inc. 617-658-4281
OH Columbus, Seltech Mktg. 614-451-3865
TX Dallas, Matthews & Assocs., Inc. 214-248-7881
EXP CT, Litchfield, Intrade, Inc. 800-243-5252

PSG INDS., 1225 Tunnel Road, Perkasie, PA 18944, Tel: 215-257-3621, Telex: 827361; FSC No.: 18509; Empl.: 150; *Sls. Mgr.:* John Feldermann, Jr.

PTC TRANSFORMERS, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505, Tel: 609-298-8200, Telex: 510-685-3645; Empl.: 25; *Sls. Mgr.:* C. W. Harrison

PTK DIVISION, Emerson Electric Co., 1173 Los Olivos Ave., Los Osos, CA 93402, Tel: 805-528-5858, Telex: 88-8863, TWX: 910-351-5802; FSC No.: 60132; Empl.: 140; *Sls. Mgr.:* Wayne Hamari

PTL ELCTRNS., 10211 Vinemont St., Dallas, TX 75218, Tel: 214-327-3180; Empl.: 10

PTS ELECTRONICS INC., Box 272, Bloomington, IN 47401, Tel: 812-824-9331; Empl.: 525; *Sls. Mgr.:* R. W. King; *Dist. Mgr.:* J. Hamilton

PTX-PENTRONIX INC., 1737 Cicotte, Lincoln Park, MI 48146, Tel: 313-388-3100, Telex: 23-0398; Empl.: 21; *Sls. Mgr.:* J. Schultz

PULIZZI ENGINEERING, INC., 3260 S. Susan St., Santa Ana, CA 92704-6865, Tel: 714-540-4229; *Sls. Mgr.:* Michael B. Pulizzi; *Dist. Mgr.:* Michael B. Pulizzi ..... **D•1956-1958**

Local Sales Offices & Reps
AL Huntsville, E.M.A 205-830-4030
CA San Jose, J & M Mktg. 408-996-8763
IA Des Moines, Beams 500 to 528 515-255-1148
MA Brookline, Vernon Newland 617-739-2727
NJ Union, Stearns Assocs. 201-686-2980
TX Dallas, T.S.S 214-458-0644

PULNIX AMERICA, INC., 770-A Lucerne Drive, Sunnyvale, CA 94086, Tel: 408-733-1560, Telex: 172541 PULNIX AMERICA; *Sls. Mgr.:* Mary Pomgrey

PULSAR PRODUCTS DIV., 2700 Merced St., San Leandro, CA 94577, Tel: 415-577-7236, TWX: 910-366-7033; Empl.: 24

PULSE ENGRG. INC., A Varian Sub., P.O. Box 12235, San Diego, CA 92112, Tel: 619-268-2400, TWX: 910-335-1527; Empl.: 1200; *Sls. Mgr.:* Leonard M. Luner

PULSE INSTRS. CO., 1234 Francisco, Torrance, CA 90502, Tel: 213-515-5330; Empl.: 20; *Sls. Mgr.:* Ron Perry

PULVER LABORATORIES, INC., 415 S. 8th. St., Boise, ID 83702, Tel: 208-342-1000, Telex: 62135850, TWX: 469834; FSC No.: 208-342-5500; *Sls. Mgr.:* Cindy Christensen

PYLE INDUSTRIES, INC., 501 Center St., P.O. Box 620, Huntington, IN 46750, Tel: 219-356-1200; Empl.: 175; *Sls. Mgr.:* Frank Pyle, Jr.; *Dist. Mgr.:* Mark Pyle

PYLE-NATIONAL, Brand-Rex Company, 1334 N. Kostner Ave., Chicago, IL 60651, Tel: 312-342-6300, Telex: 25251, TWX: 910-221-0335; FSC No.: 49367; Empl.: 800; *Sls. Mgr.:* Mike Carroccia; *Dist. Mgr.:* Neil Buchler(Eastern)/R. Williams(Western)

PYLON ELEX DEVELOPMENT CO. LTD., 2300 Victoria, Lachine, PQ, Canada H8S 1Z3, Tel: 514-637-1186, Telex: 05-821680; *Sls. Mgr.:* Andy Scrimshaw

PYROCOM CO., 924 N. 143rd St., Seattle, WA 98133, Tel: 206-365-3535

PYROFERRIC INTL., INC., 200 Madison St., Toledo, IL 62468, Tel: 217-849-3300, TWX: 910-663-0616; Empl.: 50; *Sls. Mgr.:* S. John Horner

PYROFILM RESISTOR CO., See KDI Electronics

Q-MATIC CORP., 3194-D Airport Loop Dr., Costa Mesa, CA 92626, Tel: 714-545-8233, Telex: 67-8389

Q-S PRODUCTS CO., INC., 3605 S.W. Snoqualmie St., Seattle, WA 98126, Tel: 206-937-5505

Q-SYSTEMS, PO Box 35879, Tucson, AZ 85740, Tel: 602-293-4923, TWX: 910-952-1185; Empl.: 7; *Sls. Mgr.:* M. Lloyd

Q-TECH CORP., 2201 Carmelina Ave., Los Angeles, CA 90064, Tel: 213-820-4921, Telex: 69-6140; FSC No.: 51774; Empl.: 65; *Sls. Mgr.:* H. Phillips ... **A•1420-1422**

Local Sales Offices & Reps
AZ Scottsdale, Western High Tech Mktg. 602-949-0873
CA Cupertino, Dura Elctrn. Sls. 408-255-2084
CA Northridge, Tauber-Dreyer 213-993-0048
FL Melbourne, Reynolds & Assocs. 305-259-7000
IL Northbrook, Allied Comp. Reps., Inc. .. 312-498-6658
MA Malden, J-K Assocs. 617-321-2922
NJ Glen Gardner, F & M Tech. Sls. 201-832-7216
NJ Paramus, Eltech Sls. 201-967-1309
NM Albuquerque, Western High Tech Mktg. 505-262-2461
NY Kings Park, Eltech Sls. 201-967-1309
TX Houston, TCI Elctrns. 713-774-5019

QUADRA SALES CORP., 14825 NE 40th, Suite 340, Redmond, WA 98052, Tel: 206-833-3550

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QUALIDYNE SYS., Unitech Ltd., 3055 Del Sol Blvd., San Diego, CA 92154, Tel: 619-429-7440, 619-575-4400, Telex: ESL227140; FSC No.: 619-429-1011; Empl.: 300; *Sls. Mgr.:* James J. Louden ..... **D•1803-1809**

Local Sales Offices & Reps
AL Huntsville, Beacon Elctrns. 205-881-5031
AZ Phoenix, Thor Engrg. 602-437-1463
AR Little Rock, Beacon Elctrns. 501-224-5449
CA Chatsworth, Raltech, Inc. 818-700-0933
CA Diamond Bar, Raltech, Inc. 714-861-1530
CA Santa Clara, Gagner-Toomey Assocs. 408-244-2200
CO Englewood, Frontier Reps., Inc. 303-799-6063
CT Guilford, O.E.M. Mktg. & Sls. 203-453-5424
FL Boca Raton, Beacon Elctrns. 305-392-3500
FL Clearwater, Beacon Elctrns. 813-796-2378
FL Maitland, Beacon Elctrns. 305-647-3498
FL Melbourne, Beacon Elctrns. 305-724-8010
GA Atlanta, Beacon Elctrns. 404-256-9640
IL Glencoe, Howard Benjamin & Assocs. 312-835-0150
IA Cedar Rapids, Electromec Sls., Inc. ... 319-362-6413
MA Franklin, OEM Mktg. & Sls. 617-528-4460
MN Burnsville, Electromec Sls., Inc. 612-894-8200
NH Salem, O.E.M. Mktg. & Sls. 603-893-0009
NY Great Neck, Tylinski Assocs., Inc. 516-466-9070
NY Rochester, J.G. Welch Assocs., Inc. ... 716-244-1100
NY Utica, J.G. Welch Assocs., Inc. 315-736-7821
NC Raleigh, Beacon Elctrns. 919-787-0330
OH Columbus, Micro Tec, Inc. 614-451-2400
OH Dayton, Micro Tec, Inc. 513-435-0644
OH Highland Heights, Micro Tec, Inc. 216-442-1555
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PA Pittsburgh, Micro Tec, Inc. 412-931-3380
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WA Bellevue, Quest Mktg., Inc. 206-747-9424

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KS Shawnee Mission, Florence & Meyer, Inc. 913-722-5210
MA Needham, Hatch Assocs. 617-444-3310
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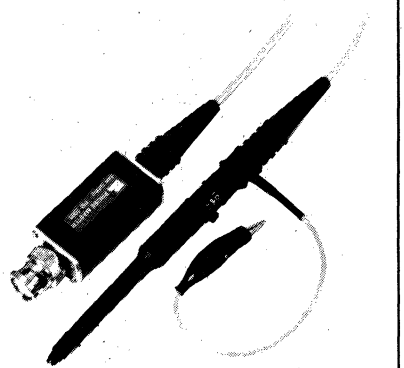

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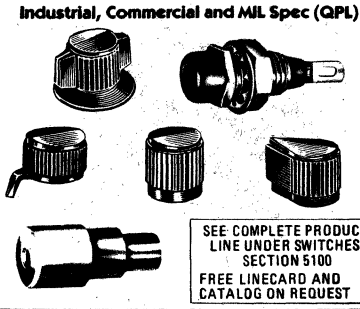

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R & D CIRCUITS, 2381B S. Clinton Ave. Dept. 1202, Plainfield, NJ 07080, Tel: 201-561-8286

RANSCO INDS., INC., Sub. Despatch Ind., Inc., 2201 Statham Blvd., Oxnard, CA 93033, Tel: 805-487-7777, Telex: 6-59235; Empl.: 280; *Sls. Mgr.:* L. W. Benjamin

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RAYTHEON CO., Laser Products, Fourth Ave., Burlington, MA 01803, Tel: 617-272-6402, Telex: 92-3455, TWX: 710-324-6568; Empl.: 60; *Sls. Mgr.:* D. J. Hoffman

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RCD COMPONENTS, INC., 330 Bedford St., Manchester, NH 03101, Tel: 603-669-0054, Telex: 943-512 RCD COMP MAN; Empl.: 350 ..... **A•1934-1935**

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CA	Santa Clara, Cummings & Assocs.	408-247-8656
CA	Woodland Hills, Cummings & Assocs.	213-340-6035
CO	Denver, Cummings & Assocs.	303-455-6860
FL	Apopka, G. F. Bohman	305-886-1882
GA	Norcross, Montgomery Mktg. Inc.	404-447-6124
ID	Boise, N. R. Schultz Co.	208-377-8686
IL	Elk Grove Village, The John G. Twist Co.	312-593-0200
KS	Overland Park, Ensco-Rep Inc	913-381-7557
MI	Livonia, Electronic Salesmasters	800-321-1848
MO	Maryland Heights, Ensco-Rep Inc	314-423-3935
NJ	Cherry Hill, Trinkle Sales Inc.	609-795-4200
NM	Alburquerque, Elec-Com Assocs.	505-898-6101
NY	Hempstead, Kahgan Sls.	516-538-2300
NY	Kingston, R. P. Kennedy Co., Inc.	914-876-2700
NY	Rochester, R. P. Kennedy Co., Inc.	716-271-6322
NC	Cary, Montgomery Mktg. Inc.	919-467-6319
OH	Beachwood, Electronic Salesmasters	216-831-9555
OR	Beaverton, N. R. Schultz Co.	503-643-1644
PA	Allentown, Trinkle Sls. Inc.	800-257-8210
TX	Dallas, Design Mktg. Inc.	214-680-9767
TX	Irving, Design Mktg.	214-255-2110
TX	Round Rock, Design Mktg.	512-255-9686
WA	Bellevue, N. R. Schultz Co.	206-454-0300
WI	Brookfield, The John G. Twist Co.	414-782-2670

R. C. ELCTRNS. INC., 5386 Hollister Ave., Santa Barbara, CA 93111, Tel: 805-964-6708, Telex: 295281; Empl.: 10; *Sls. Mgr.:* Chao-Sun Pang; *Dist. Mgr.:* Chao-Sun Pang

RCI/DATA, 1992 Lakewood Rd., Toms River, NJ 08753, Tel: 201-341-8361; Empl.: 15; *Sls. Mgr.:* Robert Fierro

RCL Shallcross
WIREWOUND RESISTORS

RCL ELECTRONICS, INC., 195 McGregor St., Manchester, NH 03102, Tel: 603-627-3831, TWX: 710-220-1876; FSC No.: 01686; Empl.: 300 ... **A•1936-1941**

SHALLCROSS, INC., U.S. 70 East, Smithfield, NC 27577, Tel: 919-934-5181, TWX: 510-939-1463; FSC No.: 54294; Empl.: 150 ..... **A•1936-1941**

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NM	Albuqerque, Nelco, Inc.	505-292-3657
NY	Buffalo, Quality Comps.	716-837-5430
OK	Tulsa, Genzel	918-622-7744
TX	Arlington, Procomp	817-640-4336
Can	Kanata, Ont., Gidden/Morton Assocs.	416-671-8111

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CA	Chatsworth, TTI	818-709-1010
CA	San Jose, Shelley Elctrns.	408-942-9111
IN	Indianapolis, Classic Comps.	317-872-4777
MA	Burlington, TLC	617-273-0140
MI	Grand Rapids, S-F Elctrn. Supp.	616-459-0216
NY	Bohemia, Shelley Elctrns.	516-567-7751
PA	Norristown, Century Elctrn. Comps.	215-631-5400
Can	Scarborough, Ont., Carsten Elctrns.	416-495-9999

RCL-Shallcross Local Sls. Offs. & Reps.

AL	Huntsville, CSR Elctrns.	205-533-2444
AZ	Phoenix, ISDS	602-971-6250
CA	Chatsworth, WCV Co.	818-700-0933
CA	Palo Alto, Mollard Mktg.	415-961-0456
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CT	North Haven, Kitchen & Kutchen	203-239-0212
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FL	Ft. Lauderdale, AMP Assocs.	305-565-0056
FL	Longwood, AMP Assocs.	305-869-6831
FL	Merritt Island, APM Assocs.	305-453-4322
FL	Tampa, AMP Assocs.	813-886-2457
GA	Dunwoody, CSR Elctrns.	404-396-3720
IL	Schaumburg, Gassner & Clark	312-882-8608
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
MD	Columbia, Delta III Assocs.	301-730-4700
MA	Burlington, Kitchen & Kutchen	617-229-2660
MI	Livonia, Luebbe Sls. Co.	313-477-3131
MN	Minneapolis, Elec. Comp. Sls.	612-933-2594
MO		
MO	Grandview, Harris/Hanson Co.	816-763-6200
MO	St. Louis, Harris/Hanson Co.	312-432-3611
NE	Lincoln, Lorenz Sls. Co.	402-475-4660
NJ	Marlton, BGR Assocs.	609-983-1020
NY		
NY	Buffalo, Quality Comps.	716-837-5430
NY	Manlius, Quality Comps.	315-682-8885
NY	Melville, Comtronic Assocs.	516-249-0505
NC	Raleigh, CSR Elctrns.	919-878-9200
OH	Cincinnati, Luebbe Sls. Co.	513-891-5770
OH	Cleveland, Luebbe Sls. Co.	216-333-0425
OH	Columbus, Luebbe Sls. Co.	614-431-0474
OH	Dayton, Luebbe Sls. Co.	513-294-0426
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OR	Portland, James J. Backer Co.	503-297-8744
OR	Salem, James J. Backer Co.	503-362-0717
PA	Pittsburgh, Luebbe Sls. Co.	412-931-0414
SC	Taylors, CSR Elctrns.	803-292-2292
UT	Salt Lake City, Elcom	801-532-7940
WA	Seattle, James J. Backer Co.	206-285-1300

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AZ	Phoenix, TTI	602-966-1616
AZ	Tempe, Shelley Elctrns.	602-894-2058
CA	Chatsworth, Shelley Elctrns.	818-998-3333
CA	Fountain Valley, Components Ctr.	714-979-0433
CA	San Diego, Shelley Elctrns.	619-453-7133
CA	San Jose, T.T.I.	408-943-9155
CO	Boulder, Shelley Elctrns.	303-442-2718
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FL	Tampa, Impala Elctrns.	813-885-4747
IL	Melrose Park, Belford Elctrns.	312-865-2400
IL	Northbrook, Classic Comps.	312-272-9650
CT	Hamden, Almo Elctrns.	203-288-6556
MD	Columbia, Aztech Elctrns.	301-995-1760
FL	Tampa, Shelley Elctrns.	813-884-0946
MA	Woburn, TTI	617-938-8800
MA	Billerica, A. W. Mayer Co.	617-229-2255
NY	Bohemia, TTI	516-567-1500
NY	Farmingdale, Command Elctrns.	516-293-1212
NY	Hauppauge, Jaco Elctrns.	516-273-5500
MN	Minneapolis, Aerospace Computer Supp.	612-884-4725
NY	Rochester, Simcona	716-328-3230
NY	Rome, Rome Elctrns.	315-337-4500
NC	Raleigh, Resco-Raleigh	919-781-5700
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OH	Englewood, Argent Inds.	513-836-8633
OH	Solon, REH-Electra	216-248-1636
OK	Tulsa, Altair	918-252-5781
PA	McKean, Advacom	814-476-7774
PA	McKeesport, Barno Radio	412-751-5966
PA	Pittsburgh, Aldertronics	412-821-5565
NY	Rockville Center, Milano Bros. Intl.	516-764-2200
TX	Ft. Worth, TTI	817-831-0441
TX	Houston, Altair	713-462-3029
TX	Richardson, Altair	214-231-5166
WA	Bellevue, Almac Elctrns.	206-643-9992
WI	New Berlin, Classic Comps.	414-786-5300

R-COLUMBIA PRODS. CO., INC., 2008 St. Johns Ave., Highland Park, IL 60035, Tel: 312-432-7915; Empl.: 20

RDF CORPORATION, 23 Elm Ave., Hudson, NH 03051, Tel: 603-882-5195, TWX: 710-228-1882; Empl.: 120; *Sls. Mgr.:* Arthur Di Venuti

RDI/REED DEVICES, INC., 525 Randy Rd., Carol Stream, IL 60188, Tel: 312-682-4100, TWX: 910-252-2118; FSC No.: 53337; Empl.: 85; *Sls. Mgr.:* H. J. Roeser ..... **C•1498-1501**

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AL	Huntsville, Alpha	205-533-0766
AZ	Phoenix, Augat Sls.	602-224-0950
CA	Los Angeles, Wiley Co.	213-666-1611
CA	San Diego, Wiley Co.	619-571-2881
CA	Sunnyvale, Schwerin/Merrill	408-735-7900
CO	Denver, Augat Sls.	303-757-2100
FL	Ft. Lauderdale, APM Assoc.	305-565-0056
FL	Longwood, APM Assoc.	305-869-6831
FL	Tampa, APM Assoc.	813-886-2457
GA	Atlanta, Alpha	404-491-9430
IL	Glen Ellyn, Rockford Controls	312-469-6016
IN	Indianapolis, Rockford Controls	317-248-2518
IA	Davenport, Ensco-Rep., Inc.	319-386-6600
KS	Overland Park, Ensco-Rep., Inc.	913-381-7557
KS	Wichita, Ensco-Rep., Inc.	316-683-1070
MA	Norwood, Augat Sls.	612-792-3164
MI	Novi, Lektronics	313-349-3304
MN	Minneapolis, HMR	612-831-7400
MO	Maryland Hts., Ensco-Rep., Inc.	314-423-3935
NJ	Pitman, Colrud Corp.	609-589-5866
NY	Commack, Augat Metro	516-864-3811
NY	Farmingdale, Augat Metro	516-753-0012
NY	Rochester, H.C. Johnson	716-586-0777
NC	Kernersville, Wallace Elctrn.	919-996-2742
OH	Columbus, K.W. Elec. Sls.	614-888-0483
OH	Dayton, K W Elctrn. Sls.	513-890-2150
OH	Shaker Hts., K.W. Elec. Sls.	216-491-9177
OR	Portland, Augat Sls.	503-253-7172
PA	Allison Park, K.W. Elec. Sls.	412-487-4300
TN	Memphis, Glen White	901-761-5941
TN	Oak Ridge, Alpha Mktg.	615-482-4681
TX	Dallas, Augat Sls.	214-788-4211
TX	Georgetown, Augat Sls.	512-479-9447
TX	Houston, Augat Sls.	713-495-3100
VA	Reston, Colrud Corp	703-620-6612
WA	Augat Sls.	206-455-2846
WI	Westbend, Rockford Controls	800-323-1042

Local Distributors

AZ	Phoenix, Dalis	602-275-2885
AZ	Phoenix, Tri-Tek	602-995-9352
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AZ	Tucson, Inland Elec. Supp.	602-889-5301
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Anaheim, Time Elctrns.	714-937-0911
CA	Belmont, Lodan Elctrns.	415-592-4600
CA	Buena Park, Control Des.	714-521-5040
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	Fremont, Term. Sls.	415-656-7722
CA	Gardena, Calif. Switch & Signal	213-538-9830
CA	Los Angeles, Elec. Switches	213-660-1310
CA	San Carlos, Control Des.	415-592-4808
CA	San Diego, Deco Elctrns.	
CA	San Diego, Time Elctrns.	619-586-1331

RDI
Reed Devices Inc.
AUTHORIZED DISTRIBUTOR

E S I
ELECTRIC SWITCHES
INCORPORATED
2478 Fletcher Dr, Los Angeles, California 90039
213-660-1310
CALL TOLL FREE
NATIONAL: 800-421-8855
CALIFORNIA: 800-252-4640
TWX 910-321-2971

SEE COMPLETE PRODUCT LINE UNDER SWITCHES SECTION 5100
FREE LINECARD AND CATALOG ON REQUEST

CA	San Jose, Con. Parts	408-263-9521
CA	San Jose, Rose Elec.	408-263-9700
CA	Santa Monica, Master Distr.	213-452-1229
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CO	Denver, CSID	303-292-9594
CO	Englewood, Indl. Elctrns.	303-694-9444
CO	Englewood, Time Elctrns.	303-850-7701
CT	Cheshire, Time Elctrns.	203-271-3200
CT	Stratford, Utronic	203-378-4201
FL	Ft. Lauderdale, Comp. Dist.	305-971-4950
FL	Ft. Lauderdale, Time Elctrns.	305-974-4800
FL	Largo, Lodan Elctrns.	813-595-5811
FL	Orlando, Time Elctrns.	305-841-6565
GA	Atlanta, Elctrl. Control Prod.	404-455-1216
GA	Atlanta, Time Elctrns.	404-351-3545
GA	Norcross, Comp. Dist.	404-441-3320
GA	Stone Mountain, Control Des.	404-979-3500
IL	Addison, Lectro Comps.	312-543-1680
IL	Arlington Heights, Lo Dan Elctrns.	312-398-5311
IL	Chicago, Otto Frankenbush	312-647-0755
IL	Genoa, Control Des.	815-784-6515
IL	Oak Park, Newark Elctrns.	312-524-1800
IL	Peoria, Klaus Radio	309-691-4840
IL	Rockford, Mid-West Assoc.	815-962-8036
IN	Ft. Wayne, Graham Elec.	219-423-3422
IN	Indianapolis, Control Des.	317-788-4559
IA	Cedar Rapids, Deeco	319-365-7551
IA	Marion, Control Des.	319-373-2923
KY	Louisville, P. I. Burks Co.	502-589-3960
LA	Lafayette, Ralph's Indl. Elec.	318-234-4507
LA	New Orleans, Southern Radio Supp.	504-524-2343
LA	New Orleans, Wm. B. Allen Supp.	800-535-9593
MD	Beltsville, Treeko Sls.	301-937-8260
MA	Burlington, QPL Elec. Dist.	617-229-2424
MA	Middleboro, Glynn Elec.	617-947-4262
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Southfield, Michigan Lectrols	313-353-1350
MN	Bloomington, Time Elctrns.	612-944-9192
MN	Minneapolis, Aero-Space Computer Supp.	612-884-4725
MN	Minneapolis, Control Des.	612-721-1628
MN	Minneapolis, Newark Elec.	612-331-6350
MO	St. Louis, Control Des.	314-426-3150
MO	St. Louis, Olive Indl.	314-426-4500
MO	St. Louis, Time Elctrns.	314-391-6444
NE	Lincoln, Scott Elctrn.	402-466-8221
NJ	Fairlawn, Relay Specialties	201-797-3313
NJ	Jersey City, Cuny & Gerber	201-653-0222
NY	Buffalo, Summit	716-884-3450
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Mt. Vernon, QAR Indl. Elec. Sls.	914-699-2224
NY	Rochester, R. Baker Elctrns.	716-586-9164
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Charlotte, Control Des.	704-588-4410
NC	Raleigh, Southeastern Radio	919-828-2311
NC	Winston-Salem, Kirkman Elctrns., Inc.	919-722-9131
OH	Akron, Akron Elctrn.	216-762-8818
OH	Cincinnati, URI Elctrns.	513-761-4030
OH	Columbus, Elctrns. Mktg. Co.	614-299-4161
OH	Columbus, Elm Equip. Co.	614-236-0888
OH	Dayton, ESCO	513-226-1133
OH	Dayton, Scotts-Friedman Co.	513-298-5555
OH	Solon, Repco	216-248-8900
OH	Warren, Rem Elctrn. Supp.	216-373-1300
OH	Wickliffe, Gateway Megatech	216-944-8565
OK	Tulsa, Radio	918-587-9123
OR	Lake Oswego, Rose Elctrn.	503-635-8823
OR	Portland, Platt Elec. Supp.	503-228-3121
OR	Portland, Radar	503-232-3404
OR	Portland, Time Elctrns.	503-684-3780
OR	Tigord, Moore Elctrns.	503-684-3100
PA	Broomall, Time Elctrns.	215-359-1200
PA	Malvern, Control Des.	215-296-0150
PA	McKean, Advacom	814-476-7774
PA	Philadelphia, Phila. Elec.	215-568-7400
SC	Greenville, Emsco	803-233-4121
SC	Greenville, Emsco	
TN	Memphis, Brownell Electro	901-795-8487
TX	Dallas, Control Des.	214-358-1441
TX	Dallas, Dallas Meter-Tech.	214-349-6044
TX	Dallas, Time Elctrns.	214-385-0566
TX	Houston, Angie Elctrns.	713-659-8386
TX	Houston, Electronic Packaging Corp.	713-447-5800
UT	Salt Lake City, Stuart Elctrns. Supp.	801-466-8603
UT	Salt Lake City, Western Controls	801-292-5900
WA	Bellevue, Time Elctrns.	206-641-3640
WA	Seattle, Pacific Elctrns.	206-575-1050
WA	Seattle, Platt Elec. Supp.	206-624-4083
WA	Seattle, Radar Elec.	206-282-2511
WI	Green Bay, A-A Elec.	414-499-0258
WI	New Berlin, Control Des.	414-784-1015
WI	West Allis, Marsh Elctrns.	414-475-6000

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AUTHORIZED MASTER DISTRIBUTOR

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ELECTRIC SWITCHES
INCORPORATED

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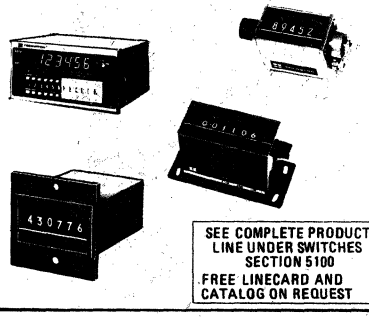
CALIFORNIA: 800-252-4640

TWX 910-321-2971



SEE COMPLETE PRODUCT LINE UNDER SWITCHES SECTION 5100
FREE LINECARD AND CATALOG ON REQUEST

REACTEL, INC.

REACTEL, INC., 687-D Lofstrand La., Rockville, MD 20850, Tel: 301-279-5535; FSC No.: 60458; Empl.: 20; *Sls. Mgr.:* D. E. Claycomb

Local Sales Offices & Reps

CA	North Hollywood, Crown Elctrns.	213-877-3550
CA	Sunnyvale, ESCO Assocs.	408-745-1410
VA	Fairfax, Beacon North	703-591-1300

REAL TIME SYS., 152 S. MacQuesten Pkwy., Mt. Vernon, NY 10550, Tel: 914-667-0425; *Sls. Mgr.:* A. Citrin

REBLING PLASTICS CO., 150 Franklin Drive, Warrington Ind. Park, Warrington, PA 18976

RECORDER SYS. DIV., See Gulton Inds., Inc., Graphic Instrs. Div.

RECOTON CORP., 46-23 Crane St., Long Island City, NY 11101, Tel: 718-392-6442, Telex: 236047 RCTN; Empl.: 150; *Sls. Mgr.:* George Calvi

RECYCLENE PRODUCTS, 1910 Trade Zone, San Jose, CA 95131, Tel: 408-945-8600; FSC No.: 24496D; *Sls. Mgr.:* Mitch Tuchman

REDINGTON COUNTERS, 130 Addison Rd., Windsor, CT 06095, Tel: 203-688-6205, Telex: 64-3390 REDCO WSOR; *Sls. Mgr.:* Alan Schoenhut; *Dist. Mgr.:* George Angelovich

REED SWITCH DEV. CO. INC., PO Box 1464, Kerrville, TX 78028, Tel: 512-896-4444; Empl.: 1

RE-EL CIRCUITS, INC., See RCI/Data

REEVE ELECTRONICS, Mellish E. Murray, 1720 W. Fulton St., Chicago, IL 60612, Tel: 312-670-0150; Empl.: 25; *Sls. Mgr.:* George Elliott

REEVES-HOFFMAN
Division, Dynamics Corporation of America

REEVES-HOFFMAN DIV., 400 W. North St., Carlisle, PA 17013, Tel: 717-243-5929, TWX: 510-650-3510; Empl.: 391; *Sls. Mgr.:* Daniel V. Kingery ..... **A•1423-1427; C•1619-1621**

Local Sales Offices & Reps

AZ	Phoenix, Chaparral Elctrns.	602-252-0897
CA	Culver City, Westaironics	213-641-4123
CA	Mountain View, Peninsula Tech. Sls.	415-965-3636
CO	Boulder, R.G. Entprs.	303-447-9211
FL	Apopka, G. F. Bohman Assocs.	305-886-1882
ID	Boise, N. R. Schultz	208-377-8686
IL	Chicago, ESCO Assocs.	312-763-0800
MD	Baltimore, R. A. Wafer Assocs.	301-744-1133
MA	Wakefield, H. Jappe Co.	617-245-9359
MN	Minneapolis, Intl. Elctrns.	612-571-0000
NY	Huntington, Compar N.Y.	516-423-5660
NC	Charlotte, JWL Assocs.	704-541-5750
OH	Cincinnati, Tri-State Mktg.	513-761-7993
OR	Beaverton, N. R. Schultz	503-643-1644
PA	Hatboro, Electro Rep Engrg.	215-674-4421
TX	Irving, Kite Elctrns. Sls.	214-438-9336
WA	Bellevue, N. R. Schultz	206-454-0300
Intl	CH, Zurich, Kurt Hirt	(01) 51-21-21
Intl	FR, Orsay, Cemitronic	(6) 907-84-38
Intl	FR, Paris, Tekelec Airtronic	(1) 534-75-35
Intl	GR, Munchen, Tekelec Airtronic	(089) 594621
Intl	IT, Milano, Tekelec Airtronic	(02) 73-80-641
Intl	NL, Zoetermeer, Tekelec Airtronic	(079) 31-01-00
Can	Ontario, R. D. Assocs.	416-444-0959

REFAC ELCTRNS. CORP., P.O. Box 809, Winsted, CT 06098, Tel: 203-379-2731, TWX: 710-449-6464; FSC No.: 28564; Empl.: 80; *Sls. Mgr.:* Chuck Altschul .... **B•1091**

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg.	205-830-0498
AZ	Scottsdale, Luscombe Engrg.	602-949-9333
CA	Campbell, Luscombe Engrg.	408-370-2020
CA	Pasadena, Luscombe Engrg.	818-684-2000
CA	San Diego, Luscombe Engrg.	619-295-4300
CO	Boulder, Luscombe Engrg.	303-772-3342
CT	Kensington, Norman Stachelek Co.	203-828-6161
FL	Clearwater, Delmac Sls.	813-447-5192
FL	Fort Lauderdale, Delmac Sls.	305-739-0016
FL	Orlando, Delmac Sls.	305-898-4688
FL	Palm Bay, Delmac Sls.	605-724-8377
GA	Norcross, Montgomery Mktg.	404-447-6124
IL	Mt. Prospect, Interep	312-577-8899
MD	Baltimore, Burgin-Kreh Assocs.	301-265-8500
MA	Canton, New England Elctrn. Sls.	617-828-4835
MI	Madison Heights, Pine Sls.	313-539-0350
MN	Minneapolis, Holmgren Assocs.	612-786-7641
MO	Kansas City, Delltron Co.	816-436-6445
MO	St. Louis, Delltron Co.	314-869-4779
NJ	Englewood, Sprung/Nussbaum	201-569-5666
NY	E. Syracuse, Nycom Co.	315-437-8343
NY	Williamsville, Nycom Co.	716-633-9395
NC	Cary, Montgomery Mktg.	919-467-6319
OH	Columbus, R. J. Sls.	614-253-2898
OR	Beaverton, Luscombe Engrg.	503-636-6664
PA	Norristown, Denco Data Equip. Corp.	215-630-8990
TX	Dallas, SW Mktg.	214-341-8631
TX	Houston, SW Mktg.	713-864-6281
VA	Lynchburg, Burgin-Kreh Assocs.	804-239-2626
WI	Milwaukee, Interep	414-774-1100
Can	Mississauga, Ont., Advanced Sls. Grp.	416-677-8200

Local Distributors

CA	Chatsworth, Anthem Elctrns.	818-700-1000
CA	San Jose, Anthem Elctrns.	408-946-8000
CA	Van Nuys, Pacific Switch Controls	213-873-4802
CA	Van Nuys, Patane Avionics	818-988-4455
CO	Denver, Integrated Elctrns.	303-292-6121
CT	Hartford, Atlantic Switch Controls	203-527-7705
FL	Lakeland, Switch Controls, Inc.	813-644-7564
IL	Carol Stream, Concetrix, Inc.	312-653-1460
IL	Hoffman Estates, Intercomp, Inc.	312-843-2040
IL	Lombard, RM Elctrns.	312-932-5150
IN	Indianapolis, Advent Elctrns.	317-872-4910
MA	Canton, Electronic Pkg.	617-821-2111
NE	Lincoln, Scott Elctrn. Supp.	402-466-8221
NH	Nashua, Atlantic Switch Co., Inc.	603-800-1971
NJ	Milford, Sintec Co.	201-996-4093
NJ	Mt. Laurel, Jersey Switch	609-778-8190
NJ	Roselle, Lectron Inds.	201-245-5858
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Farmingdale, SAI	516-293-2710

NY Rochester, Summit Distrs. 716-334-8110
OH Cleveland, Pruitt Energy Sources 216-566-1545
OH Columbus, Ohioswitch, Inc. 614-885-0319
OR Beaverton, Hansen Elctrns. Corp. 503-642-4455
PA Willow Grove, RESCO 215-659-4440
TX Houston, Electronic Pkg. 713-447-5800
Can Point Claire, Que., Future Elctrns. 514-694-7710
Can Scarborough, Ont., Carsten Elctrns. ... 416-751-5095

REGDON CORP., 3713 Grand Blvd., Brookfield, IL 60513, Tel: 312-485-5152, TWX: 910-691-2214; FSC No.: 27190; Empl.: 65 ..... **B•1475**

Local Sales Offices & Reps
San Carlos 415-594-0700
AL Decatur, Tenn Tech 205-350-0630
CA Los Altos, J. W. Wilhoit 415-961-3660
CA Valencia, DJM Elctrns. 818-362-4309
CT Woodbury, Mark-Rep Assocs. 203-263-3047
FL Maitland, EIR, Inc. 305-660-9600
GA Atlanta, Tenn Tech 404-622-5784
IL Downers Grove, Richmar Elect. Corp. 312-968-0118
IN Indianapolis, Richmar Elctrns. 317-846-6383
MN Edina, T.H. Hanson & Co. 612-893-9960
NH Plaistow, Mark-Rep Assocs. 603-382-9563
NJ Florham Park, Varrelman-Gorman Co. 201-992-2505
NY Binghamton, NHA 607-754-3214
NY Pittsford, NHA 716-586-9002
NC Raleigh, Tenn Tech 919-266-3610
OH Cleveland, J. N. Bailey 216-892-1510
OH New Lebanon, J. N. Bailey 513-687-1325
PA Abington, Indl. Mktg. Specialists Co. 215-659-0444
TN Chattanooga, Tenn Tech. 615-894-3012
TX Austin, K & H Sales 512-258-8841
TX Plano, K & H Sales 214-423-6520
WI Butler, Richmar Elctrns. 414-781-1730

Local Distributors
CA San Carlos, Logan Elctrn. Supp. 415-594-0700
MA Lynn, Land Elctrns. 617-592-2220
NJ Fairlawn, Relay Specialties 201-797-3313

REGENCY SYSTEMS, INC., 3200 Farber Drive, Champaign, IL 61820, Tel: 217-398-8067, Telex: 27-0486; Empl.: 60; *Sls. Mgr.:* Ken Perry; *Dist. Mgr.:* Jill Koepke

REGENT CONTROLS, 39 Fanny St., P.O. Box 767, Shelton, CT 06484-0767, Tel: 203-736-2924; *Sls. Mgr.:* Wendell E. Carroll

REHLANDER ASSOCS., 118A Bridge St., Beverly, MA 01915, Tel: 617-922-5961; *Sls. Mgr.:* Michael Rehlander ..... **B•1213**

REICH ASSOCS., Rt. 4, Box 4620, Lakehills, TX 78063, Tel: 512-751-3220, Telex: 358048; FSC No.: 55916; Empl.: 10; *Sls. Mgr.:* W. Reich

RE • INSTRUMENTS

Electronics for Test and Communication

RE INSTRUMENTS CORP., 31029 Center Ridge Rd., Westlake, OH 44145, Tel: 216-871-7617, TWX: 810-427-9257; Empl.: 15; *Sls. Mgr.:* P. A. Bosworth ..... **D•1295**

REI SLS., 19525 Business Centre Dr., Northridge, CA 91324, Tel: 617-938-0900; Empl.: 5; *Sls. Mgr.:* T. P. Fitzgerald

RELATIONAL MEMORY SYS., 1650 Berryessa Rd., Ste. B, San Jose, CA 95133-1082, Tel: 408-729-3011, 800-448-4880, TWX: 910-379-0014; Empl.: 10; *Sls. Mgr.:* Jennifer Phipps

LAW, R. E. INSTRUMENT, INC., 7735 W. 112th Pl., Palos Hills, IL 60465, Tel: 312-974-4000; FSC No.: 6685-6695; *Sls. Mgr.:* Harry Booth; *Dist. Mgr.:* R. Gene Law

RELAY SERVICE CO., 1310 N. Pulaski Rd., Chicago, IL 60651, Tel: 312-AL2-2700; Empl.: 30; *Sls. Mgr.:* Chas. H. Badger

RELAY SPECIALTIES, 1300 Plaza Rd., Fair Lawn, NJ 07410, Tel: 201-797-3313, 800-526-5376, Telex: 642751; Empl.: 48; *Sls. Mgr.:* S. R. Gershberg

Local Sales Offices & Reps
CA Los Alamitos, The Rep House 213-598-3379
CT Manchester, Vin-Tech, Inc. 203-646-3007
MD Baltimore, Com Tech Assocs. 301-583-1993
TX Dallas, Art Brawner & Assocs. 214-824-4013

RELCO PRODS., 5594 E. Jefferson Ave., Denver, CO 80237, Tel: 303-756-1143; FSC No.: 14454; Empl.: 7

RELIABILITY, INC., 16400 Park Row, P.O. Box 218370, Houston, TX 77218, Tel: 713-492-0550, TWX: 910-881-1739; FSC No.: 54098; Empl.: 800; *Sls. Mgr.:* J. Marcussen

RELIANCE COMM/TEC, Reliance Electric, P. O. Box 99502, Cleveland, OH 44199, Tel: 800-245-4501, in OH 800-245-4497

RELIANCE ELECTRIC CO., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199, Tel: 800-245-4501, 800-245-4497 In Ohio

RELIANCE FUSE, 2070 Maple St., Des Plaines, IL 60016, Tel: 312-299-2211, Telex: 726-453; FSC No.: 72076;F15160E; Empl.: 200

For nearest sales office, phone 1-800-245-4501 (in Ohio, 1-800-245-4497)

RELIANCE FUSE, Reliance Electric, P. O. Box 99502, Cleveland, OH 44199, Tel: 800-245-4501, in OH 800-245-4497

RELIANCE PLASTICS & PACKAGING, 225 Belleville Ave., Bloomfield, NJ 07003, Tel: 201-748-2222; Empl.: 35; *Sls. Mgr.:* Hale Smith

RELMS, See Relational Memory Systems, Inc.

REMEE PRODS. CORP., 41 Bridge St., Florida, NY 10921, Tel: 914-651-4431, Telex: 64-6715; Empl.: 135; *Sls. Mgr.:* Ken Pimental; *Dist. Mgr.:* Ken Pimental

REMEX CAM OPERATIONS, Ex-Cell-O Corporation, 1230 S. Lewis Street, Anaheim, CA 92805, Tel: 714-535-4160, Telex: 183-040; Empl.: 105; *Sls. Mgr.:* Stan Vitt; *Dist. Mgr.:* Stan Vitt

RENAISSANCE MARKETING, INC., 463 Union Ave., Westbury, NY 11590, Tel: 516-271-2389

RENBRANDT, INC., 6 Parmelee St., Boston, MA 02118, Tel: 617-445-8910; FSC No.: 99934; Empl.: 25; *Sls. Mgr.:* M. Rogers

RENCO, 26 Coromar Dr., Goleta, CA 93017-3094, Tel: 805-968-1525, TWX: 910-334-1180; FSC No.: 34479; Empl.: 170; *Sls. Mgr.:* Larry Wade ..... **B•1824-1825; D•1131**

Local Sales Offices & Reps
CA Garden Grove, Advanced Digital Group, Inc. 213-598-9645
CA Westlake Village, Electro-Craft Corp. .. 818-889-3631
CO Englewood, Electro-Craft Corp./RENCO 303-762-1754
GA Marietta, Electro-Craft Corp./RENCO 404-971-2669
IL Palatine, Electro-Craft Corp./RENCO 312-991-4570
NH Salem, Electro-Craft Corp./RENCO ... 603-893-5552
NJ Cherry Hill, Electro-Craft Corp./RENCO 609-662-0555
NY Buffalo, Ross Equip. Co., Inc. 716-634-0990
NY Elmira, Ross Equip. Co., Inc. 607-734-4175
NY Rochester, Ross Equip. Co., Inc. 716-271-5660
NY Syracuse, Ross Equip. Co., Inc. 315-463-6691
OH Cincinnati, Electro-Craft Corp./RENCO 513-474-4171
WA Bellevue, Sweo Engrg. 206-644-2725
Can Edmonton, Alb., Hank Mottle Mktg., Ltd. 403-468-1292

RENCO ELCTRNS., 60 Jefryn Blvd., E., Deer Park, NY 11729, Tel: 516-586-5566 ... **A•1274-1276, 2268-2269**

Toll-Free Engineering Hot Line 800-645-5828, in NY State 516-586-5566

REPCO, 2421 N. Orange Blossom Trail, Box 7065, Orlando, FL 32854, Tel: 305-843-8484, Telex: 56-6536

REPRODUCTION TECHNOLOGIES INC., Dept. EM, P.O. Box 815, Bristol, IN 46507-0518, Tel: 219-848-5233, 219-848-5333; Empl.: 8 ..... **D•1034**

Local Sales Offices & Reps
GA Chamblee, Secom Sys. 404-455-0672
IN Indianapolis, Carlton Security Sys. 317-787-8545
KY Louisville, Audio Mktg. Assocs. 502-935-2580
MA Falmouth Heights, R J C Assocs. 617-540-8832
MI Ferndale, Shalco 313-547-4771
MN Minneapolis, KODO Assocs. 612-881-1255
OH Brecksville, Audio Mktg. Assocs. 216-526-2426
OH North Canton, Audio Mktg. Assocs. ... 216-499-1172

REPUBLIC ELCTRNS. CORP., 176 E. 7th St., Paterson, NJ 07524, Tel: 201-279-0300, TWX: 710-988-5908; FSC No.: 93958; Empl.: 125; *Sls. Mgr.:* W. Eisenberger ..... **A•1167**

Local Sales Offices & Reps
CA Los Angeles, Corcoran Assocs. 213-823-2425
CA Sunnyvale, W. W. Posey Co. 408-746-0771
CO Commerce City, Williams Assocs. 303-289-5647
FL Sunrise, Arnold Milrot & Assoc. 305-748-6446
IL Chicago, Ropek, Cahill & Vogt 312-631-0070
IN Ft. Wayne, Given Corp. 219-432-5585
IA Cedar Rapids, Ard Sales Co. 319-393-6392
MD Ellicott City, Nelson Elctrns. 301-747-7887
MA Walthan, Deltech Sls. Inc. 617-894-4550
MN Edina, Grayden & Flemmer 612-941-1120
MO Grandview, R. R. Burton & Assocs. 816-763-5385
MO Maryland Hgts., R. R. Burton & Assocs. 314-434-1678
NJ Hasbrouck Hgts., Comp-Tech Sls. 201-288-7400
NY Liverpool, Precision Sls. 315-451-3480
NY New Hyde Park, Comp-Tech Sls. 516-593-2628
NY Pittsford, Precision Sls. 716-381-2820
NY Pleasant Valley, Precision Sls. 914-635-3233
NC Charlotte, Jake Rudisill Assocs. 704-377-6901
OH Columbus, Tom Mulligan & Assocs. .. 614-457-2242
OK Tulsa, Hugh J. Daly Co. 918-627-4159
PA Lancaster, Electro Rep. 717-299-5877
TX Lewisville, Marathon Assocs. 214-436-8882
WA Lynnwood, Blum & Assocs. 206-777-6656

Local Distributors
CA San Fernando, Petell Elctrns. 213-365-9841
IL Skokie, Kellner Elctrns. 312-677-1120
NJ Perth Amboy, Metuchen Capacitors ... 201-442-0500
NY Hauppauge, Semi Cap Elctrns. 516-582-4400

REPUBLIC ELECTRONICS CO., 575 Broad Hollow Rd., Melville, NY 11747, Tel: 516-249-1414, Telex: 96-1460; FSC No.: 95750; Empl.: 125; *Sls. Mgr.:* William Shaver

REPUBLIC PACKAGING CORP., 9160 S. Green St., Chicago, IL 60620, Tel: 312-233-6530, Telex: 25-4621; *Sls. Mgr.:* Hal Grossman; *Dist. Mgr.:* Herb Fasth

RESDEL ENGRG., 300 E. Live Oak Ave., Arcadia, CA 91006, Tel: 213-684-2600, TWX: 910-582-3219; Empl.: 170

RESEARCH, INC., Box 24064, Minneapolis, MN 55424, Tel: 612-941-3300, Telex: 29-0502; Empl.: 250; *Sls. Mgr.:* Brian Callahan

RESEARCH PRODS., 1015 E Washington Ave., Madison, WI 53701, Tel: 608-257-8801, TWX: 910-286-2781

RESISTANCE TECHNOLOGY INC., 1260 Red Fox Rd., St. Paul, MN 55112, Tel: 612-636-9770; *Sls. Mgr.:* Michael Geraci; *Dist. Mgr.:* Michael Geraci

RESISTORS, INC., 5226 W. 26th St., Chicago, IL 60650, Tel: 312-652-7555; Empl.: 50 ..... **A•1942**

Local Sales Offices & Reps
CT Plantsville, Parnetics Co. 203-628-9343
IL Arlington Hgts., Resistance Specialists 312-259-6571
IA Cedar Rapids, J.R. Sls. Engrg. 319-393-2232
MI Lathrup Village, R.C. Nordstrom & Co. 313-559-7373
NY New York City, Symon Assocs. 212-757-3638
OH Wickliffe, W.J. Brauer & Assocs. 216-943-0601
WI Milwaukee, Honkamp Sls. Co. 414-463-2530

RES-NET, 110 Route 10, Whippany, NJ 07981, Tel: 201-887-2260, out of state 800-526-0704; FSC No.: 55 877; Empl.: 42; *Sls. Mgr.:* David Beck ..... **A•1943**

Local Sales Offices & Reps
CA Palo Alto, Mollard Mktg. 415-961-0456
MA Waltham, Dynasel Assocs. 617-890-6777

Local Distributors
NJ Whippany, ADI American Distributors Inc. 201-428-0510

REVERE CORP. OF AMER., 845 N. Colony Rd., Wallingford, CT 06492, Tel: 203-269-7701, Telex: 96-3482, TWX: 710-476-3197; Empl.: 389; *Sls. Mgr.:* R. Paukstys

REXNORD CHEMICAL PRODS. INC., 6120 E. 58th Ave., Commerce City, CO 80022, Tel: 303-289-5651, Telex: 45-0331; *Sls. Mgr.:* Michael P. Manegold

Local Sales Offices & Reps
CA Glendora, Rexnord Chem. Prods. 818-963-1109
FL South Merritt Island, John Rule Assocs. 305-777-5952

IL Northfield, Special Elec. 312-446-5113
MI Roseville, Special Elec. Co. 800-558-0604
MN Excelsior, JPM Assocs. 612-474-3408
MO St. Louis, Special Elec. Co. 314-962-1150
OH Cleveland, Special Elec. Co. 216-441-5244
PA Doylestown, Rexnord Chem. Prods. ... 215-348-2147
RI Lincoln, Special Elec. Co. 401-727-1136
WI Milwaukee, Special Elec. Co. 414-383-6370

RFD, INC., 5024 Nassau St., Tampa, FL 33607, Tel: 813-872-1502, TWX: 810-876-9146; *Sls. Mgr.:* Thomas W. Facer

RFI CORPORATION, 100 E. Pine Aire Dr., Bay Shore, NY 11706, Tel: 516-231-6400, TWX: 510-227-6233; FSC No.: 13619;15733; Empl.: 250; *Sls. Mgr.:* Robert Fitzpatrick ..... **A•1629**

Local Sales Offices & Reps
AL Huntsville, Murcota Corp. 205-539-8476
AZ Scottsdale, Williams-Assocs. 602-947-4297
CA Monterey Park, M.W. Riedel Co. 213-283-7694
CA Mountain View, Peninsula Tech. Sls. .. 415-965-3636
CO Denver, Williams-Assocs. 303-373-4730
FL St. Petersburg, Tech-Rep Assocs. 813-577-2779
IL North Riverside, J. Popp Sls. 312-447-6124
IN Ft. Wayne, Denton Mktg., Inc. 219-627-5515
IA Davenport, Ensco-Rep 319-386-6600
KS Overland Park, Ensco-Rep 913-381-7557
MD Rockville, Mechtronics Sls. 301-340-2130
MO St. Louis, Ensco-Rep 314-423-3935
NH Hudson, EMC Sls., Inc. 603-880-3671
NJ Cherry Hill, H.J. White Co. 609-428-4544
NM Albuquerque, Williams-Assocs. 505-255-1638
NY Great Neck, Trionic Assocs. 516-466-2300
NC Winston-Salem, Murcota Corp. 919-722-9445
PA McKean, Ecco Elctrn. Sls. 814-476-1376
TX Garland, McBride Sci. Sls. 214-494-5000
WA Seattle, Granville Gillette Assocs. 206-284-3344

RFL INDS., A Dowty Grp. Co./Comms. Div., Powerville Rd., Boonton, NJ 07005, Tel: 201-334-3100, TWX: 710-987-8352; FSC No.: 49673; Empl.: 300

RFL INDS., A Dowty Grp. Co./Instr. Div., Powerville Rd., Boonton, NJ 07005, Tel: 201-334-3100, TWX: 710-987-8352; FSC No.: 49673; Empl.: 300

RFL INDS., Thermocontrol Div., W. Prospect St., Box 250, Brandon, VT 05733, Tel: 802-247-6811, TWX: 710-987-8352; Empl.: 350; *Sls. Mgr.:* Bob Berman; *Dist. Mgr.:* Bob Berman

RF MONOLITHICS, INC., 4441 Sigma Rd., Dallas, TX 75234, Tel: 214-233-2903, TWX: 910-860-5474; Empl.: 90; *Sls. Mgr.:* William Spurgeon

RF POWER LABS, INC., 21820 87th S. E., Woodinville, WA 98072, Tel: 206-481-8833, Telex: 32-1042; FSC No.: 057143; Empl.: 17; *Sls. Mgr.:* Greg Cook

RHG ELECTRONICS LAB., INC., 161 E. Industry Ct., Deer Park, NY 11729, Tel: 516-242-1100, TWX: 510-227-6083; Empl.: 180; *Sls. Mgr.:* Martin D. Markson

RHINO SALES CORP., 620 Andrews Ave., P.O. Box 367, Kewanee, IL 61443, Tel: 309-853-4461

RHOMBUS INDS., 15801 Chemical Ln., Huntington Bch., CA 92649-1595, Tel: 714-898-0960, TWX: 910-596-1826; Empl.: 60 ..... **A•1568-1573**

Local Sales Offices & Reps
CA Irvine, J. V. Earley & Assocs. 714-833-1806
CA Redwood City, James S. Heaton Co. .. 415-367-9000
CO Parker, A-5 Co. 303-841-3651
FL Coral Springs, MTS Assocs. 305-753-3830
MA Malden, J. K. Assocs. 617-321-2922
NC Cary, Engineering Dvcs. 919-469-9323
TX Irving, Space Elctrns. 214-251-3636
PR Caquas, Arami Camacho 809-743-0657

Local Distributors
AZ Phoenix, A-5 Co. 602-943-3941
WA Redmond, Compu-Rep 206-788-3005

RICHARD CALDWELL SOFTWARE, 1617 Whitton Ave., San Jose, CA 95116-2455, Tel: 408-251-3485

RICHARD HIRSCHMANN OF AMERICAN, See Hirschmann

RICHARD-LEE CO., Box 724, New Providence, NJ 07974, Tel: 201-276-0710; Empl.: 8

RICHARDS, ARKLAY S., CO., INC., 72 Winchester St., Newton Highlands, MA 02161-1793, Tel: 617-527-1512; *Sls. Mgr.:* L. K. Richards

RICHCO PLASTIC CO., 5825 N. Tripp Ave., Chicago, IL 60646, Tel: 312-539-4060, TWX: 910-221-1938; FSC No.: 06915; Empl.: 250; *Sls. Mgr.:* Craig Richardson; *Dist. Mgr.:* Ted Pavoris

RI/CONTROL SYSTEMS, Research, Inc., P.O. Box 24064, Minneapolis, MN 55424, Tel: 612-941-3300, Telex: 29-0502; Empl.: 260; *Sls. Mgr.:* Brian Callahan

RIDGE TOOL CO., Sub. Emerson Elec. Co., 400 Clark St., Elyria, OH 44036, Tel: 216-323-5581, Telex: 0243420

RIFA

RIFA, INC., Greenwich Off. Pk. 3, P.O. Box 3110, Greenwich, CT 06836-3110, Tel: 203-625-7300, Telex: 221976 ERIANUR ..... **D•1810-1811**

Local Sales Offices & Reps
CA Cupertino, Pacific Elctrns., Inc. 408-733-9920
FL St. Petersburg, Tech-Rep Assocs., Inc. 813-577-2779
IL Elk Grove Village, Carlson Elctrns. Sls. 312-956-8240
MD Glen Burnie, Macrotech Assocs., Ltd. 301-437-5588
NV Reno, Unitronics 702-825-1978
NH Londonderry, Power Conversion Sys. 603-434-2370
NJ Marlton, Naudain Assocs. 609-983-5300
NJ Parlin, JMR Sls., Inc. 201-254-8484
NY East Setauket, JMR Sls., Inc. 516-689-8871
TX Austin, Tesco, Inc. 512-834-8374
TX Garland, Tesco, Inc. 214-681-1376
WI Milwaukee, Carlson Elctrns., Sls. 414-476-2790
Can Calgary, Alb., Deskin Sls. 403-466-2106
Can Edmonton, Alb., Deskin Sls. 403-466-2106
Can Markham, Ont., Deskin Sls. 416-475-1412
Can Montreal, Que., Deskin Sls. 514-331-2860
Can Ottawa, Ont., Deskin Sls. 613-729-1099
Can Vancouver, B.C., Deskin Sls. 604-273-4963
Can Winnipeg, Man, Deskin Sls. 403-466-2106

Local Distributors
FL St. Petersburg, Tech-Rep Assocs. 813-577-2779

RIL ELCTRNS., INC., 125 Titus Ave., P.O. Box H, Warrington, PA 18976, Tel: 215-EL5-1361; Empl.: 25

RING KING VISIBLES, INC., 2210 Second Ave., Muscatine, IA 52761, Tel: 319-263-8144, Telex: 468559; Empl.: 150; *Sls. Mgr.:* Dave White

RIPLEY, 46 Nooks Hill Rd., Cromwell, CT 06416, Tel: 203-635-2200, TWX: 710-428-9567; Empl.: 100; *Sls. Mgr.:* R. S. Clark

RISK, GEORGE, INDS., GRI Plaza, Kimball, NE 69145, Tel: 308-235-4645, TWX: 910-620-9040; FSC No.: 24229; Empl.: 100; *Sls. Mgr.:* J. Fisher; *Dist. Mgr.:* J. Fisher ..... **B•1737**

Local Sales Offices & Reps
AZ Tempe, Cleveland Entprs. of Ariz. 602-820-1127
CA Anaheim, Galaxie Sales Int'l. 714-752-1580
CA Escondido, Cirolia Elctrn. Sls. 619-743-3015
CA San Carlos, Kafco 415-591-6758
FL Tamarac, Davmik Sls. 305-920-2222
AL Huntsville, Elctrn. Mfr. Agt. 205-830-4030
IL Wheaton, Chadra-Schilke & Assoc. ... 312-653-8126
MA Lexington, Jodan Tech. 617-862-2354
MN St. Paul, Countryman Assocs. 612-645-9151
MO Maryland Heights, Kebco 314-576-4111

Local Distributors
CA Los Angeles, Electric Switches 213-660-1310
CA Santa Ana, Advanced Computer Prods. 714-558-8813

RLC ELCTRNS., INC., 83 Radio Cir., Mt. Kisco, NY 10549, Tel: 914-241-1334, TWX: 710-571-2103; FSC No.: 12598; *Sls. Mgr.:* Philip H. Wright

RMF PRODS., INC., 1275 Paramount Pkwy., P.O. Box 520, Batavia, IL 60510, Tel: 312-879-0020; Empl.: 11; *Sls. Mgr.:* R. Frieders ..... **C•1616**

RMS ELECTRONICS INC., 50 Antin Pl., Bronx, NY 10462, Tel: 212-892-6700; Empl.: 100; *Dist. Mgr.:* Seymour Goldberg

RMS TECHN., 706 Industry Dr., Hampton, VA 23661, Tel: 804-838-2458; Empl.: 7

ROANWELL, 180 Varick St., New York, NY 10014, Tel: 212-989-1090, TWX: 710-581-6555; FSC No.: 82872; Empl.: 200; *Sls. Mgr.:* C. Carl Hilsdorf; *Dist. Mgr.:* C. Carl Hilsdorf

RO ASSOCIATES

RO ASSOCS., 246 Caspian Dr., Box 61419, Sunnyvale, CA 94088, Tel: 408-744-1450, TWX: 910-339-9304; FSC No.: 24230; Empl.: 90; *Sls. Mgr.:* R. D. Okada ..... **D•1812-1814**

Local Sales Offices & Reps
AL Huntsville, Lee Assocs. 205-533-5896
AZ Phoenix, Sigma 602-241-1334
CA Los Angeles, Amasco 213-516-8561
CA San Francisco, Amasco 408-733-8690
CO Denver, F.G. Mktg. 303-795-9176
DC Washington, Gans & Pugh 703-527-3262
FL Orlando, OEM Mktg. 305-299-1000
IL Chicago, John Kennaugh & Assoc. ... 312-980-2570
KS Shawnee Mission, Midtec 913-441-6565
MD Baltimore, Gans & Pugh 703-527-3262
MA Boston, Intersell 617-273-3844
MO St. Louis, Midtec 314-837-5200
NM Albuquerque, Fry-Gates, Inc. 505-262-1525
NY Mt Vernon, Sonkin Assocs. 914-968-8282
NY Utica, B. D. Hummel Co. 315-736-7821
OH Centerville, Omega Sls., Inc. 513-434-5507
OK Tulsa, Cunningham Comp. Corps. 918-492-0390
PA Philadelphia, Gans & Pugh 703-527-3262
TX Dallas, Cunningham Comps. Corp. 214-669-9706
TX Houston, Cunningham Comps. Corp. .. 713-461-4197
WA Seattle, Huntley Assocs. 206-353-1833

ROBBINS & MEYERS, INC., Motor & Control Sys. Div., Rte. 4, Bob McCormick Rd., Gallipolis, OH 45631, Tel: 614-446-9868, Telex: 241353 ..... **B•1184**

ROBERT BOSCH CORP., See Bosch, Robert, Corp.

ROBINSON-HALPERN, One Apollo Rd., P.O. Box 248, Plymouth Meeting, PA 19462-0248, Tel: 215-825-9200, TWX: 510-660-8637; FSC No.: 12400; Empl.: 80; *Sls. Mgr.:* J. Lanza

ROBINSON-NUGENT, INC., 800 East 8th St., New Albany, IN 47150, Tel: 812-945-0211, TWX: 810-540-4082; Empl.: 567; *Sls. Mgr.:* Hap Taylor

ROBISON ELCTRNS., P.O. Box 8121, San Luis Obispo, CA 93403-8121, Tel: 805-544-8000; FSC No.: 19080; Empl.: 45

ROCHESTER INSTR. SYS., 255 N. Union St., Rochester, NY 14605, Tel: 716-263-7700, Telex: 978457; Empl.: 330

ROCKBESTOS CO., P.O. Box 1102, New Haven, CT 06504, Tel: 203-772-2250

ROCKLAND INSULATED WIRE & CABLE, 87 Broadway, Haverstraw, NY 10927, Tel: 914-429-3103; FSC No.: 12111

ROCKLAND SYS. CORP., See Wavetek Rockland Scientific, Inc.

ROCKWELL FILTER PRODS., 2990 Airway Ave., Costa Mesa, CA 92626, Tel: 714-641-5311, Telex: 685532; Empl.: 100; *Sls. Mgr.:* Lee Cornett

ROCKWELL INT'L., 4311 Jamboree Rd., Newport Beach, CA 92660, Tel: 800-854-8099, TWX: 910-591-1654; FSC No.: 34576; Empl.: 1995; *Sls. Mgr.:* K. MacDonald; *Dist. Mgr.:* K. Foster

ROCKWELL INTL., Commercial Elctrns. Opers., 1200 N. Alma Rd., Richardson, TX 75081, Tel: 214-996-5000, Telex: 73-307, 73-2490, TWX: 910-867-4709; Empl.: 15,000

RODALE ELCTRNS. CORP., 603 Chestnut St., Garden City, NY 11530, Tel: 516-222-0050, TWX: 510-222-0274; *Sls. Mgr.:* John B. Clement

RODELCO ELCTRNS. CORP., 356A Comac Rd., Deer Park, NY 11729, Tel: 516-643-5110; Empl.: 28

ROD-L ELECTRONICS, INC., 1098 Hamilton Ct., Menlo Park, CA 94025, Tel: 415-322-0711, TWX: 296210 ..... **D•1296-1301**

Local Sales Offices & Reps

AL	Huntsville, Sci. Svcs. SE	205-536-1969
AZ	Phoenix, Venturesearch	602-894-5216
CA	Carson, Amasco	213-516-8561
CA	Sunnyvale, Amasco	408-733-8690
CO	Conifer, Energy Equip. Sls.	303-674-8111
FL	Orlando, Sci. Dvcs. SE	305-841-8180
IL	Elk Grove, Loren Green Assocs.	312-593-0282
IN	Indianapolis, Loren Green Assocs.	317-293-9827
MD	Baltimore, Sci. Reps.	301-321-1411
MA	Reading, Scheinfein Assocs.	617-944-2304
MN	Minneapolis, Instrmn. Svcs., Inc.	612-544-8916
MO	Florissant, Web Elctrns.	314-921-5720
MO	Kansas City, Paloma Sls. Co.	816-358-7272
NJ	Fairfield, Addem Sls.	201-882-0993
NJ	Pennsauken, Sci. Reps.	609-662-5222
NY	De Witt, DB Assocs.	315-446-0220
NC	Winston-Salem, Sci. Dvcs.	919-765-5776
OH	Centerville, Micro Sls.	513-433-8171
OR	Portland, Control Tek Sls., Ltd.	503-641-8180
TX	El Paso, Venturesearch	915-594-4094
TX	Houston, Spectra Sls.	713-747-2798
TX	Richardson, Spectra Sls.	214-234-3600
VA	Fairfax, Sci. Reps.	703-385-0600
WA	Spokane, Control Tek Sls., Ltd.	509-922-2971

ROEAN INDUSTRIES, INC., 12970 Branford, Ste. C, Pacoima, CA 91331, Tel: 818-767-7047, Telex: 758630 TGMC; Empl.: 8

ROEDERSTEIN ELCTRNS., INC., P.O. Box 5588, Statesville, NC 28677, Tel: 704-872-8101, Telex: 240802, TWX: 301-240802; *Sls. Mgr.:* Frank Acuff

Local Sales Offices & Reps

AL	Hunstville, CSR Elctrns.	205-533-2444
AZ	Tempe, Dowling Tech. Grp.	602-893-7555
CA	PAlo Alto, Abbott Engrg. Co., Inc.	415-968-2265
CA	Sunnyvale, REI	408-866-7950
CA	West Covina, Component Svc., Inc.	213-960-4761
CO	Aurora, Sage Sls., Inc.	303-750-3501
CT	North Haven, Kitchen & Kutchin, Inc.	203-239-0212
FL	Coral Springs, E. P. M. Corp.	305-755-5387
FL	Orlando, E. P. M. Corp.	305-425-6149
GA	Atlanta, CSR Elctrns.	404-396-3720
IL	Rosemont, STC	312-671-4208
IN	Bloomington, John Hershman	812-339-9563
IN	Ft. Wayne, J & B Engrg.	219-483-2813
KS	Kansas City, Delltron	816-436-6445
MA	Burlington, Kitchen & Kutchin	617-229-2660
MA	Lincoln, Kitchen & Kutchin	615-259-9017
MO	St. Louis, Delltron	314-869-4779
NJ	Leonia, Peter E. Schmitt Co., Inc.	201-944-2806
NY	Cazenovia, ST/Woolard	315-655-8145
NC	Raleigh, CSR Elctrns.	919-878-9200
PA	Feasterville, Knowles Assocs.	215-322-7100
TX	Austin, Semco	512-837-0893
UT	Salt Lake City, Sage Sls., Inc.	801-467-5451
VA	Lynchburg, ST/Woolard	804-528-5421
WA	Kirkland, Manon Engrg.	206-827-7449
Can	Concord, Ont., Votron Elctrns., Inc.	416-669-9870

ROGAN, 3455 Woodhead Dr., Northbrook, IL 60062, Tel: 312-498-2300, TWX: 910-686-0008; Empl.: 100; *Sls. Mgr.:* D. Pelletier; *Dist. Mgr.:* D. Pelletier

ROGERS CORP., Bus Products Division, 5750 East McKellips Rd., Mesa, AZ 85205, Tel: 602-830-3370

ROGERS CORP., Box 700, Chandler, AZ 85224, Tel: 602-963-4584, TWX: 910-950-1961; Empl.: 400; *Sls. Mgr.:* Paul Anderson

ROGERS CORP., One Technology Dr., Rogers, CT 06263, Tel: 203-774-9605, TWX: 710-448-0047; Empl.: 2500; *Sls. Mgr.:* Paul L. Anderson ..... **C•1715**

Local Sales Offices & Reps

AL	Huntsville, G. S. Jordan	205-881-7971
AZ	Scottsdale, H.R. Crowder	602-991-8908
AZ	Tempe, M. F. Iosue	602-839-5478
CA	Carlsbad, D. Bergheimer	619-434-1297
CA	Corona, R. A. Forester	714-734-5881
CA	Palo Alto, R. A. Greenman	408-947-7797
CA	Poway, A. W. Riel	619-487-1065
CA	Poway, A.W. Riel	619-487-1065
CA	San Jose, R.H. Jackson	408-947-7797
CA	San Jose, W. J. Stolp	408-947-7797
CT	Bristol, J. F. Witkewicz	203-583-4341
CT	Norwich, G. R. Jessel	203-376-0276
FL	Melbourne Beach, P. R. Pratt	305-725-6105
IL	Hazel Crest, J. R. Menees	312-798-5800
KY	Louisville, G. P. Harris	502-224-9163
MI	Livonia, J. M. Allan	313-427-8228
MN	Northfield, W. P. Kelly	507-663-1050
NH	Londonderry, W. J. Coyne	603-434-5358
NJ	Pitman, R. M. Neidig	609-582-1666
NJ	Springfield, S. D. Wellen	201-944-7777
NY	Poughkeepsie, V. H. Potter	914-485-6763
NY	Rochester, R. C. Bangs	716-454-6520
OH	Shaker Hgts., E. R. Perme	216-283-5486
OH	Xenia, J. L. Forte	513-426-8993
PA	Hermitage, H. A. Harriman	412-983-3742
PA	Holtwood, T. G. Sleasman	717-284-4328
SC	Rock Hill, E. E. Wild	803-366-2952
TX	Round Rock, B.D. Duke	512-244-3074
VA	Lynchburg, L.J. Rodrigue	804-384-9517
VA	Roanoke, J. L. Settles	703-774-8478
WA	Seattle, L. B. Keen	206-575-4175

R-OHM (EASTERN OPER.), 2303 W. Meadowview Rd. #3, Kingston Bldg., Greensboro, NC 27407, Tel: 919-855-0217

ROHM CORP., 8 Whatney, Irvine, CA 92718, Tel: 714-855-2131, TWX: 910-595-1721; Empl.: 125; *Sls. Mgr.:* Mike Hammel

ROLM MIL-SPEC COMPUTERS, Rolm Corp., 1 River Oaks Pl., San Jose, CA 95134, Tel: 408-942-8000, TWX: 910-338-0247; FSC No.: 14345; Empl.: 1000; *Sls. Mgr.:* Peter Cicata; *Dist. Mgr.:* Peter Cicata

ROLM CORP., 4900 Old Ironsides Dr., M/S 626, Santa Clara, CA 95054, Tel: 408-986-1000; Empl.: 10,000

ROLYN OPTICS CO., 738 Arrowgrand Cir., Covina, CA 91722-2199, Tel: 818-915-5707/5717, Telex: 67-0380

ROME CABLE CORP., P.O. Box 71, Rome, NY 13440, Tel: 315-337-3000

RONOR SYSTEMS, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492, Tel: 203-265-2110; Empl.: 12

RONTRON ENGINEERING, 25 Rose St., Branford, CT 06405, Tel: 203-488-5020

ROSE ENCLOSURES SYS., INC., 12140 Parklawn Dr., Rockville, MD 20852, Tel: 301-984-1783, Telex: 908-107 Resi Rove; *Sls. Mgr.:* Paul Bruhn ..... **C•1078-1079**

ROSEMONT-NASHVILLE, INC., See Chromalox Instrs. & Controls

ROSEN GRANDON ASSOCIATES INC., 7807 Whittier St., Tampa, FL 33617, Tel: 813-985-4911; Empl.: 1; *Sls. Mgr.:* Jane R. Rosen-Grandon

ROSS ENGRG. CORP., 540 Westchester Dr., Campbell, CA 95008, Tel: 408-377-4621, Telex: 858840, TWX: 910-590-8033; FSC No.: 23598; Empl.: 45; *Sls. Mgr.:* Hugh C. Ross ..... **B•1443**

ROSTONE CORP., P.O. Box 7497, Lafayette, IN 47903, Tel: 317-474-2421, TWX: 810-342-1887; Empl.: 500

Local Sales Offices & Reps

FL	Fern Park, Blair Engrg., Inc.	305-834-1244
MA	Framingham, Petri-Jones, Inc.	617-877-4233
NY	Canandaigua, Brandon Assocs., Inc.	716-394-6080
NY	Liverpool, Brandon Assocs., Inc.	315-652-3954
NC	Greenboro, Blair Engrg., Inc.	919-292-8200
OK	Tulsa, Blair Engrg., Inc.	918-622-3100
PA	Norristown, Brandon Assocs., Inc.	215-278-0500
TX	Austin, Blair Engrg., Inc.	512-458-3107
TX	Dallas, Blair Engrg., Inc.	214-241-5655
TX	Houston, Blair Engrg., Inc.	713-973-8800

ROTEK INSTR. CORP., 390 Main St., Waltham, MA 02254, Tel: 617-899-4611; *Sls. Mgr.:* Eliot Warner

ROTRON, INC., See EG & G Rotron

ROWE INDUSTRIES, INC., 6225 Benore Rd., P.O. Box 6877, Toledo, OH 43612, Tel: 419-729-9761, TWX: 810-442-1734; FSC No.: 82878; Empl.: 89; *Sls. Mgr.:* D. L. Mang; *Dist. Mgr.:* D. L. Mang ..... **C•1502-1504, 1895**

Local Sales Offices & Reps

AZ	Chandler, Blackhart Assocs.	602-831-2566
CA	San Jose, V. C. Robinson	415-969-4831
FL	Fern Park, EIR, Inc.	305-830-9600
KS	Leawood, Thunderbird	913-642-7220
KS	Wichita, Thunderbird	316-684-3941
MD	Baltimore, R. A. Wafer Assocs.	301-744-1133
MA	Burlington, Don C. Richard	617-272-1595
MA	Lowell, Underwood Sls.	617-256-8191
MI	Holland, Com-Tek Sls.	616-399-5719
MN	Hopkins, KITS Co.	612-933-1888
MO	Maryland, Thunderbird	314-567-6488
NM	Albuquerque, Ron-tek	505-299-4124
NC	Winston-Salem, Dula Assocs.	919-768-7166
OH	Beachwood, RC Assocs.	216-292-4954
OH	Cuyahoga Falls, Lee Tronics	216-928-8584

RTE AEROVOX INC., 740 Belleville Ave., New Bedford, MA 02745, Tel: 617-994-9661, TWX: 710-344-6985; FSC No.: 4K459; Empl.: 700; *Sls. Mgr.:* Jack Chmura; *Dist. Mgr.:* Matthew Simon

RTE DELTEC CORP., 2727 Kurtz St., San Diego, CA 92110, Tel: 619-291-4211, 800-854-2658, TWX: 910-335-1246; FSC No.: 52297; Empl.: 200 ..... **D•1959**

Local Sales Offices & Reps

AL	Huntsville, FM Assocs., Ltd.	205-882-0689
AK	Soldotna, Air Tek	907-262-5937
AZ	Scottsdale, Barnhill Assocs.	602-947-7841
CA	Los Altos, Jay Stone & Assocs.	415-948-4563
CA	Vista, Failsafe Power Corp.	619-726-0980
CO	Englewood, Barnhill Assocs.	303-779-3600
CT	Avon, Power Mark	203-678-0123
FL	Jupiter, FM Assocs., Ltd.	305-746-2996
FL	Orlando, FM Assocs., Ltd.	305-851-5710
GA	Atlanta, FM Assocs., Ltd.	404-446-0033
HI	Honolulu, Hawaiian Inds. Instru. Sls. Corp.	808-533-4232
IL	Arlington Heights, Dytec/Central, Inc.	312-394-3380
IN	Indianapolis, Dytec/Central, Inc.	317-247-1316
IA	W. Des Moines, Data Power Technlg. Corp.	515-223-5605
KS	Lenexa, Engineered Equip. Co.	913-492-9221
MI	Madison Heights, WKM Assocs., Inc.	313-588-2300
MN	Golden Valley, JR Assocs.	612-546-4110
MO	St. Louis, Applied Power Sys.	314-383-5858
NE	Omaha, Data Power Tech. Corp.	402-592-7860
NJ	Lodi, SDM Reps.	201-368-0125
NJ	Pennsauken, Scientific Reps.	609-662-5222
NM	Albuquerque, Barnhill Assocs.	505-299-7658
NY	Rochester, SDM Reps.	716-247-8770
NC	Ramseur, FM Assocs., Ltd.	919-824-2196
OH	Dayton, WKM Assocs., Inc.	513-434-7500
OH	Independence, WKM Assocs., Inc.	216-524-5930
PA	Pittsburgh, WKM Assocs., Inc.	412-892-2953
TX	Austin, Barnhill Assocs.	512-451-0217
TX	Houston, Barnhill Assocs.	713-688-9971
TX	Richardson, Barnhill Assocs.	214-231-2573
UT	Murray, Barnhill Assocs.	801-262-3000
VA	Fairfax, Scientific Assocs., Inc.	703-385-0600
WA	Seattle, F/M Sales Co.	206-628-9620
EXP	CA, San Diego, RTE Deltec Corp.	619-291-4211

RTE, Power/Mate Co., 514 S. River St., Hackensack, NJ 07601, Tel: 201-440-3100, TWX: 710-990-5023; Empl.: 375; *Sls. Mgr.:* Robert E. Allison ..... **D•1816-1827**

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg.	205-830-0498
AZ	Scottsdale, Luscombe Engrg. Co.	602-949-9333
CA	Campbell, Luscombe Engrg. Co.	408-370-2020
CA	Pasadena, Luscombe Engrg. Co.	213-684-2000
CA	Pasadena, Reaction Comps.	213-648-2000
CA	San Diego, Luscombe Engrg. Co.	619-295-4300
CO	Englewood, Delta Sls.	303-799-0646
FL	Winter Park, EMA, South	305-671-6800
GA	Norcross, Montgomery Mktg.	404-447-6124
IL	Chicago, Data Elctrns. Co.	312-283-0300
IN	Indianapolis, Data Elctrns. Co.	317-359-5368
KS	Overland Pk., Electri-Rep	913-649-2168
MD	Rockville, Marktron	301-251-8990
MA	N. Chelmsford, Power Assocs.	617-251-7756
MI	Southfield, Infinity, Inc.	313-557-7230

MN Plymouth, Data Elctrns. 612-559-1434
MS Jackson, Welch & Doby, Inc. 601-932-5534
MO St. Louis, Electri-Rep 314-878-8209
NJ Lodi, TRC Elctrns. 201-779-8282
NY Buffalo, R. W. Mitscher Co., Inc. 716-633-7970
NC Cary, Montgomery Mktg. 919-467-6319
OH Aurora, EMA, Inc. 216-562-6104
OH Centerville, EMA, Inc. 513-433-2800
OR Beaverton, Luscombe Engrg./NW 503-636-6664
PA Willow Grove, QED Elctrns. 215-657-5600
TX Austin, Beacon Elctrns. Assocs. 512-331-5115
TX Dallas, Beacon Elctrns. Assocs. 214-437-1505
UT Salt Lake City, Delta Sls. Assocs. 801-487-7571
EXP NY, Greast Neck, Auriema, Inc. 516-487-0700
Can Rexdale, Ont., Source Elctrns., Ltd. 416-675-6235

Local Distributors

AZ Scottsdale, Galtec 602-949-9765
CA Campbell, Sierra Comps. 408-370-2242
CA Pasadena, Reaction Comps. 213-648-2000
CO Englewood, Deltex 303-799-1088
IL Chicago, Dalec 312-283-0300
MA North Chelmsford, Power Assocs. 617-251-7756
NJ Lodi, TRC Elctrns. 201-779-8282
NC Cary, Distall Sls. 919-467-2902
OH Centerville, IPD 513-435-2086
OR Lake Oswego, Cesco Distrs. 503-636-6664
PA Willow Grove, QED Elctrns. of PA 215-657-5600
TX Dallas, CDI 214-644-0373

RTRON CORP., 7324 Lawndale, Skokie, IL 60076, Tel: 312-679-7180, TWX: 910-223-0810; FSC No.: 19130; *Sls. Mgr.:* R. McLean

RTS SYSTEMS, INC., Compact Video, Inc., 1100 W. Chestnut St., Burbank, CA 91506, Tel: 818-840-7119, Telex: 194855, TWX: 910-498-4987; Empl.: 75; *Sls. Mgr.:* Shelley Brown ..... **D•1055**

Local Sales Offices & Reps

AL Birmingham, Gray Comms. Conslt. 205-942-2824
AL Birmingham, Sonics Assocs. 205-942-9631
AL Cropwell, Broadcast Sys. 205-525-5467
AL Huntsville, Central Dynamics Corp. 205-837-5180
AL Mobile, Gray Comms. Conslt. 205-343-0662
AK Anchorage, N V S Sys. 907-349-3523
AZ Cottonwood, R I A Corp. 602-634-8065
AZ Phoenix, Siboney Communications Inc. (SCI) 602-252-5992
AZ Tucson, SCI 602-881-5432
CA Berkeley, Curtis M. Karplus, Esq. 415-642-1942
CA Burbank, H N E Inc. 213-508-7543
CA Burbank, Tri Tronics 213-843-2170
CA El Monte, Cetec Vega 213-442-0782
CA Encino, Everything Audio 213-995-4175
CA Glendale, Paramount Sound Sys. Corp. 213-956-3222
CA Inglewood, Audio Visual Hdqtrs. Corp. 213-419-4040
CA Lawndale, Omega Video 213-679-9021
CA Long Beach, K T Elctrns. 213-424-0979
CA Los Angeles, Acromedia Corp. 213-410-4141
CA Los Angeles, Hollywood Sound Sys. 213-466-2416
CA Los Angeles, Shoreline Ltd. 213-851-1236
CA Los Angeles, Skaggs Video Los Angeles 213-556-2133
CA Los Angeles, Tourkow & Co. 213-664-8884
CA N. Hollywood, Audio Svcs. Corp. 213-980-9891
CA N. Hollywood, Best Audio 213-763-2378
CA N. Hollywood, Doc Siegel Audio 213-877-2300
CA N. Hollywood, Theatre Vision 213-769-0928
CA Newbury Park, Westlake Audio 213-655-0303
CA Nipomo, Broadcast Sys. 805-929-4476
CA Pasadena, Audio Engrg. Assocs. 213-798-9127
CA San Diego, Centro Corp. 619-560-1578
CA San Diego, Skaggs Video San Diego 619-578-9640
CA San Diego, SCI 714-578-7777
CA Santa Clara, Video Comms. Corp. 408-988-2968
CA Sun Valley, Burns Audio 213-768-1701
CA Sunnyvale, Video Media 408-733-6500
CA Walnut, Video Comms. Corp. 714-594-2442
CO Denver, Film/Video Equip. Svc. 303-778-8616
CO Englewood, Skaggs Video Denver 303-740-9031
CT Shelton, Anton Bauer 203-929-1100
FL Gainesville, Gray Comms. Conslt. 904-376-2435
FL Miami, Gray Comms. Conslt. 305-591-3637
FL Miami, Hubbard Comms. 305-594-0744
FL Miami, Midwest Corp. 305-592-5355
FL Orlando, Gray Comms. Conslt. 305-896-7414
FL St. Petersburg, Hubbard Comms. 813-577-7759
FL Tampa, Gray Comms. Conslt. 813-885-1411
FL Tampa, SCI 813-985-4687
GA Albany, Gray Comms. Conslt. 912-883-2121
GA Doraville/Atlanta, Gray Comms. Conslt. 404-455-3121
GA Norcross, SCI 404-441-3300
GA Norcross/Atlanta, Tech. Video Sys. 404-447-6621
GA Union City/Atlanta, Allied Broadcast Equip. 404-964-1464
IL Chicago, Allied Broadcast Equip. 312-794-0224
IL Elk Grove Vlg., Swiderski Elctrns. 312-364-1900
IL Harvey, Bridgewater Custom Sound 312-596-0309
IL Morton Grove, Roscor Corp. 312-539-7700
IL Quincy, Harris Corp. 217-222-8200
IN Evansville, Kavco 812-476-6327
IN Indianapolis, Kavco 317-251-0800
IN Indianapolis, Midwest Corp. 317-251-5750
IN Indianapolis, R C A Corp. 317-273-3547
IN Richmond, Allied Broadcast Equip. 317-962-8596
IA Davenport, Video Midwest 319-322-1525
IA Des Moines, Video Midwest 515-244-1447
KY Edgewood, Midwest Corp. 800-543-1584
KY Lexington, Midwest Corp. 606-277-4994
KY Louisville, Midwest Corp. 502-491-2888
LA Harahan/New Orleans, Gray Comms. Conslt. 504-733-7265
MD Bethesda, Professional Prods. 301-657-2141
MD Lanham, Midwest Corp. 301-577-4903
MD Rockville, Peirce Phelps Inc. 301-984-7979
MA Boston, Professional Recording & Sound 617-254-2110
MA Framingham, Landy Assocs. 617-877-9570
MA Needham Hgts., Capron Lighting & Sound Co. 617-444-8850
MA Newton, Lake Sys. Corp. 617-244-6881
MI Ann Arbor, Hy James Audio Professionals 313-994-0934
MI Oak Park, Midwest Corp. 313-399-6361
MI Troy/Detroit, Midwest Corp. 313-689-9730
MN Minneapolis, Todd Comms. 612-941-0556
MN Minneapolis, Video Midwest 612-831-2248
MS Bay St. Louis, Harris Corp. S. Central Reg. 601-255-3337
MO Chesterfield, Television Engrg. Corp. 314-532-4700
MO El Dorado Springs, Broadcast Sys. 417-876-6254
MO St. Louis, Antech Labs 314-997-5666
NE Omaha, Todd Comms. 402-341-7600
NV Las Vegas, Acromedia Corp. Las Vegas 702-362-7552
NV Las Vegas, Western Media Entprs. 702-873-2014
NJ Atlantic City, Telemeasurements 609-345-2670
NJ Cherry Hill, Landy Assocs. 609-424-4660
NJ Clifton, Telemeasurements 201-473-8822
NJ Mahwah, Philips Television Sys. 201-529-1550
NJ Mountain Lakes, Turner Engrg. 201-263-0023
NJ Northvale, A F Assocs. 201-767-1000
NM Albuquerque, SCI 505-884-6858
NM Los Lunas, Dyma Engrg. 505-865-6700
NY New York, Adcom Comms. 212-265-1760
NY New York, Camera Mart 212-757-6977
NY New York, M P C S Video Inds. 212-586-3690
NY New York, Martin Audio/Video Corp. 212-541-5900
NY New York, Tech. Video Sys. 212-580-3104
NY New York, Westec Audio Video 212-586-1662
NC Charlotte, Midwest Corp. 704-399-6336
NC Charlotte, Reliable Music 704-375-8662
NC Raleigh, Southeastern Sight & Sound 919-828-2311
NC RTP, Broadcast Sys. 919-851-1956
NC Winston-Salem, Tech. Video Sys. 919-748-0916
OH Cleveland, Midwest Corp. 216-447-9745
OH Columbus, Kavco 614-274-0180
OH Columbus, Midwest Corp. 614-476-2800
OH Dayton, Kavco 513-898-2003
OH Dayton, Midwest Corp. 513-275-3339
OH N. Royalton, Kavco' 216-237-1950
OH Parma Hgts., Reddish Sound 216-885-1222
OK Claremore, R I A Corp. 918-341-9066
OK Tulsa, M Z B & Assocs. 918-743-2661
OR Portland, Baldwin Mktg. Co. 503-234-1359
PA Allentown, Daveland Co. 215-439-8701
PA Carnegie, Alpha Video & Elctrns. 412-923-2070
PA Gibsonia, Midwest Corp. 412-443-6720
PA King of Prussia, Maris Equip. Corp. 215-275-9300
PA Philadelphia, Lerro Elctrl. Corp. 215-223-8200
PA Philadelphia, Peirce Phelps Inc. 215-879-7205
PA Pittsburgh, R P C Elctrns. 412-782-3770
TN Knoxville, Gray Comms. Conslt. 615-523-3107
TN Nashville, Consolidated Media Sys. 615-244-3933
TN Nashville, Gray Comms. Conslt. 615-883-9175
TX Amarillo, Magnetic Media Corp. 806-358-2468
TX Arlington, Midcom 817-640-4573
TX Austin, Broadcast Sys. 512-836-6014
TX Austin, M Z B & Assocs. 512-837-7240
TX Austin, Magnetic Media Corp. 512-451-0138
TX Austin, SCI 512-454-7194
TX Corpus Christi, SCI 512-883-6688
TX Dallas, M Z B & Assocs. 214-233-5535
TX Dallas, Magnetic Media Corp. 214-931-0404
TX Dallas, Video Sys. 214-349-0951
TX El Paso, SCI 915-598-8538
TX Houston, L D Systems 713-695-9400
TX Houston, M Z B & Assocs. 713-448-0881
TX Houston, Magnetic Media Corp. 713-771-9125
TX Houston, SCI 713-686-9685
TX Houston, Video Sys. 713-686-9651
TX Irving, SCI 214-258-8470
TX Lubbock, Video Sys. 806-792-2325
TX Madison, SCI 615-865-1980
TX Plano, Allied Broadcast Equip. 214-423-8667
TX Plano, Broadcast Sys. 214-867-8775
TX San Antonio, Video Sys. 512-824-2311
UT Salt Lake City, R I A Corp. 801-486-8822
UT Salt Lake City, Skaggs Telecom Svc. 801-539-1420
UT Salt Lake City, Skaggs Video Sls. 801-539-1420
VA Richmond, Professional Prods. 804-794-2585
VA Virginia Beach, Midwest Corp. 804-464-6256
VA Woodbridge, Broadcast Sys. 703-494-4998
WA Federal Way, Allied Broadcast Equip. 206-927-4337
WV Charleston, Midwest Corp. Corporate H/Q 304-343-8874
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RUSH/HOUSTON, INC., 600 Kealrick, Ste C-40, Houston, TX 77060, Tel: 713-682-5151; *Sls. Mgr.:* Fred Murphy

RUSSELL INDS., 3000 Lawson Blvd., Oceanside, NY 11572, Tel: 516-536-5000; Empl.: 20; *Sls. Mgr.:* H. Russell

RUTHERFORD RESCH. PRODS., Box 249, Rutherford, NJ 07070, Tel: 201-933-2091; Empl.: 4; *Sls. Mgr.:* Dr. A. Blanck; *Dist. Mgr.:* Dr. A. Blanck

RVS ELECTRONICS, INC., 40 North St., Middletown, NY 10940, Tel: 914-342-3199, Telex: 820778; Empl.: 15

Local Sales Offices & Reps

CA San Diego, Mesa Engrg. (Rep) 619-268-3500
NY Middletown, RVS Elctrns., Inc. 914-342-3199

Local Distributors

AZ Phoenix, Jensen Tools 602-968-6241
MA Bedford, Continental Resources 617-275-0850
NJ Northvale, Glasgal Comms. 201-768-8082
NY Pleasantville, Electronic Tool 914-769-8070
PA Blue Bell, W.J. Wisely Assocs. 215-275-0658

RYAN INTL. CORP., 4800 Evanswood Dr., Columbus, OH 43229, Tel: 614-885-3303; Empl.: 30 ..... **D•1303**

RYE INDS., INC., 125 Spencer Pl., P.O. Box M, Mamaroneck, NY 10543, Tel: 914-698-0080; Empl.: 50

SABRE COMMS. CORP., 117 Main St., Soiux City, IA 51102, Tel: 712-258-6690; FSC No.: 60348; *Sls. Mgr.:* Bailey Aalfs; *Dist. Mgr.:* Richard Krone

SABRITEC, 16631 Noyes Ave., Irvine, CA 92714, Tel: 714-549-7350, Telex: 678401; *Sls. Mgr.:* M. J. Bennett

SAFEWAY PRODUCTS, 440 Middlefield St., Middletown, CT 06457, Tel: 203-346-6601, TWX: 710-428-7225; Empl.: 241

SAFT AMERICA INC., Box 1886, Valdosta, GA 31601, Tel: 912-247-2331, Telex: 547620, TWX: 810-786-5866

SAFT AMERICA INC., Advanced Battery Sys. Div., 107 Beaver Ct., Cockeysville, MD 21030, Tel: 301-666-3200

SAFT AMERICA, INC., Elctrns. Sys. Div., 2414 W. 14th St., Tempe, AZ 85281, Tel: 602-894-6864

SAFT AMERICA, INC., Portable Battery Division, 711 Industrial Blvd., Valdosta, GA 31601, Tel: 912-247-2331, Telex: 547-620; Empl.: 1300; *Sls. Mgr.:* R. Bartmes ..... **D•1412, 1432-1437**

Local Sales Offices & Reps

CA San Francisco 415-462-6868
CA Woodland Hills 818-884-6151
CO Denver 303-740-7781
FL Orlando 305-282-2245
IL Chicago 815-455-5344
MA Quincy 617-773-7980
MN Minneapolis 612-770-0082
NY New York City 516-249-3777
NC Winston-Salem 919-765-6690
OH Columbus 216-861-1877

PA	Philadelphia	215-831-9520
TX	Dallas	214-436-0757
VT	Rutland	802-773-8748
	Local Distributors	
AZ	Scottsdale, Electro Mktg.	602-991-0110
CA	Chatsworth, Mill Comm. Distrs., Inc.	818-998-3111
CA	Mountain View, Energy Sls.	415-969-0800
CO	Englewood, Industrial Elctrns.	303-694-9444
FL	Hialeah, Pro Battery	305-944-8800
MA	Billerica, A. W. Mayer Co., Inc.	800-225-6600
MI	Livonia, R. S. Elctrns.	313-525-1155
MN	Minneapolis, D. C. Battery Prods. Inc,	612-721-8547
MO	Maryland Heights, Ensco Distrb. Corp.	314-423-3992
NJ	Clifton, Engineered Assemblies, Inc.	201-340-0600
NY	Deer Park, TWR Tech., Inc.	516-242-4800
NC	Winston-Salem, Kirkman Elctrns.	800-334-8688, 800-672-0109
PA	Bensalem, Avex Elctrns. Corp.	800-345-1295
PA	Philadelphia, Shap Elctrns.	800-523-5248
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TX	Austin, Kent Elctrns.	512-478-8989
TX	Houston, Kent Elctrns.	713-780-7770
TX	Richardson, Kent Elctrns.	214-669-2600
TX	San Antonio, Kent Elctrns.	512-534-4848
UT	Salt Lake City, Standard Supp. Co.	800-453-7036
VA	Falls Church, Perrott Engrg. Labs, Inc.	703-532-0700
WA	Redmond, Energy Sls.	206-883-2343

SAGE LABORATORIES, INC., 3 Huron Dr., Natick, MA 01778, Tel: 617-653-0844, TWX: 710-346-0390; FSC No.: 07180; *Sls. Mgr.:* Tony Cieri

SAI TECHNLG. CO., Science Applications Inc., 4060 Sorrento Valley Blvd., San Diego, CA 92121, Tel: 619-452-9150, TWX: 756769; FSC No.: 54779; Empl.: 300

SAMARIUS, INC., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418, Tel: 203-735-7405, TWX: 710-451-2495; FSC No.: 18065; Empl.: 90 **A•2035**

SAMTEC, 810 Progress Blvd., P.O. Box 1147, New Albany, IN 47150, Tel: 812-944-6733, TWX: 810-540-4095; FSC No.: 55322; Empl.: 50; *Sls. Mgr.:* B. Shine; *Dist. Mgr.:* C. Roll

S & EI MFG., Box 832, Northridge, CA 91324, Tel: 818-349-4111, TWX: 910-493-1252; FSC No.: 24152; Empl.: 85

SANDERS ASSOCS., INC., DEFENSE, 95 Canal St., Nashua, NH 03061, Tel: 603-885-3833

SANDERS ASSOCS., INC., Electromagnetic, EMC Dept., 95 Canal St., Nashua, NH 03061, Tel: 603-885-3602; *Sls. Mgr.:* (EMC) R. Despathy

	Local Sales Offices & Reps	
MA	Scituate, New Eng. Area Reps.	617-545-6327
NJ	Princeton, Murtronic Assocs.	609-394-3737
NJ	Teaneck, Budd-Tronics Sls.	201-837-9057
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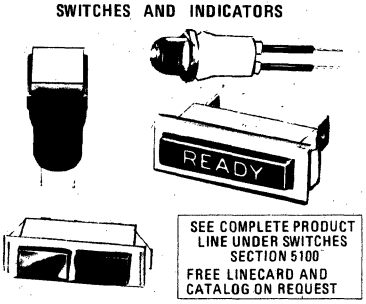

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SANDERS ASSCOS., INC., MICROWAVE, 955 Perimeter Rd., Manchester, NH 03108, Tel: 603-645-4299

S & H INDUSTRIES, INC.

S & H INDS., 119 Glen Cove Dr., Glen Head, NY 11545, Tel: 516-671-5600; Empl.: 50; *Sls. Mgr.:* R. Smith ..... **D•1829, 1984**

SAN DIEGO INSTR. LAB, See SANLAB

SAN FERNANDO ELEC. MFG., See SFE Techn.

SANFORD-MILLER CORP., 8 John St., Lynbrook, NY 11563, Tel: 516-593-2025, Outside NY 800-645-5900; Empl.: 10

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SANGANO WESTON-SANGAMO COMPONENTS DIV., Fairchild Semiconductor, Box 128, Pickens, SC 29671, Tel: 803-878-6311, Telex: 57-0441, TWX: 810-397-2496; FSC No.: 00853; *Sls. Mgr.:* Gary Luthi ..... **A•2056-2064**

Local Sales Offices & Reps

AZ Scottsdale, Ray Morton & Assocs. 502-947-1514
CA Irvine, Farley & Assocs. 714-833-1806
CA Mountain View, Westmark Assocs. 415-969-1700
CA San Diego, CK Assocs. 619-279-0420
CO Denver, Quorum 3 Sls. Grp. 303-696-8480
FL Clearwater Beach, Perrott Assocs., Inc. 813-443-5214,813-443-5414
FL Orlando, Perrott Assocs., Inc. 305-298-7748
FL Sunrise, Perrott Assocs., Inc. 305-792-2211
GA Norcross, Mountain Electro Prods., Inc. 404-448-5594
IL Rolling Meadows, Sumer, Inc. 312-991-8500
IA Marion, MSB Assocs., Inc. 319-377-6261
KS Shawnee Mission, MSB Assocs., Inc. .. 913-432-2131
MA Westwood, Mass Tech Sls. 617-329-8820
MI Warren, DEM Elctrn. Sls. 313-575-9444
MN Minneapolis, Components Grp. Corp. 612-374-1250
MO St. Charles, MSB Assocs., Inc. 314-946-5577
NJ Leonia, Peter E. Schmitt Co., Inc. 201-944-2806
NY Albany, Reagan Compar, Inc. 518-489-4777
NY Cazenovia, S. T. Woolard, Inc. 315-655-8145
NY Endwell, Reagan Compar, Inc. 607-723-8743
OH Rocky River, John Hill 216-331-5222
OR Beaverton, LD Elctrns. 503-649-8556,503-649-6177
PA Springhouse, P. W. C. 215-643-2550
TX Austin, Delta Comps. 512-458-4288
TX Seagoville, Delta Comps. 214-287-6333
UT Salt Lake City, Quorum 3 Sls. Grp. 801-943-9227
VA Fairfax, Beacon North 703-591-1300
VA Forest, Beacon North 804-239-8486
WA Snohomish, LD Elctrns. 206-568-0511
WA Spokane, LD Elctrns. 509-922-4883
WI Brookfield, Sumer, Inc. 414-784-6641
PR Playa Ponce, Ditributronics, Inc. 943-395-9311

Local Distributors

AZ Phoenix, Arizona Comps. Co. 602-269-5655
AZ Tempe, Circuit Specialists, Inc. 602-966-2878
CA Belmont, Arndt 415-592-6718
CA Chatsworth, Diplomat Elctrns. 213-700-8700
CA Chatsworth, Integrated Elcrns., Inc./JACO 213-998-2200
CA Chatsworth, Shelly Elctrns., Inc. 213-998-3333
CA Costa Mesa, Diplomat Elctrns. 714-549-8401
CA Garden Grove, Hi Rel Distr. Sls., Inc. .. 213-594-9571
CA Gardena, Bell Inds. 213-515-1800
CA Irvine, Kelex, Inc. 714-863-1230
CA San Diego, Bell Inds. 619-268-1277
CA San Diego, Diplomat Elctrns. 619-292-5693
CA San Diego, DECO 619-693-1595
CA San Diego, Park/West, Inc. 619-277-8433
CA San Fernando, Petell Elctrns., Inc. 213-365-9841
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CA Santee, Mouser Elctrns. 619-449-2222
CA Sunnyvale, Diplomat Elctrns. 408-734-1900
CA Van Nuys, Electronic Expediters 213-781-1910
CO Denver, Ragon-Elctrns. Parts Co. 303-744-1992
CO Englewood, Diplomat Elctrns. 303-740-8300
CT Danbury, Diplomat Elctrns. 203-797-9674
CT Norwalk, Park Distrs. 203-853-2011,212-931-1680
FL Clearwater, Diplomat Elctrns. 813-443-4514
FL Longwood, Intertec 305-834-7777
FL Miami, Electronic Equip. Co., Inc. 305-871-3500
FL Tampa, Impala Elctrns., Inc. 813-885-4747
GA Norcross, Diplomat Elctrns. 404-449-4133
ID Spirit Lake, Al Elctrns. 208-623-3111
IL Bensenville, Diplomat Elctrns. 312-595-1000
IL Chicago, Bell Inds. 312-982-9210
IL Elk Grove Village, GBL/Goold Elctrns. 312-593-3220
IL Skokie, Marcon Assocs., Inc. 312-675-6450
IN Indianapolis, Graham Elctrns., Inc. 317-634-8202
IN Indianapolis, Meunier Elctrn. Supp., Inc. 317-635-3511
KY Louisville, Peerless Elctrn. Equip. Co., Inc. 502-637-7674
MD Columbia, Diplomat Elctrns. 301-995-1226
MD Timonium, Zebra Elctrns., Inc. 301-252-6576
MA Canton, Impact Sls. Co., Inc. 617-821-1500
MA N. Chelmsford, Pilgrim Elctrns. 617-251-8746
MA Woburn, Diplomat Elctrns. 617-935-6611
MI Grand Rapids, RM Elctrn. Co., Inc. 616-531-9300
MN St. Paul, Ragon Elctrns., Inc. 612-642-2828
MO St. Louis, Olive Elctrns., Inc. 314-246-4500
NJ Audubon, Action Elctrns. 609-858-2450
NJ Denville, Hi-Rel Elctrns. 201-627-3800
NJ Mountainside, Enox 201-654-7600
NJ Nutley, Vantage Elctrns. 201-667-1840
NJ Totowa, Diplomat Elctrns. 201-785-1830
NY Bohemia, Justin Elctrns. Corp. 516-589-4000
NY Buffalo, Summit Distrs. 716-884-3450
NY Dobbs Ferry, Gemini Elctrn. Co. 914-693-6363
NY East Farmingdale, Tri-Start Elctrns., Inc. 516-293-0400
NY Farmingdale, Command Elctrns. Corp. 516-293-1212
NY Farmingdale, Milgray Elctrns., Inc. 516-420-9800
NY Hauppauge, Fairmont Elctrn. Sls. Corp. 516-231-3313
NY Hauppauge, JACO Elctrns. 516-273-5500
NY Liverpool, Diplomat Elctrns. 315-652-5000
NY Melville, Diplomat Elctrns. 516-454-6400
NY New York, Centaur Elctrns. Corp. 212-695-6984
NY Rochester, Masline Elctrns. 716-546-5373
NY Valley Stream, L & S Elctrns., Inc. 516-561-2474
NY West Babylon, Delmar Elctrns., Inc. ... 516-420-1234
OH Cincinnati, Hughes Peters, Inc. 513-351-2000
OH Cleveland, Pruitt Energy Sources, Inc. 216-566-1545
OH Dayton, Micro-Mil, Inc. 513-434-8231
OH Dayton, Stotts Friedman Co. 513-298-5555
PA Montgomeryville, Pyttronic Inds., Inc. .. 215-643-2850
PA Philadelphia, Encore Elctrns., Inc. 215-676-7200
PA Philadelphia, Herbach & Rademan 215-426-1700
PA Philadelphia, Shap Elctrns. 215-969-3300
PA Pittsburgh, Alder-Tronics, Inc. 412-821-5565
PA Willow Grove, Resco Elctrns. 215-659-4575
PA York, Electronic Comps. for Ind., Inc. .. 717-843-8971
TX El Paso, International Elctrns. 915-778-9761
TX Fort Worth, Allied Elctrns. 817-336-5401
TX Fort Worth, TTI 817-831-0441,817-429-1440
TX Stafford, Southwest Elctrns., Inc. 713-491-4900
UT Salt Lake City, Diplomat Elctrns. 801-486-4134
UT Salt Lake City, Standard Supp. Co. 801-486-3371
VA Charlottesville, Virginia Radio Supp. Co., Inc. 804-296-4184
WA Seattle, Pacific Elctrns. 206-575-1050

SANKEN ELEC. CO., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, Japan, Tel: 03-986-6151, Telex: 272-2323; Empl.: 4,300; *Sls. Mgr.:* K. Imaizumi; *Dist. Mgr.:* T. Hara

SANKEN ELEC. U.S.A. CORP., 3848 Carson St., Ste. 105, Torrance, CA 90503, Tel: 213-540-2209, Telex: 181839; Empl.: 5; *Sls. Mgr.:* Mr. Tack Kunimi; *Dist. Mgr.:* Mr. Tack Kunimi

SAN-O INDUSTRIAL CORP., 85 Orville Dr., Bohemia, NY 11716, Tel: 516-567-5556, TWX: 510-228-7701; Empl.: 50; *Sls. Mgr.:* M. Castellano

SANTA BARBARA RESCH. CTR., 75 Coromar Dr., Goleta, CA 93117, Tel: 805-968-3511, Telex: 910-334-1885, TWX: Hacsbar; Empl.: 2025; *Sls. Mgr.:* D.K. Smith

SANTA FE TEXTILES, Barcel Wire & Cable, 3151 W. Adams St., Santa Ana, CA 92704-5863, Tel: 714-751-7733, Telex: 910-595-1959; FSC No.: 31415; Empl.: 20; *Sls. Mgr.:* Mike Ross

SANYO ELEC. INC., 200 Riser Rd., Little Ferry, NJ 07643, Tel: 201-641-2333, Telex: 134-394; Empl.: 500; *Sls. Mgr.:* H. Matsuoka

Local Sales Offices & Reps

CA Compton, Sanyo Elec. Inc. 213-537-5830
IL Bensonville, Sanyo Elec., Inc. 312-595-5600

SANYO SEMICONDUCTOR CORP., 7 Pearl Ct., Allendale, NJ 07401, Tel: 201-825-8080, Telex: 135138 SANYOSEMI ALNJ; Empl.: 16; *Sls. Mgr.:* Koichi Takahashi; *Dist. Mgr.:* Aki Goto

SAPHIKON, 51 Powers St., Milford, NH 03055, Tel: 603-673-5831, Telex: 95-3067; Empl.: 45; *Sls. Mgr.:* K. G. Lonie

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SARONIX, 4010 Transport at San Antonio, Palo Alto, CA 94303, Tel: 415-856-6900, Telex: 348465; FSC No.: 61441; Empl.: 35; *Sls. Mgr.:* Michael N. Blewett; *Dist. Mgr.:* Michael N. Blewett ..... **A•1428-1431**

Local Sales Offices & Reps

CA Culver City, Bestronics, Inc. 213-870-9191
CA Fallbrook, Matronix/Chilcote 619-728-7678
CA Irvine, Bestronics, Inc. 714-261-7233
CA Southern California, Bestronics, Inc. ... 213-704-5616
CA Woodland Hills, Bestronics, Inc. 213-704-5616
CO Denver, Lindberg Co. 303-758-9033
GA Marietta, Rick Burns Assocs. 404-951-1181
IL Elk Grove Vlg., John G. Twist Co. 312-593-0200
IN South Bend, Schillinger Assocs., Inc. .. 219-291-6258
KS Overland Park, EPI, Inc. 314-962-1411
MN Bloomington, John G. Twist Co. 612-835-2120
MN Bloomington, The John G. Twist Co. ... 612-835-2120
MO St. Louis, EPI, Inc. 314-962-1411
NJ Cherry Hill, Trinkle Sls. 609-795-4200
NJ Englewood, Harold Gray Assocs. 201-894-0894
NM Albuquerque, Lindberg Co. 505-881-1006
NC Raleigh, Rick Burns Assocs. 919-876-2224
OH Dayton, J. C. Hofstetter 513-296-1010
OH Medina, J. C. Hofstetter 216-241-4880
TX Austin, Logic 1 Sls. 512-459-1297
TX Houston, Logic 1 Sls. 713-462-0641
TX Richardson, Logic 1 Sls. 214-234-3375
UT Salt Lake City, Lindberg Co. 801-969-2400
WI Brookfield, John G. Twist Co. 414-782-2670
WI Milwaukee, The John G. Twist Co. 414-782-2670

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EXP CA, Palo Alto, SaRonix 415-856-6900

Local Distributors

AZ Tempe, Anthem Elctrns. 602-244-0900
CA Chatsworth, Anthem Elctrns. 213-700-1000
CA Costa Mesa, Deco Elctrns. 714-754-1322
CA Manhattan Beach, Prime Electro Prods. 213-379-3642
CA San Diego, Anthem Elctrns. 619-279-5200
CA San Diego, Deco Elctrns. 619-693-1595
CA San Jose, Anthem Elctrns. 408-946-8000
CA Tustin, Anthem Elctrns. 714-730-8000
CO Englewood, Anthem Elctrns. 303-790-4500
CT North Haven, Coakley, Boyd & Abbett 800-225-8402
FL Lighthouse Point, Sales Engrg. Concepts., Inc. 305-781-4800
IN Indianapolis, MAR Elctrns., Inc. 317-875-4510
MA Andover, R2 Elctrns. 617-475-3777
MA Needham Heights, Coakley, Boyd & Abbett 617-444-5470
NH Plainstow, Coakley, Boyd & Abbett 617-444-5470
OR Lake Oswego, Anthem Elctrns. 503-684-2661
OR Portland, Northwest Mktg. Assocs. 503-620-0441
TX Addison, Active Comp. Technlg. 214-980-1888
TX Austin, Active Comp. Technlg. 512-452-5254
TX Houston, Active Comp. Technlg. 713-496-4000
UT Salt lake City, Anthem Elctrns. 801-973-8555
WA Redmond, Anthem Elctrns. 206-881-0850
Intl France, St. Quentin En Yveline, A S A P ... 604 7878
Intl Germany, Munich, LSI-Electronic Vertriebs 089 310-7272
Intl Switzerland, Duebendorf-Zueric, Compona 01 821-3737

SAVOY ELCTRNS., P.O. Box 5727, Ft. Lauderdale, FL 33310, Tel: 305-563-1333, 800-327-1282, TWX: 510-955-9766; FSC No.: 59-1672492; Empl.: 60; *Sls. Mgr.:* Lorayne Beardsley

Local Sales Offices & Reps

CA San Diego, Qualtronics 619-560-8955
CA Santa Clara, Fisher Assocs. 408-733-7350
IL Barrington, Omni Elctrns. 312-381-9087
MA Sharon, Howard Haffer 617-784-2420

SAWTEK INCORPORATED

SAWTEK INC., P.O. Box 18000, Orlando, FL 32860, Tel: 305-886-8860, Telex: 514083, TWX: 810-862-0835; FSC No.: 58068; Empl.: 140 ..... **A•1432**

Local Sales Offices & Reps

AL Huntsville, L & D, Inc. 205-837-1469
AZ Scottsdale, Faser Tech. Sls. 602-948-4404
CA Los Altos, Cain-White & Co. 415-948-6533
CA Van Nuys, R-L Assocs. 213-782-7826
FL Maitland, D. J. Ellis & Assocs. 305-645-1101
GA Atlanta, L & D 404-455-3483
IL Palatine, R-Tek 991-222-1830
IN Fort Wayne, R-Tek 219-432-8783
KS Overland Park, Barnes-Midwest Sls. .. 913-341-9317
MD Burtonsville, Eastern Instr. Corp. 301-384-8500
MN Chanhassen, Barnes Sls. Assocs. 612-934-2907
NH Amherst, Callahan & Tremblay, Inc. 603-883-9000
NJ East Windsor, Micro-Lambda 609-443-3113
NY Buffalo, Quality Comps. 716-837-5430
NY Great Neck, Phase 4 Technical Rep., Inc. 516-482-1790
NY Manlius, Quality Comps. 315-682-8885
NC Greensboro, L & D 919-292-3201
NC Raleigh, L & D 919-876-5301
TX Richardson, Vector Sls. 214-234-4291

SAXTON WIRE & CABLE

SAXTON WIRE AND CABLE, 215 N. Rte. 303, Congers, NY 10920, Tel: 914-268-6848, 800-431-2774, Telex: 13-1538; FSC No.: 16164; Empl.: 130; *Sls. Mgr.:* Bill Cullen; *Dist. Mgr.:* Steve Shelley ..... **C•1896-1903**

Local Sales Offices & Reps

CA Pico Rivera, Saxton West 213-948-4066, 800-331-WIRE
CO Denver, Tele-Electric Sls., Ltd. 303-969-9239
CT Guilford, Phil Orzell Assocs. 203-453-6488
FL Tampa, Griffin & Assocs. Elctrn. Sls., Inc. 813-887-1945
GA Marietta, Communication Mktg. 404-424-9097
IN Angola, Waid Assocs. 219-833-3523
MA Milford, Jonel Sales Assocs. 617-478-4650
MN Burnsville, Strong & Assocs. 612-890-3168
MN Maple Grove, R. C. Sls. 612-425-5543
MO Kansas City, Ron Forristal 816-358-6771
NY Mohegan Lake, Travano & De Palma Assocs. 914-245-5269, 914-968-1084
NC Oxford, Winston Elctrn. Sls. Assocs. ... 919-693-1561
OH Cleveland, Hank Miller Sls. Assocs. ... 216-329-3900
PA Collegeville, Steve Linton 215-489-9473
TN Knoxville, John Dickens 615-947-8068
TX Corwley, David Tuggle 817-294-0850
VA Arlington, Howard Golen Paul & Assocs. 703-525-5898

Local Distributors

CA Downey, David Levy Co. 213-869-2539
CA Montebello, Atlas Wire & Cable 213-723-2401
CT Manchester, Inventory Mgt. Svs. 203-649-4415
CT Meriden, New England Insulated Wire 203-204-8927
GA Atlanta, Atlanta Cable Sls. 404-448-6311
MS Hattiesburg, Wright Elctrn. 601-545-2545
NY Brooklyn, Ceco Comm. 212-646-1617
NC Greenville, Pair Elctrns. 919-756-8007
PA Broomwall, Omni Cable 215-544-7766
SC Columbia, Hesco 803-254-4575
VA Arlington, Arlington Elctrn. 703-524-2412
VA Leesburg, Elctrn. Wire & Cable 703-777-3551

SAYLOR ELECTRONICS INT'L, INC., 1824 Calash Dr., Carson City, NV 89701, Tel: 702-883-4184; Empl.: 4

SCANBE DIV., 3445 Fletcher Ave., El Monte, CA 91731, Tel: 213-579-2300, TWX: 910-587-3437; Empl.: 125

SCANNING DEVICES, 108 Elm St., Waltham, MA 02154, Tel: 617-891-8991; Empl.: 25; *Sls. Mgr.:* Louis Goldenberg

SCHAEVITZ ENGRG., U.S. 130, Union Ave., Pennsauken, NJ 08110, Tel: 609-662-8000, TWX: 710-892-0714; FSC No.: 93190; Empl.: 325; *Sls. Mgr.:* F. R. Pisaro

SCHAFFNER EMC, INC., 825 Lehigh Ave., Union, NJ 07083, Tel: 201-851-0644, Telex: 685-3444; FSC No.: 201-467-1330; *Sls. Mgr.:* Thomas Pate; *Dist. Mgr.:* Tom Morrone

Local Sales Offices & Reps

CA Buena Park, RPS Elctrns., Inc. 213-744-8400
CA Costa Mesa, Berman Gravley Co., Inc. 714-549-2122
CA Palo Alto, Mollard Mktg. 415-961-0456
CA San Jose, Cypress Elctrns. 408-945-8400
IL Arlington Heights, ZMS Elctrn. Sls., Inc. 312-394-4422
KS Overland Park, Guernsey/Web Assocs. 913-381-2225
MA Burlington, Kitchen & Kutchin Inc. 617-229-2660
MA Hopkington, Interface Elctrns., Inc. 617-435-6858
NJ Marlton, BGR Assocs. 609-983-1020
NJ Palmyra, Marlac Elctrns., Inc. 609-786-1991
NY Commack, JL Sls. Assocs. 516-462-5666
NY Rochester, H.C. Johnson Agy., Inc. 716-586-0777
NC Raleigh, Tingen Tech. Sls., Inc. 919-781-1100
TX Arlington, Comptech Sls., Inc. 817-265-6007
WI Brookfield, ZMS Elctrn. Sls. 414-782-2222

Local Distributors

CA Buena Park, RPS Elctrns., Inc. 213-744-0355
CA San Jose, Cypress Elctrns. 408-945-8400
MA Hopkington, Interface Elctrns., Inc. 617-435-6858

SCHAFFNER EMC, INC., Instr. Div., 825 Lehigh Avenue, Union, NJ 07083, Tel: 201-851-0644, Telex: 685-3444

Local Sales Offices & Reps

CA Fullerton, GRU Assocs. 714-738-0903
CO Boulder, Herb Bass Assocs. 303-530-7509
IL Elk Grove Village, Loren F. Green Assocs./Cen. 312-593-0282
IN Indianapolis, Loren F. Green Assocs. of Indiana 317-293-9827
MI Northville, Micro Sls. Corp. 315-459-1670
MN Minneapolis, Loren F. Green Assocs. of Minn. 612-571-6666
OH Centerville, Micro Sls. Corp. 513-433-8171
OH N. Olmstead, Micro Sls. Corp. 216-734-3080
OR Portland, Harry Levinson Co. 503-245-1902
WA Seattle, Harry Levinson Co. 206-382-1300

Local Distributors

AL Huntsville, Scientific Dvcs. SE 205-536-1969
CA San Jose, D. P. Assocs. 408-296-1492
CT Higganum, Intersell 203-528-5357
FL Orlando, Scientific Dvcs. SE 305-841-8180
MA Burlington, Intersell 617-273-3844
NJ Woodcliff Lake, Eastern Instrmn. 201-664-0907
NC Winston-Salem, Scientific Dvcs. SE, Inc. 919-765-5776
PA Melrose Park, Robert Meyers Assocs. 215-224-1663
WA Seattle, Harry Levinson Co. 206-382-1300

SCHAUER MFG., 4500 Alpine Ave., Cincinnati, OH 45242, Tel: 513-791-3030, Telex: 21-4576; Empl.: 195; *Sls. Mgr.:* A. A. Groenewold; *Dist. Mgr.:* Dan Shaw

SCHLAGE ELECTRONICS, 3260 Scott Blvd., Santa Clara, CA 95051, Tel: 408-727-5170, Telex: 171122; Empl.: 150; *Sls. Mgr.:* Steve Burt

SCHNEIDER INSTR., 8115 Camargo Rd., Cincinnati, OH 45243, Tel: 513-561-6803; Empl.: 23; *Sls. Mgr.:* C. A. Schneider, Pres.

SCHONSTEDT INSTR. CO., 1775 Wiehle Ave., Reston, VA 22090, Tel: 703-471-1050, TWX: 710-833-9880; Empl.: 45

SCHOTT CORP., 1000 Parkers Lk. Rd., Wayzata, MN 55391, Tel: 612-475-1173, TWX: 910-576-2964; FSC No.: 80023; Empl.: 325; *Sls. Mgr.:* A. Schmitt

Local Sales Offices & Reps

IL Des Plaines, Electro-Comp. Sls. 312-577-3788
MA Needham, Hatch Assocs. 617-444-3310

SCHOTT ELCTRNS., Hershey Dr., Ansonia, CT 06401, Tel: 203-736-2677, Telex: 170 451 8911; Empl.: 240; *Sls. Mgr.:* Don Davis

SCHOTT GLASS TECHNOLOGIES, INC., 400 York Ave., Duryea, PA 18642, Tel: 717-457-7485, TWX: 510-671-4535; FSC No.: 23-169-1403; Empl.: 600; *Sls. Mgr.:* D. Dougherty

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Local Sales Offices & Reps

AL Athens, Effective Mktg. Force 205-233-2947
CA Livemore, O'Rielly Elctrn. Sls. 415-443-5343
CA Panorama City, Viking Sls. 818-788-5501
CO Boulder, Stratford Grp. 303-530-3194
CT Manchester, Vin-Tech 203-646-3007
FL Tampa, J-R Controls, Inc. 813-961-9478
GA Atlanta, Effective Mktg. Force 404-948-6023
IL Barrington, Richard Fisk Mktg. 312-381-0653
IN Indianapolis, C.C. Elctrns. 317-255-1508
KS Shawnee Mission, Microtronics (K&M) 913-262-1444
MA Framingham, Bengal Assocs. 617-877-2639
MA Randolph, Bengal Assocs. 617-961-4120
MI Pontiac, C.C. Elctrns., Inc. 313-338-7400
MN Roseville, TLC Controls 612-483-2226
NJ Paramus, Jarms Elctrn. 201-265-2032
NY Melville, Jarms Elctrn. 516-752-0404
OH Gallion, C.C. Elctrns., Inc. 419-468-3253
TX Irving, Kite Elctrns. Sls. Co., Inc. 214-438-9336
OR Portland, Pacific Elec. Sls. 503-235-3456
NY Syracuse, PI1 Tronics 315-455-7346

Local Distributors

AK Anchorage, Electronics Supp. Ctr. 907-274-0603
AZ Phoenix, Capitol Elctrns. 602-252-5897
CA Santa Monica, Distributor Specialist 213-393-9666
CA Santa Monica, Master Distrs. 213-452-1229
CA Tustin, Caltronics Sls. 714-730-0350
CA Van Nuys, Hurley Elctrns. 818-781-8410
CT Danbury, Green Elec. 203-748-5644
CT New Haven, Hatry Elctrns. 203-755-1181
CT Norwalk, Delta Elctrns. 203-847-7285
CT Norwalk, Park Distr. 203-853-2010
FL Lakeland, AA Elec. 813-665-6941
FL Lakeland, Switch Controls 813-644-7564
FL Miami, B & R Elctrns. 305-255-4510
FL Oakland Park, Zelgon, Inc. 305-565-2555
FL Orlando, Sun Elctrns. 305-841-4650
FL Tampa, Leader Elctrns. 813-870-3315
FL W. Palm Beach, Dolphin Elec. 305-659-7166
HI Honolulu, Industrial Elctrns. 808-533-6095
IL Arlington Hgts., Lodan Elctrns. 800-323-5207
IN Bloomington, Hoosier Elctrns. 812-332-9435
IN Bloomington, Stansifer Radio 812-336-6339
IN Indianapolis, Mar Elctrns. 317-875-4510
IA Cedar Rapids, Iowa Radio Supp. 319-393-4510
KS Salina, Electronics, Inc. 913-827-7377
KY Mayfield, Pickens Supp. 502-247-6041
MD Beltsville, PSI 301-937-4960
MD Gaithersburg, Axis Elctrns. 301-840-9640
MD Salisbury, Artcraft 301-749-6151
MA Norwood, Emtel Elctrns. 617-769-9500
MA Pittsfield, Cash & Carry Elec. Supp. 413-499-9500
MA Waltham, Standard Elec. Supp. 617-890-1050
MA Wilmington, Aved Elctrns. 617-245-7406
MA Woburn, Abbott Elctrns. 617-935-2040
MI Flint, Advance Whsle. Distr. 313-238-5611
MI Troy, Empire Elctrns. 313-585-8130
MN New Brighton, Chris Elctrns. 612-631-2647
NE Lincoln, Scott Elctrns. 402-466-8221
NJ Brick, Electronic Entprs. 212-442-1046
NJ E. Rutherford, AA Elec. 800-228-0131
NJ Fair Lawn, Relay Specialties 201-797-3313
NJ Plainfield, Propac 201-755-4940
NY Bohemia, Omntec Mfg., Inc. 516-567-8685
NY Buffalo, Summit Elctrns. 716-334-8110
NY Commack, Choice Comps. 516-543-6060
NY Elmsford, Ancar Elec. 914-592-7100
NY Mt. Vernon, Janesway Elctrns. 914-699-6710
NY Nanuet, Andrea Elec. 914-623-3447
NY New Rochelle, Derf Elctrns. 914-235-4600
NY Port Washington, Bradtronics 201-641-6118
NY Rochester, Masline Elctrns. 716-546-5373
NY Rome, Rome Security 315-336-0148
NY Sodus, AED 315-483-6561
NY Stony Brook, Bomark Elctrns. 516-689-8999
NY W. Babylon, Septronics 516-643-4990
NY Wheatfield, EEC 716-693-3970
NY White Plains, Benfield Pro Shop 914-948-6650
NY Yonkers, Kintronics 914-968-7736
NC Knightdale, Systems Elctrns. 919-266-9908
NC Pineville, Control Design Supps. 702-588-4410
OH Columbus, Thompson Elec. 614-228-6191
OH Dayton, Carver Supp. 513-461-9673
OH Dayton, Industrial Sls. & Svc. 513-439-4131
OH Zanesville, Thompson Radio Supp. 614-452-8473
OR Clackamus, Amfac Elec. 503-657-3020
OR Medford, Medford Elec. Whlsr. 503-773-6656
OR Ontario, Interstate Elctrn. Corp. 503-889-9679
OR Pendleton, Round Up Elctrns. 503-276-3152
OR Portland, O-Four Controls 503-231-8058
PA Bloomsburg, E. R. Beers 717-784-1600
PA Philadelphia, Jan Indl. 215-922-1321
PA Redding, R.A.M. Motor Control 215-376-7102
TX Brownsville, Carden Inds. 512-541-3660
TX Dallas, Rawlinson Elec. Supp. 214-741-1721
TX Ft. Worth, Industrial Equip. 817-831-6151
TX Garland, Industrial Equip. 214-271-5494
TX Houston, Commercial Equip. 713-237-8682
TX Houston, Ralph's Elctrns. 713-748-4902
TX Hurst, Industrial Equip. 817-595-1814
UT Provo, Central Utah Elctrns. 801-373-7522
UT Provo, Omega Elctrns. 801-375-4664
UT Salt Lake City, Ballard Supp. 801-972-2430
VA Norfolk, Radio Parts Distr. Co. 804-461-8095
WA Port Angeles, Alphase Elec. 206-452-9705
WA Spokane, Consolidated Elctrl. Distr. 509-535-8891
WA Tacoma, Amfac Elec. 206-383-4303

Schroff®

19" Systems for Electronics Packaging

SCHROFF INC., 170 Commerce Dr., Warwick, RI 02886, Tel: 401-732-3770, Telex: 952175; *Sls. Mgr.:* Thomas Kennedy ..... **C•1080**

Local Sales Offices & Reps

AZ Scottsdale, Luscombe Engr. 602-949-9333
CA Campbell, Luscombe Engr. 408-370-2020
CA Pasadena, Luscombe Engr. 213-684-2000
CA San Diego, Luscombe Engr. 619-295-4300
FL Pompano Beach, EMA 305-943-3732
FL Winter Park, EMA 305-671-6800
GA Atlanta, CRS Elctrns. 404-396-3720
IL Berkeley, Cadre Tech. Rep. 312-449-3900
MI Troy, C. B. Jensen 313-643-0506
MN Minneapolis, D. A. Case Assoc. 612-869-3700
MO Brigeton, DY-Tronix 314-291-4777
NH Salem, Sales Engr. 603-893-5521
NJ Englewood, Sprung-Nussbaum 201-569-5666
NY Central Sqare, Bastian Sls. 315-437-1482
NY Fairport, Bastian Sls. 716-223-0237
NY Port Crane, Bastian Sls. Agency Inc. 607-722-3421
OH Aurora, EMA 216-562-6104
OH Centerville, EMA 513-433-2800
PA Huntington Valley, Omega Elctrn. Sls. 215-947-4135
TX Austin, CMZ 512-255-1663
TX Garland, CMZ 214-681-1414
TX Houston, CMZ 713-771-1500

SCHROFF UK LTD., Maylands Ave., Hemel Hempstead, Herts, England HP2 4SG, Tel: 0442-40471/6, Telex: 825658; *Sls. Mgr.:* Mr. B-U Kaupisch

SCHULZ CONTROLS, INC., P.O. Box 9555, New Haven, CT 06511, Tel: 203-562-2555; Empl.: 35; *Sls. Mgr.:* Paula Calabrese; *Dist. Mgr.:* Paula Calabrese

SCHURTER, INC., 1016 Clegg Ct., Petaluma, CA 94952, Tel: 707-778-6311, Telex: 176-084; FSC No.: 61935; *Sls. Mgr.:* Bruno H. Schurter

Local Sales Offices & Reps

CA Fullerton, Gru Assocs. 714-738-0903
CA San Jose, Ruppert Sls. & Engrg. 408-998-8717
CO Lakewood, Cristee-Meade Co. 303-232-0287
FL Ft. Lauderdale, IMR, Inc. 305-741-2449
GA Lithia Springs, Effective Mktg. Force 404-948-6023
IL Arlington Hgts., MJ Petersen & Assoc., Ltd. 312-577-8200
IN Noblesville, W. G. Brouillette & Assocs., Inc. 317-845-8157
MN Minnetonka, Frank Anthony Mktg. 612-934-0773
MS Jackson, Doby Assocs. 601-981-1138
NH Nashua, Bell Controls 603-882-6984
NJ Ho-Ho-Kus, D. J. Fisher Co. 201-652-0090
NJ Medford, Champion Elctrn. Sls. Co. 609-983-0932
NY Fairport, TAC Sls, Inc. 716-425-1070
OH Beachwood, Electronic Salesmasters 216-831-9555
OR Portland, Dussault & Associates Inc. 503-641-8780
TX Austin, OM Assocs., Inc. 512-452-1838
TX Dallas, OM Assocs., Inc. 214-241-3876
TX Houston, OM Assocs., Inc. 713-789-4426
WA Seattle, Dussault & Associates Inc. 206-527-5454

Local Distributors

CA Fremont, Fusecom, Inc. 415-657-FUSE
CA San Jose, Dansco Comp. Sls., Inc. 408-288-9740
CA San Jose, Quail Elctrns. 408-995-0812
IL Elk Grove Village, Nu-Way Elctrn. Distrbs. Inc. 312-437-7120
MD Rockville, FIC Corp. 800-638-6594
OH Strongsville, Fuse World 216-238-1330
TX Dallas, Fuses, Inc. 214-341-6407
WA Redmond, Fusecom, Inc. 206-881-2442
Can Markham, Ont., Lenbrook Elctrns. 416-777-7722

SCHWEITZER, DIV., Kimberly Clark Corp., Lee, MA 01238, Tel: 413-243-1000, TWX: 413-243-2121; Empl.: 750

SCIENCE ACCESSORIES CORP., 970 Kings Hwy. W., Southport, CT 06490, Tel: 203-255-1526, Telex: 964300 SAC SPRT; *Sls. Mgr.:* H. A. Cleveland

SCIENCE/ELCTRNS., 1224-26 McCook Ave., Dayton, OH 45404, Tel: 513-228-6011, Telex: 288-004; Empl.: 25; *Sls. Mgr.:* E. E. Pohl; *Dist. Mgr.:* J. Tanksley

SCIENTECH, INC., 5649 Arapahoe Ave., Boulder, CO 80303, Tel: 303-444-1361, 800-525-0522, TWX: 910-940-0994; Empl.: 57

SCIENTIFIC-ATLANTA, INC., P.O. Box 105600, Atlanta, GA 30348, Tel: 404-441-4000, Telex: 0542898, TWX: 810-766-4912

SPECTRAL DYNAMICS, Scientific-Atlanta, Inc., 4255 Ruffin Rd., San Diego, CA 92123-0575, Tel: 619-268-7100, TWX: 910-335-2022; Empl.: 370; *Sls. Mgr.:* Ram Waney

SCIENTIFIC-ATLANTA, INC., See Optima Enclosures

SCIENTIFIC COLUMBUS, INC., Esterline Corp., 1900 Arlingate La., Columbus, OH 43228, Tel: 614-274-7160, Telex: 245-426; Empl.: 210; *Sls. Mgr.:* Don Yore; *Dist. Mgr.:* Don Yore

SCIENTIFIC COMMUNICATIONS, INC., 3425 Kingsley Rd., Garland, TX 75041, Tel: 214-271-3685, TWX: 910-860-5172; *Sls. Mgr.:* Donald G. Luiken

SCIENTIFIC RADIATION CORP., 1201 San Antonio Rd., Mountain View, CA 94043, Tel: 415-965-0910, Telex: 345506; *Dist. Mgr.:* James A. Lazzara

SCIENTIFIC RESEARCH CORP., See TRAK Microwave Corp.

SCIENTIFIC TECHNLG., 1201 San Antonio Rd., Mountain View, CA 94043, Tel: CA 415-965-0910, 800-221-7060, Telex: 34-5506; Empl.: 50

SCITEQ ELECTRONICS, INC., 7380 Clairemont Mesa Blvd., San Diego, CA 92111, Tel: 619-292-0500, Telex: 882008; *Sls. Mgr.:* Henry Eisenson; *Dist. Mgr.:* David Norman

SCOPE, INC., 1860 Michael Faraday Dr., Reston, VA 22090, Tel: 703-471-5600, TWX: 710-883-1178; Empl.; 225; *Sls. Mgr.:* David Bess

SCOTT AVIATION, Figgie International Inc., 123 East Montecito Ave., Sierra Madre, CA 91024, Tel: 213-355-4281

SCREEN DATA CORP., 80 S. Jefferson Rd., Whippany, NJ 07981, Tel: 201-887-7713, 800-248-1212, Telex: 710-387-209; *Sls. Mgr.:* Michael A. Kling

SCREENPRINT/DOW, 271 Ballardvale St., Wilmington, MA 01887, Tel: 617-935-6395, Telex: 948227; *Sls. Mgr.:* W. F. Donovan Jr.

SEABOARD ELCTRNS., 70 Church St., New Rochelle, NY 10805, Tel: 914-235-8073, Telex: 646289; Empl.: 78; *Sls. Mgr.:* Dr. Richard Ader; *Dist. Mgr.:* Dr. R. Ader

SEACOR, INC., 123 Woodland Ave, Westwood, NJ 07675, Tel: 201-666-5600, Telex: 135-354; Empl.: 45

SEA DATA CORP., One Bridge St., Newton, MA 02158, Tel: 617-244-3216, Telex: 951107; Empl.: 40; *Sls. Mgr.:* W. Hill

SEALECTRO, 225 Hoyt St., Mamaroneck, NY 10543, Tel: 914-698-5600; Empl.: 1600; *Sls. Mgr.:* T. Lynn; *Dist. Mgr.:* N. Buonanno

SEALTRON, INC., 9705 Reading Road, Cincinnati, OH 45215, Tel: 513-733-8400, Telex: 21-4609; Empl.: 120; *Sls. Mgr.:* James Dawson

SEASTROM MFG. CO., INC., 701 Sonora Ave., Glendale, CA 91201, Tel: 213-245-9121, TWX: 910-497-2271; FSC No.: 86928; Empl.: 75

SEATTLE COMPUTER PRODUCTS, INC., 1114 Ind. Dr., Seattle, WA 98188, Tel: 206-575-1830, 800-426-8936; *Sls. Mgr.:* Max Gerdts

SECTOR MOTOR IND. INC., 999 Grand Blvd., Deer Park, NY 11729, Tel: 516-242-2300, TWX: 510-227-6075; *Sls. Mgr.:* Victor Nelson

secoinsa
digi-power

SECOINSA/DIGI POWER, 686 E. Gish Rd., San Jose, CA 95112, Tel: 408-288-5600, Telex: 910-338-0579; Empl.: 90; *Sls. Mgr.:* Ron Murphy; *Dist. Mgr.:* Ron Murphy ..... **D•1830-1832**

Local Sales Offices & Reps

CA Inglewood, Basic Sys. Corp. 213-673-4300
KS Shawnee Mission, Panatek Tech. Sls. 913-362-3349
MD Rockville, J-4 Computer Sys. 301-424-0700
MN Spring Lake Park, Holmgren Assocs. .. 612-786-7641
NJ Boonton, Winter Assocs. 201-334-3434
OK Tulsa, Genzal Sls. & Assocs. 918-622-7744
OR Portland, Power Sources Unlimited, Office 2 503-292-0918
TX Fort Worth, El Tech Sls., Inc. 817-268-2896
VA Front Royal, Eltron Sls., Ltd. 703-635-7201
WA Lynwood, Power Sources Unlimited, Ofice 1 206-743-6641

SECURITY PLASTICS, INC., 14427 N.W. 60th Ave., Miami Lakes, FL 33014, Tel: 305-823-5440, Telex: 803303; Empl.: 400; *Sls. Mgr.:* J. Licht

SEEQ TECHNLG., 1849 Fortune Dr., San Jose, CA 95131, Tel: 408-942-1990, TWX: 9103382313; Empl.: 650; *Sls. Mgr.:* J. Daniel McCranie; *Dist. Mgr.:* J. Daniel McCranie

SEIKO INSTRUMENTS

SEIKO INSTRS. U.S.A., INC., 2990 W. Lomita Blvd., Torrance, CA 90505, Tel: 213-530-8777, TWX: 910-347-7307; *Sls. Mgr.:* John Hawkins, Lee Guio; *Dist. Mgr.:* Lee Guio, John Hawkins ..... **A•1433; B•1092; D•1071**

Local Sales Offices & Reps

AL Huntsville, Electro-Mech 205-533-2100
AZ Scottsdale, Fred Board Assocs. 602-994-9388
AZ Tucson, Fred Board Assocs. 602-299-1508
CA Los Alamitos, Santana Sls. 714-827-9100
CA San Diego, CK Assocs. 619-279-0420
CA San Jose, Exis, Inc. 408-287-6680
CO Golden, Candal, Inc. 303-233-0155
FL Plantation, Gallagher & Assocs. 305-473-2101
GA Norcross, Electro-Mech 404-447-6478
IL Elk Grove Village, The John G. Twist Co., Inc. 312-593-0200
IN Greenwood, Valentine & Assocs. 317-888-2260
IN South Bend, Valentine & Assocs. 219-288-7070
IA Cedar Rapids, Tech. Elctrns. 319-366-5443
KS Overland Park, Kebco 913-541-8431
KS Wichita, Kebco 316-733-1301
MD Annapolis, Vince Iorio Assocs. 301-465-8150
MA Brockton, Forsberg Sls. 617-522-6300
MI Grosse Pointe Pk., Greiner Assoc. 313-499-0188
MN Bloomington, Quantum Sls. 612-884-4700
MO Maryland Hgts., Kebco 314-576-4111
NJ Manville, DynoRep, Inc. 201-685-0135
NJ Mt. Laurel, Comtek, Inc. 609-235-8505
NM Albuquerque, Fred Board Assocs. 505-293-1399
NY Kingston, R. P. Kennedy Co. 914-876-2700
NY Rochester, R. P. Kennedy Co. 716-271-1910
NY Rochester, R. P. Kennedy Co. 716-271-6322
NC Raleigh, Electo-Mech 919-851-8165
OH Wadsworth, Imtech 216-239-2202
OR Tigard, Components West 503-684-1671
TN Jonesboro, Electro-Mech 615-753-2964
TX Austin, TL Mktg. 512-453-4586
TX Dallas, TL Mktg. 214-357-1752
UT Salt Lake City, Aspen Sls., Inc. 801-467-2401
WA Liberty Lake, Components West 509-255-6224
WA Redmond, Components West 206-885-5880
WI Brookfield, John G. Twist Co., Inc. 414-782-2670
Can Pointe Claire, Que., Tech-Trek, Ltd. ... 514-697-3385
Can Rexdale, Ont., Tech-Trek, Ltd. 416-674-1717
Can Richmond, B.C., Tech-Trek, Ltd. 604-271-3149

Local Distributors

AL Huntsville, Contact Elctrns. 205-881-9321
AZ Phoenix, Sterling Elctrns. 602-268-2121
CA San Jose, Eric Elctrns. 408-262-1111
CA Santa Ana, Pacesetter Elctrns. USA ... 714-777-4711
CA Sunnyvale, Pacesetter Elctrns. USA ... 408-734-5470
CA Tustin, Added Value Elctrns. 714-730-5848
CO Denver, Diplomat Elctrns. 303-422-9229
CO Englewood, Sterling Elctrns. 303-796-7338
CT Wallingford, Sterling Elctrns. 203-265-9535
IL Elmhurst, Semi-Conductor Specialists 312-279-1000
IL Northbrook, Classic Comps. 312-272-9650
IN Indianapolis, Classic Comps. 317-872-4777
KS Overland Park, Sterling Elctrns. 913-236-5589
LA Metairie, Sterling Elctrns. 504-887-7610
MD Middletown, Current Comps. 301-473-5333
MA Norwood, Emtel 617-769-9500
MA Waltham, Sterling Elctrns. 617-894-6200
MN Bloomington, Semi-Conductor Specialities 612-854-8841
NJ Perth Amboy, Sterling Elctrns. 201-442-8000
NM Albuquerque, Sterling Elctrns. 505-884-1905
OH Cincinnati, Schuster 513-489-1400
OH Cleveland, Schuster 216-425-8134
OK Tulsa, Sterling Elctrns. 918-663-2410
OR Lake Oswego, Moore Elctrns. 503-684-3100
PA Allentown, Lehigh Elctrns. Comps. 215-433-3045
TX Austin, Sterling Elctrns. 512-836-1341
TX Dallas, Sterling Elctrns. 214-243-1600
TX Houston, Sterling Elctrns. 713-627-9800
UT Salt Lake City, Diplomat Elctrns. 801-487-8131
VA Richmond, Sterling Elctrns. 804-226-2190
VA Sterling, Sterling Elctrns. 703-450-2373
WA Bellevue, Moore Elctrns., Inc. 206-644-0101
WI New Berlin, Classic Comps. 414-986-5300
Can Downsview, Westburne Indl. Entprs. .. 416-635-2950
Can Markman, Semad Div. DEW Elctrns. .. 416-475-8500
Can Montreal, Semad Div. DEW Elctrns. ... 514-636-4614
Can Ottawa, Semad Div. DEW Elctrns. 613-729-6145
Can Vancouver, Semad Div. DEW Elctrns. 604-438-2515

SEIKO INSTRUMENTS U.S.A., INC., Robotics/Automation Div., 2990 W. Lomita Blvd., Torrance, CA 90505, Tel: 213-530-8777; *Sls. Mgr.:* John Dudley

SEKAI ELCTRNS. OF AMER., INC., 14700 E. Firestone Blvd., Suite 122, La Mirada, CA 90638, Tel: 714-670-1854, Telex: 685521; FSC No.: 8V398; Empl.: 4; *Sls. Mgr.:* Larry Klementowski

SELCO PRODUCTS CO., SEL Sales, Inc., 7580 Stage Rd., Buena Park, CA 90621, Tel: 714-521-8673, Telex: 65-5457; Empl.: 18; *Sls. Mgr.:* Bill Wilkinson; *Dist. Mgr.:* Ray McDowell

SELEC-KEY, Microdot, 302 Roma Jean Pkwy., Streamwood, IL 60103, Tel: 312-837-7970; *Sls. Mgr.:* Charles Stelzner

SEL-REX DIV., OMI Intl. Corp., 75 River Rd., Nutley, NJ 07110, Tel: 201-667-5200, Telex: 133-320, TWX: 710-989-1423; Empl.: 250; *Sls. Mgr.:* Larry Price

SEMCO, Rte. 6, No. Windham, CT 06226, Tel: 203-423-6316; *Sls. Mgr.:* Alan Giordano

SEMICOA, 333 McCormick Ave., Costa Mesa, CA 92626, Tel: 714-979-1900, Telex: 678-315, TWX: 910-595-1961; FSC No.: 34156; Empl.: 65; *Sls. Mgr.:* Mark Ellsberry

SEMICON, 10 North Ave., Burlington, MA 01803, Tel: 617-272-9015, TWX: 710-332-1919; Empl.: 550; *Sls. Mgr.:* Tom Le Blanc; *Dist. Mgr.:* L. Le Bow

SEMICONDUCTOR CIRCUITS, 49 Range Rd., Windham, NH 03087, Tel: 603-893-2330, TWX: 710-366-0505; Empl.: 300; *Sls. Mgr.:* J. Muckenhoupt; *Dist. Mgr.:* Marc Gauthier

SPM
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SEMICONDUCTOR PACKAGING MATLS. CO. INC., 431 Fayette Ave., Mamaroneck, NY 10543, Tel: 914-698-5353, TWX: 710-566-1103 ..... **C•1097**

Local Sales Offices & Reps

AZ Tempe, Spectrum Assoc., S.W. 602-966-1788
CA Anaheim, California Tech Svcs. 714-630-8470
CA Santa Clara, California Tech. Svcs. 408-496-1155
CA Tarzana, California Tech. Svcs. 213-343-3131
CT Southington, Libby Assocs. 203-747-5601
IL Northfield, Imex, Ltd. 312-446-8934
PA Franconia, Scharas Assocs. 215-368-2017
WA Bellevue, Mars 206-747-3292

SEMICONDUCTOR TECHNLG., INC., 3131 S.E. Jay St., Stuart, FL 33497, Tel: 305-283-4500, TWX: 510-953-7511; Empl.: 45

SEMIKRON, INC., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051, Tel: 603-883-8102, 1-800-258-1308, Telex: 6711011; FSC No.: 58687; Empl.: 45; *Sls. Mgr.:* Frank Haase; *Dist. Mgr.:* Bruce Sessler

Local Sales Offices & Reps

AL Huntsville, R. W. Mitscher 205-882-6050
AZ Phoenix, Trembly Assocs. 602-967-2058
CA Downey, Trimarco 213-861-8244
CA Redwood City, Ault Assocs. 415-367-1710
CO Denver, Trembly Assocs. 303-233-9544
FL Oldsmar, Boggs & Assocs. 813-855-1812
GA Atlanta, R. W. Mitscher 404-923-3239
IL Chicago, Ropek, Cahill & Vogt 312-631-0070
KS Kansas City, Harris-Hanson Co. 816-763-6200
MI Detroit, Favco 313-644-0173
MN Eden Prairie, Bohlig & Assocs. 612-944-8404
MO St. Louis, Harris-Hanson Co. 314-432-3611
NV Las Vegas, Trembly Assocs. 702-369-8700
NH Amherst, Eva-Tec Mktg. 603-673-4830
NM Albuquerque, Trembly Assocs. 505-266-8616
NY Albany, Lynn Assocs. 518-459-1239
NY Buffalo, Lynn Assocs. 716-631-0054
NC Raleigh, R. W. Mitscher 919-848-0941
OH Hamilton, B & J Entprs. 513-863-1353
OR Portland, Doran Sls. Assocs. 503-357-3333
PA Pittsburgh, Lynn Assocs. 412-468-8811
TX Richardson, Barry Sls. 214-234-0255
UT Salt Lake City, Trembly Assocs. 801-486-5292
WA Seattle, Doran Sls. Assocs. 206-885-1885

Local Distributors

FL Hollywood, MRO Elctrn. Distrs. 305-966-4847
GA Atlanta, Cleveland Elec. Co. 404-696-4550
MI Detroit, Osborne Transformer Co. 313-368-4136
MN New Brighton, Chris Elctrns. Distrs. 612-631-2647
NJ Roselle, Lectron Inds. 201-245-5858
NC Gastonia, JMT Elctrns. & Controls 704-867-4401
TX Dallas, Wilkinson Bros. Co., Inc. 214-941-9963
TX Houston, Industrial Drives Mtce. 713-681-6942
WA Seattle, Pacific Elctrns. 206-575-1050
WA Seattle, Radar Elec. Co., Inc. 206-282-2511

SEMTECH, 652 Mitchell Rd., Newbury Park, CA 91320, Tel: 213-628-5392, TWX: 910-336-1264; FSC No.: 14099;Multiple; Empl.: 350; *Sls. Mgr.:* John Mitchell; *Dist. Mgr.:* Will Fiske

SEMTRONICS CORP., 310 Hwy 7 74 S, P.O. Box 2248, Peachtree City, GA 30269, Tel: 404-487-6681, Telex: 8107662244; Empl.: 20; *Sls. Mgr.:* Larry Fowler

SENCORE, 3200 Sencore Dr., Sioux Falls, SD 57107, Tel: 605-339-0100, TWX: 910-660-0300; Empl.: 250 ..... **D•1399**

SENSITEK CORPORATION, See Biddle Instruments

Sensitive Research

SENSITIVE RESEARCH INSTRS., 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717; FSC No.: 32590;16034A; Empl.: 35 ..... **D•1304-1306**

Local Sales Offices & Reps

AZ Scottsdale, Williams Assocs. 602-947-4297
CO Commerce City, Williams Assocs. 303-289-5647
DC Washington, Whitcomb Assocs. 202-737-0763
IL Lincolnwood, Saffro & Assocs. 312-677-9720
KS Shawnee Mission, Comtel - Midwest .. 913-722-1030
MD Baltimore, Whitcomb Assocs. 301-889-1245
MA Lexington, Zieco 617-861-8300
MI Southfield, Comtel Instrs. Co. 313-358-2505
MN Minneapolis, Hei-Lite Sls. 612-861-6051
MO St. Louis, Comtel - Midwest 314-991-5363
NM Albuquerque, Williams Assocs. 505-255-1638
NY Mount Vernon, Elctrl. Instr. Svc. 914-699-9717
OH Cleveland, Comtel Instrs. Co. 216-442-8080
OH Dayton, Comtel Instrs. Co. 513-298-7573

OH Hilliard, Comtel Instrs. Co. 614-876-8305
OK Tulsa, Data Mktg. Assocs. 918-438-4911
PA Pittsburgh, Comtel Instrs. Co. 412-922-5720
TX Austin, Data Mktg. Assocs. 512-451-5174
TX Dallas, Data Mktg. Assocs. 214-661-0300
TX Houston, Data Mktg. Assocs. 713-780-2511
TX San Antonio, Data Mktg. Assocs. 512-342-3031
UT Salt Lake City, Williams Assocs. 801-532-7701
WI Lake Mills, Saffro & Assocs. 414-648-2605

SENSOR CORP., Box 140, Scottdale, PA 15683, Tel: 412-887-4080; Empl.: 6

SENSOR ELECTRONICS, INC., 105 Fairway Terrace, Mt. Laurel, NJ 08054, Tel: 609-778-0850; Empl.: 7; *Sls. Mgr.:* J. M. Langberg; *Dist. Mgr.:* J. M. Langberg

SENSOR SCIENTIFIC, INC., 1275 Bloomfield Ave., Fairfield, NJ 07006, Tel: 201-227-7790; *Sls. Mgr.:* Bob Brinley

SENSOR SYSTEMS, INC., 8929 Fullbright Ave., Chatsworth, CA 91311, Tel: 818-341-5366, Telex: 69-1583; *Sls. Mgr.:* E. Schneider

SENSORTEK, INC., 154 Em Huron Ave., Clifton, NJ 07013, Tel: 201-779-5577, Telex: 238790; Empl.: 26

SENSOR TECHN., 21012 Lassen St., Chatsworth, CA 91311, Tel: 213-882-4100, TWX: 910-494-4776; Empl.: 350; *Sls. Mgr.:* Robert Bryden

SENSOTEC, INC., 1200 Chesapeake Ave., Columbus, OH 43212, Tel: 614-486-7723, TWX: 810-482-1188; FSC No.: 29927; *Sls. Mgr.:* Jack Feil

SENSYM, INC., 1255 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-744-1500, Telex: 176376, TWX: 910-339-9625; *Sls. Mgr.:* Tom Johnson; *Dist. Mgr.:* Tom Johnson

SENTRY MFG., Crystal Park, Chickasha, OK 73018, Tel: 405-224-6780, 800-654-8850, TWX: 910-830-6425; Empl.: 150; *Sls. Mgr.:* R. Stephens

SENTRY SAFES, John D. Brush Co., Inc., 900 Linden Ave., Rochester, NY 14625, Tel: 716-381-4900, TWX: 510-253-6049; Empl.: 220; *Sls. Mgr.:* Ted Brush

SEQUENTIAL INFO. SYS., 249 N. Saw Mill River Rd., Elmsford, NY 10523, Tel: 914-592-5930, TWX: 710-567-1212; Empl.: 90; *Sls. Mgr.:* Murray E. Vinarub

Local Sales Offices & Reps

AL Jasper, Smith Lake Automation 205-221-2492
CA Campbell, Sedillo Co. 408-374-5220
CA Huntington Beach, Wheatcroft Engrg. 714-964-4681
CO Westminister, RMS Sls., Inc. 303-429-1111
FL Melbourne, Reynolds Assocs. 305-259-7000
IL Park Ridge, Mr. V. Kitty Mid-West Mgr. 312-698-5918
MD Baltimore, Mid States 301-583-8252
MA Bedford, Datasource, Inc. 617-275-8460
MI Detroit, Automatic Controls 313-533-8890
MN Minneapolis, Busch Elctrns. 612-835-2044
MO St. Charles, Prod. Automation 314-441-6600
NM Albuquerque, Vermillion Co. 505-883-3668
NY Melville, Carnes Assocs. 516-694-1600
NY Millbrook, Mr. R. DiMarso, East Sls. Mgr 914-677-9966
NY Moravia, Electrotech Sys. 315-497-1598
OH Cincinnati, Murray & Assocs., Inc. (ATR) 513-574-8500
OH Cleveland, Automatic Controls 216-631-0333
PA King of Prussia, Freedman & Malta 215-337-9211
TX Richardson, Spectra Sls. 214-234-3600
VA Springfield, Mid-States Mktg. 703-569-2700
WA Medical Lake, Calvert Controls 509-224-3601
WI Shorewood, Werking Indl. Sls. 414-964-2225
Can Lachine, Que., Electrodesign 514-636-4838

SERCOMP CORP., 20721 Superior St., Chatsworth, CA 91311, Tel: 818-341-1680, TWX: 4932014; Empl.: 100; *Sls. Mgr.:* John Marthens; *Dist. Mgr.:* John Marthens

SERIAL LAB PRODS., INC., 162 Cook Lane, P.O. Box 766, Marlboro, MA 01752, Tel: 617-481-1684, Telex: 955318 Attn: SERIAL LAB; Empl.: 12; *Sls. Mgr.:* R. L. Wiederman; *Dist. Mgr.:* D. Kreck

SERMETEL, 155 Limerick Rd., Limerick, PA 19468, Tel: 215-948-5100, Telex: 84-6335, TWX: 710-637-1263; Empl.: 177; *Sls. Mgr.:* Luke McLaughlin

SERVO-INSTRS. CORP., See Valley Electromagnetics

SERVOMETER CORP., 501 Little Falls Rd., Cedar Grove, NJ 07009, Tel: 201-785-4630, Telex: 384233; FSC No.: 18469; Empl.: 105; *Sls. Mgr.:* D. Walker

SERVO-TEK PRODS. CO., 1086 Goffle Rd., Hawthorne, NJ 07506, Tel: 201-427-3100, Telex: 130273; Empl.: 60; *Sls. Mgr.:* J. Duffy ..... **B•1185**

SETRA SYSTEMS, INC., 45 Nagog Park, Acton, MA 01720, Tel: 617-263-1400, Telex: 948440; FSC No.: 53367; Empl.: 85; *Sls. Mgr.:* William R. Stern ... **B•1826**

Local Sales Offices & Reps

AL Huntsville, Burnette Techno Metrics .. 205-533-9073
CA Los Altos, Qcon, Inc. 415-941-5530
CA Los Angeles, Dynasales Co. 213-268-1175
CO Westminster, RMS Sls. 303-429-1111
FL Orlando, Datarep 305-843-5224
GA Atlanta, Craft Assocs. 404-256-0420
IL Chicago, Data Elctrns. 312-283-0300
IN Indianapolis, Data Elctrns. 317-359-5368
LA Metairie, Slaton & Assocs., Inc. 504-455-3855
MA Framingham, J. M. Lancaster Co. 617-875-8893
MI Hazel Park, Tiby Co. 313-547-3550
MN Plymouth, Data Elctrns. 612-559-1434
MO St. Louis, Adelphi, Inc. 314-821-1232
NJ Cedar Grove, KLS Assocs. 201-785-4450
NY E. Rochester, A & D Dvcs. 716-385-2778
OH Cleveland, Tiby Co. 216-371-5335
OH Tulsa, Inotek Corp. 918-622-8570
OR Portland, McLaren, Inc. 503-297-2248
PA Cheltenham, Stein Instrm. 215-379-1990
TX Dallas, Inotek Corp. 214-243-7000
TX Houston, Inotek Corp. 713-688-7000
WA Bellevue, McLaren, Inc. 206-454-3400

SEVEN MOUNTAINS SCI. INC., P.O. Box 650, Boalsburg, PA 16827, Tel: 814-466-6559; Empl.: 4; *Sls. Mgr.:* Josephine Chesworth

SFE TECHNOLOGIES

SFE TECHNOLOGIES, 1501 1st St., San Fernando, CA 91340, Tel: 213-365-9411, TWX: 910-496-1535; FSC No.: 96733; Empl.: 2000; *Sls. Mgr.:* Ron Modugno; *Dist. Mgr.:* Ron Modugno ... **A•1168-1171, 1277, 1434, 1630-1631**

Local Sales Offices & Reps

AL Huntsville, Electronic Sls., Inc. 205-533-1735
AZ Tucson, West-Cap Arizona 602-294-2646
CA Milpitas, SFE Technlgs. 415-825-5133
CA Newport Beach, SFE Technlgs. 714-953-8064
CA San Diego, SFE Technlgs. 619-747-2789
CA San Fernando, San Fernando Elec. Div. 818-365-9411
CO Parker, Parker Webster 303-841-4888
CT Stratford, Gerald Rosen Co. 203-375-5456
FL Orlando, Perrott Assocs. 305-298-7748
GA Norcross, Electronic Sls., Inc. 404-448-6554
IL Downers Grove, Splon Assocs. 312-963-7011
IA Cedar Rapids, Stan Clothier Co. 319-395-0245
KS Shawnee Mission, Electro Dynamics .. 913-262-2500
LA New Orleans, SFE Technlgs. 504-254-5070
MD Baltimore, Micro-Comp 301-247-0400
MA Framingham, Gerald Rosen Co. 617-879-5505
MI Southfield, Lepofsky & Assocs. 313-569-6080
MN Minneapolis, Stan Clothier Co. 612-944-3456
NY Bethpage, SFE Technlgs. 212-245-7292
NY Chester, SFE Technlgs. 914-469-9620
NC Concord, Orchard Elctrns., Inc. 312-625-8400
OH Dayton, SFE Technlgs. 513-434-8212
OK Tulsa, Bonser Philhower 918-744-9964
OR Beaverton, General Elctrns. 503-641-5288
PA King of Prussia, SFE Technlgs. 215-265-1628
TX Austin, Bonser Philhower 512-346-9186
TX Richardson, Bonser Philhower 214-234-8438
UT Salt Lake City, Parker Webster 801-266-9939
VA Huddleston, Micro Comp 703-297-7614
Can Willowdale, Ont., SFE Technlgs. 416-491-0993

Local Distributors

AZ Tempe, Time Elctrns. 602-967-2000
CA Chatsworth, Shelley Elctrns. 818-998-3333
CA Compton, Harper S.I.D. 213-979-5090
CA Garden Grove, National Capacitor 213-598-9611
CA Westlake Village, Distel 805-495-9998
CO Englewood, Time Elctrns. 303-850-7701
CT Danbury, Diplomat Elctrns. 203-797-9674
FL Orlando, TTI, Inc. 305-859-1000
GA Norcross, Diplomat Elctrns. 404-449-4133
IL Chicago, Nep Elctrns. 312-625-8400
IL Elk Grove, Diplomat Elctrns. 312-640-1910
IA Cedar Rapids, Bell Inds. 319-395-0730
MD White Marsh, Radio Elec. Svc. Co. 301-529-0500
MA New Haven, Green Shaw 203-397-0710
MN Plymouth, Diplomat Elctrns. 612-559-2500
NJ Audubon, Action Elctrns. 609-858-2450
NJ Maple Shade, Zebra Elctrns. 609-779-8073
NY Central Islip, Semi Cap 516-582-4400
NY E. Farmingdale, Tri-Start 516-293-0400
NY Hauppauge, Fairmont 516-231-3313
NY Melville, Diplomat Elctrns. 516-454-6400
OH Fairborn, Aschbacher & Assocs. 513-252-7785
OR Portland, Time Elctrns. 503-684-3780
PA Broomall, Time Elctrns. 215-359-1200
TX Dallas, Diplomat Elctrns. 713-975-8447
TX Richardson, Jaco Elctrns. 214-235-9575
UT Salt Lake City, Diplomat Elctrns. 801-486-4134
WA Redman, Time Elctrns. 206-882-1600
WI Racine, Badger Elctrn. Parts 414-637-1256

S. F. PRODUCTS CORPORATION, P. O. Box 369, Southport, CT 06490, Tel: 203-929-6180, Telex: 220883 TAUR; Empl.: 8; *Sls. Mgr.:* Norman W. Johanson; *Dist. Mgr.:* R. S. Johanson

SL PLASTICS, Route 248, Nazareth, PA 18064, Tel: 215-759-0280; Empl.: 60; *Sls. Mgr.:* W. Tomko

SL PRINTED CIRCUITS, 827 Black Oak Ridge Rd., Wayne, NJ 07470, Tel: 201-835-2765; Empl.: 34; *Sls. Mgr.:* R. J. Puzo

SGS-ATES SEMICONDUCTOR CORP., 240 Bear Hill Rd, Waltham, MA 02154, Tel: 617-890-6688, Telex: 923495; Empl.: 9000

SGS SEMICONDUCTOR CORPORATION, 1000 E. Bell Road, Phoenix, AZ 85022, Tel: 602-867-6100, Telex: 249976,667479(Western Union), TWX: 910-950-4654; FSC No.: 7X328; Empl.: 200

SHALLCO, Box 1089, Smithfield, NC 27577, Tel: 919-934-3135, TWX: 510-939-1479; Empl.: 35; *Sls. Mgr.:* M. D. Sutton ..... **B•1692-1695; D•1036-1037**

Local Sales Offices & Reps

CA Chatsworth, WCV/RALTECH 818-700-0933
CA Santa Clara, Fischer Assocs. 408-733-7350
IL Northfield, Imex 312-446-8934
IA Cedar Rapids, S & O Sls. 310-393-1845
KS Shawnee Mission, Tech. Sls. 913-888-3330
MD Towson, Holden Engrg. Sls. 301-823-3763
MA Norwood, MPS Elctrn. 617-769-8700
MO Ferguson, Tech. Sls. 314-725-5361
NY Lynbrook, HLJ 516-599-2999
NY Manhattan, Lothar Sanford Corp. 212-757-3881
NY Pittsfield, D. Hurley Sls. 716-586-6159
OH Englewood, Allen Nace Co. 513-836-0931

Local Distributors

FL Jacksonville, Southeast Elctrns. 904-356-3007
MI Grand Rapids, Audio Distr. 616-452-1596
OH Cincinnati, United Radio 513-761-4030
PA Philadelphia, Philadelphia Elctrns. 215-568-7400
TN Bristol, Broadcast Equip. & Supp. 615-878-2531
TX Dallas, Wholesale Elctrns. 214-824-3001
Can Montreal, Que., Braydon Electro 514-332-5650

SHALLCROSS, INC., See RCL-Shallcross

SHALLTRONIX CORP., Preston St., P.O. Box 235, Selma, NC 27576, Tel: 919-965-6346; FSC No.: 58258; *Sls. Mgr.:* Joe Deans ..... **D•1307**

Local Sales Offices & Reps

TX Arlington, Electronic Prod. Reps. 817-467-0377

SHAPE MAGNETRONICS, INC., 901 DuPage Ave., Lombard, IL 60148, Tel: 312-620-8394, TWX: 910-991-2352; *Sls. Mgr.:* J. Hilgenberg ..... **D•1960-1961**

SHAPIRO SCIENTIFIC INST., 3500 E. Coast Hwy., Corona del Mar, CA 92625, Tel: 714-675-1024; Empl.: 7

SHELLY associates

SHELLY ASSOCIATES, INC., 14281 Chambers Road, Tustin, CA 92680, Tel: 714-669-9850, Telex: 85-2263; FSC No.: 00303; Empl.: 30; *Sls. Mgr.:* Chuck Feeney; *Dist. Mgr.:*

Chuck Feeney ..... B•1093

Local Sales Offices & Reps

AL Mobile, Hollingsworth & Still, Inc. 800-241-5712
CA Mountain View, Leddy Assocs. 415-969-6313
CA Redondo Beach, Vedax, Inc. 213-540-1255
FL Ft. Lauderdale, Hollingsworth & Still, Inc. 800-241-5712
FL Tampa, Hollingsworth & Still, Inc. 800-241-5712
GA Norcross, Hollingsworth & Still, Inc. ... 800-241-5712
IL Chicago, Electro-Tech Mktg. Assocs. .. 312-676-3151
IN Ft. Wayne, Scott Elctrns. 219-484-7865
IN Indianapolis, Scott Elctrns. Inc. 317-897-9976
LA Covington, HBT Assocs. Inc. 504-892-4045
MA Plainville, Enterprise Technlg. 617-695-4700
MN Mound, Allyn Assocs. 612-472-4784
MO Grandview, R. R. Burton & Assocs. 816-763-5385
MO St. Louis, R. R. Burton & Assocs. 314-647-6353
NJ Boonton, TMA 201-263-2946
NJ Sicklerville, Brown Assocs. 609-629-2240
NY Port Washington, TMA 516-883-2432
NC Charlotte, Hollingsworth & Still, Inc. ... 800-241-5712
NC Kernersville, Hollingsworth & Still, Inc. 800-241-5712
OH Cincinnati, Scott Elctrns. 513-791-2513
OH Cleveland, Scott Elctrns. Inc. 216-473-5050
OH Dayton, Scott Elctrns. Inc. 513-294-0539
OH Reynoldsburg, Scott Elctrns. 614-863-1281
OR Dallas, Ecco Mktg. 503-228-6401
PA Pittsburgh, Scott Elctrns. 412-963-6116
TX Austin, Milco Mktg., Inc. 713-723-5003
TX Dallas, Milco Mktg., Inc. 214-783-2716
TX Houston, Milco Mktg., Inc. 713-723-5003
WA Seattle, Ecco Mktg. 206-364-0200
WI Brookfield, Electro-Tech Mktg. Assocs. 414-785-9554

Local Distributors

CA Anaheim, Bisco Inds. Inc. 714-635-0380
CA San Jose, Bisco Inds. Inc. 408-946-8980
CT Norwalk, Park Distrs. Inc. 203-853-2010
CT Wallingford, Midstate Elctrns. Co. 203-265-9900
FL Clearwater, Jenkins Supp. Co., Inc. 813-584-5282
IL Franklin Park, Bisco Inds. Inc. 312-451-1230
IN Indianapolis, Mar Elctrns., Inc. 317-875-4510
IA Cedar Rapids, Iowa Radio Supp. Co. .. 319-393-4510
LA Harvey, AFG Elctrns. Supp. 504-368-9696
MA Chelmsford, Pilgrim Elctrns. 617-251-8746
MA Woburn, Elctrn. Packaging Comps. 617-935-0400
NJ Cranford, Garden State Indl. Elctrns. .. 201-272-6400
NJ East Brunswick, Brothers Elctrns. 201-238-2200
NJ Fair Lawn, Relay Specialties 201-797-3313
NJ Saddle Brook, Tide Elctrns. 201-794-9660
NY Elmsford, White Plains Elctrl. Supp. Co. 914-592-9555
OH Dayton, Televox, Inc. 513-294-4499
OH Strongsville, Roberts Elctrns. Co., Inc. 216-238-1711
OK Tulsa, Radio, Inc. 918-587-9123
TX Dallas, Wilkinson Brothers Co. 214-941-9963
WI Mequon, Lakeview Elctrns. 414-377-8250

SHIELDING TECHNOLOGY, INC., 120 Ethel Rd. West, Piscataway, NJ 08854, Tel: 201-985-8800, TWX: 710-480-6297; *Sls. Mgr.:* Mason Carter

SHINANO KENSHI CORP. (SKC), 7525 Ethel Ave., Ste. 1, N. Hollywood, CA 91605, Tel: 818-764-4266; Empl.: 5; *Sls. Mgr.:* William F. Dowis ..... B•1187

Local Sales Offices & Reps

CA North Hollywood, Shinano Kenshi Corp. 818-764-4266
CA Santa Clara, Logan Sales 408-496-0660
CO Denver, Tech Rep Sls. Co. 303-758-7031
CT Bloomfield, SIR Assocs. 203-243-9343
FL Sarasota, Phoenix Comps., Inc. 813-371-1163
IL Barrington, Richard Fisk Mktg. 312-381-0653
MA Bedford, SIR Assocs. 617-275-5550
MI Southfield, Fred Gehrke & Assoc. 313-559-5363
MN Eagan, J. Jorgenson & Assoc. 612-452-9541
NJ Hatboro, PA, Electro Rep 215-674-4421
NJ Oxford, Malin Assocs. 201-689-7398
NC Greenville, Ranico Representatives ... 615-639-7696
OK Oklahoma City, Precision Technlg. Assocs. 405-755-3103
OR Portland, Intertech Sls. 503-775-7885
TN Greenville, Lamons Sales Co. 615-639-8711
TX Austin, Precision Technlg. Assocs. 512-250-0201
TX Richardson, Precision Technlg. Assoc. 214-234-8071

SHOGYO

SHOGYO INTL. CORP., 287 Northern Blvd., Great Neck, NY 11021, Tel: 516-466-0911, Telex: 4758024, TWX: 12218 ..... A•2037, 2270-2271; B•1094-1096; C•1506-1508, 1905; D•1038, 1376

SHOKAI FAR EAST, LTD., 280 North Central Ave., Hartsdale, NY 10530, Tel: 914-681-0700, Telex: 22-4219; Empl.: 362; *Sls. Mgr.:* Bob Craig ..... D•1039

SHOW 'N TELL PRODUCTS, AMG, Inc., 155 Franklin Street, Dayton, OH 45402, Tel: 513-223-8211; *Sls. Mgr.:* Jon A. Bloyd

OPTIMEM, 435 Oakmead Parkway, Sunnyvale, CA 94086, Tel: 408-737-7373, TWX: 910-339-9615; Empl.: 140; *Sls. Mgr.:* Tom Jarrett; *Dist. Mgr.:* Tom Jarrett

SHURE BROS., 222 Hartrey Ave., Evanston, IL 60204, Tel: 312-866-2200, Telex: 72-4381, TWX: 910-231-0048; *Sls. Mgr.:* R. T. Murphy

SHURITE METERS, INC., 577 Grand Ave., P.O. Box 1848, New Haven, CT 06508, Tel: 203-624-1188; Empl.: 30; *Sls. Mgr.:* Joseph V. LeBlanc; *Dist. Mgr.:* Joseph V. LeBlanc

SIDAC ENCLOSURES, Div. of Triac Electronic Systems, Inc., 87-27 Myrtle Ave., Glendale, NY 11385, Tel: 718-441-4728; Empl.: 14; *Sls. Mgr.:* Victor Botnick ..... C•1082

SIDEREAL CORP., 9600 S.W. Barnes Rd., Portland, OR 97225, Tel: 503-297-5531, Telex: 36-0640, TWX: 910-464-6139; *Sls. Mgr.:* Jim Miller & Jeff Gretz; *Dist. Mgr.:* Joy Sakata

SIECOR CORP., Box 489, Hickory, NC 28603, Tel: 704-328-2171, Telex: 800-510, TWX: 510-934-1204; Empl.: 600; *Sls. Mgr.:* J. English

SIEMENS COMPS., INC., Optoelectronics Div., 19000 Homestead Rd., Cupertino, CA 95014, Tel: 408-257-7910, Telex: 352084, TWX: 910-338-0022; FSC No.: 50579; Empl.: 1100; *Sls. Mgr.:* Gary Durgin; *Dist. Mgr.:* Kathy Renz

SIEMENS COMPONENTS, INC., 186 Wood Ave., S., Iselin, NJ 08830, Tel: 201-321-3400, TWX: 710-998-0588/0529; Empl.: 800

Sierracin/Magnedyne

SIERRACIN/MAGNEDYNE, 2258 Rutherford Rd., P.O. Box 458, Carlsbad, CA 92008, Tel: 619-438-3321, Telex: 910 322-1391; Empl.: 190 ..... B•1188-1189

Local Sales Offices & Reps

AZ Scottsdale, Terry Thatford 602-998-3009
CA Campbell, Luscombe Engrg. Co. 408-370-2020
CA Laguna Beach, Comar Co. 714-250-0140
CA Palos Verdes, Clay Walters 213-541-6361
CA San Diego, Comar Co., Inc. 619-565-6097
CA Torrance, Carl J. Aguirre 213-541-6361
CT Tolland, Don Fontaine 203-875-0720
FL Deerfield Beach, Electrocomp Assocs. 305-429-0802
FL St. Petersburg, Electro Comp. Assocs. 813-327-9677
GA Atlanta, L & D Inc. 404-455-3483
IL Rolling Meadows, KMA Sls. Co. 312-398-5300
MD Churchville, Atlantic Tech. Sls. 301-879-2236
MI Troy, Xanthus, Inc. 313-528-2000
MN Minneapolis, North Star Motion & Controls 612-545-0586
MN St. Paul, North Star Motion & Controls 612-770-5311
NY Hasbrouck Hgts., Carnes Diamond Assocs. 516-694-1600
NY Melville, Carnes Assocs. 315-446-2346
NY Pittsford, Controlled Motion Prods. Co. 716-381-1933
NY Syracuse, Controlled Motion Prods. ... 315-424-0839
NC Greensboro, L & D Inc. 919-292-3201
OH Cleveland, Servo-Mark 216-871-2353
PA Morristown, Rivco January 215-631-1414
TX Austin, The Thorson Co. 512-451-7527
TX Dallas, Thorson Co. 214-233-5744
TX Houston, The Thorson Co. 713-771-3504
VA Richmond, L & D, Inc. 804-257-7717
WA Bellevue, Quest Mktg. 206-747-9424
WI Milwaukee, KMA Sls. Co. 414-259-1771

Sierracin/Power Systems

SIERRACIN/POWER SYSTEMS, 20500 Plummer St., Chatsworth, CA 91311, Tel: 818-998-9873, TWX: 910-494-4830; FSC No.: 58999; Empl.: 450; *Sls. Mgr.:* Nick Freyling; *Dist. Mgr.:* Julius Hirsh ..... D•1834-1836

Local Sales Offices & Reps

AZ Scottsdale, Fred Board Assocs. 602-994-9388
AZ Tucson, Fred Board Assocs. 602-299-1508
CA Huntington Beach, J. J. Riley Assocs. 714-841-1411
CA San Jose, Fahrner-Miller Assocs. 408-727-9800
CO Denver, Wm. J. Purdy Co. 303-753-6800
CT Meriden, Whitehead Assocs. 203-634-1280
FL Altamonte Springs, Semtronic 305-831-8233
FL Clearwater, Semtronic 813-461-4675
IL Elk Grove Village, John G. Twist Co. .. 312-593-0200
IN Noblesville, KW Elctrns. Sls. 317-773-5536
IA Cedar Rapids, Comstrand 319-377-1575
KS Merriam, Midwest Tech. Sls. 913-236-8555
KS Wichita, Midwest Tech. Sls. 316-262-7240
KY Louisville, KW Elctrn. Sls. 502-451-1860
MD Columbia, Delta III Assocs., Inc. 301-730-4700
MA Wakefield, Whitehead Assocs. 617-246-5070
MI Novi, Lektronics 313-349-3304
MN Bloomington, John G. Twist Co. 612-835-2120
MN Minneapolis, Comstrand 612-788-9234
MO St. Charles, Midwest Tech. Sls. 314-441-1012
NJ Franklin Lake, Hansen & Hughes 201-848-8900
NJ Marlton, BGR Assocs. 609-983-1020
NM Albuquerque, Fred Board Assocs. 505-293-1399
NY Batavia, Tech-Mark, Inc. 716-343-2568
NY Endicott, Tech-Mark, Inc. 607-748-7473
NY Greenlawn, Hansen & Hughes 516-754-3608
NY Mendon, Tech-Mark, Inc. 716-624-3840
NY Utica, Tech-Mark, Inc. 315-733-0575
NC Raleigh, J & B Sls. 919-878-8600
OH Dayton, K. W. Elctrn. Sls. 513-890-2150
OH Shaker Heights, K. W. Elctrn. Sls. 216-491-9177
OH Worthington, K. W. Elctrn. Sls. 614-888-0483
OR Beaverton, Wm. J. Purdy Co. 503-641-9373
PA Allison Park, K. W. Elctrn. Sls. 412-487-4300
TN Tullahoma, J & B Sls. 615-455-7487
TX Austin, Kruvand Assocs. 512-441-6777
TX Dallas, Kruvand Assocs. 214-437-3355
TX Houston, Kruvand Assocs. 713-780-9710
UT Salt Lake City, Wm. J. Purdy Co. 810-486-8557
WA Redmond, Wm. J. Purdy Co. 206-882-3144
WI Brookfield, John G. Twist Co. 414-782-2670

Local Distributors

AL Huntsville, Hall-Mark Elctrns. Corp. 205-837-8700
AZ Phoenix, Hallmark Elctrns. Corp. 602-437-1200
CA Canoga Park, Hallmark Elctrns. Corp. 818-716-7300
CA Chatsworth, Priority One 818-709-6789
CA Citrus Heights, Hall-Mark Elctrns. Corp. 916-722-8600
CA Costa Mesa, FLW 714-751-7512
CA El Segundo, Hall-Mark Elctrns. Corp. .. 213-643-9101
CA Hayward, FLW, Inc. 415-786-9070
CA San Diego, FLW 619-277-0993
CA San Diego, Hall-Mark Elctrns. Corp. ... 619-268-1201
CA San Jose, Hallmark Elctrns. Corp. 408-946-0900
CA Tustin, Hall-Mark Elctrns. Corp. 714-359-0330
CA Van Nuys, FLW, Inc. 818-989-5237
CO Englewood, Hall-Mark Elctrns. Corp. .. 303-694-1662
CT Wallingford, Hallmark Elctrns. Corp. ... 203-269-0100
FL Clearwater, Hall-Mark Elctrns. Corp. ... 813-530-4543
FL Orlando, Hall-Mark Elctrns. Corp. 305-855-4020
FL Pompano Beach, Hall-Mark Elctrns. Corp. 305-971-9280
FL Tampa, Reptron 813-855-4656
GA Norcross, Hall-Mark Elctrns. Corp. 404-447-8000
GA Norcross, Reptron Elctrns. 404-446-1300
IL Schaumburg, Reptron Elctrns. 312-882-1700
IL Woodale, Hall-Mark Elctrns. Corp. 312-860-3800
KS Lenexa, Hall-Mark Elctrns. Corp. 913-888-4747
MD Columbia, Hall-Mark Elctrns. Corp. 301-988-9800
MA Billerica, Hallmark Elctrns. Corp. 617-935-9777
MI Grand Rapids, Calder Elctrns. 616-949-2900

MI Livonia, Reptron Elctrns. 313-525-2700
MN Bloomington, Hall-Mark Elctrns. Corp. 612-854-3223
MO Earth City, Hall-Mark Elctrns. Corp. 314-291-5350
NJ Fairfield, Hall-Mark Elctrns. Corp. 201-575-4415
NJ Mt. Laurel, Hall-Mark Elctrns. Corp. 609-235-1900
NY Ronkonkoma, Hall-Mark Elctrns. Corp. 516-737-0600
NC Raleigh, Hall-Mark Elctrns. Corp. 919-872-0712
OH Cincinnati, Schuster Elctrn. Co. 513-489-1400
OH Solon, Hall-Mark Elctrns. Corp. 216-349-4632
OH Worthington, Hall-Mark Elctrns. Corp. 614-888-3313
OH Worthington, Reptron Elctrns. 614-888-3313
OK Tulsa, Hall-Mark Elctrns. Corp. 918-665-3200
OR Wilsonville, Zepher-Ragon 503-682-2929
TX Austin, Hall-Mark Elctrns. Corp. 512-258-8848
TX Dallas, Hall-Mark Elctrns. Corp. 214-343-5000
TX Dallas, HallMark Elctrn. Corp. 214-553-4300
TX Houston, Hall-Mark Elctrns. Corp. 713-781-6100
UT Murray, Hallmark Elctrns. Corp. 801-268-3779
UT Salt Lake City, Standard Supp. Co. 810-268-3779
WA Seattle, Zepher-Ragon 206-241-1980
WI New Berlin, Hall-Mark Elctrns. Corp. .. 414-797-7844
Can Dorval, Que., Semad 514-636-4128
Can Markham, Ont., Semad 406-475-3922

SIERRACIN/THERMAL SYS., 13920 S. Broadway, Los Angeles, CA 90061, Tel: 213-321-4350, TWX: 910-346-6774; FSC No.: 11416; Empl.: 175

SIERRA ELEC., See Pass & Seymour, Inc.

SIGMA ELECTRONICS INC., 10830 Kinghurst Dr., Houston, TX 77099, Tel: 713-933-4700; FSC No.: 60767; Empl.: 75; *Sls. Mgr.:* W. N. Dickey

SIGMA INSTRS., 170 Pearl St., Braintree, MA 02184, Tel: 617-843-5000, Telex: 94-0645, TWX: 710-348-1161; Empl.: 1,500

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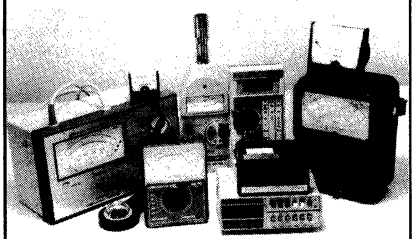

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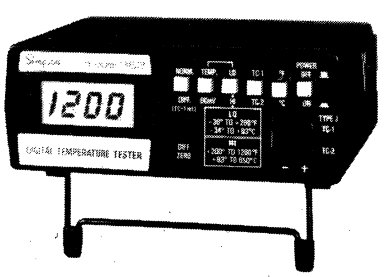

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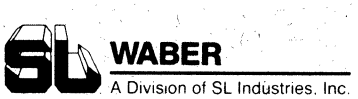

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CA	Gardena, California Switch & Signal	213-770-2330
CA	Glendale, Western Elctrns.	213-246-4861
CA	Hollywood, Pacific Radio Exch.	213-462-1393
CA	Hollywood, Yale Radio	213-465-3186
CA	Mountain View, Abacus Elctrns.	415-961-1500
CA	Oakland, Brill Elctrns.	415-834-5888
CA	Palo Alto, Zack Elctrns.	415-326-5432
CA	Pasadena, Dow Radio	213-793-1195
CA	Riverside, Electronic Supp.	714-836-7300
CA	San Diego, Shanks & Wright	714-239-0176
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	San Jose, Quement Elctrns.	408-998-5900
CA	Sunnyvale, Com-Kyl	408-734-9660
CO	Denver, Denver Wintronics	303-934-2406
CO	Denver, Elctrn. Parts	303-744-1992
CT	Stamford, Mar Le Co.	203-348-2645
CT	Waterbury, Suburban Supp.	203-757-1251
FL	Miami, Elctrn. Equip.	305-871-3500
FL	Miami, ESL Elctrn. Distrs.	305-633-6973
FL	Orlando, Hammond Elctrns.	305-849-6060
FL	Pensacola, Grice Elctrns.	904-434-2481
GA	Atlanta, Ack Radio Supp.	404-351-6340
GA	Atlanta, Specialty Distrib.	404-873-2521
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Elk Grove Village, GBL Elctrns.	312-593-3220
IL	Niles, Joseph Elctrns.	312-297-4200
IL	Northbrook, Classic Comps.	312-272-9650
IL	Palatine, Ohm Elctrns.	312-359-5500
IL	Peoria, Klaus Radio & Elctrns.	309-691-4840
IL	Rockford, Mid-West Associated	815-962-8036
IN	East Chicago, Acro Elctrns.	312-357-1269
IN	Ft. Wayne, Ft. Wayne Elctrns.	219-423-3422
IN	Indianapolis, Graham Elctrns.	317-634-8202
IN	Indianapolis, Meunier Elect.	317-635-3511
IN	Indianapolis, Radio Distrib.	317-257-2231
IN	Terre Haute, Midwest Supp. Elec.	812-232-0187
KY	Lexington, Radio Elctrn. Equip.	606-255-6661
KY	Louisville, P.I. Burks Co.	502-589-3960
KY	Louisville, Peerless Elctrn. Equip.	502-637-7674
LA	Lafayette, Ralphs of Lafayette	318-234-4507
LA	Shreveport, Industrial Elect.	318-222-9459
MD	Baltimore, ASI Elctrns.	301-265-5100
MD	Baltimore, Radio Elctrn. Svc. Co.	301-823-0700
MD	Gaithersburg, Pioneer/Wash. Elect.	301-948-0710
MD	Rockville, Capitol Radio Whlsrs.	301-881-2270
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Lynn, Land Elec. Supp.	617-592-2220
MA	Needham, You-Do-It Elctrns.	617-449-1005
MA	Newton Upper Falls, In-Stock Prods. Co.	617-964-6200
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	W. Newton, A. W. Mayer Co.	617-965-1111
MI	Ann Arbor, Wedemeyer Elect. Supp.	313-665-8611
MI	Detroit, RS Elctrns.	313-491-1012
MN	Minneapolis, Electronics Ctr.	612-371-5200
MN	Minneapolis, Stark Elctrns.	612-332-1325
MS	Jackson, Ellington Elect. Supp.	601-355-0561
MO	Kansas City, Electronic Supp. Co.	816-921-0250
MO	Kansas City, Walters Radio Supp.	816-531-7015
MO	St. Louis, Olive Indl. Elect.	314-863-7800
MO	St. Louis, Van Sickle Radio	314-621-5000
NE	Lincoln, Scott Elec. Supp.	402-466-8221
NE	Omaha, Radio Equip.	402-341-7700
NH	Hudson, C & H Elctrns.	603-882-1133
NJ	Camden, General Radio Supp.	609-964-8560
NJ	Hanover, State Elctrn. Parts	201-887-2550
NJ	Springfield, Federated Purchaser	201-376-8900
NJ	Springfield, Route Elctrns.	201-467-0166
NM	Albuquerque, Electronic Parts	505-293-6161
NM	Albuquerque, Walker Radio Co.	505-247-2288
NY	Buffalo, Summit Distrib.	716-884-3450
NY	Farmingdale, Fordham Radio	516-752-0500
NY	Hauppauge, Broadline Elctrns.	516-420-8320
NY	Hempstead, Davis Elctrns.	516-483-9200
NY	Long Island City, H. L. Dalis, Inc.	212-361-1117
NY	New York, Argil Elctrns.	212-691-8111
NY	Portchester, Wise Comps.	203-531-4880
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rome, Rome Elctrns.	315-337-5400
NY	Schenectady, Adirondack Elctrns.	518-842-8350
NC	Raleigh, Southeastern Radio Supp.	919-828-2311
OH	Akron, Akron Elctrn. Supp.	216-762-8818
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Cincinnati, United Radio	513-662-2610
OH	Cleveland, Pattison Supp.	216-441-3000
OH	Cleveland, Pioneer-Standard Elect.	216-587-3600
OH	Columbus, Hughes-Peters	614-294-5351
OH	Dayton, Becker Elctrns.	513-226-1341
OH	Dayton, ESCO, Inc.	513-226-1133
OH	Dayton, Pioneer Elctrns.	513-236-9900
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Solon, Repco	216-248-8900
OH	Toledo, Warren Radio	419-248-3364
OK	Oklahoma City, Trice Whlsl. Elect.	405-524-4411
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, EOFF Elec.	503-222-9411
PA	Allentown, A. A. Peters	215-434-5237
PA	Huntingdon Valley, Shap Elctrns.	215-322-7150
PA	Philadelphia, Almo Elctrns.	215-698-4000
PA	Philadelphia, Herbach & Rademan	215-426-1700
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
PA	Plymouth Meeting, Techni-Tool	215-825-4900
PA	Reading, Barbey Elctrns.	215-376-6116
RI	Providence, Wm. Dandreta & Co.	401-861-2800
SC	Charleston, Wholesale Radio Supp.	803-747-9672
TN	Chattanooga, Curle Elctrns.	615-266-4727
TN	Kingsport, Radio Elect. Supp.	615-247-8111
TN	Nashville, Electra Distrib.	615-329-3971
TN	Nashville, Randolph & Rice	615-255-5602
TX	Austin, Harrison Ind. Elctrns.	512-458-3555
TX	Corpus Christi, Douglas Elctrns.	512-883-5103
TX	Dallas, KA Elect. Sls.	214-634-7870
TX	Dallas, Wallace Elctrns.	214-340-0400
TX	Dallas, Wholesale Elect. Supp.	214-824-3001
TX	Ft. Worth, Sweico	817-335-6521
TX	Houston, City Electronic Supp.	713-621-1060
TX	Houston, Electrotex	713-941-7016
TX	Houston, Harrison Ind. Elctrns.	713-652-4700
TX	Houston, Lenert Co.	713-225-1465
TX	San Antonio, Sherman Elect. Supp.	512-224-1001
UT	Salt Lake City, Standard Supp.	801-486-3371
VA	Arlington, Arlington Elctrn.	703-524-2412
VA	Portsmouth, Distributors	804-399-2446
VA	Richmond, Avec Elctrns.	804-359-6071
VA	Roanoke, Peoples Radio & TV Supp.	703-342-8933
WA	Seattle, Radar Elect.	206-282-2511
WI	Madison, Satterfield Elctrns.	608-257-4801
WI	Milwaukee, Marsh Elctrns.	414-475-6000

SMC SOFTWARE SYS., Science Management Corp., P. O. Box 0600, Basking Ridge, NJ 07920, Tel: 201-647-7000; Empl.: 35; *Sls. Mgr.:* Edwin J. Schnell; *Dist. Mgr.:* Margaret Langsett

SMD TECHNOLOGY SVC. CTR., A North American Philips Co., 5855 N. Glen Pk. Rd., Milwaukee, WI 53209, Tel: 800-431-4444; *Sls. Mgr.:* F. Funk

KULKA SMITH, INC., 1913 Atlantic Ave., Manasquan, NJ 08736, Tel: 201-223-9400, TWX: 244536; FSC No.: 83330; Empl.: 500; *Sls. Mgr.:* S. Fleischman; *Dist. Mgr.:* S. Fleischman ..... **C•1509, 1693**

Local Sales Offices & Reps

AZ	Phoenix, Shefler-Kahn	602-257-9015
CA	Los Angeles, E.E. Strassner Co.	213-242-8823
CA	Santa Clara, Warren Assocs.	408-988-7762
CO	Denver, Lindberg Co.	303-758-9033
CT	North Haven, Coakley, Boyd & Abbett	203-239-6217
FL	Ft Lauderdale, Hollingsworth & Still	404-447-1700
FL	Miami, Hollingsworth & Still	404-447-1700
FL	Tampa, Hollingsworth & Still	404-447-1700
IL	Chicago, RMP/McBride Sls.	312-932-9090
IN	Indianapolis, Elctrn. Reps.	317-894-1414
KS	Shawnee Mission, Lowell Kangas & Assocs.	913-631-3515
TX	Dallas, J. Y. Schoonmaker	214-349-1650
MA	Needham Hgts, Coakley, Boyd & Abbett	617-444-5470
MA	Woburn, W&D Mktg.	617-935-5610
MI	Farmington Hills, R. C. Merchant	313-476-4600

MN Minneapolis, Electric Comp. Sls. 612-933-2594
MO St. Louis, Lowell Kangas & Assoc. 314-821-4050
NH Plaistow, Coakley, Boyd & Abbett 617-444-5470
NM Albuquerque, Shefler-Kahn 505-296-0749
NY Buffalo, L.D. Allen 716-837-1955
NY N. Syracuse, L.D. Allen 315-437-8387
NY Rochester, Warren Kaufman 716-266-2728
NY Whitestone, Jack Brown Elctrn. 212-767-1977
OH Richfield, Bear Mktg. 216-659-3131
OR Portland, Weber, Dale 503-234-7671
PA Trevose, P.S.A., Inc. 215-245-0513
MA Needham, Coakley, Boyd & Abbett 617-444-5470
TX Dallas, J. Y. Schoonmaker 214-349-1650
WA Seattle, Weber, Dale 206-623-5990

SMK ELCTRNS. CORP., U.S.A., 1901 Nancita Cir., Placentia, CA 92670, Tel: 714-996-0960, Telex: 18-3081; FSC No.: 637-7400; Empl.: 84; *Sls. Mgr.:* Charles Sochalec; *Dist. Mgr.:* Rudy Cicciarelli

SMOKE SIGNAL, 31336 Via Colinas, Westlake Vlg., CA 91362, Tel: 818-889-9340, Telex: 9104044065; Empl.: 20; *Sls. Mgr.:* Don Simonsen; *Dist. Mgr.:* Colleen Kirkpatrick

SOFTWARE DYNAMICS, 2111 W. Crescent Ave-G, Anaheim, CA 92801, Tel: 714-635-4760

SOHIO ENGINEERED MATERIALS CO., Unit of Sohio, P. O. Box 156, Niagara Falls, NY 14302, Tel: 716-278-2000; Empl.: 2000 ... **A•1172, 1944-1947; B•1772**

SOKOL CRYSTAL PRODS. DIV., 6050 N. 52nd Ave., Glendale, AZ 85301, Tel: 602-934-2108

SOKOL CRYSTAL PRODS., INC., 121 Water St., Mineral Point, WI 53565, Tel: 608-987-3363, Telex: 467581; FSC No.: 56187; Empl.: 150; *Sls. Mgr.:* Steven M. Sokol ..... **A•1435-1437**

Local Sales Offices & Reps

CA Pinole, Ron May 415-724-1203
FL Clearwater, Brennan & Assocs. 813-446-5006
IL Medinah, Wavan Assocs. 312-893-0210
IN Fort Wayne, John Kilfoil Co. 219-436-7233
IA Marion, Rep. Assocs. 319-373-0152
KS Parker, S. W. Wollard Co. 913-898-6552
MA Millis, Selmark Assocs. 617-376-2914
MN Bloomington, V. J. Gensmer Assocs. .. 612-888-2492
MO St. Louis, Abrams & Assocs. 314-569-0447
NJ Flanders, K & R Engrg. Sls. Corp. 201-584-5235
TX Dallas, Stevens Sls. Co. 214-350-2476
WA Kirkland, Manon Engrg., Inc. 206-827-7449

SOLA, A Unit of General Sign., 1717 Busse Rd., Elk Grove Village, IL 60007, Tel: 312-439-2800, Telex: 280538; *Sls. Mgr.:* Fred Lemke ..... **D•1838-1839, 1964-1967**

Local Sales Offices & Reps

AL Huntsville, Cartwright & Bean, Inc. 205-830-1540
AZ Phoenix, Zeus Elctrns., Inc. 602-263-6022
AR Little Rock, Erickson Sls., Inc. 501-225-7379
CA Los Angeles, Wiley Co. 213-666-1611
CA Pleasanton, Moulthrop Sls., Inc. 415-463-0450
CA San Diego, Wiley Co. 619-571-2881
CT Mystic, J.M.G., Inc. 203-599-5373
FL Orlando, Cartwright & Bean, Inc. 305-422-4531
GA Atlanta, Cartwright & Bean, Inc. 404-233-2939
IL Chicago, Industrial Reps. 312-647-7755
IN Indianapolis, Green-Wissler Sls. 317-872-9981
IA Cedar Rapids, R. W. Kunz & Assocs. .. 319-396-5386
KS Kansas City, R. W. Kunz & Assocs. ... 913-648-3535
LA Chalmette, Erickson Sls., Inc. 504-271-1976
MI Farmington Hills, R. C. Merchant 313-476-4600
MN Minneapolis, Boerger & Assocs. 612-560-3435
NJ Cherry Hill, Trinkle Sls. 609-795-4200
NJ East Orange, Willgold Sls. 201-678-7700
NY Rochester, LMar Assocs. 716-323-1000
NC Raleigh, Cartwright & Bean, Inc. 919-876-4130
OH Columbus, Baehr, Greenleaf & Assocs. 614-486-4046
OH Dayton, Baehr, Greenleaf & Assocs. .. 513-439-0724
OH Lakewood, Baehr, Greenleaf & Assocs. 216-221-9030
OK Broken Arrow, Erickson Sls., Inc. 918-455-4276
TN Knoxville, Cartwright & Bean, Inc. 615-693-7450
TX Austin, Erickson Sls. 512-244-3068
TX Dallas, Erickson Sls. 214-739-5833
TX Houston, Erickson Sls. 713-266-1604
WI Milwaukee, Industrial Reps. 414-259-0965

SOLARCON TECHNOLOGY, INC., P.O. Box 4715, Hayward, CA 94544, Tel: 415-489-3141; Empl.: 9; *Sls. Mgr.:* Rose Ferguson

Local Sales Offices & Reps

CA Laguna Hills, Reese Riley & Assocs. .. 714-859-9827
CA San Ramon, Reese Riley & Assocs. .. 415-961-0565
MI Southfield, Infinity, Inc. 313-557-7230
OH Solon, Infinity, Inc. 216-248-9377
PA Pittsburgh, Infinity, Inc. 412-821-6389
WA Belview, Reese Riley & Assocs. 206-462-8088

SOLAR ELCTRNS. CO., 901 N. Highland, Hollywood, CA 90038, Tel: 213-462-0806; FSC No.: 13222; Empl.: 15

SOLAREX CORP., 1335 Piccard Dr., Rockville, MD 20850, Tel: 301-948-0202, TWX: 710-828-9709; *Sls. Mgr.:* Ted Blumemstock

SOLARTRON INSTRUMENTS, Sangamo Weston, Inc., 2 Westchester Plaza, Elmsford, NY 10523, Tel: 914-592-9168, Telex: 145-487; FSC No.: 1T316; Empl.: 21; *Sls. Mgr.:* Malcolm J. Swanson

SOLATRON ENTERPRISES, 421 E. Beach Ave., Inglewood, CA 90302, Tel: 213-678-4981; Empl.: 20

SOLDER ABSORBING TECHNOLOGY (SAT), South End Bridge Circle, Agawam, MA 01001, Tel: 800-628-8862, TWX: 710-350-6466; Empl.: 8

SOLDER REMOVAL, P.O. Box 1678, Covina, CA 91722, Tel: 213-967-3681, TWX: 910-584-1820; FSC No.: 34605; *Sls. Mgr.:* Frank Hennessy; *Dist. Mgr.:* Frank Hennessy

SOLID STATE, INC., 46 Farrand St., Bloomfield, NJ 07003, Tel: 201-429-8700, TWX: 710-994-4780; Empl.: 110; *Sls. Mgr.:* T. King

SOLID STATE CIRCUITS, 3300 S. Golden, Springfield, MO 65807, Tel: 417-887-0823, TWX: 910-775-4762; Empl.: 260; *Sls. Mgr.:* Dennis Stead

SOLID STATE DEVICES, 14830 Valley View Ave., La Mirada, CA 90638, Tel: 213-921-9660, TWX: 910-583-4807; FSC No.: 30043; Empl.: 100; *Sls. Mgr.:* D. Peden

SOLID STATE ELCTRNS. CORP., 18646 Parthenia St., Northridge, CA 91324, Tel: 818-993-8257; FSC No.: 11911; Empl.: 15

SOLID STATE RELAYS, 213 Eisenhower Lane So., Lombard, IL 60148, Tel: 312-932-1660; *Sls. Mgr.:* D. E. Wienke

SOLID STATE SCIENTIFIC, 3900 Welsh Rd., Willow Grove, PA 19090, Tel: 215-657-8400, Telex: 476-1101, TWX: 510-661-7267; Empl.: 650

SOLID STATE SYSTEMS, 1990 Delk Industrial Blvd., Marietta, GA 30067, Tel: 404-952-9401; Empl.: 150; *Sls. Mgr.:* Jason Schloss; *Dist. Mgr.:* J. Schloss

SOLID STATE TESTING, INC., 56 Middlesex Tpke., Burlington, MA 01803, Tel: 617-272-0972, TWX: 710-332-1620; Empl.: 150; *Sls. Mgr.:* James Roberts; *Dist. Mgr.:* James DiGiacomo

SOLITRON DEVICES, 8808 Balboa Ave., San Diego, CA 92123, Tel: 619-278-8780, TWX: 910-335-1221; Empl.: 900

SOLITRON DEVICES, INC., Semiconductor Group, 1177 Blue Heron Rd., Riviera Beach, FL 33404, Tel: 305-848-4311, Telex: 51-3435, TWX: 510-952-7610

SOLITRON/MICROWAVE, Box 278, Port Salerno, FL 33492, Tel: 305-287-5000, TWX: 510-953-7500; FSC No.: 95077; Empl.: 300; *Sls. Mgr.:* James J. McCann

SOLTEC CORP., 11684 Pendelton St., Sun Valley, CA 91352, Tel: 818-767-0044, 800-423-2344, Telex: 494-3094; Empl.: 46; *Sls. Mgr.:* Gary A. Purser

SONIC INTERNATIONAL CORP., 2515 N.E. Riverside, Portland, OR 97211, Tel: 503-665-0187, Telex: 36-0325; Empl.: 130

Sonnenschein

SONNENSCHEIN BATTERIES INC., 300 E. Johnson Ave., P.O. Box 339, Cheshire, CT 06410, Tel: 203-271-0091, Telex: 510-100-7052; *Sls. Mgr.:* R. J. McCarthy ..... **D•1438**

Local Sales Offices & Reps

AL Huntsville, Raycom, Inc. 205-859-2017
CA Anaheim, Impact Elctrns. 714-533-1351
CO Golden, J. F. Hurlbut Co. 303-279-7796
CT Manchester, G/M Assocs. 203-646-4443
IL Park Ridge, Metcom Assocs. Corp. 312-696-1490
MA Framingham, G/M Assocs. 617-872-4871
MI Southfield, R. C. Merchant & Co. 313-354-4300
MI St. Joseph, R. C. Merchant & Co. 616-983-7378
NH Exeter, G/M Assocs. 603-778-7472
NC Raleigh, Raycom, Inc. 919-847-8276
TX Austin, Delta Comps. 512-458-4288
TX Seagoville, Delta Comps. 214-287-6333
WA Portland, Harry Levinson Co. 503-245-1902
WA Seattle, Harry Levinson Co. 206-382-1300
WI West Allis, Metcom Assocs. Corp. 414-476-1300

SONICOR INSTRUMENT CORP., 1365 Marconi Blvd., Copiague, NY 11726, Tel: 516-842-3344, Telex: 649494; FSC No.: 31605; *Sls. Mgr.:* Arthur Liers; *Dist. Mgr.:* Arthur Liers

SONOBOND, 200 E. Rosedale Ave., West Chester, PA 19380, Tel: 215-696-4710, Telex: 834511; Empl.: 50; *Sls. Mgr.:* John Harper

SONY CORP. OF AMERICA, Component Prods. Div., 15 Essex Road, Paramus, NJ 07652, Tel: 201-368-5000

SORENSEN CO., 676 E. Island Pond Rd., Manchester, NH 03103, Tel: 603-668-4500, Telex: 94-3459, TWX: 710-220-1339; Empl.: 850; *Sls. Mgr.:* Roy Allman

SORENSON LIGHTED CONTROLS, 75 Locust St., Hartford, CT 06114, Tel: 203-527-3092, TWX: 710-425-4093; Empl.: 100; *Sls. Mgr.:* Tom D'Allesantro ..... **B•1102-1103**

Local Sales Offices & Reps

CA Anaheim, Galaxie Sls. 714-752-1580
CA Mt. View, Del Bucchia & Assoc. 415-965-8045
CT Hartford, Atlantic Switch Co. 203-527-7705
FL Lakeland, Switch Controls 813-644-7564
IL Wheaton, Chadra-Schilke 312-653-8126
IN Fort Wayne, Menze Sls. 219-747-5616
MA Canton, Comtek Assoc. 617-828-2948
MI Birmingham, Favco 313-644-0173
MN Edina, Monroe/Hanna 612-566-1324
MO Clayton, Mertens Co. 314-993-6600
NY Great Neck, Pacent Eng. Co. 516-482-4678
NC Raleigh, Rick Hadley 919-362-4099
TX Dallas, Texaswitch 214-357-1768

Local Distributors

CA Los Angeles, Electric Switches 213-660-1310
CA Tustin, Western Switches 714-731-4333
CA Van Nuys, Pacific Switch Controls 213-873-4802
CT Hartford, Atlantic Switch Controls 203-527-7705
FL Lakeland, Switch Controls 813-644-7564
GA Augusta, Dixie Elctrns. 404-722-2055
IL Wheaton, Conectrix 312-653-1460
MI St. Clair Shores, Specialties Mfg. 313-771-2700
MN Minneapolis, Carl Berquist 612-835-2322
NJ Mt. Laurel, Jersey Switch 609-778-8190
NY Woodside, Switches Unltd. 212-478-5000
NC Charlotte, Dixie Elctrns. 704-377-5413
OH Columbus, Ohio Switch 614-885-0319
SC Columbia, Dixie Elctrns. 803-779-5332
TX Dallas, Texaswitch 214-357-1768
WA Seattle, Evergreen Mktg. 206-633-3160
EXP NJ, Ft. Lee, Joseph Gross 201-944-3609

SOSHIN ELEC. CO., 1-18-18 Nakamagome, Ota-Ku, Tokyo, Japan, Tel: (03) 775-2111, Telex: 246-6377; Empl.: 800; *Sls. Mgr.:* N. Hiraide, Exp. & Imp. Dept.

SOUNDCOAT CO., INC., 1 Burt Dr., Deer Park, NY 11729, Tel: 516-242-2200, Telex: 12-5514; *Sls. Mgr.:* Mr. Carl Wolaver

SOUNDLIER, American Trading & Prod. Corp., 9380 Watson Ind'l. Pk., St. Louis, MO 63126, Tel: 314-962-9870, Telex: 910-760-1650; Empl.: 350; *Sls. Mgr.:* Paul Grote; *Dist. Mgr.:* Tony Dalba

SOURIAU, INC., 25158 Avenue Stanford, Valencia, CA 91355, Tel: 805-257-4830, Telex: 4720328, TWX: 910-336-1553; Empl.: 70; *Sls. Mgr.:* Richard Monstein; *Dist. Mgr.:* Alan Rubin

SOUTH AMERICAN DEV. CORP., Rte. 9, G.R.D. Box 413, Hyde Park, NY 12538, Tel: 914-229-8866, Telex: 4990035; Empl.: 80; *Sls. Mgr.:* L. Faber

SOUTHCO, INC., 210 N. Brinton Lake Rd., Concordville, PA 19331, Tel: 215-459-4000, Telex: 83-1485, TWX: 710-760-1715; *Sls. Mgr.:* R. W. Dougherty

SOUTHERN COMPUTER CORP., 3720 N. Stratford Rd. N.E., Atlanta, GA 30342, Tel: 404-231-5363, Telex: 317867; *Sls. Mgr.:* Redd N. Mann; *Dist. Mgr.:* Robert Morris

SOUTHERN ELECTRONICS, F-Dyne, 726 So. Flower St., Burbank, CA 91502, Tel: 213-845-2458, TWX: 910-498-5707; Empl.: 100; *Sls. Mgr.:* Ron Head

SOUTH SHORE METAL PRODS., 88 E Allen Blvd, Farmingdale, NY 11735, Tel: 516-249-3322; Empl.: 30; *Sls. Mgr.:* A. G. Bauer

SOUTHWEST TECH PRODS CORP., 219 W. Rhapsody, San Antonio, TX 78216, Tel: 512-344-0242; Empl.: 34

SPACE ELECTRONICS, INC., Box 2166, Meriden, CT 06450, Tel: 203-235-7755; Empl.: 16; *Sls. Mgr.:* Richard Boynton

SPACE POWER ELCTRNS., Jeffrey Lane, RD 1, Glen Gardner, NJ 08826, Tel: 201-537-2184

SP America, Inc.

SP AMERICA INC., Shin-Etsu Polymer, 1181 N. 4th St., San Jose, CA 95112, Tel: 408-947-0311, TWX: 910-338-2229; *Sls. Mgr.:* R. L. Bucholtz ..... **B•1739; C•1510-1511**

Local Sales Offices & Reps

FL	Ft. Lauderdale, Tek-Rep	305-793-5334
GA	Atlanta, Tek-Rep Mktg.	404-963-1600
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
KY	Louisville, Technlg. Mktg. Corp.	502-499-7808
MA	Needham, Ray Perron & Co.	617-695-6179
MI	Plymouth, Jay Mktg. Assoc.	313-459-1200
PA	Broomall, TCA Assoc.	215-353-2022
TX	Dallas, TL Mktg.	214-357-1752

SPANTA, INC., Box 193, Franklin Lakes, NJ 07417, Tel: 201-337-0044, Telex: 13-6011; Empl.: 10; *Sls. Mgr.:* W. Phifer; *Dist. Mgr.:* W. Phifer

SPARKOMATIC, Rte. 6 & 209, Milford, PA 18337, Tel: 717-296-6444, TWX: 510-260-2682; Empl.: 300; *Sls. Mgr.:* Robert Schuler

SPATIAL DATA SYSTEMS, A DBA Systems Co., 508 S. Fairview, Goleta, CA 93117, Tel: 805-967-2383, Telex: 658-336; Empl.: 30; *Dist. Mgr.:* S. Schlosser

SPECIALIZED ELCTRN. MAGNETIC PRODS., INC., 272 Loudon Ridge Rd. Route 8, Loudon, NH 03301, Tel: (603) 267-6892; *Sls. Mgr.:* Eugene C. Avery

SPECIALTY CONNECTOR CO., 2620 Endress Place, Greenwood, IN 46142, Tel: 317-535-5353

SPECIALITY ELECTRONICS, INC., 208 E. Rutherford St., Landrum, SC 29356, Tel: 803-457-3824; Empl.: 10; *Sls. Mgr.:* Mary A. Galli

SPECO DIV., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757, Tel: 516-957-8700, 800-645-5516, Telex: 96-7754; Empl.: 33; *Sls. Mgr.:* Mel Hulkower; *Dist. Mgr.:* Stan Hulkower

SPECTRACOM, 101 Despatch Drive, East Rochester, NY 14445, Tel: 716-381-4827, Telex: 9103509587

SPECTRAGRAPHICS CORP., 10260 Sorrento Valley Rd., San Diego, CA 92121, Tel: 619-450-0611; Empl.: 100

SPECTRAL DYNAMICS DIV., Scientific-Atlanta, Box 671, San Diego, CA 92112, Tel: 619-268-7100, TWX: 910-335-2022; Empl.: 600; *Sls. Mgr.:* Robert N. Saunders

SPECTRA LUX CORP., 12840 N.E. 21 St. Pl., Bellevue, WA 98005, Tel: 206-747-0560; FSC No.: 51896; *Sls. Mgr.:* Ron Bustad

Local Sales Offices & Reps

AZ	Tempe, Cantec Sls., Inc.	602-829-0191

SPECTRAN CORP., 50 Hall Road, Sturbridge, MA 01566, Tel: 617-347-2261; FSC No.: 6V569; Empl.: 175

SPECTRAN INSTRUMENTS, INC., Box 891, La Habra, CA 90631, Tel: 213-694-3995

SPECTRA SONICS, 3750 Airport Rd., Ogden, UT 84403, Tel: 801-392-7531; Empl.: 35

SPECTRA-STRIP OPERATIONS, Ampheral Prods., 7100 Lampson Ave., Garden Grove, CA 92642-0415, Tel: 714-892-3361, TWX: 910-596-1314; Empl.: 300

SPECTRO EQUIPMENT, INC., 13821 Progress Pkwy., N. Royalton, OH 44133, Tel: 216-237-8910; Empl.: 25

SPECTROLAB, INC., 12500 Gladstone Ave., Sylmar, CA 91342, Tel: 213-365-4611, TWX: 910-496-1488; Empl.: 250

SPECTROL ELCTRNS., 17070 East Gale Ave., City of Industry, CA 91749, Tel: 818-964-6565, TWX: 910-584-1314; Empl.: 600; *Sls. Mgr.:* R. Shackelford ..... **A•2039-2047**

Local Sales Offices & Reps

AL	Huntsville, Beacon Sls.	205-881-5031
AZ	Phoenix, Thom Luke Sls.	602-941-1901
CA	San Diego, Hadden Assocs.	619-565-9444
CA	Santa Clara, I2	408-988-3400
CA	Westlake Village, Astralonics	818-706-3936
CO	Denver, Spectrum Sls.	303-696-1601
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Clearwater, Beacon Sls.	813-796-2378
FL	Ft. Lauderdale, Beacon Sls.	305-491-1054
IL	Downers Grove, Momak Sls.	312-963-6400
IA	Hiawatha, Gassner & Clark	319-393-5763
KS	Shawnee Mission, Lowell-Kangas	913-631-3515
MD	Baltimore, Component Sls.	301-484-3647
MA	Burlington, Kitchen & Kutchin	617-229-2660
MI	Livonia, Luebbe Sls.	313-477-3131
MN	St. Paul, Murnco	612-484-8200
MO	St. Louis, Lowell-Kangas	314-821-4050
NJ	Haddonfield, Sunday-O'Brien	609-429-4013
NY	Commack, E.R.A.	516-543-0510
NY	Liverpool, Gen Tech	315-451-3480
NY	Syracuse, L Mar	315-437-7779
NC	Raleigh, Beacon Sls.	919-787-0330
OH	Cincinnati, Luebbe Sls.	513-891-5770
OH	Cleveland, Luebbe Sls.	216-333-0425
OH	Columbus, Luebbe Sls.	614-431-0474
OH	Dayton, Luebbe Sls.	513-294-0426
OR	Beaverton, Eclipse Mktg.	503-642-1661
PA	Pittsburgh, R. F. Clark	412-242-9500
TX	Arlington, Pro Comp	817-640-4336
TX	Houston, Pro Comp	713-556-9622
WA	Redmond, Eclipse Mktg.	206-885-6991

SPECTRON CORP., 344 New Albany Rd., Moorestown, NJ 08057, Tel: 609-234-5700, Telex: 83-1488, TWX: 710-897-1359

SPECTRONICS CORP., 956 Brush Hollow Rd., Westbury, NY 11590, Tel: 516-333-4840, TWX: 510-222-5877; Empl.: 125; *Sls. Mgr.:* Henry K. Lee; *Dist. Mgr.:* James J. Weglarz

SPECTRONICS, DIV. HONEYWELL, See Honeywell Optoelctrns.

SPECTRUM CONTROL, INC., 8061 Avonia Rd., Fairview, PA 16415, Tel: 814-474-1571

SPECTRUM CONTROL, INC., 2185 W. 8th St., Erie, PA 16505, Tel: 814-455-0966, TWX: 510-699-6871; FSC No.: 33095;5733; Empl.: 450; *Sls. Mgr.:* R. Greer; *Dist. Mgr.:* C. Pirro ..... **A•1635-1637; C•1513-1517**

Local Sales Offices & Reps

CA	Sunnyvale, Spectrum Control	408-735-9015
CA	Valencia, Spectrum Control	805-257-2280
FL	Melbourne, Spectrum Control	305-724-4900
IL	Elgin, Spectrum Control	312-888-8011
MA	Chelmsford, Spectrum Control	617-458-9079
NJ	Brielle, Spectrum Control	201-528-8420
NJ	Fairfield, Pantronics	201-575-1177
NY	New York, Landseas	212-265-8323
TX	Irving, Spectrum Control	214-251-1669
EXP	PA, Erie, Spectrum Control	814-455-0966

Local Distributors

CA	San Jose, Cypress Elctrns.	408-945-8400
CA	Torrance, Cypress Elctrns.	213-533-6005
FL	Dania, Summit Distrs.	305-920-6253
IL	Chicago, Newark Elctrns.	312-784-5100
NJ	Perth Amboy, Metuchen Capacitors	201-442-0500
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Rochester, Summit Distrs.	716-334-8110
OH	Dayton, Aschbacher	513-252-7785
Intl	Australia, Rifa	03-480 1211
Intl	Denmark, E.V.J. Johanssen Elektronics	01-839022
Intl	Eng., Birmingham, Steatite Insulations	021 454-6961-2
Intl	France, Gentilly, Radio Television Franchise S.A.	664.11.01
Intl	Israel, Tel-Aviv, Landseas, Ltd.	247291-4
Intl	Japan, Tokyo, Stauffer Japan, Ltd.	Tokyo (81) 3239-0661
Intl	Netherlands, Zaandam, Bodamer Intl. BV	075-351521
Intl	Norway, H.C.A. Melbye/AS	02-106050
Intl	S. Africa, Bryanston, Taltronics Pty. Ltd.	618-2014/5
Intl	Sweden, Farsta, Traco AB	08-93-0960
Intl	Switzerland, Ebmatingen, EME, Ernst Egli	01-980-11-11
Intl	W. Germany, Ettlingen, Bodamer GmbH	(07243) 79263
Intl	W. Germany, Hamburg, Bodamer GmbH	(040) 7111091
Intl	W. Germany, Munchen, Bodamer GmbH	(089) 641801

SPECTRUM TECHNOLOGY, INC., 300 Lopez Rd., Goleta, CA 93116, Tel: 805-964-7791, TWX: 910-334-1163; FSC No.: 32464; Empl.: 100; *Sls. Mgr.:* Wm. L. Bishop ..... **A•1438-1439**

Local Sales Offices & Reps

AZ	Tempe, Sedco Sls.	602-835-6281
AZ	Tucson, Sedco Sls.	602-298-1758
CA	San Jose, Frequency Control Assocs.	408-446-0200
CT	Milford, Todino Engrg. Sls.	203-874-6643
FL	Ft. Myers, Rainbow Sls.	813-332-2210
FL	Melbourne, Rainbow Sls.	305-727-3305
IL	Elgin, R.K. Elctrns.	312-695-8552
MA	Needham, Todino Engrg. Sls.	617-444-7925
NJ	Haddonfield, Mesa Tech. Assocs.	609-429-9531
NM	Albuquerque, I.M.E.C.	505-883-9010
NY	Huntington, Compar N.Y.	516-423-5660
OK	Tulsa, Ion Assocs.	918-664-0186
TX	Austin, Ion Assocs.	512-458-2108
TX	Grand Prairie, Ion Assocs.	817-640-8282
TX	Houston, Ion Assocs.	713-461-5311

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High Voltage Electronics Corporation

SPELLMAN HIGH VOLTAGE ELCTRNS. CORP., 7 Fairchild Ave., Plainview, NY 11803, Tel: 516-349-8686, TWX: 510-221-2155; Empl.: 200; *Sls. Mgr.:* Russell E. Posser ..... **D•1840-1842**

Local Sales Offices & Reps

FL	Orlando, Gra-Mar, Inc.	305-894-3351
MA	Concord, Nortech Engrg. Sls.	617-259-0032
MA	Medfield, Nortech Engrg.	617-359-6063
MN	St. Paul, Knox Assocs.	612-488-5402

SPEMCO SWITCHES, 23425 Harper, Box 386, St. Clair Shores, MI 48080, Tel: 800-482-2828; Empl.: 9

SPERRY, A. W., INSTRS., P.O. Box 9300, Smithtown, NY 11787, Tel: 516-231-7050, Telex: 645104; Empl.: 40; *Sls. Mgr.:* Dennis W. Carroll

SPERRY UNIVAC, Mini-Computer Operations, Box C-19504, Irvine, CA 92713, Tel: 714-754-6900, TWX: 910-596-1358; Empl.: 500

SPIRICON, INC., 2600 North Main, Logan, UT 84321, Tel: 801-753-3729; Empl.: 5; *Sls. Mgr.:* Steve Teare

SPLIT BALL BEARING, MPB Corp., Highway 4, Lebanon, NH 03766, Tel: 603-448-3000, TWX: 710-366-1661; *Sls. Mgr.:* Lew Peterson; *Dist. Mgr.:* Jack F. Barker

SPRAGUE ELEC. CO., 481 Marshall St., No. Adams, MA 01247, Tel: 413-664-4411, Telex: 92-6415, TWX: 710-369-1360; FSC No.: 56289; Empl.: 10,500; *Dist. Mgr.:* J. J. Judge

SPRAGUE ELECTRIC COMPANY, Distribution Division, 481 Marshall St., No. Adams, MA 01247, Tel: 413-664-4481, TWX: 710-369-1363; FSC No.: 56289; *Sls. Mgr.:* J. Judge; *Dist. Mgr.:* Lyle Pirnie

SPRAGUE ELEC. CO., Integrated Circuit Div., 115 Northeast Cutoff, Worcester, MA 01606, Tel: 617-853-5000, TWX: 710-340-6304; FSC No.: 56289; Empl.: 700

SPRAGUE-GOODMAN ELCTRNS., INC., 134 Fulton Ave., Garden City Pk., NY 11040, Tel: 516-746-1385, Telex: 14-4533; FSC No.: 52769; Empl.: 80; *Sls. Mgr.:* David Taub; *Dist. Mgr.:* David Taub ..... **A•1173**

Local Sales Offices & Reps

AZ	Phoenix, Sanford Sls. Assocs.	602-957-3570
CA	Burlingame, W. J. Purdy Co.	415-347-7701
CA	Garden Grove, Megacap	714-891-5176
CA	Garden Grove, National Capacitor	800-854-2451
CA	Los Angeles, R.F. Assocs.	213-478-1586
CA	San Diego, R. D. Miner, Inc.	619-566-9891
CO	Denver, W. J. Purdy Co.	303-753-6800
FL	Pompano Beach, Cole-Tek	305-781-8110
GA	Smyrna, Spartech	404-446-7300
IL	Chicago, B.N.I. Elctrns.	312-775-1717
IN	Ft. Wayne, Denton Mktg., Inc.	219-627-5515
IA	Marion, M.S.B. Assocs.	319-377-6261
KS	Shawnee Mission, M.S.B. Assocs.	913-432-2131
MD	Pikesville, Imagitron Sls.	301-521-2020
MA	Southboro, KSA of New England	617-485-9432
MI	Southfield, Fred H. Gehrke & Assocs.	313-559-5363
MN	Marion, M.S.B. Assocs., Inc.	319-377-6261
MO	St. Charles, M.S.B. Assocs.	314-946-5577
NJ	Wayne, Richman Salesco - Kagan	201-694-1115
NY	Commack, Richman Salesco	516-543-5532
NY	Utica, Sweetco Assocs.	315-797-6721
OH	Cincinnati, Stegman Blaine Mktg.	513-729-1969
TX	Austin, Delta Comps.	512-458-4288
TX	Seagoville, Delta Comps.	214-287-6333
WA	Seattle, Sprague Elec. Co.	206-632-7761
WA	Vancouver, Sprague Elec. Co.	206-892-0361

Local Distributors

CA	Garden Grove, National Capacitor	714-891-5179
CA	Santa Ana, Projections Unlimited	714-641-1472
MA	Burlington, T.L.C.	617-273-0140
MA	Needham, Cronin Elctrns.	617-449-5000
NY	Lynbrook, Varitech Elctrns.	516-593-9300
PA	State College, ALVO Elctrns.	814-238-0505
TX	Addison, Captronics	214-980-0123
TX	Garland, J & S Elctrns.	214-487-8808
WA	Seattle, KAM Elctrns.	206-382-1300

SPRINGFIELD MOULDERS, INC., See ITT Thermotech

SPRUCE PINE MICA CO., Mtn. Laurel Dr., Spruce Pine, NC 28777, Tel: 704-765-4241; Empl.: 45; *Sls. Mgr.:* Hugh M. Wiseman

SPS SOFTWARE PRODUCTS & SERVICES, INC., 14 E. 38th Street, 14th Fl., New York, NY 10016, Tel: 212-686-3790, Telex: 852616; *Sls. Mgr.:* Dr. Alex Rainer

SPUR PRODUCTS CORP., 13649 Beach Ave., Marina Del Rey, CA 90292, Tel: 213-822-7100; Empl.: 12; *Sls. Mgr.:* Ray Lorenz

SQUARE D CO., Executive Plaza, Palatine, IL 60067, Tel: 312-397-2600, Telex: 255274; Empl.: 21100; *Sls. Mgr.:* R. M. O'Neal; *Dist. Mgr.:* T. W. Wilbor

SR ENGINEERING, INC., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643, Tel: 714-554-4200, Telex: 364412INTR-871; FSC No.: 21441; *Sls. Mgr.:* Coleman W. Conrad

S S A C, Box 395, Liverpool, NY 13088, Tel: 315-622-1000, Telex: 646221, TWX: SSAC LIPL; FSC No.: 16-0985719; Empl.: 220; *Sls. Mgr.:* G. Weeks

STACKBIN CORP., Albion Road, Lincoln, RI 02865, Tel: 401-333-1600; Empl.: 75; *Sls. Mgr.:* J. J. Patterson

STACKPOLE (THE STACKPOLE CORP.), Stackpole St., St. Marys, PA 15857, Tel: 814-781-1234, Telex: 914-514, TWX: 510-693-4511; FSC No.: 78488

STACKPOLE, CARBON DIV., 201 Stackpole St., St. Marys, PA 15857, Tel: 814-781-1234, Telex: 914-514, TWX: 510-693-4511; *Sls. Mgr.:* T. M. Eynon; *Dist. Mgr.:* B. E. Speedy

STACKPOLE, ELECTRONIC COMPONENTS DIV., 201 Stackpole St., St. Marys, PA 15857, Tel: 814-781-1234, Telex: 914-514, TWX: 510-693-4511; *Sls. Mgr.:* Ronald E. Braund

STACKPOLE, MAGNET DIV., 700 Elk Ave., Kane, PA 16735, Tel: 814-837-7000, TWX: 510-695-8360; *Sls. Mgr.:* V. D. Venigni

STACO, INC., See Staco Transpower

STACO ENERGY PRODS. CO., 301 Gaddis Blvd., Dayton, OH 45403, Tel: 513-253-1191, Telex: 288-032, TWX: 810-459-1798; FSC No.: 83008; Empl.: 146; *Sls. Mgr.:* Robert Simpson

STACOSWITCH, 1139 Baker St., Costa Mesa, CA 92626, Tel: 714-549-3041, TWX: 910-595-1507; FSC No.: 12522;Multiple; Empl.: 100; *Sls. Mgr.:* D. Sugg

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg., Inc.	205-533-9281
CA	Los Altos, Recht Assocs.	415-964-6321
CO	Golden, J. F. Hurlbut Co.	303-279-7796
CT	Marion, Sands Co.	203-628-4363
FL	Orlando, EMA, Inc.	305-671-6800
GA	Stone Mountain, 20th Century Mktg., Inc.	404-292-7088
IL	Oak Brook, MSL Assocs.	312-655-8977
IN	Richmond, EMA, Inc.	513-433-2800
IA	Cedar Rapids, H. R. Brown Sls.	319-366-0635
KS	Kansas City, B-C Elctrn. Sls.	913-342-1211
MD	Silversprings, Youth & Nelson	301-598-5740
MA	Woburn, Sands Co.	617-935-7495
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
MO	St. Louis, B-C Elctrn. Sls.	314-731-1255
NJ	Wayne, G.T. Assocs.	201-694-6040
NY	Syracuse, Lenard Co.	315-479-9191
OH	Cleveland, C.A. Robinson Co.	216-381-9049
OH	Dayton, C.A. Robinson	513-278-7969
OR	Portland, Frank Jackson Assocs.	503-292-2638
PA	Media, W. Reeves Assocs.	215-566-6709
TN	Knoxville, 20th Century Mktg., Inc.	615-690-1618
TX	Austin, Delta Comps.	512-458-4288
TX	Dallas, Delta Comp.	214-358-4288
TX	Houston, Delta Comps.	713-664-6777
UT	Salt Lake City, J. F. Hurlbut Co.	801-973-4443
WA	Redmond, Frank Jackson Assocs.	206-881-7277

STACO TRANSPOWER

STACO TRANSPOWER, 301 Gaddis Blvd., Dayton, OH 45403, Tel: 513-253-1191, Telex: 288-032, TWX: 810-459-1798; FSC No.: 83008; Empl.: 100; *Sls. Mgr.:* T. D. McNulty ..... **A•2288**

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
AZ	Scottsdale, Power Specialists	602-996-4100
CA	Buena Park, Chuck Cooper Co.	714-739-8526
CA	Los Altos, Frauman Assoc.	415-941-0660
CT	Natick, Benchmark Assoc.	617-899-3390
FL	Tampa, J R Controls	813-961-9478
GA	Atlanta, Remco	404-447-6937
IA	Cedar Rapids, Di-tronix, Inc.	319-377-8275
KY	Cinci, Tri-State Mktg.	513-761-7993
MA	Natick, Benchmark Assocs.	617-655-9333
MI	Southfield, Fred Gehrke & Assocs.	313-559-5363
MN	Arlington Hgts., Diethert-Angel	312-593-7600
MN	Minneapolis, Diethert Angel	612-546-6099
MO	Kansas City, Di-tronix, Inc.	816-356-6340
MO	St. Louis, Di-tronix, Inc.	314-291-4777
NJ	King of Prussia, Freeman-Malta Assoc.	215-337-9211
NJ	Mountain Lakes, Levison Sls. Co. Inc.	201-334-2921
NC	Raleigh, Remco	919-847-5079
OH	Cleveland, Marlow Assocs.	216-991-6500
OH	Columbus, Marlow Assocs.	614-885-7643
PA	Pittsburgh, Marlow Assocs.	412-367-8886
TX	Richardson, Jim D. Gray & Assocs.	214-699-9976
WI	Menomonee Falls, Walter M. Braun & Assocs.	414-251-8685

STAFFALL INC., 7 Woodland St., Providence, RI 02908, Tel: 401-351-8282, TWX: 710-381-6964; Empl.: 25

STAINLESS, INC., 3rd St., N. Wales, PA 19454, Tel: 215-699-4871, TWX: 510-661-8097; Empl.: 80; *Sls. Mgr.:* Jess C. Rodriguez

STANCOR/HAMILTON STANDARD CONTROLS, 131 Godfrey St., Logansport, IN 46947, Tel: 219-722-2244, TWX: 810-295-0699; FSC No.: 80089; *Sls. Mgr.:* Hubert Daubs ..... **A•2289-2297; B•1447**

STANDARD CONDENSER CORP., 1065 W. Addison St., Chicago, IL 60613, Tel: 312-327-5440; FSC No.: 97419; *Sls. Mgr.:* B. P. McLean

STANDARD ENERGY, Div. WBH Scientific, Inc., Rte. 32, Greenville, NY 12083, Tel: 518-966-4197, Telex: 754180; *Sls. Mgr.:* Gary Hanington ..... **D•1844-1845**

Local Sales Offices & Reps

CT	Cheshire, Meco Co.	203-271-0026
TX	Dallas, P.J. Scanlon Co.	214-231-4661

STANDARD ENGRG., 44800 Industrial Dr., Fremont, CA 94538, Tel: 415-657-7555, TWX: 910-381-6048; Empl.: 40

STANDARD ENVIRONMENTAL SYSTEMS, INC., 383 Minnisink Rd., Totowa, NJ 07512, Tel: 201-256-2200, TWX: 710-988-5722; Empl.: 50

STANDARD GRIGSBY, INC., Gordos International Corp., 920 Rathbone Ave., Aurora, IL 60507, Tel: 312-844-4300, TWX: 910-232-3138; Empl.: 350; *Sls. Mgr.:* Lou Falco; *Dist. Mgr.:* Ed Barry ..... **B•1568-1570**

Local Sales Offices & Reps

AZ	Tempe, Gassner & Clarke Co.	602-968-9037
CA	Laguna Hills, Jack Fitch & Assocs.	714-951-0196
CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
NJ	Mountain Lakes, Components for Elctrns.	201-334-2921
NC	Peachland, D. P. McDonald	704-272-8747
CT	East Haven, Eagle Assocs.	203-467-6542
FL	Casselberry, Southern Elctrn. Mktg.	305-831-2822
IN	Indianapolis, Wilson Tech. Sls.	317-298-3345
IA	Marion, Rep Assocs.	319-373-0152
KS	Parker, S. W. Wollard	918-898-6552
LA	Hammond, Design Mktg.	504-294-3076
MI	Ann Arbor, R. L. Rowe & Assocs.	313-995-8711
MI	Livonia, Luebbe Sls.	313-477-3131
MN	Bloomington, Murnco	612-854-4161
NY	East Northport, Comps. for Elctrncs.	516-266-5020
OH	Cincinnati, Luebbe Sls.	513-891-5770
OK	Tulsa, Design Mktg.	918-622-7744
OR	Aloha, Micro Sls.	513-642-1818
PA	Pittsburgh, Luebbe Sls.	412-931-0414
TX	Dallas, Design Mktg.	214-680-9767
WA	Bellevue, Micro Sls.	206-451-0568

Refer to Gordos Corporation, Bloomfield, New Jersey for Authorized Distributor information.

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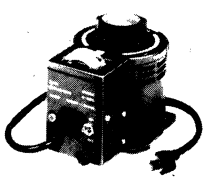

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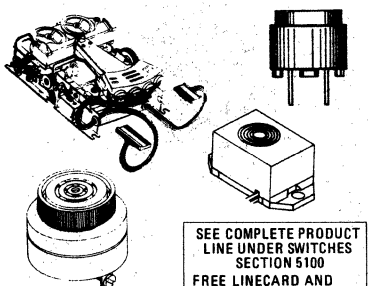

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STANDARD LOGIC, 2215 S. Standard Ave., Santa Ana, CA 92707, Tel: 714-979-4770, TWX: 910-595-1707; Empl.: 150; *Sls. Mgr.:* B. L. Billington

STANDARD MICROSYSTEMS, 35 Marcus Blvd., Hauppauge, NY 11788, Tel: 516-273-3100, TWX: 510-227-8898; FSC No.: 53848; Empl.: 700; *Sls. Mgr.:* J. P. Chalmin; *Dist. Mgr.:* Steve Brander

STANDARD PNEUMATIC MOTOR, Box 10530, Reno, NV 89510, Tel: 702-329-6311, TWX: 910-935-6031; FSC No.: 53623; Empl.: 125

STANDARD POWER, INC., 1400 S. Village Way, Santa Ana, CA 92705, Tel: 714-558-8512, TWX: 910-595-1760; *Sls. Mgr.:* Sydele M. Petch; *Dist. Mgr.:* Sydele M. Petch

STANDARD WIRE & CABLE CO., 2345 Alaska Ave., El Segundo, CA 90245, Tel: 213-536-0006, Telex: 65-3423, TWX: 910-340-6758; FSC No.: 04946; Empl.: 125; *Sls. Mgr.:* J. Gaither; *Dist. Mgr.:* Jerry Gaither

STANDEX ELCTRNS., 4538 Camberwell Rd., Cincinnati, OH 45209, Tel: 513-871-3777, Telex: 212066; Empl.: 1,039; *Sls. Mgr.:* Charles C. Johnson ..... **A•1638-1639; B•1448**

Local Sales Offices & Reps

AL	Hunstville, Rob Radkley/Mitscher Co.	205-882-6050
CA	Los Altos, Frauman Assocs.	415-941-0660
CA	Los Angeles, Ellard Strassner Co.	818-242-8823
FL	Altamonte Springs, Jack Alexander/Mitscher Co.	305-788-6844
GA	Lawrenceville, Tom Hill/Mitscher Co.	404-923-3239
IL	Arlington Hts, Brainard-Wilson Mktg.	312-437-2700
IN	Brownsburg, William Deem	317-852-8006
IA	W. Des Moines, Jerry Skinner/Nevco	515-225-9866
MA	Southboro, KSA of New England	617-485-9432
MI	Farmington Hills, WR Hummon	313-474-0661
MN	Bloomington, Quantum Sls.	612-884-4700
MO	N.Kansas City, Nevco, Inc.	816-421-1751
NY	Buffalo, RW Mitscher	716-633-7970
NY	Jamaica, S-J Sls.	718-291-3232
NY	Rochester, Jim Baker/Mitscher Co.	716-227-0839
NY	Utica, Doug Hendrick/Mitscher Co.	315-733-0171
NC	Raleigh, RW Mitscher Co.	919-848-0941
OH	Cincinnati, Standex	513-871-3777
OH	Dayton, JC Hofstetter	513-296-1010
OR	Portland, Components Tech.	503-292-1518
PA	Wynnewood, Metz-Benham Assoc.	215-896-7300
TN	Johnson City, Peg Pickens/Mitscher Co.	615-929-7258
TX	Arlington, Hite Electonic Sls.	817-265-2912
VA	Midlothian, Jeff Ward/Mitscher Co.	804-744-4676
WI	Waukesha, Brainard-Wilson Mktg.	414-797-7940
Can	Oakville, Anbak Sls.	416-842-6630

Local Distributors

CA	San Carlos, Logan Electrn. Supp.	415-594-0700
CA	Santa Ana, Norstan Elctrns. Inc.	714-250-4903
CT	North Haven, Elm State Elctrns. Inc	800-243-0049
IL	Crystal Lake, Sub-Sem, Inc.	815-459-4139
MA	Westford, Electronic Specialties	617-486-8495
NJ	Nutly, Vantage Comp.	201-667-1840
SC	Florence, Anco Elctrns.	803-669-3956

STANFORD APPLIED ENGRG. INC., 3520 De La Cruz Blvd., Santa Clara, CA 95050, Tel: 400-988-0700, Telex: 4990877; Empl.: 500; *Sls. Mgr.:* Dick Hudspeth/Dick Foley/Iver Sonderby; *Dist. Mgr.:* Dick Hudspeth

Local Sales Offices & Reps

Filter/Power Devices

CA	San Diego, Stanford Applied Engrg.	619-569-6959
NY	Nelville, Stanford Applied Engrg.	516-420-8027

Interconnections & Packaging

CA	Santa Clara, Stanford Applied Engrg.	408-988-0700
CO	Boulder, Stanford Applied Engrg.	303-530-1900
CT	Farmington, Stanford Applied Engrg.	203-677-6046

STANFORD TELECOMMUNICATIONS, INC., 2421 Mission College Blvd., Santa Clara, CA 95054, Tel: 408-748-1010, TWX: 910-339-9531; FSC No.: 61362; Empl.: 300 +; *Sls. Mgr.:* J. A. Kirby

STANLEY/AC INTERFACE, 17911 Sampson Lane, Costa Mesa, CA 92647, Tel: 714-841-6090, Telex: 655328; Empl.: 24; *Sls. Mgr.:* R. D. Henwood; *Dist. Mgr.:* Wayne Neal

STANLEY ELCTRNS., INC., 592 Oak St., Copiague, NY 11726, Tel: 516-842-8866; FSC No.: 61544; Empl.: 6; *Sls. Mgr.:* Isabel Goldberg

Local Sales Offices & Reps

CA	Santa Ana, Electrotechnical Sls.	714-546-9305
MD	Baltimore, R. A. Wafer Assocs.	301-744-1133
MN	Edina, J. H. Hanson Co.	612-893-9960
NY	Great Neck, M C S Assocs.	516-487-3966
OH	Dayton, L. D. Bruno Co.	513-434-1847

STANLEY-VIDMAR, Stanley Works, 11 Grammes Rd., Allentown, PA 18103, Tel: 215-797-6600; *Sls. Mgr.:* Ernie Gitlin

STANPAT PRODS., 366 Main St., Port Washington, NY 11050, Tel: 516-883-8400; Empl.: 25

STANTEL COMPONENTS, 636 Remington Rd., Schaumburg, IL 60195, Tel: 312-490-7150, TWX: 910-291-1280

STANTON MAGNETICS, INC., Terminal Dr., Plainview, NY 11803, Tel: 718-445-0063, 516-349-0235, TWX: 510-221-1845; Empl.: 300; *Sls. Mgr.:* Joseph S. Woodstock

STANTRON

STANTRON DIV., 6900 Beck Ave., N. Hollywood, CA 91605, Tel: 818-875-0800, TWX: 910-499-2177; FSC No.: 06514; Empl.: 125; *Sls. Mgr.:* G. A. Tessier ..... **C•1083**

Local Sales Offices & Reps

	Bradenton	813-792-7899
AZ	Phoenix, Shefler-Kahn Co.	602-257-9015
AZ	Tucson, Shefler/Kahn Co.	602-293-7181
CA	Los Angeles, Landa/Minyard	213-879-0770
CA	Pleasanton, Moulthrop Sls.	415-463-0450
CA	San Diego, Landal Minyard	619-942-1086
CA	Santa Ana, Landal Minyard	714-543-7805
CO	Golden, J. F. Hurlbut Co.	303-279-7796
CT	Farmington, Ray Perron & Co.	203-673-4825
CT	New Melford, Ray Perron & Co.	203-355-0082
GA	Jonesboro, Wallace Elctrn. Sls.	800-334-3578
HI	Honolulu, J.C. Elctrns.	808-841-5526
IL	Chicago, Berndt Assocs.	312-283-0713
IN	Carmel, Berndt Assocs.	317-844-0114
MA	Needham, Ray Perron & Co.	617-449-6162, 800-225-4280
MN	Minneapolis, Berndt Assocs.	612-546-2021
MS	Hazelwood, Stone & Assocs.	314-895-4565
NH	Dover, Ray Perron & Co.	603-742-2321
NJ	Pennsauken, Sci-Rep	609-662-5222
NJ	Wayne, G.T. Assocs.	201-694-6040
NM	Albuquerque, Shefler-Kahn Co.	505-265-7049
NY	Rochester, Gislason Sls.	716-328-7400
NC	Kernersville, Wallace Elctrn. Sls.	919-996-2742
OH	Cincinnati, Kenneth C Hoffman Jr., Co.	513-931-1686
OR	Beaverton, Don Smith Sls.	503-643-8020
TX	Austin, Barry Sls.	512-837-3616
TX	Houston, Barry Sls. Co.	713-784-5860
TX	Richardson, Barry Sls. Co.	214-234-0255
VA	Fairfax, Sci-Rep	703-385-0600
WA	Seattle, D. Smith Sls.	206-633-3160

STAR-KITS, P.O. Box 209, Mt. Kisco, NY 10549, Tel: 914-241-0287

star micronics·inc
COMPONENTS DIVISION

STAR MICRONICS, INC., Components Div., 70-D Ethel Rd. W., Piscataway, NJ 08854, Tel: 201-572-9512; Empl.: 120; *Sls. Mgr.:* R. Messer .. **D•1040-1044, 1072**

Local Sales Offices & Reps

AL	Huntsville, REMCO	205-533-3763
AZ	Phoenix, MacDonald Assocs.	602-998-1848
CA	Fullerton, Groh Assocs.	714-738-7105
CA	San Diego, Groh Assocs.	619-696-0054
CA	San Jose, G. R. McKnight Co.	408-942-0880
CO	Englewood, Martec Assocs.	303-741-2704
FL	Casselberry, Southern Elctrn. Mktg.	305-831-2822
FL	Ft. Lauderdale, Southern Elec. Mktg.	305-475-3686
GA	Atlanta, REMCO	404-447-6937
IL	Elk Grove Village, Parcom, Inc.	312-338-6360

IN Indianapolis, Midstates Mktg. 317-639-9999
IA Cedar Rapids, Elctrn. Innovators 319-362-2217
KS Shawnee Mission, Microtronics 913-262-1444
MD Baltimore, Adcour 301-521-3536
MA Sharon, Adcour 617-784-8123
MI Southfield, Component Assocs. 313-557-3232
MN Eden Prairie, Elctrn. Innovators 612-941-0830
MO St. Charles, Microtronics, Inc. 314-946-8500
NJ Sparta, Instr. & Equip. 201-729-4293
NY Rockaway Park, Metropolitan Sls. 718-634-3100
NC Greensboro, Magaro & Assocs. 919-294-4783
OH Bedford, A.S.A. Assocs. 216-662-6080
OR Portland, Controltek Sls. 503-641-0877
TX Houston, Repmaster-Houston 713-692-8204
TX Richardson, McCoy Assocs. 214-238-1017
UT Bountiful, Martec Assocs. 801-298-9341
WA Seattle, Controltek 206-467-0622
WV Spokane, Controltek 509-922-2971
Can Markham, Lenbrook 416-477-7722
Can Calgary, Alberta, Lenbrook 403-252-3577

Local Distributors

CA Costa Mesa, Marvac 714-540-3280
CA Hayward, Kea Elec., Inc. 415-887-2900
CA Los Angeles, Elect. Switches 213-660-1301
CA San Diego, Tauber Elctrns. 619-274-7242
CA Santa Clara, Waltronics Sls. 408-727-1200
FL Davie, Arco Dist., Inc. 305-473-2550
IL Chicago, NEP Elctrns. 312-625-8400
IL Wheeling, Hawk Elctrns. 312-459-4030
MA Sharon, Adcour 617-784-8123
MI Brighton, AP Sls. Co. 313-229-6550
MI Grand Rapids, S. F. Elec. Supp., Inc. ... 616-459-0126
NJ Sparta, Instr. & Equip. 201-447-3525
NJ Sparta, Instrument & Equip. 201-729-4293
NJ Waldwick, Production Supp. & Equip. 201-447-3525
NY Rockaway Park, Metropolitan Sls. 212-634-3100
OH Cincinnati, United Radio Inc. 513-761-4030
OR Portland, United Radio Supp. 503-233-7151
TX Channelview, R. T. Henry Elctrns. 713-452-4451
TX Dallas, Foxfire 214-353-9543
TX Dallas, Wholesale Elec. Supp. 214-824-3001
TX Houston, Copper Alarm Supp. Co. 713-868-1794
WI New Berlin, NEP Elctrns. 414-785-9100
Can Markham, Ont., Lenbrook Elctrns. 416-477-7722

STAR PORCELAIN, 71 Muirhead Ave., Trenton, NJ 08638, Tel: 609-392-3154; Empl.: 100; *Sls. Mgr.:* Art Hobson

STAR-TRON CORP., 58 Curtis St., Providence, RI 02909, Tel: 401-274-5090, Telex: 929490; FSC No.: 32494; Empl.: 50; *Sls. Mgr.:* Anna Coski

STATEK

STATEK CORP., 512 N. Main St., Orange, CA 92668, Tel: 714-639-7810, Telex: 67-8394, TWX: 910-593-1355; FSC No.: 51791; Empl.: 100; *Sls. Mgr.:* J. Ownby ..... **A•1441-1445**

Local Sales Offices & Reps

AL Huntsville, MacKay Smith & Assocs. .. 205-539-8000
AZ Phoenix, Eltron 602-266-2164
CA El Toro, Martronix 714-858-0632
CA Mountain View, Weseloh/Swanson & Assocs. 415-961-0565
CA San Diego, Mesa Engrg. & Sls. Assocs. 619-278-8021
CO Denver, Elcom 303-337-2300
FL Madeira Beach, MacKay, Smith & Assocs. 813-393-7144
FL Orlando, MacKay, Smith & Assocs. ... 305-423-4353
GA Norcross, MacKay, Smith & Assocs. .. 404-449-7444
IL Northbrook, Raines & Assocs. 312-498-0890
IN Fort Wayne, M/S Sls. & Assocs. 219-436-3023
IN Indianapolis, M/S Sls. & Assocs. 317-257-8916
KS Overland Park, Thomas L. Dowell & Assocs. 913-648-7373
MD Columbia, Professional Reps. 301-992-7460
MA Woburn, Radian Assocs. 617-933-7386
MO St. Louis, Thomas L. Dowell & Assocs. 913-648-7373
NJ Bellmawr, TAI Corp. 609-933-2600
NJ Manhasset, Win-Cor Elec. Sls. Corp. .. 516-627-9474
NY Syracuse, PI' Tronics 315-455-7346
NC Charlotte, MacKay, Smith & Assocs. .. 704-372-1188
NC Raleigh, MacKay, Smith & Assocs. 919-851-5000
TX Austin, Norcom 512-451-2757
TX Dallas, Norcom 214-386-4888
TX Houston, Norcom 713-778-0392
UT Salt Lake City, Elcom 801-485-7415
WA Redmond, Halbar Assocs. 206-882-0990
WA Vancouver, Halbar Assocs. 206-696-0170

Local Distributors

AL Huntsville, Contact Elctrns. 205-881-9321
CA Irvine, Ryno Elctrns. 714-261-2500
CA Mountain View, Target Elctrns. 415-961-1170
CA San Diego, Ryno Elctrns. 619-453-8430
FL Longwood, Intertec 305-834-7777
IL Palatine, OHM Elctrns. 312-359-5500
IN Indianapolis, Mar Elctrns., Inc. 317-875-4510
MD Columbia, Aztech Elctrns. 301-995-1760
MA Woburn, First Frequency 617-935-3885
MO St. Louis, Olive Elctrns. 314-426-4500
NY Buffalo, Summit Distrs. 716-884-3450
TX Richardson, Ewing Elctrns., Inc. 214-231-6725

STATE OF THE ART, INC., 2470 Fox Hill Rd., State College, PA 16801, Tel: 814-355-8004 ... **A•1949-1951**

STATIC, INC., Rte. 113 & Mensch Rd., P.O. Box 80, Skippack, PA 19474, Tel: 215-584-9600, Telex: 846079; Empl.: 50; *Sls. Mgr.:* H. L. Cauffman

STAVER CO., INC., 47 Saxon Ave., Bay Shore, NY 11706, Tel: 516-666-8000, TWX: 510-227-6142; Empl.: 140; *Sls. Mgr.:* Arnold Lazarus ..... **B•1105-1107**

Local Sales Offices & Reps

CA Woodland Hill, R. H. McDonald & Assocs. 213-348-3766
IL Lombard, RMP/McBride Corp. 312-932-9090
MA Scituate, Jack Goss 617-545-6327
MI Ann Arbor, Elliott Sls. 313-662-4087
MN St. Louis Park, Lestronix 612-926-8466
NH Hancock, Eisenbeis Sls. 603-357-4892
NY East Northport, Levison Sls. Co. 516-266-5020
NY Manlius, Bowser & Sapecky Assocs. .. 315-682-8885
NC Cary, Tom G. Santel 919-467-7595
OK Tulsa, Jerry Robinson & Assocs. 918-492-0390
OR Beaverton, Quest Mkgt. 503-641-7377
PA Colmar, Eastern Scientific Mktg. 215-822-0157
PA Sewickley, T. H. Stewart Co. 412-741-8665
SC Mauldin, Carl Hart 803-288-2323
TX Houston, Cunningham Co. 713-461-4197
VA Portsmouth, F.B.D. Sls. 804-484-3162
WA Bellevue, Quest Mkgt. 206-747-9424

STD MICROSYSTEMS, 399 Sherman Ave., Palo Alto, CA 94306, Tel: 415-327-6800; *Sls. Mgr.:* Gary Whittaker; *Dist. Mgr.:* Gary Whittaker

STENNING INSTRMENTS, INC., 671 Enchanted Way, Pacific Palisades, CA 90272, Tel: 213-459-2930; *Sls. Mgr.:* Charles Stenning

STEP ENGINEERING, P.O. Box 61166, Sunnyvale, CA 94088, Tel: 408-733-7837, TWX: 910-339-9506; Empl.: 30; *Sls. Mgr.:* Stan Trumbull

STERLING INSTR., Div. Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040, Tel: 516-328-3300, TWX: 510-223-0642; Empl.: 150

STERLING TRANSFORMER CORP., 510 Driggs Ave., Brooklyn, NY 11211, Tel: 718-782-4200; FSC No.: 97102; Empl.: 45; *Sls. Mgr.:* P. H. Odessey ..... **A•2299-2303**

STETTNER ELCTRNS., 6135 Airways Blvd., Chattanooga, TN 37421, Tel: 615-892-0291, TWX: 810-573-5224; FSC No.: 52763; *Sls. Mgr.:* Ralph S. Souders ..... **A•1175**

Local Sales Offices & Reps

AZ Scottsdale, Western High Tech. Mktg. 602-949-0873
CA Cupertino, F & F Assocs., Inc. 408-446-2349
CA San Marcos, Stettner California, Inc. ... 619-471-0124
CO Aurora, Mountain View Mktg. 303-360-9641
CT Ridgefield, Phoenix Sls. Co. 203-438-9644
FL Orlando, Stettner Elctrns.-Florida 305-291-7756
IL Rosemont, Stettner Central, Inc. 312-671-4208
IN Fort Wayne, J & B Engrg. Sls. 219-483-2813
MA Stow, Today Comp. Sls. Corp. 617-897-7500
MO Kansas City, Delltron Co., Inc. 816-436-6445
MO St. Louis, Delltron Co., Inc. 314-769-4779
NJ Englewood, Sprung & Nussbaum, Inc. 201-569-5666
NJ Medford, Champion Elctrn. Sls. Co. 609-983-0932
NM Albuquerque, Western High Technlg. Mktg. 505-262-2461
NY Cazenovia, S.T. Woolard Co. 315-655-8145
OR Beaverton, Luscombe Engrg. Co., NW 503-636-6664
TN Chattanooga, Stettner Elctrn Sls. 615-892-0291
TX Richardson, Lelko-Paulsen Sls. Co. ... 213-680-9588
UT Murray, Mountain View Mktg. 801-264-8488
Can Concord, Ont., Stettner Canada, LTD. 416-661-5190

Local Distributors

AZ Phoenix, Arizona Comps. 602-269-5655
CA Garden Grove, National Capacitor Corp. 213-598-9611
CA San Jose, Capacitors Comps. 408-946-7676
CA San Marcos, California Comps. 619-471-0123
CA Sunnyvale, Capsco Sls., Inc. 408-734-3020
CA West Covina, Component Svc., Inc. ... 818-960-4761
CO Englewood, Industrial Elctrns., Inc. 303-694-9444
FL Orlando, South-East Comps. 305-298-0321
IL Rosemont, Central Comps. 312-671-4787
MO St. Louis, RIC-Tronics 314-576-9816
NJ Garfield, B & R Elctrns., Inc. 201-825-1304
NJ Rockaway, Tonar Inds., Inc. 201-586-9000
NY Lynbrook, Varitech Elctrns. 516-593-9300
NY Rochester, Masline Elctrns. 716-546-5373
PA Norristown, Century Elctrn.-Comps., Inc. 215-631-5400
PA York, Electronic Comps. for Inds. 717-843-8971
TX McKinney, Prime Distrb. Co. 214-231-0170
UT Salt Lake City, Standard Supp. Co. 801-486-3371
Can Concord, Ont., Stettner-Canada 416-661-5190

COMPUTER PRODUCTS™
POWER CONVERSION

STEVENS-ARNOLD DIV., Computer Prods., Inc., 7 Elkins St., So. Boston, MA 02127, Tel: 617-268-1170, Telex: 95-1465 STEARCO, TWX: 710-339-0855; FSC No.: 80640; Empl.: 334; *Sls. Mgr.:* John T. Parent ..... **D•1446, 1552-1553, 1573-1585**

Refer to Computer Products, Inc., Pompano Beach, FL for sls. offices and reps. and for distrs. listings.

STEVENS PRODUCTS, INC., 128 N. Park St., E. Orange, NJ 07019, Tel: 201-672-2140; Empl.: 50; *Sls. Mgr.:* John Thomson

STEWARD, D. M., MFG. CO., P.O. Box 510, Chattanooga, TN 37401, Tel: 615-867-4100, Telex: 558490; Empl.: 185; *Sls. Mgr.:* Arlin Grant

STOCK DRIVE PRODS., Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040, Tel: 516-328-0200, 328-3300, TWX: 510-223-0642; Empl.: 228; *Sls. Mgr.:* Murray Ores ..... **B•1191; C•1674**

Local Sales Offices & Reps

AL Huntsville, Par Marketing, Inc. 205-837-6534
CA Chatsworth, Western Comp. Sls. 818-882-6226
CO Wheatridge, Manufacturers Mktg. 303-425-9569
FL St. Petersburg, Tech-Rep Assoc., Inc. 813-577-2779
IL Glen Ellyn, Rockford Controls Co. 312-469-6016
MD Randallstown, Imagitron Sls. Co. 301-521-2020
MA Lowell, Underwood Sls. 617-256-8191
MI Southfield, R.C. Nordstrom & Co. 313-559-7373
MN St. Paul, Northstar Motion & Control .. 612-770-5311
NY Clark Mills, KLM-Garner, Inc. 315-853-6126
NY New Hyde Park, SDP 516-328-3300
OH Euclid, Rockford Controls Ohio, Inc. ... 216-731-5250
TX Richardson, Zonk & Associates 214-238-7651
WA Seattle, Northmar Inc. 206-524-5170

Local Distributors

CA San Carlos, Logan Elctrns. 415-594-0700

STOELTING CO., 1350 S. Kostner Ave., Chicago, IL 60623, Tel: 312-522-4500; Empl.: 50; *Sls. Mgr.:* D. A. Peterson

STOLZBERG RESEARCH, INC., 3 Seabrook Court, Stony Brook, NY 11790, Tel: 516-751-4277; Empl.: 4; *Sls. Mgr.:* Bruce Davis; *Dist. Mgr.:* Bruce Davis

STONE CITY PRODUCTS CO., 1206 Seventh Street, Bedford, IN 47421, Tel: 812-275-3373, Telex: 810-350-0321; FSC No.: 09166; Empl.: 85

STORM PRODUCTS CO., 116 Shore Drive, Hinsdale, IL 60521, Tel: 312-323-9121, TWX: 910-651-0850; *Sls. Mgr.:* John W. Holland

STOW LABS., INC., Kane Ind'l. Dr., Hudson, MA 01749, Tel: 617-562-9347, Telex: 94-8330; Empl.: 15

STRATEGIC SYS. DIV. POWER SYS. OPERATIONS, GTE Prods. Corp. Sylvania Sys. Grp., 520 Winter St., Waltham, MA 02254, Tel: 617-466-3000, Telex: 951-953, TWX: 710-290-0376

STRAWBERRY TREE COMPUTERS, 949 Cascade Dr., Sunnyvale, CA 94087, Tel: 408-736-3083

STREET ELECTRONICS CORP., 1140 Mark Ave., Carpinteria, CA 93013, Tel: 805-684-4593; *Dist. Mgr.:* Rich Jenkins

STROBE, INC., 897 Independence Ave., Mountain View, CA 94043, Tel: 415-969-5130

STRONGBOX, P.O. Box 84508, Los Angeles, CA 90073, Tel: 213-204-0472; FSC No.: 2T043; Empl.: 3; *Sls. Mgr.:* Larry Martinek ..... **C•1084-1085**

Local Sales Offices & Reps

NM	Albuquerque, Betatron	505-344-2381

STRUCTURED DESIGN, INC., 1700 Wyatt Dr. # 7, Santa Clara, CA 95054, Tel: 408-988-0725, Telex: 172931; *Sls. Mgr.:* Noel C. Hendricks; *Dist. Mgr.:* Noel C. Hendricks

STRUTHERS-DUNN, INC., Lamb's Rd., Pitman, NJ 08071, Tel: 609-589-7500, TWX: 510-686-7510; FSC No.: 78290;78290; Empl.: 700; *Sls. Mgr.:* W.L. Capewell; *Dist. Mgr.:* Walter Woodward ..... **B•1449**

Local Sales Offices & Reps

AL	Huntsville, Rep, Inc.	205-881-9270
AZ	Phoenix, Hecht, Henscher & Assocs.	602-275-4411
AR	Little Rock, Controls & Power	501-851-3048
CA	Culver City, DeAngelo, Rothman & Co.	213-827-2202
CA	Palo Alto, Mollard Mktg.	415-961-0456
CA	San Diego, Struthers-Dunn	619-560-9922
CO	Denver, Lindberg Co.	303-758-9033
CT	Bloomfield, Zaslow Sls. Co.	203-242-7781
FL	Miami, Ludlum Assocs.	305-592-6524
FL	Orlando, Ludlum Assocs.	305-894-7761
GA	Tucker, Rep, Inc.	404-938-4358
IL	Glen Ellyn, Rockford Controls Co.	312-469-6016
IN	Indianapolis, Rockford Controls Co.	317-248-2518
IA	Bettendorf, BSI, Ltd.	319-355-5623
KS	Wichita, Avionics Engrg.	316-264-6201
LA	Lafayette, Kemp Engrg.	318-269-9452
MD	Baltimore, Struthers-Dunn, Inc.	609-589-7500
MI	Southfield, L. H. Dickelman Co.	313-353-8210
MN	Minneapolis, HMR, Inc.	612-888-2122
MO	Maryland Heights, Hitt & Assocs.	314-878-5404
NJ	Pitman, Struthers-Dunn, Inc.	609-585-7500
NJ	West Caldwell, Grimm, Siegel Assocs.	201-575-9300
NM	Albuquerque, Hecht, Henschen & Assocs., Inc.	505-821-3979
NY	Buffalo, H. C. Zang Agency	716-877-3677
NC	Charlotte, J. Rudisill Assocs.	704-377-6901
OH	Cincinnati, Struthers-Dunn	513-772-3108
OH	Strongsville, Struthers-Dunn	216-572-1333
PA	Pittsburgh, R. F. Clark Co.	412-242-9500
TX	Bedford, W. Pat Fralia Co.	817-267-3577
TX	Houston, W. Pat Fralia Co	713-772-1572
WA	Seattle, Eicher-Richards Co.	206-523-7888
Can	Scarborough, Ont., Renfrew Elec. Co., Ltd.	416-752-4611

ST-SEMICON, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402, Tel: 812-332-1435, TWX: 810-351-1384; Empl.: 100; *Sls. Mgr.:* Robert Muldoan

SUCKLE CORP., 733 Davis St., Dept. EM, Scranton, PA 18505, Tel: 717-346-3871; Empl.: 200; *Sls. Mgr.:* M. H. Brenner

SULLINS ELCTRNS. CORP., P.O. Box 189, 801 Mission Rd., San Marcos, CA 92069, Tel: 619-744-0125, TWX: 910-322-1472; Empl.: 100; *Sls. Mgr.:* Chip Bruss; *Dist. Mgr.:* Chip Bruss ..... **C•1518-1521**

Local Sales Offices & Reps

AL	Decatur, Tenn Tech, Inc.	205-350-0630
AZ	Scottsdale, Harris & Croy Sls.	602-951-9121
AZ	Tucson, Harris & Croy Sls.	602-575-5109
CA	Canoga Park, K.C.P. Ent.	818-340-8086
CA	La Canada, K.C.P. Ent.	818-790-3939
CA	San Diego, Sun Harbor Mktg.	619-695-2994
CA	Sunnyvale, Schwerin & Merril, Inc.	408-735-7900
CO	Arvada, Cluff & Assocs.	303-423-9354
CT	New Canaan, Impact Sls.	203-972-1458
GA	Atlanta, Tenn Tech., Inc.	404-622-5784
IL	Elmhurst, Utronix Sls., Inc.	312-834-1100
IN	Indianapolis, Sukup & Cox	317-253-5501
IA	Marion, M-S-B Assoc.	319-377-6261
KS	Shawnee Mission, M-S-B Assoc.	913-432-2131
MD	Laurel, CSDS, Inc.	301-490-3800
MA	Canton, Impact Sls.	617-821-1500
MN	Minneapolis, RK Sls. Assocs., Inc.	612-786-5713
MO	St. Charles, M-S-B Assoc.	314-946-5577
NJ	Medford, Comp. Consultants	609-654-5300
NY	Lynbrook, HLJ Comp-Tech	516-599-2999
NC	Tenn Tech., Inc.	919-266-3610
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
OR	Portland, Electronic Mktg. Grp.	503-252-0610
TX	Austin, T.L. Mktg.	512-453-4586
TX	Dallas, T.L. Mktg.	214-357-1752
UT	Salt Lake City, Cluff & Assocs.	801-486-7297
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
WI	Mequon, Artmor Ltd.	414-241-4040

Local Distributors

AL	Huntsville, Contact Elctrns., Inc.	205-881-9321
AL	Huntsville, RM Elctrns.	205-852-1550
AZ	Phoenix, Arizona Comps.	602-279-9446
AZ	Phoenix, Camco Elctrn. Dist.	602-269-6201
AZ	Scottsdale, Comp. Tech., Inc.	602-998-1484
CA	Burbank, Atwater Elctrns.	818-841-9050
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	San Jose, Cypress Elctrns.	408-945-8400
CA	Torrance, Cypress Elctrns.	213-533-6005
CO	Arvada, Denver Wintronics	303-431-7161
CO	Denver, C.S.I.D.	303-292-9594
CO	Wheatridge, Cypress Elctrns.	303-431-2622
FL	Hialeah Gardens, Baron Elctrns. Sls. Co.	305-556-1300
FL	Miami, Elctrn. Equip.	305-871-3500
FL	Winter Park, Deanco	305-671-5100
GA	Atlanta, Ack Radio Supp.	404-351-6340
GA	Marietta, Deanco	404-429-0126
IL	Carol Stream, Lectro Comps.	800-323-2282
IL	Chicago, NEP Elctrns.	312-625-8400
IL	Melrose Pk., Belford Elctrns.	312-865-2400
IL	Wheeling, Hawk Elctrns.	312-459-4030
IN	Ft. Wayne, Graham Elctrns.	317-634-8202
IN	Indianapolis, Graham Elctrns.	317-634-8202
IN	Indianapolis, RM Elctrns.	317-291-7110
KS	Shawnee Mission, M-S-B Assocs., Inc.	913-432-2131
MD	Gaithersburg, Axis Elctrns., Inc.	301-840-9640
MD	Gaithersburg, Deanco	301-948-5444
MD	Timonium, M x 4 Elctrns., Inc.	301-251-1192
MA	Canton, Impact Sls.	617-821-1500
MI	Farmington Hills, Advent Elctrns.	313-477-1650
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MN	Minneapolis, Glenmark	612-941-4825
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NY	Ithaca, Deanco	607-257-4444
NY	Lynbrook, Forejay Assocs.	516-599-2999
NC	Charlotte, Southeastern Elctrns.	704-523-1122
NC	Durham, Southeastern Elctrns., Inc.	919-688-8204
NC	Fayetteville, Southeastern Elctrns., Inc.	704-523-1122
NC	Raleigh, Southeastern Elctrns., Inc.	919-828-2311
OH	Cincinnati, Schuster Electr.	513-489-1400
OH	Solon, REH Elctrns.	216-248-1636
OH	Twinsburg, Schuster Elec. Co.	216-425-8134
OR	Portland, Dunn Elctrns.	503-285-0214
RI	Warwick, Cal-Greg Comps., Inc.	401-738-6170
TN	Chattanooga, Indl. Elctrns. Dist.	615-698-3413
TN	Knoxville, Indl. Electrns.	615-573-7135
TX	Addison, Connec/Tek, Inc.	214-733-4411
TX	Dallas, Cypress Elctrns.	214-869-1435
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TX	Dallas, RM Elctrns.	214-869-2080
TX	Garland, J&S Elctrns.	214-487-8808
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
VA	Annadale, Arcade Elctrns., Inc.	703-256-4610
WA	Seattle, Carlyle Techn. Sls.	206-575-6750
WI	Mequon, Lake-View Elctrns.	414-377-8250
WI	Milwaukee, Industrial Elctrns. Corp.	414-276-1212
WI	Oconomowoc, G.W. Elctrns., Ltd.	414-367-6003
Can	Pointe Claire, Que., A. R. Gray & Assocs.	514-694-6378

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Local Sales Offices & Reps

AL	Huntsville, Electro-Mech	205-533-2100
AZ	Phoenix, MacDonald Assoc.	602-998-1848
CA	Agoura, Cal Rep	213-991-1940
CA	Sunnyvale, Sourcetronics	408-773-1931
CA	Sunnyvale, SourceTronics	408-773-1931
CA	Woodland Hills, Craig Assoc.	213-887-2444
CA	Woodland Hills, Craig Assocs.	213-887-2444
CO	Broomfield, Wescom Mktg.	303-741-4900
FL	Pompano Beach, Electrocraft	
FL	Winter Park, Electrocraft	305-628-4705
GA	Atlanta, Electro-Mech	404-447-6478
IL	Barrington, Omni Elctrns. Mktg.	312-381-9087
IL	Roselle, Omni Elctrns. Mktg.	312-351-2507
IN	Indianapolis, Wilson Tech. Sls.	317-298-3345
MD	Timonium, Heller Sales	301-252-4780
MD	Timonium, Heller Sls.	301-252-4780
MA	Braintree, R. F. Duffy	617-848-3550
MA	Braintree, R. F. Duffy & Assocs.	617-848-3550
MI	Detroit, Jack M. Thorpe	313-779-6363
MI	E. Detroit, Jack M. Thorp	317-779-6363
MN	Minneapolis, Electro Serve	612-338-3475
MN	Minneapolis, Electro-Serv	612-338-3475
MO	Hazelwood, Stone & Assoc.	314-895-4564
MO	Hazelwood, Stone & Assocs.	314-895-4564
NJ	N. Plainfield, T & K Sls.	201-755-2878
NJ	Upper Sadle River, Bob Cameron	201-825-1304
NM	Albuquerque, McDonald & Assoc.	505-883-0500
NY	Smithtown, T & K Sales	516-724-3456
NY	Smithtown, T & K Sls.	516-724-3456
NC	Raleigh, Electro-Mech	919-851-8165
OH	Cleveland, Arthur Baier Co.	216-461-6161
OH	Dayton, Arthur Baier Co.	513-276-4128
OK	Tulsa, Barry Sls.	918-749-7775
PA	Horsham, TMI	215-441-4300
TN	Nashville, Electro-Mech	615-885-0073
TX	Austin, Barry Sls.	512-837-3616
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255
Can	Mississauga, ON, T. W. Wilson Sls.	

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CA	Carson, Superior Elec.	213-830-7750
CA	Santa Clara, Superior Elec.	408-748-7772
CO	Denver, W. J. Purdy Co.	303-753-6800
CT	Bristol, Superior Elec.	203-582-9561
FL	Apopka, G. F. Bohman Assocs.	305-886-1882
FL	Deerfield Beach, Power Solutions	305-428-8330
FL	Ft. Lauderdale, Bredesen & Assocs.	305-566-3289
HI	Honolulu, B. F. Wittenberg Co.	808-833-1602
IL	Glen Ellyn, Superior Elec.	312-858-2960
IA	W. Des Moines, JPS Assoc. Ltd.	515-225-0607
MA	Wellesley Hills, Superior Elec.	617-237-0750
MI	Detroit, Superior Elec.	313-229-2381
NY	Rochester, R. L. Kistler, Inc.	716-436-1940
NY	Rochester, Ross Equip. Co. Inc.	716-271-5660
NY	Smithtown, Superior Elec.	516-361-9177
NC	Charlotte, Superior Elec.	704-535-7777
OH	Medina, Superior Elec.	216-725-8887
PA	Blue Bell, Superior Elec.	215-825-9123
TX	Dallas, Superior Elec.	214-350-1368
TX	Plano, B & R Elctrn. Sls. Corp.	214-985-0028
WA	Issaquah, Superior Elec.	206-392-8559
Can	Toronto, Ont., American Superior Elec. Co., Ltd.	416-255-2318

SUPERIOR FLUX & MFG. CO., 95 Alpha Pk., Cleveland, OH 44143, Tel: 216-461-3315; Empl.: 5

SUPERIOR MFG. & INSTR., 19-36 38th St., Long Island City, NY 11105, Tel: 212-932-1800, TWX: 710-582-2626; Empl.: 120; *Sls. Mgr.:* C. J. Robison

SUPERTEX, INC., 1225 Bordeaux Dr., P.O. Box 3607, Sunnyvale, CA 94088, Tel: 408-744-0100, TWX: 6839143 SUPTX; *Sls. Mgr.:* Richard Siegel

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AL	Huntsville, Macro Mktg.	205-883-9630
AZ	Scottsdale, SMS & Assocs.	602-998-0831
CA	El Toro, Supertex, Inc.	714-533-0481
CA	Glendale, Orion Sls.	818-240-3151
CA	Los Altos, Ewing-Foley	415-941-4525
CA	San Diego, Earle Assocs.	619-278-5441
CA	Tustin, Orion Sls.	714-832-9687
CO	Denver, Elcom	303-337-2300
CT	Englewood, Ed Glass Assocs.	201-592-0200
FL	Clearwater, Dyne-A-Mark	813-441-4702
FL	Ft. Lauderdale, Dyne-A-Mark	305-771-6501
FL	Maitland, Dyne-A-Mark	305-831-2097
FL	Palm Bay, Dyne-A-Mark	305-727-0192
IL	Des Plaines, Janus	312-298-9330
IN	Indianapolis, Sai Mktg.	317-241-9276
KS	Overland Park, Advanced Tech. Sls.	913-642-6675
MA	Burlington, Mill-Bern Assocs.	617-273-1313
MI	Brighton, Sai Mktg.	313-227-1786
MN	Bloomington, Smiley-Scott Assocs.	612-888-5551
MO	St. Louis, Advanced Tech. Sls.	314-878-2921
NJ	Englewood Cliffs, Supertex, Inc.	201-947-3844
NJ	Haddonfield, Tritek Sls.	609-429-1551
NY	Hauppague, Calita	516-582-5432
NY	Binghamton, Gen-Tech Elctrn. Sls.	607-648-8833
NY	Liverpool, Gen-Tech Elctrn. Sls.	315-451-3480
NY	Pittsford, Gen-Tech Elctrn. Sls.	716-381-2820
NY	Pleasant Valley, Gen-Tech Elctrn. Sls.	914-635-3233
OH	Centerville, Omega Sls.	513-434-5507
OH	Centerville, Sai Mktg.	513-435-3181
OH	Shaker Heights, Sai Mktg.	216-751-3633
OR	Tigard, Electronic Comp. Sls.	503-245-2342
TX	Austin, T. L. Mktg.	512-453-4586
TX	Dallas, T. L. Mktg.	214-357-1752
TX	Fort Worth, Supertex, Inc.	817-457-5677
UT	Salt Lake City, Elcom, Inc.	801-532-7940
VA	Columbia, Delta III Assocs.	301-730-4700
VA	Midlothain, Delta III Assocs.	804-379-1816
WA	Mercer Island, Elctrn. Comp. Sls.	206-232-9301
WI	Milwaukee, Janus	414-476-9104

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Local Sales Offices & Reps

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CA	Santa Clara, Ross Mktg. Assoc.	408-988-8111
CO	Denver, Moss Mktg.	303-455-7205
CT	Stamford, Unesco/Genex	203-322-9308
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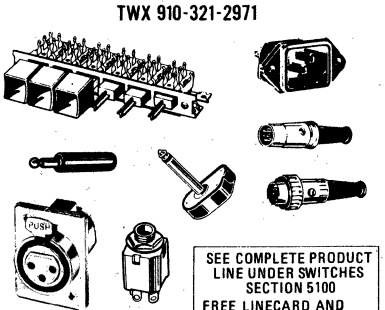

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NY Syracuse, Ossmann Comp. Sls. 716-424-4460
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CA Hayward, Pacific Mktg. Inc. 415-887-1620
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GA Atlanta, Rakes Engrg. & Mktg. Corp. 404-447-6937
IL Arlington Heights, Thermek Inc. 312-577-6900
MD Glen Burnie, Macrotech Assocs. 301-437-5588
MA Hingham, Northeast Reps., Inc. 617-749-8700
MI Dearborn 313-582-8754
NJ Haddonfield, G. L. Williams Assocs. 609-428-6060
NJ Manville, Dynorep Inc. 201-685-0135
NY Albany, H. C. Johnson Agencies, Inc. 518-459-1239
NY Buffalo, H. C. Johnson Agencies, Inc. 716-632-7880
NY Rochester, H. C. Johnson Agencies, Inc. 716-586-0777
NC Raleigh, Rakes Engrg. & Mktg. Corp. 919-847-5079
OH Dayton 513-223-6227
OR Portland, SPS Elctrns. 503-297-6919
PA Glenshaw, H. C. Johnson Agencies, Inc. 412-961-0414
WA Redmond, SPS Elctrns. 206-323-4140

SYLVANIA ELECTRONIC, Box 360, Muncy, PA 17756, Tel: 717-546-3191; Empl.: 395; *Sls. Mgr.:* A. M. Serang; *Dist. Mgr.:* S. R. Sisak

PhilipsECG

SYLVANIA ELECTRONIC COMPONENTS, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, Tel: 617-890-6107; Empl.: 4213; *Sls. Mgr.:* D. R. Kronenwetter; *Dist. Mgr.:* E. H. Frost ..... **A•2090-2091**

Local Sales Offices & Reps

CA Costa Mesa, Philips ECG, Inc. 714-557-3100
CA Pleasanton, Philips ECG, Inc. 415-846-2427
FL Clearwater, Philips ECG, Inc. 813-446-8602
GA Atlanta, Philips ECG, Inc. 404-491-6003
IL Buffalo Grove, Philips ECG, Inc. 312-459-1180
MD Ellicott City, Philips ECG, Inc. 301-531-6423
MO Kansas City, Philips ECG, Inc. 816-741-4019
NJ Norwood, Philips ECG, Inc. 201-768-3280
NY Seneca Falls, Philips ECG, Inc. 315-568-5432
NC Greensboro, Philips ECG, Inc. 919-299-6204
OH Dayton, Philips ECG, Inc. 513-890-4421
OH Rocky River, Philips ECG, Inc. 216-331-1088
TX Dallas, Philips ECG, Inc. 214-239-9370

Local Distributors

AL Albertville, Electronic Part & Supp. Co. 205-878-3041
AL Andalusia, Wholesale Elctr. Supps. Co. 205-222-5100
AL Anniston, Radio Dist. & Sup. Co. 205-236-8654
AL Birmingham, Forbes Distributing Co. 205-251-4104
AL Birmingham, JLS Indl. Elctrns., Inc. 205-322-2486
AL Decatur, Forbes Distributing Co. 205-353-4762
AL Dothan, Carmichael Elctrns. Inc. 205-793-7066
AL East Gadsden, Radio Dist. & Supp. Co. 205-547-1636
AL Huntsville, Forbes Distrbg. Co. 205-533-4150
AL Mobile, Electronic Supp. Co. 205-478-0455
AL Mobile, Forbes Elctrn. Distrs. Inc. 205-479-4535
AL Mobile, Specialty Distributing Co. 205-344-0450
AL Montgomery, Forbes-Godfrey TV Elctrns. Inc. 205-263-0283
AL Muscle Shoals, Jones Elctrns. 205-383-1241
AL Opelika, Southern Elctrns. Corp. 205-745-5298
AK Anchorage, Alaska Elctrn. Supp. 907-563-3774
AK Juneau, Juneau Elctrns. 907-586-2260
AZ Phoenix, Dalis Elctrn. Supp. 602-275-2885
AZ Phoenix, Elctrn. Parts Co. Inc. 602-277-7281
AZ Phoenix, Electronic Distrs. 602-955-8303
AZ Phoenix, Parts Elctrn. of AZ 602-258-6476
AZ Tucson, Elliott Elctrns., Inc. 602-884-7394
AZ Tucson, Inland Elctrn. Supp. 602-889-5301
AR El Dorado, Electra Inc. 501-862-4901
AR Ft. Smith, Carlton Bates Co. 501-646-8201
AR Ft. Smith, Wise Wholesale Elctrns. 501-783-8925
AR Hot Springs, Prince Elctrns. Co. 501-624-2825
AR Little Rock, Bluff City Elctrns. 501-376-7044
AR Little Rock, Carlton Bates Co. 501-562-9100
AR Little Rock, David White Elctrns. 501-375-8887
AR Little Rock, Lavender Elctrn. Supp. Inc. 501-372-0248
AR Little Rock, Southern Elctrns. Co. 501-372-4196
AR Mt. Home, Show-Me Elctrns., Inc. 501-425-8979
AR Paragould, Martin Wholesale Radio Supp. 501-236-6049
AR Pine Bluff, Carlton Bates Co. 501-535-1354
AR Pine Bluff, David White Elctrns. 501-534-0612
AR Springdale, Carlton Bates Co. 501-756-5012
AR Springdale, Wise Wholesale Elctrns. 501-751-4814
AR Texarkana, Lavender Elctrns. Inc. 501-773-4631
CA Anaheim, Ball Elctrns. 714-828-1310
CA Berkeley, Al Lasher Elctrns. 415-843-5915
CA Calexico, Hurley Elctrns., Inc. 714-357-3148
CA Canoga Park, Tri-Valley Elec. Supp. 213-348-6210
CA Concord, Pacific Radio Supp. Inc. 415-682-4700
CA Downey, Net Elctrns. 213-923-4591
CA Dublin, Pacific Radio Supp. Inc. 415-829-5960
CA Eureka, Redwood Elctrn. Supp. 707-443-3107
CA Fresno, B. J. De Jarnatt Wholesale Co., Inc. 209-268-8544
CA Fullerton, Orvac Elctrns. 714-871-1020
CA Garden Grove, Sav-On 714-530-0555
CA Huntington Park, Martin Distributing Co. 213-582-7111
CA Inglewood, Hurley Elctrns., Inc. 213-678-7644
CA Long Beach, Hurley Elctrns., Inc. 213-537-5375
CA Los Angeles, Radio Equip. Distrs. 213-668-1100
CA Modesto, Inland Elctrns. 209-524-7945
CA Mtn. View, Associated Radio 415-968-1689
CA Oakland, Cass Elctrns. 415-834-4225
CA Oakland, Chuck Hurley Elctrns. 415-834-9185
CA Oceanside, Hurley Elctrns., Inc. 619-722-7694
CA Ontario, Hurley Elctrns., Inc. 714-986-6638
CA Oxnard, Dow Radio, Inc. 805-486-6353
CA Oxnard, Hurley Elctrns., Inc. 805-483-0133
CA Pasadena, Dow Radio, Inc. 213-681-3416
CA Redding, North Valley Elctrns. 916-222-1500
CA Sacramento, Chuck Hurley Elctrns. Inc. 916-927-5891
CA Sacramento, Dunlap Elctrns. Inc. 916-442-5801
CA Sacramento, Popkey Distributing 916-448-8848
CA Salinas, Ardco Elctrns. Supp. 408-422-5318
CA San Bernadino, Hurley Elctrns., Inc. 714-885-0721
CA San Diego, Hurley Elctrns. 619-235-6245
CA San Diego, Steren Elctrns. Intl. 619-274-4120
CA San Francisco, Associated Radio 415-431-0212
CA San Jose, John E. Schad Inc. 408-275-6484
CA San Jose, Peninsula Elec. Supp. 408-294-8781
CA San Luis Obispo, Midstate Wholesale Elctrns. 805-543-2770
CA San Rafael, Beaver Elctrns. 415-453-1130
CA Santa Ana, Hurley Elctrns., Inc. 714-971-2203
CA Santa Maria, Electronics Parts Supermart 805-925-8604
CA Santa Rosa, Associated Radio Distrs. 707-527-6000
CA Santa Rosa, Chuck Hurley Elctrns. Inc. 707-542-5423
CA Stockton, Cal-Centron 209-942-2094
CA Torrance, Cash Elctrns. 213-373-6333
CA Vallejo, Associated Radio 707-552-2363
CA Van Nuys, Hurley Elctrns., Inc. 818-781-8410
CO Colorado Springs, Walker Colorado Springs Elect. 303-636-1661
CO Denver, Elliott Elctrn. Supp. Inc. 303-778-0333
CO Denver, Walker Denver Elctrns. 303-935-2401
CO Englewood, Roth Distrbg. Co. 303-761-6531
CO Grand Junction, Walker Grand Junction Elctrns. 303-242-4435
CO Greeley, Walker Greeley Elctrns. Co. 303-353-3241
CO Pueblo, Walker Pueblo Elctrns. 303-542-1924
CT Greenwich, Wise Comps., Inc. 203-531-4880
CT Hartford, Signal Center, Inc. 203-233-8551
CT New London, Aikins Elctrn. Supp. 203-442-4406
CT New London, Jan Elctrn. Supps., Inc. 203-442-4386
CT South Windsor, Sceli Elctrns. 203-289-6853
CT West Haven, Amerling Co. 203-934-7901
DE Wilmington, Wholesale Elctrns. 302-656-9988
FL Bradenton, Leader Elctrns. 813-756-9571
FL Cocoa, Cape Elctrns. 305-636-6331
FL Daytona Beach, C & S Elctrn. Supp. Co. 904-253-8131
FL Ft. Lauderdale, Leader Dixie Elctrns., Inc. 305-561-2544
FL Ft. Lauderdale, Southeastern Elctrns. 305-563-4131
FL Ft. Lauderdale, Vance Baldwin Inc. 305-523-3461
FL Ft. Myers, Dow Elctrns. 813-334-6577
FL Ft. Walton Beach, Key Elctrn. Supp. 904-863-2191
FL Gainesville, Dow Elctrns. Inc. 904-376-3231
FL Homestead, United Elctrn. Supp. Inc. 305-245-0955
FL Jacksonville, Mitchell Elctrns. 904-356-8427
FL Jacksonville, The Bay Co. 904-255-2614
FL Lakeland, Leader Elctrns. 813-686-8193
FL Largo, Chester Elctrn. Supp. Co. 813-585-4736
FL Melbourne, Leader Elctrn. Distributing Inc. 305-254-5274
FL Miami, Central Elctrns. Distrs., Inc. 305-635-1080
FL Miami, Elctrn. Equip. Co., Inc. 305-871-3500
FL Miami, Gulf Elctrn. Supp., Inc. 305-592-6583
FL Miami, Southeastern Wholesalers Inc. 305-634-6591
FL Miami, Vance Baldwin Inc. 305-769-0225
FL Miami, Walder Elctrn. Distr. Co. 305-379-9393
FL Naples, Joe Coomes Distr. Inc. 813-775-4442
FL Orlando, C & S Elctrn. Supp. Co., Inc. 305-299-4300
FL Orlando, Dow Elctrns. Inc. 305-299-2771
FL Panama City, Central Elctrn. Supp. Co. 904-785-0237
FL Pensacola, Elctrn. Supp. Co. 904-432-6916
FL Pensacola, Forbes Elctrn. Distributing Inc. 904-944-5551
FL Pensacola, Pensacola Elctrns. 904-478-3771
FL Sarasota, Dow Elctrns. 813-365-3393
FL St. Petersburg, Dow Elctrns. 813-525-1131
FL Tallahassee, Dell Elctrns. Inc. 904-224-5145
FL Tallahassee, Fouraker Elctrns. Inc. 904-224-5101
FL Tampa, Dow Elctrns., Inc. 813-626-5191
FL Tampa, Leader Elctrns. Distrs. 813-870-3315
FL Tampa, Sunex Elctrns. Supp., Inc. 813-885-4074
FL Tampa, Vance Baldwin, Inc. 813-870-2606
FL Venice, Ferguson Elctrns. Co. 813-493-0000
FL W. Palm Beach, Dolphin Elctrn. Supp. Inc. 305-659-7166
FL W. Palm Beach, Vance Baldwin Inc. 305-832-5671
GA Albany, Specialty Distributing Co. 912-435-1711
GA Athens, Specialty Distributing Co. 404-458-1334
GA Atlanta, Specialty Distributing Co. 404-458-6341
GA Atlanta, Specialty Distributing Co. 404-873-2521
GA Atlanta, Wholesale Indl. Elctrns. 404-447-8431
GA Augusta, Specialty Distributing Co. 404-722-1526
GA Brunswick, Specialty Distributing Co. 912-265-1927
GA College Park, Specialty Distributing Co. 404-763-3828
GA Columbus, Specialty Distributing Co. 404-327-7414
GA Macon, Specialty Distributing Co. 912-743-5421
GA Marietta, Specialty Distributing Co. 404-422-4333
GA Savannah, Specialty Distributing Co. 912-234-1684
GA Valdosta, Specialty Distributing Co. 912-242-4910
HI Honolulu, Admor Distr. Corp. 808-537-4501
HI Honolulu, Electrical Equip. Co., Ltd. 808-533-3884
HI Honolulu, Industrial Elctrns. 808-533-6095
HI Honolulu, Precision Radio Ltd. 808-537-5291
ID Boise, Kimball Elctrns. 208-342-3559
ID Pocatello, Kimball Elctrns. 208-232-2201
IL Alton, Ebinger Radio Co. 618-462-9783

IL Belleville, Deltronics Distrbg. Co. 618-398-2183
IL Benton, Lampley Radio Co. 618-435-8194
IL Berwyn, B-B & W Inc. 312-749-1710
IL Chicago, Alpha Elctrns. 312-561-0300
IL Chicago, Howard Elctrn. Sls. 312-254-1777
IL Chicago, Newark Elctrns. Corp. 312-638-4411
IL Chicago, U. S. Electronics 312-925-4111
IL Elgin, Mainline Supp. Co., Inc. 312-697-6746
IL Evergreen, Beaty Elctrns. Inc. 312-423-5500
IL Franklin Park, Richardson Elctrns. 312-456-0600
IL Geneva, Melvin Elctrns., Inc. 312-232-8050
IL Harrisburg, Standard Distrs. 618-252-1478
IL Jacksonville, Baptist Elctrn. Supp. Co., Inc. 217-243-6464
IL Joliet, Mainline Supp. Co., Inc. 815-436-3900
IL Kankakee, S&S Elctrn. Supp. Co. 815-933-5595
IL Mattoon, Mattoon Radio & TV Supp. Co. 217-235-5457
IL Moline, Lofgren Distributing Co. 309-764-7436
IL Niles, Joseph Elctrns. Inc. 312-297-4200
IL Peoria, Warren Radio Co. 309-674-5998
IL Quincy, Show Me Elctrns. 217-223-9880
IL Rockford, Jay-tronics 815-965-8786
IL Rockford, Midwest Associated 815-962-8036
IL Salem, Laco Elctrns. Inc. 618-548-3150
IL Springfield, Baptist Elctrn. Supp. Co., Inc. 217-753-0111
IL Sterling, Warren Radio Co. 815-625-6253
IL Waukegon, Chester Elctrn. Supp. 312-623-5000
IN Angola, Lakeland Elctrn. Supp. 219-665-6311
IN Bloomington, Stansifer Radio Co. 812-336-6339
IN Chesterton, Chesterton Elctrn. Supp. 219-926-2109
IN Elkhart, Warren Radio Co. 219-295-4205
IN Evansville, Hutch & Son, Inc. 812-425-7201
IN Evansville, Ohio Valley Sound 812-425-6173
IN Ft. Wayne, Pembleton Elctrns. 219-426-1812
IN Ft. Wayne, Warren Radio Co. 219-426-5344
IN Gary, B&B Elctrn. Supp. 219-980-8200
IN Gary, Calumet Elctrn. Supp. Inc. 219-887-4961
IN Indianapolis, Elctrn. Svc. Parts 317-632-8586
IN Indianapolis, Graham Elctrns. Supp. Inc. 317-634-8202
IN Indianapolis, ROBCO Distrs., Inc. 317-788-0857
IN Indianapolis, Warren Radio Co. 317-634-5566
IN Jasper, Elex Mart 812-482-3535
IN Kokomo, Television Radio Distr. 317-457-5942
IN Logansport, Television Radio Distr., Inc. 219-753-2879
IN Marion, J&W Elctrns. Inc. 317-662-1114
IN Mishawaka, Television Supp., Inc. 219-255-4720
IN Peru, Television Radio Distr., Inc. 317-472-2005
IN Terre Haute, Mid West Supp. 812-232-0187
IN Vincennes, Ohio Valley Sound, Inc. 812-882-3615
IA Ames, Electronic Supp. Inc. 515-232-7020
IA Ames, Mid-State Distrbg. Co. 515-232-2104
IA Burlington, Union Supp. Co. 319-754-5745
IA Burlington, Warren Radio Co. 319-752-1842
IA Carroll, Mid-State Distrbg. Co. 712-792-2177
IA Cedar Rapids, Deeco, Inc. 319-365-7551
IA Cedar Rapids, Iowa Radio Supp. Co. 319-364-6154
IA Cedar Rapids, Mid-State Distrbg. Co. 319-365-9411
IA Clinton, Union Supp. Co., Inc. 319-242-4572
IA Davenport, Union Supp. Co. 319-322-3531
IA Davenport, Warren Radio Co. 319-322-5301
IA Des Moines, Gifford-Brown of Des Moines 515-243-1257
IA Des Moines, Mid State Distributing Co. 515-244-7231
IA Dubuque, Warren Radio Co. 319-582-4300
IA Iowa City, Union Supp. Co. 319-338-6165
IA Mason City, Mid State Distributing Co. 515-423-8012
IA Ottumwa, Mid-State Distrbg. Co. 515-682-5407
IA Sioux City, Molstad Dist. 712-255-8023
IA Waterloo, Gifford-Brown, Inc. 319-234-2603
KS Great Bend, RSC Elctrns., Inc. 316-793-3507
KS Kansas City, Video Elctrn. Supp. Co. 913-371-5731
KS Salina, RSC Electronics 913-823-6353
KS Wichita, RSC Electronics 316-267-5213
KY Ashland, Electronic Supp. Inc. 606-325-1511
KY Bowling Green, Randolph, Hale & Meredith 602-781-1460
KY Hopkinsville, Randolph & Hale 502-885-5357
KY Lexington, Service Elctrn. Supp. 606-254-5786
KY Louisville, P. I. Burks & Co. 502-589-3960
KY Newport, Holub Dist. Co. 606-431-4211
KY Paducah, Warren Radio Co. 502-442-4367
LA Alexandria, Elctrn. Svc. Supp. 318-443-8483
LA Alexandria, Ralph's Indl. Elctrns. 318-443-8483
LA Baton Rouge, Industrial Elec. Supp., Inc. 504-357-4249
LA Baton Rouge, Menard Elctrns. 504-355-0232
LA Baton Rouge, Ralph's of Baton Rouge 504-344-3761
LA Baton Rouge, Southern Radio Supp. Co., Inc. 514-355-0396
LA Broussard, Menard Elctrns., Inc. 318-837-9204
LA Gretna, Pelican Elctrn. Supp. Inc. 504-361-4187
LA Harahan, United Distrs., Inc. 504-733-7920
LA Harvey, AFG Elctrn. Supp., Inc. 504-368-9696
LA Houma, Pelican Elctrn. Supp. Inc. 504-868-1285
LA Lafayette, Lafayette Radio Equip. 318-234-2364
LA Lafayette, Ralph's of Lafayette 318-234-4507
LA Lake Charles, Ralph's of Lake Charles 318-439-2493
LA Lake Charles, Sparton Elctrns. Supp., Inc. 318-491-9223
LA Lake Charles, Wholesale Radio Equip. 318-439-2431
LA Metairie, Pelican Elctrn. Supp. 504-888-4720
LA Monroe, Martin Elctrns. Inc. 318-388-4224
LA Monroe, Tri-State Elctrns. 218-387-9711
LA Morgan City, Ralph's of Morgan City 504-384-9831
LA New Iberia, Ralph's of New Iberia 318-369-9861
LA New Orleans, Radio Parts 504-581-5959
LA New Orleans, Southern Radio Supp. Co. 504-524-2343
LA New Orleans, Wm. B. Allen, Inc. 504-525-8222
LA Opelousas, Opelousas Radio Equip. 318-942-5702
LA Shreveport, Elctrn. Supp. of Shreveport 318-227-9080
LA Shreveport, Indl. Elctrn. Supp. Inc. 318-222-9459
LA Shreveport, Wholesale Elec. Supp., Inc. 318-422-2063
LA West Monroe, Brooks Supp. of La 318-323-0344
ME Lewiston, Stark Wholesale Elctrns. 207-784-6979
ME Portland, LAD Elctrns. Distrs. 207-772-2174
MD Baltimore, Fairway Elctrns. of MD Inc. 301-247-8383
MD Baltimore, Modern Elctrns. 301-282-5300
MD Baltimore, Tritronics 301-256-4400
MD Beltsville, Radio Elec. Svc. Co. 301-937-5890
MD Bethesda, Empire Elec. Supp. 301-656-3300
MD Frederic, Hankey's Radio Inc. 301-662-1381
MD Hagerstown, Fairway Elctrns. Inc. 301-791-0200
MD Kensington, Fairway Elctrns. Inc. 301-564-1440
MD Towson, Baynesville Elctrns. 301-823-0082
MD White Marsh, Radio Elec. Svc. Co. 301-529-0500
MA Billerica, A. W. Mayer Co. 617-667-6900
MA Boston, Tee Vee Supp. Co. 617-522-9330
MA Brockton, Ware Radio Supp. Corp. 617-583-0810
MA Fall River, E. A. Ross Co. 617-673-0921
MA Lawrence, Lawrence Elctrn. Distrs. 617-683-0257
MA Lowell, Frank P. McCartin Co. 617-454-9101
MA New Bedford, Burns Elctrn. Supp. Co. 617-998-3344
MA New Bedford, C. E. Beckman Co. 617-994-9674
MA New Bedford, E. A. Ross Co. 617-673-0921
MA Norwood, Morrison Elctrn. Supp. 617-769-7280
MA Peabody, Tee Vee Supp. Co. 617-531-5777
MA Quincy, Electronic Dists. Corp. 617-328-7800
MA Springfield, Signal Electr. Ctr. of Springfield 413-739-3893
MA Waltham, MIL Elctrns. Inc. 617-891-6730
MA Woburn, Abbott Elctrns., Inc. 617-935-2040
MA Woburn, Semtex 617-935-2150
MA Worcester, Stark Wholesale Elctrns. Inc. 617-756-7136
MI Adrian, Wedemeyer Elctrn. Supp. Co. 313-263-2925
MI Battle Creek, Warren Radio Co. 616-965-3338
MI Bay City, Kinde Distributing 517-892-1594
MI Dearborn, West Side Radio 313-933-6972
MI Detroit, Elctrn. Parts Co. 313-891-7400
MI Detroit, S & S Elctrns. 313-521-3610
MI Detroit, Top Radio Supp. Corp. 313-366-9088
MI East Detroit, Electronic Parts Co. 313-773-0030
MI Flint, Electronic Parts Specialists 313-238-7311
MI Flint, Shand Elctrns. 313-743-8940
MI Grand Rapids, T & W Elctrns. 616-241-3645
MI Grand Rapids, Warren Radio Co. 616-456-5385
MI Kalamazoo, Warren Radio Co. 616-381-4203
MI Lansing, Wedemeyer Elctrns. 517-489-9047
MI Livonia, Norwest Elctrns. 313-261-4551
MI Livonia, RS Electronics 313-525-1155
MI Madison Hgts., Warren Radio Co. 313-588-3327
MI Muskegon, T & W Elctrns., Inc. 616-759-7666
MI Niles, Niles Radio Supp. Co. 616-684-0550
MI Oak Park, Remcor Elctrns., Inc. 313-541-5666
MI Owasso, Warren Radio Co. 517-723-5239
MI Pontiac, Joe Coomes 313-334-1526
MI Saginaw, Ryder Distributing 517-799-2411
MI Traverse City, Traverse City Elctrns. 616-946-5153
MN Minneapolis, Electronic Center 612-371-5200
MN Minneapolis, Ness Elctrns. Inc. 612-824-2646
MN Minneapolis, Stark Elctrn. Supp. Co. 612-332-1325
MN Rochester, Pace Elctrns. Inc. 507-288-1853
MN St. Cloud, Team Elctrns. # 4 612-251-1335
MN St. Paul, Electronics Ctr., Inc. 612-371-5260
MN St. Paul, Ness Elctrns. 612-224-5411
MS Biloxi, Electronic Parts Co. 601-435-3221
MS Columbus, Bluff City Elctrns. 601-328-6212
MS Greenville, Tri-State Elctrns. Co. 601-335-3594
MS Hattiesburg, N & H Elctrn. Distr. Co. 601-582-5571
MS Jackson, Tri-State Elctrns. Co. 601-355-3431
MS McComb, Risher Radio Supp. Co. 601-684-3731
MS Meridian, Hooper Elctrn. Supp. Co., Inc. 601-693-2668
MS Pascagoula, Hooper Elctrn. Supp. Co. 601-762-9383
MS Philadelphia, Risher Whls. Co. 601-656-8802
MS Tupelo, Bluff City Elctrns. 601-842-6832
MO Columbia, Show-Me Elctrns. 314-449-2944
MO Flat River, Show-Me Elctrns. 317-431-4816
MO Jefferson City, Central Missouri Distributing Co. 314-636-3149
MO Jefferson City, Show-Me Elctrns. 314-636-2191
MO Joplin, Show-Me Elctrns., Inc. 417-623-1608
MO Kansas City, Elctrn. Supp. Co. 816-931-0250
MO Kirkville, Mid State Distrbg. Co. 816-665-5625
MO Rolla, Show-Me Elctrns. 314-364-1515
MO Sedelia, Show-Me Elctrns., Inc. 816-826-3044
MO Sikeston, Baileys Elect. Supp. 314-471-6142
MO Springfield, Mason Elect. Supp. 417-865-5542
MO Springfield, Show-Me Elctrns. 417-869-0752
MO St. Charles, Deltronics Distrbg. Co. 314-723-0210
MO St. John, Ralph Toler Radio Co. 314-426-3260
MO St. Joseph, Show-Me Elctrns., Inc. 816-233-3118
MO St. Louis, City Refrigeration Co., Inc. 314-427-3420
MO St. Louis, Deltronics Distributing Co. 314-725-6060
MO St. Louis, Ebinger Elctrns. 314-353-8818
MO St. Louis, M C Distrs., Inc. 314-231-6350
MO St. Louis, Olive Elctrns. Inc. 314-426-4500
MO St. Louis, Show-Me Elctrns., Inc. 314-781-7643
MT Billings, Television & Elec. Supp. Co. 406-252-7193
MT Great Falls, The Source Inc. 406-761-2420
MT Havre, Northern Elctrns. 406-265-5568
MT Kalispell, Professional Elctrns. Ctr. 406-257-4545
NE Hastings, Meyerson Distrbg. Co. 402-463-3145
NE Lincoln, Leuck Radio Co. 402-476-2797
NE Norfolk, Radio Equip. Co. 402-371-2728
NE Omaha, Meyerson Distrbg. Co. 402-342-3088
NE Omaha, Omaha Elctrns. Co. 402-341-3440
NE Omaha, Radio Equip. Co. 402-341-7700
NE Scottsbluff, D&H Elctrns. Supp. Inc. 308-632-2181
NV Las Vegas, Hurley Elctrns. 702-384-5666
NV Reno, Bennett Elctrn. Supp. Co. 702-322-2127
NV Reno, Nevada Elctrns. 702-329-1308
NH Dover, American Radio Corp. 603-742-6800
NH Manchester, Stark Wholesale Elect. of N.H. Inc. 603-688-7611
NH Nashua, Tee Vee Supp. Co. 603-889-4171
NJ Eatontown, Atkinson & Smith Co. 201-542-2447
NJ Edison, William Elctrn. Supp. Inc. 201-985-3700
NJ Hillside, Leader Elctrn. Supp. Corp. 201-354-4200
NJ Pleasantville, Kearns Elctrn. Prods. Co. 609-646-7010
NJ Raritan, Masters Elctrn. Supp. 201-725-3583
NJ Trenton, Service Parts & Supp. Co. 609-393-7135
NJ Union City, NIDISCO, Inc. 201-863-2111
NM Albuquerque, Elctrn. Parts Co. 505-293-6161
NM Albuquerque, Southwest Elctrns. 505-345-8611
NM Albuquerque, US Module 505-345-7968
NM Farmington, Walker Farmington Elctrns. Inc. 505-327-9138
NM Hobbs, Trice Wholesale Elctrns. 505-393-5107
NM Las Cruces, Electronic Parts, Inc. 505-523-4578
NM Roswell, R & R Elctrn. Supp. Co. 505-622-0670
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NY Bronx, CAM Elctrns. Distr. Co., Inc. 212-893-8300
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NY Buffalo, Summit Distrbg. Co., Inc. 716-884-3450
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NY Lackawanna, Metromill Distrs. Inc. 716-826-2600
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NY Massapequa, A&P Elctrns. Corp. 516-541-4200
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NY Rochester, R. W. Mitscher Co., Inc. 716-227-0839
NC Cary, Elctrn. Sls. 919-467-8486
OH Columbus, Norm Case Assocs. 614-863-5686
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OH Rocky River, Norm Case Assocs. 216-333-0400
OR Falls City, Ecco Mktg. 503-787-3509
PA Southampton, Symbex Corp. 215-322-8040
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UT Salt Lake City, Lange Sls., Inc. 801-487-0843
WA Seattle, Ecco Mktg. 206-364-0200
WI Colgate, Rep. 1 & Assoc. 414-628-4016

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CT Danbury, Pilgrim Elctrns 203-792-7274
MA Danvers, Criterion 617-777-4725
MA Middleboro, Glynn Elctrns. 617-947-4262
OK Tulsa, Combined Tech. Comps. 918-665-3002
WI Madison, Schrenk Sls. 608-255-7400
WI Milwaukee, Marsh Elctrns. 414-475-6000

SYMBICON, 89 Route 101A, Amherst, NH 03031, Tel: 603-673-8898, Telex: 953059; *Sls. Mgr.:* S. Harrington; *Dist. Mgr.:* W. Ferrier

SYM-TEK SYS., INC., 3912 Calle Fortunada, San Diego, CA 92123, Tel: 619-569-6800, Telex: 249036; Empl.: 325; *Sls. Mgr.:* John Robinson

Local Sales Offices & Reps

AZ Phoenix, Scientific Dvs. 602-957-0401
CA Huntington Beach, Scientific Dvcs. 714-840-3501
CA San Diego, Scientific Dvcs. 619-268-9635
CA San Jose, Scientific Dvs. 408-554-0455
CO Broomfield, Scientific Dvcs. 303-469-5145
FL Longwood, Richard Schoonover, Inc. 305-788-3344
GA Marietta, MoRe 404-992-5172
MA E. Longmeadow, System Sls. 413-525-3679
MA Hudson, System Sls. 617-562-9777
NM Albuquerque, Scientific Dvcs. 505-883-3668
NY Valley Stream, Levison Sls. 516-266-5020
OH Brecksville, WRR Assocs. 216-526-2023
TX Richardson, Sym-Tek Sls. 214-680-3004
UT W. Valley City, Scientific Dvcs. 801-966-0105
WA Marysville, Scientific Dvcs. 206-653-6031
Can Montreal, Interfax Sys., Inc. 514-336-0392

SYMTRON CORP., 2415 E. Charleston Rd., Mountain View, CA 94043, Tel: 415-965-4500, TWX: 910-379-5002; Empl.: 350; *Sls. Mgr.:* Don Atkins

SYNEKTRON CORPORATION, 12000 S. W. Garden Place, Portland, OR 97223, Tel: 503-684-3090, Telex: 517441; Empl.: 72

SYNERGETICS INTL., INC., 6565 Odell Pl., P.O. Box E, Boulder, CO 80306-1236, Tel: 303-530-2020; *Sls. Mgr.:* Mike Sharkey

SYNERTEK, 3001 Stender Way, Santa Clara, CA 95051

SYNTEL DIV., Tegam, Inc., 7230 North Ridge Rd., Madison, OH 44057, Tel: 216-428-7505; Empl.: 15

SYNTEST CORP., 40 Locke Dr., Marlboro, MA 01752, Tel: 617-481-7827, TWX: 710-390-7659; *Sls. Mgr.:* Curtis P. Hoffman ..... **D•1073**

Local Sales Offices & Reps

CA Encino, King Engrg. 818-981-8677
CA Fullerton, King Engrg. 714-525-6782
CT Hamden, Digital Sls. 203-248-3641
IL Arlington Heights, Coombs Assocs. ... 312-439-9810
MD Silver Spring, Source Assoc. 301-725-5330
MA Waltham, Digital Assocs. 617-899-4300
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PA Newtown Square, SWR Assoc 215-356-8550
TX Waller, Vital Process Sys. 713-463-6811

SYNTRONIC INSTRUMENTS, INC., 100 Industrial Rd., Addison, IL 60101, Tel: 312-543-6444, TWX: 910-651-2191; FSC No.: 99409; Empl.: 175; *Sls. Mgr.:* Paul Evans

SYRACUSE ELCTRNS., P.O. Box 4770, Syracuse, NY 13221, Tel: 315-488-4911, Telex: 937-232; Empl.: 150

SYSCON INTL., INC., 1108 So. High St., So. Bend, IN 46618-1096, Tel: 219-232-3900, 800-348-2993, TWX: 810-299-2523; Empl.: 40; *Sls. Mgr.:* Les Barney

SYSTEK, 1023 N. Kellogg St., Kennewick, WA 99336, Tel: 509-735-1200; Empl.: 5

SYSTEMS DATA, INC., 2830 Copley Road, P.O. Box 4297, Akron, OH 44321, Tel: 216-666-0085; Empl.: 12; *Sls. Mgr.:* John C. Hall

SYSTEMS FURNITURE CO., 2727 Maricopa St., Torrance, CA 90503, Tel: 213-533-1212, TWX: 910-349-7518; *Sls. Mgr.:* Rick Labowitz

SYSTEMS PLUS, 1120 San Antonio Rd., Palo Alto, CA 94303, Tel: 415-969-7047, TWX: 910-373-2096; Empl.: 35

SYSTEMS RESCH. LABS., INC., 2800 Indian Ripple Rd., Dayton, OH 45440, Tel: 513-426-6000, TWX: 810-450-2621; FSC No.: 14590; Empl.: 1000

SYSTONICS, INC., Box 121, Winchester, MA 01890, Tel: 617-729-4439; Empl.: 11

SYSTRON-DONNER INERTIAL DIV., 2700 Systron Dr., Concord, CA 94518, Tel: 415-682-6161, TWX: 910-481-9478; Empl.: 416

SYSTRON-DONNER INSTR. DIV., 2727 Systron Dr., Concord, CA 94518, Tel: 415-676-5000, Telex: 171996, TWX: 910-481-9472; FSC No.: 52542; Empl.: 1400; *Sls. Mgr.:* Howard W. Mette

SYSTRON-DONNER MICROWAVE DIV., 14844 Oxnard St., Van Nuys, CA 91409, Tel: 818-786-1760, TWX: 910-495-1786; Empl.: 160; *Sls. Mgr.:* Tim A. Meehan

SYT, 1220 Barranca, El Paso, TX 79935, Tel: 915-593-1234; Empl.: 70; *Sls. Mgr.:* Larry Crum; *Dist. Mgr.:* John Sullivan

SYTEK, INC., 1225 Charleston Rd., Mountain View, CA 94043, Tel: 415-966-7300; *Sls. Mgr.:* Rhonda St. James

TAB BOOKS, Monterey & Pinola Aves., Blue Ridge Summit, PA 17214, Tel: 717-794-2191, Telex: 820562; Empl.: 175; *Sls. Mgr.:* Kevin Moran

TACHTRONIC INSTRUMENTS, INC., New Ulm, MN 56073, Tel: 507-354-3105

TADIRAN BATTERIES, See Plainview Elctrns.

TAFA, INC., Dow Rd, Box 1157, Bow, NH 03301-1157, Tel: 603-224-9585, Telex: 94-3424; Empl.: 50; *Sls. Mgr.:* Bob Unger; *Dist. Mgr.:* Leon Grant

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AL Huntsville, BJR Mfg. Reps. 205-881-3569
AZ Phoenix, Tri-Fab Sls. 602-265-3341
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CO Littleton, Omega Ltd. 303-798-7040
CT Hartford, Sturgeon Co. 203-249-7800

FL	Orlando, Oem Mktg. Corp.	305-299-1000
FL	Walton Beach, BJR Mfg. Reps.	904-863-3315
IL	Chicago, Aktron Corp.	312-658-3538
IN	Fort Wayne, Aktron	219-747-3650
IA	Davenport, Ensco Rep., Inc. Iowa	319-386-6600
KS	Overland Park, Ensco Rep. - Kansas	913-381-7557
KS	Wichita, Ensco Rep. - Wichita	316-683-1070
KS	Wichita, Ensco Wichita	316-683-1070
MD	Rockville, Datek	301-294-0744
MA	Needham, Sturgeon Co.	617-444-6603
MO	Markland Hgts., Ensco Rep., Inc.	314-423-3935
NJ	Ridgewood, Balloou, Inc.	201-444-6990
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TX	Arlington, Bell Comps.	817-461-5303
TX	El Paso, C.T. Carlberg & Assocs.	505-888-3883
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Intl	IS, Bnei Brak, Mono Elctrns.	011-44955-3606
Intl	ST, Wick, Osprey Elctrns.	011-44955-3606
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Can	Quebec, Avotronics	514-697-2135

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TAKEDA RIKEN CO., LTD., NS Bldg. 14th,4-1,Nishi-Shinjuku 2-Chome,Shinjuku-ku, Tokyo 160, Tokyo 176, Japan, Tel: 03-342-7500, Telex: 232-4914 Takeda J; Empl.: 1200; *Sls. Mgr.:* Hiroshi Yasui

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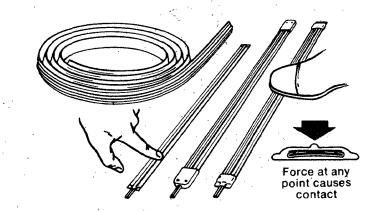

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TANSITOR ELCTRNS., West Rd., Bennington, VT 05201, Tel: 802-442-5473, TWX: 710-360-1782; FSC No.: 05079; Empl.: 200; *Sls. Mgr.:* Tom Moore; *Dist. Mgr.:* Tom Moore

TAPE CONCEPTS, INC., P. O. Box 815, 110 E. Vistula St., Bristol, IN 46507, Tel: 219-848-5234 ..... **D•1035**

TAPECON, INC., 10 Latta Rd., Rochester, NY 14612, Tel: 716-621-8400; Empl.: 80

TAPESWITCH CORP. OF AMERICA, 100 Schmitt Blvd., Farmingdale, NY 11735, Tel: 516-694-6312, Telex: 14-4611; Empl.: 100 ..... **B•1699**

TAPPAN WIRE & CABLE, 256 Oak Tree Rd., Tappan, NY 10983, Tel: 914-359-9300; FSC No.: 2G330; Empl.: 20; *Sls. Mgr.:* Mike Ressa

TARGA ELECTRONICS, Systems Inc., 3101 Hawthorne Rd., P. O. Box 8485, Ottawa, ON, Canada K1G 3H9, Tel: 613-731-9941, Telex: 053-3351; Empl.: 25; *Sls. Mgr.:* James E. Saarinen

TASKER SYSTEMS, 20131 Sunburst St., Chatsworth, CA 91311, Tel: 213-341-3010, TWX: 910-494-1214; FSC No.: 09017; Empl.: 250; *Sls. Mgr.:* Gary B. Etzler

TAUBER ELCTRNS. INC., 4901 Morena Blvd., Bldg. 314, San Diego, CA 92117, Tel: 619-274-7242; Empl.: 16; *Dist. Mgr.:* Doug Bennett ..... **D•1439**

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AZ	Phoenix, MacDonald & Assocs.	602-998-1848
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CA	Northridge, Myco Sls.	818-886-7101
CA	San Jose, Tom Haskins	415-964-0329
CA	Sunnyvale, Tom Haskins	415-964-0329
IL	Wheeling, Ed Joyner & Co.	312-520-1200
NV	Reno, Connie Dunning	702-849-0722
OK	Tulsa, Cunningham Comps. Corp.	918-492-0390
OR	Portland, Frank Jackson Assocs.	503-292-2638
TX	Dallas, Cunningham Comps. Corp.	214-233-4303
TX	Houston, Cunningham Comps. Corp.	713-451-4197
WA	Redmond, Frank Jackson Assocs.	206-881-7277

TAURUS COMPUTER PRODUCTS, INC., 1755 Woodward Dr., Ottawa, ON, Canada K2COPQ, Tel: 613-226-5361, Telex: 053-3577; Empl.: 17; *Sls. Mgr.:* Bill Ormerod; *Dist. Mgr.:* Bill Ormerod

TAURUS CORP., Academy Hill, P.O. Box 278, Lambertville, NJ 08530, Tel: 609-397-2390 ..... **D•1074**

Local Sales Offices & Reps

CA	Pasadena, Sci. Sls.	213-793-1244
FL	Clearwater, Brennan Assocs.	813-446-5006

TAU-TRON, INC., A Unit of General Signal, 10 Lyberty Way, Westford, MA 01886, Tel: 617-692-5100, Telex: 750245; Empl.: 300; *Sls. Mgr.:* Tom Lillard

TAYLOR ELECTRONICS, INC., 401 West Orion, Tempe, AZ 85283, Tel: 602-838-4523; Empl.: 25; *Sls. Mgr.:* Sharon F. Hansen ..... **D•1848**

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CA	Los Angeles, Power Partners., Inc.	213-215-0800
CA	Sunnyvale, Qualtech Assocs.	408-732-4800
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MN	Minneapolis, D. A. Case Assocs., Inc.	612-869-3700
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FL	St. Petersburg, Tech-Rep Assocs.	813-577-2779
GA	Atlanta, CSR Elctrns.	404-396-3720
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MA	Westwood, Apex Assocs.	617-326-5042
NY	Mount Vernon, Sonkin Assocs.	914-968-8282
NC	Raleigh, CSR Elctrns.	919-878-9200
TX	Richardson, McCoy Assocs. Co.	214-238-1017

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CA	Laguna Hills, English-Damco	714-837-3801
CA	Torrance, TDK Corp. of Amer.	213-539-6631
FL	St. Petersburg, Tech. Rep. Assocs.	813-577-2779
ID	Meridian, Intermountain Techn.	208-888-5708
IL	Palatine, Technology Sls.	312-991-6600
IN	Indianapolis, TDK Corp. of Amer.	317-872-0370
MA	Westwood, Comp. Rep. Assocs.	617-329-3454
MN	Bloomington, Smiley-Scott Assocs.	612-888-5551
NJ	Mount Laurel, Comtek, Inc.	609-235-8505
NY	East Syracuse, Nycom, Inc.	315-437-8343
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TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703, Tel: 602-792-2230, TWX: 910-952-1377; Empl.: 600; *Sls. Mgr.:* Barry Hamilton; *Dist. Mgr.:* Barry Hamilton

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CO	Castle Rock, Romulus	303-688-5127
CT	Cheshire, Scientific Comps.	203-272-2963
FL	Clearwater Beach, Perrott Assocs.	813-443-5214
FL	Orlando, Perrott Assocs.	305-298-7748
FL	Sunrise, Perrott Assocs.	305-482-6909
GA	Norcross, Interep Assocs.	404-449-8680
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KS Olathe, SPS Assocs. 913-764-4460
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CA Santee, Mouser Elctrns. 619-449-2220
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TECHCON SYSTEMS INC., 1059 E. Bedmar St., Carson, CA 90746, Tel: 213-603-8888; Empl.: 25; *Sls. Mgr.:* S. L. Morse

TECH-ETCH, INC., 45 Aldrin Rd., Plymouth, MA 02360, Tel: 617-747-0300; Empl.: 280; *Sls. Mgr.:* P. A. Thomas

TECH LABS., INC., Bergen & Edsall Blvds., Palisades Pk., NJ 07650, Tel: 201-944-2221; FSC No.: 83332; Empl.: 31 ..... **B•1700-1701**

Local Sales Offices & Reps

CT New Preston, NBS Assoc. 203-868-0501
GA Atlanta, Grady Duckett Sls. 404-451-3529
IL Glenview, Crimson Engrg. Co. 312-470-0024
KS DeSoto, Midtec Assocs. 913-441-6565
MI Jackson, N. Scroggs Co. 517-750-1170
MO Florissant, Midtec Assocs. 314-837-5200
NJ Haddonfield, Gray Assocs. 609-429-5300
NJ Upper Saddle River, Bob Cameron, Inc. 201-825-1304
NY Huntington Station, Haner Assocs. 516-242-7855
NY Pittsford, Net Sls. 716-467-4538
OH Cincinnati, Patco 513-931-3311
PA Pittsburgh, VerHill Assocs. 412-241-5202
TX Dallas, Southwest Elctrns. 214-690-9881
TX Houston, Southwest Elctrns. 713-729-1670
WA Seattle, SPS Elctrns. 206-323-4140

Local Distributors

CA Granada Hills, C & W Comps. Sls. 818-368-4032
CA Palo Alto, Mollard Mktg. 415-961-0456
NJ Garfield, Bob Cameron Assocs. 201-470-0700
NY Huntington Station, Haner Assocs., Inc. 516-242-7855

TECHLAND SYSTEMS, INC., 25 Waterside Plaza, New York, NY 10010, Tel: 212-684-7788, Telex: 961-134

TECHMAR

TECHMAR CORP., 2232 S. Cotner Ave., Los Angeles, CA 90064, Tel: 213-478-0046, 800-TECHMAR; Empl.: 12; *Sls. Mgr.:* Tom Cooper ..... **C•1090-1091**

TECHNAR INC., 205 N. 2nd Ave., Arcadia, CA 91006, Tel: 818-445-1143; *Sls. Mgr.:* James Rhodes

TECHNIC, INC., Box 965, Providence, RI 02901, Tel: 401-781-6100, Telex: 927514; Empl.: 125; *Sls. Mgr.:* A. A. Amtos

TECHNICAL AIDS TO INDEPENDENCE, INC., 12 Hyde Road, Bloomfield, NJ 07003, Tel: 201-338-8826; Empl.: 2

TECHNICAL COMMUNICATIONS CORPORATION, 100 Domino Drive, Concord, MA 01742, Tel: 617-862-6035, Telex: 923407

TECHNICAL DEVICES, 560 Alaska Ave., Torrance, CA 90503, Tel: 213-618-8437; FSC No.: 04772; Empl.: 21; *Sls. Mgr.:* D. Murrin; *Dist. Mgr.:* D. Murrin

TECHNICAL MARKING SYS., P.O. Box 10, Lynnfield, MA 01940, Tel: 617-334-6940; Empl.: 20

TECHNICAL MATERIALS, INC., Sub. of Brush Wellman, Inc., 5 Wellington Rd., Lincoln, RI 02865, Tel: 401-333-1700, TWX: 710-384-0600; Empl.: 250; *Sls. Mgr.:* John S. Seligman

Local Sales Offices & Reps

CA Los Angeles, E. J. Brookes Co. 213-722-8100
CA Santa Clara, E. J. Brookes Co. 408-988-1201
IL Elmhurst, Technical Materials 312-832-1263
IN Carmel, Larry Woodling Co. 317-844-7365
SC Greenville, B & B Sls. 803-297-1200

TECHNICAL PANELS, INC., 9162 La Rosa Dr., Temple City, CA 91780, Tel: 818-285-3105; Empl.: 13; *Sls. Mgr.:* Janlyn Prendiz

TECHNICAL RESEARCH & MFG., INC., R.F.D. # 10, Manchester, NH 03103, Tel: 603-627-6000, TWX: 710-220-6765; Empl.: 25; *Sls. Mgr.:* A. Marin

TECHNIPOWER, A PENRIL CO., P.O. Box 222, Commerce Pk., Danbury, CT 06810, Tel: 203-748-7001, TWX: 710-456-9280; FSC No.: 13850; Empl.: 135; *Sls. Mgr.:* Ivan Bourgoin (Variac); *Dist. Mgr.:* James McCarty ..... **A•2306; D•1850**

Local Sales Offices & Reps

CA Thousand Oaks, Technipower 805-493-2244
FL Maitland, EIR, Inc. 305-660-9600
MA Sudbury, Technipower 617-443-7347
MN Burnsville, Electromec Sls., Inc. 612-894-8200
MO St. Louis, Rothkopf & Assocs. 314-961-4485
NY Pennsauken, Ar-Jay Tech. 609-663-4260
TX Richardson, Scientific Sls. Co. 214-231-6541
Can Guelph, Ont., Victrix, Ltd. 518-836-1480

Local Distributors

CA Hollywood, Yale Radio Elctrn. 213-465-3186, 800-421-4144
CA Los Angeles, Cal-State Elctrns. 213-933-8187
CA Oakland, N. A. D'Arcy 415-638-7773
CA Santa Ana, Action Elctrns. 714-547-5169
IL Chicago, Delta Tech. Prods. Co. 312-478-1134
MA Woburn, Abbott Elctrns. Co. 617-935-2040
MI Dearborn, Indl. Temperature & Control 313-278-2210
MN St. Paul, Gopher Elctrns. Co. 612-483-3322
MO St. Louis, Olive Elctrns., Inc. 314-426-4500
NY Albany, Adirondack Elctrns., Inc. 518-456-0203
NY Farmingdale, Midway Indl. Elctrns. 516-293-6800
NC Charlotte, Jenkins Elec. Co. 704-392-7371
OH Dayton, Esco Inc. 513-226-1133
OK Tulsa, Inotek 918-627-1500
PA Philadelphia, PEI/Genesis 215-568-7400
TX Dallas, Inotek 214-243-7000
TX Houston, Inotek 713-688-4494
Can Guelph, Ont., Victrix, Ltd. 519-836-1480

TECHNIQUES, INC., 235 Jackson St., Englewood, NJ 07631, Tel: 201-569-5900; Empl.: 60

TECHNISERV INC., 1560 Teaneck Rd., Teaneck, NJ 07666, Tel: 201-837-0032; *Sls. Mgr.:* L. G. Mansoor

TECHNI-TOOL, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462, Tel: 215-825-4990, Telex: 834-763; Empl.: 40

Technitrol, Inc.

TECHNITROL, 1952 E. Allegheny, Philadelphia, PA 19134, Tel: 215-426-9105, Telex: 834245; FSC No.: 90095; Empl.: 350; *Sls. Mgr.:* G. Shilling ...**A•1458, 1574-1579, 2307; B•1002, 1010**

Local Sales Offices & Reps

AL Huntsville, Murcota 205-539-8476
AZ Phoenix, Integrated Sys. & Dev. Sls. ... 602-971-6250
CA San Rafael, Wright Assocs. 415-457-9940
CA Torrance, Detomasi & Grupp, Inc. 213-327-1775
CO Castle Rock, Romulus Elctrns., Ltd. ... 303-688-5127
GA Norcross, Dixie Tech. Mktg. 404-447-6832
IL Wauconda, Cudahy Sls. 312-526-2484
IA Des Moines, The Beams Co. 515-255-1148
MD Baltimore, Callas Elctrns. 301-744-7711
MA Newton, Normell Assoc. 617-969-5478
NM Albuquerque, Syntech 505-266-7951
NY Fairport, TAC Assoc. 716-425-1070
NY Jericho, J. Square Mktg. 516-935-3200
NY Syracuse, Tac Sls. 315-637-9861
OH Galion, Retronics 419-468-4568
PA Easton, The Kendon Co. 215-253-3100
PA Pittsburgh, Robert Kneip 412-823-0169
TX Austin, Elctrns. Mktg. Assoc. 512-837-0893
TX Grapevine, Elctrns. Mktg. Assoc. 817-481-7502
TX Houston, Elctrns. Mktg. Assoc. 713-498-8120
WA Redmond, General Technlg., Inc. 206-881-6456

TECHNO-COMPONENTS CORP., 7803 Lemona, Van Nuys, CA 91405, Tel: 818-781-1642, TWX: 910-495-2015; FSC No.: 17826;Multiple; Empl.: 135; *Sls. Mgr.:* Vivian Meranda

TECHNOLOGY DYNAMICS, 91 E. Carver Ave., Westwood, NJ 07675, Tel: 201-664-7636 ..... **D•1851**

Local Sales Offices & Reps

CA Sunnyvale, Sourcetronics, Inc. 408-988-8801
CA West Lake Village, Powerdyne Assocs. 818-991-0632
CO Aurora, Butler Tech. Sls. 303-343-3787
FL Orlando, Gramar, Inc. 305-894-3351
MD Hagerston, Stinson Assocs., Inc. 301-790-1193
VA Reston, Stinson Assocs., Inc. 703-620-0088

TECHNOLOGY PRODS., INC., 8900 Eton Ave., Canoga Park, CA 91304, Tel: 213-998-8555; FSC No.: 8K984; *Sls. Mgr.:* N. Lerman

TECHNO VATION, INC., 14 Crandall Ave., Pompton Lakes, NJ 07442, Tel: 201-839-0740; Empl.: 10; *Sls. Mgr.:* Fredric S. Miller

TECH SPRAY, INC., Box 949, Amarillo, TX 79105, Tel: 806-372-8523, Telex: 738450; Empl.: 40; *Sls. Mgr.:* R. G. Russell; *Dist. Mgr.:* Jack Swanson

TCI

TECHTROL CYCLONETICS, INC., 815 Market St, New Cumberland, PA 17070, Tel: 717-774-2746, TWX: 510-650-7003; FSC No.: 58792; Empl.: 25; *Sls. Mgr.:* Robert Nemeth ..... **A•1446-1449**

Local Sales Offices & Reps

CA	Mountain View, Dimes Grp.	415-493-1885
CA	San Jose, MC Assocs.	408-446-4100
CA	Signal Hill, Thorson Co.	213-595-0361
MD	Ellicott City, Nelson Elctrns. Inc.	301-747-7887
NY	Brooklyn, Pensky Assocs.	212-763-4936
PA	Philadelphia, Eastern Instrmn.	215-245-6660
TX	Dallas, Airep Elctrns.	214-349-4360

TECKNIT®

TECKNIT (EASTERN FACILITY), 129 Dermody St, Cranford, NJ 07016, Tel: 201-272-5500, Telex: 6853079 TCKNT, TWX: 710-996-5961; FSC No.: 07700; Empl.: 300; *Sls. Mgr.:* Thomas McCreery ..... **C•1530-1535, 1730-1737**

Local Sales Offices & Reps

AZ	Tempe, Tempe Assocs.	602-829-1901
CA	Granada Hills, C & W Comp. Sls.	818-368-4032
CA	San Diego, Cerco	619-450-1754
CA	Santa Barbara, Tecknit (Western Facility)	809-963-5811
CA	Santa Clara, Nova-Tronix	408-727-9530
CO	Denver, Tecknit Mid-West	303-733-8645
FL	Altamonte Springs, Lawrence Assocs.	305-339-3855
FL	Boca Raton, Lawrence Assocs.	305-368-7373
FL	Clearwater, Lawrence Assocs.	813-584-8110
FL	Maitland, EIR, Inc.	305-660-9600
FL	N. Lauderdale, EIR, Inc.	305-975-8718
FL	West Melbourne, Lawrence Assocs.	305-724-8294
IL	Arlington Hgts., Diethert/Angel	312-593-7600
IL	Chicago, Industrial Reps.	312-647-7755
IA	Davenport, Ensco-Rep, Inc.	319-386-6600
KS	Overland Park, Ensco-Rep, Inc.	913-381-7557
KS	Wichita, Ensco-Rep, Inc.	316-683-1070
MD	Rockville, Mechtronics	301-340-2130
MA	Wallingford, Com-Sale	203-269-7964
MI	Lavonia, Lowell-Wendt Mktg. Co.	313-464-2722
MN	Eden Prairie, Elctrn. Innovators, Inc.	612-941-0830
MN	St. Paul, Repco	612-642-2828
MO	Maryland Heights, Ensco-Rep, Inc.	314-423-3935
NH	Hudson, EMC Sales	603-889-5751
NJ	N. Plainfield, Brady Co.	201-753-7988
NJ	Union, Meridian Entprs.	201-687-6220
OH	Columbus, McFadden Sls.	614-459-1280
OH	Dayton, Jay Engrg.	513-253-2151
OH	N. Royalton, Jay Engrg.	216-237-4235
TX	Austin, P. J. Scanlon & Co.	512-255-2664
TX	Dallas, P. J. Scanlon & Co.	214-231-4661
TX	Houston, P. J. Scanlon & Co.	713-663-7779
WA	Bellevue, Quest Mktg.	206-747-9424

TECMAR, INC., 6225 Cochran Rd., Solon, OH 44139, Tel: 216-349-0600; Empl.: 600; *Sls. Mgr.:* Tim Mahoney

TECNETICS, Box 910, Boulder, CO 80306, Tel: 303-442-3837, TWX: 910-940-3246; Empl.: 225; *Sls. Mgr.:* V.L. Garrison

TECO CORP., Bay Rd., P. O. Box A, Winnisquam, NH 03289, Tel: 603-524-1998; Empl.: 80-100; *Sls. Mgr.:* Sandra Murphy

TECOM INDS., 9324 Topanga Canyon Blvd., Chatsworth, CA 91311, Tel: 818-341-4010, Telex: 69 8476; FSC No.: 59850001; Empl.: 107; *Sls. Mgr.:* Philip R. Poutre'

Local Sales Offices & Reps

AZ	Phoenix, J. Smith & Assocs.	602-267-0981
CA	Mountain View, Disman - Bakner	415-969-3010
CO	Colorado Springs, J. Smith & Assocs.	303-597-5343
FL	Ft. Lauderdale, The Snow Co.	305-563-2448
FL	Melbourne, Barkman Assocs.	305-254-1863
IL	Northfield, Feller Assocs.	312-446-8065
IA	Cedar Rapids, Feller Assocs.	319-364-0566
MD	Rockville, CLC Assocs.	301-340-1175
MD	Severna Pk., Delmarva Engrg.	301-647-8007
MA	Topsfield, R. F. Assocs.	617-887-9762
NM	Albuquerque, J. Smith & Assocs.	505-265-3406
NY	Hartsdale, Spectrum Sls.	914-472-8600
NY	Skaneateles, Robtron, Inc.	315-685-5731
OH	Dayton, GVT Assocs.	513-253-1356
PA	Lafayette Hill, M. Lader Co.	215-825-3177
TX	Arlington, John Houston Assocs.	817-265-2931
TX	San Antonio, John Casey	512-492-8154
WA	Bellevue, Thorson Co. Northwest	206-455-9180
Can	Ottawa, Ont., Gigatron Assocs.	613-225-4090

TECRON INDUSTRIAL PRODS., Crown Intl., Inc., 1718 W. Mishawaka Rd., Elkhart, IN 46517, Tel: 219-294-8300, Telex: 810-294-2160; Empl.: 335; *Sls. Mgr.:* Howard King ..... **D•1018-1021, 1310-1311**

Local Sales Offices & Reps

CA	Milpitas, IFM Inc.	408-945-5920
CA	Thousand Oaks, HTEC	805-492-2889
CT	Woodbridge, Electronic Marketing Assoc.	203-397-1461
IL	Chicago, Berndt Assocs.	312-283-0713
IA	Cedar Rapids, MAI Assocs.	319-396-8030
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
MN	St. Paul, Timewave Technigy., Inc.	612-451-7575
NJ	Wayne, Ramapo, Inc.	201-839-6767
NY	Syracuse, Labtronics Inc.	315-455-7314
OH	Brecksville, Audio Mktg. Assoc.	216-526-2426
TX	Longview, Audex	214-758-9392
WA	Bellevue, Showalter Instrs., Inc.	206-746-7970

TECSTOR, INC., 16161 Gothard Street, Huntington Beach, CA 92647, Tel: 714-842-0077, TWX: 856305; Empl.: 100; *Sls. Mgr.:* Nancy Moren/Robert Whitegiver

TED CORP., 11415 Johnson Dr., Shawnee Mission, KS 66203, Tel: 913-631-6211; FSC No.: 05209; Empl.: 48

TEDEA USA

TEDEA USA, 7800 Deering Ave., Canoga Park, CA 91304, Tel: 818-884-8818, Telex: 67-3382, TWX: 910-494-1951; Empl.: 10; *Sls. Mgr.:* Tony Smalarz ..... **B•1827**

Local Sales Offices & Reps

AZ	Tempe, Trembly Assocs.	505-266-8616
CA	Carlsbad, Elotek Sys.	714-438-4856
CA	Palo Alto, Gado Instr. Sls.	415-961-2222
CO	Littleton, Rado Elctrns.	303-794-4279
GA	Atlanta, Physimetrics	404-955-0155
KS	Shawnee Mission, Tech. Sls. Assocs.	913-888-3330
MA	Lexington, Jodan Technology	617-862-2354
MI	Trenton, I & C Sls.	313-671-1320
MN	Minneapolis, CMI	612-566-6930
MO	St. Louis, Tech. Sls. Assocs.	314-725-5361
NV	Las Vegas, Trembly Assocs.	702-739-6816
NJ	Hillsdale, C B Assocs.	201-664-6230
NM	Albuquerque, Trembly Assocs.	505-266-8616
OH	Cincinnati, I & C Sls.	513-772-3101
OR	Boring, Westerberg & Assocs.	503-667-8048
PA	Bethayres, Control Instr. Sls.	215-676-1808
UT	Bountiful, Rado Elctrns.	801-292-3248
WA	Bellevue, Westerberg & Assocs.	206-453-8881
Can	Rexdale, ON, SRP Control Sys. Ltd.	416-746-0117

TEGAM, 7230 N. Ridge Rd., Madison, OH 44057, Tel: 216-428-7505; Empl.: 25

TEGAL SCIENTIFIC, INC., Box 5905, Concord, CA 94524, Tel: 415-827-1054; *Sls. Mgr.:* L. Rigali

TEKA PRODS., 45 Salem, Providence, RI 02907, Tel: 401-785-4110, TWX: 710-582-4946; Empl.: 89; *Sls. Mgr.:* John Robertson; *Dist. Mgr.:* John Robertson

TEK-COM CORPORATION, 1887 O'Toole Avenue, C103, San Jose, CA 95131, Tel: 408-263-7400, Telex: 171617; Empl.: 23; *Sls. Mgr.:* Becki Huntington; *Dist. Mgr.:* Ms. Kimberly Swensen

TEKNATIONAL INDS., INC., 430 S. Clinton Ave., Rochester, NY 14620, Tel: 716-232-1291; FSC No.: 24227; Empl.: 15; *Sls. Mgr.:* J. D. Hochheimer

TEKTITE CORP., 4756 Platt Rd., Ann Arbor, MI 48104, Tel: 313-971-9379; *Sls. Mgr.:* Jose Padilla

TEKTONE SOUND & SIGNAL, 1331 S. Killian Dr., Lake Park, FL 33403, Tel: 305-844-2383, Telex: 51-3438; FSC No.: 59-1500771; Empl.: 50; *Sls. Mgr.:* Carlos Mira; *Dist. Mgr.:* Carlos Mira

TEKTRONIX, INC., P. O. Box 500, Y3-314, Beaverton, OR 97077, Tel: 800-547-1512, Oregon only 800-452-1877, TWX: 910-467-8708; FSC No.: 80009; Empl.: 20000

TELAUTOGRAPH, 8700 Bellanca Ave., Los Angeles, CA 90045, Tel: 213-641-3690, TWX: 910-328-6117; Empl.: 300

TELCOM INC., 8027 Leesburg Pike, Vienna, VA 22180, Tel: 703-893-7700, Telex: 89-2321

TELCO PRODUCTS CO., 44 Sea Cliff, Glen Cove, NY 11542, Tel: 516-759-0300; Empl.: 34

TELEBYTE TECHNOLOGY, INC., Remark Datacom Div., 270 East Pulaski Road, Greenlawn, NY 11740, Tel: 516-423-3232, TWX: 510-226-0449; Empl.: 40; *Sls. Mgr.:* Curt DeForest

TELECOMMUNICATIONS DEVICES, 2320 Wisconsin Ave., Downers Grove, IL 60515, Tel: 312-971-3460, TWX: 910-695-3222; Empl.: 45; *Sls. Mgr.:* Joel Peterson; *Dist. Mgr.:* Theresa Kanaga

TELECOMMUNICATIONS TECHNIQUES CORP., 444 N. Frederick Ave., Gaithersburg, MD 20877, Tel: 301-258-5011, Telex: 908736; Empl.: 100; *Sls. Mgr.:* John Farrell

TELECTRO SYS., 96-18 43rd Ave., Corona, NY 11368, Tel: 212-651-8900; Empl.: 75; *Sls. Mgr.:* H. Sussman

TELEDYNE AEROSPACE SYS., 1007 E. 10th St., Fairmont, MN 56031, Tel: 507-235-3355, 507-235-9712, TWX: 910-565-2120; FSC No.: 24600; Empl.: 150; *Sls. Mgr.:* Robert L. Johnson

TELEDYNE ANSONIA, One Riverside Dr., Ansonia, CT 06401, Tel: 203-735-9311, Telex: 963408; *Sls. Mgr.:* Frank J. Stvebbe

TELEDYNE CAMERA SYS., 131 N. Fifth Ave., Arcadia, CA 91006, Tel: 818-359-6691, Telex: 675-423; FSC No.: 14440; Empl.: 96; *Sls. Mgr.:* Roy Larson

TELEDYNE-CRYSTALONICS, 147 Sherman St, Cambridge, MA 02140, Tel: 617-491-1670, TWX: 710-320-1196; FSC No.: 12498;Multiple; Empl.: 185; *Sls. Mgr.:* A. H. Pauk; *Dist. Mgr.:* W. J. Kilgarriff

TELEDYNE/GEOTECH, 3401 Shiloh Rd., Garland, TX 75041, Tel: 214-271-2561, Telex: 73-2394; FSC No.: 99019; Empl.: 440

TELEDYNE GURLEY, 514 Fulton St. P.O. Box 88, Troy, NY 12181, Tel: 518-272-6300, TWX: 710-443-8156; *Sls. Mgr.:* G. S. Gordon

Local Sales Offices & Reps

CA	Los Altos, Servo Data	415-964-1325
CA	Montebello, Tucul Engrg.	213-728-7397
CO	Longmont, Piper Sls.	303-443-5337
CT	Hamden, JBL Assocs.	203-281-3161
FL	Melbourne, R-Rep Co.	305-725-6993
IL	Berkeley, Cadre Tech. Reps.	312-449-3900
IN	Indianapolis, Ron Schafer & Assocs.	317-848-2702
MD	Columbia, Stein Instr.	301-596-3748
MA	Holbrook, McLellan Assocs.	617-767-4771
MI	Livonia, Lowell-Wendt Mktg.	313-464-2722
MN	St. Paul, Northstar Motion & Control	612-770-5311
NJ	Union, Friedman Assocs.	201-964-6200
NY	Buffalo, Good Comps.	716-634-4400
OH	Cleveland, Geotronix	216-526-2535
OH	Trotwood, Geotronix	513-854-5939
OK	Tulsa, Spectra Sls.	918-633-7188
OR	Portland, Tech. Comp.	503-292-1518
PA	Cheltenham, Stein Instr.	215-379-1990
TX	Houston, Spectra Sls.	713-747-2798
TX	Richardson, Spectra Sls.	214-234-3600
UT	Salt Lake City, Piper Sls.	801-466-9336
Can	Ottawa, Ont., Intrade	613-727-1272

TELEDYNE INET, 2750 W. Lomita Blvd., Torrance, CA 90509, Tel: 213-325-5040, Telex: 67-7228; Empl.: 600

TELEDYNE KINETICS, Div. of Teledyne, Inc., 410 S. Cedros Ave., Solana Beach, CA 92075, Tel: 619-755-1181, TWX: 910-322-1135; Empl.: 110; *Sls. Mgr.:* John Schuler

TELEDYNE MECCA, Box 36393, Houston, TX 77236, Tel: 713-772-2811, TWX: 913-881-7039; Empl.: 75; *Sls. Mgr.:* J. M. Barrow

TELEDYNE MICROELECTRONICS, 12964 Panama St., Los Angeles, CA 90066, Tel: 213-822-8229, 213-870-9831, TWX: 910-343-7436; FSC No.: 16170; Empl.: 1500; *Sls. Mgr.:* W. Kennedy

TELEDYNE MICRONETICS, 7155 Mission Gorge Rd., San Diego, CA 92120, Tel: 619-583-3525, TWX: 910-335-2085; Empl.: 120; *Sls. Mgr.:* S. Amarillas

TELEDYNE MICROWAVE, 1290 Terra Bella Ave., Mountain View, CA 94043, Tel: 415-968-2211, TWX: 910-379-6939; FSC No.: 24022; Empl.: 325

TELEDYNE PHILBRICK, Allied Dr. Rte 128, Dedham, MA 02026, Tel: 617-329-1600, TWX: 710-348-6726; Empl.: 250

TELEDYNE RELAYS, 12525 Daphne Ave., Hawthorne, CA 90250, Tel: 213-777-0077, TWX: 910-321-4610; *Sls. Mgr.:* Tom Garland

Local Sales Offices & Reps

AL Huntsville, Montgomery Mktg. 205-830-0498
AZ Scottsdale, Arcom Sls. 602-947-5745
CA Saratoga, Teledyne Relays 408-996-9944
CO Denver, Quorum 3 303-696-8480
CT Stratford, G. Rosen Co. 203-375-5456
FL Clearwater, Hutto, Hawkins & Peregoy 813-797-4447
FL Maitland, Hutto, Hawkins & Peregoy .. 305-831-2474
FL Pompano Beach, Hutto, Hawkins & Peregoy 305-971-5750
GA Norcross, Montgomery Mktg. 404-447-6124
IL Glen Ellyn, Teledyne Relays 312-858-1090
IN Kokomo, Schillinger Asso. 317-452-4057
IA Cedar Rapids, Stan Clothier Co. 319-395-0245
KS Olathe, C-Tron 913-829-0073
MD Towson, Arbotek Assocs. 301-825-0775
MA Framingham, G. Rosen Co. 617-879-5505
MN Minneapolis, S. Clothier Co. 612-944-3456
MO St. Louis, Rothkoph & Assocs. 314-961-4485
NJ Cranford, Teledyne Relays 201-272-0020
NM Albuquerque, Reptronix 505-292-1718
NY Mount Vernon, Friedman-Smith Elctrns. 914-664-4866
NY Syracuse, I.A. Hotze Co. 315-479-6641
NC Cary, Montgomery Mktg. 919-467-6319
OH Dayton, J.C. Hofstetter Co. 513-296-1010
OH Medina, J.C. Hofstetter Co. 216-241-4880
OR Beaverton, B & P Sls. 503-641-3486
PA Hickory, J. C. Hofstetter Co. 412-356-2305
PA Pennsauken, Vantage Sls. 609-663-6660
TX Austin, Kruvand Assocs. 512-441-6777
TX Dallas, Kruvand Asso. 214-437-3355
TX Houston, Kruvand Asso. 713-780-9710
UT Sandy, Quorum 3 801-943-9227
WA Bellevue, B & P Asso. 206-454-6571
Can Calgary, Alb., Deskin Sls. 403-466-2106
Can Edmonton, Alb., Deskin Sls. 403-466-2106
Can Markham, Ont., Deskin Sls. 416-475-1412
Can Ottawa, Ont., Deskin Sls. 613-729-1099
Can Richmond, B.C., Deskin Sls. 604-273-4963
Can St. Laurent, Que., Deskin Sls. 514-331-2860
Can Transcona, Man., Deskin Sls. 403-466-2106

Local Distributors

AL Huntsville, Pioneer Elctrns. 205-837-9300
AZ Phoenix, Wyle 602-249-2232
AZ Tempe, Time-Arizona 602-967-2000
CA Anaheim, Time-Anaheim 714-937-0911
CA Chatsworth, Time 818-998-7200
CA El Segundo, Wyle Dist. Grp. 213-322-8100
CA Irvine, Wyle Dist. Grp. 714-863-9953
CA Rancho Cordova, Wyle 916-638-5282
CA San Diego, Time 619-586-1331
CA San Diego, Wyle Dist. Grp. 619-565-9171
CA Santa Clara, Wyle Dist. Grp. 408-727-2500
CA Sunnyvale, Time-N. Cal. 408-734-9888
CA Torrance, Time-West 213-320-0880
CO Englewood, Time-Colorado 303-850-7701
CO Thornton, Wyle Dist. Grp. 303-457-9953
CT Cheshire, Time 203-271-3200
CT Orange, Milgray/Conn. 203-795-0711
FL Altamonte Springs, Pioneer Elctrns. ... 305-834-9090
FL Dania, Summit 305-920-6253
FL Deerfield Beach, Pioneer 305-428-8877
FL Ft. Lauderdale, Time-Florida 305-974-4800
FL Winter Pk., Milgray/Fla. 305-647-5747
GA Atlanta, Electro-Air-Georgia 404-351-3545
GA Atlanta, Milgray 404-393-9666
GA Norcross, Pioneer 404-448-1711
IL Bensenville, Milgray 312-350-0490
IL Elk Grove Village, Pioneer/Chicago ... 312-437-9680
IN Indianapolis, Pioneer/Indianapolis 317-849-7300
KS Overland Pk., Milgray/Kansas City 913-236-8800
MD Columbia, Time-Maryland 301-964-3090
MD Gaithersburg, Pioneer/Wash. 301-921-0660
MD Rockville, Milgray/Wash. 301-468-6400
MA Burlington, Milgray/New England 617-272-6800
MA Woburn, Time-New England 617-935-8080
MI Livonia, Pioneer/Mich. 313-525-1800
MN Bloomington, Time 612-944-9192
MN Minnetonka, Pioneer 612-935-5444
MO St. Louis, Time-Mid West 314-391-6444
NJ Marlton, Milgray/Delaware Valley 609-983-5010
NY Buffalo, Summit Dist. 716-887-2800
NY Farmingdale, Milgray Elctrns. 516-420-9800
NY Hauppauge, Time-NY 516-273-0100
NY Pittsford, Milgray 716-385-9330
NY Rochester, Summit Dist. 716-334-8110
NC Charlotte, Pioneer 704-527-8188
OH Cleveland, Milgray/Cleveland 216-447-1520
OH Cleveland, Pioneer/Cleveland 216-587-3600
OH Dayton, Pioneer/Dayton 513-236-9900
OR Hillsboro, Wyle Dist. Grp. 503-640-6000
PA Horsham, Pioneer/Delaware Valley ... 215-674-4000
PA King of Prussia, Time-Mid Atlantic 215-337-0900
PA Pittsburgh, Pioneer/Pittsburgh 412-782-2300
TX Austin, Pioneer 512-835-4000
TX Austin, Wyle 512-834-9957
TX Dallas, Electro-Air-Southwest 214-385-0566
TX Dallas, Milgray 214-248-1603
TX Dallas, Pioneer Std. 214-386-7300
TX Houston, Pioneer Elctrns. 713-988-5555
TX Houston, Wyle 713-879-9953
TX Richardson, Wyle-Dallas 214-235-9953
UT Salt Lake City, Wyle Dist. Grp. 801-974-9953
WA Bellevue, Electro-Air-Northwest 206-641-3640
WA Bellevue, Wyle Dist. Grp. 206-453-8300
Can Calgary, Alb., Deskin Sls. 403-466-2106
Can Edmonton, Alb., Deskin Sls. 403-466-2106
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Can St. Laurent, Que., Deskin Sls. 514-331-2860
Can Transcona, Man., Deskin Sls. 403-466-2106

TELEDYNE ROTOLITE, 150 Mt. Bethel Rd., Warren, NJ 07060, Tel: 201-647-1040, TWX: 710-986-3017; *Sls. Mgr.:* J. F. Stickel

TELEDYNE SEMICONDUCTOR, 1300 Terra Bella Ave., PO Box 7267, Mountain View, CA 94039-7267, Tel: 415-968-9241, TWX: 910-379-6494; FSC No.: 15818; Empl.: 2000; *Sls. Mgr.:* Ralph Granchelli

TELEDYNE SOLID STATE PRODUCTS, 12525 Daphne Ave., Hawthorne, CA 90250, Tel: 213-777-0077, TWX: 910-321-4610; *Sls. Mgr.:* Tom Garland

Local Sales Offices & Reps

AL Huntsville, Montgomery Mktg. 205-830-0498
AZ Scottsdale, Arcom Sls. 602-947-5745
CA Saratoga, Teledyne Relays 408-996-9944
CO Denver, Quorum 3 303-696-8480
CT Stratford, G. Rosen Co. 203-375-5456
FL Clearwater, Hutto, Hawkins & Peregoy 813-797-4447
FL Maitland, Hutto, Hawkins & Peregoy .. 305-831-2474
FL Pompano Beach, Hutto, Hawkins & Peregoy 305-971-5750
GA Norcross, Montogmery Mktg. 404-447-6124
IL Glen Ellyn, Teledyne Relays 312-858-1090
IN Kokomo, Schillinger Assocs. 317-452-4057
IA Cedar Rapids, Stan Clothier Co. 319-395-0245
KS Olathe, C-Tron 913-829-0073
MD Towson, Arbotek Assocs. 301-825-0775
MA Framingham, G. Rosen Co. 617-879-5505
MN Minneapolis, S. Clothier Co. 612-944-3456
MO St. Louis, RothKopf & Assocs. 314-961-4485
NJ Cranford, Teledyne Relays 201-272-0020
NM Albuquerque, Reptronix 505-292-1718
NY Mount Vernon, Friedman-Smith Elctrns. 914-664-4866
NY Syracuse, I. A. Hotze Co. 315-479-6641
NC Cary, Montgomery Mktg. 919-467-6319
OH Dayton, J. C. Hofstetter Co. 513-296-1010
OH Medina, J. C. Hofstetter Co. 216-241-4880
OR Beaverton, B & P Sls. 503-641-3486
PA Hickory, J. C. Hofstetter Co. 412-356-2305
PA Pennsauken, Vantage Sls. 609-663-6660
TX Austin, Kruvand Assocs. 512-441-6777
TX Dallas, Kruvand Assocs. 214-437-3355
TX Houston, Kruvand Assocs. 713-780-9710
UT Sandy, Quorum 3 801-943-9227
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Can St. Laurent, Que., Deskin Sls. 514-331-2860
Can Transcona, Man., Deskin Sls. 403-466-2106

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CA Santa Clara, Wyle Dist. Grp. 408-727-2500
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CA Torrance, Time/West 213-320-0880
CO Englewood, Time/Colorado 303-850-7701
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CT Cheshire, Time/Connecticut 203-271-3200
CT Orange, Milgray/Conn. 203-795-0711
FL Altamonte Springs, Pioneer Elctrns. ... 305-834-9090
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MD Rockville, Milgray/Wash. 301-468-6400
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MI Livonia, Pioneer/Mich. 313-525-1800
MN Bloomington, Time/Minnesota 612-944-9192
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NY Buffalo, Summit Dist. 716-887-2800
NY Farmingdale, Milgray Elctrns. 516-420-9800
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PA King of Prussia, Time/Mid Atlantic 215-337-0900
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TX Austin, Wyle/Austin 512-834-9957
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TX Dallas, Milgray/Dallas 214-248-1603
TX Dallas, Pioneer Std. 214-386-7300
TX Houston, Pioneer Elctrns. 713-988-5555
TX Houston, Wyle/Houston 713-879-9953
TX Richardson, Wyle/Dallas 214-235-9953
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Can St.Laurent,Que., Deskin Sls. 514-331-2860
Can Transcona, Man., Deskin Sls. 403-466-2106

TELEDYNE WESTERN WIRE & CABLE, 2425 E. 30th St., Los Angeles, CA 90051, Tel: 213-587-7103, Telex: 67-7110; Empl.: 250; *Sls. Mgr.:* W. Drolet, Jr.; *Dist. Mgr.:* M. Ibrahim

TELEFACE CORP., 111 Rivington St., New York, NY 10002, Tel: 212-477-6802, Telex: 125126; Empl.: 4; *Sls. Mgr.:* Richard W. Gans

TELEFUNKEN, See AEG Telefunken

TELEMECANIQUE, INC., Allied Control Products, 100 Relay Rd., Plantsville, CT 06479, Tel: 203-621-6771; FSC No.: 5945; Empl.: 1200; *Sls. Mgr.:* Mark Freyermuth ..... **B•1450-1459**

Local Sales Offices & Reps

AZ Tempe, Delta Elctrns. Sls. Corp. 602-244-1601
CA Cerritos, El-Com, Inc. 213-404-2961

CA Milpitas, Maxim Elec. Sls. 408-946-6001
CO Denver, Electronic Sls., Inc. 303-771-6300
CT Clinton, Selmark Assocs., Inc. 203-573-9088
FL Melbourne, Raycom, Inc. 305-259-7988
FL Melbourne Beach, Raycom, Inc. 305-725-4558
FL Orlando, Raycom, Inc. 305-859-5504
FL Plantation, Raycom, Inc. 305-741-6690
FL Wellborn, Raycom, Inc. 904-963-5023
GA Atlanta, Electro-Rep Assocs. 404-320-1134
IL Chicago, Industrial Reps., Inc. 312-647-7755
IN Indianapolis, M & L Elctrn. Sls. 317-359-4742
MD Columbia, Delta III Assocs., Inc. 301-730-4700
MA Millis, Selmark Assocs., Inc. 617-376-2914
MI Livonia, Electronic Salesmasters, Inc. 313-421-2520
MN Minneapolis, Giefer Sls. 612-884-2395
NH Hopkinton, Selmark Assocs., Inc. 603-746-3299
NJ Medford, Component Consultants 609-654-5300
NJ Oakland, CRG Grp., Inc. 201-337-8149
NY Marcellus, Noeth-Honsinger Assocs. 315-673-1052
NY Pittsford, Noeth-Honsinger Assocs. 716-586-9002
NC Charlotte, Electro-Rep Assocs. 704-527-2530
OH Beachwood, Electronic Salesmasters, Inc. 216-831-9555
OR Aloha, Huntley Assocs. 503-649-5388
PA Champhill, Process Engrg. Co. 717-761-5083
PA Pittsburgh, Process Engrg. Co. 412-561-5050
TX Austin, Delta Comps., Inc. 512-458-4288
TX El Paso, Alexander Entprs. 915-591-3142
TX Seagoville, Delta Comps., Inc. 214-287-6333
VA Midlothian, Delta III Assocs., Inc. 804-379-1816
WA Everett, Huntley Assocs. 206-353-1833
WI Milwaukee, Industrial Reps., Inc. 414-259-0965
Can Don Mills, R. D. Assocs. 416-444-0959

Local Distributors

AL Birmingham, Newark Elctrns. 205-942-4044
AL Huntsville, Newark Elctrns. 205-837-9091
AZ Pheonix, Newark Elctrns. 602-957-0085
AZ Phoenix, Newark Elctrns. 602-957-0085
AZ Tempe, AnJon Elctrns. 602-894-1332
AZ Tempe, Newark Elctrns. 602-968-7441
AZ Tucson, Newark Elctrns. 602-628-7891
AR Little Rock, Newark Elctrns. 501-225-8130
CA Buena Park, Control Design 714-521-5040
CA Cerritos, El-Com, Inc. 213-404-2961
CA Chula Vista, Newark Elctrns. 619-585-1023
CA Corona, Inter-Conn Elctrns. 714-735-8200
CA Covina, Newark Elctrns. 213-339-9027
CA Foster City, Newark Elctrns. 415-572-8300
CA Hayward, KEA Elctrns. 415-887-2900
CA Hayward, Newark Elctrns. 415-632-7522
CA Inglewood, Newark Elctrns. 213-671-7066
CA Long Beach, Newark Elctrns. 213-427-7408
CA Los Angeles, Master Distrs. 213-452-1229
CA Monrovia, Erik-A Elctrns. 818-574-1020
CA Orange, Newark Elctrns. 714-634-8224
CA Reseda, Newark Elctrns. 213-344-2686
CA Riverside, Newark Elctrns. 714-784-1101
CA Sacramento, Newark Elctrns. 916-971-9555
CA San Carlos, Control Design 415-952-4808
CA San Diego, Newark Elctrns. 619-272-9480
CA San Jose, Newark Elctrns. 408-995-6255
CA San Jose, Newark Elctrns. 408-554-1616
CA San Mateo, Newark Elctrns. 415-571-5300
CA Sunnyvale, Newark Elctrns. 408-720-8755
CA Torrance, Newark Elctrns. 213-212-6161
CA Tustin, Newark Elctrns. 714-549-3004
CO Arvada, Newark Elctrns. 303-423-7941
CO Colorado Springs, Newark Elctrns. 303-576-2644
CO Denver, Newark Elctrns. 303-757-3351
CO Denver, Newark Elctrns. 303-373-4540
CO Englewood, Electronic Sls. 303-771-6300
CT Bloomfield, Newark Elctrns. 203-243-1731
CT East Hartford, R & S Elctrn. Distrs. 203-528-9901
CT East Haven, J V Elctrns. 203-469-2321
CA Orange, Newark Elctrns. 714-634-8224
CT Stamford, Bond Elctrns. 203-348-2663
FL Altamonte Springs, Control Design 305-788-3220
FL Clearwater, Newark Elctrns. 813-443-0661
FL Cocoa, Newark Elctrns. 305-631-2017
FL Ft. Lauderdale, Newark Elctrns. 305-587-2372
FL Ft. Lauderdale, Peerless Radio 305-973-4141
FL Ft. Walton Beach, Newark Elctrns. 904-862-2157
FL Jacksonville, Newark Elctrns. 904-399-5041
FL Orlando, Newark Elctrns. 305-896-8350
FL Tampa, Newark Elctrns. 813-872-5618
GA Fayetteville, Frankland, Inc. 404-461-4026
GA Forest Park, Newark Elctrns. 404-366-4050
GA Norcros, Newark Elctrns. 404-448-1300
GA Savannah, Newark Elctrns. 912-355-0457
HI Pearl City, Newark Elctrns. 808-456-5933
ID Boise, Newark Elctrns. 208-342-4311
ID Pocatello, Kimball Elctrns. 208-232-2201
ID Spirit Lake, A-I Elctrn. Supp. 208-623-3111
IL Chicago, Newark Elctrns. 312-784-5100
IL Downers Grove, Newark Elctrns. 312-969-9440
IL Genoa, Control Design 815-784-6515
IL Hickory Hills, Newark Elctrns. 312-430-4370
IL Hillside, Newark Elctrns. 312-544-8340
IL Mt. Prospect, Newark Elctrns. 312-259-9090
IL Northbrook, Newark Elctrns. 312-480-1300
IL Oak Park, Newark Elctrns. 312-524-1800
IL Rockford, Newark Elctrns. 815-229-0225
IL Schaumburg, Newark Elctrns. 312-843-0700
IL Springfield, Newark Elctrns. 217-787-9972
IN Ft. Wayne, Graham Elctrns. 219-423-3422
IN Ft. Wayne, Newark Elctrns. 219-484-0766
IN Indianapolis, Control Design 317-788-4559
IN Indianapolis, Graham Elctrns. 317-634-8202
IN Indianapolis, Newark Elctrns. 317-872-7070
IN Indianapolis, Newark Elctrns. 317-926-7050
IN Merrillville, Newark Elctrns. 312-768-5059
IA Bettendorf, Newark Elctrns. 319-359-3711
IA Cedar Rapids, Newark Elctrns. 319-362-1171
IA Des Moines, Newark Elctrns. 515-278-0670
KS Overland Park, Newark Elctrns. 913-341-1121
KS Wichita, Newark Elctrns. 316-267-8755
KS Wichita, RSC, Inc. 316-267-5213
KY Louisville, Newark Elctrns. 502-423-0280
LA Metarie, Newark Elctrns. 504-838-9771
LA New Orleans, Newark Elctrns. 504-364-1031
MD Beltsville, Newark Elctrns. 301-937-9540
MD Cheverly, Newark Elctrns. 301-773-1333
MD Columbia, Aztech Elctrns. 301-995-1760
MD Ellicott City, Newark Elctrns. 301-461-2300
MD Gaithersburg, Axis Elctrns. 301-840-9640
MA Methuen, Newark Elctrns. 617-688-1837
MA Newton, Greene-Shaw 617-969-8900
MA Sharon, Newark Elctrns. 617-784-4061
MA Springfield, Newark Elctrns. 413-785-5851
MA Waltham, Newark Elctrns. 617-894-8050
MA Wilmington, J V Elctrns. of Boston 617-657-6523
MA Woburn, Newark Elctrns. 617-935-8350
MA Worcester, Newark Elctrns. 617-757-4515
MI Grand Rapids, Newark Elctrns. 616-241-6681
MI Oak Park, Newark Elctrns. 313-968-2950
MI Oak Park, Newark Elctrns. 313-967-0600
MI Saginaw, Newark Elctrns. 517-799-0480
MN Burnsville, Newark Elctrns. 612-890-7362
MO Crestwood, Newark Elctrns. 314-821-7466
CT East Haven, J V Elctrns. 203-469-2321
MN Minneapolis, Control Design 612-721-1628
MN Minneapolis, Newark Elctrns. 612-331-6350
NH Nashua, Newark Elctrns. 603-883-9010
MO St. Louis, Newark Elctrns. 314-521-5066
NJ Bordentown, Newark Elctrns. 609-298-4450
NJ Edison, Newark Elctrns. 201-572-2103
MO Independence, Newark Elctrns. 816-478-0561
MN Minneapolis, Industrial Comps. 612-831-2666
MO St. Louis, Control Design 314-426-3150
MO St. Louis, Interstate Industrial 314-423-4322
MN Crystal, Newark Elctrns. 612-561-7541
NE Omaha, Newark Elctrns. 402-392-1221
MO Blue Springs, Newark Elctrns. 816-228-3170
NJ Fairfield, Newark Elctrns. 201-882-0300
MS Jackson, Newark Elctrns. 601-956-3834
NJ Kenilworth, Federated Purchaser 201-272-0505
NJ Medford, Component Consultants 609-654-5300
NJ Pennsauken, Newark Elctrns. 609-663-9490
NJ Springfield, Newark Elctrns. 201-376-9500
MN St. Paul, Newark Elctrns. 612-631-2683
NM Albuquerque, International Elctrns. 505-345-8127
NM Albuquerque, Newark Elctrns. 505-883-6181
NY Amherst, Standard Elctrns. 716-691-3801
NY Buffalo, Newark Elctrns. 716-892-4321
NY Buffalo, Summit Distrbg. 716-884-3450
NY Farmingdale, Pride Elctrns. 516-293-4020
NY Hauppauge, Sherburn Elctrns. 516-231-4300
NY Latham, Newark Elctrns. 518-783-0983
NY Newburgh, Newark Elctrns. 914-564-2700
NY Rochester, Newark Elctrns. 716-427-8220
NY Rochester, Summit Distrbg. 716-334-8110
NY Rome, Rome Elctrns. 315-337-5400
NY Syracuse, Newark Elctrns. 315-437-6611
NY Valley Stream, Newark Elctrns. 516-825-6200
NC Charlotte, Control Design 704-588-4410
NC Charlotte, Newark Elctrns. 704-535-5650
NC Greensboro, Newark Elctrns. 919-292-7240
NC Raleigh, Newark Elctrns. 919-781-7677
NC Winston Salem, Kirkman Elctrns. 919-722-9131
OH Akron, Akron Elctrns. 216-762-8818
OH Akron, Newark Elctrns. 216-374-9987
OH Bedford Heights, Newark Elctrns. 216-439-4383
OH Cincinnati, Graham Elctrns. 513-772-1661
OH Cincinnati, Newark Elctrns. 513-771-9700
OH Cleveland, Newark Elctrns. 216-391-9330
OH Columbus, Newark Elctrns. 614-481-8141
OH Columbus, Newark Elctrns. 614-451-0002
OH Dayton, Newark Elctrns. 513-294-8980
OH Dayton, Stotts Friedman 513-298-5555
OH North Canton, Newark Elctrns. 216-497-7713
OH Solon, Target Elctrns. 216-248-7930
OH Toledo, Newark Elctrns. 419-866-0404
OH Warrensville Heights, Newark Elctrns. 216-587-1700
OH Wickliffe, Gateway Megatech 216-944-5801
OH Youngstown, Newark Elctrns. 216-793-6134
OK Oklahoma City, Electro Entprs. 405-427-6591
OK Oklahoma City, Newark Elctrns. 405-495-5000
OK Tulsa, Newark Elctrns. 918-832-7004
OR Portland, Carlyle Tech. Sls. 503-244-1375
OR Portland, Newark Elctrns. 503-257-0741
PA Allentown, Federated Purchaser 215-437-4481
PA Allentown, Newark Elctrns. 215-434-7171
PA Cornwells Heights, Newark Elctrns. 215-245-7300
PA Erie, Newark Elctrns. 814-453-5726
PA Erie, Wettekin Elctrns. 814-838-9184
PA Johnstown, Bird Elec. & Supp. 814-535-3574
PA King of Prussia, Newark Elctrns. 215-265-0933
PA Malvern, Control Design 215-296-0150
PA Malvern, Newark Elctrns. 215-296-5522
PA McKees Rocks, Newark Elctrns. 412-331-2400
PA McKeesport, Barno Radio 412-751-5966
PA North Versailles, Newark Elctrns. 412-824-8504
PA Philadelphia, Philadelphia Elctrns. 215-568-7400
PA Philadelphia, Shap Elctrns. 215-969-3300
PA Pittsburgh, Newark Elctrns. 412-367-2790
RI Warwick, Newark Elctrns. 401-738-4010
SC Greenville, Newark Elctrns. 803-288-9610
TN Knoxville, Newark Elctrns. 615-588-6493
TN Memphis, Newark Elctrns. 901-365-8060
TN Nashville, Electra Distrbg. Co. 615-329-3971
TN Nashville, Newark Elctrns. 615-883-2482
TX Dallas, Control Design 214-358-1441
TX Dallas, Newark Elctrns. 214-340-3585
TX Dallas, Sterling Elctrns. 214-243-1600
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TX El Paso, International Elctrns. 915-598-3406
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TX Ft. Worth, Newark Elctrns. 817-589-1295
TX Garland, Newark Elctrns. 214-494-5911
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TX Houston, Newark Elctrns. 713-782-4800
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TX San Antonio, Newark Elctrns. 512-349-2641
UT Salt Lake City, Kimball Elctrns. 801-328-2075
UT Salt Lake City, Newark Elctrns. 801-484-8611
VA Arlington, Newark Elctrns. 703-522-0880
VA Richmond, Newark Elctrns. 804-282-5671
VA Virginia Beach, Newark Elctrns. 804-499-0719
WA Bellevue, Newark Elctrns. 206-641-9809
WA Bellevue, Newark Elctrns. 206-641-4676
WA Bellevue, Newark Elctrns. 206-641-9900
WA Seattle, Carlyle Tech. Sls. 206-575-6750
WA Spokane, Newark Elctrns. 509-922-5007
WV Charleston, Newark Elctrns. 304-345-6505
WI Green Bay, Newark Elctrns. 414-494-1400
WI Madison, Newark Elctrns. 608-221-4738
WI Milwaukee, Newark Elctrns. 414-463-1000
WI Milwaukee, Newark Elctrns. 414-351-6031
WI New Berlin, Control Design 414-784-1015
Can Downsview, Ont., Future Elctrns. 416-638-4771
Can Ottawa, Ont., Future Elctrns. 613-820-9471
Can Pointe Claire, Que., Future Elctrns. 514-694-7710
Can Vancouver, B.C., Future Elctrns. 604-438-5545

TELEMET, 185 Dixon Ave., Amityville, NY 11701, Tel: 516-842-2300, TWX: 510-227-9850; Empl.: 60

TELEPACIFIC ELECTRONICS CO., INC., 772 N. Twin Oaks Valley Road, San Marcos, CA 92069, Tel: 619-744-4415; Empl.: 25; *Sls. Mgr.:* Vernon P. Cooke

TELEPHONICS, 770 Park Ave., Huntington, NY 11743, Tel: 516-549-6000, Telex: 96-7815, TWX: 510-226-6983; Empl.: 800; *Sls. Mgr.:* R. H. Collopy

TELERAM COMMUNICATIONS, 2 Corporate Park Dr., White Plains, NY 10604, Tel: 914-694-9270, Telex: 64-6658; Empl.: 50; *Sls. Mgr.:* R. R. Ansell

TELESENSORY SPEECH SYS., Telesensory Sys., Inc., 3408 Hillview Ave., Palo Alto, CA 94304, Tel: 415-856-8255, Telex: 348352; *Sls. Mgr.:* David Giblon

TELESIS LABORATORY, Box 1972, Chillocothe, OH 45601, Tel: 614-642-5000, Telex: 24-5451; Empl.: 22; *Sls. Mgr.:* John Robertson

TELETERMINAL CORP., Greenland, NH 03840, Tel: 603-431-1200; Empl.: 13

TELETYPE, 5555 Touhy Ave., Skokie, IL 60076, Tel: 312-982-2000, Telex: 25-4051, TWX: 910-223-3611; FSC No.: 5815; Empl.: 6,000; *Sls. Mgr.:* D. M. Printz

TELEVIDEO SYS., INC., 1170 Morse Ave., Sunnyvale, CA 94086, Tel: 408-745-7760, TWX: 910-338-7633; *Sls. Mgr.:* Steve Tatum (VDT Div.)

TELEVISION EQUIP. ASSOCS., Box 393, So. Salem, NY 10590-0393, Tel: 914-763-8893, TWX: 710-575-2600; Empl.: 10

TELEVISION MICROTIME, INC., 1280 Blue Hills Ave., Bloomfield, CT 06002, Tel: 203-242-4242, TWX: 710-425-2390; Empl.: 80

TEL LABS, INC., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053, Tel: 603-625-8994, TWX: 710-220-1844; FSC No.: 94322;Multiple; Empl.: 180 ..... **A•1952-1953**

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrn. Sls.	205-881-5031
AZ	Tempe, Gassner & Clark	602-968-9037
CA	La Mirada, Select Elec.	714-739-8891
CA	Mountain View, Serra Assocs.	415-964-4300
CO	Aurora, Sage Sls.	303-750-3501
FL	Clearwater, Beacon Elec. Sls.	813-796-2378
FL	Ft. Lauderdale, Beacon Elec. Sls.	305-491-1054
FL	Maitland, Beacon Elec. Sls.	305-647-3498
FL	Melbourne, Beacon Elec. Sls.	305-724-8010
GA	Atlanta, Beacon Elec. Sls.	404-256-9640
IL	Downers Grove, Richmar Elec. Corp.	312-968-0118
IN	West Lafayette, Richmar Elec. Corp.	317-846-6383
MD	Randallstown, Precision Mktg.	301-521-5353
MA	Topsfield, RFC Assocs.	617-887-8545
NJ	Clifton, Ossmann	201-778-8888
NY	Rochester, Ossmann Comps.	716-424-4460
NY	Syracuse, Ossmann Comps.	315-455-6611
NC	Greensboro, Beacon Elec. Sls.	919-275-9997
NC	Raleigh, Beacon Elec. Sls.	919-787-0330
OH	Akron, Augnat Assocs.	216-535-4396
OH	Dayton, Augnat Assocs.	513-298-1507
OK	Tulsa, ION Assocs.	918-664-0186
OR	Aloha, Caruso & Northcutt	503-624-1606
PA	Ardmore, Precision Mktg.	215-649-6301
PA	Pittsburgh, Augnat Assocs.	412-281-8283
TN	Johnson City, Beacon Elec. Sls.	615-282-2421
TX	Austin, ION Assocs.	512-458-2108
TX	Grand Prairie, ION Assocs.	214-647-8225
TX	Houston, ION Assocs.	713-681-6266
UT	Salt Lake City, Sage Sls.	801-467-5451
WA	Bellevue, Caruso & Northcutt	206-454-9699
WI	Butler, Richmar Elec. Corp.	414-781-1730

TELONIC/BERKELEY, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652, Tel: 714-494-9401, Telex: 182720; FSC No.: 04423; Empl.: 75; *Sls. Mgr.:* H. Elmes

TELPAR, INC., 4137 Billy Mitchell Rd., P.O. Box 796, Addison, TX 75001, Tel: 214-233-6631, Telex: 73-2561; Empl.: 28; *Sls. Mgr.:* Wm. Konrad ..... **D•1075**

TELTONE, 10801-120 Ave. NE, Kirkland, WA 98033, Tel: 206-827-9626, TWX: 910-449-2862; Empl.: 450; *Sls. Mgr.:* D. E. Johnson; *Dist. Mgr.:* Mike Arndt

TEMESCAL, 2850 Seventh St., Berkeley, CA 94710, Tel: 415-841-5720, TWX: 910-366-7366; Empl.: 300

TEMPIL DIV., Big Three Inds., Hamilton Blvd., S. Plainfield, NJ 07080, Tel: 201-757-8300, Telex: 138-662; Empl.: 38; *Sls. Mgr.:* A. P. Jeanguenin

TEMPO INSTRUMENT, INC., 87 Modular Ave., Commack, NY 11725, Tel: 516-864-3700, TWX: 510-226-3787; FSC No.: 07031; Empl.: 205

TEMPOSONICS, MTS Sys. Corp., 111 East Ames Ct., Plainview, NY 11803, Tel: 516-349-1950, TWX: 510-226-3787; *Sls. Mgr.:* W. Brenner

TEMPTRONIC, 55 Chapel St., Newton, MA 02158, Tel: 617-969-2501, Telex: 200-119 TEMP UR; Empl.: 100+; *Sls. Mgr.:* Frank Healy

TENCOR INSTR., 2400 Charleston Road, Mountain View, CA 94043, Tel: 415-969-6767; *Sls. Mgr.:* Barry Hart

TENNELEC, 601 Turnpike, Oak Ridge, TN 37830, Tel: 615-483-8405, TWX: 810-572-1018; Empl.: 80

TENNEY ENGRG., 109 Springfield Rd., Union, NJ 07083, Tel: 201-686-7870, TWX: 710-985-4725; Empl.: 204; *Sls. Mgr.:* Jerome Perlstein ..... **D•1173**

Local Sales Offices & Reps

AL	Huntsville, Equipment Sales Co., Inc.	205-536-5399
AZ	Phoenix, Jayson Co.	602-867-1964
CA	Sunnyvale, Tenney Engrg., Inc.	408-745-6232
CA	Van Nuys, Environment Assocs.	818-997-3791
CO	Englewood, Tenney Engrg.	303-798-0955
CT	Hamden, Equip. Sls.	203-281-4578
FL	Altamonte Springs, Equip. Sls.	305-339-2972
FL	Delray Beach, Equip. Sls.	305-243-0709
IL	Des Plaines, Marsland Assocs.	312-298-2620
IN	Indianapolis, Marsland Assocs.	317-293-5437
MD	Wheaton, Brimberg Sls.	301-946-2670
MA	Lowell, Equip. Sls. Co.	617-459-7000
MI	Warren, Dietrich & Assoc.	313-751-4990
MO	Blue Springs, Tenney Engrg., Inc.	816-229-7667
NJ	Mt. Laurel, Tan-Mar, Inc.	609-235-4345
NJ	Union, Tenney Engrg., Inc.	201-686-7870
NY	Fayetteville, M. P. Andrews	315-637-3144
NC	Raleigh, Equip. Sls.	919-872-8376
OH	Cleveland, Dietrich & Assocs.	216-781-1855
OH	Dayton, Dietrich & Assoc.	513-223-6042
PA	Pittsburgh, Dietrich & Assoc.	412-892-2992
TX	Austin, Carey, McMahill & Zerbe Co.	512-255-1663
TX	Garland, Carey, McMahill & Zerbe Co.	214-681-1414
TX	Houston, Carey, McMahill & Zerbe Co.	713-771-1500
WI	New Berlin, Marsland Assocs., Inc.	414-786-6611

TENOR, 17020 W. Rogers Dr., New Berlin, WI 53151, Tel: 414-782-3800, Telex: 26-706; Empl.: 30; *Sls. Mgr.:* P. Yoblin; *Dist. Mgr.:* P. Yoblin

TENSOLITE, Old Post Rd., Rte. 9A, Buchanan, NY 10511, Tel: 914-737-5600, TWX: 710-573-2341; Empl.: 300; *Sls. Mgr.:* David Yellin

TENSOR, Box 14843, Austin, TX 78761, Tel: 512-251-4131, Telex: ITT 4940124; Empl.: 15

TEN-TEC, INC., Industrial Park, Sevierville, TN 37862, Tel: 615-453-7172, Telex: 261337 ACTAUR; Empl.: 110; *Sls. Mgr.:* Joe Redwine

TEPRO OF FLORIDA, 2608 Enterprise Rd., Clearwater, FL 33575, Tel: 813-796-1044; FSC No.: 15915; Empl.: 97; *Sls. Mgr.:* Roger C. Mayo; *Dist. Mgr.:* Beverly Mayer

Local Sales Offices & Reps

CA	Burbank, MODCO	818-848-2215
CA	San Mateo, Melvin Sls.	415-349-7445
FL	Clearwater, Tepro of Florida	813-796-1044
IL	Glencoe, Howard Benjamin	312-835-0150
MA	Hopkinton, Berkshire Elctrns.	617-435-9356
NY	Great Neck, Pacent Engrg.	516-482-4678
OH	Cleveland, Components, Inc.	216-243-9200
TX	Dallas, Elctrn. Prods. Reps.	214-341-2666

TERADO, 1068 Raymond Ave., St. Paul, MN 55108, Tel: 612-646-2868; Empl.: 17; *Sls. Mgr.:* Don Munson; *Dist. Mgr.:* Fred Munson

TERADYNE, INC., 183 Essex St., Boston, MA 02111, Tel: 617-482-2700, TWX: 710-321-1055; Empl.: 3200; *Sls. Mgr.:* D. O'Connell

TERADYNE CONNECTION SYS., 44 Simon St., Nashua, NH 03060, Tel: 603-889-5156, TWX: 710-228-1431; FSC No.: 31413; Empl.: 1,400; *Sls. Mgr.:* D. Murphy

TERMINAL DATA CORP., 15733 Crabbs Branch Way, Rockville, MD 20855, Tel: 301-921-8282; Empl.: 12

TERMINAL SYS., See A & B Technical Services

TERRA TECHNLG. CORP., 3860 148th Ave. N.E., Redmond, WA 98052, Tel: 206-883-7300, Telex: 15-2070; *Sls. Mgr.:* Irl Davis

TEST & MEASUREMENT SYSTEMS, INC., 349 Cobalt Way, Ste. 301, Sunnyvale, CA 94086, Tel: 408-720-8877, Telex: 297584 TEAM UR; *Sls. Mgr.:* Bill Nicklin

TESTLINE, See Fairchild Test Sys. Grp., Testline Instrs.

TESTOTERM, P.O. Box 111509, Nashville, TN 37211, Tel: 615-834-5082, Telex: 55-5112

TEST PROBES, INC., Box 2113, La Jolla, CA 92038, Tel: 619-459-4197, Telex: 697192; *Sls. Mgr.:* Hal Wardein; *Dist. Mgr.:* Hal Wardein

TESTRONICS, 1810-102 N. Glenville Dr., Richardson, TX 75081, Tel: 214-238-8378, Telex: 469602; Empl.: 21

TETRAGENICS, Box 1338, Butte, MT 59701, Tel: 406-782-8606; Empl.: 40; *Sls. Mgr.:* Jack Dunn

TETTEX INSTRUMENTS, INC., P.O. Box 281, Fairview Village, PA 19409-0281, Tel: 215-539-6050, Telex: 753-899 TETTEX; Empl.: 100; *Sls. Mgr.:* Charles Prievys ..... **D•1312**

TEXAS INSTRS., INC., Box 225012-MS-84, Dallas, TX 75265, Tel: 214-995-6611, TWX: 910-867-4702; Empl.: 85,000

TEXAS INSTRS., Data Sys. Group, P. O. Box 809063, Dallas, TX 75380-9063, Tel: 1-800-527-3500, Telex: 73324 TEXINS DAL, TWX: 910-867-4702; Empl.: 80,696

TEXAS INSTRS., Matls. & Controls Grp., 34 Forrest St., Attleboro, MA 02703, Tel: 617-699-3800, Telex: 92-7708, TWX: 710-346-0566

TEXAS INSTRUMENTS

TEXAS INSTRUMENTS OPTOELECTRONICS, P.O. Box 225012 MS12, Dallas, TX 75265, Tel: 214-995-3821, Telex: 910-867-4702; Empl.: 89,000 world wide; *Sls. Mgr.:* Glenn Snyder; *Dist. Mgr.:* Rudy Profaizer ..... **B•1216-1219**

Local Sales Offices & Reps

AL	Huntsville	205-837-7530
AZ	Phoenix	602-995-1007
CA	Irvine	714-660-1200
CA	Sacramento	916-929-1521
CA	San Diego	619-278-9601
CA	Santa Clara	408-980-9000
CA	Torrance	213-217-7010
CA	Woodland Hills	213-704-7759
CO	Aurora	303-368-8000
CT	Wallingford	203-269-0074
FL	Ft. Lauderdale	305-973-8502
FL	Maitland	305-660-4600
FL	Tampa	813-870-6420
GA	Norcross	404-662-7900
IL	Arlington Heights	312-640-2925
IN	Ft. Wayne	219-424-5174
IN	Indianapolis	317-248-8555
IA	Cedar Rapids	319-395-9550
MD	Baltimore	301-944-8600
MA	Walthman	617-895-9100
MI	Farmington Hills	313-553-1500
MN	Eden Prairie	612-828-9300
MO	Kansas City	816-523-2500
MO	St. Louis	314-569-7600
NJ	Iselin	201-750-1050
NM	Albuquerque	505-345-2555
NY	East Syracuse	315-483-9291
NY	Endicott	607-754-3900
NY	Melville	516-454-6600
NY	Pittsford	716-385-6770
NY	Poughkeepsie	914-473-2900
NC	Charlotte	704-527-0930
NC	Raleigh	919-876-2725
OH	Beachwood	216-464-6100
OH	Dayton	513-258-3877
OK	Tulsa	918-250-0633
OR	Beaverton	503-643-6758
PA	Coraopolis	412-771-8550
PA	Ft. Washington	215-643-6450
TX	Austin	512-250-7655
TX	Houston	713-778-6592
TX	Richardson	214-680-5082
TX	San Antonio	512-496-1779
UT	Murray	801-266-8972
VA	Fairfax	703-849-1400
WA	Redmond	206-881-3080
WI	Brookfield	414-785-7140
PR	Hato Ray	809-753-8700
Can	Neapean, Ont.	613-726-1970
Can	Richmond Hill, Ont.	416-884-9181
Can	St. Laurent, Que.	514-334-3635

Local Distributors

AL Huntsville, Arrow Elctrns. 205-837-6955
AL Huntsville, Kierulff Elctrns. 205-883-6070
AL Huntsville, Marshall Elctrns. 205-881-9235
AZ Phoenix, Kierulff Elctrns. 602-437-0750
AZ Phoenix, Wyle Elctrns. 602-249-2232
AZ Tempe, Arrow Elctrns. 602-968-4800
AZ Tempe, Marshall Elctrns. 602-968-6181
CA Anaheim, R.V. Weatherford Elctrns. ... 714-634-9600
CA Canoga Park, Marshall Elctrns. 213-999-5001
CA Chatsworth, Arrow Elctrns. 818-701-7500
CA Commerce, Kierulff Elctrns. 213-725-0325
CA Cypruss, Kierulff Elctrns. 714-220-6300
CA El Segundo, Wyle Elctrns. 213-322-8100
CA Elmonte, Marshall Elctrns. 818-442-7204
CA Glendale, R.V. Weatherford Elctrns. ... 213-849-3451
CA Hayward, Arrow Elctrns. 415-487-4600
CA Irvine, Marshall Elctrns. 714-660-0951
CA Irvine, Wyle Elctrns. 714-863-9953
CA Sacramento, Arrow Elctrns. 916-925-7456
CA Sacramento, Wyle Elctrns. 916-638-5282
CA San Diego, Arrow Elctrns. 619-565-4800
CA San Diego, Kierulff Elctrns. 619-278-2112
CA San Diego, Marshall Elctrns. 619-578-9600
CA San Diego, Wyle Elctrns. 619-565-9171
CA San Jose, Kierulff Elctrns. 408-971-2600
CA Santa Barbara, R.V. Weatherford Elctrns. 805-965-8551
CA Sunnyvale, Arrow Elctrns. 408-745-6600
CA Sunnyvale, Marshall Elctrns. 408-732-1100
CA Tustin, Arrow Elctrns. 714-838-5422
CA Tustin, Kierulff Elctrns. 714-731-5711
CO Denver, Arrow Elctrns. 303-696-1111
CO Englewood, Kierulff Elctrns. 303-790-4444
CO Thornton, Wyle Elctrns. 303-457-9953
CT Danbury, Diplomat Elctrns. 203-797-9674
CT Orange, Milgray Elctrns. 203-795-0714
CT Wallingford, Arrow Elctrns. 203-265-7741
CT Wallingford, Kierulff Elctrns. 203-265-1115
CT Wallingford, Marshall Elctrns. 203-265-3822
FL Ft. Lauderdale, Arrow Elctrns. 305-429-8200
FL Ft. Lauderdale, Diplomat Elctrns. 305-974-8700
FL Ft. Lauderdale, Kierulff Elctrns. 305-486-4004
FL Orlando, Arrow Elctrns. 305-725-1480
FL Orlando, Milgray Elctrns. 305-647-5747
FL Tampa, Arrow Elctrns. 813-576-8995
FL Tampa, Diplomat Elctrns. 813-443-4514
FL Tampa, Kierulff Elctrns. 813-576-1966
GA Atlanta, Kierulff Elctrns. 404-447-5252
GA Norcross, Arrow Elctrns. 404-449-8252
GA Norcross, Marshall Elctrns. 404-923-5750
IL Bensenville, Diplomat Elctrns. 312-595-1000
IL Chicago, Arrow Elctrns. 312-397-3440
IL Chicago, Newark Elctrns. 312-784-5100
IL Itasca, Kierulff Elctrns. 312-250-0500
IL Schaumburg, Marshall Elctrns. 312-490-0155
IN Ft. Wayne, Graham Elctrns. 219-423-3422
IN Indianapolis, Arrow Elctrns. 317-243-9353
IN Indianapolis, Graham Elctrns. 317-634-8202
IA Cedar Rapids, Arrow Elctrns. 319-395-7230
KS Lenexa, Marshall Elctrns. 913-492-3121
KS Wichita, LComp 316-265-9507
MD Columbia, Arrow Elctrns. 301-995-0003
MD Columbia, Diplomat Elctrns. 301-995-1226
MD Linthicum, Kierulff Elctrns. 301-636-5800
MD Rockville, Milgram Elctrns. 301-793-3993
MA Billerica, Kierulff Elctrns. 617-667-8331
MA Burlington, Marshall Elctrns. 617-272-8200
MA Woburn, Arrow Elctrns. 617-933-8130
MA Woburn, Diplomat Elctrns. 617-935-6611
MA Woburn, Time Elctrns. 617-935-8080
MI Detroit, Arrow Elctrns. 313-971-8220
MI Detroit, Marshall Elctrns. 313-525-5850
MI Detroit, Newark Elctrns. 313-967-0600
MI Grand Rapids, Arrow Elctrns. 616-243-0912
MN Edina, Kierulff Elctrns. 612-941-7500
MN Minneapolis, Arrow Elctrns. 612-830-1800
MN Minneapolis, Marshall Elctrns. 612-559-2211
MO Kansas City, LComp 816-221-2400
MO St. Louis, Arrow Elctrns. 314-567-6888
MO St. Louis, Kierulff Elctrns. 314-739-0855
NH Manchester, Arrow Elctrns. 603-668-6968
NM Albuquerque, Milgram Elctrns. 609-983-5010
NJ Camden, General Radio 215-922-7037
NJ Camden, General Radio 609-964-8560
NJ Fairfield, Arrow Elctrns. 201-575-5300
NJ Fairfield, Kierulff Elctrns. 201-575-6750
NJ Fairfield, Marshall Elctrns. 201-882-0320
NJ Marlton, Arrow Elctrns. 215-928-1800
NJ Marlton, Arrow Elctrns. 609-596-8000
NJ Mt. Laurel, Kierulff Elctrns. 609-235-1444
NJ Mt. Laurel, Marshall Elctrns. 609-234-9100
NJ Totawa, Diplomat Elctrns. 201-785-1830
NM Albuquerque, Arrow Elctrns. 505-243-4566
NM Albuquerque, International Elctrns. 505-345-8127
NY Farmingdale, Milgray Elctrns. 516-420-9800
NY Hauppauge, Arrow Elctrns. 516-231-1000
NY Hauppauge, Jaco 516-273-5500
NY Hauppauge, Marshall Elctrns. 516-272-2053
NY Melville, Diplomat Elctrns. 516-454-6400
NY Rochester, Arrow Elctrns. 716-275-0300
NY Rochester, Marshall Elctrns. 716-235-7620
NY Rochester, Rochester Radio Supp. 716-454-7800
NY Syracuse, Arrow Elctrns. 315-652-1000
NY Syracuse, Diplomat Elctrns. 315-652-5000
NY Syracuse, Marshall Elctrns. 607-754-1570
NC Raleigh, Arrow Elctrns. 919-876-3132
NC Raleigh, Kieroff Elctrns. 919-872-8410
NC Winston-Salem, Arrow Elctrns. 919-725-8711
OH Cincinnati, Graham Elctrns. 513-772-1661
OH Cleveland, Arrow Elctrns. 216-248-3990
OH Cleveland, Kierulff Elctrns. 216-587-6558
OH Cleveland, Marshall Elctrns. 216-248-1788
OH Columbus, Graham Elctrns. 614-895-1590
OH Dayton, Arrow Elctrns. 513-435-5563
OH Dayton, Esco 513-226-1133
OH Dayton, Kierulff Elctrns. 513-439-0045
OH Dayton, Marshall Elctrns. 513-236-8088
OK Tulsa, Arrow Elctrns. 918-665-7700
OK Tulsa, Kierulff Elctrns. 918-252-7537
OR Beaverton, Marshall Elctrns. 503-644-5050
OR Hillsboro, Wyle Elctrns. 503-640-6000
OR Portland, Arrow Elctrns. 503-684-1690
PA Monroeville, Arrow Elctrns. 412-856-7000
TX Austin, Arrow Elctrns. 512-835-4180
TX Austin, Kierulff Elctrns. 512-835-2090
TX Austin, Marshall Elctrns. 512-458-5654
TX Austin, Wyle Elctrns. 512-834-9957
TX Dallas, Arrow Elctrns. 214-380-6464
TX Dallas, International Elctrns. 214-233-9323
TX Dallas, Kierulff Elctrns. 214-343-2400
TX Dallas, Marshall Elctrns. 214-233-5200
TX Dallas, Wyle Elctrns. 214-235-9953
TX El Paso, International Elctrns. 915-598-3406
TX Houston, Arrow Elctrns. 713-530-4700
TX Houston, Harrison Equip. 713-879-2600
TX Houston, Kierulff Elctrns. 713-530-7030
TX Houston, Marshall Elctrns. 713-789-6600
TX Houston, Wyle Elctrns. 713-879-9953
UT Salt Lake City, Diplomat Elctrns. 801-486-4134
UT Salt Lake City, Kierulff Elctrns. 801-973-6913
UT Salt Lake City, Wyle Elctrns. 801-974-9953
VA Richmond, Arrow Elctrns. 804-282-0413
WA Bellevue, Arrow Elctrns. 206-643-4800
WA Bellevue, Marshall Elctrns. 206-747-9100
WA Bellevue, Wyle Elctrns. 206-453-8300
WA Kent, Kierulff Elctrns. 206-575-4420
WI Oak Creek, Arrow Elctrns. 414-764-6600
WI Wakesha, Kierulff Elctrns. 414-784-8160
Can Calgary, Alb., Future Elctrns. 403-259-6408
Can Calgary, Alb., Varah Elctrns. 403-230-1235
Can Edmonton, Alb, Future Elctrns. 403-438-2858
Can Montreal, Que., CESCO 613-226-6903
Can Montreal, Que., Future Elctrns. 514-694-7710
Can Montreal, Que., ITT Comps. 514-735-1177
Can Ottawa, Ont., CESCO 613-226-6903
Can Ottawa, Ont., Future Elctrns. 613-820-8313
Can Ottawa, Ont., ITT Comps. 613-226-7406
Can Ottawa, Ont., Varah Elctrns. 613-726-8884
Can Quebec City, Que., CESCO 418-687-4231
Can Toronto, Ont., CESCO 416-661-0220
Can Toronto, Ont., Future Elctrns. 416-638-4771
Can Toronto, Ont., ITT Comps. 416-630-7971
Can Toronto, Ont., Varah Elctrns. 416-516-9311
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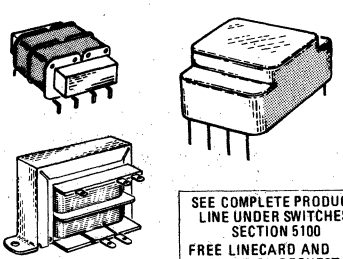

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TNR TECHNICAL, INC., Saft & Gates Batteries, 45 Jefryn Blvd. West, Deer Park, NY 11735, Tel: 516-242-4800; Empl.: 35; *Sls. Mgr.:* Wayne Thaw

TOBE DEUTSCHMANN LABS., INC., 550 Turnpike St., Canton, MA 02021, Tel: 617-828-3366, Telex: 92-4427; FSC No.: 21966; Empl.: 40; *Sls. Mgr.:* T. Deutschumann, Jr.

TOCOS AMERICA, INC., Tokyo Cosmos Electric Co., Ltd., Ste. 565 Arlington Center, Golf Rd., Arlington Heights, IL 60005, Tel: 312-310-8641, TWX: 910-997-0078; Empl.: 2,000; *Sls. Mgr.:* Masaji Matsunami

TODD PRODUCTS POWER SUPPLIES

TODD PRODS. CORP., 50 Emjay Blvd., Brentwood, NY 11717, Tel: 516-231-3366, TWX: 510-227-4905; Empl.: 250; *Sls. Mgr.:* R. Schlote ..... **D•1854-1855**

Local Sales Offices & Reps

AL Huntsville, R. W. Mitscher Co. 205-882-6050
AZ Scottsdale, Thorson Desert States 602-998-2444
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CA Sunnyvale, Todd Prods. Corp. 408-732-0512
CO Wheat Ridge, Waugaman Assocs., Inc. 303-423-1020
CT Weston, Northeast Reps. 203-866-6030
FL Alamonte Springs, R.W. Mitscher Co. 305-788-6844
FL Boca Raton, R.W. Mitscher Co. 305-368-3841
GA Lawrenceville, R. W. Mitscher Co. 404-923-3239
IL Arlington Heights, Coombs Assocs. 312-439-9810
IN Indianapolis, E. T. Kaul Assocs. 317-888-6187
IA Cedar Rapids, Coombs Assocs. 319-362-4116
MA Hingham, Northeast Reps. 617-749-8700
MI Livonia, Electro Sls. Assocs. 313-474-7320
MN Minneapolis, R. K. Sales Assocs. 612-786-5713
MO St. Louis, AME Sls. 314-965-1779
NH Nashau, Todd Prods. Corp. 603-881-3175
NH Nashua, Northeast Reps. 603-880-8199
NJ Pennsauken, Scientific Reps. 609-662-5222
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NY Charlotte, R. W. Mitscher Co. 704-598-8644
NY E. Syracuse, Nycom 315-437-8343
NC Raleigh, R. W. Mitscher Co. 919-848-0941
OH Dayton, Thompson & Assocs., Inc. 513-435-7733
PA Mars, Thompson & Assocs., Inc. 412-776-6495
TN Johnson City, R. W. Mitscher Co. 615-929-7258
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TX Dallas, J. Clay Co. 214-350-1281
UT Salt Lake City, Waugaman Assocs., Inc. 801-261-0802
VA Fairfax, Scientific Assocs., Inc. 703-385-0600
WA Bellevue, Venture Elctrns. 206-454-4594
WI Milwaukee, Coombs Assocs. 414-351-6123

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AL Mobile, Athenian, Inc. 205-432-2985
CA San Francisco, Aris Corp. 415-550-8605
CA San Francisco, Delray Distr. 415-777-4405
CT Norwalk, Park Distr. 203-853-2010
FL Miami, Gay Mar, Inc. 305-371-0765
GA Macon, Giga Corp. 912-745-2897
IL Chicago, Irv Wolfson Co. 312-267-7828
LA New Orleans, Trestman Supp. 504-561-8590
MD Bethesda, Albee Sls. 301-897-8088
NJ Newark, Cotrapex, Inc. 201-589-1416
NJ Newark, Pinto Trading 201-344-7748
NY Long Island City, H. L. Dalis, Inc. 212-361-1100
NY New York, Geib Sls. 212-475-7940
NY New York, Rosetta Elec. 212-233-9088
OH Dayton, K. Elctrns. 513-426-1877
PA Philadelphia, H & Z Sls. 215-912-2500
TX Houston, Cross & Co. 713-673-3100
TX Houston, Western Sls. 713-869-6671
VA Fall Church, Arya Corp. 703-845-0800
WA Seattle, ForeigN Elctrns. 206-682-2761
EXP NY, New York, Able Intl., Ltd. 212-696-5300

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Local Sales Offices & Reps

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IL	Chicago, Esco Assocs.	312-763-0800
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IL	Skokie, Ultech Assocs.	312-674-3820
NY	White Plains, Toko America, Inc.	914-694-5618

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TOLEDO SCALE, Reliance Electric, P. O. Box 99502, Cleveland, OH 44199, Tel: 800-245-4501, in OH 800-245-4497

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TOPFLIGHT, 160 East 9th Ave., York, PA 17404, Tel: 800-233-9386, TWX: 510-657-4849; Empl.: 250; *Sls. Mgr.:* James Danser

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TORELCO, INC., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111, Tel: 201-374-8641; Empl.: 20; *Sls. Mgr.:* Stewart H. Cook

TOROID CORP. OF MARYLAND, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, Tel: 301-464-2100, TWX: 710-826-0414; *Sls. Mgr.:* Marshall Sorenson ..... **A•2318-2319**

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CA	Seal Beach, Texel	213-596-9411
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PA	Hatboro, Electro Rep Engrg.	215-674-4421

TOROTEL PRODS. INC., 13402 S. 71 Hwy., Grandview, MO 64030, Tel: 816-761-6314, TWX: 910-777-7037; Empl.: 275; *Sls. Mgr.:* H. Foland ..... **A•1280-1295, 2320-2325**

Local Sales Offices & Reps

AL	Huntsville, L & D, Inc.	205-837-1469
AL	Westlake, OH, JN Bailey & Assocs.	216-892-1513
AZ	Tempe, Gassner & Clark Co.	602-968-9037
CA	Aurora, Hi Tech. Assocs.	303-696-7403
CA	Redwood City, Hickey Ind. Sls.	415-368-3849
CA	San Diego, California Elctrn. Mktg.	619-692-3551
CA	Santa Ana, California Elctrn. Mktg.	714-835-2702
FL	Orlando, Perrott Assocs.	305-298-7748
GA	Atlanta, L & D, Inc.	404-395-7079
IL	Schaumburg, Gassner & Clark Co.	312-882-8608
IA	Hiawatha, Gassner & Clark Co.	319-393-5763
MD	Towson, Dickison Sls. Co.	301-823-0923
MA	Weston, John Goode Assocs.	617-235-3900
NY	Manhasset, Win-Cor Elctrns.	516-627-9474
NY	Syracuse, Rep, Tech, Inc.	315-437-2845
NC	Greensboro, L & D, Inc.	919-292-3201
NC	Raleigh, L & D, Inc.	919-876-5301
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OH	Westlake, J. N. Bailey & Assocs.	216-892-1513
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PA	Philadelphia, Jadelectronic Assocs.	215-455-0664
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TX	Dallas, Oeler & Menelaides	214-361-8876
TX	Houston, Oeler & Menelaides	713-772-0730

TOROTRON CORP., 519 South Fifth Ave., Mt. Vernon, NY 10550, Tel: 914-664-2050; Empl.: 14; *Sls. Mgr.:* Lee Abramson ..... **D•1315**

TORQ CORP., 32 W. Monroe St., Bedford, OH 44146, Tel: 216-232-4100; Empl.: 135

TORRINGTON CO., 59 Field St., Torrington, CT 06790, Tel: 203-482-9511

TORWICO ELCTRNS. INC., 410 Oberlin Ave. South, Lakewood, NJ 08701, Tel: 201-364-1800, TWX: 710-723-8343; Empl.: 240 ..... **A•2328-2329**

Local Sales Offices & Reps

CA	El Cajon, KCE Corp.	619-588-1198
CA	Menlo Park, Long and Assocs.	415-327-1300
FL	Orlando, Gra-Mar	305-894-3351
IN	Noblesville, Patco & Assocs.	317-877-5986
IA	Davenport, Ensco Rep	319-386-6600
KS	Overland Park, Ensco Rep	913-381-7557
KS	Wichita, Ensco Rep	316-683-1070
MD	Riderwood, W. S. Warrington & Assoc.	301-823-8759
MA	Hingham, N.E. Reps.	617-749-8700
MO	Maryland Heights, Ensco Rep	314-423-3935
NJ	Marlton, BGR Assocs.	609-983-1020
NY	Albany, Lynn Assocs.	518-459-1239
NY	Buffalo, Lynn Assocs.	716-631-0054
NY	Great Neck, Trionic	516-466-2300
OH	Copley, Eljay Assoc.	216-666-3774
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PA	Pittsburgh, Lynn Assocs.	412-341-5155
TX	Irving, Kite Elctrns. Sls. Co.	214-438-9336

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TOUCH TECHNOLOGY, INC., 107 Gibralter Street, Annapolis, MD 21401, Tel: 301-269-6181; Empl.: 19

TOWNSEND INDUSTRIES, 51 Carl Rd., Orange, CT 06477, Tel: 203-795-0241, TWX: 710-465-1898; *Sls. Mgr.:* Charles Dorsa

TOYO COMM. EQUIP. CO., LTD., No. 8 Mori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, Tokyo, Japan 105, Tel: 03-459-7320/03-459-7310, Telex: 02423115 Toyocoj.; Empl.: 1800; *Sls. Mgr.:* T. Nagai/S. Nakagome

TRACEWELL ENCLOSURES, 7032 Worthington Galena Rd., Columbus, OH 43085, Tel: 614-846-6175, 800-848-4525; Empl.: 30 ..... **C•1092-1093**

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TRACOR INSTRUMENTS, 6500 Tracor La., Bldg. 27, Austin, TX 78725, Tel: 512-929-2051, TWX: 910-874-1366; Empl.: 9100; *Sls. Mgr.:* William R. Murphy; *Dist. Mgr.:* Will Hoover

TRACOR PAKTRONICS, 2441 Northeast Pkwy., Ft. Worth, TX 76106, Tel: 817-625-2311, Telex: 758-273; Empl.: 10; *Sls. Mgr.:* Harold Whittenton

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Local Sales Offices & Reps

AL	Huntsville, Magaro & Assocs.	205-882-0827
AZ	Phoenix, J. Smith Assocs.	602-267-0981
CA	Malibu, RL Comps.	213-456-9021
CA	Mountain View, Disman Bakner	415-969-3010
CO	Colorado Springs, J. Smith Assocs.	303-597-5343
CO	Greely, W. H. Howard Assocs.	303-426-3499
FL	Melbourne, Jerry Williams, Inc.	305-259-7700
GA	Atlanta, Magaro & Assocs.	404-451-8862
IL	Franklin Park, Dekotech	312-455-5100
IN	Ft. Wayne, TX Sls. Indiana	219-489-4447
IA	Cedar Rapids, J.R. Sls. Engrg.	319-393-2232
MD	Columbia, M. Lader Co.	301-730-1550
MD	Conowingo, M. Lader Co.	301-378-3449
MA	Andover, Bee Assoc.	617-475-2124
MN	Minneapolis, Deerland Distrs.	612-331-6433
NJ	Belford, Ascor Elctrns.	201-787-6011
NM	Albuquerque, J. Smith Assocs.	505-265-3406
NY	Liverpool, R&D Assocs.	315-457-0100
NY	New Rochelle, Ascor Elctrns.	914-235-8838
NC	Raleigh, M. Lader Co.	919-848-3231
PA	Lafayette Hill, M. Lader Co.	215-825-3177
TX	Dallas, Cain & Co.	214-247-3901
UT	Salt Lake City, Effective Sls.	801-266-9617
WA	Seattle, Datacom Assocs.	206-285-2525

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Local Sales Offices & Reps

AL	Huntsville, Magaro & Assocs.	205-882-0827
AZ	Scottsdale, Territorial Mktg.	602-994-8665
CA	Malibu, RL Comps.	213-456-9021
CA	Mountain View, Disman-Bakner	415-969-3010
CO	Colorado Springs, J. Smith Assocs.	303-597-5343
FL	Melbourne, Jerry Williams, Inc.	305-259-7700
GA	Altanta, Magaro & Assocs.	404-451-8862
IL	Franklin Park, Dekotech, Inc.	312-455-5100
IN	Ft. Wayne, TX Sls. Indiana	219-489-4447
IA	Cedar Rapids, J. R. Sls. Engrg.	319-393-2232
MD	Conowingo, M. Lader Co.	301-378-3449
MA	Andover, Bee Assocs.	617-475-2124
MN	Minneapolis, Deerland Dists., Inc.	612-331-6433
NM	Albuquerque, J. Smith Assocs.	505-265-3406
NY	Hartsdale, Spectrum Sls.	914-472-8600
NY	Liverpool, R&D Assocs.	315-457-0100
NC	Raleigh, M. Lader Co.	919-848-3231
PA	Lafayette Hill, M. Lader Co.	215-825-3177
TX	Dallas, Cain & Co.	214-247-3901
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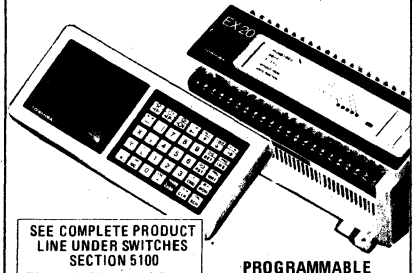

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Local Sales Offices & Reps

AL	Huntsville, Magaro & Assocs.	205-882-0827
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TX	Arlington, J. T. Houston Assocs.	817-265-2931
WA	Bellevue, Tasco, Inc.	206-453-1414

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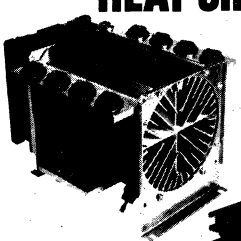

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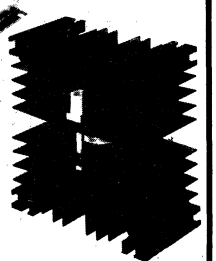

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FL	Indian Rocks Beach, PAR Assocs.	813-596-8841
GA	Atlanta, PAR Assocs.	404-391-9117
IL	Des Plaines, Marsland Assocs.	312-298-2620
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MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Louis, Marsland Assocs.	314-991-1399
NJ	Cherrry Hill, Markey Instrmn.	609-667-3809
NJ	Hillsdale, CB Assocs., Inc.	201-644-6230
NY	Rochester, TAE-REP	716-586-8710
NY	Whitney Point, TAE-REP, Inc.	607-692-3705
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OH	Stow, Rixan Assocs., Inc.	216-686-2909
TX	Lewisville, Electric Control Assocs.	214-221-3143
WI	New Berlin, Marsland Assocs., Inc.	414-786-6611

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IN	Indianapolis, Electro Dev. Engrg.	317-547-5274
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MN	Mendota, Gll Sls.	612-454-3086

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CA	Pasadena, EMI	818-795-7193
CA	Sunnyvale, Schwerin & Merrill	408-735-7900
CO	Englewood, Elctrn. Comp. Sys.	303-781-5904
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GA	Norcross, New South Mktg. Ltd.	404-887-7254
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FL	Winter Park, Russell Assocs.	813-526-1134
GA	Atlanta, Russell Assocs.	404-225-8422
IN	Indianapolis, Scott Elctrns, Inc.	317-897-9976
IA	Cedar Rapids, Ard Sls. Co.	319-366-8733
MD	Bel Air, Russell Assocs.	301-879-9180
MA	Wakefield, H.C. Jappe Co.	617-245-9359
NJ	Fair Haven, Russell Assocs.	201-747-0600
NY	Bay Shore, Russell Assocs.	516-666-6500
NY	Cazenovia, Naylor Elec. Co.	315-655-8174
OH	Cleveland, D. Steffen & Assocs.	216-461-8333
TX	Dallas, Russell Assocs.	214-699-0383
WA	Bellevue, Russell Assocs.	206-455-3694

TRAN-TROL CO., 2525 N. Alvernon Way, C-6, Tucson, AZ 85712, Tel: 602-795-8008

TRENDATA/STANDARD MEMORIES, 3400 W. Segerstrom, Santa Ana, CA 92704, Tel: 714-540-3605, TWX: 910-595-1596; Empl.: 200; *Sls. Mgr.:* M.S. Efron

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AR	Little Rock, J. Y. Schoonmaker Co.	501-375-2168
CA	Chino, Tracy Elec. Sls.	714-591-4736
CA	Santa Clara, Logan Sls.	408-496-0660
CO	Denver, West Inc.	303-692-0131
FL	Maitland, Hutto-Hawkins-Peregoy	305-831-2474
GA	Atlanta, Effective Mktg. Force	404-948-6023
HI	Honolulu, Hawaii Elctrn. Svc.	808-845-8207
IL	Wilmette, J. Wasserman Assocs.	312-256-3566
KS	Overland Park, T.L. Dowell, Inc.	913-648-7373
LA	Little Rock, J. Y. Schoonmaker	501-375-2168
MA	Framingham, Bay Colony	617-620-0607
MN	Minneapolis, Elec. Comp. Sls.	612-933-2594
MO	St. Louis, T.L. Dowell, Inc.	314-849-4234
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NY	Rochester, Marchese, Marsey, Barden	716-544-4300
NY	Rockville Centre, Schmitt Indl. Mktg.	516-486-3510
OH	Cincinnati, F.E. Kahsar Sls.	513-922-3133
OH	Hudson, F.E. Kahsar Sls.	216-650-1089
OR	Portland, J. J. Backer Co.	503-297-3777
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WA	Seattle, J. J. Backer Co.	206-285-1300
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AL	Birmingham, Forbes Distrbg.	205-251-4104
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CO	Denver, Integrated Elctrns.	303-534-6121
FL	Ft. Lauderdale, Peerless Radio Corp. of Fla.	305-973-4141
GA	Atlanta, Ack Radio Supp.	404-351-6340
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IL	Chicago, Newark Elctrns.	312-638-4411
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LA	New Orleans, William B. Allen Co.	504-525-8222
MD	Rockville, Capitol Radio Whls.	301-881-2270
MA	Burlington, Marshall Wilshire Elctrns.	617-272-8200
MA	Wilmington, Cronin Elctrns.	617-449-0500
MI	Grand Rapids, S-F Elctrns.	616-459-0216
MI	Livonia, R. S. Elctrns.	313-525-1155
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IN	New Albany, Walter W. Bieberich	812-945-3187
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TRIO-TECH INTL., 2040 N. Lincoln St., Burbank, CA 91504, Tel: 818-846-9200, Telex: 194811; Empl.: 266; *Sls. Mgr.:* Ted Mezo

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CO	Denver, IW Strong & Assocs.	303-292-6900
FL	Lighthouse Pt., Jack Krutek & Assocs.	305-941-6544
FL	Maitland, Jack Krutek & Assocs.	305-628-4837
GA	Atlanta, Millar Elctrns.	404-261-6160
IL	Berkeley, G. Petitt Co.	312-449-8000
IN	Ft. Wayne, W. Bieberich	219-432-2537
IN	New Albany, W. Bieberich	812-945-3187
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NY	Hauppauge, Masin Esco	516-273-3500
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NC	Raleigh, Millar Elctrns.	919-787-9564
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OH	Strongsville, Dolfuss-Root	216-238-0300
OR	Portland, J.J. Backer	503-297-8744
PA	Bridgeville, Dolfuss-Root	412-221-4420
PA	Trevose, PSA	215-245-0513
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RI	West Warwick, Adams McGregor, Inc.	401-821-1320
TX	Dallas, Elcom Mktg. Inc.	214-241-2166
WA	Seattle, J.J. Backer	206-285-1300
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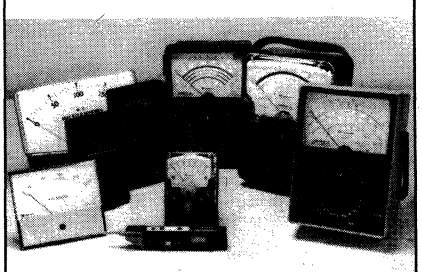

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TRO DYNE CORP., 900 Corporate Dr., Mahwah, NJ 07430, Tel: 201-529-1800, TWX: 710-988-2138; FSC No.: 17346; Empl.: 55; *Sls. Mgr.:* T. Mazzaccaro

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TX El Paso, Straube Assocs. 915-594-8259
TX El Paso, TRW/ECG 915-594-8259
TX Houston, TRW/ECG 713-772-5541
UT Salt Lake City, Straube Assocs. 801-263-2640
VA Richmond, TRW/ECG 804-288-8334
WA Bellevue, TRW/ECG 206-641-9996
WI Brookfield, TRW/ECG 414-784-7773

Local Distributors

CA Brea, Aeroflite 714-773-4251
CA Chatsworth, Arrow Elctrns. 213-701-7500
CA Newport Beach, Arrow Elctrns. 714-851-8961
CA San Diego, Arrow Elctrns. 619-565-4800
CA Sunnyvale, Arrow Elctrns. 408-745-6600
CO Denver, Arrow Elctrns. 303-758-2100
CT Wallingford, Arrow Elctrns. 203-265-7741
FL Ft. Lauderdale, Arrow Elctrns. 305-776-7790
FL Palm Bay, Arrow Elctrns. 305-725-1480
GA Norcross, Arrow Elctrns. 404-449-8252
IL Chicago, Electronic Connector 312-767-2200
IL Schaumburg, Arrow Elctrns. 312-397-3440
IN Indianapolis, Arrow Elctrns. 317-243-9353
IA Cedar Rapids, Arrow Elctrns. 319-395-7230
MD Baltimore, Arrow Elctrns. 301-247-5200
MA Woburn, Arrow Elctrns. 617-933-8130
MI Ann Arbor, Arrow Elctrns. 313-971-8220
MN Edina, Arrow Elctrns. 612-830-1800
MO St. Louis, Arrow Elctrns. 314-567-6888
NH Manchester, Arrow Elctrns. 603-668-6968
NJ Fairfield, Arrow Elctrns. 201-575-5300
NJ Moorestown, Arrow Elctrns. 609-235-1900
NM Albuquerque, Arrow Elctrns. 505-243-4566
NY Hauppauge, Arrow Elctrns. 516-231-1000
NY Liverpool, Arrow Elctrns. 315-652-1000
NY Rochester, Arrow Elctrns. 716-275-0300
NY Ronkonkoma, Conco 516-467-8200
NC Raleigh, Arrow Elctrns. 919-876-3132
NC Winston-Salem, Arrow Elctrns. 919-725-8711
OH Centerville, Arrow Elctrns. 513-435-5563
OH Dayton, Pioneer/Dayton 513-236-9900
OH Solon, Arrow Elctrns. 216-248-3990
PA Monroeville, Arrow Elctrns. 412-856-7000
TX Austin, Arrow Elctrns. 512-835-4180
TX Dallas, Arrow Elctrns. 214-386-7500
TX Dallas, Hall-Mark 214-341-1147
TX Houston, Hall-Mark 713-781-6100
TX Stafford, Arrow Elctrns. 713-491-4100
UT Salt Lake City, Arrow Elctrns. 801-539-1135
WA Bellevue, Arrow Elctrns. 206-643-4800
WI Madison, Arrow Elctrns. 608-273-4977
WI Oak Creek, Arrow Elctrns. 414-764-6600

TRW, Dynalco Controls Div., 5200 NW 37th, P.O. Box 8187, Ft. Lauderdale, FL 33310, Tel: 305-739-4300, Telex: 514833; Empl.: 125; *Sls. Mgr.:* Kurlin Wilson; *Dist. Mgr.:* Joe Stephens

TRW ELECTRONIC COMPONENTS GRP., 2525 E. El Segundo Blvd., El Segundo, CA 90245, Tel: 213-536-0600

TRW FIBER OPTIC PRODS., CONNECTOR DIV., TRW Elctrn. Comps. Grp., 401 N. Broad St., Philadelphia, PA 19108, Tel: 215-922-8900, TWX: 710-670-2286; *Sls. Mgr.:* Harry Saleker

TRW LSI PRODUCTS, PO Box 2472, La Jolla, CA 92038, Tel: 619-457-1000, Telex: 697957, TWX: 910-335-1571; Empl.: 400; *Sls. Mgr.:* Doug Turnage; *Dist. Mgr.:* Ron Courtois

TRW MICROWAVE, 825 Stewart Dr., Sunnyvale, CA 94086, Tel: 408-732-0880, TWX: 910-339-9207; FSC No.: 21847; Empl.: 600; *Sls. Mgr.:* R. J. Roy

TRW MOTOR DIVISION, Industrial/Commerical Products, Napierfield Road, Postal Route 6, Box M-30A, Dothan, AL 36303, Tel: 205-983-3542, Telex: 810-744-1000; *Sls. Mgr.:* Dave Hall ..... **B•1194**

TRW MOTOR DIV. (MILITARY), 2275 Stanley Ave., Dayton, OH 45404, Tel: 513-228-3171, Telex: 288-224, TWX: 810-459-1642; Empl.: 580; *Sls. Mgr.:* Bill Pelfrey; *Dist. Mgr.:* Tom Coyle ..... **B•1195**

Local Sales Offices & Reps

AL Huntsville, TRW/ECG 205-533-7600
AZ Scottsdale, TRW/ECG 602-994-0441
CA Los Angeles, Integrated Sls. 213-478-0183
CA Mountain View, Straube Assocs. 415-969-6060
CA San Diego, Integrated Sls. 619-571-1544
CA Santa Ana, Integrated Sls. 714-973-2162
CA Woodland Hills, Integrated Sls. 213-883-7130
CO Westminster, Straube Assocs. 303-426-0890
CT Rowayton, TRW 203-853-4466
FL Ft. Lauderdale, TRW/ECG 305-772-3000
FL Orlando, TRW/ECG 305-857-3650
GA Norcross, TRW/ECG 404-447-6154
IL Chicago, TRW/ECG 312-693-7730
IN Ft. Wayne, R. O. Whitesell & Assocs. .. 219-432-5591
IN Indianapolis, R. O. Whitesell & Assocs. 317-359-9283
IN Kokomo, R. O. Whitesell & Assocs. ... 317-457-9127
IA Cedar Rapids, C. H. Horn & Assocs. .. 319-393-8703
KS De Soto, Midtec Assocs. 913-441-6565
KY Louisville, R. O. Whitesell & Assocs. .. 502-426-7696
MD Baltimore, TRW/ECG 301 964-9110
MA Framingham, TRW/ECG 617-620-0625
MI Grand Rapids, R. O. Whitesell & Assocs. 616-942-5420
MI Southfield, R. O. Whitesell & Assocs. .. 313-559-5454
MI St. Joseph, R. O. Whitesell & Assocs. 616-983-7337
MN Minneapolis, TRW/ECG 612-854-6616
MO St. Louis, John G. Macke Co. 314-432-2830
NY Fairport, TRW/ECG 716-425-3775
NC Greensboro, TRW 919-852-4676
OH Cincinnati, R.O. Whitesell 513-521-2290
OH Cleveland, R.O. Whitesell 216-447-9020
OH Columbus, R.O. Whitesell 614-888-9396
OH Dayton, R.O. Whitesell 513-298-9546
OR Tigard, N. R. Schultz Co. 503-620-5032
PA Bala Cynwyd, TRW/ECG 215-667-3400
PA Pittsburgh, R. O. Whitesell & Assocs. .. 412-963-6161
TN Greeneville, R. O. Whitesell & Assocs. 615-639-6154
TX Austin, Technlg. Sls. 512-346-9940
TX Dallas, TRW/ECG 214-248-8000
TX El Paso, TRW/ECG 915-594-8259
TX Houston, TRW/ECG 713-772-5541
UT Salt Lake City, Straube Assocs. 801-263-2640
VA Richmond, TRW/ECG 804-288-8334
WA Bellevue, TRW/ECG 206-641-9996
WI Brookfield, TRW/ECG 414-784-7773

Local Distributors

AL Huntsville, Arrow Elctrns. 205-882-2730
AL Huntsville, Hallmark Elctrns. 205-837-8700
AL Huntsville, Hamilton/Avnet Elctrns. ... 205-837-7210
AZ Phoenix, Hallmark Elctrns. 602-243-6601
AZ Tempe, Arrow Elctrns. 602-968-4800
AZ Tempe, Fisher Brownell 602-967-1464
AZ Tempe, Hamilton/Avnet Elctrns. 602-231-5100
CA Alhambra, Fisher Brownell 213-289-0255
CA Chatsworth, Arrow Elctrns. 213-701-7500
CA Chatsworth, Avnet Elctrns. 213-700-2600
CA Costa Mesa, Avnet Elctrns. 714-754-6111
CA Culver City, Hamilton/Avnet Elctrns. .. 213-558-2252
CA El Segundo, Hallmark Elctrns. 213-643-9101
CA Sacramento, Hamilton/Avnet Elctrns. 916-925-2216
CA San Diego, Arrow Elctrns. 619-565-4800
CA San Diego, Fisher Brownell 619-560-8545
CA San Diego, Hallmark Elctrns. 619-268-1201
CA San Diego, Hamilton/Avnet Elctrns. ... 619-571-7510
CA San Jose, Hallmark Elctrns. 408-946-2575
CA Santa Clara, Fisher Brownell 408-988-6041
CA Sunnyvale, Arrow Elctrns. 408-745-6600
CA Sunnyvale, Hallmark Elctrns. 408-773-9990
CA Sunnyvale, Hamilton/Avnet Elctrns. ... 408-743-3355
CA Tustin, Arrow Elctrns. 714-838-5422
CO Aurora, Arrow Elctrns. 303-696-1111
CO Englewood, Hallmark Elctrns. 303-790-1662
CO Englewood, Hamilton/Avnet Elctrns. .. 303-740-1000
CT Danbury, Hamilton/Avnet Elctrns. 203-797-2800
CT Wallingford, Arrow Elctrns. 203-265-7741
FL Clearwater, Hallmark Elctrns. 813-530-4543
FL Ft. Lauderdale, Arrow Elctrns. 305-776-7790
FL Ft. Lauderdale, Hallmark Elctrns. 305-971-9280
FL Ft. Lauderdale, Hamilton/Avnet Elctrns. 305-971-2900
FL Orlando, Hallmark Elctrns. 305-855-4020
FL Palm Bay, Arrow Elctrns. 305-725-1480
FL St. Petersburg, Hamilton/Avnet Elctrns. 813-576-3930
FL Winter Park, Hamilton/Avnet Elctrns. .. 305-628-3888
GA Norcross, Arrow Elctrns. 404-449-8252
GA Norcross, Hallmark Elctrns. 404-447-8000
GA Norcross, Hamilton/Avnet Elctrns. 404-447-7507
IL Bensenville, Hallmark Elctrns. 312-860-3800
IL Bensenville, Hamilton/Avnet Elctrns. .. 312-860-7700
IL Elk Grove Village, Pioneer/Chicago ... 312-437-9680
IL Schaumburg, Arrow Elctrns. 312-397-3440
IN Carmel, Hamilton/Avnet Elctrns. 317-844-9333
IN Indianapolis, Arrow Elctrns. 317-243-9353
IN Indianapolis, Pioneer/Indiana 317-849-7300
KS Lenexa, Hallmark Elctrns. 913-888-4747
KS Overland Park, Hamilton/Avnet Elctrns. 913-888-8900
MD Baltimore, Arrow Elctrns. 301-247-5200
MD Bethesda, Arrow Elctrns. 301-564-3000
MD Columbia, Hallmark Elctrns. 301 988-9800
MD Columbia, Hamilton/Avnet Elctrns. 301-995-3500
MA Woburn, Arrow Elctrns. 617-933-8130
MA Woburn, Hallmark Elctrns. 617-935-9777
MA Woburn, Hamilton/Avnet Elctrns. 617-273-7500
MI Ann Arbor, Arrow Elctrns. 313-971-8220
MI Grand Rapids, Hamilton/Avnet Elctrns. 616-243-8805
MI Livonia, Hamilton/Avnet Elctrns. 313-522-4700
MI Livonia, Pioneer/Michigan 313-525-1800
MN Bloomington, Hallmark Elctrns. 612-854-3223
MN Edina, Arrow Elctrns. 612-830-1800
MN Minnetonka, Hamilton/Avnet Elctrns. .. 612-932-0600
MN Minnetonka, Pioneer/Twin Cities 612-935-5444
MO Earth City, Hamilton/Avnet Elctrns. ... 314-344-1200
MO Maryland Heights, Hallmark Elctrns. ... 314-291-5350
MO St. Louis, Arrow Elctrns. 314-567-6888
NH Manchester, Arrow Elctrns. 603-688-6968
NJ Cherry Hill, Hallmark Elctrns. 609-424-7300
NJ Cherry Hill, Hamilton/Avnet Elctrns. ... 609-424-0100
NJ Fairfield, Arrow Elctrns. 201-575-5300
NJ Fairfield, Hallmark Elctrns. 201-575-4415
NJ Fairfield, Hamilton/Avnet Elctrns. 201-575-3390
NJ Marlton, Arrow Elctrns. 609-596-8000
NM Albuquerque, Arrow Elctrns. 505-243-4566
NM Albuquerque, Hamilton/Avnet Elctrns. 505-765-1500
NY E. Syracuse, Hamilton/Avnet Elctrns. 315-437-2641
NY Hauppauge, Arrow Elctrns. 516-231-1000
NY Hauppauge, Hamilton/Avnet Elctrns. .. 516-434-7421
NY Hauppauge, Jaco Elctrns. 516-273-5500
NY Liverpool, Arrow Elctrns. 315-652-1000
NY Rochester, Arrow Elctrns. 716-427-0300
NY Rochester, Hamilton/Avnet Elctrns. ... 716-475-9130
NY Ronkonkoma, Hallmark Elctrns. 516-737-0600
NC Raleigh, Arrow Elctrns. 919-876-3132
NC Raleigh, Hallmark Elctrns. 919-872-0712
NC Raleigh, Hamilton/Avnet Elctrns. 919-878-0819
NC Winston-Salem, Arrow Elctrns. 919-725-8711
OH Centerville, Arrow Elctrns. 513-435-5563
OH Cincinnati, Hallmark Elctrns. 513-563-2980
OH Cleveland, Hamilton/Avnet Elctrns. ... 216-831-3500
OH Cleveland, Pioneer/Cleveland 216-587-3600
OH Dayton, Hamilton/Avnet Elctrns. 513-433-0610
OH Dayton, Pioneer/Dayton 513-236-9900
OH Solon, Arrow Elctrns. 216-248-3990
OH Solon, Hallmark Elctrns. 216-349-4632
OH Westerville, Hallmark Elctrns. 614-891-4555
OK Tulsa, Hallmark Elctrns. 918-665-3200
OR Lake Oswego, Hamilton/Avnet Elctrns. 503-635-8157
OR Tigard, Arrow Elctrns. 503-684-1690
PA Monroeville, Arrow Elctrns. 412-856-7000
PA Pittsburgh, Pioneer/Pittsburgh 412-782-2300

TX Austin, Arrow Elctrns. 512-835-4180
TX Austin, Hallmark Elctrns. 512-258-8848
TX Dallas, Arrow Elctrns. 214-386-7500
TX Dallas, Hall-Mark Elctrns. 214-343-5000
TX Houston, Arrow Elctrns. 713-530-4700
TX Houston, Hallmark Elctrns. 713-781-6100
TX Houston, Hamilton/Avnet Elctrns. 713-780-1771
TX Irving, Hamilton/Avnet Elctrns. 214-659-4111
TX Richardson, Fisher Brownell 214-235-3177
UT Salt Lake City, Hamilton/Avnet Elctrns. 801-972-2800
WA Bellevue, Arrow Elctrns. 206-643-4800
WA Bellevue, Hamilton/Avnet Elctrns. 206-643-3950
WI New Berlin, Hamilton/Avnet Elctrns. 414-784-4510
WI Oak Creek, Arrow Elctrns. 414-764-6600
WI Oak Creek, Hallmark Elctrns. 414-761-3000

TRW OPTOELECTRONICS DIV., 1207 Tappan Circle, Carrollton, TX 75006, Tel: 214-323-2200, TWX: 910-860-5958; Empl.: 2200; *Sls. Mgr.:* Ron Komatz; *Dist. Mgr.:* Robert Linker ..... **A•2094; B•1221-1223**

Local Sales Offices & Reps
AL Huntsville, TRW/ECG 205-533-7600
AK Dallas, TRW/ECG 214-248-8000
AZ Scottsdale, TRW/ECG 602-994-0441
AZ Scottsdale, TRW/Phoenix 602-994-0441
CA Los Angeles, Integrated Sys. & Device Sls. 213-478-0183
CA Mountain View, Straube Assocs. 415-969-6060
CA San Diego, Integrated Sys. & Device Sls. 619-571-1544
CA Santa Ana, Integrated Sys. & Device Sls. 714-973-2162
CA Woodland Hills, Integrated Sys. & Device Sls. 818-883-7130
CO Westminster, Straube Assocs. 303-426-0890
CT Rowayton, TRW/ECG 203-853-4466
DE Richmond, TRW/ECG 804-288-8334
DC Richmond, TRW/ECG 804-288-8334
FL Ft. Lauderdale, TRW/ECG 305-772-3000
FL Orlando, TRW/ECG 305-857-3650
GA Norcross, TRW/ECG 404-447-6154
ID Boise, N.R. Schultz/Idaho 801-263-2640
IL Cedar Rapids, C. H. Horn & Assocs. 319-393-8703
IL Chicago, TRW/ECG 312-693-7730
IL St. Louis, John G. Macke Co. 314-432-2830
IN Ft. Wayne, Robert O. Whitesell 219-432-5591
IN Indianapolis, Robert O. Whitesell 317-359-9238
IN Kokomo, Robert O. Whitesell 317-457-9127
IA Cedar Rapids, C. H. Horne & Assocs. 319-393-8703
KS DeSoto, MIDTEC Assocs. 913-441-6565
KY Louisville, Robert O. Whitesell 502-426-7696
LA Dallas, TRW/ECG 214-248-8000
ME Framingham, TRW/ECG 617-620-0625
MD Columbia, TRW/ECG 301-964-9110
MA Framingham, TRW/ECG 617-870-0745
MA Maynard, Byrne Assoc. 617-897-3131
MI Farmington Hills, TRW/ECG 313-478-7210
MI Grand Rapids, Robert O. Whitesell 616-942-5420
MI Southfield, Robert O. Whitesell 313-559-5454
MI St. Joseph, Robert O. Whitesell 616-983-7337
MN Minneapolis, TRW/ECG 612-854-6616
MS Norcross, TRW/ECG 404-447-6154
MO DeSoto, MIDTEC Assoc. 913-441-6565
MO St. Louis, John G. Macke Co. 314-432-2830
MT Salt Lake City, Straube Assoc. 801-263-2640
NE DeSoto, MIDTEC Assoc. 913-441-6565
NV Scottsdale, TRW/ECG 602-994-0441
NH Framingham, TRW/ECG 617-870-0745
NJ Bala Cynwyd, TRW/ECG 215-667-3400
NJ Rowayton, TRW/ECG 203-853-4466
NM Albuquerque, S.W. Sales 505-883-1388
NY Fairport, TRW/ECG 716-425-3775
NY Rowayton, TRW/ECG 203-853-4466
NC Greensboro, TRW/ECG 919-852-4676
OH Cincinnati, TRW/ECG 513-521-2290
OH Cleveland, Robert O. Whitesell 216-447-9020
OH Columbus, Robert O. Whitesell 614-888-9396
OH Dayton, Robert O. Whitesell 513-298-9546
PA Bala Cynwyd, TRW/ECG 215-667-3400
PA Pittsburg, Robert O. Whitesell 412-963-6161
RI Westborough, TRW/ECG 617-870-0745
SC Greensboro, TRW/ECG 919-852-4676
SD Minneapolis, TRW/ECG 612-854-6616
TN Knoxville, Robert O. Whitesell 615-694-9476
TX Austin, Technology Sls. Co. 512-346-9940
TX Dallas, TRW/ECG 214-248-8000
TX El Paso, S.W. Sls. 915-594-8259
TX Houston, TRW/ECG 713-772-5541
UT Salt Lake City, Straube Assocs. 801-263-2640
VT Westborough, TRW/ECG 617-870-0745
VA Richmond, TRW/ECG 804-288-8334
WA Bellevue, TRW/ECG 206-641-9996
WV Dayton, Robert O. Whitesell 513-298-9546
WI Brookfield, TRW/ECG 414-784-7773
WY Salt Lake City, Straube Assocs. 801-263-2640
WY Westminster, Straube Assocs. 303-426-0890
Intl Rio Piedras, Electronics Sls. Assocs. .. 809-769-2911
Can Carleton Place, ONT, Renmark Elctrns. Ltd. 613-257-1490
Can Toronto, ONT, Renmark Elctrns. Ltd. .. 416-494-5445

Local Distributors
AL Huntsville, Arrow Elctrns. 205-882-2730
AL Huntsville, Hall-Mark Elctrns. 205-837-8700
AL Huntsville, Hamilton-Avnet 205-837-7210
AL Huntsville, Pioneer Elctrns. 205-837-9300
AZ Phoenix, Hall-Mark Elctrns. 602-437-1200
AZ Tempe, Arrow Elctrns. 602-968-4800
AZ Tempe, Fisher/Brownell 602-967-1464
AZ Tempe, Hamilton-Avnet 602-231-5100
CA Alhambra, Fisher/Brownell 818-289-0255
CA Anaheim, Pacesetter Elctrns. 714-777-4711
CA Chatsworth, Arrow Elctrns. 818-701-7500
CA Chatsworth, Avnet Elctrns. 818-700-2600
CA Costa Mesa, Avnet Elctrns. 714-754-6111
CA Costa Mesa, Hamilton Electro Sls. 714-641-4100
CA Culver City, Hamilton Electro Sls. 818-558-2121
CA El Segundo, Hall-Mark Elctrns. 213-643-9101
CA Garden Grove, Bell Inds. 714-220-0681
CA Gardena, Bell Inds. 213-515-1800
CA Manhattan Beach, Prime Electro 213-379-3642
CA Sacramento, Hamilton-Avnet 916-925-2216
CA San Diego, Arrow Elctrns. 619-565-4800
CA San Diego, Fisher/Brownell 619-560-8545
CA San Diego, Hall-Mark Elctrns. 619-268-1201
CA San Diego, Hamilton-Avnet 619-571-7510
CA San Jose, Hall-Mark Elctrns. 408-946-0900
CA Santa Clara, Fisher/Brownell 408-988-6041
CA Sunnyvale, Arrow Elctrns. 408-745-6600
CA Sunnyvale, Bell Inds. 408-734-8570
CA Sunnyvale, Hamilton-Avnet 408-743-3355
CA Sunnyvale, Pacesetter Elctrns. 408-734-5470
CA Tustin, Arrow Elctrns. 714-838-5422
CO Aurora, Arrow Elctrns. 303-696-1111
CO Englewood, Hall-Mark Elctrns. 303-790-1662
CO Englewood, Hamilton-Avnet 303-740-1000
CO Wheatridge, Bell Inds. 303-424-1985
CT Danbury, Hamilton-Avnet 203-797-2800
CT Wallingford, Arrow Elctrns. 203-265-7741
FL Altamonte Spring, Pioneer Elctrns. 305-834-9090
FL Clearwater, Hall-Mark Elctrns. 813-530-4543
FL Deerfield Beach, Pioneer Elctrns. 305-428-8877
FL Orlando, Chip Supp. Co. 305-298-7100
FL Orlando, Hall-Mark Elctrns. 305-855-4020
FL Palm Bay, Arrow Elctrns. 305-725-1480
FL Winter Park, Hamilton-Avnet 305-628-3888
GA Norcross, Arrow Elctrns. 404-449-8252
GA Norcross, Hall-Mark Elctrns. 404-447-8000
GA Norcross, Hamilton-Avnet 404-447-7507
GA Norcross, Pioneer Elctrns. 404-448-1711
IL Bensenville, Hall-Mark Elctrns. 312-806-3800
IL Bensenville, Hamilton-Avnet 312-860-7700
IL Elk Grove Vlg., Pioneer Elctrns. 312-437-9680
IL Elk Grove Vlg., R M Elctrns. 312-364-6122
IL Schaumburg, Arrow Elctrns. 312-397-3440
IN Carmel, Hamilton-Avnet 317-844-9333
IN Indianapolis, Pioneer Elctrns. 317-849-7300
IN Indianapolis, R M Elctrns. 317-291-7110
IA Cedar Rapids, Arrow Elctrns. 319-395-7230
KS Lenexa, Hall-Mark Elctrns. 913-888-4747
KS Overland Park, Hamilton-Avnet 913-888-8900
MD Columbia, Arrow Elctrns. 301-995-0003
MD Columbia, Hall-Mark Elctrns. 301-988-9800
MD Columbia, Hamilton-Avnet 301-995-3500
MD Gaithersburg, Pioneer Elctrns. 301-921-0660
MA Billerica, Hall-Mark Elctrns. 617-667-0902
MA Newton, Greene-Shaw Elctrns. 617-969-8900
MA Norwood, Gerber Elctrns. 617-769-6000
MA Woburn, Arrow Elctrns. 617-933-8130
MA Woburn, Hamilton-Avnet 617-935-9700
MI Ann Arbor, Arrow Elctrns. 313-971-8220
MI Grand Rapids, Hamilton-Avnet 616-243-8805
MI Livonia, Hamilton-Avnet 313-522-4700
MI Livonia, Pioneer Elctrns. 313-525-1800
MI Wyoming, R M Elctrns. 616-531-9300
MN Bloomington, Hall-Mark Elctrns. 612-854-3223
MN Edina, Arrow Elctrns. 612-830-1800
MN Minnetonka, Hamilton-Avnet 612-932-0600
MN Minnetonka, Pioneer Elctrns. 612-935-5444
MO Earth City, Hamilton-Avnet 314-344-1200
MO Maryland Hts., Hall-Mark Elctrns. 314-291-5350
MO St. Louis, Arrow Elctrns. 314-567-6888
NH Manchester, Arrow Elctrns. 603-668-6968
NJ Cherry Hill, Hall-Mark Elctrns. 609-424-7300
NJ Cherry Hill, Hamilton-Avnet 609-424-0100
NJ Fairfield, Arrow Elctrns. 201-575-5300
NJ Fairfield, Hall-Mark Elctrns. 201-575-4415
NJ Fairfield, Hamilton-Avnet 201-575-3390
NJ Marlton, Arrow Elctrns. 609-596-8000
NM Albuquerque, Arrow Elctrns. 505-243-4566
NM Albuquerque, Bell Inds. 505-292-2700
NM Albuquerque, Hamilton-Avnet 505-765-1500
NM Albuquerque, Intl. Elctrns. 505-345-8127
NY Hauppauge, Arrow Elctrns. 516-231-1000
NY Hauppauge, Hamilton-Avnet 516-231-9800
NY Liverpool, Arrow Elctrns. 315-652-1000
NY Melville, Arrow Elctrns. 516-694-6800
NY Port Chester, Zeus Comps. 914-937-7400
NY Rochester, Arrow Elctrns. 716-275-0300
NY Rochester, Hamilton-Avnet 716-475-9130
NY Rochester, Rochester Radio Supp. 716-454-7800
NC Charlotte, Pioneer Elctrns. 704-527-8188
NC Raleigh, Arrow Elctrns. 919-876-3132
NC Raleigh, Hall-Mark Elctrns. 919-872-0712
NC Raleigh, Hamilton-Avnet 919-878-0819
NC Winston-Salem, Arrow Elctrns. 919-725-8711
OH Centerville, Arrow Elctrns. 513-435-5563
OH Cincinnati, Hall-Mark Elctrns. 513-563-5980
OH Cleveland, Hamilton-Avnet 216-831-3500
OH Cleveland, Pioneer Elctrns. 216-587-3600
OH Dayton, Hamilton-Avnet 513-439-6700
OH Dayton, Pioneer Elctrns. 513-237-9900
OH Solon, Arrow Elctrns. 216-248-3990
OH Westerville, Hall-Mark Elctrns. 614-891-4555
OK Tulsa, Hall-Mark Elctrns. 918-665-3200
OK Tulsa, Quality Comps. 918-664-8812
OR Lake Oswego, Bell Inds. 503-241-4115
OR Lake Oswego, Hamilton-Avnet 503-635-8157
OR Tigard, Arrow Elctrns. 503-684-1690
PA Horsham, Pioneer Elctrns. 215-674-4000
PA Monroeville, Arrow Elctrns. 412-856-7000
PA Pittsburgh, Pioneer Elctrns. 412-782-2300
TX Addison, Quality Comps. 214-733-4300
TX Austin, Arrow Elctrns. 512-835-4180
TX Austin, Hamilton-Avnet 512-837-8911
TX Austin, Pioneer Elctrns. 512-835-4000
TX Austin, Quality Comps. 512-835-0220
TX Dallas, Hall-Mark Elctrns. 214-553-4300
TX Dallas, Intl. Elctrns. 214-233-9323
TX Dallas, Pioneer Elctrns. 214-386-7300
TX El Paso, Intl. Elctrns. 915-598-3406
TX Houston, Arrow Elctrns. 713-530-4700
TX Houston, Hall-Mark Elctrns. 713-781-6100
TX Houston, Hamilton-Avnet 713-780-1771
TX Houston, Pioneer Elctrns. 713-988-5555
TX Irving, Hamilton-Avnet 214-659-4111
TX Richardson, Fisher/Brown 214-235-3177
TX Sugarland, Quality Comps. 713-240-2255
UT Salt Lake City, Arrow Elctrns. 801-539-1135
UT Salt Lake City, Bell Inds. 801-972-6969
UT Salt Lake City, Hamilton-Avnet 801-972-2800
VA Richmond, Arrow Elctrns. 804-282-0413
WA Bellevue, Arrow Elctrns. 206-653-4800
WA Bellevue, Bell Inds. 206-747-1515
WA Bellevue, Hamilton-Avnet 206-643-3950
WI New Berlin, Classic Comps. 414-786-5300
WI New Berlin, Hall-Mark Elctrns. 414-797-7844
WI New Berlin, Hamilton-Avnet 414-784-4510
WI Oak Creek, Arrow Elctrns. 414-764-6600
Can Calgary, Future Elctrns. 403-259-6408
Can Calgary, Alberta, Hamilton-Avnet 403-230-3586
Can Edmonton, Future Elctrns. 403-486-0974
Can Mississauga, Ontario, Hamilton-Avnet 416-677-7432
Can Nepean, Ontario, Hamilton-Avnet 613-226-1700
Can Ottawa, Future Elctrns. 613-820-8313
Can Pointe Clair, Quebec, Future Elctrns. .. 514-694-7710
Can St. Laurent, Quebec, Hamilton-Avnet .. 514-331-6443
Can Toronto, Future Elctrns. 416-663-5563
Can Vancouver, Future Elctrns. 604-438-5545
Can Willowdale, Ontario, Electrosonic 416-494-1555

TRW RESISTIVE PRODUCTS DIV., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, Tel: 215-923-8230, TWX: 710-670-3370; Empl.: 600; *Dist. Mgr.:* Hugh Bolen ..... **A•1954-1957**

Local Sales Offices & Reps
AL Huntsville, TRW/ECG 205-533-7600
AZ Scottsdale, TRW/ECG 602-994-0441
CA Los Angeles, TRW/ECG 213-535-6175
CA Mountain View, Straube Assocs. 415-969-6060
CA San Diego, TRW/ECG 619-279-3990

CA Santa Ana, TRW/ECG 714-550-1101
CA Woodland Hills, TRW/ECG 818-703-1771
CO Westminster, Straube Assocs. 303-426-0890
CT Rowayton, TRW/ECG 203-853-4466
FL Ft. Lauderdale, TRW/ECG 305-772-3000
FL Orlando, TRW/ECG 305-857-3650
GA Norcross, TRW/ECG 404-447-6154
IL Chicago, TRW/ECG 312-693-7730
IN Ft. Wayne, R. O. Whitesell & Assocs. .. 219-432-5591
IN Indianapolis, R. O. Whitesell & Assocs. 317-359-9283
IN Kokomo, R. O. Whitesell & Assocs. 317-457-9127
KS De Soto, Midtec Assocs. 913-441-6565
KY Louisville, R. O. Whitesell & Assocs. .. 502-426-7696
MD Columbia, TRW/ECG 301-964-9110
MA Westborough, TRW/ECG 617-870-0745
MI Grand Rapids, R. O. Whitesell & Assocs. 616-942-5420
MI Southfield, R. O. Whitesell & Assocs. .. 313-559-5454
MI St. Joseph, R. O. Whitesell & Assocs. 616-983-7337
MN Minneapolis, TRW/ECG 612-854-6616
MO St. Louis, Jack Macke Co. 314-432-2830
NY Fairport, TRW/ECG 716-425-3775
NC Greensboro, TRW/ECG 919-852-4676
OH Cincinnati, R. O. Whitesell & Assocs. .. 513-521-2290
OH Cleveland, R. O. Whitesell & Assocs. .. 216-447-9020
OH Columbus, R. O. Whitesell & Assocs. .. 614-888-9396
OH Dayton, R. O. Whitesell & Assocs. 513-298-9546
OR Portland, TRW/ECG 503-620-5032
PA Bala Cynwyd, TRW/ECG 215-667-3400
PA Pittsburgh, R. O. Whitesell & Assocs. .. 412-963-6161
TN Greeneville, R. O. Whitesell & Assocs. 615-639-6154
TX Austin, Technlg. Sls. Co. 512-345-2331
TX Dallas, TRW/ECG 214-248-8000
TX El Paso, S. W. Sales 915-594-8259
TX Houston, TRW/ECG 713-772-5541
UT Salt Lake City, Straube Assocs. 801-263-2640
VA Richmond, TRW/ECG 804-288-8334
WA Bellevue, TRW/ECG 206-641-1996
WI Brookfield, TRW/ECG 414-784-7773

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AL Huntsville, Arrow Elctrns. 205-882-2730
AL Huntsville, Hamilton/Avnet 205-837-7210
AZ Tempe, Arrow Electronics 602-968-4800
AZ Tempe, Bell Inds. 602-966-7800
AZ Tempe, Fisher Brownell 602-967-1464
AZ Tempe, Hamilton/Avnet 602-231-5100
CA Alhambra, Fisher Brownell 818-289-0255
CA Chatsworth, Arrow Elctrns. 213-701-7500
CA Chatsworth, Avnet Elctrns. 818-700-2600
CA Chatsworth, Hamilton Electro Sls. 818-700-6500
CA Costa Mesa, Avnet Elctrns. 714-754-6111
CA Costa Mesa, Hamilton Electro Sls. 712-641-4100
CA Culver City, Hamilton Electro Sls. 213-558-2121
CA Gardena, Bell Inds. 213-515-1800
CA Glendale, R. V. Weatherford 213-849-3451
CA Hayward, Arrow Elctrns. 415-487-4600
CA Ontario, Hamilton/Avnet 714-989-4602
CA Sacramento, Arrow Electronics 916-925-7456
CA Sacramento, Hamilton/Avnet 916-925-2216
CA San Diego, Arrow Elctrns. 619-565-4800
CA San Diego, Fisher Brownell 619-560-8545
CA San Diego, Hamilton/Avnet 619-571-7510
CA Santa Clara, Fisher Brownell 408-988-6041
CA Sunnyvale, Arrow Elctrns. 408-745-6600
CA Sunnyvale, Bell Inds. 408-734-8570
CA Sunnyvale, Hamilton/Avnet 408-743-3355
CA Tustin, Arrow Electronics 714-838-5422
CO Aurora, Arrow Elctrns. 303-696-1111
CO Englewood, Hamilton/Avnet 303-779-9998
CT Danbury, Hamilton/Avnet 203-797-2800
CT Wallingford, Arrow Elctrns. 203-265-7741
CT Wallingford, Midan Elctrns. 203-265-2077
FL Clearwater, Arrow Elctrns. 813-576-8995
FL Deerfield Beach, Arrow Elctrns. 305-429-8200
FL Ft. Lauderdale, Hamilton/Avnet 305-971-2900
FL Palm Bay, Arrow Elctrns. 305-725-1480
FL St. Petersburg, Hamilton/Avnet 813-576-3930
FL Tampa, Impala Elctrns. 813-885-4747
FL Winter Park, Hamilton/Avnet 305-628-3888
GA Norcross, Arrow Elctrns. 404-449-8252
GA Norcross, Hamilton/Avnet 404-447-7507
IL Bensenville, Hamilton/Avnet 312-860-7700
IL Chicago, Newark Elctrns. 312-638-4411
IL Elk Grove Village, Bell Inds. 312-640-1910
IL Schaumburg, Arrow Elctrns. 312-397-3440
IN Carmel, Hamilton/Avnet 317-844-9333
IN Indianapolis, Arrow Elctrns. 317-243-9353
IN Indianapolis, Graham Elctrns. 317-634-8202
IA Cedar Rapids, Arrow Elctrns. 319-395-7203
IA Cedar Rapids, Deeco 319-365-7551
IA Cedar Rapids, Hamilton/Avnet 319-362-4757
KS Overland Park, Arrow Electrns. 913-642-0592
KS Overland Park, Hamilton/Avnet 913-888-8900
MD Columbia, Arrow Elctrns. 301-995-0003
MD Columbia, Hamilton/Avnet 301-995-3500
MD Timonium, Zebra Elctrns. 301-252-6576
MA Norwood, Gerber Elctrns. 617-769-6000
MA Wilmington, R.C. Components 617-273-1860
MA Woburn, Arrow Elctrns. 617-933-8130
MA Woburn, Hamilton/Avnet 617-273-7500
MI Ann Arbor, Arrow Elctrns. 313-971-8220
MI Grand Rapids, Arrow Elctrns. 616-243-0912
MI Grand Rapids, Hamilton/Avnet 616-243-8805
MI Livonia, Hamilton/Avnet 313-522-4700
MI Livonia, R.S. Elctrns. 313-525-1155
MN Edina, Arrow Elctrns. 612-830-1800
MN Minnetonka, Hamilton/Avnet 612-932-0600
MO Earth City, Hamilton/Avnet 314-344-1200
MO St. Louis, Arrow Elctrns. 314-567-6888
NH Manchester, Arrow Elctrns. 603-668-6968
NH Manchester, Hamilton/Avnet 603-624-9400
NJ Cherry Hill, Hamilton/Avnet 609-424-0100
NJ Fairfield, Arrow Elctrns. 201-575-5300
NJ Fairfield, Hamilton/Avnet 201-575-3390
NJ Hanover, State Elctrns. 201-887-2550
NJ Marlton, Arrow Elctrns. 609-596-8000
NJ Mountainside, Enox Resistors 201-654-7600
NM Albuquerque, Arrow Elctrns. 505-243-4566
NM Albuquerque, Hamilton/Avnet 505-765-1500
NM Albuquerque, Intl. Elctrns. 915-778-9761
NY Hauppauge, Arrow Elctrns. 516-231-1000
NY Hauppauge, Hamilton/Avnet 516-231-9800
NY Hauppauge, Jaco Elctrns. 516-273-5500
NY Liverpool, Arrow Elctrns. 315-652-1000
NY Rochester, Arrow Elctrns. 716-275-0300
NY Rochester, Hamilton/Avnet 716-475-9130
NY Rochester, Rochester Radio 716-454-7800
NC Charlotte, Elctrn. Mktg. Corp. 704-394-6195
NC Raleigh, Arrow Elctrns. 919-876-3132
NC Raleigh, Hamilton/Avnet 919-878-0819
NC Raleigh, Resco/Raleigh 919-781-5700
NC Winston-Salem, Arrow Elctrns. 919-725-8711
OH Cleveland, Hamilton/Avnet 216-831-3500
OH Columbus, Arrow Elctrns. 614-885-8362
OH Columbus, Electronic Mktg. 614-299-4161
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OH Dayton, Bell Inds. 513-434-8231
OH Dayton, Elctrn. Mktg. Corp. 513-439-4711
OH Dayton, Hamilton/Avnet 513-439-6700
OH Highland Hgts, Elctrn. Mktg. Corp. 216-442-3441
OH Solon, Arrow Elctrns. 216-248-3990
OH Westerville, Hamilton/Avnet 614-882-7004
OK Tulsa, Arrow Elctrns. 918-665-7700
OR Lake Oswego, Hamilton/Avnet 503-635-8157
OR Tigard, Arrow Elctrns. 503-684-1690
PA Monroeville, Arrow Elctrns. 412-856-7000
PA Philadelphia, Philadelphia Elctrns. 215-568-7400
PA Pittsburgh, Hamilton/Avnet 412-281-4150
PA Wayne, Peak Elctrns. 215-293-9000
TX Austin, Arrow Elctrns 512-835-4180
TX Austin, Hamilton/Avnet 512-837-8911
TX Carrollton, Arrow Elctrns. 214-380-6464
TX Dallas, Intl. Elctrns. 214-233-9323
TX El Paso, Intl. Elctrns. 915-778-9761
TX Houston, Arrow Elctrns. 713-530-4700
TX Houston, Hamilton/Avnet 713-780-1771
TX Irving, Hamilton/Avnet 214-659-4100
TX Richardson, Fisher Brownell 214-235-3177
TX Richardson, Jaco Elctrns. 214-235-9575
UT Salt Lake City, Arrow Elctrns. 801-972-0404
UT Salt Lake City, Hamilton/Avnet 801-972-2800
VA Richmond, Arrow Elctrns. 804-282-0413
WA Bellevue, Arrow Elctrns. 206-643-4800
WA Bellevue, Hamilton/Avnet 206-643-3950
WA Bellevue, Priebe Elctrns. 206-821-4695
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI New Berlin, Hamilton/Avnet 414-784-4510
WI Oak Creek, Arrow Elctrns. 414-764-6600

TRW, RF Devices Div., 14520 Aviation Blvd., Lawndale, CA 90260, Tel: 213-536-0888, TWX: 910-325-6206; Empl.: 1000; *Dist. Mgr.:* G. Vegvari

TRW UTC TRANSFORMERS, See TRW Inductive Products Div.

TS PRODUCTS, INC., 12455 Branford St., Bldg. 22, Arleta, CA 91331, Tel: 818-896-6676; Empl.: 20; *Sls. Mgr.:* Jon Thomasson; *Dist. Mgr.:* Jon Thomasson ..... **D•1990**

Local Sales Offices & Reps

CA Los Angeles, TS Products, Inc. 818-896-6676
CA San Marino, Motion Control, Inc. 818-796-0189

TTE, INC., 11650 W. Olympic Blvd., Los Angeles, CA 90064, Tel: 213-478-8224; FSC No.: 07766; *Sls. Mgr.:* S. J. Sodaro ..... **A•1644-1655**

Local Sales Offices & Reps

CA Culver City, Sodaro 213-478-7733

TTS-TELECOM TERMINAL SYSTEMS, 621 Hindry Ave, Inglewood, CA 90301, Tel: 213-641-8111, Telex: 182405, TWX: 3715831; Empl.: 18; *Sls. Mgr.:* L. Winters

TUCKER ELCTRNS., Box 461966, Garland, TX 75046, Tel: 214-348-8800, 800-527-4642, Telex: 79-1726; Empl.: 51; *Sls. Mgr.:* Clay Aclin

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TURNER DESIGNS, 2247 Old Middlefield Way, Mountain View, CA 94043-2489, Tel: 415-965-9800; Empl.: 16; *Sls. Mgr.:* John Griffin

Local Sales Offices & Reps

CA Garden Grove, Advanced Digital Grp. 714-897-0319
CA Santa Clara, MANCO 408-496-6611
CO Wheat Ridge, Active Component Tech. 303-422-9229
MD Baltimore, Rep-Tron, Inc. 301-799-7490
MA North Reading, Martindale Assocs. 617-942-0514
NY Fayetteville, Martin P. Andrews 315-637-5291
TX Addison, Active Component Tech. 214-980-1888
TX Austin, Active Component Tech. 512-452-5254

TUSONIX

TUSONIX, INC., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, Tel: 602-744-0400, Telex: 102-299640, TWX: 310-299640; FSC No.: 59660; Empl.: 800; *Sls. Mgr.:* Robert H. Jones; *Dist. Mgr.:* John H. Ohlrich ..... **A•1187-1193, 1656-1657**

Local Sales Offices & Reps

AZ Tucson, Tusonix, Inc. 602-744-0400
CA N. Hollywood, Tusonix, Inc. 213-509-0449
CA Redwood City, James S. Heaton Co. .. 415-367-9000
FL Winter Park, Tusonix 305-647-2936
IA Cedar Rapids, J.R. Sls. Engrg. 319-393-2232
MA Andover, Richard Purinton, Inc. 617-475-7055
NY Webster, Tusonix, Inc. 716-671-4073
NC Greensboro, Tusonix, Inc. 919-292-4286
OR Portland, Tusonix, Inc. 503-297-1555
TX Ft. Worth, P.T.I. 817-831-0441

Local Distributors

FL Ft. Lauderdale, Newark Elctrns. 350-587-2372
IL Chicago, Newark Elctrns. 312-638-4411
MD Beltsville, Resco 301-937-9100
MD White Marsh, Resco 301-529-0500
MN Minneapolis, Newark Elctrns. 612-331-6350
NY Hauppauge, Fairmont Elctrn. Sls. 516-231-3313
NY Melville, Arrow Elctrns. 516-694-6800
NC Raleigh, Resco 919-781-5700

TUSTIN ELCTRNS. CO., 1431 E. Saint Andrews Pl., Santa Ana, CA 92705, Tel: 714-549-0391; FSC No.: 7025-0010; *Sls. Mgr.:* Saul Tunkelrott

TWP, INC., 2133 4th St., Berkeley, CA 94710, Tel: 415-548-4434, Telex: 171-267; Empl.: 10; *Sls. Mgr.:* R. Moreno

TYCO INSTR. DIV., See Data Instrs.

TYTON CORP., Box 23055, 7930 N. Faulkner Rd., Milwaukee, WI 53223, Tel: 414-355-1130, TWX: 910-262-3094; *Sls. Mgr.:* Tom Bednar

UBER GRAFIC INSTRS., Box 4, Palo Alto, CA 94302, Tel: 415-327-4732; Empl.: 2

UCCEL CORPORATION, UCCEL Tower Exchange Park, Dallas, TX 75235, Tel: 214-353-7100, TWX: 910-861-4990; Empl.: 1381 (U.S.) 644 (Foreign)

UCE, INC., 24 Fitch St., Norwalk, CT 06855, Tel: 203-838-7509; Empl.: 20; *Sls. Mgr.:* Richard Eicher

Local Sales Offices & Reps

CA	Fullerton, Electronic Comp. Mkt.	714-879-9460
CA	Mountain View, Leddy Assocs.	415-969-6313
CO	Denver, Butler Tech. Sls.	303-343-3787
IA	Cedar Rapids, Coombs Assocs.	319-362-4116
TX	Richardson, Eagle Mktg.	214-238-5383

UID SWITCHES INC., Sub. of ITW, 6615 W. Irving Park Rd., Chicago, IL 60634, Tel: 312-282-4040, Telex: 4330130, TWX: 910-221-0275; Empl.: 250; *Sls. Mgr.:* A. Steiner; *Dist. Mgr.:* A. Steiner

ULTRA CARBON, Box X-924, Bay City, MI 48707, Tel: 517-894-2911, TWX: 810-265-1222; Empl.: 200; *Sls. Mgr.:* R. J. Anthony

ULTRAPAR, 90 Liberty Corner Road, Warren, NJ 07060-6709, Tel: 201-647-6650; Empl.: 1; *Sls. Mgr.:* Chris Parkinson

Local Sales Offices & Reps

CT	Northford, Indeco	203-484-0093
GA	Norcross, Alup America	404-446-3614
PA	Wallingford, Eled	215-566-7595
RI	Smithfield, Alcom	401-232-0119

ULTRONIX, INC., P.O. Box 1090, Grand Junction, CO 81502, Tel: 303-242-0810, TWX: 910-929-6965; FSC No.: 05347; Empl.: 260; *Sls. Mgr.:* Gerald Krebill; *Dist. Mgr.:* Gerald Krebill **A•1958-1965**

Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westrep	619-566-6580
CA	Santa Clara, Westrep	408-988-8833
CO	Denver, West Inc.	303-773-8180
IL	Elk Grove Village, Parcom	312-228-6360
IA	Cedar Rapids, Stan Clothier Co.	319-395-0245
KS	Parker, S. W. Wollard Co.	913-898-6552
MA	Newton Upper Falls, Anchor Engrg.	617-964-6205
MN	Minneapolis, S. Clothier Co.	612-944-3456
MO	St. Louis, Abrams & Assoc.	314-569-0447
NJ	Cherry Hill, Danco Corp.	609-424-5590
NM	Albuquerque, West, Inc.	505-822-8901
NY	Jericho, J-Square Mktg.	516-935-3200
NY	Rochester, Apex Assocs.	716-254-6050
TX	Austin, O. M. Sls.	512-452-1838
TX	Houston, O. M. Sls.	713-789-4426
TX	Richardson, O. M. Sls.	214-690-6746
EXP	CT, Stamford, Dage Corp.	203-324-3123

Local Distributors

CA	North Hollywood, T.T.I., Inc.	213-982-0201
CA	San Fernando, Petell Electronics	213-365-3984
FL	Orlando, Hammond Elctrns.	305-849-6060
FL	Orlando, T.T.I-2	305-859-1000
FL	Tampa, Impala Elctrns.	813-885-4747
MD	Columbia, Azteck Elctrns.	301-995-1760
MA	Burlington, TLC Elctrns.	617-273-0140
MA	Woburn, T.T.I., Inc.	617-938-8800
NY	Farmingdale, SAI, Inc.	516-293-2710
OH	Dayton, Electro-Line	513-461-5683
TX	Fort Worth, Allied Elctrns.	817-336-5401
TX	Fort Worth, T.T.I., Inc.	800-433-7092
WA	Kent, Shannon Ltd.	206-763-0545

ULVAC NORTH AMERICA, P.O. Box 799, 105 York Street, Kennebunk, ME 04043, Tel: 207-985-2973, Telex: 94-4344, TWX: 510-299-0007; Empl.: 35; *Sls. Mgr.:* Susan Zilaro; *Dist. Mgr.:* Harold Baum

ULVECO, INC., 323 Vintage Park Drive, Foster City, CA 94404, Tel: 415-574-1100, TWX: 856446 ULVECO **A•2338-2339**

Local Sales Offices & Reps

CA	Foster City, Ulveco, Inc.	415-574-1100
CT	Avon, Ulveco, Inc.	203-678-7711
MI	Detroit, CMP	313-477-7700
NJ	Cherry Hill, Power2	609-424-6737
NY	Rochester, KLM Garner	716-381-8350
NY	Rochester, Ulveco, Inc.	716-381-4673
NY	Syracuse, KLM Garner	315-458-6214
OH	Cleveland, CMP	216-779-5100
OH	Dayton, CMP	513-836-0951
PA	Pittsburgh, CMP	412-372-4415
Can	Toronto, Ont., Stetron Intl.	416-475-6202

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UNDERWRITERS SAFETY DEVICE, Allied Amphenol Prods., 7300 W. Wilson Ave., Chicago, IL 60656, Tel: 312-867-4600, TWX: 910-221-3474; Empl.: 200; *Sls. Mgr.:* J. A. VanCura; *Dist. Mgr.:* R. S. Heyne

UNGAR, Div. Eldon Inds., Inc., 100 W. Manville St., Compton, CA 90224-6005, Tel: 213-774-5950, Telex: 4720750 Eldon; FSC No.: 78976; Empl.: 140; *Sls. Mgr.:* George Mellevold

UNHOLTZ-DICKIE CORP., 6 Brookside Dr., Wallingford, CT 06492, Tel: 203-265-3929, Telex: 643802; Empl.: 49

UNIBOX, Div. of Amerex, P.O. Box 2815, Riverside, CA 92516, Tel: 714-686-1400; *Sls. Mgr.:* Roger Orton

UNICO, 3725 Nicholson Rd., Franksville, WI 53126-0505, Tel: 414-886-5678, TWX: 910-271-2385; Empl.: 175; *Sls. Mgr.:* Eric Hogse

UNICORN ENGRG. CO., Membrane Keyboard Div., 6201 Harwood Ave., Oakland, CA 94618, Tel: 415-428-1626; *Sls. Mgr.:* Steve Gensler

UNICORP, 291 Cleveland St., Orange, NJ 07050, Tel: 201-674-1700; FSC No.: 04729; Empl.: 82; *Sls. Mgr.:* B. Levine **C•1696**

Local Sales Offices & Reps

AL	Tuscumbia, MSC Corp.	205-383-6850
CA	South Gate, James E. Fitch	213-563-2336
IL	Palatine, Claeson Assocs.	312-359-7230
MA	Shrewsbury, Nordstrom Assocs.	617-842-8646
MI	Farmington, Amtech Rep.	313-474-8300
MN	Bloomington, Termatech	612-854-2001
OH	Centerville, EMA, Inc.	513-433-2800
PA	Media, The Balwin Co.	215-565-6044

UNIDOT, INC., 602 Park Point Dr., Golden, CO 80401, Tel: 303-526-9263, Telex: RCA-296621

UNILATOR TECHNICAL CERAMICS INC., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770, Tel: 213-463-5618, TWX: 910 321-2903; *Sls. Mgr.:* Norman R. Sutherland

UNIMAX SWITCH CORP., Ives Rd., Wallingford, CT 06492, Tel: 203-269-8701, Telex: 96-3485, TWX: 710-476-1397; FSC No.: 80207; Empl.: 300; *Dist. Mgr.:* Neil Gould **B•1702**

Local Sales Offices & Reps

AZ	Phoenix, Mercury Engrg. Sls., Inc.	602-244-0123
CA	Brea, MASCO	714-529-0866
CA	Los Altos, Ewing-Foley	415-941-4525
CA	Los Angeles, MASCO	213-295-7781
CO	Englewood, CompuTech Mktg.	303-773-2981
CT	Ansonia, Zaslow Sls.	203-735-9581
CT	Bloomfield, Zaslow Sls.	203-242-7781
FL	Tampa, J. R. Controls	813-961-9478
IL	Lisle, Wasson-Gallagher	312-963-5954
IN	Ft. Wayne, O. H. Bromberg & Assocs.	219-744-1636
KY	Louisville, O. H. Bromberg & Assocs.	502-245-8916
MD	Silver Spring, L. G. White & Co.	301-434-1555
MD	Silver Spring, NKA, Inc.	301-585-6141
MA	Norton, Zaslow Sls.	617-285-3992
MA	Westboro, Zaslow Sls.	617-393-8150
MI	Grosse Pointe Park, Greiner Assocs.	313-499-0188
MN	Minneapolis, Jos-Co. Sls. Engrg.	612-861-3343
MO	St. Louis, Hill & Co.	314-432-1136
NH	Londonderry, Zaslow Sls.	603-432-8907
NJ	West Caldwell, Grimm, Siegel Assocs.	201-575-9300
NY	E. Syracuse, Nycom	315-437-8343
NY	Williamsville, Nycom	
NC	Winston-Salem, L. G. White & Co.	919-725-3612
OH	Cincinnati, O. H. Bromberg & Assocs.	513-771-9333
OH	Dayton, O. H. Bromberg & Assocs.	513-434-8788
OH	Medina, J. C. Hofstetter Co.	216-241-4880
PA	Edgemont, White-Whiddett	215-353-6343
PA	Hickory, J. C. Hofstetter Co.	412-356-2305
SC	Greenville, L. G. White & Co.	803-271-0630
SC	Greenville, Sunbelt Sls.	803-877-0771
TN	Taft, Sunbelt Sls.	615-425-6164
TX	Bedford, W. Pat Fralia Co.	817-267-3577
VA	Richmond, L. G. White & Co.	804-740-7093
WA	Mercer Island, J. H. Andersen	206-232-0484

Local Distributors

AL	Decatur, Forbes Distr. Co.	205-353-4762
AL	Montgomery, Southern Controls	205-277-5030
AK	Anchorage, Alaska Elctrns.	907-563-3774
AZ	Phoenix, Continental Light & Supp.	602-263-6000
AZ	Phoenix, Electro Comps.	602-258-2665
AZ	Tempe, Electronic Supp.	602-258-4769
AR	Fort Smith, Southern Elec.	501-646-5500
CA	Belmont, Arndt Elctrns.	415-592-6718
CA	Belmont, Lo Dan Elctrns.	415-592-4600
CA	Covina, Selecta Switch	213-915-3409, 213-967-4123
CA	Fountain Valley, Components Ctr.	213-582-0667
CA	Gardena, California Switch & Signal	213-538-9830
CA	Inglewood, Newark Elctrns.	213-671-7066
CA	Los Angeles, Master Distrs.	213-829-4656
CA	Riverside, Electronic Supp.	714-683-7300
CA	Sacramento, Dunlap Elctrns.	916-442-5801
CA	San Diego, Electronic Supp.	619-693-8222
CA	San Jose, Cypress Elctrns.	408-945-8400
CA	Santa Monica, Master Distrs.	213-452-1229, 213-829-4656
CA	Torrance, Cypress Elctrns.	213-533-6005
CA	Van Nuys, Pacific Switch	213-873-4802
CO	Denver, Fistell's Elec. Supp.	303-629-1312
CO	Denver, Newark Elctrns.	303-757-3351
CO	Wheat Ridge, Cypress	303-431-2622
CT	East Haven, J.V. Elctrns.	203-469-2321
CT	Hartford, Atlantic Switch Controls	203-525-6907
CT	Taftville, Atlantic Switch	203-887-1639
CT	Wallingford, Sager Elect.	203-265-4600
FL	Hialeah, Atlas Elec. Supp.	305-885-8941
FL	Lakeland, Switch Controls	813-644-7564
FL	Largo, Lodan Elctrns.	813-586-2851
FL	Miami, Electronic Equip.	305-871-3500
GA	Macon, Quality Bearing Co.	912-746-5655
IL	Arlington Hgts., Lo Dan Elctrns.	312-398-5311
IL	Carol Stream, Connectrix	312-653-1460, 800-323-9431
IL	Carol Stream, Lectro Comps.	312-690-0520
IL	Chicago, Newark Elctrns.	312-638-4411
IA	West Des Moines, Ramco	515-225-6933
KS	Emporia, Emporia Elec., Inc.	316-342-2965
KY	Louisville, Main Elect. Equip.	502-587-6511
LA	Harvey, AFG Elctrns.	504-368-9696
LA	New Orleans, William B. Allen Supp.	504-525-8222
ME	Portland, Rockingham Elect. Supp.	207-772-4614
MA	Hingham, Sager Elec. Supp.	617-749-6700
MI	Battlecreek, Great Lakes Elctrns.	616-731-4156
MI	Oak Park, Newark Elctrns.	313-967-0600
MI	St. Claire Shores, Specialties Mfg. Co.	313-771-2700
MN	Hopkins, Joel Co.	612-935-6202
MN	Minneapolis, Newark Elctrns.	612-331-6350
MO	Maryland Hgts., Western Extralite	314-432-4560
NH	Nashua, Atlantic Switch	603-732-8500
NH	Salem, Sager Elec.	603-898-1348
NJ	Audubon, Universal Elctrn. Supp.	215-627-4646, 609-547-3430
NJ	Fair Lawn, Relay Specialities	201-797-3313
NJ	Mt. Laurel, Jerseyswitch	609-778-8190
NJ	Paterson, Feldman Bros. Elec. Supp.	201-742-7330
NY	Bohemia, Key Comps.	516-567-7500
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Geneva, Gersh	315-789-4505
NY	Hempstead, Elctrn. Equip.	516-538-5510
NY	Rochester, Summit Elctrns.	716-334-8110
NY	Sodus, AED Distrs.	315-483-6561
NY	Woodside, Switches Unltd.	212-478-5000
NC	Charlotte, Dixie Elctrns.	704-377-4348
NC	Winston-Salem, Kirkman Elect.	919-722-9131
OH	Cincinnati, Cartessa Corp.	513-385-7700
OH	Cincinnati, Institutional Svc. Parts	513-242-3139
OH	Cincinnati, Rilco	513-474-5400
OH	Columbus, Ohio Switch	614-885-0319
OH	Valley View, Trexon Elctrns.	216-447-1050
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, Johnstone	503-231-4833
PA	Allentown, Lehigh Elctrns.	215-433-3045
PA	Drexel Hill, Kass Elctrn. Dist.	215-789-7700
PA	Philadelphia, Herbach & Rademan	215-426-1700
PA	Pittsburgh, Alder-tronics	412-821-5565
SC	Columbia, Dixie Elctrns.	803-779-5332
TX	Dallas, Cypress Elctrns.	214-869-1435
TX	Dallas, Texaswitch	214-357-1768
TX	Dallas, Watson Elec. Supp. Co.	214-742-8441
TX	Dallas, Wilkinson Bros.	214-941-9963
TX	El Paso, Ideal Indl. Elctrn. Supp.	915-779-6647
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Newark Elctrns.	713-782-4800
TX	San Antonia, Purvis Bearing	512-299-1010
TX	Waco, Hargis Co.	817-754-5667
TX	Waco, Purvis Bearing	817-753-6477
VA	Alexandria, Techn. Distrs.	703-971-8979
VA	Roanoke, Peoples Elctrn. Supp.	703-342-8933
WI	Mequon, Taylor Elec.	414-241-4321
Can	Burlington, Ont., Motion Controls	416-637-9369
Can	Vancouver, B.C., Canadian Dynamics	604-872-8106

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CA	San Francisco	415-875-2800
CT	Danbury, Military & Govt. App. Only	203-794-7547
GA	Norcross	404-446-2400
IL	Itasca	312-773-3444
NJ	Saddle Brook	201-845-5400
OH	Middleburg Hgts.	216-826-4444
TX	Dallas	214-241-9100

UNION CARBIDE CORP., ELCTRNS. DIV., Component Dept., Box 5928, Greenville, SC 29606, Tel: 803-963-6348, Telex: 57-0496, TWX: 810-287-2536; FSC No.: 31433; *Sls. Mgr.:* Robert Taylor; *Dist. Mgr.:* Dan Manly ..... **A•1106-1107**

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UNION CARBIDE CORPORATION, Elctrns. Div., Crystal Prods. Dept., 9320 Chesapeake Dr., Ste. 104, San Diego, CA 92123, Tel: 619-279-4500, Telex: 695-465; Empl.: 125; *Sls. Mgr.:* J. J. Beeman

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Local Sales Offices & Reps

NJ	Medford, Jack McCoy, Inc.	609-953-0770
AL	Huntsville, R. D. Whitesell	205-883-5110
CA	Culver City, DeAngelo, Rothman Co.	213-827-2202
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assocs. Mountain States, Inc.	303-426-0890
CT	Connecticut, John E. Boeing	203-723-2355
FL	Altamonte Springs, Semtronic Assocs., Inc.	305-831-8233
FL	Clearwater, Semtronic Assocs., Inc.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assocs., Inc.	305-731-2484
GA	Norcross, Twentieth Century	404-446-1999
ID	Boise, Cascade Comps., Inc.	208-343-9886
IL	Chicago, M. Gottlieb Assocs.	312-775-1151
IL	Elk Grove Village, John G. Twist Co.	312-593-0200
IN	Fort Wayne, R. O. Whitesell	219-432-5591
IN	Indianapolis, M. Gottlieb Assocs.	314-846-5788
IN	Indianapolis, R. O. Whitesell	317-359-9283
IN	Kokomo, M. Gottlieb Assocs.	317-455-0444
IN	Kokomo, R. O. Whitesell	317-457-9127
KS	Shawnee Mission, Lowell Kangas & Assocs., Inc.	913-631-3515
KY	Louisville, R. D. Whitesell	502-426-7696
MD	Baltimore, Pro-Rep, Inc.	301-653-3600
MA	Lexington, John E. Boeing Co., Inc.	617-862-2500
MI	Grand Rapids, R. O. Whitesell	616-942-5420
MI	Southfield, M. Gottlieb Assocs.	313-569-5501
MI	Southfield, R. O. Whitesell	313-559-5454
MI	St. Joseph, R. O. Whitesell	616-983-7337
MN	Bloomington, Twist Co.	612-835-2120
NM	Albuquerque, Straube Assocs. Mountain States, Inc.	303-426-0890
NY	Jamaica, S-J Assocs., Inc.	212-291-3232
NY	New York, Caravan Sls., Corp.	212-734-5800
NY	Pittsford, Franklin Sls. Corp.	716-248-8251
NC	Greensboro, Caravan Sls.	919-294-1500
NC	Raleigh, Tingen Tech Sls., Inc.	919-878-4440
OH	Cincinnati, Makin Assoc.	513-871-2424
OH	Columbus, Makin Assoc.	513-871-2424
OK	Tulsa, ION Assocs., Inc.	918-664-0186
OR	Portland, Earl & Brown	503-245-2283
PA	Dowington, Jack McCoy Inc.	215-363-0350
PA	Pittsburgh, R. O. Whitesell	412-963-6161
TN	Knoxville, M. Gottlieb Assocs.	615-966-1314
TN	Knoxville, R. O. Whitesell	615-694-9476
TX	Austin, ION Assocs., Inc.	512-331-7251
TX	Grand Prairie, ION Assocs., Inc.	214-647-8225
TX	Houston, ION Assocs., Inc.	713-977-4354
UT	Salt Lake City, Straube Assocs. Mountain States, Inc.	801-263-2640
WA	Seattle, Earl & Brown	206-284-1121
WI	Brookfield, Twist Co.	414-782-2670
Can	Oakville, Ont., Haltronics, Ltd.	416-844-2121

Local Distributors

AL	Huntsville, Contact Elctrn. Inc.	205-881-9321
AZ	Tempe, Bell Inds.	602-966-7800
CA	Chatsworth, QC Comps.	818-700-2622
CA	Garden Grove, National Capacitor Corp.	714-892-7749
CA	San Diego, Bell Inds.	619-268-1277
CA	Santa Ana, Nesco	714-541-6181
CA	Santa Ana, Projections Unltd., Inc.	714-621-2323
CA	Van Nuys, Nesco	818-781-0505
CO	Wheatridge, Bell Inds.	303-424-1985
CT	Pawcatuck, Glynn Elctrns.	203-599-5373
FL	Fort Lauderdale, Hammond Elctrns., Inc.	305-973-7103
FL	Tampa, Reptron Elctrns.	813-855-4656, 813-441-2893
GA	Norcross, Hammond Elctrns., Inc.	404-869-2080
IL	Chicago, NEP Elctrns.	312-625-8400
IL	Elk Grove, RM Elctrns.	312-449-1996
IL	Northbrook, Classic Comps. Supp., Inc.	312-272-9650
IN	Indianapolis, Classic Comps.	317-872-4777
IN	Indianapolis, RM Electronics	317-291-7110
IA	Arlington Hgts., Reptron Elctrns.	312-593-7070
MA	Burlington, TLC Elctrns.	617-273-0140/0141
MA	Hopkinton, Interface Elctrns. Corp.	617-435-6858
MA	Middleboro, Glynn Elctrns.	617-947-4262
MA	Westford, Electronic's Specialties	617-486-8495
MI	Grand Rapids, RM Elctrns.	616-531-9300
MI	Lavonia, Reptron	313-525-2700
MN	Hopkins, Joel Co.	612-935-6202
NH	Salem, Glynn Elctrns.	603-893-8313
NJ	Clifton, J-Mar Elctrns., Inc.	201-772-6400
NM	Albuquerque, Bell Ind.	505-292-2700
NY	Glen Cove, Jacques Ebert Assocs.	516-671-6123
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Ronkonkoma, Prime Comps.	516-737-1730
NC	Greensboro, Hammond Elctrns., Inc.	919-275-6391
OH	Worthington, Reptron	614-436-6675
OR	Lake Oswego, Bell Inds.	503-241-4115
OR	Lake Oswego, Moore Elctrns.	503-684-3100
PA	Exton, VSH	215-363-2250
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
PA	York, E.C.I.	717-846-5334
SC	Greenville, Hammond Elctrns., Inc.	803-233-4121
TX	Austin, Captronics, Inc.	512-459-4328
TX	Austin, Kent Elctrns.	512-834-1900
TX	Dallas, Captronics, Inc.	214-340-3592
TX	Fort Worth, Patco Supp. Co.	817-429-8596
TX	Houston, Kent Elctrns.	713-780-7770
TX	Richardson, Jaco Elctrns.	214-235-9575
TX	Richardson, Kent Elctrns.	214-669-2600
WA	Bellevue, Bell Inds.	206-747-1515
WI	New Berlin, Classic Comps. Supp., Inc.	414-786-5300
WI	New Berlin, NEP Elctrns.	414-785-9100
WI	New Berlin, RM Elctrns.	414-784-4420
Can	Pointe Claire, Future Elctrns.	514-694-7710
Can	Willowdale, Electro Sonic, Inc.	416-494-1616

UNITED DETECTOR TECH., 12525 Chadron Ave., Hawthorne, CA 90250, Tel: 213-978-0516, Telex: 18-2458; FSC No.: 50486; Empl.: 200; *Sls. Mgr.:* Michael Feeney

UNITED ELEC. CONTROLS, 85 School St., Watertown, MA 02172, Tel: 617-WA6-1000, Telex: 92 2445; Empl.: 420; *Dist. Mgr.:* Jim Dever

UNITED FOAM PLASTICS, 172 E. Main St., Georgetown, MA 01833, Tel: 617-352-2200, TWX: 710-347-0315; FSC No.: 55900; Empl.: 163

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UNITED SOLDER WRAP INC., 2608 Electronic La., Ste 509, Dallas, TX 75220, Tel: 214-350-4978, Telex: 79-1535; Empl.: 80; *Sls. Mgr.:* Perry L. Gross

UNITED STATES CRYSTAL CORP., 3605 McCart St., Fort Worth, TX 76110, Tel: 817-921-3014, TWX: 910-893-4084; FSC No.: 52847; Empl.: 75; *Sls. Mgr.:* Jan Henderson

UNITED STATES SOFTWARE CORP., 5470 N.W. Innisbrook Place, Portland, OR 97229, Tel: 503-645-5043, TWX: 4993875 U S SOFTWARE; *Sls. Mgr.:* Donald L. Dunstan

UNITED STATES TESTING CO., INC., 1415 Park Ave., Hoboken, NJ 07030, Tel: 800-631-3096, 201-792-2400, Telex: 126493, TWX: 219504; FSC No.: 93282; *Sls. Mgr.:* R. Donohue

UNITED TECHNOLOGIES AUTOMOTIVE, 1230 Sabine St., Huntington, IN 46750, Tel: 219-356-2700, Telex: 23-2461, TWX: 810-332-1519; Empl.: 465; *Sls. Mgr.:* R. Michael Gibson

UNITED WIRE & CABLE, 425 Shrewsbury St., Worcester, MA 01604, Tel: 617-757-3872, TWX: 710-340-0635; FSC No.: 51348; Empl.: 10; *Sls. Mgr.:* T. P. Andrews

UNIT INDS., 1140 E. Valencia Dr., Fullerton, CA 92631, Tel: 714-871-4161; Empl.: 40

UNITRACK DIV., Calabro Inds., Inc., Goshen Corp. Pk., P.O. Box 1927, 1372 Enterprise Dr., West Chester, PA 19380, Tel: 215-692-0800, TWX: 510-663-0000; Empl.: 25 ..... **C•1094**

Local Sales Offices & Reps

AZ	Phoenix, Finn-Pat Co.	602-954-0301
CA	Agoura, Robert A. Borden	818-991-1940
CA	San Jose, Ruby Sls.	408-224-0881
CO	Aurora, Delltron Co.	303-373-0300
FL	Coral Springs, H.A., Inc.	305-752-7520
GA	Atlanta, Magaro & Assocs.	404-451-8862
IL	Des Plaines, Lincoln, Hodges & Assocs.	312-297-3810
IN	Ft. Wayne, Aktron Corp.	219-747-3650
MA	Northboro, Henik Assocs.	617-393-3127
MI	Kentwood, C.A. Geer Co.	616-534-9449
MN	St. Paul, Countrymen Assocs.	612-645-9151
MO	Blue Springs, Chesco	816-229-1404
NJ	Clinton, Churchill Assocs.	201-735-8971
NY	Larchmont, Hingston Walsh Assocs., Inc.	914-834-5781
NY	Syracuse, Lenard Co.	315-479-9191
OH	Akron, Augnat Assocs.	216-273-1211
PA	Norristown, Rivco January	215-631-1414
TX	Wylie, Air Quip/Robleyco	214-442-3573
MD	Timmonium, Eastern Comps.	301-561-5811
Can	Guelph, Ont., Hammond Mfg. Co., Ltd.	519-822-2960

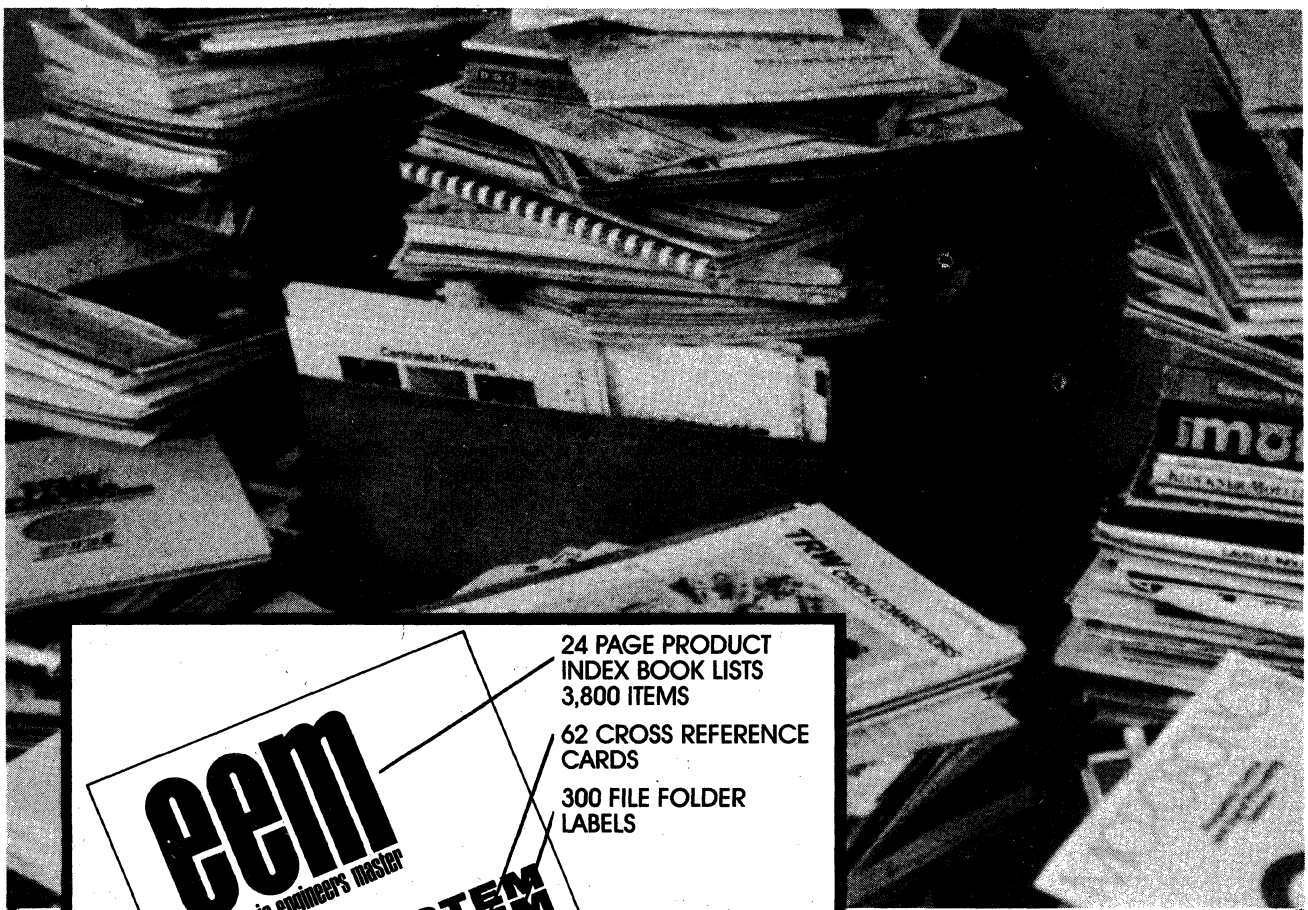
Local Distributors

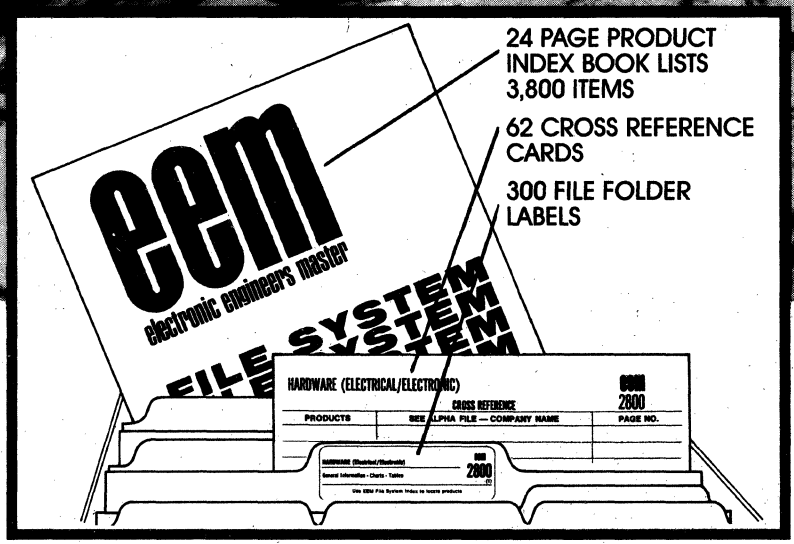
CA	Cerritos, El-Com	213-404-2961
CO	Denver, Integrated Elctrns.	303-534-6121
GA	Atlanta, Trans Southern	404-451-4425
MA	Northboro, Papi Supp.	617-393-3127
MA	Winchester, Rush Inds.	617-729-5800
MI	Grand Rapids, S-F Elctrn. Supp. Co.	616-459-0216
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Dayton, Televox, Inc.	513-294-4499
OH	Warren, Rem Elctrns. Supp. Co., Inc.	216-373-1300
PA	Erie, Rem Elctrns. Supp. Co., Inc.	814-453-5625
TX	Wylie, Air Quip/Robleyco	214-442-3573
Can	Guelph, Ont., Hammonds Mfg. Co., Ltd.	519-822-2960

UNITRODE CORP., 5 Forbes Rd., Lexington, MA 02173, Tel: 617-861-6540, Telex: 95-1064, TWX: 710-326-6509; Empl.: 2,000; *Sls. Mgr.:* Frederick Myers; *Dist. Mgr.:* John Flannery ..... **A•1697-1699**

Local Sales Offices & Reps

AL	Huntsville, Advanced Comp. Mktg.	205-881-5495
AZ	Phoenix, Compass Mktg. & Sls., Inc.	609-996-0635
AZ	Tucson, Compass Mktg. & Sls., Inc.	602-293-1220
CA	Irvine, Centaur Corp.	714-261-2123
CA	San Diego, Centaur Corp.	619-571-7871
CA	San Jose, Unitrode Corp.	408-294-4210
CA	Santa Ana, Unitrode Corp.	714-261-1546
CA	Santa Clara, I2, Inc.	408-988-3400
CA	Tarzana, Unitrode Corp.	818-705-8085
CA	Woodland Hills, Centaur Corp.	818-704-1655
CO	Denver, Component Sls. Co.	303-779-8060
CO	Littleton, Unitrode Corp.	303-972-2693
CT	Yalesville, Kanan Assocs.	203-265-2404
FL	Clearwater, Delmac Sls., Inc.	813-447-5192
FL	Orlando, Delmac Sls., Inc.	305-898-4688
FL	Palm Bay, Delmac Sls., Inc.	305-724-8377
FL	Talmarac, Delmac Sls., Inc.	305-726-1330
FL	Tampa, Unitrode Corp.	813-932-5807
IL	Arlington Heights, Unitrode Corp.	312-394-5240
IL	Elk Grove Village, Oasis Sls. Corp.	312-640-1850
IN	Carmel, Shamrock Assocs.	317-848-5265
IA	Davenport, Rush & West Assocs.	319-326-3091
KS	Olathe, Rush & West Assocs.	913-764-2700
MD	Columbia, Unitrode Corp.	301-995-0994
MD	Severna Park, New Era Sls., Inc.	301-544-4100
MA	Maynard, Byrne Assocs.	617-897-3131





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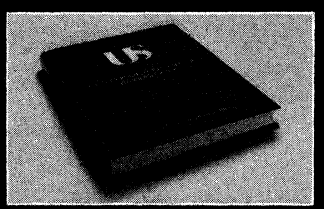

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MI Novi, Miltimore Sls., Inc. 313-349-0260
MN Eden Prairie, Aldridge Assocs. 612-944-8433
NJ Cedar Knolls, T.A.M., Inc. 201-575-4390
NM Albuquerque, Compass Mktg. & Sls., Inc. 505-888-0800
NY Albany, Reagan/Compar Albany, Inc. 518-489-7408
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NY Endwell, Reagan/Compar Albany, Inc. 607-754-8946,607-723-8743
NY Fairport, Reagan/Compar Albany, Inc. 716-271-2230
NY New Hartford, Reagan/Compar Albany, Inc. 315-732-3775
NY South Hauppauge, T.A.M., Inc. 516-348-0800
NC Raleigh, J & B Sls. 919-878-8600
OH Cleveland, Baehr, Greenleaf & Assocs., Inc. 216-221-9030
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PA Evans City, Baehr, Greenleaf & Assocs., Inc. 412-776-2151
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TX Dallas, Unitrode Corp. 214-231-8700
TX Houston, Sundance Sls., Inc. 713-772-4988
UT Salt Lake City, Component Sls., Inc. ... 801-268-8440
WA Seattle, Jas J. Backer Co. 206-285-1300
WI Brookfield, Oasis Sls. Corp. 414-782-6660
Can Concord, Ont., Kaytronics, Ltd. 416-669-2262
Can Kanata, Ont., Kaytronics, Ltd. 613-592-6606
Can Quebec, Kaytronics, Ltd. 514-367-0101
Can Surrey, Kaytronics, Ltd. 604-581-7611

UNITRODE CORP., Capacitor Div., 11494 Sorrento Valley Road, San Diego, CA 92121, Tel: 619-453-8020

Unitron INCORPORATED

UNITRON INC., 10925 Miller Rd., Dept. EE, Dallas, TX 75238, Tel: 214-340-8600, Telex: 882511; FSC No.: 6130; Empl.: 113; *Sls. Mgr.:* R. L. Beutel ..... **D•1895-1897**

Local Sales Offices & Reps
CA Sunland, Unitron (Jim Crevier) 818-352-7348
GA Byron, Unitron (Joe Joiner) 912-956-2866

UNITRONIX CORP., 197 Meister Ave., Somerville, NJ 08876, Tel: 201-231-9400, Telex: 833184; Empl.: 35; *Sls. Mgr.:* Frank Zimmer; *Dist. Mgr.:* Joseph Murawski

UNIVERSAL AD-YU ELCTRNS., INC., 2517 E. Norwich St., Milwaukee, WI 53207, Tel: 414-482-4100; FSC No.: 90101; Empl.: 10

UNIVERSAL CAPACITORS, See TRW/Capacitor Div.

UNIVERSAL DATA SYSTEMS, INC., Motorola Information Systems Group, 5000 Bradford Dr., Huntsville, AL 35805-1953, Tel: 205-837-8100, Telex: 752602 UDS HTV; Empl.: 1; *Sls. Mgr.:* John Jurenko; *Dist. Mgr.:* Tom Scott

UNIVERSAL ELECTRONICS INC., 3475 A. Victor St., Santa Clara, CA 95050, Tel: 408-970-0455, Telex: 3719249 UNIVESAL; FSC No.: 94-2845455; *Sls. Mgr.:* Paul Shieh

UNIVERSAL INSTRS., P.O. Box 825, Binghamton, NY 13902, Tel: 607-775-1102, TWX: 510-252-1990; FSC No.: 607-775-5272; Empl.: 2200

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UNIVERSAL MFG. CO., INC., 1168 Grove St., Irvington, NJ 07111, Tel: 201-374-9800, TWX: 710-995-4647; Empl.: 70; *Sls. Mgr.:* M. Mayer

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Local Sales Offices & Reps
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MA Woburn, Jenks Assocs. 617-938-0488
MN Minneapolis, R.J. Sls. 612-866-3661
NM Albuquerque, Fry Gates Co. 505-262-1525
PA Audubon, Holmes Assocs. 215-666-0636

UNIVERSITY SOUND, P.O. Box 26105, Oklahoma City, OK 73126, Tel: 405-354-5311, Telex: 748-510; *Sls. Mgr.:* David Jetzke

UNIVERSITY SOUND, Altec Corp., 1250 N. Red Gum St., Anaheim, CA 92806, Tel: 714-632-7117, Telex: 655415; Empl.: 200; *Sls. Mgr.:* G. H. Rilling

UPSystems INC.

UPSYSTEMS, INC., 7801 E. Compton Blvd., Paramount, CA 90723, Tel: 213-634-0621, TWX: 910-346-7814; FSC No.: 3698; *Sls. Mgr.:* Dick Williams ..... **D•1973**

URBAN ELCTRNS., P. O. Box 456, Dover, MA 02030, Tel: 617-329-4068, TWX: 710-325-1579; Empl.: 50; *Sls. Mgr.:* G. Urban

U S CAPACITOR CORP., See U S Microtek Components

U.S. COMPONENTS, INC., Unitech PLC., 35 Carlough Rd., Bohemia, NY 11716, Tel: 516-589-8080; *Sls. Mgr.:* H. Nalbantian; *Dist. Mgr.:* H. Nalbantian

DIGITAL

U.S. DIGITAL, 12371 Kensington Rd., Los Alamitos, CA 90720, Tel: 213-594-0094 ..... **B•1829**

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Intl UK, Bedford, Control Transducers, Ltd.

USECO DIV., Litton Inds, 13536 Saticoy St, Van Nuys, CA 91409, Tel: 818-786-9388, TWX: 910-495-1700; Empl.: 250

U.S. INSTR. RENTALS, 2988 Campus Dr., San Mateo, CA 94403, Tel: 415-572-6600, Telex: 34 301 USIR SMT; Empl.: 300; *Dist. Mgr.:* Randy Steyer ..... **D•1322-1323**

Local Sales Offices & Reps
AZ Phoenix, U.S. Instr Rentals 602-257-1345
CA Burbank, U.S. Instr. Rentals 213-849-5861
CA San Diego, U.S. Instr. Rentals 619-231-3990
CA San Mateo, U.S. Instr. Rentals 415-579-0911
CA Santa Ana, U.S. Instr. Rentals 714-641-9101
CO Denver, U.S. Instr. Rentals 303-790-0523
CT Watertown, U.S. Instr Rentals 1-800-526-7563
FL Orlando, U.S. Instr. Rentals 305-352-0923
GA Atlanta, U.S. Instr Rentals 404-955-4473
IL Arlington Hgts., U.S. Instr. Rentals 312-991-9770
KS Kansas City, U.S. Instr Rentals 913-677-0011
MD Rockville, U.S. Instr. Rentals 301-258-9888
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NY Rochester, U.S. Inst Rentals 800-631-5321
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OK Oklahoma City, U.S. Instr. Rentals 405-525-2659
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OR Portland, U.S. Instr. Rentals 800-227-5075
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WA Redmond, U.S. Instr. Rentals 800-227-5075

U S MICROTEK COMPONENTS CORPORATION, 11144 Penrose St., Sun Valley, CA 91352, Tel: 818-767-6770, TWX: 910-498-4998; FSC No.: 59942; Empl.: 210; *Sls. Mgr.:* Donald F. Hosmer

U.S. SCIENTIFIC INSTRS., 61 North Beacon St., Boston, MA 02134, Tel: 617-787-2411; Empl.: 50; *Sls. Mgr.:* S. Eric Kondi

U.S. TERMINALS, 7502 Camargo Rd., Cincinnati, OH 45243, Tel: 513-561-8145, TWX: 810-461-2290; FSC No.: 12615; *Sls. Mgr.:* G.L. Stepp

U.S. TOYO FAN CORPORATION

U.S. TOYO FAN CORP., 4915 Walnut Grove Ave., San Gabriel, CA 91776, Tel: 818-287-5297, TWX: 910-589-1540; Empl.: 20; *Sls. Mgr.:* Bruce Rockwell; *Dist. Mgr.:* Bruce Rockwell ..... **C•1680-1681**

Local Sales Offices & Reps
AL Huntsville, Par Mktg. 205-837-6534
AZ Tempe, Delta Elctrn. Sls. 602-224-1601
CA San Diego, Noo Rep Tech Sls. 619-483-4861
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CA Santa Clara, U.S. Toyo Fan Corp. 408-984-2618
CO Denver, Troy Sls./Wintronics 303-934-2406
FL Clearwater, WMM Assocs. 813-442-3913
GA Marietta, Par Mktg. 404-953-4168
IL Elk Grove, Martec Assocs. 312-956-8090
KS DeSoto, Midtec Assocs. 913-441-6565
MA Westboro, Tech. Mktg. Svcs. Co. 617-366-6655
MN Osseo, Gaffney Sls. Co. 612-425-5484
MO Florissant, Midtec Assocs. 314-837-5200
NH Windham, Tech. Mktg. Svcs. Co. 603-434-2716
NJ Madison, Livera-Polk Assocs. 201-377-3220
NY Cooperstown, Fitzelle Assocs. 607-547-9333
NY Glen Head, Livera-Polk Assocs. 516-759-9300

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OR Troutdale, Comtec 503-227-2111
PA Horsham, Dalbrook Corp. 215-441-8380
TX Richardson, Zonk Assocs. 214-238-7651
WA Bellevue, Comtec 206-453-1188

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AZ Phoenix, Aero-Space Southwest 602-861-1785
CA Anaheim, Pacesetter Elec. 714-777-4711
CA Fremont, Terminal Sls. Corp. 415-656-7722
CA San Jose, Cypress Elctrns. 408-945-8400
CA Santa Ana, Pacesetter Elctrns. 714-557-7131
CA Torrance, Cypress Elctrns. 213-530-1900
CA Tustin, Added Value Elctrns. Distr. 714-730-5848
CO Denver, Wintronics 303-934-2406
FL Longwood, Intertec Comps. 305-834-7777
IL Elk Grove, Martec Assocs. 312-956-8090
MA Westboro, TMSC Elctrns. Supp. 617-366-8462
NV Las Vegas, Kiesub Corp. 702-733-3888
NJ Collingswood, Index 609-429-4055
NY Elmsford, Multimeterics 914-347-3666
NY Glen Head, Livera-Polk Assocs. 516-759-9300
OH Cleveland, Alpha Distr. Corp. 216-526-3716
OR Beaverton, Hansen Elctrns. 503-642-4455
TX Dallas, Cypress Elctrns. 214-869-1435
TX Richardson, Zec Sls. 214-238-7651
WA Kent, Shannon, Ltd. 206-763-0545

USUS, INC., UCSD Pascal Sys. User's Society, P.O. Box 1148, La Jolla, CA 92038

UTE MICROWAVE, 3500 Sunset Ave., Asbury Park, NJ 07712, Tel: 201-922-1009, Telex: 13-2461; FSC No.: 23261; Empl.: 20

Local Sales Offices & Reps

AZ Mesa, PTL, Inc. 602-892-9329
CA Goleta, Thorson Co. 805-964-8751
FL Melbourne, EMS Assocs. 305-724-1027
MA Wakefield, Nerem 617-245-4426
NY Commack, Richman Sls. 516-543-5532
OH Dayton, Fred Ohmer Assocs. 513-434-1454
TX Dallas, Airep Elctrns. 214-349-4360
VA Annandale, Q.T. Elctrn. 703-941-4242
EXP FL, Boca Raton, Microwave Intl. Corp. 305-391-7475

UTICA TOOL CO., INC., Cameron Rd., P.O. Box 1807, Orangeburg, SC 29115, Tel: 803-534-7010

UTI INSTRUMENTS CO., 325 N. Mathilda Ave., Sunnyvale, CA 94086, Tel: 408-738-3301, TWX: 910-339-9546; Empl.: 80; *Sls. Mgr.:* Jim Nicholson

UVP, INC., 5100 Walnut Grove Ave., P.O. Box 1501, San Gabriel, CA 91778, Tel: 818-285-3123, Telex: 688-461; Empl.: 100; *Sls. Mgr.:* Phil Cashen

VACO PRODS., 1510 Skokie Blvd., Northbrook, IL 60062, Tel: 312-564-3300, TWX: 910-686-0658; Empl.: 250; *Sls. Mgr.:* Fred Grede

VACTRONIC LAB. EQUIP., 65 Brightside Ave., E. Northport, NY 11731, Tel: 516-AN1-2660; Empl.: 25

VALHALLA SCIENTIFIC, 9955 Mesa Rim Rd., San Diego, CA 92126, Tel: 619-457-5576, Telex: 181750 VALHALLA SDG; Empl.: 75; *Sls. Mgr.:* Kerry Clark

VALIDYNE ENGRG. CORP., 8626 Wilbur Ave., Northridge, CA 91324, Tel: 818-886-2057, Telex: 65-1303; Empl.: 200; *Sls. Mgr.:* Gene Goodrich ..... **D•1164**

VALLEY ELECTROMAGNETICS CORP., P.O. Box 557, Crystal Lake, IL 60014, Tel: 815-459-3080, Telex: 72-2417

VALLEY ELECTROMAGNETICS, P.O. Box 131, Spring Valley, IL 61362, Tel: 815-664-2348; Empl.: 70; *Sls. Mgr.:* T. Heldt

VALOR ELECTRONICS, INC., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626, Tel: 714-540-9261, TWX: 910-595-2480; FSC No.: 15003; *Sls. Mgr.:* T. N. Kasabali

VALPEY-FISHER, 75 South St, Hopkinton, MA 01748, Tel: 617-435-6831, Telex: 94-8332; Empl.: 160; *Sls. Mgr.:* Donald Elliott

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VAMISTOR CORP., 115 Industrial Pk., Sevierville, TN 37862, Tel: 615-453-0001, Telex: 810-570-4931; Empl.: 49; *Sls. Mgr.:* George Hebner; *Dist. Mgr.:* George Hebner ..... **A•1967**

Local Distributors

CA San Fernando, Petell Elctrns., Inc. 818-365-9841
MD Timonium, Zebra Elctrns., Inc.
MA Needham, Cronin Elctrns., Inc. 617-449-5000
NY Bohemia, Justin Elctrns. 516-589-4000
NY Hauppauge, Fairmont Elctrns. 516-231-3313
NY Hauppauge, Jaco Elctrns. 800-645-5112
NY Valley Stream, L & S Elctrns., Inc. 516-561-2474

VANGUARD ELCTRNS. CO., 1480 W. 178th St, Gardena, CA 90248, Tel: 213-323-4100, TWX: 910-346-7067; FSC No.: 03550; Empl.: 250; *Sls. Mgr.:* T. A. Crawford; *Dist. Mgr.:* T. A. Crawford

VANGUARD RELAY CORP., 225 Cortland St., Lindenhurst, NY 11757, Tel: 516-226-5000; *Sls. Mgr.:* B. S. Gilman

VANN INSTRUMENTS, 1200 Schofield La., Farmington, NM 87401, Tel: 505-326-7557; *Sls. Mgr.:* Michael E. Vann

VARIAN ASSOCS., Indl. Equip. Grp., 611 Hansen Way, Palo Alto, CA 94303, Tel: 415-493-4000, TWX: 910-373-1731; Empl.: 1500

VARIAN ASSOCS., Instr. Grp., 611 Hansen Way, Palo Alto, CA 94303, Tel: 415-493-4000, TWX: 910-373-1731

VARIAN ASSOCIATES, INC., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303, Tel: 415-493-4000, Telex: 910-373-1731; Empl.: 16,000; *Sls. Mgr.:* Dominic Ruggieri

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AL Huntsville, Varian Electron Dvc. Grp. .. 205-837-9225
CA Palo Alto, Varian Assocs. Image Tube Div. 415-493-1800
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CA Palo Alto, Varian Electron Dvc. Grp. ... 415-424-6400
CA San Carlos, Varian Assocs., Electron Dvc. Grp. 415-592-1221
CA Santa Clara, Varian Assoc, Solid State Microwave Div. 408-988-1331
CA Santa Clara, Varian Electron Dvc. Grp. 408-496-6273
FL Clearwater, Varian Electron Dvc. Grp. 813-446-8513
GA Warner Robins, Varian Electron Dvc. Grp. 912-922-2202
IL Park Ridge, Varian Electron Dvc. Grp. 312-825-6686
IN Bloomington, Varian Electron Dvc. Grp. 812-334-9900
MD Linthicum, Varian Electron Dvc. Grp. .. 301-850-5010
MA Beverly, Varian Assocs., Beverly Div. .. 617-922-6000
MA Burlington, Varian Electron Dvc. Grp. .. 617-272-8532
NJ Cranford, Varian Electron Dvc. Grp. ... 201-276-9050
NJ Moorestown, Varian Electron Dvc. Grp. 609-235-6800
OH Dayton, Varian Electron Dvc. Grp. 513-258-3930
TX Dallas, Varian Electron Dvc. Grp. 214-235-2385
UT Salt Lake City, Varian EIMAC Salt Lake City 801-972-5000
VA Arlington, Varian Electron Dvc. Grp. ... 703-522-8002

VARIAN CANADA, INC., Microwave Div., 45 River Drive, Georgetown, ON, Canada L7G2J4, Tel: 416-877-0161, Telex: 069-7502, TWX: 610-492-2641; *Sls. Mgr.:* George C. Plhak ..... **D•1859-1862**

Local Distributors

AL Huntsville, Varian Assocs. 205-837-9225
CA Los Angeles, Varian Assocs. 818-967-3834
CA Sacramento, Varian Assocs. 916-331-5552
CA San Francisco, Varian Assocs. 415-424-6400
FL Clearwater, Varian Assocs. 813-446-8513
GA Warner Robins, Varian Assocs. 912-922-2202
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MA Boston, Varian Assocs. 617-272-8532
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NY Syracuse, Varian Assocs. 315-455-2810
OH Dayton, Varian Assocs. 513-258-3930
PA Philadelphia, Varian Assocs. 609-235-6800
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Can Ottawa, Varian Assocs. 613-725-9285

VARIAN DATA MACHINES, See Sperry Univac, Mini-Comp. Opers.

VARITRONIX, See VL Electronics

VARO, INC., Electron Devices Div., 2203 W. Walnut St., Garland, TX 75040, Tel: 214-272-3561, TWX: 910-860-5093; FSC No.: 27777;Multiple; Empl.: 250; *Sls. Mgr.:* Lon Hodge

VARO SEMICONDUCTOR, INC., 2800 W. Kingsley Dr., Garland, TX 75046, Tel: 214-271-8511, TWX: 910-860-5178; Empl.: 550; *Sls. Mgr.:* Charlie Merz; *Dist. Mgr.:* Mike Hawkins ..... **A•2095**

Local Sales Offices & Reps

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AZ Scottsdale, SMS & Assocs. 602-998-0831
CA Los Angeles, Corcoran Assocs. 213-823-4589
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CT North Haven, Comp Rep Assocs. 203-269-1145
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NC Charlotte, Rep, Inc. 704-563-5554
NC Raleigh, Rep, Inc. 919-851-3007
OH Dayton, J. C. Hofstetter Co. 513-296-1010
OH Medina, J. C. Hofstetter Co. 216-241-4880
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OR Hillsboro, Western Tech. Sls. 503-640-4621
PA Feasterville, Knowles Assocs. 215-322-7100
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WI Milwaukee, D. Dolin Sales Co. 414-482-1111

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CA Thousand Oaks, Bell Inds. 805-499-6821
CA Tustin, Anthem Elctrns. 714-730-8000
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CT Cheshire, Time Elctrns. 203-271-3200
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NM Albuquerque, Bell Inds. 505-292-2700

NY Buffalo, Summit Distrs. 716-887-2800
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OH Cleveland, Milgray Elctrns. 216-447-1520
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OH Dayton, Pioneer Std. 513-236-9900
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PA Pittsburgh, Pioneer Std. 412-782-2300
SC Greenville, Hammond Elctrns. 803-233-4121
TN Memphis, Bluff City Elctrns. 901-345-9500
TX Dallas, Pioneer Std. 214-386-7300
TX Fort Worth, Allied Elctrns. 817-336-5401
TX Houston, Altair Co. 713-462-3029
TX Richardson, Altair Co. 214-231-5166
TX San Antonio, Sherman Elctrns. 512-224-1004
UT Salt Lake City, Bell Inds. 801-972-6969
UT Salt Lake City, Standard Supp. 801-486-3371
WA Bellevue, Bell Inds. 206-747-1515
WA Seattle, Priebe Elctrns. 206-821-4695
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI Waukesha, Bell Inds. 414-547-8879

VARTA BATTERIES, INC., 300 Executive Blvd., Elmsford, NY 10523, Tel: 914-592-2500, Telex: 996-548; *Sls. Mgr.:* Dominick Isola ..... **D•1442**

Local Sales Offices & Reps

AL Huntsville, 20th Century Mktg. 404-446-1999
CA Norwalk, Ed Rivers Assocs. 213-868-1471
CO Denver, Moss Mktg. 303-455-7205
FL Fern Park, EIR, Inc. 305-660-9600
KS Shawnee Mission, Microtronics 913-262-1444
MI Brighton, Elctronic Sources 313-227-3598
NY Glen Head, Livera-Polk 201-377-3239
PA Broomall, TCA Assocs. 215-353-2022
WA Bellevue, Gene Stout Assocs. 503-649-9074
Can Mississauga, Ont., Nikon Power Battery Corp.

Local Distributors

CA La Mirada, Energy Devices 213-921-8775
CA San Diego, Tauber Elctrns. 619-274-7242
CA Van Nuys, Nesco, Inc. 818-781-0505
GA Atlanta, Falcon Batteries 404-953-3500
IL Downers Grove, Telecommunications Dvcs. 312-971-3460
IL Morton Grove, Power Pak 312-966-6000
MA Sharon, Adcour 617-784-8123
NJ Clifton, Engineered Assemblies 201-772-6400
NY Commack, Brentronics 516-499-5155
TX Stafford, Southwest Elctrns. 713-491-4900

VECTOR CABLE CO., 555 Industrial Rd., Sugarland, TX 77478, Tel: 713-240-9196

VECTOR ELECTRONIC CO., INC., 12460 Gladstone Ave., Dept. EP, Box 4336, Sylmar, CA 91342, Tel: 818-365-9661, TWX: 910-496-1539; FSC No.: 82893; Empl.: 140; *Sls. Mgr.:* F. L. Hill ..... **C•1095, 1098, 1102-1103; D•1103-1104**

Local Distributors

AL Huntsville, Mock Elctrns. 205-539-2401
AZ Phoenix, Dalis Elctrns. 602-275-2626
CA Buena Park, RPS, Inc. 714-521-5230
CA Canoga Pk., Sandy's Elec. Supp. 818-346-8353
CA Chatsworth, Priority I Elctrns. 818-709-5464
CA Inglewood, Newark Elctrns. Co. 213-671-7066
CA Mountain View, Abacus Elctrns. Co. 415-961-1500
CA Oakland, Brill Elctrns. 415-834-5888
CA Palo Alto, Zack Elctrns. 415-326-5432
CA Pasadena, Dow Radio 213-793-1195
CA Pasadena, Empire Elctrns. Distr. 213-681-2711
CA Riverside, Elctrn. Supp. 714-787-9220
CA San Diego, RPS Elctrns. 619-292-5611
CA San Diego, Shanks & Wright 619-239-0176
CA San Francisco, Zack Elctrns. 415-626-1444
CA San Jose, Quement Elctrns. 408-998-5900
CO Denver, Electronic Parts-Ragon 303-744-3601
CO Denver, Newark-Denver Elctrn. Supp. 303-757-3351
CT Wallingford, Sager Elec. 203-265-4600
FL Ft. Lauderdale, Powell-Florida Elctrns. 305-972-4300
FL Miami, Elctrn. Equip. 305-871-3500
GA Atlanta, Jack Spears Elctrns. 404-237-4531
IL Chicago, Newark Elctrns. Corp. 312-638-4411
IL Elgin, Allied Elctrn. Corp. 312-697-8200
IL Niles, Joseph Elctrns. 312-297-4200
IL Palatine, Ohm/Elctrns. 312-359-5500
IL Peoria, Klaus Radio 309-691-4840
IN Indianapolis, Graham Elctrn. Supp. 317-634-8202
MD Baltimore, A S I Elctrns. 301-265-5100
MD Rockville, Capitol Radio Whlsrs. 301-881-2270
MA Hingham, Sager Elec. Supp. 617-749-6700
MA Lynn, Land Elctrn. Supp. 617-592-2220
MA Needham, Cronin Elctrns. 617-449-0500
MA Norwood, Gerber Elctrns. 617-329-2400
MI Ann Arbor, Wedemeyer Elctrn. Supp. 313-665-8611
MI Livonia, RS Elctrns. 313-525-1155
MI Oak Park, Newark - Detroit Elctrns. 313-967-0600
MN St. Paul, Gopher Elctrns. Co. 612-483-3322
MO St. Louis, Olive Indl. Elctrns. 314-426-4500
NE Lincoln, Scott Elctrn. Supp. Corp. 402-466-8221
NJ Camden, General Radio Supp. 609-964-8560
NJ E. Hanover, State Elctrn. Parts Corp. 201-887-2550
NJ Kenilworth, Federated Purchaser 201-272-0505
NM Albuquerque, Elctrn. Parts Co. 505-293-6161
NY Buffalo, Summit Distrs. 716-884-3450
NY Hauppauge, Broadline Elctrn. Dist. 516-231-4100
NY Hempstead, Davis Elctrns. 516-483-9200
NY Lynbrook, Peerless Radio Dist. 516-593-2121
NY Rochester, Rochester Radio Supp. Co. 716-454-7800
NY Rochester, Simcona Elctrns. 716-328-3230
NC Raleigh, Southeastern Elctrns. 919-828-2311
OH Akron, Akron Elctrns. Supp. 216-762-8818
OH Cleveland, Pioneer/Cleveland 216-587-3600
OH Columbus, Hughes Peters Co. 614-294-5351
OH Dayton, Stotts Friedman Co. 513-298-5555
OK Tulsa, Radio, Inc. 918-587-9123
OR Beaverton, Almac Elctrns. 503-629-8090
PA Drexel Hill, Kass Elctrn. Distr. 215-449-2300
PA Philadelphia, Powell Elctrns. 215-365-1900
PA Pittsburgh, CAM/RPC 412-782-3770
TN Memphis, Bluff City Distrb. Co. 901-345-9500
TX Dallas, Harrison Equip. 214-239-2750
TX Dallas, Whls. Elctrn. Supp. 214-824-3001
TX Fort Worth, Allied Elctrns. 817-336-5401
TX Fort Worth, Whls. Elctrn. Supp. 817-336-0461
TX Garland, Newark-Dallas Elctrns. Corp. 214-494-5911
WA Seattle, Almac Elctrns. 206-643-9992
WA Seattle, Radar Electric Co. 206-282-2511
WI Milwaukee, Marsh Elctrns. 414-475-6000
EXP CA, Los Angeles, Trans-World Trade 213-476-8406

VECTROL, Division of Westinghouse Elec. Corp., 110 Douglas Rd, Oldsmar, FL 33557, Tel: 813-855-4621, Telex: 803784; Empl.: 120; *Sls. Mgr.:* G. Lierman

VECTRONICS MICROWAVE CORP., 276 Lincoln Blvd., Middlesex, NJ 08846, Tel: 201-356-2377, Telex: 833560; FSC No.: 32846; *Sls. Mgr.:* John G. Vogler

VECTRON LABS., 166 Glover Ave., Norwalk, CT 06850, Tel: 203-853-4433, TWX: 710-468-3796; FSC No.: 27802; Empl.: 325; *Sls. Mgr.:* Larry Jawitz ..... **A•1450-1454**

Local Sales Offices & Reps

AL Huntsville, Saber Assocs. 800-327-0853
AZ Glendale, Fetty/Schoenduve 602-241-9009
CA El Segundo, Fetty/Schoenduve 213-322-4991
CA Mountain View, Fetty/Schoenduve 415-962-8330
CA San Diego, Fetty/Schoenduve 619-292-5136
CO Parker, Techn. Mktg. Assocs. 303-841-3435
CT Cheshire, Meco 800-225-3409
FL Melbourne, Saber Assocs. 800-432-6288
FL Pensacola, Saber Assocs. 800-327-0853
GA Norcross, Saber Assocs. 800-327-0853
IL Bannockburn, Heth, Inc. 312-295-8440
IN Indianapolis, Ihrig Assocs. 317-783-7630
KS OLATHE, C-Tron, Inc. 913-829-0073
AR Hot Springs, Automation Supp. 501-767-5444
MA Reading, Meco 617-944-6660
MI Detroit, R. P. Urban Assocs. 313-535-2355
MI Grand Rapids, R. P. Urban Assocs. 616-245-0511
MN Burnsville, Allied Comp. Reps. 612-435-7876
KS Olathe, C-Tron 913-829-0073
NJ Woodcliff Lake, J. Freid & Assocs. 201-391-6792
NM Albuquerque, J. Smith & Assocs. 505-265-3406
NY Great Neck, F & F Metro 516-482-4080
NY Syracuse, Rep Tech 315-437-2845
NC Clayton, Saber Assocs. 800-327-0853
OH Englewood, A. Nace Co. 513-836-0931
OH Richfield, A. Nace Co. 216-659-7178
PA Allison Park, A. Nace Co. 412-487-1217
PA Newtown Sq., SWR Assocs. 215-356-8550
TX Dallas, Texas Avionics 214-363-6324
UT Salt Lake City, Techn. Mktg. Assocs. 801-483-1009
VA Springfield, Tech-Reps 703-569-6868
WA Seattle, Datacom 206-285-2525
Can Montreal, Ont., Soquelec, Ltd. 514-482-6427
Can Nepean, Que., Soquelec, Ltd. 613-226-1696

VEECO INSTRS. INC., 370 San Aleso Ave., Sunnyvale, CA 94086, Tel: 408-733-3700, TWX: 910-339-9263; Empl.: 95; *Sls. Mgr.:* T. McKee

VEECO INSTRUMENTS INC., Terminal Dr., Plainview, NY 11803, Tel: 516-349-8300; *Sls. Mgr.:* Tony Carrozzo

VEEDER-ROOT, 70 Sargeant St., Hartford, CT 06102, Tel: 203-527-7201, Telex: 9-9219; Empl.: 1200; *Sls. Mgr.:* J. R. Garrison; *Dist. Mgr.:* K. Boyle

VEETRONIX, INC., Sub. Reach Electronics, Box 480, Lexington, NE 68850, Tel: 308-324-4600; Empl.: 25; *Sls. Mgr.:* Robert M. Wallace ..... **B•1703**

Local Sales Offices & Reps

CA Arcadia, Van Gott & Assocs., Inc. 213-445-9728
CA San Jose, Ruby Sls. 408-224-0881

VEGA PRECISION LABS., 800 Follin La., Vienna, VA 22180, Tel: 703-938-6300, Telex: 89-2521; Empl.: 350; *Sls. Mgr.:* W. E. Kinsley

VELONEX, 560 Robert Ave., Santa Clara, CA 95050, Tel: 408-727-7370, Telex: 756562; Empl.: 60; *Sls. Mgr.:* Customer Service ..... **D•1324-1325, 1383**

VELONEX, 560 Robert Ave., Santa Clara, CA 95050, Tel: 408-727-7370, Telex: 756562; Empl.: 45

VEMALINE PRODS. DIV., P.O. Box 6267, Providence, RI 02940, Tel: 401-739-7600, Telex: 927573; FSC No.: 08730; Empl.: 35; *Sls. Mgr.:* Paul Vamvaketis; *Dist. Mgr.:* Paul Vamvaketis

VENABLE INDUSTRIES, INC., 3555 Lomita Blvd., Torrance, CA 90505, Tel: 213-539-2522, Telex: 752421; Empl.: 20; *Sls. Mgr.:* Wayne H. Tuttle; *Dist. Mgr.:* Shelley Scott

VENT-RAK DIV., P.O. Box 39100, Indianapolis, IN 46239-9632, Tel: 317-897-7000, Telex: 27-2169; Empl.: 61; *Sls. Mgr.:* Glenn Feest ..... **C•1064-1065**

Local Sales Offices & Reps

AZ Phoenix, Synder Eng. 602-279-2010
CA Fullerton, Groh Assocs. 714-738-7105
CA Mountain View, G. C. Woempner Co. 415-964-5454
CO Boulder, R. F. Mayo Assocs. 303-499-2155
CT North Haven, Coakley, Boyd & Abbett 203-481-2828
FL Maitland, J. Krutek & Assocs. 305-628-4837
FL North Miami, J. Krutek & Assocs. 305-941-6544
IL Glencoe, Howard Benjamin Assocs. 312-835-0150
IN Noblesville, Century Elctrns. 317-849-2026
KS Shawnee Mission, Lowell-Kangas & Assocs. 913-631-3515
MA Needham, Coakley, Boyd & Abbett 617-444-5470
MO St. Louis, Lowell-Kangas & Assocs. 314-821-4050
NH Plaistow, Coakley, Boyd & Abbett 617-444-5470
NJ Mountainside, H. G. Richter 201-233-4615
NY Fayetteville, H. G. Richter 315-637-6713
OH Cleveland, Electronic Comp., Inc. 216-261-4103
OH Miamisburg, Electronic Comp., Inc. 513-866-3340
OK Tulsa, Advance Tech. Sls. 918-664-0482
PA Doylestown, Monteiro & Assocs. 215-345-5855
TX Austin, Advance Tech. Sls. 512-440-7677
TX Dallas, Advance Tech. Sls. 214-340-1300
TX Houston, Advance Tech. Sls. 713-440-3888
WA Olympia, Bergford & Assocs. 206-866-2001
EXP IN, Indianapolis, General Devices Co. 317-897-7000

VENUS SCIENTIFIC, INC., 399 Smith St., Farmingdale, NY 11735, Tel: 516-293-4100, TWX: 510-224-6492; Empl.: 450; *Sls. Mgr.:* Mike Maletta ..... **D•1863**

Local Sales Offices & Reps

AZ Scottsdale, Venus Scientific Inc. 602-991-9684
MA Norwood, MPS Electronics Inc. 617-769-8700

VERBATIM CORP., 323 Soquel Way, Sunnyvale, CA 94086, Tel: 408-245-4400, Telex: 940-692, TWX: 910-339-9381; Empl.: 1800; *Sls. Mgr.:* S.P. Cochran; *Dist. Mgr.:* Earl Liebich

VERMONT AUTOMATION CO., INC., 18 Morse Dr., Essex Junction, VT 05452, Tel: 802-879-7571; Empl.: 7; *Sls. Mgr.:* J. Littlefield

VERMONT PRECISION RESISTOR, Codeco Corp. of Vermont, Box 1170, Stowe, VT 05672, Tel: 802-253-8567; Empl.: 8

VERMONT RESCH. CORP., Precision Pk., N. Springfield, VT 05150, Tel: 802-886-2256, TWX: 710-363-6533; Empl.: 175; *Sls. Mgr.:* Richard Simmons

VERNAY LABORATORIES, INC., S. College St., Yellow Springs, OH 45387, Tel: 513-767-7261; Empl.: 600; *Sls. Mgr.:* Alex Le Pera

VERNITECH DIVISION

VERNITECH, 300 Marcus Blvd., Deer Pk., NY 11729, Tel: 516-586-5100, TWX: 510-227-6079; FSC No.: 30223; Empl.: 300; *Sls. Mgr.:* S. Wexler ..... **A•2048-2049; B•1011, 1196-1197, 1830-1831; D•1991**

Local Sales Offices & Reps

AL	Huntsville, Remco	205-883-9260
AZ	Fountain Hills, Halbar Assocs.	602-837-2464
CA	Glendale, Halbar Assocs.	213-246-8263
CA	San Mateo, Halbar Assocs.	415-349-4700
CO	Parker, Techn. Mktg. Assocs.	303-841-3435
CT	Cheshire, Selmark Assocs.	203-272-8764
FL	Orlando, E.P.M. Corp.	305-425-6149
GA	Atlanta, Remco	404-447-6937
IL	Glencoe, Howard Benjamin Assocs.	312-835-0150
IA	Cedar Rapids, Dytronix	319-377-8275
MD	Baltimore, R.P. Luce & Co.	301-752-8200
MA	Millis, Selmark Assocs.	617-376-2914
MA	Norwell, Bordewieck Eng. Sls.	617-659-4915
MN	St. Paul, Wikeland Sls.	612-645-4747
MO	Bridgeton, Dytronix	314-731-5799
MO	Independence, Dytronix	816-373-6600
NH	Concord, Selmark Assocs.	603-623-5774
NM	Albuquerque, Technology Mktg.	505-265-5661
NY	Endicott, Tech-Mark	607-748-7473
NY	Melville, Comtronic Engrg. Sls.	516-249-0505
NY	Pittsford, Net Sls. Co.	716-467-4538
NC	Raleigh, Remco	919-847-5079
OH	Dayton, George Lessis	513-294-1551
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Dayton, Rixan Assocs.	513-278-4216
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Beaverton, Halbar Assocs.	503-226-0451
PA	Philadelphia, R.P. Luce & Co.	215-884-8365
TX	Bellaire, Seaton Corp.	713-731-2649
TX	Dallas, Seaton Corp.	214-380-0414
UT	Sandy, TMA, Inc.	801-254-6410
VA	Powhatan, R.P. Luce & Co.	804-598-4804
WA	Redmond, Halbar Assocs.	206-882-0990
WA	Seattle, G.M. Gillette & Assocs.	206-284-3344
WA	Vancouver, Halbar Assocs.	206-696-0170

VERNITRON CORP., Control Comps. Div., 1601 Precision Park La., San Diego, CA 92073, Tel: 619-428-5581, TWX: 910-322-1862; FSC No.: 10112; *Sls. Mgr.:* S. J. Rado ..... **B•1199-1202**

Local Sales Offices & Reps

AZ	Fountain Hills, Halbar Assocs.	602-837-2464
CA	Glendale, Halbar Assocs.	818-246-8263
CA	Santa Clara, Comtronics	408-773-9800
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Orlando, Mackay Smith & Assocs.	305-423-4353
IL	Glencoe, Howard Benjamin Assocs.	312-835-0150
MA	Burlington, Kitchen & Kutchin	617-229-2660
MN	Minneapolis, SMC	612-545-3618
NJ	Cherry Hill, Lanson Assocs.	609-424-4670
NJ	Harrington Park, Metro Tech. Sls.	201-768-8495
NY	Fairport, NET Sls.	716-467-4538
NY	Jericho, Metro Tech. Sls.	516-935-3330
OH	Dayton, Rixan Assocs.	513-222-0011
TX	Dallas, Norcom, Inc.	214-386-4888
TX	Houston, Norcom, Inc.	713-778-0392
VA	Fredericksburg, Vernitron	703-752-4499

VERNITRON ELEC. COMPS., See Beau Prods. Div.

VERNITRON PIEZOELECTRIC DIV., 232 Forbes Rd., Bedford, OH 44146-5478, Tel: 216-232-8600, TWX: 810-427-2274; Empl.: 120; *Sls. Mgr.:* William K. Dorn ..... **A•1455**

Local Sales Offices & Reps

CA	Fullerton, GRU Assocs.	714-738-0903

VERSALOGIC, 87070 Dukhobar Rd., Eugene, OR 97402, Tel: 503-485-8575

VERTEX INDS., INC., Vertel Div., P.O. Box 1123, 23 Carol St., Clifton, NJ 07014, Tel: 201-472-1331, TWX: 710-989-7021; Empl.: 85; *Sls. Mgr.:* Ron Byer

Local Sales Offices & Reps

AL	Huntsville, Electrn. Mfgrs. Agts.	205-830-4030
CA	Santa Ana, California Elctrn. Mktg.	714-835-2702
FL	Melbourne, Reynolds & Assocs.	305-259-7000
IL	Elk GRove Village, Quad Data, Inc.	312-228-1722
KS	Shawnee Mission, Panatek	913-362-3349
NJ	Haddonfield, G.L. Williams Assocs.	609-428-6060
NY	New York, Daner Hayes, Inc.	201-889-4515
TX	Dallas, IBL Engrg. & Sls.	214-363-2921
WA	Seattle, SJI Corp.	206-763-8981
Can	Lachine, Quebec, Electrodesign Ltd.	514-636-4838

VERTOX CO., 9252 Garden Grove Blvd. #22, Garden Grove, CA 92644, Tel: 714-530-4541, Telex: 678401 TAB IRIN; FSC No.: 53688; Empl.: 12; *Sls. Mgr.:* Steve Hacker; *Dist. Mgr.:* Steve Hacker

VESTA TECHNOLOGY, INC., 7100 W. 44th Ave. Ste. 101, Wheat Ridge, CO 80033, Tel: 303-759-4988; Empl.: 10

VIABLE SYSTEMS INC., Box 438, Needham, MA 02192, Tel: 617-449-4570; Empl.: 15

VIA WEST INC., 534 N. Stone Ave., Tucson, AZ 85705, Tel: 602-623-5716, Telex: 165025; Empl.: 25; *Sls. Mgr.:* David C. Troupe

VIBRAC, 1 Columbia Dr., Amherst, NH 03031, Tel: 603-882-6777, Telex: 312698 VIBRAC; Empl.: 50; *Sls. Mgr.:* R. Searle

VIBRA-METRICS, 1014 Sherman Ave., Hamden, CT 06514, Tel: 203-288-6158, 1-800-352-2001, TWX: 710-465-0169; Empl.: 25 ..... **B•1832**

Local Sales Offices & Reps

CA	Long Beach, Saber Enterprises	213-595-5646
CA	Mountain View, Saber Enterprises	415-968-0427
CA	San Diego, Saber Enterprises	619-271-1523
CT	North Haven, International Sls.	203-288-1638
FL	Ft. Lauderdale, Elctrn. Devices & Controls	305-974-2500
IL	Chicago, Comtel-Midwest	312-539-4838
IN	Indianapolis, Comtel Corp.	317-253-1681
IA	Cedar Rapids, Comtel Corp.	319-377-9434
KS	Shawnee Mission, Comtel Corp.	913-722-1030
MI	Southfield, Comtel Instrs.	313-358-2505
MN	Wayzata, Comtel Corp.	612-476-1551
MO	St. Louis, Comtel Corp.	314-428-5508
NH	Chester, Compline	603-887-3515
NJ	Basking Ridge, Blejwas Assocs.	201-221-1440
NY	Baldwinsville, Oshex Assocs., Inc.	315-635-6027
NC	Raleigh, Lee-Carolinas	919-848-8818
OH	Cleveland, Comtel Instrs.	216-442-8080
OH	Dayton, Comtel Instrs.	513-298-7573
OH	Hilliard, Comtel Instrs.	614-876-8305
PA	Pittsburgh, Comtel Instrs.	412-922-5720
TN	Knoxville, Mace Instr. Co.	615-938-3773
TX	Houston, Techsas, Inc.	713-578-3750
UT	West American Fork, Highland Tech. Mktg.	801-756-3744
WI	New Berlin, Comtel Corp.	414-544-6042
Can	Montreal, Que., Predictive Mtce.	514-374-8720
Can	N. Vancouver, B.C., Interworld Elctrns.	604-984-4171

VIBRATION INSTRS. CO., 1614 Orangethorpe Way, Anaheim, CA 92801, Tel: 714-879-6085, Telex: 692433; FSC No.: 32102; Empl.: 21; *Sls. Mgr.:* L. Rothberg

VIBRO-METER CORP., 1 Progress Rd., Billerica, MA 01822-5058, Tel: 617-663-7600, Telex: 948145, TWX: 710-320-1872; FSC No.: 617-667-1944; Empl.: 50; *Sls. Mgr.:* Carl Nicolino

VICKERS INST., INC., Vickers Instruments, P.O. Box 99, Malden, MA 02148, Tel: 617-324-0350, Telex: 949913; Empl.: 20; *Sls. Mgr.:* Phill Truckle

VICLAN, 7373A Engineers Rd., San Diego, CA 92138, Tel: 619-292-1411, TWX: 910-335-1264; FSC No.: 51959; Empl.: 250; *Sls. Mgr.:* Bob Goodman

VICOM SYSTEMS, INC., 2520 Junction Avenue, San Jose, CA 95134, Tel: 408-946-5660, Telex: 171-603; Empl.: 85; *Sls. Mgr.:* R. P. LaJeunesse

VICON INDUSTRIES, INC., 525 Broad Hollow Rd., Melville, NY 11747, Tel: 516-293-2200, Telex: 144581; Empl.: 500; *Sls. Mgr.:* Ronald Klein

VICTOREEN, INC., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, Tel: 216-795-8200, TWX: 810-421-8287 ..... **A•1968-1971**

Local Sales Offices & Reps

CA	Santa Cruz, Brenda Costa	408-438-2110
MD	Gaithersburg, Axis Elctrns.	800-368-2815
MA	Boston, Com Serve, Inc.	617-862-3080
OH	Cleveland, Pruitt Energy Sources	216-566-1545
WA	Edmonds, EDCO Sls.	206-776-8922
WA	Edmonton, Edco Sls.	206-776-8922

Local Distributors

MD	Gaithersburg, Axis Elctrns.	800-368-2815
MA	Boston, Com Serve, Inc.	617-969-4905
OH	Cleveland, Pruitt Energy Sources	216-566-1545
WA	Edmonton, Edco Sls. Inc.	206-776-8922

VICTOR ELEC. WIRE & CABLE, 618 Main St., W. Warwick, RI 02893, Tel: 401-821-1700, SALES 401-821-7800, Telex: 952122, TWX: 710-382-1534; Empl.: 900; *Sls. Mgr.:* E. M. Colasanto

VICTOR WIRE & CABLE CORP., 3601 Holdrege Ave., Los Angeles, CA 90016, Tel: 213-870-9933; Empl.: 30

VICTORY ENGRG. CORP., Victory Rd., Springfield, NJ 07081, Tel: 201-379-5900, TWX: 710-983-4430; Empl.: 300; *Sls. Mgr.:* J. Bacek

VIDAIRE ELECTRONICS MFG. CORP., P. O. Box 788, Freeport, NY 11520, Tel: 516-623-6696; Empl.: 20

VIDCO, 8323 S.W. Cirrus Drive, Beaverton, OR 97005, Tel: 503-641-1804; Empl.: 8; *Sls. Mgr.:* Bradley Cohen

VIDEO AUTOMATION SYSTEMS, Upper Shad Rd., Pound Ridge, NY 10576, Tel: 914-764-4613; Empl.: 5

VIDEO LOGIC CORP., 597 No. Mathilda Ave., Sunnyvale, CA 94086, Tel: 408-245-8622, Telex: 35-7400

VIDEO MONITORS, INC., 3833 N. White Ave., Eau Claire, WI 54703, Tel: 715-834-7785; *Sls. Mgr.:* J. Carpentier

VIDEX INC., 1105 NW Circle Blvd., Corvallis, OR 97330, Tel: 503-758-0521, Telex: 469570

VIKING CASES, 10480 Oak St. N.E., St. Petersburg, FL 33702, Tel: 813-577-1216; *Sls. Mgr.:* Robert D. Stemler

VIKING CONNECTORS, 21001 Nordhoff St., P.O. Box 2379, Chatsworth, CA 91311, Tel: 818-341-4330, TWX: 910-494-2094; FSC No.: 05574; Empl.: 500; *Sls. Mgr.:* Bob Ploudre

VIKING ELECTRONICS, Industrial St., Hudson, WI 54016, Tel: 715-386-8861; Empl.: 24; *Sls. Mgr.:* Bill Wiese

Viking Labs/Honeywell

VIKING LABS/HONEYWELL, Operation of Test Instruments Div. of Honeywell, Inc., 440 Bernardo Ave., Mountain View, CA 94043, Tel: 415-969-5500, TWX: 910-379-6555; Empl.: 140; *Sls. Mgr.:* Jack Eagan, Prod. Reliability; *Dist. Mgr.:* M. J. Marchman, Comp. Test ..... **B•1013; D•1327**

Local Sales Offices & Reps

CA	Irvine, Centaur Corp.	714-556-5420
FL	Orlando, Donato & Assocs.	
FL	Palm harbor, Donato & Assocs.	
FL	Tampa, Donato & Assocs.	
MD	Baltimore, Stemler Assocs.	301-944-8262

VILLARREAL ELECTRONICS, Box 43A, RD 2, South Rd., Millbrook, NY 12545, Tel: 914-677-3447

V.I.P. INDS., INC., 246 Knickerbocker Ave., Paterson, NJ 07503, Tel: 201-345-5800; Empl.: 30; *Sls. Mgr.:* John M. Sonatore

VIRGINIA PANEL, 1400 New Hope Rd., Waynesboro, VA 22980, Tel: 703-949-8376, TWX: 710-839-0406; Empl.: 225; *Sls. Mgr.:* Jeff Stowers

VIRGINIA PLASTICS CO., P.O. Box 4577, Roanoke, VA 24015-0577, Tel: 703-985-3811, TWX: 710-870-0440; FSC No.: 59608; Empl.: 120; *Sls. Mgr.:* Charles Bogese; *Dist. Mgr.:* Carl Bump ..... **C•1567-1569, 1909-1911**

Local Sales Offices & Reps

AZ	Tempe, General Comps. Grp.	602-829-8124
CA	Granada Hills, C&W Comps.	213-368-4032
CA	San Jose, Pitts Sls. Assocs.	408-252-6177
CO	Parker, Mikro Sls. Co.	303-841-4131
CT	Middletown, Gerber Sls.	204-346-3000
FL	Altamonte Springs, APM Assocs.	305-869-6831
FL	Ft. Lauderdale, APM Assocs.	305-565-0056
FL	Merritt Island, APM Assocs.	305-453-4322
FL	Tampa, APM Assocs.	813-886-2457
GA	Stone Mountain, H & H Mktg.	404-296-9830
IL	Palatine, Claeson Assocs.	312-359-7230
MD	Silver Spring, Carwithen Assocs.	301-589-9040
MA	Monson, Gerber Sls.	413-267-5051
MA	Waltham, Gerber Sls.	617-890-3334
MN	Minneapolis, Northstar Comps.	612-553-1888
NJ	Haworth, Kay Sls.	201-384-3261
NY	Syracuse, Canavan-Scanlon Assocs.	315-437-1271
OH	Worthington, Roc Assocs., Inc.	614-885-1057
PA	Southampton, Campbell Assocs.	215-322-6630
TX	Dallas, MGR Elctrns., Inc.	214-238-5246
TX	El Paso, El Paso Elctrn. Comps.	919-593-8481
TX	Houston, AID Elctrns.	713-955-6204

Local Distributors

MN	Minneapolis, K & H Elctrn. Distrbg.	800-328-8515

VIRTIS CO., Rte. 208, Gardiner, NY 12525, Tel: 914-255-5000, Telex: 926474; Empl.: 92; *Sls. Mgr.:* J. D. Schmidt

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Local Sales Offices & Reps

AL	Huntsville, REMCO	205-533-3763
AZ	Phoenix, Howe & Howe	602-264-7971
CA	Cupertino, Vishay Resistive Sys. Grp.	408-730-1292
CA	Fullerton, Vishay Resistive Sys. Grp.	714-738-1581
CO	Englewood, Comps. Sls. Inc.	303-779-8060
CT	Wallingford, Comp Rep Assocs.	203-269-1145
FL	Altamonte Springs, Semtronic Assocs.	305-831-8233
FL	Clearwater, Semtronic Assocs.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assocs.	305-731-2484
GA	Atlanta, REMCO	404-447-6937
ID	Boise, N. R. Schultz Co.	208-377-8686
IL	Rolling Meadows, Eagle Tech. Sls.	312-991-0700
IN	Carmel, Shamrock Elctrn. Sls.	317-848-5265
KS	Shawnee Misson, Technical Sls. Assocs.	913-888-3330
MD	Lutherville, J. A. Dougherty Sls. Co.	301-321-7890
MA	Westwood, Comp Rep Assocs.	617-329-3454
MI	Bloomfield Hills, Enco Mktg.	313-642-0203
MN	St. Paul, Proud Inds.	612-646-9428
MO	Ferguson, Technical Sls. Assocs.	314-725-5361
NJ	Flanders, K & R Engrg. Sls. Co.	201-584-5235
NM	Albuquerque, Compass Mktg. & Sls.	505-888-0800
NY	E. Syracuse, L-Mar Assocs.	315-437-7779
NY	Rochester, L-Mar Assocs.	716-323-1000
NC	Raleigh, REMCO	919-847-5079
OH	Aurora, EMA, Inc.	216-562-6104
OH	Centerville, EMA, Inc.	513-433-2800
OR	Beaverton, N. R. Schultz Co.	503-643-1644
PA	Malvern, Vishay Resistive Sys. Grp.	215-644-1300
TX	Houston, Vishay Resistive Sys. Grp.	713-550-0568
UT	Salt Lake City, Component Sls., Inc.	801-268-8440
WA	Bellevue, N. R. Schultz Co.	206-454-0300
WI	Brookfield, Oasis Sls. Corp.	414-782-6660
EXP	Mayaguez, Comp Rep Assocs.	809-832-9529

Local Distributors

AZ	Phoenix, TTI, Inc.	602-966-1616
AZ	Tempe, Bell Inds.	602-966-7800
AZ	Tempe, Shelley Elctrns.	602-894-2058
CA	Chatsworth, Passive Comps., Inc.	818-341-1745
CA	Chatsworth, Shelley Elctrns., Inc.	213-998-3333
CA	Irvine, Hi-Rel Elctrns.	714-768-6656
CA	Los Alamitos, Semi-Dice, Inc.	213-594-4631
CA	San Diego, Shelley Elctrns., Inc.	619-453-7133
CA	San Fernando, Petel Elctrns., Inc.	818-365-9841
CA	San Jose, Shelley Elctrns., Inc.	408-942-9111
CA	San Jose, TTI, Inc.	408-943-9155
CA	Santa Clara, Semi-Dice, Inc.	408-980-9777
CO	Boulder, Shelley Elctrns., Inc.	303-442-2718
FL	Orlando, TTI, Inc.	305-859-1000
FL	Tampa, Impala Elctrns., Inc.	813-885-4747, 800-237-7777
FL	Tampa, Shelley Elctrns.	813-884-0946
GA	Norcross, TTI, Inc.	404-662-0911
ID	Spirit Lake, A-I Elctrns.	208-623-3111
IL	Palatine, Ohm Elctrns.	312-359-5500
MD	Beltsville, RESCO/Washington	301-937-9100
MD	Whitemarsh, RESCO/Baltimore	301-529-0500, 800-638-1242
MA	Canton, Semi-Dice, Inc.	617-821-0070
MA	Framingham, Cavalier Comps., Inc.	617-875-2000
MA	Woburn, TTI, Inc.	617-938-8800
NJ	Fairfield, CHPS, Inc.	201-882-0997
NJ	Flanders, VKR Svcs., Inc.	201-584-5235, 800-631-9362
NY	Bohemia, Justin Elctrns., Inc.	516-589-4000
NY	Bohemia, Shelley Elctrns.	516-567-7751
NY	Bohemia, TTI, Inc.	516-567-1500
NY	Farmingdale, Command Elctrns. Corp.	516-293-1212
NY	Hauppauge, Mast Distrs., Inc.	516-273-4422
OH	Cleveland, Specialized & Comps. Sls.	216-464-0404
OH	Dayton, Micro Mil Div.	513-434-8231
PA	Royersford, Hybrid Service Lab	215-948-6880
TX	Carrollton, Ohm Elctrns.	214-620-2230
TX	Fort Worth, TTI, Inc.	817-831-0441
TX	Houston, Texas Comp., Inc.	713-468-3882
WA	Kirkland, Priebe Elctrns.	206-821-4695

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VISHAY ANGSTROHM, 1 Precision Pl., Hagerstown, MD 21740, Tel: 301-739-8722, TWX: 710-853-6834; FSC No.: 17745; Empl.: 250; *Sls. Mgr.:* John Kinnaw; *Dist. Mgr.:* Jeff Reed

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VISION ENGRG., INC., 570 Danbury Rd., New Milford, CT 06776, Tel: 203-355-3776, Telex: 643769; Empl.: 15; *Sls. Mgr.:* S. Phillips

VISTAR CORP., 13740 McCormick Dr., Tampa, FL 33625, Tel: 813-855-6611, Telex: 522434; Empl.: 20; *Sls. Mgr.:* Ron Rooks

VISUAL COMMUNICATIONS CO., INC., P.O. Box 986, El Segundo, CA 90245, Tel: 213-822-4727; Empl.: 9; *Sls. Mgr.:* J. Savage ..... **B•1113-1115**

Local Sales Offices & Reps

AL	Huntsville, Remco	205-553-3763
AZ	Phoenix, Bob Anderson Co.	602-266-2070
CA	Mountain View, Westech Sls.	415-961-1422
CA	San Diego, Harvey King, Inc.	619-566-5252
CA	Torrance, Assoc Reps.	213-328-6708
FL	Boca Raton, Beacon Elctrns.	305-392-3500
GA	Atlanta, Remco	404-447-6937
IL	Elmhurst, Utronix Sls.	312-834-1100
MA	Sharon, Adcour	617-784-8123
MI	Jenison, R. C. Nordstrom & Co.	616-457-5762
MI	Lathrup Village, R. C. Nordstrom & Co.	313-559-7373
MN	Eden Prairie, Bohlig & Assocs.	612-944-8404
NY	New York, Robert Smith Assocs.	212-541-4885
NY	Plainview, Robert Smith Assocs.	516-681-3155
NC	Raleigh, Remco	919-847-5079
OH	Worthington, Dynel Co.	513-434-6467
OK	Tulsa, J. B. Guenther	918-587-3801
OR	Portland, Electronic Mktg. Grp.	206-882-0962
PA	Penndel, Rayco Sls.	215-757-1899
TX	Austin, J. B. Guenther	512-472-3825
TX	Dallas, J. B. Guenther	214-691-8500
TX	Houston, J. B. Guenther	713-974-0383
VA	Fairfax, Beacon No.	703-591-1300
VA	Forest, Beacon North	804-239-8486
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
EXP	CT, Litchfield, Intrade	203-567-5901

Local Distributors

AL	Huntsville, Component Distr.	205-883-7501
AZ	Tempe, Anjon Entprs.	602-894-1332
AR	Little Rock, Component Distr.	501-227-6278
CA	Costa Mesa, Orange County Comps.	714-979-3597
CA	Los Angeles, Electric Switch	213-660-1310
CA	San Jose, Cypress Elctrns.	408-945-8400
CA	Torrance, WBC Electro Supp.	213-328-6871
CO	Englewood, Industrial Elctrns. Inc.	303-694-9444
FL	Ft. Lauderdale, Component Distr.	305-971-4950
GA	Norcross, Component Distrs.	404-441-3320
MA	Lynn, Land Elctrn. Supp.	617-592-2220
MI	Grand Rapids, S. F. Elctrns. Supp.	616-459-0216
MN	New Brighton, Chris Elctrn. Distr.	612-631-2647
NJ	Bellmawr, Midatlantic Elctrns.	609-931-5303
NY	Elmsford, Ancar Elctrn. Supp.	914-592-7100
NY	Plainview, Plainview Elctrns.	516-249-6677
NC	Raleigh, Component Distr.	919-834-9465
OH	Aurora, IPD	216-562-8113
OH	Centerville, IPD	513-435-2086
TX	Houston, Force Elctrns.	713-772-8483
TX	Irving, Force Elctrns.	214-438-5700
VA	Falls Church, Component Distr.	703-241-8227
WA	Redmond, Paccom	206-883-9200
EXP	CT, Litchfield, Intrade	203-567-5901

VISUAL INFO. INSTITUTE, Box 33, Xenia, OH 45385, Tel: 513-376-4361, Telex: 501031 VIS INFO INST; FSC No.: 27432; Empl.: 45

Local Sales Offices & Reps

CA	San Diego, DRF Assocs.	619-292-9431
CA	San Diego, Perspective Meas.	619-259-8000
CA	San Jose, Fox Marketing	408-984-2221
CO	Bailey, Scientific Sys.	303-838-4615
MA	Clemsford, Meritron Corp.	617-250-1774
NC	High Point, EME, Inc.	919-869-3335
VA	Williamsburg, EME IV, Inc.	804-253-0171

VITEK ELCTRNS., 4 Gladys Ct., Edison, NJ 08817, Tel: 201-287-3200; *Sls. Mgr.:* Joe Griffin

VITRAMON N.A., P. O. Box 544, Bridgeport, CT 06601, Tel: 203-268-6261, TWX: 710-450-3640; Empl.: 606; *Sls. Mgr.:* Paul Davis; *Dist. Mgr.:* S. Judt

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Local Sales Offices & Reps

CA	Laguna Hills, English/Damco Sls. Assocs.	714-837-3801
CA	Sunnyvale, W. W. Posey	408-746-0771
CO	Denver, Mountain Reps.	303-623-0972
FL	Ft. Lauderdale, Unirep, Inc.	305-587-7481
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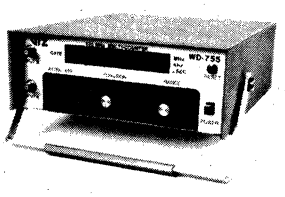

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IL Park Ridge, Bob Burns & Assocs. 312-775-1233
IN Zionsville, Midwest Reps. & Assocs. .. 317-844-4555
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MA Milford, Jonel Sls. 617-478-4650
MI Ferndale, Hilltronics 313-398-5556
MN White Bear Lake, Yore Co. 612-770-9760
MO Raytown, Marty Taraski Sls. Co. 816-358-1442
NJ Fort Lee, TMC Sls. Corp. 201-944-8340
NY Grand Island, L. J. McTaggart Assocs. 716-773-9222
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OR Portland, Joseph V. Belusko 503-222-4279
PA Phildelphia, Instrumentation Spec. 215-742-0898
PA Pittsburgh, John O. Olson Co. 412-341-8391
TX Dallas, Crockett Sls. Co. 214-350-3377

VL ELECTRONICS, 2775 Glendower Ave., Los Angeles, CA 90027, Tel: 213-661-8883, Telex: 821554; FSC No.: 95-3896380; Empl.: 6; *Sls. Mgr.:* Christopher Sieh; *Dist. Mgr.:* Christopher Sieh ..... **B•1117**

Local Sales Offices & Reps
CA Los Angeles, KT Elctrns. 714-432-8465
CO Denver, Andale 303-693-4331
MA Framington, Bay Colony Reps 617-620-0607

VLSI TECHNOLOGY, INC., 1101 McKay Dr., San Jose, CA 95131, Tel: 408-942-1810, Telex: 278807; Empl.: 450; *Sls. Mgr.:* Ronald C. Kasper

VOICE IDENTIFICATION, Box 714, Somerville, NJ 08876, Tel: 201-526-3408; Empl.: 7

VOICE MACHINE COMMS., INC., KTI, 1000 S. Grand Ave., Santa Ana, CA 92705, Tel: 714-541-0454; *Sls. Mgr.:* Rod Runge; *Dist. Mgr.:* Rod Runge

VOLITION SYSTEMS, P.O. Box 99628, San Diego, CA 92109, Tel: 619-270-6800, Telex: 695241 COMEX SDG; Empl.: 7

VOLTAGE MULTIPLIERS, INC., 8711 W. Roosevelt Ave., Visalia, CA 93291, Tel: 209-651-1402, Telex: 530484; FSC No.: 60211; Empl.: 70; *Sls. Mgr.:* Ken Haag ..... **A•2097**

VOLTAMPERE CORP., 146 Horton Ave., Lynbrook, NY 11563, Tel: 516-887-9443; FSC No.: 64196; Empl.: 30; *Sls. Mgr.:* Jesse Stitzer

VOLTARC TUBES, 176 Linwood Ave., Fairfield, CT 06430, Tel: 203-255-2633, Telex: 96-4337; Empl.: 180; *Sls. Mgr.:* Albert H. Katz

VOLTEX, 3460 Great Neck Rd., Amityville, NY 11701, Tel: 516-842-2772; Empl.: 55; *Sls. Mgr.:* S. Vogel ... **D•1865**

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VOLTRONICS, West St., P.O. Box 476, E. Hanover, NJ 07936, Tel: 201-887-1517, TWX: 710-986-8253; FSC No.: 18736;Multiple; Empl.: 70; *Sls. Mgr.:* Richard J. Newman

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AZ Glendale, Fetty/Schoenduve, Inc. 602-241-9009
AR Little Rock, Beacon Elctrns. 501-224-5449
CA El Segundo, Fetty/Schoenduve, Inc. .. 213-322-4991
CA Mountain View, Fetty/Schoenduve, Inc. 415-962-8330
CA San Diego, Fetty/Schoenduve, Inc. ... 619-292-5136
CO Boulder, Herb Bass Assocs. 303-530-7509
FL Boca Raton, Beacon Elctrns. 305-392-3500
FL Clearwater, Beacon Elctrns. 813-796-2378
FL Maitland, Beacon Elctrns. 305-647-3498
FL Melbourne, Beacon Elctrns. 305-724-8010
GA Atlanta, Beacon Elctrns. 404-256-9640
IL Palatine, R-Tek Central 312-991-4404
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KS Parker, S. W. Wollard Co. 913-898-6552
MD Mt. Airy, Beacon North 703-591-1300
MD Randallstown, Beacon North 703-591-1300
MA Malden, JK Assocs. 617-321-2922
MN St. Paul, Countryman Assocs. 612-645-9151
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NY Melville, RF Elctrn. Sls. Grp. 516-420-8890
NY Utica, B. D. Hummel Co. 315-736-7821
NC Raleigh, Beacon Elctrns. 919-787-0330
OH Chesterland, K-T/DEPCO 216-729-3588
PA Newton Square, SWR Assocs. 215-353-6711
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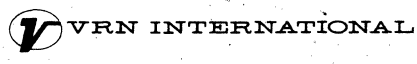
UT Bountiful, Herb Bass Assocs. 801-292-8991
VA Fairfax, Beacon North 703-591-1300
VA Forest, Beacon North 804-239-8486

VOTAN, 4487 Technology Dr., Fremont, CA 94538, Tel: 415-490-7600; *Sls. Mgr.:* Robert Russo

VOYAGER TECHNOLOGIES, INC., 2250 Cabot Blvd. W. Bldg. 40M, Langhorne, PA 19047, Tel: 215-750-0270; Empl.: 15; *Sls. Mgr.:* Roger J. Peirce



VRN INTERNATIONAL, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, Tel: 813-347-2181, Telex: 6815306, TWX: 310-681-5306; FSC No.: 84048; Empl.: 500; *Sls. Mgr.:* R. Fielder; *Dist. Mgr.:* R. Fielder ..... **A•2054-2055; D•1056**

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CA Campbell, Kottmeier Assocs. 408-371-8700
CA San Diego, M.W. Riedel & Co. 619-272-2359
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CT Stratford, Gerald Rosen Co. 203-375-5456
FL Boca Raton, Lawrence Assocs. 305-368-7373
FL Clearwater, Lawrence Assocs. 813-584-8110
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CA San Jose, Future 408-945-9100
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CA Thousand Oaks, Bell Inds. 818-340-1940
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NY E. Syracuse, Add Elctrns. Corp. 315-437-0300
NY Farmingdale, Command Elctrns. Corp. 516-293-1212
NY Farmingdale, Pride Elctrns. 516-293-4020
NY Hauppauge, Fairmont Elec. Sls. 516-231-3313
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NY Huntington Station, Sherburn Elctrns. 516-231-4300
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NY Rochester, Rochester Radio Supp. 716-454-7800
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TX Richardson, Altair 214-231-5166
UT Salt Lake City, Bell 801-972-6969
UT Salt Lake City, Future 801-972-8489
VA Charlottesville, Virginia Radio 804-296-4184
WA Bellevue, Future 206-881-8199
WA Seattle, Robert E. Priebe Co. 206-682-8242
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI New Berlin, Classic 414-786-5300

VTM MICROWAVES, INC., 4975 W. 80 Ave., Westminster, CO 80030, Tel: 303-426-6866; Empl.: 15

V-TRON ELCTRNS. CORP., 10 Venus Way, P.O. Box 297-S, S. Attleboro, MA 02703, Tel: 617-761-9100; Empl.: 250; *Sls. Mgr.:* Richard E. French

Local Sales Offices & Reps
CA Cerritos, Don Lumpkin & Assocs. 213-402-4589
CT Wallingford, Com-Sale 203-269-7964
FL Juniter, Southern Elctrns. Sls. Corp. ... 305-744-0028
MA Waltham, Com-Sale 617-890-0011
NH Manchester, Com-Sale 603-668-1440
NJ Haworth, Kay Sls. Assocs. 201-384-3261
TX Fort Worth, Diversified Comps. 817-249-5818
VA Portsmouth, FDB Sls. Corp. 804-484-3162

VU-DATA, 7122 Convoy Ct., San Diego, CA 92111, Tel: 619-279-6572, TWX: 910-335-1586; FSC No.: 34160; Empl.: 15

WABASH ELECTRICAL COMPONENTS GROUP, A Kearney-National Co., 1375 Swan Street, Huntington, IN 46750, Tel: 219-356-8300, TWX: 810-333-1533; Empl.: 1000

WABASH RELAY & ELCTRNS., First & Webster Sts., Wabash, IN 46992, Tel: 219-563-2191, TWX: 810-290-2722; Empl.: 250; *Sls. Mgr.:* David L. Snodgrass ..... **B•1460-1461**

Local Sales Offices & Reps
Midtec Assocs., Ltd.
AL Huntsville, Hughes Assocs., Inc. 205-533-9108
AZ Fountain Hills, Halbar Assocs., INc. ... 602-837-2464
CA Glendale, Halbar 818-246-8263
CA San Mateo, Halbar 415-349-4700
CO Aurora, Mountain View Mktg. 303-699-1665
DE Medford, Comp. Consit. 609-654-5300
FL Altamonte Springs, APM Assocs. 305-869-6831
FL Ft. Lauderdale, APM Assocs. 305-565-0056
FL Tampa, APM Assocs. 813-886-2457
GA Huntsville, Hughes Assocs., Inc. 205-533-9108
ID Redmond, Halbar Assocs., Inc. 206-882-0990
IL Arlington Hgts., M. J. Petersen Assocs. 312-577-8200
IN Fort Wayne, M/S Sls. 219-436-3023
KS De Soto, Midtec Assoc. 913-441-6565
MD Glen Burnie, Macrotech Assocs., Ltd. 301-437-5588
MA Andover, Crawford Assocs. 617-470-2122
MI Novi, Lektronics 313-349-3304
MN Edina, PWC, Inc. 612-831-5999
MS Huntsville, Hughes Assocs., Inc. 205-533-9108
MO Florissant, Midtec Assocs. 314-837-5200
NV San Mateo, Halbar Assocs., INc. 415-349-4700
NJ Watchung, Dolan Assocs. 201-753-2671
NM Fountain Hills, Halbar Assocs., Inc. 602-837-2464

NY Penfield, Upstate Comp. Sls. 716-381-6070
NC Raleigh, Tingen Tech. Sls. 919-781-1100
OH Dayton, KW Elctrn. Sls. 513-890-2150
OH Shaker Heights, KW Elctrn. Sls. 216-491-9177
OH Worthington, KW Elctrn. Sls. 614-888-0483
OR Vancouver, Halbar Assocs., Inc. 206-696-0170
PA Medford, Comp. Consits. 609-654-5300
TX Dallas, Stevens Sls. Co. 214-350-2476
VA Glen Burnie, Macrotech Assocs., Ltd. 301-437-5588
WA Redmond, Halbar Assocs., Inc. 206-882-0990
WA Vancouver, Halbar Assocs., Inc. 206-696-0170

Local Distributors

CA Fullerton, Pyramid Elctrn. Supp. 714-773-0781
CA Santa Clara, Pyramid Elctrn. Supp. 408-727-9810
CT Wallingford, Cronin Elctrns., Inc. 203-265-3134
FL Palm Bay, Action Elctrns., Inc. 305-725-4920
IL Elk Grove Village, Nu-Way Elctrn. Distrs. 800-323-7957
MA Needham, Cronin Elctrns., Inc. 617-449-5000
NH Salem, Cronin Elctrns., Inc. 603-898-4440
WA Kent, Pyramid Elctrn. Supp., Inc. 206-872-5800

WABER ELECTRIC, See SL Waber Electric.

THE WADSWORTH ELEC. MFG. CO., INC., 20 W. 11th St., Covington, KY 41012, Tel: 606-431-0900; *Sls. Mgr.:* D. W. Phillips

WAGNER ELECTRIC CORP., Tung-Sol Div., 100 Misty Lane, Parsippany, NJ 07054, Tel: 201-386-9300

WAGO CORP., 6657 N. Sidney Pl., Milwaukee, Wi 53209-3217, Tel: 414-352-1035, Telex: 260123; *Sls. Mgr.:* Michael A. Lane

WAHL INSTRUMENTS, INC., 5750 Hannum Ave., Culver City, CA 90230, Tel: 213-822-6144, TWX: 910-343-6867; Empl.: 48

WALDES KOHINOOR, 47-16 Austel Pl., Long Island City, NY 11101-4478, Tel: 718-392-3100, Telex: 126-829; Empl.: 450

WALDOM ELCTRNS., 4301 W. 69th St., Dept. EEM, Chicago, IL 60629, Tel: 312-585-1212, Telex: 25-4604; FSC No.: 92219; Empl.: 143; *Sls. Mgr.:* E. R. Beutler

WALKER SCIENTIFIC, Rockdale St., Worcester, MA 01606, Tel: 617-852-3674, Telex: 92-0489; Empl.: 83; *Sls. Mgr.:* B. Langley

WALL, A. T., CO., 55 Service Ave., Warwick, RI 02886, Tel: 401-739-0740, TWX: 710-382-1535; Empl.: 75; *Sls. Mgr.:* Carl Gibbs; *Dist. Mgr.:* R. Huntsman

WALL-ABLE MANUFACTURING CORP., 1800 N. Clybourn Ave., Chicago, IL 60614, Tel: 312-440-1000, Telex: 312288; Empl.: 150; *Sls. Mgr.:* Dennis O'Brien ..... **C•1570-1571**

Local Sales Offices & Reps

IL Wheeling, AL&W Sls. Co. 312-541-9080
NY Dobbs Ferry, L. J. Valle, Inc. 914-693-5089

WALL INDS., 2 Franklin, Lawrence, MA 01840, Tel: 617-688-1287; Empl.: 55; *Sls. Mgr.:* Mark P. Aiello

WALL LENK, Box 3349, Dept. EEM-71, Kinston, NC 28501, Tel: 919-527-4186; Empl.: 60; *Sls. Mgr.:* Richard W. Cooper

WALMOR DATA SYSTEMS, INC., 300 E. Irving Park Rd., Wood Dale, IL 60190, Tel: 312-350-0625; Empl.: 10; *Sls. Mgr.:* Wayne D. Pickette

WAMCO, INC., 11555-A Coley River Cir., Fountain Valley, CA 92708, Tel: 714-545-5560, Telex: 678-459; *Sls. Mgr.:* Gordon R. Calvert; *Dist. Mgr.:* Sheila A. Sherman

WARD LEONARD ELEC., 31 South St., Mt. Vernon, NY 10550, Tel: 914-664-1000, TWX: 710-562-0144; FSC No.: 63743;15109; Empl.: 450; *Dist. Mgr.:* Barry Daly ..... **A•1986-1987**

Local Sales Offices & Reps

KY Louisville, Goldschmidt Elec. Sls. 502-241-0303
MD Glen Burnie, Faion Lott & Co. 301-744-4611
MA Framingham, KSA of New England 617-235-8940
MN Edina, Hallock Co. 612-835-7100
NY Buffalo, Rudell-Merrifield Assoc. 716-634-4300
OH Cincinnati, Goldschmidt Elec. Sls 513-641-1708
OH Painesville, Ward Leonard 216-951-2262
OH Westlake, Assoc. Elec. Comps. 216-835-9960
OK Tulsa, Hammond Elec. 918-582-4104
OK Tulsa, Mac's Elec. 918-583-3101
OR Beaverton, Steve Bryan & Assoc. 503-644-5729
PA Harrison City, Rudell-Merrifield Assoc. 412-327-0858
PA Philadelphia, S. K. MacDonald 215-545-1205
TX Dallas, Ward Leonard 214-458-8511
WA Federal Way, Ward Leonard 206-941-8888
WA Spokane, K & N Elec. Motors 509-328-3260
WI Appleton, Langstadt 414-733-3791

Local Distributors

CA Emeryville, Beck Elec. Supp. 415-652-5665
CA Sunnyvale, Independent Elec. 408-732-7101
CT E. Hartford, R & S Elctrn. Distrs. 203-528-9901
CT Naugatuck, S.C.R. Electric 203-729-8274
CT Norwalk, Park Distrs. 203-853-2010
NY Buffalo, CMH Indl. Sls. 716-684-5250
NY Buffalo, Glauber & Carpenter 716-681-1234
NY Rochester, Preferred Elec. Motors 716-342-5080
OH Cleveland, Fordes Elec. & Control 216-229-4700
OH Cleveland, Specialized Comp. Sls. 216-464-0405
OH Columbus, Columbus Elctrn. 614-294-4651
OH Dayton, Summit Inds. 513-434-8192
PA Philadelphia, Capital Elctrl. Supp. 215-225-7850
WI Milwaukee, Hunt Co. 414-383-1781
WI Milwaukee, Tech. Elec. Co. 414-353-4383

WARREN COMMS., 101 Okner Pkwy., Livingston, NJ 07039, Tel: 201-992-6200, Telex: 139-384, TWX: 710-994-4852; Empl.: 200; *Sls. Mgr.:* William Vandertulip

WARREN-KNIGHT INSTR. CO., Warren Inds., Inc., 2045 Bennett Rd., Philadelphia, PA 19116, Tel: 215-464-9300; Empl.: 50; *Sls. Mgr.:* Richard M. Marron

WAVETEK ROCKLAND SCI., 245 Livingston St., Northvale, NJ 07647, Tel: 201-767-7100, TWX: 710-991-9619; Empl.: 200; *Sls. Mgr.:* Howard Siegerman

WASATCH HIGH VOLTAGE, P.O. Box 9027, Salt Lake City, UT 84109, Tel: 801-265-9561; Empl.: 9; *Sls. Mgr.:* T. J. Bruzenak

WATERS MFG., Longfellow Ctr., Wayland, MA 01778, Tel: 617-358-2777, Telex: 948441; FSC No.: ;Multiple; Empl.: 125; *Sls. Mgr.:* Ralph Pietro

WATKINS-JOHNSON CO., 3333 Hillview Ave., Palo Alto, CA 94304, Tel: 415-493-4141, Telex: 34-8415, TWX: 910-373-1253; FSC No.: 14482; Empl.: 2800

WATKINS-JOHNSON CO., Stewart Div., 440 Mount Herman Road, Scotts Valley, CA 95060, Tel: 408-438-2100

WATT-CLOCK CORP., P.O. Box 697, Stratford, CT 06497, Tel: 203-378-2500; Empl.: 5; *Sls. Mgr.:* M. Dee

WAVECOM, 9036 Winnetka Ave., Northridge, CA 91324, Tel: 818-882-3010, TWX: 910-493-2172; FSC No.: 28979; Empl.: 93

WAVELINE, Box 718, W. Caldwell, NJ 07006, Tel: 201-226-9100, TWX: 710-734-4324; FSC No.: 00443; Empl.: 95; *Sls. Mgr.:* J. F. Harty

WAVETEK INDIANA, INC., 5808 Churchman, Beech Grove, IN 46107, Tel: 317-787-3332, TWX: 810-341-3226; FSC No.: 34280; Empl.: 900; *Sls. Mgr.:* Dick Koerner

WAVETEK ROCKLAND SCIENTIFIC, INC., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647, Tel: 201-767-7900, TWX: 710-991-9852; Empl.: 100

WAVETEK CORPORATION, 9191 Towne Centre Drive, San Diego, CA 92122, Tel: 619-450-9971, TWX: 910-335-2007; Empl.: 1206; *Sls. Mgr.:* Sam Lewis

WAYNE KERR, INC., W.K.R. Ltd., 400 West Cummings Pk., Woburn, MA 01801, Tel: 617-938-8390, Telex: 6817257 WKERR WOBN; *Sls. Mgr.:* Ken Berquist

WAYNE TRANSFORMER CO., INC., 99 Hazel St., Paterson, NJ 07503, Tel: 201-278-7674; *Sls. Mgr.:* Fred Demauro ..... **A•2340-2341**

WECKESSER CO. INC., 4444 W. Irving Park Rd., Chicago, IL 60641, Tel: 312-282-8626; Empl.: 90

WEBER, 147 W. Cedan St., Norwalk, CT 06854, Tel: 203-866-8474

WECO

WECO ELECTRICAL CONNECTORS, INC., Rt. 11, Mooers, NY 12958, Tel: 518-298-4810, Telex: 05-821840; Empl.: 15; *Sls. Mgr.:* Heiner Kammann; *Dist. Mgr.:* Heiner Kammann ..... **C•1572-1578**

Local Sales Offices & Reps

CO Englewood, Protronics Grp. 303-781-6050
FL Coral Springs, HAI Elctrns. 305-752-7520
MI Brooklyn, Engineered Comps., Inc. 517-592-3236
OH Cincinnati, Engineered Comps., Inc. 513-471-2949
OR Portland, SPS Elctrns. 503-297-6919
WA Redmond, SPS Elctrns. 206-323-4140
Can Montreal, QC., WECO Elec. Connectors, Inc. 514-457-3640
Can Rexdale, Ont., WECO Elec. Connectors, Inc. 416-674-1084

Local Distributors

CA Fullerton, ISI Mktg. Co. 714-773-0411
CA Santa Clara, Glynn Elctrns., Inc. 408-748-1666
CA Union City, Interwest Sys., Inc. 415-489-1820
CT Pawcatuck, Glynn Elctrns., Inc. 203-599-5373
IL Carol Stream, Lectro Comps. 312-690-0520
MA Middleboro, Glynn Elctrns., Inc. 617-947-4262
NH Salem, Glynn Elctrns., Inc. 603-893-8313
NJ South River, Kon-Tac, Inc. 201-254-5100
WA Seattle, H.D. Campvelle 206-433-1900
Can Concord, Ont., Ziereck, Ont. 416-669-1429
Can Manitoba, Winnepeg, WES Elctrns. 204-632-1260
Can Mississauga, Ont., Prelco Ltd. 416-678-0401
Can Montreal, Que., Prelco Ltd. 514-389-8051
Can Montreal, Que., Taylor Ind. Controls 514-334-5900
Can Nepean, Ont., Prelco Ltd. 613-726-1800
Can St. Laurent, Que., De-Taylec, Ltd. 514-331-7460
Can St. Laurent, Que., Taylor Indl. Controls, Ltd. 514-334-5900

WEED INSTR. CO., INC., 707 Jeffrey Way, P.O. Box 300, Round Rock, TX 78664-0300, Tel: 512-255-7043, Telex: 776492; Empl.: 110; *Sls. Mgr.:* Frank Ofner

WEI CORP., 1405 S. Village Way, Santa Ana, CA 92705, Tel: 714-834-9333, TWX: 910-595-1709; FSC No.: 51272; Empl.: 50; *Sls. Mgr.:* R. H. Thomason

WEIDMULLER TERMINATIONS, 821 Southlake Blvd., Richmond, VA 23236, Tel: 804-794-2877, Telex: 828376; Empl.: 31; *Sls. Mgr.:* James G. Dunn; *Dist. Mgr.:* Mort Gelfand

WEINSCHEL ENGRG., One Weinschel La., Gaithersburg, MD 20877, Tel: 301-948-3434, 800-638-2048, Telex: ITT 440702, TWX: WU 89-8352; FSC No.: 93459; Empl.: 325; *Sls. Mgr.:* Ron Bastien

WELLMAN THERMAL SYS., 1 Progress Rd, Shelbyville, IN 46176, Tel: 317-398-4411, TWX: 810-260-2616; FSC No.: 4S017; Empl.: 600; *Sls. Mgr.:* E. W. Abel; *Dist. Mgr.:* W. L. McNamee

WELLS ELCTRNS., 1701 S. Main St., South Bend, IN 46613, Tel: 219-287-5941, Telex: 25-8325; FSC No.: 219-287-0356; Empl.: 200; *Sls. Mgr.:* Michael Myers ..... **C•1580-1587**

Local Sales Offices & Reps

AL Huntsville, Southeastern Mktg. 205-882-1633
AZ Scottsdale, Luscombe Engrg. Co. 602-949-9333
CA Los Angeles, EESCO 818-242-8823
CA San Jose, Western Indl. Network 408-559-8118
CO Boulder, Luscombe Engrg. Co. 303-772-3342
CT Wethersfield, Com/Pak, Inc. 203-563-4784
FL Lighthouse Point, Jack Krutek & Assocs. 305-941-6544
GA Atlanta, L & D, Inc. 404-395-7079
IL Glencoe, Howard Benjamin Assocs. Inc. 312-835-0150
IN Greenfield, France Entprs., Inc. 317-462-6098
MD Phoenix, Phoenix Elctrn. Sls. 301-628-2066
MA Woburn, Com/Pak, Inc. 617-938-8580
MI Brighton, Michigan Mktg. & Sls. 313-229-6218
MN Minneapolis, RK Sls., Inc. 612-786-5713
MO St. Louis, Reptronics 314-576-9816
NJ Berkeley Heights, Cambridge Allen and Assocs. 201-464-0203
NJ Medford, Component Consits. 609-654-5300
NY Syracuse, T-Squared Elctrns. Co., Inc. 315-463-8592
NC Greensboro, L & D, Inc. 919-292-3201
OR Tigard, El Tech, Inc. 503-684-3458
TN Knoxville, L & D, Inc. 615-573-6511
TX El Paso, EPEC, Inc. 915-593-8481
TX Irving, AID Elctrns., Inc. 214-790-4761
VA Centerville, Phoenix Elctrns. Sls. 703-631-2924
WA Bellevue, El Tech, Inc. 206-643-4330
WI Colgate, Rep 1 & Assocs. 414-628-4016

Local Distributors

AZ Tempe, Waltronic Sls. 602-967-1020
CA Anaheim, A To Z Elctrns., Inc. 714-634-3620
CA San Jose, Cypress Elctrns., Inc. 408-945-8400
CO Wheat Ridge, Cypress Elctrns., Inc. 303-431-2622
FL Pompano Beach, Comps. South 305-971-0350
GA Atlanta, Prehler Elctrns. 404-447-5540

IL Chicago, Semiconductor Specialists, Inc. 312-279-1005
IN Indianapolis, Graham Elctrns. 317-634-8202
MD Gaithersburg, MS Elctrns., Inc. 301-921-0200
MA Mendon, Add Elctrn. Corp. 617-429-7945
MI Southfield, L.S.I. Mktg. 313-474-4400
MN St. Paul, Gopher Elctrns. 612-483-3322
MO Kansas City, Semiconductor Specialists, Inc. 816-452-3900
NH Hampstead, Astrum Elctrns. 603-329-5656
NJ Bellmawr, Mid-Atlantic Elctrns. Corp. 609-931-5303
NJ Rahway, RSR Elctrns. 201-381-8777
NY East Syracuse, Add Elctrn. Corp. 315-437-0300
NY Farmingdale, Pride Elctrns. 516-293-4020
NY Ronkonkoma, Prime Comps. 516-737-1730
OH Columbus, Elctrns. Mktg. Corp. 614-299-4161
OR Tigard, Moore Elctrns., Inc. 503-684-3100
PA Pittsburgh, Semiconductor Specialists, Inc. 412-963-7241
TX Houston, Kent Elctrns., Inc. 713-780-7770
TX Richardson, Kent Elctrns., Inc. 214-669-2600
WI Milwaukee, Marsh Elctrns. 414-475-6000

WELTEK INTL., INC., 760 W. Cotter St., South Bend, IN 46613, Tel: 219-232-5400, Telex: 23-3131; Empl.: 28; *Sls. Mgr.:* Tom Gerschoffer

WESCO ELECTRICAL CO., 201 Munson St., Greenfield, MA 01301, Tel: 413-774-4358; FSC No.: 12673; Empl.: 190; *Sls. Mgr.:* James R. DeSanty ..... **A•1198-1203**

Local Sales Offices & Reps
CA Costa Mesa, Electro-Mech Sls. Co. ... 714-642-2390
CA La Jolla, Southwest Tech. Sls. 619-454-2034
CA Santa Clara, Gagner-Toomey Assocs. 408-244-2200
CT Milford, Cuming Assoc. 203-878-3946
FL Fern Park, EIR Inc. 305-830-9600
IL Addison, Banner Tech. Sls. 312-279-6070
IN Columbus, J. H. Weaver Co. 812-372-3625
MA Framingham, Bengal Assocs. 617-877-2639
MA Randolph, Bengal Assocs. 617-961-4120
MN Bloomington, Electronic Sls. Agcy. 612-884-8291
NJ Madison, Livera-Polk Assocs. 201-377-3220
NY Glen Head, Livera-Polk Assocs. 516-759-9300
NC Raleigh, Leigh Sls. 919-872-1484
OH Wickliffe, W. Brauer & Assoc. 216-943-0601
OR Beaverton, L-D Elctrns. 503-649-6177
PA Pittsburgh, W. Brauer & Assoc. 412-921-3213
TX Dallas, Blackburn Assocs. 214-692-8885
WA Snohomish, L-D Elctrns. 206-568-0511

WESCORP ANTISTATIC PRODS., 144 S. Whisman Rd., Mountain View, CA 94041, Tel: 415-969-7717, Telex: 345507; Empl.: 15; *Sls. Mgr.:* Lourdes Rivera

Local Distributors
MA Canton, Hub Matls. 617-821-1870

Distributor

WES-GARDE COMPONENTS GROUP, INC., 190 Elliott St., Hartford, CT 06114, Tel: 203-525-6907 ..... **B•1698**

WESTAMP, 1542 15th St., Santa Monica, CA 90404, Tel: 213-393-0401, Telex: 3720078; FSC No.: 12745; Empl.: 100; *Sls. Mgr.:* Michael Mula

Local Sales Offices & Reps
CT Ridgefield, E. S. Williams Co. 203-438-7474
FL Tampa, Brawley Tech. Sls. 813-251-6816
IL Libertyville, Westamp 312-680-1979
MA Wellesley Hills, R. H. Sturdy Co. 617-235-2330
MI Troy, Xanthus 313-528-2000
MN Minneapolis, Lakeland Engrg. Equip. Co. 612-544-0321
NY Pittsford, Controlled Motion Prods. 716-381-1933
NY White Plains, Westamp 914-949-7949
OH Cincinnati, Dorsey Alexander Assocs. 513-221-7518
PA Warrendale, Superior Sys. 412-935-5230

WESTBERG MFG., INC., 3400 Westach Way, Sonoma, CA 95476, Tel: 707-938-2121; Empl.: 20; *Sls. Mgr.:* R. R. Westberg

WEST-CAP ARIZONA, Sub. of San Fernando Electric Mfg. Co., 2201 East Elvira Road, Tucson, AZ 85706, Tel: 602-294-2646

WEST COAST ELEC. MFG., 14045 Garfield Ave, Paramount, CA 90723, Tel: 213-633-1010; FSC No.: 81823; Empl.: 25; *Sls. Mgr.:* W. E. Seal

WESTCODE SEMICONDUCTORS, INC., 0-02 Fair Lawn Ave., Fair Lawn, NJ 07410, Tel: 201-791-3020, Telex: 353279; *Sls. Mgr.:* Alan J. Melnyk

WEST DIVISION, Gulton Industries, Inc., 3860 N. River Rd., Schiller Park, IL 60176, Tel: 312-678-6400, Telex: 910-227-0723; Empl.: 400; *Sls. Mgr.:* Williard J. Bell, Jr.; *Dist. Mgr.:* Williard J. Bell, Jr.

WESTEMP CORP., Box 767, Cardiff, CA 92007, Tel: 619-942-9800; Empl.: 20; *Sls. Mgr.:* J. Huston

WESTERN DATACOM, 5083 Market St., Youngstown, OH 44512, Tel: 216-788-6583, Telex: 910-333-8609; Empl.: 15; *Sls. Mgr.:* Carol Zinstine; *Dist. Mgr.:* Carol Zinstine

Local Sales Offices & Reps
CA Campbell, Data Express 408-371-2788
CA Costa Mesa, Dalcom Sys. 714-851-8142
CA Woodland Hills, Dalcom Sys. 213-703-7983
CO Englewood, Beta Distrs. 303-779-4494
CT Vernon, IMF Sls. Assocs. 203-643-0187
DC Edgewater, Commart 301-261-4344
FL Orlando, COL-INS-CO 305-423-7615
GA Atlanta, COL-INS-CO 404-491-9395
IL Downers Grove, ARC Elctrn. Assocs. 312-960-4325
MA Wakefield, IMF Sls. Assocs. 617-245-8900
MI Ann Arbor, ARC Elctrn. Assocs. 313-995-1211
MN Eden Prairie, Scientific Dvcs. 612-944-3515
NJ Northvale, Glasgal Comm. 201-768-8082
NY E. Syracuse, Ossman Computer Prods. 315-437-7052
NY Rochester, Ossman Computer Prods. 716-424-4460
NY Vestal, Ossman Computer Prods. 607-754-3264
NC Raleigh, COL-INS-CO 919-848-4006
OH Cleveland, ARC Elctrn. Assocs. 216-835-8400
OR Portland, Rush Drake 503-224-3145
PA Pittsburgh, Applied Delta 609-853-5400
TN Knoxville, COL-INS-CO 615-546-9016
TX Houston, Beta Distrs. 713-682-1234
TX Richardson, Beta Distrs. 214-783-1065
WA Seattle, Rush Drake 206-454-2383
Can Ottowa, Tempest Security Integrators 613-226-3227

WESTERN DIGITAL CORP., 2445 McCabe Way, Irvine, CA 92714, Tel: 714-557-3550, TWX: 910-595-1139; *Dist. Mgr.:* Ron Weaver

WESTERN ELECTRIC CO., INC., 222 Broadway, New York, NY 10038, Tel: 212-669-2345

WESTERN ELECTRO. MECH. CO. INC., 300 Broadway, Oakland, CA 94607, Tel: 415-452-1936; Empl.: 9; *Sls. Mgr.:* W. J. Foster

WESTERN ELCTRN. PRODS., 107 Los Molinos, San Clemente, CA 92672, Tel: 714-492-4677; FSC No.: 13988

WESTERN GEAR CORP., Applied Tech. Div., 14724 E. Proctor, City of Industry, CA 91744, Tel: 818-968-6525, TWX: 910-584-4856; Empl.: 1125; *Sls. Mgr.:* D. Waite

WESTERN GRAPHTEC, 12 Chrysler St., Irvine, CA 92718, Tel: 714-770-6010, 800-854-8385

WESTERN MULTIPLEX CORP., 1320 Bayport Avenue, San Carlos, CA 94070, Tel: 415-592-8832, Telex: 295114 VIA RCA; FSC No.: 94-2620670; *Sls. Mgr.:* J.P. Bartelme

WESTERN RESERVE ELCTRNS., 2150 Highland Rd., Twinsburg, OH 44087, Tel: 216-425-4951; Empl.: 45; *Sls. Mgr.:* Robert Rhodes

WESTINGHOUSE ELECTRIC CORP., Aerospace Electrical Div., P.O. Box 989, Lima, OH 45802, Tel: 419-226-3121

WESTINGHOUSE ELECTRIC CORP., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845, Tel: 607-796-3211, Telex: 510-252-1588; Empl.: 700; *Sls. Mgr.:* R. R. Kaemmener

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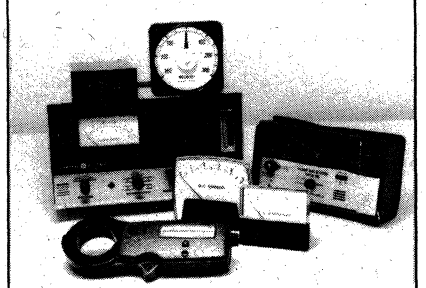

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TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 85/86 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1166, **B**•1012, **C**•1028, **D**•1016
ASCII Code ..... **D**•1087
Batteries, Product Selection Guide ..... **D**•1413
Batteries & Fuel Cells, Characteristics ..... **D**•1430
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide ..... **A**•1003
Circuit Boards (Printed) Product Selection Guide ..... **C**•1099
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1205
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1863
Connectors, Miniglossary ..... **C**•1129
Connectors, Terminals, & Sockets, Product Selection Guide ..... **C**•1105
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Gude ..... **A**•1309
Delay Lines, Product Selection Guide ..... **A**•1459
Discrete Semiconductors, Product Selection Guide ..... **A**•2067
Displays, Readouts, Lamps, & Lights, Product Selection Guide ..... **B**•1015
EBCDIC Code ..... **D**•1092
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Filters, Product Selection Guide ..... **A**•1583
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Instruments, Panel Meters, Product Selection Guide ..... **D**•1329
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Power Supplies, Miniglossary ..... **D**•1462
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Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide .... **B**•1225
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Relays, Product Selection Guide ..... **B**•1261
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Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1744
Thyristors/High Power Diodes, Miniglossary ..... **A**•2076
Transducers & Encoders, Product Selection Guide ..... **B**•1777
Transformers, Product Selection Guide ..... **A**•2099
Wire & Cable, Product Selection Guide ..... **C**•1743
Wire Gauges—Diameter, Area, Copper Weight ..... **C**•1844

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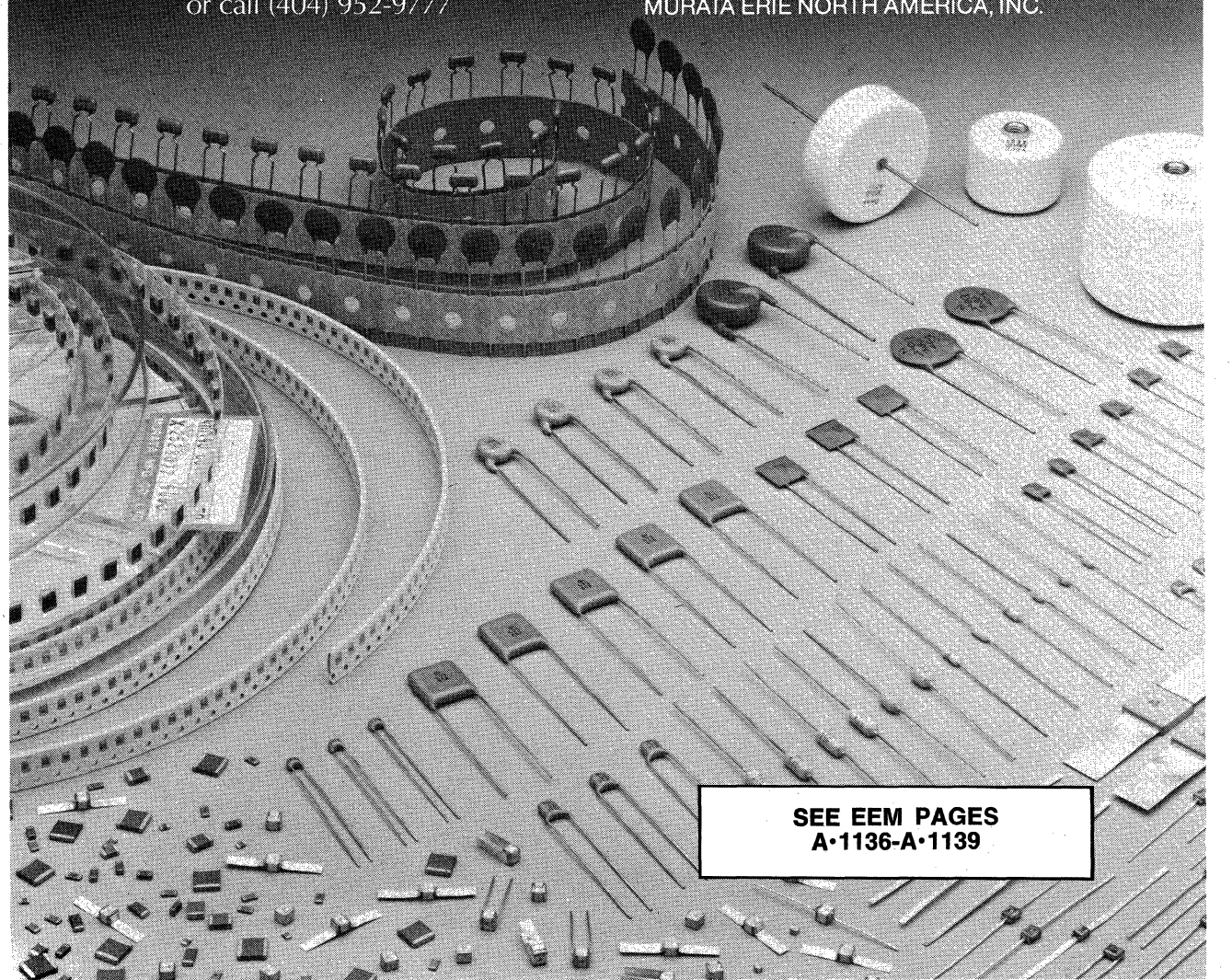

SEE EEM PAGES
A•1136-A•1139

CAPACITORS, FIXED, ELECTROSTATIC

FILM/FOIL (NONMETALLIZED)

Manufacturer	Polyester (Mylar)		Polystyrene		Polycarbonate		Polypropylene		Teflon	Paralene		Combinations
	Axial	Radial	Axial	Radial	Axial	Radial	Axial	Radial	Axial	Axial	Radial	
Capar Components	A•1013	A•1013					A•1013	A•1013				
Component Research			A•1014*		A•1014*		A•1014*		A•1014*			A•1014*
Dai-Ichi Shoji		A•1071		A•1071								
Electronic Concepts												
Elpac Components	A•1079	A•1079	A•1079	A•1079			A•1079	A•1079	A•1078			
Illinois Capacitor		A•1085										
Intl. Components	A•1086	A•1086						A•1086				
Inter-Technical/WIMA		A•1087				A•1087		A•1087				
ISL Products Intl.	A•1095	A•1095		A•1095		A•1095		A•1095				
Kemet/Union Carbide										A•1106*	A•1106*	
Mepco//Electra	A•1126	A•1126	A•1126	A•1126	A•1126		A•1126	A•1126				
Matsuo Electronics		A•1123										
NIC Components	A•1141	A•1141	A•1141									
Nytronics	A•1143		A•1146				A•1144					
PPD							A•1159					
TRW Capacitor	A•1182	A•1182	A•1185				A•1185					
Wesco Electrical	A•1198		A•1201				A•1203					

* Mil. Spec.

METALLIZED FILM

Manufacturer	Polyester (Mylar)		Polysulfone		Polycarbonate			Polypropylene			Teflon	Combinations
	Axial	Radial	Axial	Radial	Axial	Radial	Chip	Axial	Radial	AC Motor Run	Axial	
Capar Components	A•1013	A•1013										
Component Research					A•1014*			A•1014*			A•1014*	A•1014
Cornell-Dubilier	A•1067				A•1067			A•1067		A•1067		
Dai-Ichi Shoji	A•1071	A•1071										
Electronic Concepts					A•1074	A•1074	A•1077					
Elpac Components	A•1079	A•1079			A•1079	A•1079		A•1079	A•1079		A•1078	
IEI-Iskra Elctrns.	A•1081	A•1081										
Illinois Capacitor	A•1085	A•1085										
Intl. Components	A•1086	A•1086										
Inter-Technical/WIMA		A•1087				A•1087			A•1087			A•1087
ISL Products Intl.	A•1095	A•1095			A•1095			A•1095				
Kemet/Union Carbide					A•1106*							
KOA Speer		A•1108										
Mallory Capacitor										A•1114		
Matsuo		A•1123							A•1123			
Mepco//Electra	A•1126	A•1126			A•1126	A•1126			A•1126	A•1126		A•1126
NIC Components	A•1141	A•1141						A•1141	A•1141			
Nytronics	A•1153				A•1154			A•1147				
PPD	A•1158	A•1163						A•1160				
SFE					A•1171*							
TRW Capacitor		A•1179			A•1181	A•1181		A•1179				
Wesco Electrical	A•1199	A•1200			A•1201			A•1202				

* Mil. Spec.

CAPACITORS, FIXED, ELECTROSTATIC

CERAMIC

Manufacturer	General Purpose (Z5U)		Special Purpose (COG, X7R, NPO, etc.)				Monolithic					Feed Thru	High Voltage/ Power
								Encapsulated					
	Axial	Disc/ Radial	Axial	Disc/ Radial	DIP	Chip	Chip	Axial	Dipped Radial	Molded Radial	DIP		
AVX							A•1010	A•1011		A•1011	A•1010		
Capar Components		A•1013		A•1013					A•1013				
Concept									A•1065				
Corning Glass Works	A•1068	A•1068	A•1068	A•1068		A•1068	A•1068	A•1068	A•1068				
IEI-Iskra Elctrns.		A•1080		A•1080		A•1080						A•1080	
Illinois Capacitor		A•1085		A•1085									
Intl. Components		A•1086		A•1086									
ISL Products Intl.		A•1095		A•1095		A•1095			A•1095			A•1095	
Johanson Dielectrics							A•1104*						A•1104*
Kemet/Union Carbide							A•1106*	A•1106*	A•1106*	A•1106*			
Maida Development		A•1110		A•1110		A•1110							A•1109
Metuchen Capacitors							A•1134	A•1128	A•1129	A•1133*		A•1131	
Multi Products Intl.		A•1135		A•1135			A•1135						
Murata Erie		A•1137		A•1137			A•1136	A•1136					A•1138
NIC Components		A•1141		A•1141			A•1141		A•1141				
Republic Elctrns.							A•1167*	A•1167*	A•1167*	A•1167*			
SFE	A•1170*	A•1168*	A•1170*	A•1168*	A•1170*	A•1169*	A•1169*	A•1170*	A•1168*		A•1170*		
Stettner Electronics						A•1175	A•1175						
TDK							A•1176	A•1176	A•1176				
Tusonix		A•1190		A•1190					A•1187				

* Mil. Spec.

DOUBLE LAYER BATTERY/CAPACITOR

Manufacturer	DLC
Sohio	A•1172

CAPACITORS, FIXED, ELECTROSTATIC

MICA

Manufacturer	Stacked (Silvered Mica/Foil)				Reconstituted
	Dipped	Chip	Button	Transmitting	
Capar Comps.	A•1013				
CSI Capacitors				A•1070*	A•1070*
Murata Erie			A•1139*		

PAPER & PAPER/FILM

Manufacturer	Paper/Foil (Dry)			Paper/Foil (Impregnated)		Metallized Paper			Paper/Film (Axial)
	Axial	Single End	Herm. Sealed	Energy Storage	Motor Run	Axial	Single Ended	Herm. Sealed	
CSI Capacitors		A•1070*	A•1070*	A•1070*			A•1070*	A•1070*	
Inter-Technical/ WIMA							A•1087		
Marcon				A•1116	A•1116				
Nytronics	A•1152*	A•1152*	A•1152*	A•1152*					

GLASS, PORCELAIN, VACUUM, GAS-FILLED

Manufacturer	Glass		Porcelain			Gas-Filled	Vacuum
	Axial	Flat	Axial	Radial	Flat		
American Tech. Ceramics			A•1007*	A•1007*	A•1007*		
Corning Glass Works	A•1069	A•1069	A•1608	A•1608			
Jennings						A•1102	A•1102

* Mil. Spec.

CAPACITORS, VARIABLE, ELECTROSTATIC

CAPACITORS, VARIABLE

Manufacturer	Ceramic				Film	Mica	Air	Gas Filled	Vacuum	Sapphire	Glass
	Tubular		Disc								
	Piston	Other	Single	Multiple							
Jennings								A•1102	A•1102		
Johanson Mfg.	A•1105*	A•1105*	A•1105*	A•1105*			A•1105*				
Mepco//Electra	A•1126							A•1126			
Murata Erie			A•1139	A•1139			A•1139				
Sprague-Goodman	A•1173	A•1173	A•1173	A•1173	A•1173	A•1173	A•1173			A•1173	A•1173
Tusonix			A•1188	A•1188							

* Mil. Spec.

eem selection guide

capacitors-1500

CAPACITORS, FIXED, ELECTROLYTIC

ALUMINUM

Manufacturer	Subminiature Tubular				Standard Tubular				Small Can		Large Can Energy Storage	Plastic Case	AC Motor Start
	Axial Leads		Single End		Axial Leads		Single End		Single	Multi-			
	Polar	Non-Pol.	Polar	Non-Pol.	Polar	Non-Pol.	Polar	Non-Pol.	Section	Section	Cmptr. Grd.		
Capacitor Technology									A•1012		A•1012		
Capar Components	A•1013	A•1013	A•1013	A•1013	A•1013	A•1013	A•1013	A•1013	A•1013				
Concept	A•1064	A•1064	A•1064	A•1064			A•1064	A•1064	A•1064		A•1064		
Dai-Ichi Shoji	A•1071	A•1071	A•1071	A•1071	A•1071	A•1071	A•1071	A•1071					
Illinois Capacitor	A•1084	A•1084	A•1084	A•1084	A•1084	A•1084	A•1084	A•1084					
Intl. Components	A.1086	A•1086	A•1086	A•1086	A•1086	A•1086	A•1086	A•1086	A•1086				
ISL Products Intl.	A•1094	A•1094	A•1094	A•1094	A•1094	A•1094	A•1094	A•1094	A•1094		A•1094		
ITT Components	A•1096	A•1101	A•1096	A•1101			A•1099		A•1099		A•1100		
KOA Speer	A•1108	A•1108	A•1108	A•1108	A•1108	A•1108	A•1108	A•1108					
Mallory Capacitor	A•1114	A•1114	A•1114	A•1114	A•1114	A•1114	A•114	A.1114	A•1114	A•1114	A•1114	A•1114	A•1114
Marcon	A•1116	A•1116	A•1116	A•1116	A•1116	A•1116	A•1116	A•1116	A•1116		A•1116		
Mepco//Electra	A•1125	A•1125	A•1125	A•1125	A•1125	A•1125	A•1125	A•1125	A•1125		A•1125		A•1125
NIC Components	A•1140	A•1140	A•1140	A•1140	A•1140	A•1140	A•1140	A•1140	A•1140				
United Chemi-Con	A•1195	A•1195	A•1195	A•1195	A•1195	A•1195	A•1195	A•1195	A•1195	A•1195	A•1195		

TANTALUM

Manufacturer	Solid Electrolyte						Wet-Slug		Foil	
	Dipped Radial	Axial	Molded Radial	DIP	Chip	Metal Case	Tubular Case	Large Case	Polar	Non-Pol.
Capar Components	A•1013									
Corning Glass Works	A•1069		A•1069	A•1069	A•1069					
Dai-Ichi Shoji	A•1071									
Intl. Components	A•1086									
ISL Products Intl.	A•1095									
ITT Components	A•1097	A•1098								
Kemet/Union Carbide	A•1106*	A•1106*	A•1106*	A•1106*	A•1106*	A•1106*				
Mallory Capacitor	A•1114	A•1114	A•1114	A•1114		A•1114	A•1114	A•1114		
Marcon		A•1116	A•1116		A•1116					
Matsuo	A•1118		A•1121		A•1120					
Mepco//Electra	A•1124	A•1124	A•1124	A•1124	A•1124	A•1124	A•1124		A•1124	A•1124
NIC Components	A•1140				A•1140	A•1140				

* Mil. Spec.

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ATC UHF/MICROWAVE CHIP CAPACITORS

American Technical Ceramics, the recognized leader in RF capacitor technology, offers a product line of outstanding quality and reliability to meet the most demanding requirements of the design engineer.

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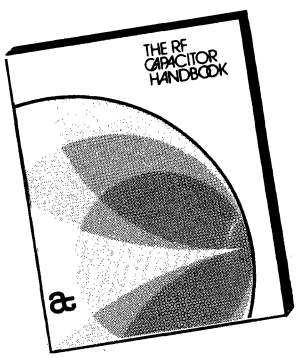
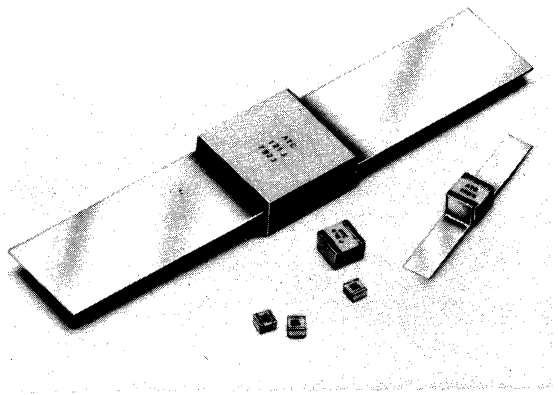
The severe thermal shock to which capacitors are subjected by direct soldering during circuit assembly can destroy the integrity of conventional capacitors, permitting flux and solvents to penetrate the dielectric. ATC porcelain capacitors have outstanding reliability and ultra-stable performance due to their hermetic, self-encapsulated porcelain construction. Rare metal internal electrodes are molecularly bonded and sealed in a monolith of non-porous porcelain, providing a rugged and hermetic structure that is not degraded by the circuit assembly process. ATC's design of the chip capacitor internal structure has resulted in the most reliable porcelain capacitors available proven by extensive testing programs of approximately 2 million component hours per month.



The ATC UNI-TERM® Termination (Gold over Nickel over Silver) is now standard on all chips and the ATC BARRIER/CAP® Termination is now standard on all pellets (pre-tinned capacitors). The terminations remain intact under the most severe thermal shock, and are not dissolved away even by the most careless soldering. They easily withstand a 5-minute submersion in 260°C solder pot without leaching, while retaining complete solderability. Migration is virtually eliminated and a bond strength greater than 30 lbs. is typical for "B" Case capacitors (110 mils square) with nail head leads.



Laser Marking is available on ATC capacitors for quick and complete identification of capacity value and tolerance. This highly legible and permanent marking results in no degradation of performance or reliability and is impervious to all cleaning solvents.

The RF Capacitor Handbook presents over 190 pages of comprehensive detail design considerations and uses for miniature chip and leaded RF capacitors. You'll find theoretical and empirical high-frequency circuit design equations, especially at high RF power levels and frequencies, actual test data at frequencies from 100 MHz to 3 GHz, and practical design methods for increasing gain and power, DC to RF conversion efficiency, bandwidth, transistor lifetime, circuit MTBF, and low-noise performance. Request a copy from your representative or direct from ATC.

MILITARY PRODUCTS

American Technical Ceramics is QPL Listed for UHF/Microwave Capacitors in MIL-C-11272/16, /17 and /18 since May 25, 1973, and for established reliability UHF/Microwave Capacitors in MIL-C-55681/4 and /5 since August 3, 1977.

For MIL-C-11272/16, /17 and /18, the QPL List includes styles CY81 through CY89 (ATC 100 Series).

For MIL-C-55681/4 and /5, the QPL List includes BG (90 ±20 PPM/°C) characteristic (ATC 100 Series), and BP (0 ±30 PPM/°C) characteristic (ATC 700 Series). Styles CDR 11, 12, 13, 14, and 21 through 25 are available in both the above characteristics.

For MIL-C-55681/4 and /5, the QPL List includes the following terminations:

M — Palladium Silver (CDR 11, CDR 13)

*N — Gold over Nickel over Silver (ATC's UNI-TERM® Termination), (CDR 11, CDR 13)

S — Solder Coated, Final (CDR 12, CDR 14, CDR 23, CDR 25)

T — Silver (CDR 21, CDR 22, CDR 24)

*U — Solder Coated, Nickel Barrier (ATC's BARRIER/CAP® Termination) (CDR 12, CDR 14)

*"N" and "U" are preferred terminations for best solderability, thermocompression bonding, leach and migration resistance, and shelf life for chips and pellets.

ATC has complete Government approved Hi-Rel testing facilities as well as RF production testing capability through 18 GHz.

ATC's Military Product Manual includes a correlation between ATC sizes and lead styles and MIL-C-11272 and MIL-C-55681 sizes and styles.

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american technical ceramics CORP.

ATC UHF/MICROWAVE CHIP CAPACITORS

ATC 100 HIGH Q SUPERCHIPS™

UHF/MICROWAVE PORCELAIN CAPACITORS

Ultra High Q even at high ambient temperatures and at extremely high currents. High power operation through microwave frequencies. Extremely low ESR and high dielectric strength.

High self-resonant frequencies.

Low noise figure in receiving systems due to low ESR.

Ultra stable performance assured by hermetic, self-encapsulating porcelain construction.

Capacitance Range:
- Case A-0.1 pF to 100 pF to 50 WVDC, standard values per RETMA 5% Table
- Case B-0.1 pF to 1000 pF to 500 WVDC, standard values per RETMA 5% Table

IR: 10^6 Megohms Min. @ 25°C, 10^5 Megohms Min. @ 125°C up to and including 470 pF;
10^5 Megohms Min. @ 25°C, 10^4 Megohms Min. @ 125°C, 510 to 1000 pF.

Available in Case A and B Chips, Pellets and Case B Leaded Styles.

QPL Approved, MIL-C-11272, MIL-C-55681.

ATC 175

ULTRA HIGH Q PORCELAIN CAPACITORS

Q is typically four times higher than ATC 100 at Microwave frequencies.

Capacitance Range:
- 1.0 pF to 100 pF to 500 WVDC, standard values per RETMA 5% Table.

IR: 10^6 Megohms Min. @ 25°C, 10^5 Megohms Min. @ 175°C at rated voltage.

Available in Case B Pellets and Microstrip (MS) leaded.

ATC 200

HIGH CAPACITY CERAMIC CAPACITORS

High packaging density, stable high K chip capacitors for coupling and bypass applications.

Capacitance Range:
- Case A, 510 pF to 0.01 MF, 50 WVDC, standard values per RETMA 10% Table.
- Case B, 0.005 MF to 0.1 MF, 50 WVDC, standard values per RETMA 10% Table.

IR: 10^4 Megohms Min.

Available in Case A and B Chips, Pellets and Case B Leaded Styles.

DWV: 300% of working voltage.

ATC 700

TEMPERATURE STABLE CERAMIC CAPACITORS

Ultra-stable NPO's with RF characterization.

Capacitance Range:
- Case A, 0.1 pF to 1000 pF, 50 WVDC, standard values per RETMA 5% Table.
- Case B, 0.1 pF to 5100 pF to 500 WVDC, standard values per RETMA 5% Table.

IR: 10^6 Megohms Min. up to 470 pF;
10^5 Megohms Min. above 470 pF @ 25°C; one-tenth these values @ 125°C.

Available in Case A and B Chips, Pellets and Case B Leaded Styles.

QPL Approved, MIL-C-55681

Operating Temperature Range for all Series is −55°C to +125°C.

CALL FOR COMPLETE ATC PRODUCT CATALOG AND PERFORMANCE DATA • (516) 271-9600

ATC 111 Millimeter Wavelength Microcaps®

GENERAL SPECIFICATIONS FOR ALL STYLES

ELECTRICAL CHARACTERISTICS

OPERATING FREQUENCY: Up to 50 GHz.

CAPACITANCE VALUES: 0.1 to 1800 pF, 100 WVDC, standard values per RETMA 10% Table.

STANDARD MEASUREMENT FREQUENCY: 1 MHz for 0.1 to 100 pF; 1 KHz for values greater than 100 pF.

IR: 10^{11} Ohms Min. at 25°C and rated voltage for all dielectrics except CB; 10^9 Ohms Min. at 25°C and rated voltage for CB dielectric. The IR is 1/10 of 25°C value at 125°C and rated voltage.

MECHANICAL CHARACTERISTICS

HERMETICITY: The dielectric is virtually unaffected by moisture and commonly used cleaning solvents.

BODY DIMENSIONS

Case Size	S	T	U	X	Y	Z
W = L (Nom.)	.018 (.459)	.025 (.637)	.035 (.889)	.050 (1.27)	.070 (1.78)	.090 (2.29)

1. H is .005 (.127) to .011 (.279); H depends upon actual capacity value.
2. All dimensions are in inches except those in parentheses, which are in mm.

TERMINATION STYLES

	TERM. SUFFIX	MATERIAL
STANDARD	AP *	Platinum Gold (Thick Film)
	AC *	Gold Over Chromium (Thin Film)
SPECIAL	SP	Platinum Silver (Thick Film)
	AN	Gold Over Nickel (Thin Film)
	HT	Gold Over Base Metals (Thin Film)

* Preferred

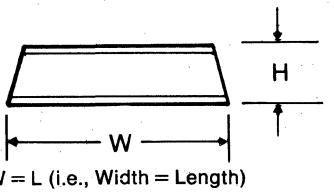
RUGGED CONSTRUCTION to minimize handling problems and circuit assembly problems. Impervious to static discharge failures.

BOND STRENGTH: Exceeds MIL-STD-883 Method 2011.2 for wire bondability of all terminations and method 2019.1 for die shear strength.

ENVIRONMENTAL CHARACTERISTICS

OPERATING TEMPERATURE RANGE: −55°C to +125°C.

ATC Microcaps™ are designed and manufactured to meet or exceed the requirements of MIL-C-55681 and MIL-C-11272. These include Hi-Rel tests in accordance with MIL-STD-202.



W = L (i.e., Width = Length)

RECOMMENDED BONDING TECHNIQUES

- Thermocompression, ultrasonic and thermosonic gold wire and aluminum silicon wire bonding are applicable with all termination materials.
- Lead/tin soldering is recommended for AP and SP.
- High temperature, gold content solders are recommended for HT. Gold-germanium, gold-silicon, and gold-tin solders are primarily used.
- Conductive epoxy can be used with all termination materials.

NOTE: ATC Microcaps® are now available in a variety of leaded styles. Request latest catalog.

MECHANICAL CONFIGURATIONS: CASE SIZES A & B

Case Size & Type	ATC Term. Code	ATC Series	QPL MIL-C-11272C	QPL MIL-C-55681	Outlines	Body Dimensions Length (L)	Width (W)	Thickness (T)	Lead and Termination Dimensions and Materials Length (L)	Width (W)	Thickness (T)
A Chip	CA	100	CY81*	CDR11 BG	W/T IS A TERMINATION SURFACE	.055 ±.010 (1.4 ±.25)		.055 (1.4) max.	Uni-Term® Gold over Nickel over Silver (CA)		
		700	—	CDR11 BP							
B Chip	CA	100	CY83*	CDR13 BG		.110 ±.015 (2.79 ±.38)		.100 (2.54) max.			
		700	—	CDR13 BP							
	C	175	—						Palladium Silver (C) 175 ONLY		
A Pellet	P	100	CY82	CDR12 BG	W/T IS A TERMINATION SURFACE	Same as chip plus twice solder build-up: Solder build-up for size A is: .003 (.076) typ. Solder build-up for size B is: .005 (.127) typ.			barrierCap® Pellets are solder-coated chips with a nickel barrier over the termination. Solder melting temperature is 372°F, 179°C.		
		700	—	CDR12 BP							
B Pellet	P	100	CY84	CDR14 BG							
		700	—	CDR14 BP							
		175	—								
B Microstrip	MS	100	CY85	CDR21 BG		.120 (3.05) min.	.110 ±.015 (2.79 ±.38)	.100 (2.54) max.	.250 (6.35) min.	.093 ±.005 (2.36 ±.13)	.004 ±.001 (.102 ±.025)
		700	—	CDR21 BP							
		175	—								
B Axial Ribbon	AR	100	CY86	CDR22 BG		.150 (3.81) max.					
		700	—	CDR22 BP							
B Radial Ribbon	RR	100	CY88	CDR24 BG							
		700	—	CDR24 BP							
B Narrow Axial Ribbon	NAR	100	—			.120 (3.05) min.	.110 ±.015 (2.79 ±.38)	.100 (2.54) max.	.250 (6.35) min.	.050 ±.005 (1.27 ±.13)	.006 ±.003 (.15 ±.08)
		700									
B Narrow Microstrip	NMS	100	—								
		700									
B Vertical Narrow MS	** VNMS	100	—			.155 (3.94) max.					
B Radial Wire	RW	100	CY87	CDR23 BG		.120 (3.05) min.	.110 ±.015 (2.79 ±.38)	.100 (2.54) max.	.500 (12.7) min.	#26 AWG., .016 (.375) dia. nominal.	
		700	—	CDR23 BP							
B Axial Wire	AW	100	CY89	CDR25 BG		.165 (4.19) max.					
		700	—	CDR25 BP							

Note: Mechanical configurations for the ATC200 Series are the same as those for ATC100 Series, except for VNMS which is not offered in the 200 Series.

All dimensions are in inches except those in parentheses which are in millimeters.

* CY81 and CY83 are Palladium Silver terminated Chips per MIL-C-11272 requirements.

** VNMS improves the resonant frequency performance over that of the standard Microstrip. The first important parallel resonance is approximately twice as high in frequency as with "flat" mounting (NMS). Note that in this configuration, the marking is now on a vertical surface. For details, contact factory.

All leads are high purity silver and are attached with high temperature solder.

LASER MARKED CAPACITORS with manufacturer's indentification, capacity and tolerance code are available for any case size (including chips and pellets). To order, add suffix (X) to code.

Special parts for NMR are also available.

ATC has made every effort to have this information as accurate as possible. However, no responsibility is assumed by ATC for its use, nor for any infringements of rights of third parties which may result from its use. ATC reserves the right to revise the content or modify its product line without prior notice.

ATC PART NUMBER CODE:

ATC 100 B 910 F AW 500 X

- 100 — Series
- B — Case Size
- 910 — Capacitance
  - Indicates number of zeros following digits of capacitance in picofarads
- F — Capacitance Tolerances
- AW — Term. Code
- 500 — WVDC
- X — Laser Marking

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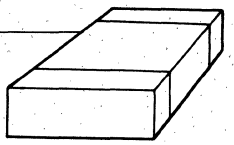
AVX

MLC Chips



Dimensions: Inches

SIZE	0805	1206	1210	1812	1825
Length	.080 ± .010	.120 ± .010	.125 ± .010	.175 ± .010	.185 ± .010
Width	.050 ± .010	.060 ± .010	.095 ± .010	.125 ± .010	.250 ± .010
Thickness	.050	.050	.050	.050	.050
Terminal	.020 ± .010	.020 ± .010	.025 ± .010	.025 ± .010	.025 ± .010

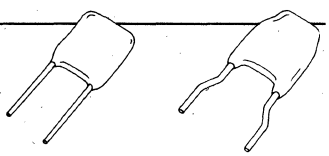
Capacitance Range pf or mfd if 10,000 pf or greater

NPO	100	1.0-680	10-1500	82-3300	390-6800	1800-8200
	50	1.0-1500	10-3300	82-5600	390-.010	1800-.027
X7R	100	100-.022	2700-.056	2700-.10	.010-.18	.033-.10
	50	100-.033	2700-.10	2700-.22	.010-.27	.033-1.0
Z5U	100	2700-6800	6800-.018	.018-.039	.033-.082	.10-.22
	50	2700-.022	6800-.033	.018-.12	.033-.22	.10-.47
	25	2700-.047	6800-.12	.018-.22	.033-.47	.10-1.0

NOTE: For 0504, 1005, 0907, 1505, 1805, 1808, 2321, 2224, contact the factory.

SkyCap

AVX SR Series
Conformally Coated Radial Leaded MLC



Size and Capacitance Specifications
EIA Characteristic

Dimensions: Inches

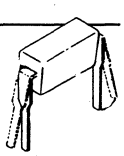
AVX	SR15	SR20	SR21	SR26	SR27	SR30	SR40	SR50
Width	.150	.200	.200	.260	.260	.300	.400	.500
Height	.150	.200	.200	.200	.250	.300	.400	.500
Thickness	.100	.125	.125	.150	.160	.150	.150	.200
Lead Spacing	.100	.100	.200	.250	.300	.200	.200	.400
Lead Diameter	.020	.020	.020	.020	.020	.020	.020	.025

Capacitance Range pf or mfd if 10,000 pf or greater

EIA TC	WVDC	SR15	SR20	SR21	SR26	SR27	SR30	SR40	SR50
NPO	100	10-330	390-2200	10-2200	1000-2200	1000-2200	3300-.015	.015-.030	.010-.068
	50	10-470	470-4700	1000-4700	1000-4700	1000-4700	6800-.022		.010-.10
X7R	100	470-4700	6800-4700	1000-.047	1000-.047	1000-.047	.15	.22-.47	.33-.47
	50	470-.015	.022-.10	1000-.10	1000-.10	1000-.10	.15-.47	1.0	1.0-2.2
Z5U	100	.010	.047-.10	1000-.10	1000-.10	1000-.10	.015-.47	.68-1.0	1.0-2.2
	50	.010	.047-.33	1000-.33	1000-.33	1000-.33	.15-1.0	1.0-2.2	1.0-4.7

DipGuard

AVX MD Series
Molded dual-in-line MLC



Size Specifications

AVX	MD01	MD02
Length	.260	.260
Height	.135 max	.165 max
Height	.165 max	.195 max
Thickness	1098 max	.098 max

Capacitance Range pf or mfd if 10,000 pf or greater

EIA/TC	WVDC		
NPO	100	10-3900	4700
	50	10-4700	4700-.010
X7R	100	220-.010	—
	50	.015-.10	15-.22
Z5U	100	—	—
	50	.010-.22	.33-.47

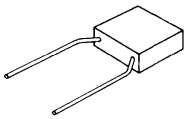
Where to Order:

AVX Corporation, Myrtle Beach, SC 29577 Tel: (803) 448-9411 TWX: 810-661-2252
AVX Corporation, Conway, SC 29526 Tel: (803) 293-4404
AVX Corporation, Olean, NY 14760 Tel: (716) 372-6611 TWX: 510-245-2815
AVX Limited, Aldershot, England Tel: (0252) 312131 Telex: 858473
AVX K.K. Tokyo, Japan Tel: 03-490-6501 Telex: ACXTYO 246 8091
AVX Asia Limited, Hong Kong Tel: 3-689-171-5 Telex: 49576 AVX AS HX

AVX

Molded Radials

AVX MR Series
Molded Radial Lead Capacitors



Dimensions: Inches

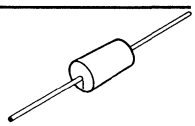
AVX	MR04	MR05	MR06	MR07	MR08
Length	.190	.190	.290	.490	.490
Width	.190	.190	.290	.490	.490
Thickness	.090	.090	.090	.140	.240
Lead Spacing	.100	.200	.200	.400	.400
Lead Diameter	.025	.025	.025	.025	.025

Tolerances ±.254 mm (±.010"). Lead diameter ±.05 mm (±.002")
Capacitance Range — pf or mfd if 10,000 pf or greater

NPO	200 100 150	1-820 1-3300 1-5600	1-1200 1-4700 1-8200	1-3900 5600-.015 .010-.18	2200-.015 2200-.068 2200-.10	3900-.027 3900-.12 3900-.18
X7R	200 100 50	100-.015 100-.027 100-.12	100-.015 100-.056 100-.120	.018-.039 .068-.015 .015-1.0	6800-.18 6800-.47 6800-2.2	.015-.33 .015-1.2 .015-4.7
Z5U	100 50	.010-.15 .010-.39	.010-.22 .010-.39	.27-.68 .47-1.0	.15-2.7 .15-4.7	.33-4.7 .33-10.0

Molded Axials

AVX MA Series
Molded Axial Leaded MLC



Dimensions: Inches

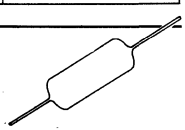
AVX	MA10	MA20	MA30	MA40	MA50	MA60
Length	.160±.010	.250±.010	.240±.010	.390±.010	.500±.020	.690±.020
Diameter	.090±.010	.090±.010	.130±.010	.140±.010	.250±.015	.350±.015
Lead Diameter	.019±.002	.019±.002	.019±.002	.025±.002	.025±.002	.025±.002

Capacitance Range pf or mfd if 10,000 pf or greater

		MA10	MA20	MA30	MA40	MA50	MA60
NPO	200 100 50	1.0-220 150-820 1000	270-390 470-1500 1800	470-1200 1500-4700 5600	1500-2200 2700-6800 8200-.012	2700-8200 8200-3300 .027-.10	.010-.033 .039-.10 .068-.15
X7R	200 100 50	200-1200 1500-6800 8200-.022	1500-2700 3300-.018 .022-.056	3300-6800 8200-.047 .056-.10	8200-.022 .027-.10 .120-.27	.027-.068 .082-.33 .33-1.0	.082-.33 .39-1.0 1.2-3.3
Z5U	100 50	1000-.022 100-.10	.015-.047 .056-.10	.010-.082 .047-.22	.082-.22 .27-1.0	.22-.68 .82-2.2	.82-2.7 2.7-8.2

SpinGuard

AVX SA Series — Conformally Coated Axial
Leaded MLC



AVX	SA10	SA20	SA30	SA40
(L)	.170	.260	.290	.400
Diameter	.100	.100	.150	.150
Lead Diameter	.019	.019	.019	.019

Capacitance Range pf or mfd if 10,000 pf or greater

	WVDC	SA10	SA20	SA30	SA40
NPO	200 100 50	10-120 150-820 1000	— 1000-1500 1800	— 1800-3900 4700	— 4700-6800 8200-.010
X7R	200 100 50	220-470 560-6800 8200-.022	— 8200-.018 .027-.047	— .022-.047 .056-.10	— .056-.10 .12-.27
Z5U	100 50	.010-.022 .010-.10	.033-.047 .10	.068-.10 .15-.33	.150-.22 .47-1.0

AVX Part Numbering System/How to Order

AVX Leaded MLCs: Example: SR205A561FAA

SR20	5	A	561	F	A	A
AVX Style SR_ _ = Dipped Radials MR_ _ = Molded Radials MA_ _ = Molded Axials MD_ _ = 2-Pin Dips	**Voltage** 5 = 50V 1 = 100V 6 = 200V	**Temperature Coefficient** A = NPO	**Capacitance Code** (Example) 561 = 560 pf 56 = sig. figures of cap. 1 = addit. no of zeros	**Capacitance Tolerance** C = ±.25 pf D = ±.5 pf E = ±.5% F = ±1% G = ±2%	**Failure Rate** A = Standard	**Leads** A = Standard T = Trimmed

AVX Chip MLC: Example: 08055A101FA1050R

0805	5	A	101	F	A	1	050	R
Chip Size (L" x W") 0805 0504	**Voltage** 50V = 5 100V = 1 200V = 6	**Dielectric** NPO = A	**Capacitance Code** (2 significant digits + no. of zeros)	**Capacitance Tolerance** D = ±.5 pf F = ±1% G = ±2%	**Failure Rate** A = Standard	**Terminations** 1 = Palladium / Silver 2 = Solder 3 = Silver 4 = Nickel / Tin	**Thickness** Max thickness in mils	**Packaging** R = Reel B = Bulk

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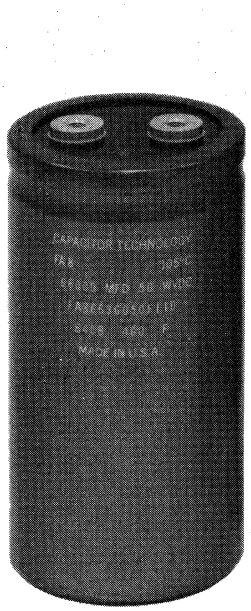
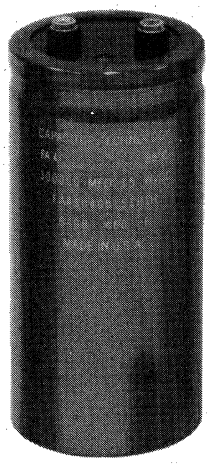
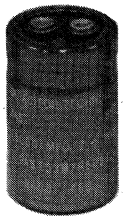

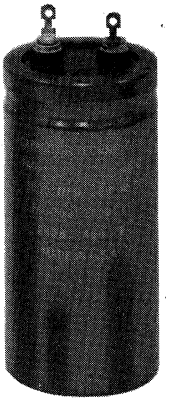

COMPUTER GRADE ALUMINUM ELECTROLYTIC CAPACITORS

PRODUCT DATA

TYPE FA0
GRADE: Standard computer
CAPACITANCE: 1 farad-170mfd
WVDC: 5-500
MIN. ESR, OHMS: .0057
TEMPERATURE °C: −40 to +85°C
LIFE TEST: 1000hrs +85°C

TYPE FA2
GRADE: Miniaturized premium computer
CAPACITANCE: 670,000-500mfd
WVDC: 7.5-250
MIN. ESR, OHMS: .0031
TEMPERATURE °C: −40 to +85°C
LIFE TEST: 3000hrs +85°C

TYPE FA3
GRADE: Miniaturized computer
CAPACITANCE: 880,000-200mfd
WVDC: 7.5-450
MIN. ESR, OHMS: .006
TEMPERATURE °C: −40 to +85°C
LIFE TEST: 1000 +85°C

TYPE FA4
GRADE: Miniaturized long life computer
CAPACITANCE: 800,000-180mfd
WVDC: 7.5-250
MIN. ESR, OHMS: .0056
TEMPERATURE °C: −40 to +85°C
LIFE TEST: 2000hrs +85°C

TYPE FA5
GRADE: Output switcher computer
CAPACITANCE: 67,000-2800mfd
WVDC: 5-55
MIN. ESR, OHMS: 20KHz
TEMPERATURE °C: −55 to +85°C
LIFE TEST: 1000hrs +85°C

TYPE FA6
GRADE: Long life computer
CAPACITANCE: 620,000-5600mfd
WVDC: 7.5-250
MIN. ESR, OHMS: .0056
TEMPERATURE °C: −40 to +85°C
LIFE TEST: 2000hrs +85°C

TYPE FA7
GRADE: Premium computer
CAPACITANCE: 650,000-25000mfd
WVDC: 7.5-150
MIN. ESR, OHMS: .0065
TEMPERATURE °C: −55 to +85°C
LIFE TEST: 3000hrs +85°C

TYPE FA8
GRADE: Extended temperature computer
CAPACITANCE: 430,000-4200mfd
WVDC: 7.5-250
MIN. ESR, OHMS: .0031
TEMPERATURE °C: −55 to +85°C
LIFE TEST: 1000hrs +105°C
3000hrs +85°C

TYPE FA9
GRADE: Premium input switcher
CAPACITANCE: 7400-260mfd
WVDC: 200-250
MIN. ESR, OHMS: .020
TEMPERATURE °C: −40 to +85°C
LIFE TEST: 3000hrs +85°C

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We've always been big in capacitors, diodes and resistors... Now we're big in a lot of new little ways

New
Subminiature 63 Volt Polyester Film Capacitors

Case size: down to 5 X 7.5 mm
Capacitance Range: .001 to .22 µf
Type: CEM

Call for literature.

New
Subminature Metalized Polyester Box Type

Case size: down to 7.2 X 6.5 mm
Capacitance range: .0047 to .47 µf
Voltage range: 63, 100 WVDC
Type: CUB

Call for literature.

New
Miniature Aluminum Axial and Radial leaded

General purpose Types, first with −10% +20% tolerances for cost-effective standardization.
Types: CAE (axial), CRE (radial)

Call for literature.

New
Super Sub-miniature radial leaded aluminum

Case size: down to 4 X 7 mm
Capacitance range: .1 to 3300 µf
Voltage range: 6.3 to 50 WVDC
Type: CRES

Call for literature.

New
Chip packaged Mica Capacitors

High temperature: 125°C
High stability: −0 +50 PPM/°C Typ.
Capacitance range: 1PF to 2000PF
Voltage: 100, 500 WVDC
High Q, Tolerances: down to .25%, 5% standard
Type: UC

Call for literature.

New
Printed Filters

Mica dielectric, high stability, size efficient, cost efficient.
High pass
Band Pass
FM, CATV, mobile radio, satellite TV, special applications
Conformally coated or chip packaging.
Type: Printed Filters

Call for literature.

New
Stacked Film Mica Capacitors

150°/C operating temperature
200 PPM/° C stability
Capacitance range: 470 PF to 68,000 PF.
Voltage range: 250, 630, 1000 WVDC
Type: SE

New
Bridge Rectifier Assemblies

1 amp through 35 amp
All case styles and lead configurations, DIP up to 1.125 square.

Call for literature.

New
Shottky Barrier Rectifiers

1 amp, 3 amp ratings
20, 30, 40 volts
Low coat
Low leakage
Type: IN5817 to IN5820

Call for literature.

New
Low Cost Precision Film Resistors

Metal fim construction
High stability, excellent TC
Low Noise
2%, 5% Tolerance
EIA Decade Values
Type: CFR

Call for literature.

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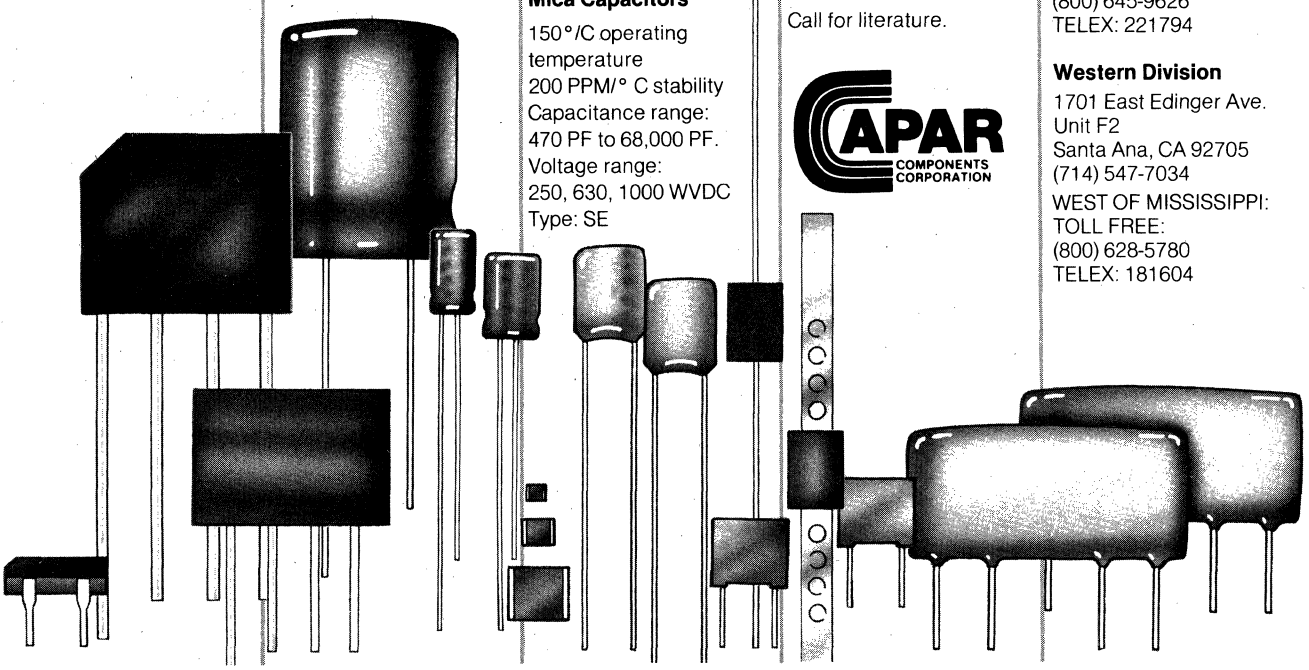

CRC COMPONENT RESEARCH CO.

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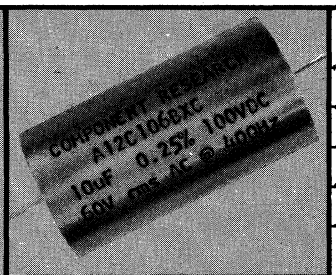
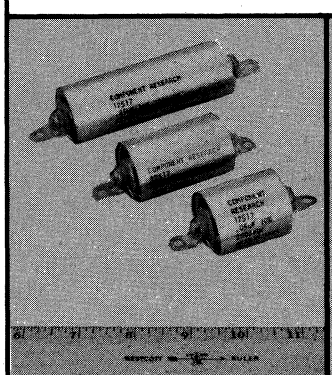
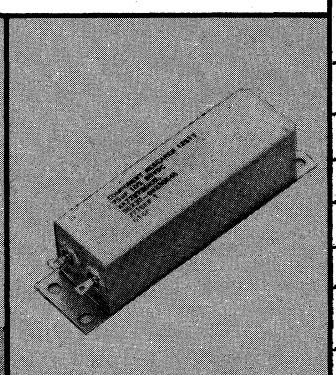
CRITICAL PROGRAMS QUALIFICATION



TRIDENT	MARK 46
LANCE MISSILE	MARK 48
F15 AIRCRAFT	SPARROW
F18 AIRCRAFT	NEARTIP
SPACE SHUTTLE	NOMI I
ROLAND	HARPOON
AND MANY OTHERS	

CRC hermetically sealed plastic film capacitors are acknowledged world wide as the highest quality. Standard tubular metallized polycarbonate capacitor, AC rated to 40 KHz and qualified to MIL-C-83421/01 is shown above.





UPPER LEFT Type 55 foil polypropylene capacitors are used in power resonating applications up to 160KHz and with fast switching, high peak current devices. A typical 10uF capacitor measuring 1.25" diameter x 3.375" length can handle up to 50A rms under continuous duty operation. Its ESR at 100KHz is approximately 0.0016 ohms which is typical of the low loss inherent in these capacitors.

UPPER RIGHT This 75uF, 50VDC, metallized polycarbonate capacitor is 1" square by 3¾" long and is rated at 10A rms at 25KHz at 100°C. Each capacitor receives 168 hours of AC voltage at 25KHz to produce 10A rms in combination with 50VDC applied during burn-in at 100°C.

TYPE A12 & K12

DIELECTRIC: Metallized Polycarbonate

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 30-400 VDC

A.C. RATING: 22 to 240 VRMS @ 400Hz, AC ratings to 40KHz

OPERATING TEMPERATURE: −65°C to +125° (Derate 50% from 100°C to 125°C)

CAPACITANCE RANGE: .001 to 27uF, .1% to 10% tolerances

INSULATION RESISTANCE: 300,000 meg-uF (100,000 meg-uF for K12 @ 25°C)

DISSIPATION FACTOR: .15% max. @ 1KHz

DIELECTRIC ABSORPTION: .1% maximum

SCREENING: 100% Quality conformance inspection. Qualified to Failure Rate "S" of MIL-C-83421/01.

APPLICATIONS: Timing, filter and feed-back circuits, pulse-forming networks. A12 and K12 capacitors are used extensively in the Space Shuttle Program.

TYPE G12

DIELECTRIC: Miniaturized Metallized Polycarbonate

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 30-200VDC

A.C. RATING: 22 to 120 VRMS @ 400Hz, AC ratings to 40KHz

OPERATING TEMPERATURE: −65°C to +125°C (Derate 50% from 100°C to 125°C)

CAPACITANCE RANGE: .001 to 10uF, .1% to 10% tolerances

INSULATION RESISTANCE: 100,000 meg-uF @ 25°C

DISSIPATION FACTOR: .15% max. @ 1KHz

DIELECTRIC ABSORPTION: .1% maximum

SCREENING: 100% Quality conformance inspection per applicable paragraphs of MIL-C-83421.

APPLICATIONS: Timing, filter, feed-back circuits, and pulse-forming networks. Used where small size is critical. G12 capacitors are used in numerous Navy missile and torpedo projects.

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TYPE J11 & K11

DIELECTRIC: Metallized Teflon

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 50-200VDC

OPERATING TEMPERATURE: −65°C to +125°C

CAPACITANCE RANGE: .001 to 2uF, .1% to 10% tolerances

INSULATION RESISTANCE: 1,000,000 meg-uF

DISSIPATION FACTOR: .05% max. @ 1KHz

DIELECTRIC ABSORPTION: .01% maximum

SCREENING: 100% Quality conformance inspection per applicable paragraphs of MIL-C-83421. Will meet all environmental requirements of MIL-C-83421 except vibration at 20 g's and shock at 50 g's.

APPLICATIONS: Timing, sample and hold, integrating and tuning circuits. J11 and K11 are used in critical space, military applications which require lowest dielectric absorption and highest insulation resistance and low dielectric loss.

TYPE A52

DIELECTRIC: Foil Polycarbonate

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 100-400VDC

A.C. RATING: 60 to 240 VRMS @ 40KHz

OPERATING TEMPERATURE: −65°C to +125°C (Derate 50% from 100°C to 125°C)

CAPACITANCE RANGE: .001 to .47uF, 1% to 10% tolerances

INSULATION RESISTANCE: 100,000 meg-uF

DISSIPATION FACTOR: .1% max. @ 10KHz

DIELECTRIC ABSORPTION: .2% maximum

SCREENING: 100% Quality conformance inspection with 400Hz burn-in.

APPLICATIONS: Snubber, high current pulse applications. **A52** capacitors are used in the F18 aircraft.

TYPE A91

DIELECTRIC: Foil Teflon

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 50-400VDC

A.C. RATING: 36 to 240 VRMS @ 400Hz, AC ratings to 40KHz

OPERATING TEMPERATURE: −65°C to +150°C

CAPACITANCE RANGE: .001 to 1.2uF, 1% to 10% tolerances

INSULATION RESISTANCE: 1,000,000 meg-UF

DISSIPATION FACTOR: .02% max. @ 1KHz

DIELECTRIC ABSORPTION: .01% maximum

SCREENING: 100% Quality conformance inspection per applicable paragraphs of MIL-C-83421. Will meet all environmental requirements of MIL-C-83421 except vibration at 20 g's and shock at 60 g's.

APPLICATIONS: Pulse-forming networks, timing, sample and hold, integration and tuning circuits. A91 is used in hi-rel programs which require a rugged low loss capacitor with high insulation resistance and low dielectric absorption.

TYPE B55

DIELECTRIC: Foil Polypropylene

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 600 & 800VDC

A.C. RATING: 400 & 600 VRMS @ 400Hz, high current ratings to 40KHz, low E.S.R.

OPERATING TEMPERATURE: −55°C to +85°C

CAPACITANCE RANGE: .033 to .82uF

INSULATION RESISTANCE: 100,000 meg-uF

DISSIPATION FACTOR: .05% @ 10KHz

SCREENING: 100% Quality conformance inspection with 400Hz burn-in.

APPLICATIONS: Snubber circuits, switching power supplies and where high RMS and peak current ratings are required.

TYPE K93

DIELECTRIC: Polystyrene

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 50-400VDC

A.C. RATING: 36 to 240 VRMS @ 400Hz, AC ratings to 40KHz

OPERATING TEMPERATURE: −65°C to +85°C

CAPACITANCE RANGE: .001 to 2.7uF, .1% to 10% tolerances

INSULATION RESISTANCE: 1,000,000 meg-uF

DISSIPATION FACTOR: .02% max. @ 1KHz

DIELECTRIC ABSORPTION: .02% maximum

SCREENING: 100% Quality conformance inspection

APPLICATIONS: Qualified for the Trident Program. Used in critical space and military applications that require stability, high insulation resistance, low dielectric absorption and low dissipation factor.

TYPE B15

DIELECTRIC: Metallized Polypropylene

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 600 & 800 VDC

A.C. RATING: 400 & 600 VRMS @ 400Hz, high current ratings to 40KHz, low E.S.R.

OPERATING TEMPERATURE: −55°C to +85°C

CAPACITANCE RANGE: .01 to 1.2uF

INSULATION RESISTANCE: 100,000 meg-uF

DISSIPATION FACTOR: .05% max. @ 10KHz

SCREENING: 100% Quality conformance inspection with 400Hz burn-in.

APPLICATIONS: Snubber circuits, switching power supplies and where high RMS and peak current ratings are required.

COMPONENT RESEARCH CO. CAPACITORS

are qualified to the following military specifications:

MIL-C-83421/1

MIL-C-87217/1

MIL-C-39022/7

MIL-C-39022/9

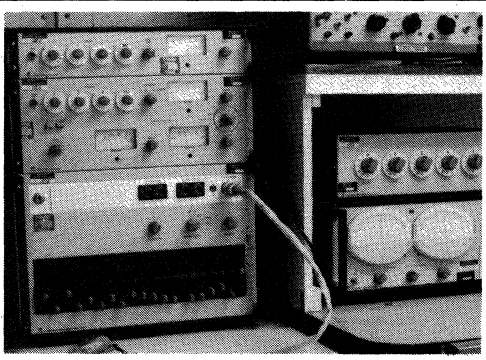
MIL-C-39022/10

CRC
COMPONENT RESEARCH CO.

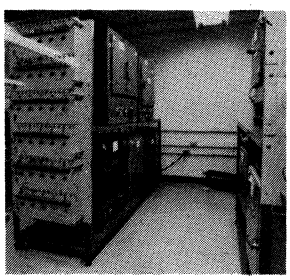
A VIEW OF CRC MANUFACTURING GENERAL PRODUCT INFORMATION

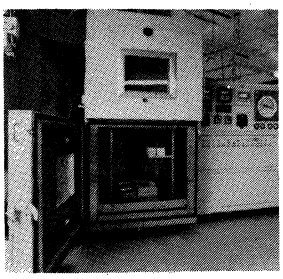
ESTABLISHED RELIABILITY CAPACITORS

CAPACITOR ASSEMBLY: Typical production area located within our award winning 50,000 sq. ft. manufacturing facility. Ideal assembly conditions enable CRC employees to produce high reliability precisely and efficiently.



CALIBRATION EQUIPMENT: Hundreds of precision instruments for parametric measurement are maintained under constant calibration. One out of approximately four employees is dedicated to quality control assurance, and inspection. CRC supplies capacitors for laboratory standards use throughout the world.

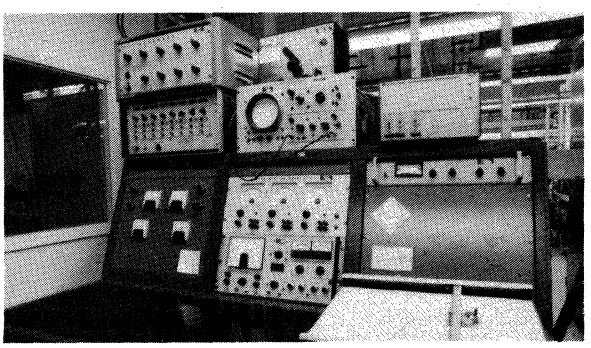




BURN-IN AND TEMPERATURE CYCLING: Before and after hermetic sealing, CRC capacitors receive 100% burn-in.

The 12 foot high shock chamber above right, was used in performing 500 thermal shock cycles (−55°C to +125°C) on CRC metallized polycarbonate capacitors being qualified for the space shuttle program.

Vibration, shock, salt spray, humidity, pressure, and various other stress tests are conducted in our modern laboratories. During these tests, capacitance parameters are accurately monitored in order to study how our products can be constantly improved. CRC has over 200 cubic feet of thermal shock and aging work space available.



ENVIRONMENTAL TESTING: Our qualified testing laboratory contains equipment necessary to perform random and sinusoidal vibration, shock, acceleration, moisture resistance, salt spray, solderability, resistance to solvents, barometric pressure, and many other tests. This laboratory is used daily to qualify standard and special designs as well as to prove out new designs. These capabilities ensure the consistent quality of our established reliability capacitors.

ORDERING INFORMATION — Terms: Our terms are net 30 days to customers approved by our credit department. All shipments are F.O.B., Santa Monica, Calif. **Minimum Order:** Minimum billing per order is $50.00. **Complete Part Number:** Please make certain that you have complete part number to avoid any errors or delays. Please check part number instructions on individual specification pages.

PART NUMBER OBSOLESCENCE — Due to changes in military specifications for which we are qualified, upgrading of our catalog specifications, or size reduction, part numbers formerly used may now be obsolete. We urge our customers to change their existing drawings to indicate the new part numbers for old and new design, wherever possible. If you are unable to make this change, CRC will continue to supply and mark parts indefinitely to the old specifications.

CONSTRUCTION INFORMATION — Unless otherwise specified all parts listed are metal cased, tubular, with both wire terminals isolated from the metal case.

INSTALLATION INSTRUCTIONS — To prevent damage to the hermetic seal joint, use a tweezer type heat sink between the soldering iron and solder beads when soldering within ¼" of beads. Prior to lead bending or twisting, protect glass seals and solder joints by gripping lead near solder bead with a small plier.

Contaminating films on the glass seal surfaces may appear during customer handling and installation of capacitors. To preserve the high insulation resistance inherent in CRC capacitors, clean the glass seal surfaces thoroughly with acetone or chlorinated hydrocarbon fluid.

CAPACITOR MEASUREMENT INFORMATION — The high quality of CRC capacitors may be difficult to evaluate unless sufficiently sensitive and accurate equipment is utilized in conjunction with proper measurement techniques.

Capacitance bridges equal to the General Radio 1620A are recommended for best accuracy of capacitance. This bridge is satisfactory for dissipation factor measurement of capacitors up to 1 uF. CRC has developed a special bridge capable of accurately measuring dissipation factor of capacitors up to 100 uF or more at frequencies up to 1 KHz. For inspection of DF of larger than 1 uF capacitors it is suggested that you use samples correlated by our measurement laboratory.

Insulation resistance measurement is performed by Component Research Co. using leakage current methods which are repeatable to 1 picoamp for capacitors less than 0.1 uF. Larger values require adequate charge time to minimize dielectric absorption effects. Guard boxes are used to perform leakage current and dielectric absorption measurements.

PATENT INFORMATION — CRC capacitors are exclusively manufactured under one or more of the following patents: 3,238,428; 3,260,906; 3,292,063; 3,506,895; 3,539,886; 3,603,849; 3,626,362. Additional patents pending.

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CRC COMPONENT RESEARCH CO.

OPTIONS AVAILABLE FOR STANDARD CAPACITORS

ESTABLISHED RELIABILITY CAPACITORS

Following is a list of some options and characteristics available when you are required to meet special design or operating conditions.

SPECIAL CAPACITOR VALUES

If your application requires odd values such as 0.10015uF ±0.1% or 0.9999uF ±0.25%, such requirements are readily met from our large stock of standard and non-standard values. Individual capacitors can be permanently marked or tagged with discrete values accurate to six places if required.

SPECIAL VOLTAGE RATINGS

Problems of size may occur when replacement of a poor quality capacitor is required. Under certain conditions such as restricting the operating temperature, or limiting DC hipot to 150% of rated volts, a substantial size reduction is possible. Check with our applications engineering department for our recommendations in such cases.

LINEAR TC SLOPE for RESISTOR MATCHING

CRC Series A93 Polystyrene Capacitors provide the closest approximation to a straight line plot for capacitance vs temperature over the range of −50°C to +85°C, with less than 150PPM/°C in negative slope. Larger capacitor values appear to have lower TC than smaller capacitor values. Typically, values ranging 0.01uF average −100PPM/°C and 1.0uF range −40PPM/°C. The normal worst case limits in non-linearity of TC slopes are ±50PPM/°C for all A93 polystyrene capacitors. Slopes are available as low as ±10PPM/°C for the full temperature range of −50°C to +85°C. This slope is a permanent characteristic and will remain constant with temperature cycling and time.

±10PPM/°C TRACKING MATCHED CAPACITORS

In some applications it is desirable to have several capacitors of the same value track together over a specified temperature range.

Frequently good linearity is not mandatory, provided all capacitors although non-linear, follow the same pattern of varying in capacitance with temperature. In other applications a set of different capacitors must track within a defined ratio limit of each other as temperature changes.

From its large stock of 100% screened and batch controlled high reliability capacitors, CRC can furnish many combinations of desired matched capacitors in a minimum of time.

MATCHED SETS TO ±0.05% ACCURACY

CRC can provide matched sets of two or more capacitors with readings of ±0.05% of each other although the purchase tolerance is as high as ±1%. This is more economical than purchasing individual capacitors to ±0.1% or ±0.25% tolerances.

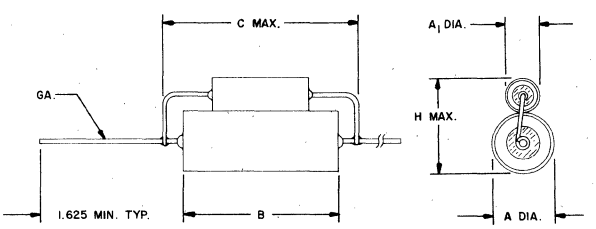
ZERO TEMPERATURE COEFFICIENT BY TC MATCHED PAIRS

It is difficult to obtain zero TC over a wide temperature range. But over a more limited range CRC can provide a TC as low as zero ±5PPM/°C by pairing two capacitors with opposing slopes. Typically an A93 polystyrene capacitor matched with the same value A12 polycarbonate capacitor will match to zero ±30PPM/°C from −10°C to +85°C, as off the shelf purchased items.

If lower TC than this is required, we can 100% measure and match for closer temperature coefficient.

"PIGGYBACK" PERMANENTLY CONNECTED MATCHED CAPACITORS

Customers sometimes prefer the matched capacitors connected together as one to prevent their separation prior to installation. CRC standards are made by "piggyback" connection of trimmers which can provide accuracies to ±0.05%. Shown below is a figure of a "piggyback" connected matched capacitor.



50,000,000 MEGOHMS INSULATION RESISTANCE

This may seem incredible but CRC is supplying special 1uF teflon capacitors which measure up to 5,000,000 megohms at 100°C, and up to 50,000,000 megohms at temperature from 25°C to −40°C.

CRC is developing new methods of measuring to higher levels of insulation resistance and believes it will be able to verify that specially selected smaller values such as 0.1uF can be supplied to meet a specification of 500,000,000 megohms. When you use capacitors in such sensitive applications certain errors and disturbances not normally observed become visible. Some of these are described below.

LOW "PIEZO ELECTRIC LIKE" VOLTAGE GENERATION CAPACITORS

When subjected to a temperature change, capacitors generate a voltage which may vary from one to another within the lot. Voltage up to ten millivolts per °C have been observed. While voltage outputs generally do not increase linearly with temperature, in some cases there has actually been voltage reversal during a temperature run in a given direction.

CRC supplies specially selected 0.5uF, 50VDC teflon capacitors similar to the J11B504 styles to meet requirement of 0.5 millivolts maximum/°C voltage generation, for a critical application.

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CRC COMPONENT RESEARCH CO.

HIGH PULSE CURRENT METALLIZED CAPACITORS

ESTABLISHED RELIABILITY CAPACITORS

CRC PLASTIC FILM CAPACITORS have low loss electrode terminations that are unsurpassed for current handling after exposure to the extremes of thermal shock and operational life.

CRC FOIL CAPACITORS utilizing low loss plastic films such as polypropylene, teflon, polystyrene, and polysulfone are recommended for use with fast switching rates at very high peak currents.

CRC METALLIZED FILM CAPACITORS with lower repetition rates and relatively high currents, can be used to conserve space and weight.

As an example a 10uF, 30VDC, metallized polycarbonate capacitor type G12A106 was charged at 30VDC and discharged into a 0.02 ohm vacuum switch at a 1 PPS rate for days to determine if it would open up. There was no noticeable effect on ESR or dissipation factor as a result of this test.

During this test the first ½ sine discharge current pulse was approximately 180 amperes and decayed to zero current after several 100 KHz resonant cycles.

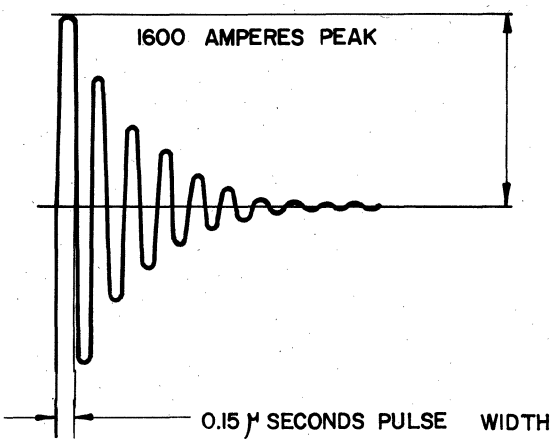
We attempted to open this miniature 10uF capacitor by charging it with 100VDC which resulted in a first ½ sine pulse current of 500 amperes peak at a 1 PPS rate for several hours. Despite the voltage overstress applied and the extremely high peak capacitor current developed, we could not degrade the termination quality of the G12A106 capacitor.

We can conclude that CRC miniature metallized polycarbonate capacitors are capable of handling enormous discharge current provided the repetition rate is slow.

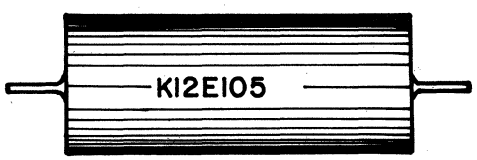
A study is now being conducted by CRC to determine the optimum AC operating conditions with maximum energy density under high current pulse conditions for metallized vs. metal foil capacitors.

These tests will determine what repetition rate conditions require a larger foil capacitor instead of a smaller metallized film capacitor for failure-free operation.

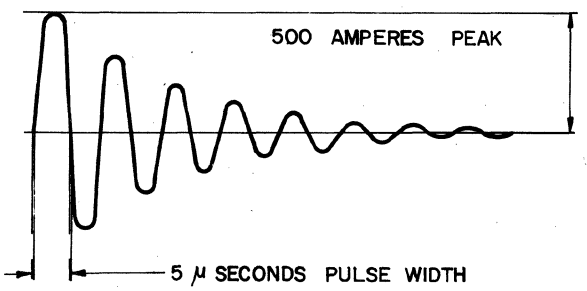
IF YOUR APPLICATION REQUIRES MAXIMUM RELIABILITY, SMALLEST SIZE, AND OPERATION IN CRITICAL AEROSPACE OR INDUSTRIAL ENVIRONMENTS, CRC APPLICATION ENGINEERS WILL BE PLEASED TO REVIEW YOUR SPECIFICATIONS FOR CORRECT CAPACITOR USAGE.



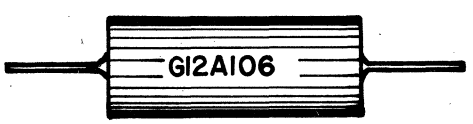
IN THIS TEST A 1 uF, 400VDC, METALLIZED POLYCARBONATE CAPACITOR, TYPE K12E105, IN A 0.750" X 1.875" CASE DEVELOPED 1600 AMPERES PULSE CURRENT WHEN DISCHARGED INTO A 0.02 OHM SWITCH LOAD AFTER CHARGE AT 800VDC. REPETITION RATE WAS 1 PPS AND NO DEGRADATION OF ESR OR DISSIPATION FACTOR OR CASE WARM-UP WAS MEASURABLE AFTER SEVERAL HOURS OF OPERATION.



Actual size of the 1uF, 400VDC capacitor tested at developed pulse currents up to 2600 amperes peak to peak at 1 PPS rate.



CAPACITOR DISCHARGE CURRENT SHOWN FOR TYPE G12A106 METALLIZED POLYCARBONATE CAPACITOR, 10 uF, 30VDC, AFTER CHARGE AT 100VDC AND DISCHARGE INTO A 0.02 OHM SWITCH LOAD. REPETITION RATE WAS ONE PULSE PER SECOND AND THE RESONANT FREQUENCY RESULTING FROM DISCHARGE INTO THE LOAD IS 100KHz.



Actual size of the 10uF, 30VDC capacitor tested at developed pulse currents up to 900 amperes peak to peak at 1 PPS rate.

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MIL-C-83421/1 - MIL-C-39022/9 MANUFACTURING & INSPECTION FLOW PLAN

ESTABLISHED RELIABILITY CAPACITORS

100% INSPECTION PER MIL-C-83421 & MIL-C-39022

The high reliability capacitor screening plans developed by Component Research Co. have been adopted by space and military contractors throughout the world for critical programs. The new general specification MIL-C-83421 incorporates much of the screening features shown below at an attempt to provide a "state of the art" capacitor specification for general industrial and aerospace use.

Our flow plan for manufacturing and inspection shown below covers the steps used to process and screen all of our polycarbonate, teflon, polystyrene and polysulfone film capacitors. The individual specifications shown in the catalog list the actual screening performed for each style. A choice of three quality levels provides different degrees of intensive screening to assure the highest possible quality at lowest cost. Special screening plans are available which include tests such as 100% corona inception inspection, 40KHz AC burn-in at 100°C, high impedance monitoring for intermittent conditions at low voltage during temperature cycling, ESR inspection at 100KHz, dielectric absorption effects with rapid switching rates and varying temperature, and many other sensitive measurement phenomena.

100% PROCESSED AND SCREENED

Steps 1-9 show the 100% processing (up to and including hermetic sealing), of MIL-C-39022/9 and MIL-C-83421/1 qualified polycarbonate and CRC standard capacitors — Polycarbonate, Teflon, Polystyrene and Polysulfone. The quality level selected will be determined by the individual capacitor specification.

PROCESSING STEPS

A. CAPACITOR MATERIAL INSPECTION
B. IDENTIFY PROCESS PAPERWORK WITH MATERIAL LOT NUMBERS
C. CAPACITOR SUB-ASSEMBLY INSPECTION
D. SPECIAL VACUUM PROCESSING
E. HERMETIC SEAL AFTER NITROGEN BACK-FILL
F. INITIAL INSPECTION OF COMPLETED CAPACITOR (7X POWER)

QUALITY LEVEL 1 MIL-C-83421/1 & MIL-C-39022/9

1. BURN-IN
2. TEMPERATURE CYCLING
3. HELIUM LEAK TEST AND GROSS LEAK TEST
4. AC-DIELECTRIC STRENGTH
5. DC-DIELECTRIC STRENGTH
6. INSULATION RESISTANCE
7. % CAPACITANCE TOLERANCE
8. % DISSIPATION FACTOR
9. SELECTION FOR PERFORMANCE GRADES
10. REPEAT ELECTRICAL MEASUREMENT AND RECORD DATA AS REQUIRED
11. CONDUCT SPECIAL MEASUREMENT WHEN REQUIRED BY CUSTOMER
12. FINAL VISUAL INSPECTION OF WORKMANSHIP, MARKING, PAPERWORK AND PACKAGING
13. SHIP CERTIFICATE OF COMPLIANCE WITH PARTS

Highest reliability capacitors with standard or special screening for Apollo, Viking, and other space programs. Also used in military and ultra high quality industrial applications.

Qualified for space, critical applications, F15 aircraft, Trident, space shuttle and other programs.

QUALITY LEVEL 2 MIL-C-39022/9

1. BURN-IN
2. TEMPERATURE CYCLING
3. HELIUM LEAK TEST AND GROSS LEAK TEST
4. AC-DIELECTRIC STRENGTH
5. DC-DIELECTRIC STRENGTH
6. INSULATION RESISTANCE
7. % CAPACITANCE TOLERANCE
8. % DISSIPATION FACTOR
9. FINAL VISUAL INSPECTION OF WORKMANSHIP, MARKING, PAPERWORK, AND PACKAGING
10. SHIP C OF C WITH PARTS

High reliability capacitors screened for space, missile and industrial applications. Qualified for many programs such as The Tow Missile, The Lance Missile and F15 aircraft.

QUALITY LEVEL 3 MIL-C-83421/1 & MIL-C-39022/9

1. TEMPERATURE CYCLING
2. HELIUM LEAK TEST AND GROSS LEAK TEST
3. AC-DIELECTRIC STRENGTH
4. DC-DIELECTRIC STRENGTH
5. INSULATION RESISTANCE
6. % CAPACITANCE TOLERANCE
7. %DISSIPATION FACTOR
8. FINAL VISUAL INSPECTION OF WORKMANSHIP, MARKING, PAPERWORK AND PACKAGING
9. SHIP C OF C WITH PARTS

High reliability capacitors with reduced screening and performance levels for lower cost high volume programs, such as missiles, aircraft and telephone equipment applications.

Random samples from completed production lots of all quality levels are periodically tested.

These tests may consist of Insulation Resistance at high temperature, Dielectric Absorption, Temperature Coefficient and AC stress analysis tests.

In addition, samples are life tested for retention of qualification.

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RETENTION OF QPL - MIL-C-83421/1 FAILURE RATE "S"

ESTABLISHED RELIABILITY CAPACITORS

PERIODIC TESTING PROGRAM

GROUP "B" INSPECTION PER MIL-C-83421, TABLE IV

GROUP B, SUBGROUPS 1, 2 and 3: In order to maintain qualification, CRC performs periodic testing. Capacitors from current production lots of CRH01 through CRH00 which have successfully completed "Group A" Inspection (see "A12 and K12 Quality Conformance Inspection") are selected.

SUBGROUP 1 TESTS

10 Each CRH Style Monthly

- Barometric Pressure
- Insulation Resistance at Max. Rated Temperature
- Temperature Coefficient
- Life (2,000 Hours)

SUBGROUP 2 TESTS

CRH01 Parts Jan., July
CRH02 Parts Feb., Aug.
CRH03 Parts March, Sept.
CRH04 Parts April, Oct.
CRH05 Parts May, Nov.

- AC Conditioning 250 Hours
- Dissipation Factor
- Insulation Resistance
- △ Capacitance

SUBGROUP 3 TESTS

18 Parts Every 6 Months, Consisting of CRH01, CRH02, CRH03, CRH04 and CRH05

- Vibration
- Salt Spray
- Immersion
- Solderability
- Shock
- Dielectric Absorption
- Moisture Resistance
- Terminal Strength
- Resistance to Solvents

DC LIFE TEST PERFORMED MONTHLY

GROUP B, SUBGROUP 1 FOR ALL CRH STYLES COVERING ALL FAILURE RATE LEVELS

Capacitors are DC-Life tested at 100°C and at 140% of the rated D.C. voltage for 2,000 hours. (This is an acceleration factor of 5:1).

EXAMINATION OR TEST	CONDITIONS	POST TEST LIMITS CRH01, CRH02, CRH03, CRH04, and CRH05	POST TEST LIMITS CRH06, CRH07, CRH08, CRH09, and CRH00
Barometric Pressure	Per MIL-C-83421	No breakdowns	No breakdowns
Insulation Resistance	@ Rated voltage @ 125°C	2,000 Megs-uF need not exceed 20,000 Megs	1,000 Megs-uF need not exceed 10,000 Megs
Temperature Coefficient	△ Cap. at −55°C Retrace at 25°C △ Cap. at +125°C	−2.5% to 0% ±.25% max. −1.0% to +1.2%	−2.5% to 0% ±.25% max. ±2.0%

POST LIFE TEST LIMITS AFTER 2,000 HOURS LIFE

Insulation Resistance at Rated Voltage and 25°C	Terminal to Terminal	100,000 Meg-uF need not exceed 1,000,000 Megs	33,333 Megs-uF need not exceed 333,333 Megs
	Terminals to Case	10,000 Megs min.	10,000 Megs min.
△ Capacitance % change with life	At 1KHz and 25°C	±2% max. of initial value	±5% max. of initial value
% Dissipation Factor	At 1KHz and 25°C	0.25% max.	0.35% max.

AC-SINUSOIDAL LIFE TEST PERFORMED MONTHLY

Capacitors are AC life tested for 250 hours at 100°C and at the 40 KHz RMS voltage rating. This test is performed monthly in order to verify the AC RMS voltage and current ratings.

POST AC TEST

Insulation Resistance at Rated Voltage and 25°C	Data for Reference Only.
Capacitance % Change at 1KHz and 25°C	Data for Reference Only.
% Dissipation Factor at 25°C	Data for Reference Only.

TABLE V AC-LIFE TEST PARAMETERS PER MIL-C-83421/1

CRH Style	Equiv. CRC Type	DC Volts Rating	400 Hz AC RMS Volts Rating	250 Hours at 100°C Life Test Conditions: AC RMS Volts	Frequency In Hertz
01	A12A	30	22	At 40 KHz RMS Voltage Rating	40 KHz
02	A12B	50	36		40 KHz
03	A12C	100	60		40 KHz
04	A12D	200	120		40 KHz
05	A12E	400	240		40 KHz

CRC COMPONENT RESEARCH CO.

HIGHEST RELIABILITY SCREENING

ESTABLISHED RELIABILITY CAPACITORS

CRC SCREENS AND TESTS MANY ORDERS TO SPECIFIC CUSTOMER REQUIREMENTS FOR HIGHER RELIABILITY. IN ADDITION, CRC PERFORMS MANY IN-HOUSE TESTS THAT ARE NOT REQUIRED BY THE CUSTOMER, BUT WHICH CRC FEELS WILL IMPROVE QUALITY AND RELIABILITY. BELOW IS CRC'S MANUFACTURING AND INSPECTION FLOW PLAN FOR METALLIZED POLYCARBONATE CAPACITORS SUPPLIED TO TRIDENT SPECIFICATION 2864019.

MANUFACTURING AND INSPECTION FLOW PLAN

1. CAPACITOR MATERIAL INSPECTION
2. IDENTIFY PROCESS PAPERWORK WITH MATERIAL LOT NUMBERS
3. CAPACITOR SUB-ASSEMBLY
4. CAPACITOR SUB-ASSEMBLY INSPECTION
5. SPECIAL VACUUM PROCESSING
6. IN-PROCESS ELECTRICAL TESTING
7. VACUUM PROCESSING
8. NITROGEN BACKFILL
9. HERMETIC SEAL
10. INITIAL INSPECTION OF COMPLETED CAPACITOR AT 7X MAGNIFICATION

COMPONENT RESEARCH 100% PRE-SCREENING

1. 100% Screen and test per MIL-C-83421, table 4.
2. Select parts for Trident order.
3. Sample test capacitance, I.R. % D.F. & ESR at 25°C. Record readings on five samples.
4. Burn-in for 16 hours at 100°C at 40KHz at rated RMS voltage (100% test).
5. Thermal aging, 5 cycles −65°C to +125°C (100% test).
6. Seal test, fine leak (100% test).
7. I.R. at 125°C terminal to terminal (100% test, record samples).
8. I.R. at 25°C terminal to terminal (100% test, record samples).
9. Tolerance assort at 25°C at 10KHz (100% test).
10. Record capitance drift for 5 samples.
11. % dissipation factor at 25°C at 10KHz (100% test, record samples).
12. ESR at 25°C at 100KHz (record 5 samples only).
13. Select 2 random samples and dissect for product conformance.
14. Quality control manager review of data for lot acceptance.

QUALITY CONFORMANCE INSPECTION PER 2864019

TEST STEP	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	% CAPACITANCE TOLERANCE	At 25°C at 10KHz	4.7.8	±1%	100% TEST
2	BURN-IN	168 hrs. @ 100°C @ 40KHz @ maximum rated RMS voltage	4.7.2	There shall be no evidence of physical damage	100% TEST
3	THERMAL AGING	10 cycles from −65°C to +125°C	4.7.3	There shall be no evidence of physical damage	100% TEST
4	SEAL TEST (FINE LEAK)	Helium bomb and check for helium leak	4.7.5	$1x10^{-6}$atm/cm³/sec. max. leak rate	100% TEST
5	SEAL TEST (GROSS LEAK)	Per MIL-STD-202 Meth. 112B, Cond. D.	4.7.5	No bubble stream	100% TEST
6	AC SQUARE WAVE TERMINAL TO TERMINAL	Apply 100Hz square wave at a peak to peak voltage of 3 times DC rated voltage	4.7.6	No shorts	100% TEST
7	DC HI-POT	Apply 200% of rated DC voltage from terminal to terminal and terminals to case for 60 seconds minimum	4.7.6	No shorts	100% TEST
8	INSULATION RESISTANCE TERMINAL TO TERMINAL	At +125°C at rated DC voltage	4.7.7	1,000 meg's-uF, need not exceed 10,000 megohms	100% TEST
9	INSULATION RESISTANCE TERMINAL TO TERMINAL	At 25°C at rated DC voltage	4.7.7	100,000 meg's-uF, need not exceed 1,000,000 megohms	100% TEST
10	% CAPACITANCE TOLERANCE	At 25°C at 10KHz	4.7.8	±1%	100% TEST
11	% CAPACITANCE DRIFT FROM STEP 1 TO 10	At 25°C at 10KHz referenced to initial reading	4.7.8	±0.5%	100% TEST
12	% DISSIPATION FACTOR	At 25°C at 10KHz	4.7.9	0.5%	100% TEST
13	RADIOGRAPHIC INSPECTION	Two views at 90° per OD 48491	N/A	Per OD 48491	100% TEST
14	VISUAL MECHANICAL INSPECTION	Per 2864019	4.7.1	Per 2864019	1.0% AQL

NOTE: 5% PDA (percent defective allowable) or 1 device, whichever is greater for each test step 7, 8, 9, 11, 12 and 13.

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CRITICAL APPLICATIONS SCREENING

ESTABLISHED RELIABILITY CAPACITORS

Component Research capacitors are used in critical applications where their reliability and performance can affect the success of an entire program involving years of preparation and billions of dollars of program cost. For over a decade, aerospace programs from Apollo to Space Shuttle have used CRC capacitors for timing circuits and other control circuits, essential for controlling spacecraft millions of miles from earth, after years of space travel.

DC burn-in, thermal aging (temperature cycling), and Group "A" testing generally is sufficient to assure that the capacitors will be reliable for aerospace applications. The standard CRC capacitors listed in this catalog are offered with screening options most commonly required. Special screening can also be provided for critical requirements.

You can depend upon CRC to provide the most reliable capacitor and screening plan for your critical applications. Following are typical screening plans for standard and special applications.

AC BURN-IN AT 400Hz TO 40KHz

400Hz burn-in at 140Vrms at 125°C is generally a standard screen for metallized polysulfone capacitors supplied for aircraft programs. Typically low-loss filter, shunt, and feed-thru capacitors ranging from 1 μF to 240 μF in value receive from 16 hours to 96 hours of 400Hz burn-in at 125°C to provide high reliability performance in programs such as the F18 fighter aircraft, space shuttle, and commercial aircraft equipment.

40KHz burn-in is used in screening small valued metallized polycarbonate capacitors at 100°C for 168 hours for the Trident Program. CRC capacitors used for this program are the A12 Series which undergo rigorous burn-in and special screening for elimination of any possible defects or unusual behavior modes. With incorporation of such severe inspection and surveillance restraints, CRC production standards are maintained at a very high caliber of performance suited to the most critical programs.

AC AND DC COMBINED BURN-IN SCREENING

Several customers specify that the AC and DC voltages be simultaneously applied during burn-in to assure that the capacitor will operate reliably in this mode. Typically we have applied 100VDC together with approximately 2Vrms at 40KHz at 100°C to 22μF, 100VDC metallized polycarbonate capacitors for 168 hours of burn-in time as a Group "A" screen. In this application the 1" diameter x 1.875" long capacitor handles approximately 8 AMPS RMS during burn-in. Following 100% Group "A" screening, a lot sample is tested for 2000 hours as above without DC voltage applied.

CORONA INCEPTION INSPECTION PREVENTS OPERATIONAL FAILURES

In AC applications at 240Vrms levels and higher or where peak voltages exceed 320 volts approximately, capacitors may fail short or long term due to corona attack.

For such applications, CRC recommends capacitors which are uniformly free from corona inception for at least 20% higher than operational voltage conditions.

100% Group "A" corona inspection for no indication of inception is an excellent substitute for dielectric withstanding voltage tests and is a better monitor of possible shorting problems.

RECORDED READINGS BEFORE AND AFTER BURN-IN

Some programs must have recorded data for each capacitor taken prior to and after completion of burn-in and thermal aging. The capacitors are serialized and readings of capacitance, insulation resistance at 25°C and sometimes at elevated temperature are recorded. In addition, readings of capacitance vs. temperature for purposes of determining temperature coefficient and drift can be recorded.

On occasion dissipation factor is recorded at 1KHz and 10KHz and ESR at 100KHz for determination of reliable electrode connections.

40KHz BURN-IN AND CORONA SCREENING

Type BF51 teflon foil capacitors are being used in a high frequency switching application with a rise time of less than 1 microsecond, in a limited space. Typically a 0.025 μF, 400VDC rated teflon foil, oil impregnated capacitor operates with; 200 volt peak to peak, 10KHz square wave voltage conditions, a rise and fall time of 100 nanoseconds, in a 0.312 x 1.063 case. Under these conditions this teflon capacitor is relatively cool with peak current of 30 amps developed at a 20KHz repetition rate.

Following is the 100% screening used for this AC application.

1. **Burn-in** for 48 hours at 125°C. Apply 180Vrms at 40KHz ±5%.
2. **Thermal aging** temperature cycle 5 times −65°C to +125°C. Per MIL-C-83421.
3. **Seal Test** Bake for 4 hours at 125°C. Check for oil leakage or visual damage.
4. **Corona Test** Apply 400Vrms at 60Hz and check for evidence of corona inception.
5. **AC Stress Test** Apply 100Hz square wave voltage, terminal to terminal, for 1 minute, per MIL-C-83421/1, at 1000 volts peak to peak.
6. **DC Hipot** Apply 800VDC terminal to terminal and to case at 25°C for 1 minute, per MIL-C-83421.
7. **Insulation Resistance** when measured with 400VDC at 25°C, 1,000,000 megohms minimum.
8. **% Capacitance** at 1 KHz
9. **% Dissipation** factor at 10KHz, 0.01% maximum.
10. **Final visual** and mechanical inspection.

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FAILURE ANTICIPATION
& IMPROVED RELIABILITY

ESTABLISHED RELIABILITY CAPACITORS

Plastic film dielectric type capacitors can provide remarkably good electrical characteristics and high reliability but it takes a combination of sound construction, suitable film quality, exacting process control, and 100% testing to achieve this.

Because we are concerned with a proliferation of marginal quality capacitors frequently used in high reliability level aerospace and industrial applications, we are listing below some pitfalls to avoid.

MIS-APPLICATION OF CAPACITORS IN AC CIRCUITS

The highest quality capacitor will fail if its ratings are exceeded by subjecting it to excessive voltage and current stresses. In sinusoidal applications metallized capacitors that warm up over 20°C after several hours of operation are considered a borderline case. You may be applying too high an RMS voltage or frequency.

If the capacitors you are using have higher than normal dissipation factor readings, this may be a sign of high series resistance caused by poor termination on the capacitor section. The square wave AC screening for one minute covered in MIL-C-83421/1 is a good way of eliminating capacitors with gross dissipation factor quality.

If dissipation factor limits are set too high as post test requirements, suspect capacitors will pass the square wave test. In fact terminations may have been damaged by this test, but are permitted to pass what we consider are abnormally high DF limits. A termination that is poor at room temperature generally should be worse at higher temperature and increased heating caused by power loss at the terminations may cause ultimate degeneration and possible failure. We consider 100% AC burn-in at elevated temperature an excellent method of checking for good terminations. Burn-in should be followed in 100% dissipation factor examination.

In SCR commutation and transistor switching type applications heat rise measurements by themselves are not a sufficient means of determining capacitor reliability. In these cases the capacitor is subjected to relatively high peak currents at a low duty cycle. A capacitor not designed for high peak current use while never exhibiting more than a few degrees of heat rise during operation, may open after hours or possibly months of operation.

We recommend that you forward copies of your oscilloscope current and voltage waveforms for analysis of your non-sinusoidal applications.

CAPACITOR OPENS & INTERMITTENTS AFTER ENVIRONMENTAL TESTING OR LONG TERM STORAGE

CRC is frequently requested to replace "Brand X" metallized capacitors (which may have cost 50% less) that fail after being qualified for the application and after passing initial breadboard and preproduction test.

Unfortunately many specifications and programs do not take the effects of temperature cycling into consideration. Capacitor termination may withstand DC burn-in, DC life and even AC life.

Dimensional changes between plastic and metal materials as a result of temperature cycling may result in microscopic ruptures of termination joints, possible electrode oxidation and generally unstable termination series resistance. This is the reason we recommend 100% temperature cycling or thermal aging followed by the screening as described above. Component Research Company patented stress-free termination designs and precise quality control eliminates the above problems.

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AC RATED CAPACITORS RELIABILITY QUESTIONS & ANSWERS

ESTABLISHED RELIABILITY CAPACITORS

What are the limiting factors restricting the use of metallized polycarbonate capacitors for AC applications?

A properly manufactured and screened capacitor can handle considerable RMS and peak currents from −55°C to +125°C without significant heat rise. The dissipation factor of capacitors to be used in AC applications must be uniformly low to limit watt loss.

We recommend a maximum dissipation factor of 0.15% at 1KHz as the acceptance test limit. All capacitors should be subjected to temperature cycling prior to final measurement of DF to insure that they remain less than 0.15%. This test eliminates failures which may occur after storage at extreme temperatures.

CRC specifications contain the maximum RMS current and voltage ratings for sinusoidal conditions, continuous duty cycle, at 400Hz and 40KHz. For conditions other than shown, send a sketch of the current and voltage waveforms under worst case and normal operating conditions to our sales office. Include all other information necessary for quotation purposes.

Is polycarbonate better than other dielectrics for AC applications?

If size, weight, cost, or operating temperatures were not important considerations, then other dielectric style capacitors would be superior to polycarbonate.

As an example, CRC can supply polystyrene, teflon, or polypropylene AC capacitors with approximately ten times lower loss than the series 12 polycarbonate capacitors.

Polysulfone is slightly better than polycarbonate for AC applications below 100° C, and can be used above 125°C (the limit for polycarbonate), to 150°C with proper voltage derating.

CRC considers mylar and paper dielectric styles too lossy for AC applications and therefore does not recommend this type for such requirements. Additional information on AC capacitors appears on other pages of this catalog.

What type of screening test will assure that the polycarbonate capacitors are reliable for AC applications?

Once it has been determined that your application requirements can be met by CRC standard polycarbonate series 12 capacitors, the screening test used by CRC and incorporated into MIL-C-83421/1 will be sufficient to provide the quality assurance needed.

As an example, 100% of the capacitors are temperature cycled then subjected to a square wave voltage at 100Hz at 300% of rated DC voltage for peak to peak amplitude.

During this test the capacitors must handle approximately 35 microsecond wide current pulses for one minute at a rate of 200 per second.

A routine examination of the current and voltage waveforms during square wave hipot of 10 uF, 50VDC type CRH capacitors, shows that with 150 volts peak to peak voltage at 100Hz applied, the peak current is 85 amps. This is equivalent to operation with a half sine wave peak current pulse of 8.5 amps/uF at a 200 PPS rate. SEE WAVEFORMS AT RIGHT.

Following the square wave voltage stress test the capacitors must meet 0.15% max. dissipation factor limits.

Life testing of CRC metallized polycarbonate capacitors at 400 Hz and 4000 Hz is performed continuously as retention of qualification to MIL-C-83421/1.

Why are CRC low dissipation factor polycarbonate capacitors replacing commonly manufactured capacitors in AC applications?

There is a risk that the dissipation factor of such capacitors will increase with use and result in hot spots at the terminations. Field failures of such capacitors have been reported where the capacitors have exploded and caused fire damage.

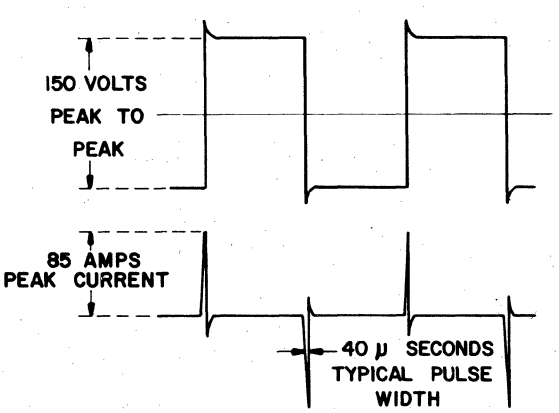
It may be possible to use ordinary higher DF capacitors without noticeable problems at 400Hz, provided that RMS voltage is sufficiently low such that the RMS current is limited. Heat sinking will also help prevent excess heat rise due to poor quality terminations.

Interestingly enough CRC polycarbonate capacitors have a lower dissipation factor at temperatures from 75°C to 125°C than at 25°C which lowers their effective heat rise at higher temperatures. Where the current source is limited, higher DF capacitors may not heat sufficiently to short, but may gradually suffer from increasing DF to the point where they are effectively open.

What is the maximum current that can be applied to MIL-C-83421/1 capacitors?

The 40 KHz current and voltage ratings listed in Table 1 of the Mil-Spec and CRC's specifications shown in this catalog, are based upon continuous operation under sinusoidal conditions. In order to eliminate failures it is essential that any use under conditions exceeding these limits be discussed further with our applications engineers. Under certain conditions, the capacitors can be used at higher frequencies and in square wave filtering applications. For good reliability it is best to study these special applications on an individual basis. CRC plans to provide data tables showing allowable working conditions during higher frequency sinusoidal, pulsed, and non-sinusoidal conditions.

TYPICAL VOLTAGE AND PEAK CURRENT WAVEFORMS SHOWN FOR A12B106, 10 uF, 50 V, METALLIZED POLYCARBONATE CAPACITOR DURING THE ONE MINUTE AC SQUARE WAVE SCREENING AT 100 Hz.



CRC COMPONENT RESEARCH CO.

VOLTAGE TEMPERATURE SCANNING FOR CAPACITOR FAULTS

ESTABLISHED RELIABILITY CAPACITORS

SCREENING FOR LOW VOLTAGE MOMENTARY BREAKDOWNS

In recent years some concern has arisen over the use of metallized polycarbonate capacitors in low voltage applications. The cause for this concern is due to a phenomenon existing in these capacitors known as "momentary breakdown." Testing in our laboratories has shown that other metallized dielectrics such as polypropylene, polysulfone, and polyester exhibit this same failure mode, as well. In addition, screening done by Component Research Company on a number of hi-rel ceramic capacitors has shown similar failures.

Programs such as Atlas and Voyager have experienced capacitor failures which have been attributed to momentary breakdown. These costly failures have demonstrated a real need for further investigation into this phenomenon.

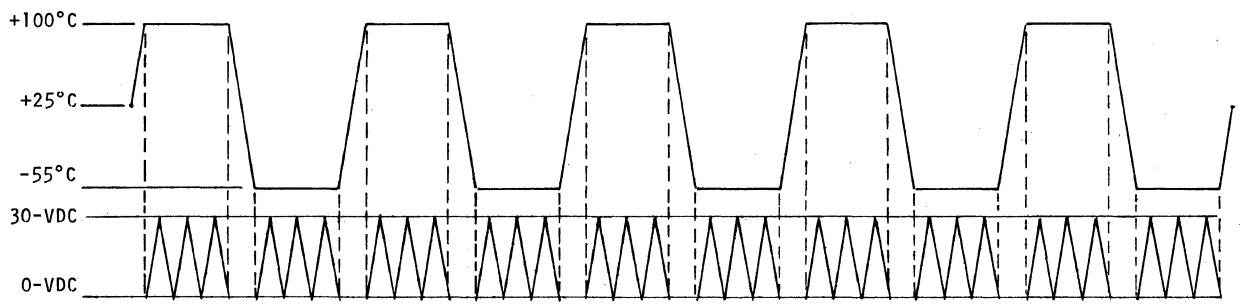
Component Research Company as a manufacturer of established reliability plastic film capacitors has been involved in screening capacitors for momentary breakdown since its involvement in the Viking program in 1973.

Considerable work has been done to develop effective screening methods to eliminate those capacitors that will possibly exhibit momentary breakdown. Component Research Company has developed various screening methods to cull out those capacitors which can exhibit a possibility of momentary breakdown.

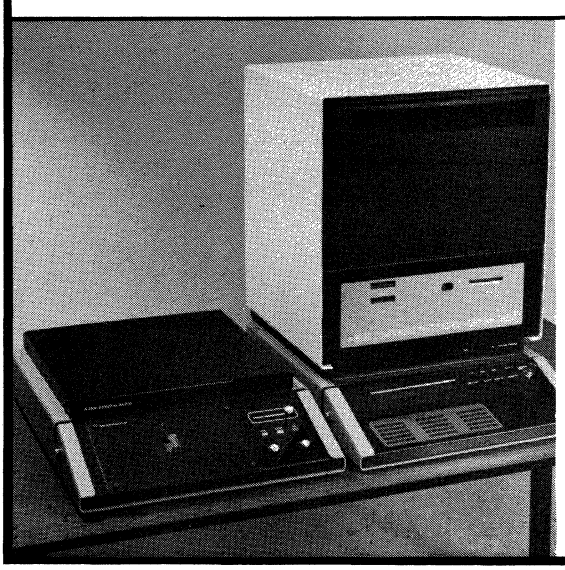
As a result a new military specification, MIL-C-87217, has been established to define screening procedures to be performed for applications in which momentary breakdowns cannot be tolerated.

Please contact our application engineers for assistance in choosing the suitable capacitor and screening procedure for your requirement.

TYPICAL VOLTAGE/TEMPERATURE RAMP SCREENING CYCLE



Stabilize capacitors at at temperature extremes and voltage ramp 3 times 0 to 30VDC and 30 to 0VDC while monitoring for leakage current.



This General Radio model 2230 Component Test System is used in conjunction with CRC specially designed ramp generators, cycling chambers, and interface equipment for voltage/temperature capacitor fault-scanning.

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THERMAL SHOCK TEST 500 CYCLES

ESTABLISHED RELIABILITY CAPACITORS

DATA COVERS A12A 30VDC METALLIZED POLYCARBONATE CAPACITORS

Applications such as the space shuttle require capacitors which can withstand many thermal shock cycles without deterioration of terminations.

In 1976 George C. Marshall Space Flight Center contracted Component Research to manufacture and test MIL-C-83421/1 style parts to withstand 500 thermal shock cycles, while maintaining electrical integrity without becoming intermittent.

One hundred and fifty capacitors incorporating design improvements (which have been implemented in all standard parts since completion of the test) were manufactured and subsequently underwent 500 thermal shock cycles.

One hundred and forty nine (149) capacitors survived the tests. Failure analysis of the failed part was due to a poor solder joint, initially detected during acceptance tests as having poor dissipation factor and equivalent series resistance measurements. Operator error precluded the capacitor being eliminated from the test program.

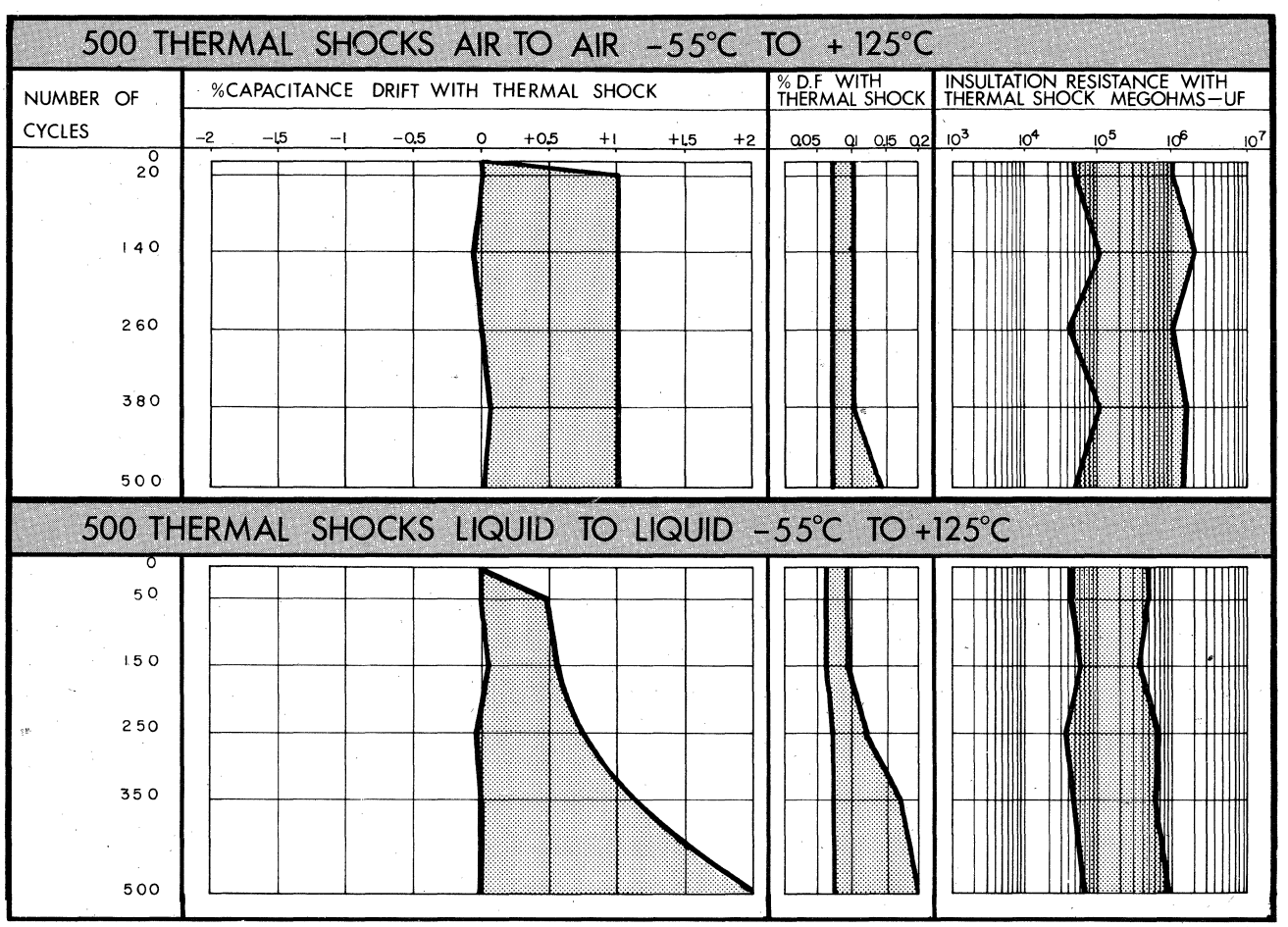
HIGHLIGHTS OF 500 THERMAL SHOCK CYCLE TEST

■ **60 capacitors were subjected to 500 thermal shock cycles** for accelerated test in liquid to liquid, at the rate of fifty (50) cycles per day. The capacitors were immersed into each liquid for sixty (60) seconds and transferred from one bath to another within fifteen (15) seconds. The temperature extremes were −55°C and 125°C.

TEST RESULTS: (60 CAPACITORS)
+0.84% MAXIMUM CAPACITANCE DRIFT
0.11% MAXIMUM DISSIPATION FACTOR @ 1KHz
0.22% MAXIMUM DISSIPATION FACTOR @ 10KHz
0.19 OHMS MAXIMUM EQUIVALENT SERIES RESISTANCE @ 100KHz
1.6×10^7 MEG's-uF MINIMUM INSULATION RESISTANCE
■ ALL PARTS PASSED 1×10^{-8} ATM/CM³/SEC MAX LEAK RATE

■ **90 capacitors were subjected to 500 thermal shock cycles** in air to air, at the rate of one (1) cycle per hour. The dwell time at each temperature extreme was a minimum of thirty (30) minutes. The maximum transfer time from one chamber to another was sixty (60) seconds. The temperature extremes were −55°C to +125°C.

TEST RESULTS: (90 CAPACITORS)
+6.3% MAXIMUM CAPACITANCE DRIFT
0.095% MAXIMUM DISSIPATION FACTOR @ 1KHz
0.46% MAXIMUM DISSIPATION FACTOR @ 10KHz
0.53 OHMS MAXIMUM EQUIVALENT SERIES RESISTANCE @ 100KHz
9.7×10^5 MEG'S-uF MINIMUM INSULATION RESISTANCE



COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343-6864

CRC COMPONENT RESEARCH CO.

LIFE TEST - 40,000 HOURS

ESTABLISHED RELIABILITY CAPACITORS

PURPOSE OF 40,000 HOUR LIFE TEST

In 1972 CRC decided to conduct long term life tests on 50VDC metallized polycarbonate capacitors to study the effects of operation at 100°C and rated voltage on capacitance drift, insulation resistance, and dissipation factor.

After five years of test (including approximately 10 months of overstress at 125°C and 280% of rated DC), CRC is pleased to report that our capacitors are highly recommended for long life requirements.

In 1970 thousands of CRC metallized polycarbonate capacitors were used in an underwater cable application requiring a minimum of 20 years operation without failure. There have been no reported failures to date in this critical application or in others, such as long term space probes.

HIGHLIGHTS OF 40,000 HOUR LIFE TESTING

Test conditions were 50VDC at 100°C for 12,000 hours for 45 capacitors resulting in 1.3% max. capacitance drift, 0.12% max. dissipation factor, and 750,000 megs-uF minimum insulation resistance.

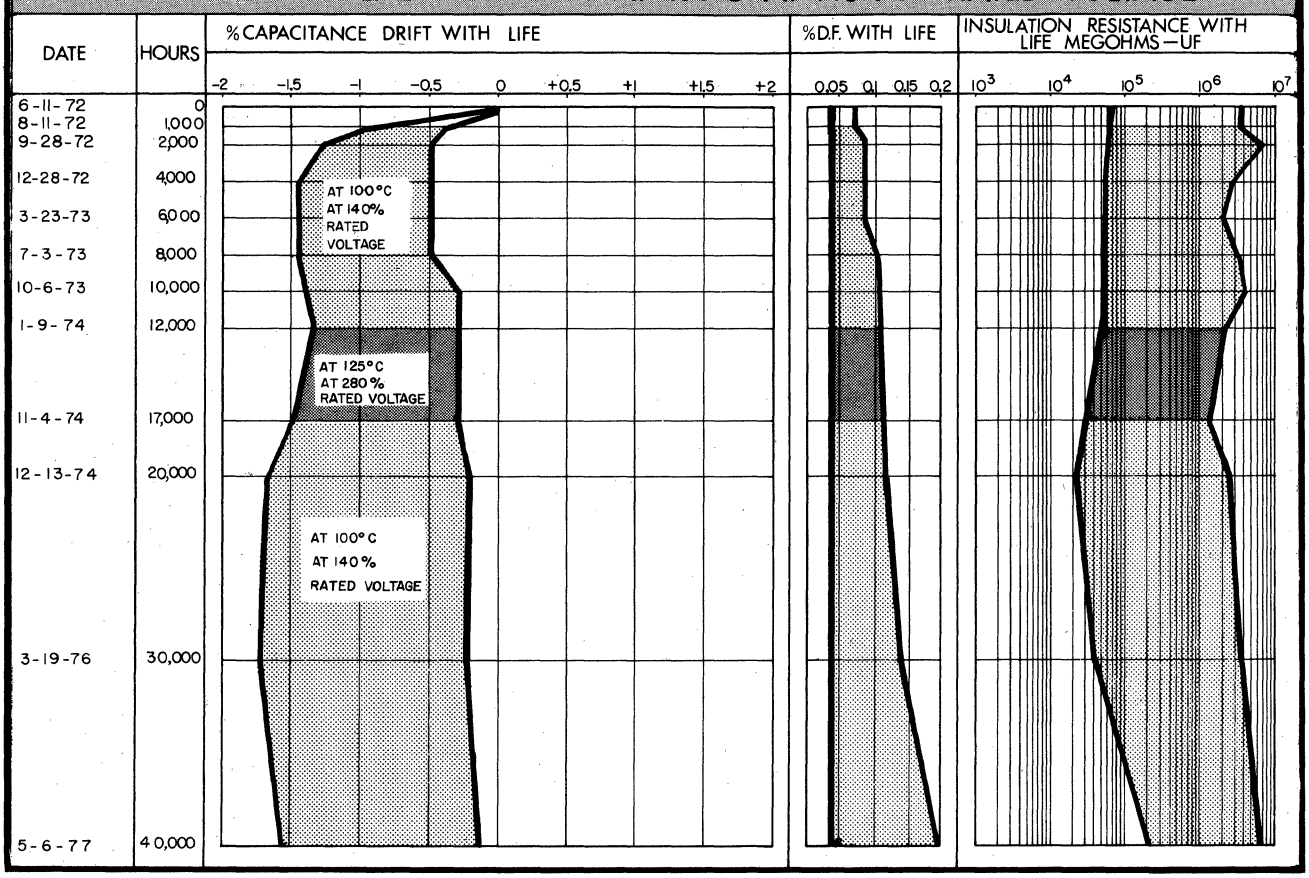
5000 additional hours (in error) were at 125°C and 70VDC which is actually at 280% of rated voltage considering that 50% derating is required from 100°C to 125°C.

As a result one capacitor shorted, capacitance drift was −1.5% worst case. Dissipation factor remained 0.17% max. and insulation resistance was 1,000,000 Megs-uF minimum.

Life testing was continued from 17,000 to 40,000 hours at 50VDC and 100°C with 1.25% max. capacitance drift, 0.19% max. dissipation factor, and 35,000 megs-uF minimum insulation resistance at end of test.

It is obvious that considerably reduced drift and parametric change would have resulted if the 5000 hr. overstress period had not occurred.

LONG TERM DC LIFE TEST DATA AT 100°C AT 140% OF RATED VOLTAGE



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CRC
COMPONENT RESEARCH CO.

METALLIZED POLYCARBONATE A12 & K12

ESTABLISHED RELIABILITY CAPACITORS

PRODUCT FEATURES

1.0 μF 30VDC ACTUAL SIZE CAPACITOR

QUALIFIED TO MIL-C-83421/01 FAILURE RATE S.

HERMETICALLY SEALED, HIGH RELIABILITY SCREENED FOR CRITICAL AEROSPACE APPLICATIONS.

AC RATED FROM 22VRMS TO 240VRMS AT FREQUENCIES FROM 0 TO 400Hz. RATINGS TO 40KHz AT LOWER VOLTAGE RATINGS, −65°C TO +100°C WITH DERATED OPERATION AT 125°C, DC RATED 30VDC TO 400VDC.

100% RELIABILITY SCREENING, INCLUDES BURN-IN, TEMPERATURE CYCLING, FINE LEAK TESTS, AND AC SQUARE WAVE TESTS.

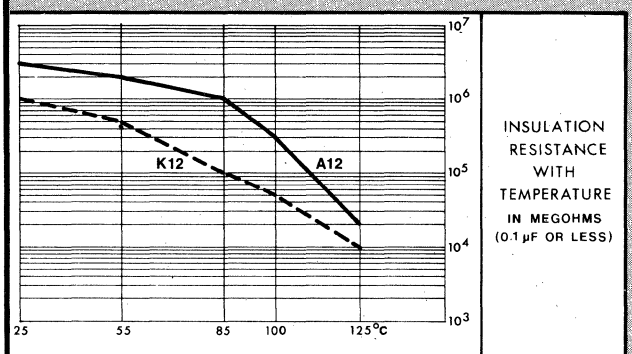
LOW LOSS, RUGGED INTERNAL TERMINATIONS QUALIFIED FOR ALL HI-REL PROGRAMS (CRC PATENTED CONSTRUCTION).

CAPACITORS HAVE BEEN THERMAL SHOCK TESTED FOR 1000 CYCLES FROM −65°C to +125°C, AIR TO AIR AND LIQUID TO LIQUID, SEE THERMAL SHOCK TEST PAGE.

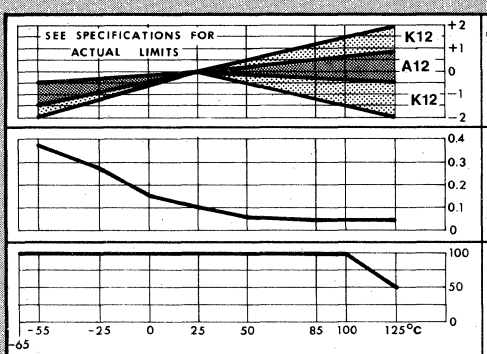
CAPACITORS OF SAME DESIGN AND CONSTRUCTION HAVE BEEN LIFE TESTED TO 40,000 HOURS, SEE 40,000 HOUR LIFE TEST DATA PAGE.

AVAILABLE IN STANDARD TOLERANCES: 0.25%, 0.5%, 1%, 2%, 5%, 10%. OTHER TOLERANCES AVAILABLE ON REQUEST.

TYPICAL CURVES



INSULATION RESISTANCE WITH TEMPERATURE IN MEGOHMS (0.1 μF OR LESS)



% CAPACITANCE CHANGE WITH TEMPERATURE

% DISSIPATION FACTOR WITH TEMPERATURE

% VOLTAGE RATING WITH TEMPERATURE

TYPICAL APPLICATIONS

- CRITICAL TIMING CIRCUITS
- FIXED TUNING CIRCUITS
- FILTERING
- TEMPERATURE COMPENSATION
- COUPLING AND DECOUPLING
- FEEDBACK CIRCUITS
- POWER SUPPLY FILTERING
- GYRO CIRCUITS
- PULSE FORMING NETWORKS
- INTEGRATING CIRCUITS

LIFE TEST DATA CRC TEST REPORT #77TR116

TEST RESULTS FOR SERIES A12 CAPACITORS LIFE TESTED FOR 2000 HOURS AT 100°C AT 140% OF RATED DC VOLTAGE.

THERE WERE NO FAILURES FOR THIS TEST.

LIST OF CAPACITORS SUBMITTED TO LIFE TEST			INSULATION RESISTANCE IN MEGOHMS AT 25°C			% CAPACITANCE CHANGE WITH LIFE			% DISSIPATION FACTOR AT 25°C WITH LIFE		
CRC TYPE	uF VALUE	Q'TY TESTED	POST TEST LIMITS (MIN. I.R.)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. △C)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. D.F.)	TEST RESULTS LOW	TEST RESULTS HIGH
A12A	.1	20	$1x10^6$	$3x10^6$	$4x10^6$	±2.0	0.00	+.40	.25	.07	.08
A12A	.001	20	$1x10^6$	$1x10^7$	$30x10^6$	±2.0	−.38	+.06	.25	.05	.05
A12B	1.0	20	$1x10^5$	$8x10^5$	$1x10^6$	±2.0	−.03	+.18	.25	.04	.05
A12B	.018	20	$1x10^6$	$1.2x10^7$	$2.5x10^7$	±2.0	−.33	−.16	.25	.07	.08
A12C	4.7	20	$2x10^4$	$1.1x10^5$	$5x10^5$	±2.0	−.13	−.06	.25	.04	.05
A12C	.039	20	$1x10^6$	$1.4x10^7$	$2x10^7$	±2.0	−.07	+.05	.25	.08	.08
A12D	.56	30	$1.8x10^5$	$1.6x10^6$	$1.8x10^6$	±2.0	−.03	+.05	.25	.05	.06
A12E	.01	30	$1x10^6$	$4x10^7$	$6.6x10^7$	±2.0	+.02	−.16	.25	.07	.07

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CRC
COMPONENT RESEARCH CO.

METALLIZED POLYCARBONATE A12 & K12

ESTABLISHED RELIABILITY CAPACITORS

A12 AND K12 SPECIFICATIONS

CONSTRUCTION	Metallized polycarbonate dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.		
ENVIRONMENTAL	Capacitors meet all environmental requirements and are qualified to MIL-C-83421/1.		
OPERATING TEMPERATURE	−65°C to +100°C		At full rated voltage, derate linearly to 50% of rated voltage at 125°C.
DIELECTRIC ABSORPTION	0.1% maximum		At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.15% maximum		At 25°C when measured per MIL-C-83421.
AC SQUARE WAVE	100Hz, 60 seconds minimum		At 25°C at a peak to peak voltage of 3 times rated DC voltage, terminal to terminal per MIL-C-83421.
DIELECTRIC STRENGTH	200% rated DC voltage		At 25°C from terminal to terminal and terminal to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT (IN % CAPACITANCE)	A12	−1.0% to +1.2%	From +25°C to +125°C
	K12	±2%	
	A12	−0% to −2.5%	From −55°C to 25°C
	K12	−0% to −2.5%	
CAPACITANCE STABILITY (IN % CAPACITANCE)	A12	±0.25%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
	K12	±0.25%	
HERMETIC SEAL	1×10^{-6} atm/cm³/sec.		Maximum leak rate.
INSULATION RESISTANCE	See Insulation Resistance Table		Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R.
EXAMPLE: A 0.5uF, SERIES A12 CAPACITOR AT 25°C IS 300,000 ÷ 0.5 = 600,000 MEGOHMS.

RANGE	STYLE	25°C	55°C	85°C	100°C	125°C
.001 TO 0.1uF	A12	3,000,000 Megohms	2,000,000 Megohms	1,000,000 Megohms	300,000 Megohms	20,000 Megohms
	K12	1,000,000 Megohms	500,000 Megohms	100,000 Megohms	50,000 Megohms	10,000 Megohms
GREATER THAN 0.1uF	A12	300,000 Megohms-uF	200,000 Megohms-uF	100,000 Megohms-uF	30,000 Megohms-uF	2,000 Megohms-uF
	K12	100,000 Megohms-uF	50,000 Megohms-uF	10,000 Megohms-uF	5,000 Megohms-uF	1,000 Megohms-uF

A12 AND K12 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL A12	QUALITY LEVEL K12
1	BURN-IN	48 hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test	Not Req'd
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C (5 cycles min. for K12)	4.7.3	No physical damage	100% Test	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1×10^{-6} atm/cm³/sec. max.	100% Test	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test	100% Test
5	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz at a peak to peak voltage of 3 times DC rated voltage for 60 seconds minimum	4.7.6	No shorts	100% Test	100% Test
6	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum. Do not exceed 800 volts peak to peak.	4.7.6	No shorts	100% Test	100% Test
7	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test	100% Test
8	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8.	Per part number	100% Test	100% Test
9	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.15% max.	100% Test	100% Test
10	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

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CRC COMPONENT RESEARCH CO.

METALLIZED POLYCARBONATE A12 & K12 CASE DIMENSIONS

ESTABLISHED RELIABILITY CAPACITORS

µF	TYPE 12A 30VDC			TYPE 12B 50VDC			TYPE 12C 100VDC			TYPE 12D 200VDC			TYPE 12E 400VDC		
	Diam. A	Length B	Length C	Diam. A	Length B	Length C	Diam. A	Length B	Length C	Diam. A	Length B	Length C	Diam. A	Length B	Length C
.001	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0012	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0015	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0018	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.002	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0022	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0027	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.0033	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.0039	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.0047	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.005	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.0056	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.0068	.170	.500	.600	.170	.500	.600	.170	.562	.662	.170	.562	.662	.235	.687	.787
.0075	.170	.500	.600	.170	.562	.662	.170	.562	.662	.193	.562	.662	.235	.687	.787
.0082	.170	.500	.600	.170	.562	.662	.170	.562	.662	.193	.562	.662	.235	.687	.787
.01	.170	.500	.600	.170	.562	.662	.170	.687	.787	.193	.562	.662	.235	.687	.787
.012	.170	.500	.600	.170	.562	.662	.170	.687	.787	.193	.562	.662	.235	.687	.787
.015	.170	.500	.600	.170	.562	.662	.170	.687	.787	.235	.562	.662	.235	.813	.913
.018	.170	.500	.600	.193	.562	.662	.193	.687	.787	.235	.687	.787	.312	.813	.913
.02	.170	.500	.600	.193	.562	.662	.193	.687	.787	.235	.687	.787	.312	.813	.913
.022	.170	.500	.600	.193	.562	.662	.193	.687	.787	.235	.687	.787	.312	.813	.913
.027	.170	.562	.662	.193	.562	.662	.193	.687	.787	.312	.687	.787	.312	.813	.913
.033	.170	.562	.662	.193	.562	.662	.193	.687	.787	.312	.687	.787	.312	.813	.913
.039	.170	.562	.662	.170	.687	.787	.235	.687	.787	.312	.687	.787	.312	.813	.913
.047	.170	.562	.662	.170	.687	.787	.235	.687	.787	.312	.687	.787	.400	.813	.913
.05	.170	.562	.662	.170	.687	.787	.235	.687	.787	.312	.687	.787	.400	.813	.913
.056	.170	.562	.662	.193	.687	.787	.235	.687	.787	.312	.813	.913	.400	.813	.913
.068	.170	.687	.787	.193	.687	.787	.235	.813	.913	.312	.813	.913	.400	.813	.913
.075	.170	.687	.787	.193	.813	.913	.312	.687	.787	.312	.813	.913	.400	1.063	1.163
.082	.170	.687	.787	.193	.813	.913	.312	.687	.787	.312	.813	.913	.400	1.063	1.163
.1	.193	.687	.787	.193	.813	.913	.312	.687	.787	.312	.813	.913	.400	1.063	1.163
.12	.193	.687	.787	.235	.687	.787	.312	.687	.787	.312	.813	.913	.400	1.063	1.163
.15	.235	.562	.662	.235	.687	.787	.312	.813	.913	.400	1.063	1.163	.400	1.375	1.475
.18	.235	.687	.787	.235	.813	.913	.312	.813	.913	.400	1.375	1.475	.500	1.375	1.475
.2	.235	.687	.787	.235	.813	.913	.312	.813	.913	.400	1.375	1.475	.500	1.375	1.475
.22	.235	.687	.787	.235	.813	.913	.312	.813	.913	.400	1.375	1.475	.500	1.375	1.475
.27	.235	.687	.787	.312	.687	.787	.312	1.063	1.163	.500	1.375	1.475	.562	1.375	1.475
.33	.235	.687	.787	.312	.687	.787	.312	1.063	1.163	.500	1.375	1.475	.562	1.375	1.475
.39	.235	.687	.787	.312	.813	.913	.400	1.063	1.163	.500	1.375	1.475	.562	1.875	1.975
.47	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.500	1.375	1.475	.562	1.875	1.975
.5	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.500	1.375	1.475	.562	1.875	1.975
.56	.312	.687	.787	.400	.813	.913	.400	1.063	1.163	.500	1.375	1.475	.562	1.875	1.975
.68	.312	.687	.787	.400	.813	.913	.500	1.125	1.225	.562	1.375	1.475	.750	1.875	1.975
.75	.312	.813	.913	.400	1.063	1.163	.500	1.125	1.225	.562	1.875	1.975	.750	1.875	1.975
.82	.312	.813	.913	.400	1.063	1.163	.500	1.125	1.225	.562	1.875	1.975	.750	1.875	1.975
1.0	.312	.813	.913	.400	1.063	1.163	.562	1.125	1.225	.562	1.875	1.975	.750	1.875	1.975
1.2	.312	.813	.913	.400	1.063	1.163	.562	1.125	1.225	.562	1.875	1.975	1.000	1.875	1.975
1.5	.400	.813	.913	.400	1.063	1.163	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475
1.8	.400	.813	.913	.400	1.063	1.163	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
2.0	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
2.2	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
2.5	.400	1.063	1.163	.500	1.375	1.475	.670	1.875	1.975	.750	1.875	1.975			
2.7	.400	1.063	1.163	.500	1.375	1.475	.670	1.875	1.975	.750	1.875	1.975			
3.0	.400	1.063	1.163	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975			
3.3	.400	1.063	1.163	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975			
3.9	.400	1.375	1.475	.562	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475			
4.7	.500	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475			
5.0	.500	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475			
5.6	.500	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475			
6.8	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475						
7.5	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475						
8.2	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475						
10.0	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475						
12.0	.562	1.875	1.975	.750	1.875	1.975	1.000	2.375	2.475						
15.0	.562	1.875	1.975	.750	1.875	1.975									
18.0	.670	1.875	1.975	1.000	1.875	1.975									
20.0	.670	1.875	1.975	1.000	1.875	1.975									
22.0	.670	1.875	1.975	1.000	1.875	1.975									
25.0	.750	1.875	1.975	1.000	2.375	2.475									
27.0	.750	1.875	1.975	1.000	2.375	2.475									

FOR SPECIAL VALUES AND TOLERANCES, PLEASE CONTACT OUR APPLICATION DEPARTMENT.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads. CRC "C" dimensions for A12 and K12 capacitors is 0.1" less than MIL-C-83421/1 requires.

A12 | A | 104 | J | S | W

STYLE

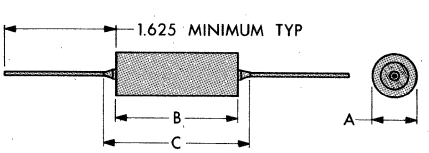
VOLTAGE
A=30VDC
B=50VDC
C=100VDC
D=200VDC
E=400VDC

SLEEVING CODE
S=Mylar sleeve
X=No sleeve

CAPACITANCE TOLERANCE
K=10% F=1% B=¼%
J=5% D=½% A=.1%
G=2%

LEAD CODE
W=Tinned copper clad steel: #22 (.025") for .312" case dia & smaller; #20 (.032") for .400" & .500" case dia.
C=Tinned oxygen-free copper: #18 (.040") for .562" case dia. & larger.

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.



COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343-6864

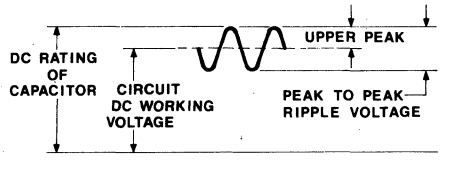
CRC COMPONENT RESEARCH CO.

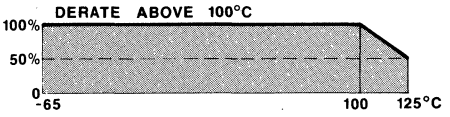
METALLIZED POLYCARBONATE
A12 & K12 AC RATINGS

ESTABLISHED RELIABILITY CAPACITORS

uF	TYPE 12A 30VDC AC RATINGS			TYPE 12B 50VDC AC RATINGS			TYPE 12C 100VDC AC RATINGS			TYPE 12D 200VDC AC RATINGS			TYPE 12E 400VDC AC RATINGS		
	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps
.001	22.0	22.0	.0055	36.0	36.0	.0090	60.0	60.0	.015	120.0	120.0	.030	240.0	240.0	.060
.0012	22.0	22.0	.0066	36.0	36.0	.0108	60.0	60.0	.018	120.0	120.0	.036	240.0	240.0	.072
.0015	22.0	22.0	.0083	36.0	36.0	.0135	60.0	60.0	.0225	120.0	120.0	.045	240.0	240.0	.090
.0018	22.0	22.0	.0099	36.0	36.0	.0162	60.0	60.0	.027	120.0	120.0	.054	240.0	240.0	.108
.002	22.0	22.0	.0110	36.0	36.0	.0180	60.0	60.0	.030	120.0	120.0	.060	240.0	240.0	.120
.0022	22.0	22.0	.0121	36.0	36.0	.0198	60.0	60.0	.033	120.0	120.0	.066	240.0	240.0	.132
.0027	22.0	22.0	.0149	36.0	36.0	.0243	60.0	60.0	.0405	120.0	120.0	.081	240.0	240.0	.162
.0033	22.0	22.0	.0182	36.0	36.0	.0297	60.0	60.0	.0495	120.0	120.0	.099	240.0	240.0	.198
.0039	22.0	22.0	.0215	36.0	36.0	.0351	60.0	60.0	.0585	120.0	120.0	.117	240.0	240.0	.234
.0047	22.0	22.0	.0259	36.0	36.0	.0423	60.0	60.0	.0705	120.0	120.0	.141	240.0	240.0	.282
.005	22.0	22.0	.0275	36.0	36.0	.0450	60.0	60.0	.075	120.0	120.0	.150	240.0	240.0	.300
.0056	22.0	22.0	.0308	36.0	36.0	.0504	60.0	60.0	.084	120.0	120.0	.168	240.0	240.0	.336
.0068	22.0	22.0	.0374	36.0	36.0	.0612	60.0	60.0	.102	120.0	120.0	.204	240.0	240.0	.408
.0075	22.0	22.0	.0413	36.0	36.0	.0675	60.0	60.0	.1125	120.0	120.0	.225	240.0	240.0	.450
.0082	22.0	22.0	.0451	36.0	36.0	.0738	60.0	60.0	.123	120.0	120.0	.246	240.0	240.0	.492
.01	22.0	22.0	.0550	36.0	36.0	.090	60.0	60.0	.150	120.0	120.0	.30	240.0	240.0	.60
.012	22.0	22.0	.0660	36.0	36.0	.108	60.0	60.0	.180	120.0	120.0	.36	240.0	240.0	.72
.015	22.0	22.0	.0825	36.0	36.0	.135	60.0	60.0	.225	120.0	120.0	.45	240.0	240.0	.90
.018	22.0	22.0	.0990	36.0	36.0	.162	60.0	60.0	.270	120.0	120.0	.54	240.0	240.0	1.08
.02	22.0	22.0	.1100	36.0	36.0	.180	60.0	60.0	.300	120.0	120.0	.60	240.0	240.0	1.20
.022	22.0	22.0	.1210	36.0	36.0	.198	60.0	60.0	.330	120.0	120.0	.66	240.0	240.0	1.32
.027	22.0	22.0	.1485	36.0	36.0	.243	60.0	60.0	.405	120.0	120.0	.81	240.0	240.0	1.62
.033	22.0	22.0	.1815	36.0	36.0	.297	60.0	60.0	.495	120.0	120.0	.99	240.0	240.0	1.98
.039	22.0	22.0	.2145	36.0	36.0	.351	60.0	60.0	.585	120.0	120.0	1.17	240.0	220.51	2.15
.047	22.0	22.0	.2585	36.0	36.0	.423	60.0	60.0	.705	120.0	120.0	1.41	240.0	212.76	2.50
.05	22.0	22.0	.2750	36.0	36.0	.450	60.0	60.0	.750	120.0	120.0	1.50	240.0	200.00	2.50
.056	22.0	22.0	.3080	36.0	36.0	.504	60.0	60.0	.840	120.0	120.0	1.68	240.0	178.57	2.50
.068	22.0	22.0	.3740	36.0	36.0	.612	60.0	60.0	1.020	120.0	120.0	2.04	240.0	147.05	2.50
.075	22.0	22.0	.4125	36.0	36.0	.675	60.0	60.0	1.125	120.0	114.66	2.15	240.0	160.00	3.00
.082	22.0	21.95	.450	36.0	36.0	.738	60.0	60.0	1.23	120.0	104.87	2.15	240.0	146.34	3.00
.1	22.0	22.0	.550	36.0	36.0	.85	60.0	60.0	1.50	120.0	86.00	2.15	240.0	120.00	3.00
.12	22.0	22.0	.660	36.0	36.0	1.08	60.0	60.0	1.80	120.0	71.66	2.15	240.0	99.99	3.00
.15	22.0	22.0	.825	36.0	36.0	1.35	60.0	57.33	2.15	120.0	80.00	3.00	240.0	88.00	3.30
.18	22.0	22.0	.990	36.0	36.0	1.62	60.0	47.77	2.15	120.0	73.33	3.30	240.0	77.77	3.50
.2	22.0	22.0	1.100	36.0	34.4	1.72	60.0	43.00	2.15	120.0	66.00	3.30	240.0	70.00	3.50
.22	22.0	22.0	1.210	36.0	31.27	1.72	60.0	39.09	2.15	120.0	60.00	3.30	240.0	63.63	3.50
.27	22.0	22.0	1.485	36.0	30.37	2.05	60.0	33.33	2.25	120.0	51.85	3.50	240.0	63.70	4.30
.33	22.0	18.18	1.50	36.0	24.84	2.05	60.0	27.27	2.25	120.0	42.42	3.50	240.0	52.12	4.30
.39	22.0	15.38	1.50	36.0	22.05	2.15	60.0	30.76	3.00	120.0	35.89	2.50	240.0	46.15	4.50
.47	22.0	17.44	2.05	36.0	18.29	2.15	60.0	25.53	3.00	120.0	29.78	3.50	240.0	38.29	4.50
.5	22.0	16.4	2.05	36.0	17.20	2.15	60.0	24.00	3.00	120.0	28.00	3.50	240.0	36.00	4.50
.56	22.0	14.64	2.05	36.0	17.85	2.50	60.0	21.42	3.00	120.0	25.00	3.50	240.0	32.14	4.50
.68	22.0	12.05	2.05	36.0	14.70	2.50	60.0	19.41	3.30	120.0	25.29	4.30	240.0	35.29	6.00
.75	22.0	11.46	2.15	36.0	16.00	3.00	60.0	17.60	3.30	120.0	24.00	4.50	240.0	32.00	6.00
.82	22.0	10.48	2.15	36.0	14.63	3.00	60.0	16.09	3.30	120.0	21.95	4.50	240.0	29.26	6.00
1.0	22.0	8.6	2.15	36.0	12.00	3.00	60.0	16.00	4.00	120.0	18.00	4.50	240.0	24.00	6.00
1.2	22.0	7.16	2.15	36.0	9.99	3.00	60.0	13.33	4.00	120.0	15.00	4.50	240.0	21.33	6.40
1.5	22.0	6.66	2.50	36.0	8.00	3.00	60.0	11.46	4.30	120.0	14.13	5.30	240.0	18.66	7.00
1.8	22.0	5.55	2.50	36.0	6.66	3.00	60.0	11.11	5.00	120.0	13.33	6.00	240.0	15.55	7.00
2.0	22.0	5.0	2.50	36.0	6.60	3.30	60.0	10.00	5.00	120.0	12.00	6.00	240.0	14.00	7.00
2.2	22.0	4.54	2.50	36.0	6.00	3.30	60.0	9.09	5.00	120.0	10.09	6.00	240.0	12.72	7.00
2.5	22.0	4.8	3.00	36.0	5.60	3.50	60.0	8.48	5.30	120.0	9.60	6.00			
2.7	22.0	4.44	3.00	36.0	5.18	3.50	60.0	7.85	5.30	120.0	8.88	6.00			
3.0	22.0	3.99	3.00	36.0	4.66	3.50	60.0	7.06	5.30	120.0	8.53	6.40			
3.3	22.0	3.63	3.00	36.0	4.24	3.50	60.0	6.42	5.30	120.0	7.75	6.40			
3.9	22.0	3.38	3.30	36.0	4.41	4.30	60.0	6.15	6.00	120.0	7.17	7.00			
4.7	22.0	2.97	3.50	36.0	4.25	5.00	60.0	5.10	6.00	120.0	5.95	7.00			
5.0	22.0	2.8	3.50	36.0	4.00	5.00	60.0	4.80	6.00	120.0	5.60	7.00			
5.6	22.0	2.5	3.50	36.0	3.57	5.00	60.0	4.28	6.00	120.0	5.00	7.00			
6.8	22.0	2.52	4.30	36.0	3.11	5.30	60.0	4.11	7.00						
7.5	22.0	2.29	4.30	36.0	2.82	5.30	60.0	3.73	7.00						
8.2	22.0	2.09	4.30	36.0	2.58	5.30	60.0	3.41	7.00						
10.0	22.0	1.72	4.30	36.0	2.12	5.30	60.0	2.80	7.00						
12.0	22.0	1.50	4.50	36.0	2.00	6.00	60.0	2.33	7.00						
15.0	22.0	1.2	4.50	36.0	1.60	6.00									
18.0	22.0	1.17	5.30	36.0	1.42	6.40									
20.0	22.0	1.06	5.30	36.0	1.28	6.40									
22.0	22.0	0.96	5.30	36.0	1.16	6.40									
25.0	22.0	0.96	6.00	36.0	1.12	7.00									
27.0	22.0	0.88	6.00	36.0	1.03	7.00									

1. THE COMBINED DC AND AC VOLTAGES SHOULD NOT EXCEED THE DC RATINGS, SEE FIGURE.
2. CAPACITORS MAY BE OPERATED AT HIGHER FREQUENCIES, AT REDUCED RMS VOLTAGE SUCH THAT MAX. AC CURRENT RATINGS ARE NOT EXCEEDED.
3. CAPACITORS CAN HANDLE PULSE CURRENTS UP TO 100 TIMES GREATER THAN THE PEAK CURRENTS CALCULATED FROM THE RATED RMS RATING (PROVIDED SLOW REPETITION RATES ARE USED). IF THERE IS ANY DOUBT, A SKETCH OF THE VOLTAGE AND CURRENT WAVE FORMS WITH TIME BASE SHOULD BE SENT TO CRC FOR ANALYSIS.





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CRC COMPONENT RESEARCH CO.

METALLIZED POLYCARBONATE G12

ESTABLISHED RELIABILITY CAPACITORS

PRODUCT FEATURES

2.5 μF 30VDC ACTUAL SIZE CAPACITOR

MINIATURE SIZE TO REPLACE NON-HERMETIC WRAP AND FILL, AND MOLDED CAPACITORS.

HERMETICALLY SEALED, HIGH RELIABILITY SCREENED FOR CRITICAL AEROSPACE APPLICATIONS.

AC RATED FROM 22VRMS TO 120VRMS AT FREQUENCIES UP TO 20KHz, −65°C to 100°C, WITH DERATED OPERATION AT 125°C. DC RATED 30VDC TO 200VDC.

100% RELIABILITY SCREENING, INCLUDES BURN-IN, TEMPERATURE CYCLING, FINE LEAK TESTS, AC SQUARE WAVE TESTS.

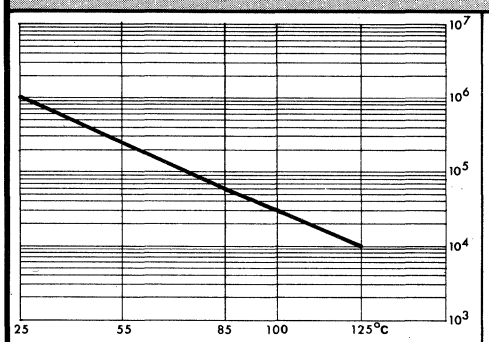
G12 CAPACITORS ARE PRESENTLY DESIGNED INTO MANY NAVY AND AIRFORCE PROGRAMS.

LOW LOSS, RUGGED INTERNAL TERMINATIONS QUALIFIED FOR ALL HI-REL PROGRAMS (CRC PATENTED CONSTRUCTION).

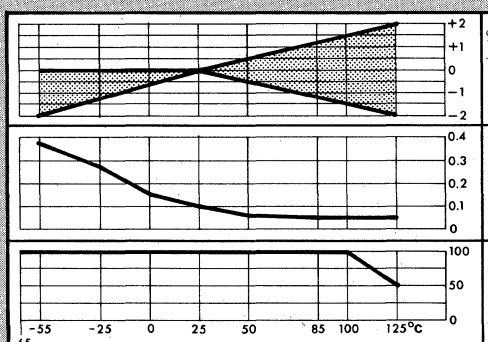
LOWEST PRICED, HIGH RELIABILITY, METALLIZED FILM CAPACITORS FOR HIGH VOLUME PROGRAM USE.

AVAILABLE IN STANDARD CAPACITANCE TOLERANCES, ±1%, ±2%, ±5%, ±10%. OTHER TOLERANCES AVAILABLE ON REQUEST.

TYPICAL CURVES



INSULATION RESISTANCE WITH TEMPERATURE IN MEGOHMS (0.1 μF OR LESS)



% CAPACITANCE CHANGE WITH TEMPERATURE

% DISSIPATION FACTOR WITH TEMPERATURE

% VOLTAGE RATING WITH TEMPERATURE

TYPICAL APPLICATIONS

- CRITICAL TIMING CIRCUITS
- FIXED TUNING CIRCUITS
- FILTERING
- TEMPERATURE COMPENSATION
- COUPLING AND DECOUPLING
- FEEDBACK CIRCUITS
- POWER SUPPLY FILTERING
- GYRO CIRCUITS
- PULSE FORMING NETWORKS
- INTEGRATING CIRCUITS

LIFE TEST DATA CRC TEST REPORT #78TR129

TEST RESULTS FOR 180 SERIES G12 CAPACITORS LIFE TESTED FOR 2000 HOURS AT 100°C AT 140% OF RATED DC VOLTAGE. THERE WERE NO FAILURES FOR THIS TEST.

LIST OF CAPACITORS LIFE TESTED			INSULATION RESISTANCE IN MEGOHMS AT 25°C			% CAPACITANCE CHANGE WITH LIFE			% DISSIPATION FACTOR AT 25°C WITH LIFE		
CRC TYPE	uF VALUE	Q'TY TESTED	POST TEST LIMITS (MIN. I.R.)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. △C)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. D.F.)	TEST RESULTS LOW	TEST RESULTS HIGH
G12A102	.001	20	$3.3x10^5$	$1.5x10^7$	$3x10^7$	±2	0.000	−.245	.25	.035	.055
G12A153	.015	20	$3.3x10^5$	$1.5x10^7$	$3x10^7$	±2	−.055	−.215	.25	.06	.08
G12B102	.001	20	$3.3x10^5$	$2x10^7$	$5x10^7$	±2	+.005	+.15	.25	.045	.055
G12B684	.68	20	$4.9x10^4$	$1.9x10^6$	$5x10^6$	±2	−.035	−.13	.25	.045	.055
G12C222	.0022	20	$3.3x10^5$	$5x10^7$	$1x10^8$	±2	+.01	−.225	.25	.055	.065
G12C305	3.0	20	$1.1x10^4$	$2.7x10^5$	$8.3x10^5$	±2	0.00	+.07	.25	.04	.045
G12D333	.033	20	$3.3x10^5$	$2x10^7$	$2.8x10^7$	±2	−.005	−.22	.25	.07	.075
G12D564	.56	20	$5.9x10^4$	$1.7x10^6$	$3.4x10^6$	±2	−.06	−.15	.25	.045	.055

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CRC COMPONENT RESEARCH CO.

METALLIZED POLYCARBONATE G12

ESTABLISHED RELIABILITY CAPACITORS

G12 SPECIFICATIONS

CONSTRUCTION	Metallized polycarbonate dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmental requirements of MIL-C-83421.	
OPERATING TEMPERATURE	−65°C to +100°C	At full rated voltage, derate linearly to 50% of rated voltage at 125°C.
DIELECTRIC ABSORPTION	0.1% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.15% maximum	At 25°C when measured per MIL-C-83421.
AC SQUARE WAVE	100Hz, 60 seconds minimum	At 25°C at a peak to peak voltage of 2 times rated DC voltage, terminal to terminal per MIL-C-83421.
DIELECTRIC STRENGTH	200% DC volts	At 25°C from terminal to terminal and terminal to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	±2% 0% to −2%	From 25°C to +125°C. From 25°C to −55°C.
CAPACITANCE STABILITY	±0.25%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1×10^{-6}atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 0.18uF CAPACITOR AT 25°C IS 100,000 ÷ 0.18 = 555,555 MEGOHMS.

RANGE	25°C	85°C	100°C	125°C
.001 TO 0.1uF	1,000,000 Megohms	60,000 Megohms	30,000 Megohms	10,000 Megohms
GREATER THAN 0.1uF	100,000 Megohms-uF	6,000 Megohms-uF	3,000 Megohms-uF	1,000 Megohms-uF

G12 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	48 hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1×10^{-6}atm/cm³/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz at a peak to peak voltage of 2 times DC rated voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
7	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	100,000 megohm-uF, need not exceed 1,000,000 megohms	100% Test
8	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
9	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.15% max.	100% Test
10	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

CRC COMPONENT RESEARCH CO.

METALLIZED POLYCARBONATE G12 CASE DIMENSIONS

ESTABLISHED RELIABILITY CAPACITORS

uF	TYPE G12A 30VDC				TYPE G12B 50VDC				TYPE G12C 100VDC				TYPE G12D 200VDC			
	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C
.001	G12A102	.170	.500	.600	G12B102	.170	.500	.600	G12C102	.170	.500	.600	G12D102	.170	.500	.600
.0012	G12A122	.170	.500	.600	G12B122	.170	.500	.600	G12C122	.170	.500	.600	G12D122	.170	.500	.600
.0015	G12A152	.170	.500	.600	G12B152	.170	.500	.600	G12C152	.170	.500	.600	G12D152	.170	.500	.600
.0018	G12A182	.170	.500	.600	G12B182	.170	.500	.600	G12C182	.170	.500	.600	G12D182	.170	.500	.600
.002	G12A202	.170	.500	.600	G12B202	.170	.500	.600	G12C202	.170	.500	.600	G12D202	.170	.500	.600
.0022	G12A222	.170	.500	.600	G12B222	.170	.500	.600	G12C222	.170	.500	.600	G12D222	.170	.500	.600
.0027	G12A272	.170	.500	.600	G12B272	.170	.500	.600	G12C272	.170	.500	.600	G12D272	.170	.500	.600
.0033	G12A332	.170	.500	.600	G12B332	.170	.500	.600	G12C332	.170	.500	.600	G12D332	.170	.500	.600
.0039	G12A392	.170	.500	.600	G12B392	.170	.500	.600	G12C392	.170	.500	.600	G12D392	.170	.500	.600
.0047	G12A472	.170	.500	.600	G12B472	.170	.500	.600	G12C472	.170	.500	.600	G12D472	.170	.500	.600
.005	G12A502	.170	.500	.600	G12B502	.170	.500	.600	G12C502	.170	.500	.600	G12D502	.170	.500	.600
.0056	G12A562	.170	.500	.600	G12B562	.170	.500	.600	G12C562	.170	.500	.600	G12D562	.170	.500	.600
.0068	G12A682	.170	.500	.600	G12B682	.170	.500	.600	G12C682	.170	.500	.600	G12D682	.170	.500	.600
.0075	G12A752	.170	.500	.600	G12B752	.170	.500	.600	G12C752	.170	.500	.600	G12D752	.170	.562	.662
.0082	G12A822	.170	.500	.600	G12B822	.170	.500	.600	G12C822	.170	.500	.600	G12D822	.170	.562	.662
.01	G12A103	.170	.500	.600	G12B103	.170	.500	.600	G12C103	.170	.500	.600	G12D103	.170	.687	.787
.012	G12A123	.170	.500	.600	G12B123	.170	.500	.600	G12C123	.170	.500	.600	G12D123	.170	.687	.787
.015	G12A153	.170	.500	.600	G12B153	.170	.500	.600	G12C153	.170	.500	.600	G12D153	.170	.687	.787
.018	G12A183	.170	.500	.600	G12B183	.170	.500	.600	G12C183	.170	.562	.662	G12D183	.193	.687	.787
.02	G12A203	.170	.500	.600	G12B203	.170	.500	.600	G12C203	.170	.562	.662	G12D203	.193	.687	.787
.022	G12A223	.170	.500	.600	G12B223	.170	.500	.600	G12C223	.170	.562	.662	G12D223	.193	.687	.787
.027	G12A273	.170	.500	.600	G12B273	.170	.500	.600	G12C273	.170	.562	.662	G12D273	.193	.687	.787
.033	G12A333	.170	.500	.600	G12B333	.170	.500	.600	G12C333	.170	.562	.662	G12D333	.193	.687	.787
.039	G12A393	.170	.500	.600	G12B393	.170	.500	.600	G12C393	.170	.562	.662	G12D393	.235	.687	.787
.047	G12A473	.170	.500	.600	G12B473	.170	.500	.600	G12C473	.193	.562	.662	G12D473	.235	.687	.787
.05	G12A503	.170	.500	.600	G12B503	.170	.500	.600	G12C503	.193	.562	.662	G12D503	.235	.687	.787
.056	G12A563	.170	.500	.600	G12B563	.170	.500	.600	G12C563	.193	.562	.662	G12D563	.235	.687	.787
.068	G12A683	.170	.500	.600	G12B683	.170	.562	.662	G12C683	.235	.562	.662	G12D683	.312	.687	.787
.075	G12A753	.170	.500	.600	G12B753	.170	.562	.662	G12C753	.235	.562	.662	G12D753	.312	.687	.787
.082	G12A823	.170	.562	.662	G12B823	.170	.562	.662	G12C823	.235	.562	.662	G12D823	.312	.687	.787
.1	G12A104	.170	.562	.662	G12B104	.193	.562	.662	G12C104	.235	.687	.787	G12D104	.312	.687	.787
.12	G12A124	.170	.562	.662	G12B124	.193	.562	.662	G12C124	.235	.687	.787	G12D124	.312	.687	.787
.15	G12A154	.170	.562	.662	G12B154	.193	.562	.662	G12C154	.235	.687	.787	G12D154	.312	.813	.913
.18	G12A184	.193	.562	.662	G12B184	.235	.562	.662	G12C184	.235	.687	.787	G12D184	.312	.813	.913
.2	G12A204	.193	.562	.662	G12B204	.235	.562	.662	G12C204	.235	.687	.787	G12D204	.312	.813	.913
.22	G12A224	.193	.562	.662	G12B224	.235	.562	.662	G12C224	.235	.687	.787	G12D224	.312	.813	.913
.27	G12A274	.235	.562	.662	G12B274	.235	.687	.787	G12C274	.312	.687	.787	G12D274	.312	1.063	1.163
.33	G12A334	.235	.562	.662	G12B334	.235	.687	.787	G12C334	.312	.813	.913	G12D334	.312	1.063	1.163
.39	G12A394	.235	.687	.787	G12B394	.235	.687	.787	G12C394	.312	.813	.913	G12D394	.400	1.063	1.163
.47	G12A474	.235	.687	.787	G12B474	.312	.687	.787	G12C474	.400	.687	.787	G12D474	.400	1.063	1.163
.5	G12A504	.235	.687	.787	G12B504	.312	.687	.787	G12C504	.400	.687	.787	G12D504	.400	1.063	1.163
.56	G12A564	.235	.687	.787	G12B564	.312	.687	.787	G12C564	.400	.687	.787	G12D564	.400	1.063	1.163
.68	G12A684	.235	.813	.913	G12B684	.312	.687	.787	G12C684	.400	.813	.913	G12D684	.500	1.125	1.225
.75	G12A754	.235	.813	.913	G12B754	.312	.687	.787	G12C754	.400	.813	.913	G12D754	.500	1.125	1.225
.82	G12A824	.235	.813	.913	G12B824	.312	.687	.787	G12C824	.400	.813	.913	G12D824	.500	1.375	1.475
1.0	G12A105	.235	.813	.913	G12B105	.312	.813	.913	G12C105	.400	1.063	1.163	G12D105	.500	1.375	1.475
1.2	G12A125	.312	.813	.913	G12B125	.312	.813	.913	G12C125	.400	1.063	1.163	G12D125	.500	1.375	1.475
1.5	G12A155	.312	.813	.913	G12B155	.400	.813	.913	G12C155	.400	1.375	1.475				
1.8	G12A185	.312	.813	.913	G12B185	.400	.813	.913	G12C185	.400	1.375	1.475				
2.0	G12A205	.312	.813	.913	G12B205	.400	.813	.913	G12C205	.500	1.375	1.475				
2.2	G12A225	.312	.813	.913	G12B225	.400	.813	.913	G12C225	.500	1.375	1.475				
					G12B255	.400	.813	.913	G12C255	.500	1.375	1.475				
					G12B275	.400	1.063	1.163	G12C275	.500	1.375	1.475				
					G12B305	.400	1.063	1.163	G12C305	.500	1.375	1.475				
					G12B335	.400	1.063	1.163	G12C335	.500	1.375	1.475				
					G12B395	.400	1.375	1.475								
					G12B475	.500	1.375	1.475								
					G12B505	.500	1.375	1.475								
					G12B565	.500	1.375	1.475								
					G12B685	.500	1.375	1.475								
					G12B755	.500	1.375	1.475								
					G12B825	.500	1.375	1.475								

FOR SPECIAL VALUES AND TOLERANCES, PLEASE CONTACT OUR APPLICATION DEPARTMENT.

FOR VALUES ABOVE 2.2 MICROFARADS, USE TYPE G12B.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±0.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads

G12 | A | 104 | J | S | W

STYLE

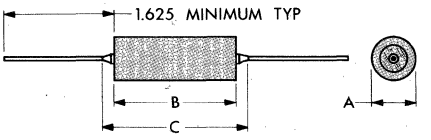
VOLTAGE
A=30VDC
B=50VDC
C=100VDC
D=200VDC

SLEEVING CODE
S=Mylar sleeve
X=No sleeve

LEAD CODE
W=Tinned copper clad steel: #22 (.025″) for .312″ case dia. & smaller; #20 (.032″) for .400″ & .500″ case dia.

CAPACITANCE TOLERANCE
K=10% J=5% G=2% F=1% D=½% B=¼% A=.1%

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.



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CRC
COMPONENT RESEARCH CO.

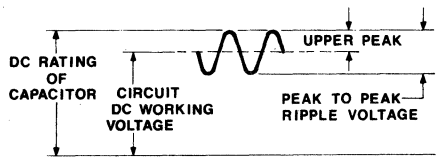
METALLIZED POLYCARBONATE G12 AC RATINGS

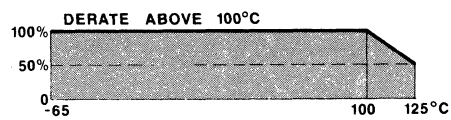
ESTABLISHED RELIABILITY CAPACITORS

uF	TYPE G12A 30VDC MAXIMUM RATING			TYPE G12B 50VDC MAXIMUM RATING			TYPE G12C 100VDC MAXIMUM RATING			TYPE G12D 200VDC MAXIMUM RATING		
	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps
.0010	22.0	22.0	.0055	36.0	36.0	.0090	60.0	60.0	.0150	120.0	120.0	.030
.0012	22.0	22.0	.0066	36.0	36.0	.0108	60.0	60.0	.0180	120.0	120.0	.036
.0015	22.0	22.0	.0083	36.0	36.0	.0135	60.0	60.0	.0225	120.0	120.0	.045
.0018	22.0	22.0	.0099	36.0	36.0	.0162	60.0	60.0	.0270	120.0	120.0	.054
.0020	22.0	22.0	.0110	36.0	36.0	.0180	60.0	60.0	.0300	120.0	120.0	.060
.0022	22.0	22.0	.0121	36.0	36.0	.0198	60.0	60.0	.0330	120.0	120.0	.066
.0027	22.0	22.0	.0149	36.0	36.0	.0243	60.0	60.0	.0405	120.0	120.0	.081
.0033	22.0	22.0	.0182	36.0	36.0	.0297	60.0	60.0	.0495	120.0	120.0	.099
.0039	22.0	22.0	.0215	36.0	36.0	.0351	60.0	60.0	.0585	120.0	120.0	.117
.0047	22.0	22.0	.0259	36.0	36.0	.0423	60.0	60.0	.0705	120.0	120.0	.141
.0050	22.0	22.0	.0275	36.0	36.0	.0450	60.0	60.0	.0750	120.0	120.0	.150
.0056	22.0	22.0	.0308	36.0	36.0	.0504	60.0	60.0	.0840	120.0	120.0	.168
.0068	22.0	22.0	.0374	36.0	36.0	.0612	60.0	60.0	.1020	120.0	120.0	.204
.0075	22.0	22.0	.0413	36.0	36.0	.0675	60.0	60.0	.1125	120.0	120.0	.225
.0082	22.0	22.0	.0451	36.0	36.0	.0738	60.0	60.0	.123	120.0	120.0	.246
.010	22.0	22.0	.0550	36.0	36.0	.090	60.0	60.0	.150	120.0	120.0	.30
.012	22.0	22.0	.0660	36.0	36.0	.108	60.0	60.0	.180	120.0	120.0	.36
.015	22.0	22.0	.0825	36.0	36.0	.135	60.0	60.0	.225	120.0	120.0	.45
.018	22.0	22.0	.0990	36.0	36.0	.162	60.0	60.0	.27	120.0	120.0	.54
.020	22.0	22.0	.1100	36.0	26.0	.180	60.0	60.0	.30	120.0	120.0	.60
.022	22.0	22.0	.1210	36.0	36.0	.198	60.0	60.0	.33	120.0	120.0	.66
.027	22.0	22.0	.1485	36.0	36.0	.243	60.0	60.0	.405	120.0	120.0	.81
.033	22.0	22.0	.1815	36.0	36.0	.297	60.0	54.54	.45	120.0	103.03	.85
.039	22.0	22.0	.2145	36.0	31.79	.31	60.0	46.15	.45	120.0	120.0	1.17
.047	22.0	22.0	.2585	36.0	26.38	.31	60.0	60.00	.705	120.0	120.0	1.41
.050	22.0	22.0	.275	36.0	24.80	.31	60.0	60.00	.75	120.0	120.0	1.50
.056	22.0	22.0	.308	36.0	22.14	.31	60.0	60.00	.84	120.0	107.14	1.50
.068	22.0	18.23	.31	36.0	26.47	.45	60.0	60.00	1.02	120.0	120.00	2.04
.075	22.0	16.53	.31	36.0	24.00	.45	60.0	58.66	1.10	120.0	109.33	2.05
.082	22.0	21.95	.45	36.0	21.95	.45	60.0	53.65	1.10	120.0	100.00	2.05
.100	22.0	18.00	.45	36.0	34.00	.85	60.0	60.00	1.50	120.0	82.00	2.05
.12	22.0	15.00	.45	36.0	28.33	.85	60.0	50.00	1.50	120.0	68.33	2.05
.15	22.0	12.00	.45	36.0	22.66	.85	60.0	40.00	1.50	120.0	57.33	2.15
.18	22.0	18.88	.85	36.0	24.44	1.10	60.0	33.33	1.50	120.0	47.77	2.15
.20	22.0	17.00	.85	36.0	22.00	1.10	60.0	30.00	1.50	120.0	43.00	2.15
.22	22.0	15.45	.85	36.0	20.00	1.10	60.0	27.27	1.50	120.0	39.09	2.15
.27	22.0	16.29	1.10	36.0	22.22	1.50	60.0	30.37	2.05	120.0	33.33	2.25
.33	22.0	13.33	1.10	36.0	18.18	1.50	60.0	26.06	2.15	120.0	27.27	2.25
.39	22.0	15.38	1.50	36.0	15.38	1.50	60.0	22.05	2.15	120.0	30.76	3.00
.47	22.0	12.76	1.50	36.0	17.44	2.05	60.0	19.14	2.25	120.0	25.53	3.00
.50	22.0	12.00	1.50	36.0	16.40	2.05	60.0	18.00	2.25	120.0	24.00	3.00
.56	22.0	10.71	1.50	36.0	14.64	2.05	60.0	16.07	2.25	120.0	21.42	3.00
.68	22.0	10.11	1.72	36.0	12.05	2.05	60.0	14.70	2.50	120.0	19.41	3.30
.75	22.0	9.17	1.72	36.0	10.93	2.05	60.0	13.33	2.50	120.0	17.60	3.30
.82	22.0	8.39	1.72	36.0	10.00	2.05	60.0	12.19	2.50	120.0	17.07	3.50
1.0	22.0	6.88	1.72	36.0	8.60	2.15	60.0	12.00	3.00	120.0	14.00	3.50
1.2	22.0	7.16	2.15	36.0	7.16	2.15	60.0	9.99	3.00	120.0	11.66	3.50
1.5	22.0	5.73	2.15	36.0	6.66	2.50	60.0	8.80	3.30			
1.8	22.0	4.77	2.15	36.0	5.55	2.50	60.0	7.33	3.30			
2.0	22.0	4.30	2.15	36.0	5.00	2.50	60.0	7.00	3.50			
2.2	22.0	3.90	2.15	36.0	4.54	2.50	60.0	6.36	3.50			
				36.0	4.00	2.50	60.0	5.60	3.50			
				36.0	4.44	3.00	60.0	5.18	3.50			
				36.0	3.99	3.00	60.0	4.66	3.50			
				36.0	3.63	3.00	60.0	4.24	3.50			
				36.0	3.38	3.30						
				36.0	2.97	3.50						
				36.0	2.80	3.50						
				36.0	2.50	3.50						
				36.0	2.05	3.50						
				36.0	1.86	3.50						
				36.0	1.70	3.50						

FOR VALUES ABOVE 2.2 MICROFARADS, USE TYPE G12B.

1. THE COMBINED DC AND AC VOLTAGES SHOULD NOT EXCEED THE DC RATINGS, SEE FIGURE.
2. CAPACITORS MAY BE OPERATED AT HIGHER FREQUENCIES, AT REDUCED RMS VOLTAGE SUCH THAT MAX. AC CURRENT RATINGS ARE NOT EXCEEDED.
3. CAPACITORS CAN HANDLE PULSE CURRENTS UP TO 100 TIMES GREATER THAN THE PEAK CURRENTS CALCULATED FROM THE RATED RMS RATING (PROVIDED SLOW REPETITION RATES ARE USED). IF THERE IS ANY DOUBT, A SKETCH OF THE VOLTAGE AND CURRENT WAVE FORMS WITH TIME BASE SHOULD BE SENT TO CRC FOR ANALYSIS.





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CRC
COMPONENT RESEARCH CO.

METALLIZED POLYCARBONATE
P12

ESTABLISHED RELIABILITY CAPACITORS

PRODUCT FEATURES:

MINIATURE SIZE - RATED TO 100°C OPERATION.

HERMETICALLY SEALED, HIGH RELIABILITY AC SCREENED FOR AEROSPACE APPLICATIONS.

AC RATED FROM 36VRMS TO 240VRMS AT FREQUENCIES UP TO 20KHz, −65°C TO 100°C WITH 50% DERATED OPERATION AT 125°C.

DC RATED FROM 50VDC TO 400VDC, −65°C TO 100°C WITH 50% DERATED OPERATION AT 125°C.

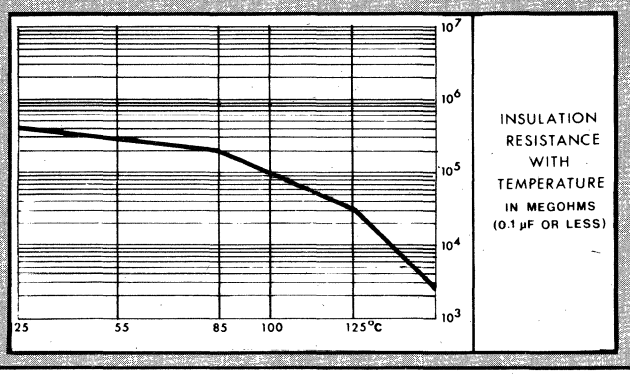
P12 CAPACITORS ARE SCREENED PER MIL-C-83421, AND ARE PRESENTLY DESIGNED INTO MANY MILITARY PROGRAMS.

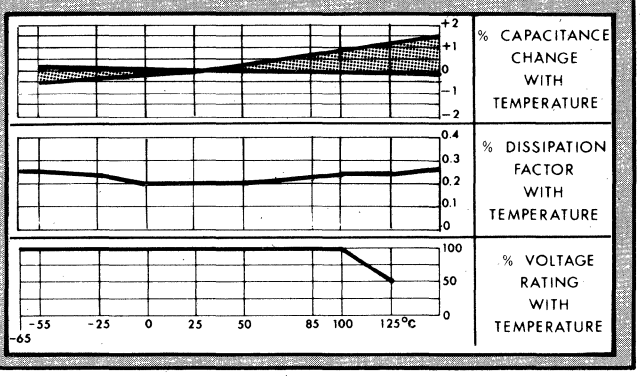
LOW LOSS, RUGGED INTERNAL TERMINATIONS, QUALIFIED FOR ALL HIGH RELIABILITY PROGRAMS (CRC PATENTED CONSTRUCTION).

LOW CAPACITANCE DRIFT AND TC, HIGH INSULATION RESISTANCE.

AVAILABLE IN STANDARD CAPACITANCE TOLERANCES ±1%, ±2%, ±5%, ±10%. OTHER TOLERANCES AVAILABLE ON REQUEST.

TYPICAL CURVES





TYPICAL APPLICATIONS

- CRITICAL TIMING CIRCUITS
- FIXED TUNING CIRCUITS
- FILTERING
- TEMPERATURE COMPENSATION
- COUPLING AND DECOUPLING
- FEEDBACK CIRCUITS
- POWER SUPPLY FILTERING
- GYRO CIRCUITS
- PULSE FORMING NETWORKS
- INTEGRATING CIRCUITS

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

CRC COMPONENT RESEARCH CO.

METALLIZED POLYCARBONATE P12

ESTABLISHED RELIABILITY CAPACITORS

P12 SPECIFICATIONS

CONSTRUCTION	Metallized polycarbonate dielectric, hermetically sealed, extended metal film electrodes axial leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmental requirements of MIL-C-83421.	
OPERATING TEMPERATURE	−65°C to +100°C	At full rated voltage, derated linearly to 50% of rated voltage at 125°C.
DIELECTRIC ABSORPTION	0.1% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.15% maximum	At 25°C when measured per MIL-C-83421.
AC SQUARE WAVE	100Hz, 60 seconds minimum	At 25°C at a peak to peak voltage of 2 times rated DC voltage, terminal to terminal per MIL-C-83421.
DIELECTRIC STRENGTH	150% rated DC voltage	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	+1.5% to −1.0% +0.5% to −1.5	From 25°C to +125°C. From 25°C to −55°C.
CAPACITANCE STABILITY	±0.25%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1×10^{-6}atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1 uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.5uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 0.68uF CAPACITOR AT 25°C IS 200,000 ÷ 0.68 = 294,117 MEGOHMS.

RANGE	25°C	85°C	100°C	125°C
.001 TO 0.5uF	400,000 Megohms	200,000 Megohms	30,000 Megohms	2,500 Megohms
GREATER THAN 0.5uF	200,000 Megohms-uF	100,000 Megohms-uF	15,000 Megohms-uF	1,250 Megohms-uF

P12 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	48 hrs. minimum at 100°C, at 120% rated AC voltage at 400Hz	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1×10^{-6}atm/cm³/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz at a peak to peak voltage of 2 times DC rated voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	DC HI-POT (TERMINAL TO TERMINAL) AND TERMINALS TO CASE)	Apply 150% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
7	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	200,000 megohm-uF need not exceed 400,000 megohms	100% Test
8	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
9	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.15% max.	100% Test
10	VISUAL AND MECHANICAL INSPECTION	For marking dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. **2.** Traceability to production and test records by permanent making of parts with date code lot. **3.** Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

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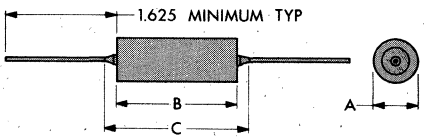
CRC COMPONENT RESEARCH CO.

METALLIZED POLYCARBONATE P12 CASE DIMENSIONS

ESTABLISHED RELIABILITY CAPACITORS

CAP uF	TYPE P12B 50VDC (36Vrms AC)			TYPE P12C 100VDC (60Vrms AC)			TYPE P12D 200VDC (120Vrms AC)			Type P12E 400VDC (240Vrms AC)		
	Diam. A	Length B	Length C	Diam. A	Length B	Length C	Diam. A	Length B	Length C	Diam. A	Length B	Length C
.001	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0012	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0015	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0018	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.002	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0022	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0027	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.0033	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.0039	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.0047	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.005	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.0056	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.0068	.170	.500	.600	.170	.500	.600	.193	.562	.662	.235	.687	.787
.0075	.170	.500	.600	.170	.500	.600	.193	.562	.662	.235	.687	.787
.0082	.170	.500	.600	.170	.500	.600	.193	.562	.662	.235	.687	.787
.01	.170	.500	.600	.170	.562	.662	.193	.687	.787	.312	.687	.787
.012	.170	.500	.600	.170	.562	.662	.193	.687	.787	.312	.687	.787
.015	.170	.500	.600	.170	.562	.662	.193	.687	.787	.312	.687	.787
.018	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.02	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.022	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.027	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.033	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.039	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.047	.193	.562	.662	.193	.687	.787	.312	.687	.787	.400	.813	.913
.05	.193	.562	.662	.193	.687	.787	.312	.687	.787	.400	.813	.913
.056	.193	.562	.662	.193	.687	.787	.312	.687	.787	.400	.813	.913
.068	.193	.562	.662	.193	.687	.787	.312	.687	.787	.400	.813	.913
.075	.193	.687	.787	.235	.687	.787	.312	.813	.913	.400	1.063	1.163
.082	.193	.687	.787	.235	.687	.787	.312	.813	.913	.400	1.063	1.163
.1	.193	.687	.787	.235	.687	.787	.312	.813	.913	.400	1.063	1.163
.12	.193	.687	.787	.235	.687	.787	.312	.813	.913	.400	1.063	1.163
.15	.235	.687	.787	.312	.687	.787	.312	.813	.913	.500	1.125	1.225
.18	.235	.687	.787	.312	.687	.787	.400	.813	.913	.500	1.125	1.225
.20	.235	.687	.787	.312	.687	.787	.400	.813	.913	.500	1.125	1.225
.22	.235	.687	.787	.312	.687	.787	.400	.813	.913	.500	1.125	1.225
.27	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.562	1.375	1.475
.33	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.562	1.375	1.475
.39	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.562	1.375	1.475
.47	.312	.813	.913	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475
.50	.312	.813	.913	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475
.56	.312	.813	.913	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475
.68	.400	.813	.913	.400	1.063	1.163	.562	1.375	1.475	.670	1.375	1.475
.75	.400	.813	.913	.400	1.063	1.163	.562	1.375	1.475	.670	1.375	1.475
.82	.400	.813	.913	.400	1.063	1.163	.562	1.375	1.475	.670	1.375	1.475
1.0	.400	.813	.913	.400	1.063	1.163	.562	1.375	1.475	.750	1.875	1.975
1.2	.400	1.063	1.163	.500	1.125	1.225	.670	1.375	1.475	.750	1.875	1.975
1.5	.400	1.063	1.163	.500	1.125	1.225	.670	1.375	1.475	.750	1.875	1.975
1.8	.500	1.125	1.225	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975
2.0	.500	1.125	1.225	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975
2.2	.500	1.125	1.225	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975
2.5	.562	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
2.7	.562	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
3.0	.562	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
3.3	.562	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
3.9	.562	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975			
4.7	.670	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975			
5.0	.670	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975			
5.6	.670	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975			
6.8	.670	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475			
7.5	.670	1.875	1.975	.750	1.875	1.975	1.000	2.375	2.475			
8.2	.670	1.875	1.975	.750	1.875	1.975	1.000	2.375	2.475			
10.0	.670	1.875	1.975	.750	1.875	1.975	1.000	2.375	2.475			
12.0	.750	1.875	1.975	1.000	1.875	1.975						
15.0	.750	1.875	1.975	1.000	1.875	1.975						
18.0	1.000	1.875	1.975	1.000	2.375	2.475						
20.0	1.000	1.875	1.975	1.000	2.375	2.475						
22.0	1.000	1.875	1.975	1.000	2.375	2.475						
25.0	1.000	2.375	2.475									
27.0	1.000	2.375	2.475									

FOR SPECIAL VALUES AND TOLERANCES, PLEASE CONTACT OUR APPLICATION DEPARTMENT.



P12 | B | 104 | J | S | W

STYLE

VOLTAGE
- B = 50VDC
- C = 100VDC
- D = 200VDC
- E = 400VDC

SLEEVING CODE
S = Mylar sleeve
X = No sleeve

LEAD CODE
W = Tinned copper clad steel: #22 (.025") for .312" case dia. & smaller; #20 (.032") for .400" & .500" case dia.
C = Tinned oxygen-free copper: #18 (.040") for .562" case dia. & larger.

CAPACITANCE TOLERANCE
K = 10% G = 2% D = ½%
J = 5% F = 1% B = ¼%

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 1000,000 picofarads.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±0.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads

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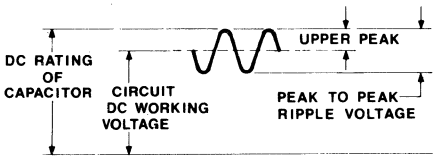
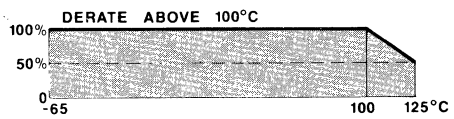
CRC COMPONENT RESEARCH CO.

METALLIZED POLYCARBONATE P12 AC RATINGS

ESTABLISHED RELIABILITY CAPACITORS

CAP uF	TYPE P12B 50VDC			TYPE P12C 100VDC			TYPE P12D 200VDC			TYPE P12E 400VDC		
	MAXIMUM RATING			MAXIMUM RATING			MAXIMUM RATING			MAXIMUM RATING		
	Volts RMS	In KHz Freq.	Amps RMS	Volts RMS	In KHz Freq.	Amps RMS	Volts RMS	In KHz Freq.	Amps RMS	Volts RMS	In KHz Freq.	Amps RMS
.001	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.0012	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.0015	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.0018	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.002	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.0022	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.0027	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.0033	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.0039	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.0047	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.005	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.0056	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.0068	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.40	240.0	40.0	1.0
.0075	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.40	240.0	40.0	1.0
.0082	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.40	240.0	40.0	1.0
.01	36.0	40.00	.14	60.0	40.00	.25	120.0	40.00	.60	240.0	40.0	1.4
.012	36.0	40.00	.14	60.0	40.00	.25	120.0	40.00	.60	240.0	40.0	1.4
.015	36.0	40.00	.14	60.0	40.00	.25	120.0	40.00	.60	240.0	40.0	1.4
.018	36.0	40.00	.25	60.0	40.00	.40	120.0	40.00	1.00	240.0	40.0	1.6
.02	36.0	40.00	.25	60.0	40.00	.40	120.0	40.00	1.00	240.0	40.0	1.6
.022	36.0	40.00	.25	60.0	40.00	.40	120.0	40.00	1.00	240.0	40.0	1.6
.027	36.0	40.00	.25	60.0	40.00	.40	120.0	40.00	1.00	240.0	40.0	1.6
.033	36.0	40.00	.25	60.0	32.00	.40	120.0	40.00	1.00	240.0	32.3	1.6
.039	36.0	32.00	.28	60.0	29.00	.42	120.0	40.00	1.20	240.0	27.4	1.6
.047	36.0	32.00	.34	60.0	28.00	.50	120.0	39.70	1.40	240.0	25.5	1.8
.05	36.0	32.00	.36	60.0	28.00	.53	120.0	37.30	1.40	240.0	24.0	1.8
.056	36.0	31.70	.40	60.0	27.50	.58	120.0	33.30	1.40	240.0	21.4	1.8
.068	36.0	29.00	.45	60.0	27.40	.70	120.0	27.40	1.40	240.0	17.0	1.8
.075	36.0	29.00	.50	60.0	25.00	.70	120.0	27.00	1.50	240.0	17.0	2.0
.082	36.0	28.00	.53	60.0	25.00	.78	120.0	26.00	1.60	240.0	16.3	2.0
.1	36.0	26.60	.60	60.0	25.00	.94	120.0	21.30	1.60	240.0	13.3	2.0
.12	36.0	26.00	.70	60.0	25.00	1.10	120.0	17.80	1.60	240.0	11.1	2.0
.15	36.0	25.00	.85	60.0	24.80	1.40	120.0	16.00	1.80	240.0	11.0	2.4
.18	36.0	24.60	1.00	60.0	20.70	1.40	120.0	13.30	1.80	240.0	11.0	3.0
.20	36.0	22.20	1.00	60.0	18.70	1.40	120.0	12.00	1.80	240.0	10.0	3.0
.22	36.0	20.00	1.00	60.0	16.90	1.40	120.0	11.00	1.80	240.0	10.0	3.0
.27	36.0	20.00	1.20	60.0	15.80	1.60	120.0	10.00	2.00	240.0	10.0	4.2
.33	36.0	16.00	1.20	60.0	13.00	1.60	120.0	8.80	2.20	240.0	8.7	4.3
.39	36.0	14.00	1.20	60.0	11.00	1.60	120.0	8.20	2.40	240.0	7.3	4.3
.47	36.0	14.00	1.50	60.0	10.20	1.80	120.0	8.00	2.80	240.0	6.4	4.5
.50	36.0	13.30	1.50	60.0	9.60	1.80	120.0	8.00	3.00	240.0	6.0	4.5
.56	36.0	11.90	1.50	60.0	8.60	1.80	120.0	7.60	3.20	240.0	5.4	4.5
.68	36.0	11.90	1.80	60.0	7.80	2.00	120.0	7.40	3.80	240.0	5.0	5.0
.75	36.0	10.60	1.80	60.0	7.10	2.00	120.0	7.40	4.20	240.0	4.4	5.0
.82	36.0	9.75	1.80	60.0	6.50	2.00	120.0	7.00	4.30	240.0	4.1	5.0
1.0	36.0	8.00	1.80	60.0	5.80	2.20	120.0	5.70	4.30	240.0	3.3	5.0
1.2	36.0	7.40	2.00	60.0	5.70	2.60	120.0	5.00	4.50	240.0	3.3	6.0
1.5	36.0	5.90	2.00	60.0	5.30	3.00	120.0	4.00	4.50	240.0	2.7	6.0
1.8	36.0	5.70	2.30	60.0	5.10	3.50	120.0	3.70	5.00	240.0	2.4	6.4
2.0	36.0	5.10	2.30	60.0	4.70	3.50	120.0	3.30	5.00	240.0	2.1	6.4
2.2	36.0	4.60	2.30	60.0	4.20	3.50	120.0	3.00	5.00	240.0	2.0	6.4
2.5	36.0	4.60	2.60	60.0	4.80	4.50	120.0	3.20	6.00	240.0	1.9	7.0
2.7	36.0	4.30	2.60	60.0	4.40	4.50	120.0	3.00	6.00	240.0	1.7	7.0
3.0	36.0	3.90	2.60	60.0	4.00	4.50	120.0	2.70	6.00	240.0	1.6	7.0
3.3	36.0	3.50	2.60	60.0	3.60	4.50	120.0	2.40	6.00	240.0	1.4	7.0
3.9	36.0	3.00	2.60	60.0	3.10	4.50	120.0	2.10	6.00			
4.7	36.0	2.80	3.00	60.0	2.80	5.00	120.0	1.80	6.40			
5.0	36.0	2.60	3.00	60.0	2.70	5.00	120.0	1.70	6.40			
5.6	36.0	2.40	3.00	60.0	2.40	5.00	120.0	1.50	6.40			
6.8	36.0	2.00	3.00	60.0	2.00	5.00	120.0	1.30	6.40			
7.5	36.0	2.00	3.50	60.0	2.00	6.00	120.0	1.20	7.00			
8.2	36.0	1.90	3.50	60.0	1.95	6.00	120.0	1.14	7.00			
10.0	36.0	1.60	3.50	60.0	1.60	6.00	120.0	.93	7.00			
12.0	36.0	1.50	4.00	60.0	1.42	6.40						
15.0	36.0	1.20	4.00	60.0	1.14	6.40						
18.0	36.0	1.18	4.80	60.0	.98	6.60						
20.0	36.0	1.10	4.80	60.0	.88	6.60						
22.0	36.0	.97	4.80	60.0	.80	6.60						
25.0	36.0	.96	5.40									
27.0	36.0	.88	5.40									





1. THE COMBINED DC AND AC VOLTAGES SHOULD NOT EXCEED THE DC RATINGS, SEE FIGURE.
2. CAPACITORS MAY BE OPERATED AT HIGHER FREQUENCIES, AT REDUCED RMS VOLTAGE SUCH THAT MAX. AC CURRENT RATINGS ARE NOT EXCEEDED.
3. CAPACITORS CAN HANDLE PULSE CURRENTS UP TO 100 TIMES GREATER THAN THE PEAK CURRENTS CALCULATED FROM THE RATED RMS RATING (PROVIDED SLOW REPETITION RATES ARE USED). IF THERE IS ANY DOUBT, A SKETCH OF THE VOLTAGE AND CURRENT WAVE FORMS WITH TIME BASE SHOULD BE SENT TO CRC FOR ANALYSIS.

CRC
COMPONENT RESEARCH CO.

METALLIZED TEFLON J11 & K11

ESTABLISHED RELIABILITY CAPACITORS

PRODUCT FEATURES

.068 μF 50VDC ACTUAL SIZE CAPACITOR

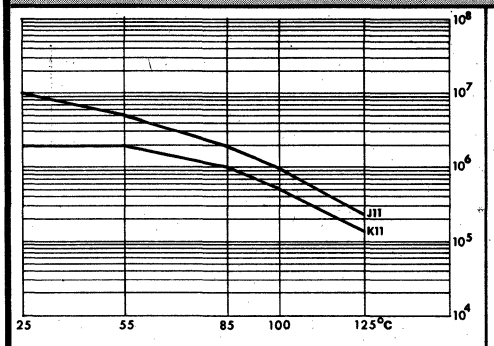
HIGH INSULATION RESISTANCE: 10,000,000 MEGOHMS MINIMUM. (FOR J11 SERIES, ALL VALUES UP TO 0.1uF).

LOW DIELECTRIC ABSORPTION: 0.01% MAXIMUM VOLTAGE RECOVERY.

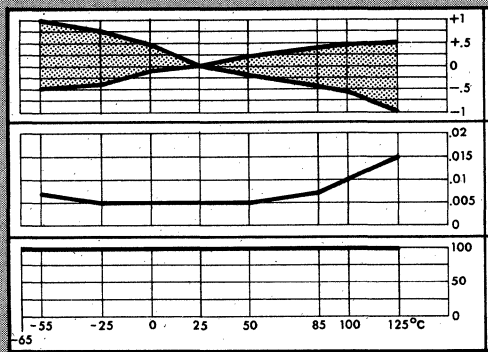
LONG TERM STABILITY: LESS THAN 0.5% CAPACITANCE DRIFT AFTER 2000 HRS. AT 125°C AT RATED VOLTS.

SERIES 11 CAPACITORS HAVE BEEN QUALIFIED FOR USE IN SPACE AND MISSILE SYSTEMS WHERE MAXIMUM RELIABILITY AND LOW DIELECTRIC LOSS ARE ESSENTIAL.

TYPICAL CURVES



INSULATION RESISTANCE WITH TEMPERATURE IN MEGOHMS (0.1 μF OR LESS)



TYPICAL APPLICATIONS

- CRITICAL TIMING CIRCUITS
- FIXED TUNING CIRCUITS
- TEMPERATURE COMPENSATION
- COUPLING AND DECOUPLING
- FEEDBACK CIRCUITS
- GYRO CIRCUITS
- INTEGRATING CIRCUITS

LIFE TEST DATA CRC TEST REPORT #XT1303

TEST RESULTS FOR 80 SERIES D11B CAPACITORS LIFE TESTED FOR 2000 HOURS AT 125°C AT 140% OF RATED DC VOLTAGE. THERE WERE NO FAILURES FOR THIS TEST. D11B CAPACITORS ARE THE SAME CONSTRUCTION AND DESIGN AS J11-K11 SERIES.

LIST OF CAPACITORS LIFE TESTED			INSULATION RESISTANCE IN MEGOHMS AT 25°C			% CAPACITANCE CHANGE WITH LIFE			% DISSIPATION FACTOR AT 25°C WITH LIFE		
CRC TYPE	uF VALUE	Q'TY TESTED	POST TEST LIMITS (MIN. I.R.)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. △C)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. D.F.)	TEST RESULTS LOW	TEST RESULTS HIGH
D11B	0.1	12	$5x10^5$	$3.9x10^6$	$5x10^7$	±1	−.035	−.35	.2	.01	.065
D11B	0.22	32	$5x10^5$	$2x10^6$	$2.5x10^7$	±1	−.01	+.85	.2	.005	.075
D11B	0.47	11	$5x10^5$	$1x10^6$	$1x10^6$	±1	−.005	+.58	.2	.01	.10
D11B	1.0	6	$2.5x10^5$	$5.2x10^5$	$3.8x10^6$	±1	−.005	+.24	.2	.01	.12
D11B	0.5	20	$5x10^5$	$3.8x10^6$	$5x10^7$	±1	+.02	+.48	.2	.01	.02

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

CRC COMPONENT RESEARCH CO.

METALLIZED TEFLON J11

ESTABLISHED RELIABILITY CAPACITORS

J11 SPECIFICATIONS

CONSTRUCTION	Metallized teflon dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmetal requirements of MIL-C-83421, except vibration at 20g and shock at 50g.	
OPERATING TEMPERATURE	−65°C to +125°C	At full rated voltage.
DIELECTRIC ABSORPTION	0.01% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.05% maximum	At 25°C when measured per MIL-C-83421.
DIELECTRIC STRENGTH	200% rated voltage	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	Referenced to 25°C −55°C −25°C 0°C 50°C 85°C 100°C 125°C	 From −0.5% to +1.0% From −0.35% to +0.75% From −0.1% to +0.45% From −0.2% to +0.2% From −0.45% to +0.4% From −0.65% to +0.45% From −1.0% to +0.5%
CAPACITANCE STABILITY	±0.10%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1×10^{-6} atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 0.68uF CAPACITOR AT 25°C IS 1,000,000 ÷ 0.68 = 1,475,000 MEGOHMS.

RANGE	25°	55°C	85°C	100°C	125°C
.001 TO 0.1uF	10,000,000 Megohms	5,000,000 Megohms	2,000,000 Megohms	1,000,000 Megohms	250,000 Megohms
GREATER THAN 0.1uF	1,000,000 Megohms-uF	500,000 Megohms-uF	200,000 Megohms-uF	100,000 Megohms-uF	25,000 Megohms-uF

J11 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	48 hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1x10⁻⁶atm/cm³/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test
7	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
8	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.05% max.	100% Test
9	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

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CRC COMPONENT RESEARCH CO.

METALLIZED TEFLON K11

ESTABLISHED RELIABILITY CAPACITORS

K11 SPECIFICATIONS

CONSTRUCTION	Metallized teflon dielectric, hermetically sealed, extended metal film electrodes, leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmental requirements of MIL-C-83421, except vibration at 20g and shock at 50g.	
OPERATING TEMPERATURE	−65°C to +125°C	At full rated voltage.
DIELECTRIC ABSORPTION	0.01% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.1% maximum	At 25°C when measured per MIL-C-83421.
DIELECTRIC STRENGTH	200% rated voltage	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	Referenced to 25°C −55°C −25°C 0°C 50°C 85°C 100°C 125°C	 From −0.5% to +1.0% From −0.35% to +0.75% From −0.1% to +0.45% From −0.2% to +0.2% From −0.45% to +0.4% From −0.65% to +0.45% From −1.0% to +0.5%
CAPACITANCE STABILITY	±0.10%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1 × 10^{-6}atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 0.18uF CAPACITOR AT 25°C IS 200,000 ÷ 0.18 = 1,111,000 MEGOHMS.

RANGE	25°C	55°C	85°C	100°C	125°C
.001 TO 0.1uF	2,000,000 Megohms	2,000,000 Megohms	1,000,000 Megohms	500,000 Megohms	150,000 Megohms
GREATER THAN 0.1uF	200,000 Megohms-uF	200,000 Megohms-uF	100,000 Megohms-uF	50,000 Megohms-uF	15,000 Megohms-uF

K11 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	THERMAL AGING	5 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
2	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1x10^{-6}atm/cm³/sec. max.	100% Test
3	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
4	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
5	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test
6	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
7	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.1% max.	100% Test
8	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

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CRC COMPONENT RESEARCH CO.

METALLIZED TEFLON J11 & K11 CASE DIMENSIONS

ESTABLISHED RELIABILITY CAPACITORS

uF	50VDC					100VDC					200VDC				
	J11	K11	Diam. A	Length B	Length C	J11	K11	Diam. A	Length B	Length C	J11	K11	Diam. A	Length B	Length C
.001	J11B102	K11B102	.235	.687	.887	J11C102	K11C102	.235	.687	.887	J11D102	K11D102	.235	.687	.887
.0012	J11B122	K11B122	.235	.687	.887	J11C122	K11C122	.235	.687	.887	J11D122	K11D122	.235	.687	.887
.0015	J11B152	K11B152	.235	.687	.887	J11C152	K11C152	.235	.687	.887	J11D152	K11D152	.235	.687	.887
.0018	J11B182	K11B182	.235	.687	.887	J11C182	K11C182	.235	.687	.887	J11D182	K11D182	.235	.687	.887
.002	J11B202	K11B202	.235	.687	.887	J11C202	K11C202	.235	.687	.887	J11D202	K11D202	.235	.687	.887
.0022	J11B222	K11B222	.235	.687	.887	J11C222	K11C222	.235	.687	.887	J11D222	K11D222	.235	.687	.887
.0027	J11B272	K11B272	.235	.687	.887	J11C272	K11C272	.235	.687	.887	J11D272	K11D272	.235	.687	.887
.0033	J11B332	K11B332	.235	.687	.887	J11C332	K11C332	.235	.687	.887	J11D332	K11D332	.235	.687	.887
.0039	J11B392	K11B392	.235	.687	.887	J11C392	K11C392	.235	.687	.887	J11D392	K11D392	.235	.687	.887
.0047	J11B472	K11B472	.235	.687	.887	J11C472	K11C472	.235	.687	.887	J11D472	K11D472	.235	.687	.887
.005	J11B502	K11B502	.235	.687	.887	J11C502	K11C502	.235	.687	.887	J11D502	K11D502	.235	.687	.887
.0056	J11B562	K11B562	.235	.687	.887	J11C562	K11C562	.235	.687	.887	J11D562	K11D562	.235	.687	.887
.0068	J11B682	K11B682	.235	.687	.887	J11C682	K11C682	.235	.687	.887	J11D682	K11D682	.235	.687	.887
.0082	J11B822	K11B822	.235	.687	.887	J11C822	K11C822	.235	.687	.887	J11D822	K11D822	.235	.687	.887
.01	J11B103	K11B103	.235	.687	.887	J11C103	K11C103	.235	.687	.887	J11D103	K11D103	.235	.687	.887
.012	J11B123	K11B123	.235	.687	.887	J11C123	K11C123	.235	.687	.887	J11D123	K11D123	.235	.687	.887
.015	J11B153	K11B153	.312	.687	.887	J11C153	K11C153	.312	.687	.887	J11D153	K11D153	.312	.687	.887
.018	J11B183	K11B183	.312	.687	.887	J11C183	K11C183	.312	.687	.887	J11D183	K11D183	.312	.813	1.013
.02	J11B203	K11B203	.312	.687	.887	J11C203	K11C203	.312	.687	.887	J11D203	K11D203	.312	.813	1.013
.022	J11B223	K11B223	.312	.687	.887	J11C223	K11C223	.312	.687	.887	J11D223	K11D223	.312	.813	1.013
.027	J11B273	K11B273	.312	.687	.887	J11C273	K11C273	.312	.813	1.013	J11D273	K11D273	.312	.813	1.013
.033	J11B333	K11B333	.312	.687	.887	J11C333	K11C333	.312	.813	1.013	J11D333	K11D333	.400	.813	1.013
.039	J11B393	K11B393	.312	.687	.887	J11C393	K11C393	.400	.813	1.013	J11D393	K11D393	.400	1.063	1.263
.047	J11B473	K11B473	.312	.687	.887	J11C473	K11C473	.400	.813	1.013	J11D473	K11D473	.400	1.063	1.263
.05	J11B503	K11B503	.312	.687	.887	J11C503	K11C503	.400	.813	1.013	J11D503	K11D503	.400	1.063	1.263
.056	J11B563	K11B563	.312	.813	1.013	J11C563	K11C563	.400	.813	1.013	J11D563	K11D563	.400	1.063	1.263
.068	J11B683	K11B683	.312	.813	1.013	J11C683	K11C683	.400	.813	1.013	J11D683	K11D683	.400	1.063	1.263
.082	J11B823	K11B823	.312	.937	1.137	J11C823	K11C823	.400	1.063	1.263	J11D823	K11D823	.500	1.125	1.325
.1	J11B104	K11B104	.312	.937	1.137	J11C104	K11C104	.400	1.063	1.263	J11D104	K11D104	.500	1.125	1.325
.12	J11B124	K11B124	.312	1.063	1.263	J11C124	K11C124	.500	1.125	1.325	J11D124	K11D124	.500	1.375	1.575
.15	J11B154	K11B154	.312	1.063	1.263	J11C154	K11C154	.500	1.125	1.325	J11D154	K11D154	.562	1.375	1.575
.18	J11B184	K11B184	.400	1.063	1.263	J11C184	K11C184	.500	1.125	1.325	J11D184	K11D184	.562	1.375	1.575
.20	J11B204	K11B204	.400	1.063	1.263	J11C204	K11C204	.562	1.125	1.325	J11D204	K11D204	.562	1.375	1.575
.22	J11B224	K11B224	.400	1.063	1.263	J11C224	K11C224	.562	1.125	1.325	J11D224	K11D224	.562	1.375	1.575
.27	J11B274	K11B274	.400	1.063	1.263	J11C274	K11C274	.562	1.125	1.325	J11D274	K11D274	.670	1.375	1.575
.33	J11B334	K11B334	.500	1.125	1.325	J11C334	K11C334	.562	1.125	1.325	J11D334	K11D334	.670	1.375	1.575
.39	J11B394	K11B394	.500	1.125	1.325	J11C394	K11C394	.562	1.375	1.575	J11D394	K11D394	.562	1.875	2.075
.47	J11B474	K11B474	.562	1.125	1.325	J11C474	K11C474	.670	1.375	1.575	J11D474	K11D474	.670	1.875	2.075
.50	J11B504	K11B504	.562	1.125	1.325	J11C504	K11C504	.670	1.375	1.575	J11D504	K11D504	.670	1.875	2.075
.56	J11B564	K11B564	.562	1.125	1.325	J11C564	K11C564	.670	1.375	1.575	J11D564	K11D564	.670	1.875	2.075
.68	J11B684	K11B684	.562	1.125	1.325	J11C684	K11C684	.670	1.875	2.075	J11D684	K11D684	.750	1.875	2.075
.82	J11B824	K11B824	.562	1.375	1.575	J11C824	K11C824	.670	1.875	2.075	J11D824	K11D824	.750	1.875	2.075
1.0	J11B105	K11B105	.670	1.375	1.575	J11C105	K11C105	.670	1.875	2.075	J11D105	K11D105	.750	1.875	2.075
1.5	J11B155	K11B155	.670	1.875	2.075	J11C155	K11C155	.750	1.875	2.075	J11D155	K11D155	1.00	1.875	2.075
2.0	J11B205	K11B205	.670	1.875	2.075	J11C205	K11C205	1.00	1.875	2.075	J11D205	K11D205	1.00	2.375	2.575

J11 | B | 104 | J | S | A

STYLE

SLEEVING CODE
S = Mylar sleeve
X = No sleeve

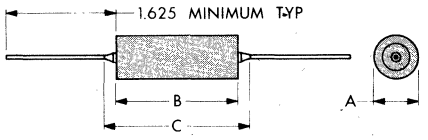
LEAD CODE
A = Solderable leads: #22 (.025″) for .312″ case dia. & smaller; #20 (.032″) for .400″ case dia. & larger.

CAPACITANCE TOLERANCE
K = 10% F = 1% B = ¼%
J = 5% D = ½% A = .1%
G = 2%

VOLTAGE
B = 50VDC
C = 100VDC
D = 200VDC

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±0.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads



COMPONENT RESEARCH CO., INC. ■ 1655 26TH STREET ■ SANTA MONICA, CALIF. 90404 ■ (213) 829-3615. TWX: (910) 343-6864

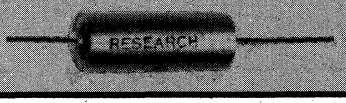
CRC COMPONENT RESEARCH CO.

FOIL TEFLON A91

ESTABLISHED RELIABILITY CAPACITORS

PRODUCT FEATURES

.056 μF 50VDC ACTUAL SIZE CAPACITOR



AC AND DC RATED TO 125°C AT FULL RATED VOLTAGE.

HERMETICALLY SEALED, HIGH RELIABILITY SCREENED FOR CRITICAL AEROSPACE APPLICATIONS.

AC RATED FROM 36VRMS TO 240VRMS AT FREQUENCIES FROM 0 TO 400 Hz. RATINGS AT 40KHz AT LOWER VOLTAGE RATINGS.

HIGH INSULATION RESISTANCE, 10,000,000 MEGOHMS MINIMUM. ALL VALUES UP TO 0.1uF.

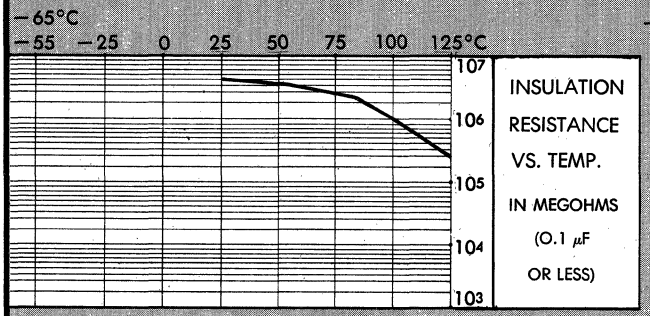
LOW DIELECTRIC ABSORPTION, 0.01% MAXIMUM VOLTAGE RECOVERY.

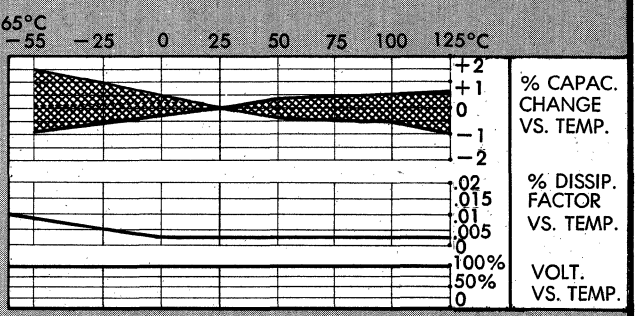
LOW LOSS, RUGGED INTERNAL TERMINATIONS FOR ALL HI-REL PROGRAMS (CRC PATENTED CONSTRUCTION).

0.1% MAXIMUM SHELF DRIFT FOR 10 YEARS (OR IN NORMAL USE).

AVAILABLE IN 1%, 2%, 5% AND 10%, CAPACITANCE TOLERANCE FROM 50VDC TO 400VDC. OTHER TOLERANCES AVAILABLE ON REQUEST.

TYPICAL CURVES





TYPICAL APPLICATIONS

- CRITICAL TIMING CIRCUITS
- FIXED TUNING CIRCUITS
- FILTERING
- TEMPERATURE COMPENSATION
- COUPLING AND DECOUPLING
- FEEDBACK CIRCUITS
- POWER SUPPLY FILTERING
- GYRO CIRCUITS
- PULSE FORMING NETWORKS
- INTEGRATING CIRCUITS

LIFE TEST DATA CRC TEST REPORT #XT-1306

TEST RESULTS FOR D51 SERIES CAPACITORS LIFE TESTED FOR 2000 HOURS AT 125°C AT 140% OF RATED DC VOLTAGE. THERE WERE NO FAILURES FOR THIS TEST. D51 CAPACITORS ARE THE SAME CONSTRUCTION AND DESIGN AS A91.

LIST OF CAPACITORS SUBMITTED TO LIFE TEST			INSULATION RESISTANCE IN MEGOHMS AT 25°C			% CAPACITANCE CHANGE WITH LIFE			% DISSIPATION FACTOR AT 25°C WITH LIFE		
CRC TYPE	uF VALUE	Q'TY TESTED	POST TEST LIMITS (MIN. I.R.)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. △C)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. D.F.)	TEST RESULTS LOW	TEST RESULTS HIGH
D51C	.01	48	3.3×10^6	2.5×10^7	5×10^7	±2	−.01	−.56	.05	−.01	.02
D51C	.002	6	3.3×10^6	2.5×10^7	5×10^7	±2	−.15	−.64	.05	−.01	−.01
D51C	.0039	5	3.3×10^6	2×10^7	1×10^8	±2	−.075	−.64	.05	−.01	−.01
D51C	.02	10	3.3×10^6	2×10^7	1×10^8	±2	−.01	−.33	.05	−.01	−.01

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CRC COMPONENT RESEARCH CO.

FOIL TEFLON A91

ESTABLISHED RELIABILITY CAPACITORS

A91 SPECIFICATIONS

CONSTRUCTION	Foil teflon, hermetically sealed, extended metallized film electrodes, axial leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmetal requirements of MIL-C-83421, except vibration at 20g and shock at 50g.	
OPERATING TEMPERATURE	−65°C to +125°C	At full rated voltage.
DIELECTRIC ABSORPTION	0.01% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.02% maximum	At 25°C when measured per MIL-C-83421.
AC SQUARE WAVE	100Hz, 60 seconds minimum	At 25°C at a peak to peak voltage of 3 times rated DC voltage, terminal to terminal per MIL-C-83421.
DIELECTRIC STRENGTH	200% rated DC voltage	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	Referenced to 25°C −55°C −25°C 0°C 50°C 85°C 100°C 125°C	 +1.5% to −0.8% +1.0% to −0.5% +0.5% to −0.3% +0.3% to −0.3% +0.5% to −0.5% +0.5% to −0.8% +0.6% to −1.0%
CAPACITANCE STABILITY	±0.25%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1×10^{-6}atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

RANGE	25°C	85°C	100°C	125°C
.001 TO 0.1uF	10,000,000 Megohms	2,000,000 Megohms	1,000,000 Megohms	250,000 Megohms
GREATER THAN 0.1uF	1,000,000 Megohms	200,000 Megohms	100,000 Megohms	25,000 Megohms

A91 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	16 hrs. minimum at 125°C at 140% AC rated voltage, at 400Hz or 240VRMS, whichever is less	4.7.2	No physical damage	100% Test
2	THERMAL AGING	5 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb for 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1x10⁻⁶atm/cm³/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz at a peak to peak voltage of 3 times DC rated voltage for 60 seconds minimum. Do not exceed 800 volts peak to peak.	4.7.6	No shorts	100% Test
6	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
7	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test
8	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
9	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.02% max.	100% Test
10	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

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CRC COMPONENT RESEARCH CO.

FOIL TEFLON
A91 CASE DIMENSIONS

ESTABLISHED RELIABILITY CAPACITORS

uF	TYPE A91B 50VDC RATED				TYPE A91C 100VDC RATED				TYPE A91D 200VDC RATED				TYPE A91E 400VDC RATED			
	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C
.001	A91B102	.193	.562	.662	A91C102	.235	.562	.662	A91D102	.235	.687	.787	A91E102	.235	.687	.787
.0012	A91B122	.193	.562	.662	A91C122	.235	.562	.662	A91D122	.235	.687	.787	A91E122	.235	.687	.787
.0015	A91B152	.193	.562	.662	A91C152	.235	.562	.662	A91D152	.235	.687	.787	A91E152	.235	.687	.787
.0018	A91B182	.193	.562	.662	A91C182	.235	.562	.662	A91D182	.235	.687	.787	A91E182	.235	.687	.787
.002	A91B202	.193	.562	.662	A91C202	.235	.562	.662	A91D202	.235	.687	.787	A91E202	.235	.687	.787
.0022	A91B222	.193	.562	.662	A91C222	.235	.562	.662	A91D222	.235	.687	.787	A91E222	.235	.687	.787
.0027	A91B272	.193	.562	.662	A91C272	.235	.562	.662	A91D272	.235	.687	.787	A91E272	.312	.687	.787
.0033	A91B332	.193	.562	.662	A91C332	.235	.562	.662	A91D332	.235	.687	.787	A91E332	.312	.687	.787
.0039	A91B392	.193	.562	.662	A91C392	.235	.562	.662	A91D392	.235	.687	.787	A91E392	.312	.687	.787
.0047	A91B472	.193	.562	.662	A91C472	.235	.562	.662	A91D472	.235	.687	.787	A91E472	.312	.687	.787
.005	A91B502	.193	.562	.662	A91C502	.235	.562	.662	A91D502	.235	.687	.787	A91E502	.312	.687	.787
.0056	A91B562	.193	.562	.662	A91C562	.235	.562	.662	A91D562	.235	.687	.787	A91E562	.312	.687	.787
.0068	A91B682	.235	.562	.662	A91C682	.235	.687	.787	A91D682	.312	.687	.787	A91E582	.312	.813	.913
.0075	A91B752	.235	.562	.662	A91C752	.235	.687	.787	A91D752	.312	.687	.787	A91E752	.312	.813	.913
.0082	A91B822	.235	.562	.662	A91C822	.235	.687	.787	A91D822	.312	.687	.787	A91E822	.312	.813	.913
.01	A91B103	.235	.562	.662	A91C103	.235	.687	.787	A91D103	.312	.687	.787	A91E103	.312	.813	.913
.012	A91B123	.235	.562	.662	A91C123	.235	.687	.787	A91D123	.312	.687	.787	A91E123	.312	.813	.913
.015	A91B153	.235	.687	.787	A91C153	.312	.687	.787	A91D153	.312	.813	.913	A91E153	.400	.813	.913
.018	A91B183	.235	.687	.787	A91C183	.312	.687	.787	A91D183	.312	.813	.913	A91E183	.400	.813	.913
.02	A91B203	.312	.687	.787	A91C203	.312	.813	.913	A91D203	.400	.813	.913	A91E203	.400	1.063	1.163
.022	A91B223	.312	.687	.787	A91C223	.312	.813	.913	A91D223	.400	.813	.913	A91E223	.400	1.063	1.163
.027	A91B273	.312	.687	.787	A91C273	.312	.813	.913	A91D273	.400	.813	.913	A91E273	.400	1.063	1.163
.033	A91B333	.312	.687	.787	A91C333	.312	.813	.913	A91D333	.400	.813	.913	A91E333	.400	1.063	1.163
.039	A91B393	.312	.813	.913	A91C393	.400	.813	.913	A91D393	.400	1.063	1.163	A91E393	.500	1.125	1.225
.047	A91B473	.312	.813	.913	A91C473	.400	.813	.913	A91D473	.400	1.063	1.163	A91E473	.500	1.125	1.225
.05	A91B503	.312	.813	.913	A91C503	.400	.813	.913	A91D503	.400	1.063	1.163	A91E503	.500	1.125	1.225
.056	A91B563	.312	.813	.913	A91C563	.400	.813	.913	A91D563	.400	1.063	1.163	A91E563	.500	1.125	1.225
.068	A91B683	.400	.813	.913	A91C683	.400	1.063	1.163	A91D683	.500	1.125	1.225	A91E683	.500	1.375	1.475
.075	A91B753	.400	.813	.913	A91C753	.400	1.063	1.163	A91D753	.500	1.125	1.225	A91E753	.500	1.375	1.475
.082	A91B823	.400	.813	.913	A91C823	.400	1.063	1.163	A91D823	.500	1.125	1.225	A91E823	.562	1.375	1.475
.1	A19B104	.400	.813	.913	A91C104	.400	1.063	1.163	A91D104	.500	1.375	1.475	A91E104	.670	1.375	1.475
.12	A91B124	.400	.813	.913	A91C124	.400	1.063	1.163	A91D124	.500	1.375	1.475	A91E124	.670	1.375	1.475
.15	A91B154	.400	.813	.913	A91C154	.500	1.125	1.225	A91D154	.500	1.375	1.475	A91E154	.670	1.375	1.475
.18	A91B184	.400	1.063	1.163	A91C184	.500	1.125	1.225	A91D184	.562	1.375	1.475	A91E184	.670	1.875	1.975
.20	A91B204	.400	1.063	1.163	A91C204	.500	1.125	1.225	A91D204	.670	1.375	1.475	A91E204	.670	1.875	1.975
.22	A91B224	.400	1.063	1.163	A91C224	.500	1.125	1.225	A91D224	.670	1.375	1.475	A91E224	.670	1.875	1.975
.27	A91B274	.500	1.125	1.225	A91C274	.562	1.375	1.475	A91D274	.670	1.375	1.475				
.33	A91B334	.500	1.125	1.225	A91C334	.562	1.375	1.475	A91D334	.670	1.875	1.975				
.39	A91B394	.500	1.125	1.225	A91C394	.562	1.375	1.475	A91D394	.670	1.875	1.975				
.47	A91B474	.562	1.125	1.225	A91C474	.670	1.375	1.475	A91D474	.750	1.875	1.975				
.50	A91B504	.562	1.125	1.225	A91C504	.670	1.375	1.475	A91D504	.750	1.875	1.975				
.56	A91B564	.562	1.375	1.475	A91C564	.670	1.375	1.475								
.68	A91B684	.562	1.375	1.475	A91C684	.670	1.875	1.975								
.75	A91B754	.670	1.375	1.475	A91C754	.750	1.875	1.975								
.82	A91B824	.670	1.375	1.475	A91C824	.750	1.875	1.975								
1.0	A91B105	.670	1.375	1.475	A91C105	.750	1.875	1.975								
1.2	A91B125	.670	1.375	1.475												

FOR SPECIAL VALUES AND TOLERANCES, PLEASE CONTACT OUR APPLICATION DEPARTMENT.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±0.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads

A91 | B | 104 | J | S | W

STYLE

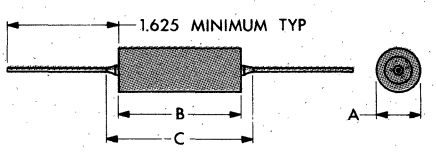
VOLTAGE
B=50VDC
C=100VDC
D=200VDC
E=400VDC

SLEEVING CODE
S=Mylar sleeve
X=No sleeve

CAPACITANCE TOLERANCE
K=10% F=1% B=¼%
J=5% D=½%
G=2%

LEAD CODE
W=Tinned copper clad steel: #22 (.025″) for .312″ case dia. & smaller; #20 (.032″) for .400″ & .500″ case dia.
C=Tinned oxygen-free copper: #18 (.040″) for .562″ case dia. & larger.

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.



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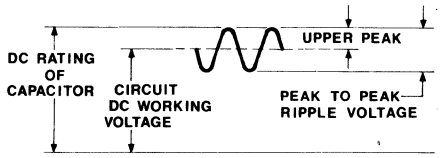
CRC
COMPONENT RESEARCH CO.

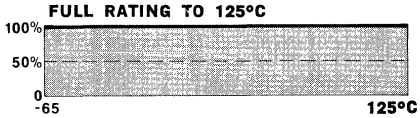
FOIL TEFLON
A91 AC RATINGS

ESTABLISHED RELIABILITY CAPACITORS

uF	TYPE A91B 50VDC			TYPE A91C 100VDC			TYPE A91D 200VDC			TYPE A91E 400VDC		
	AC RATINGS			AC RATINGS			AC RATINGS			AC RATINGS		
	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps
.001	36.0	36.0	.009	60.0	60.0	.015	120.0	80.0	.020	240.0	100.0	.025
.0012	36.0	36.0	.011	60.0	60.0	.018	120.0	80.0	.024	240.0	100.0	.030
.0015	36.0	36.0	.013	60.0	60.0	.022	120.0	80.0	.030	240.0	100.0	.037
.0018	36.0	36.0	.016	60.0	60.0	.027	120.0	80.0	.036	240.0	100.0	.045
.002	36.0	36.0	.018	60.0	60.0	.030	120.0	80.0	.040	240.0	100.0	.050
.0022	36.0	36.0	.020	60.0	60.0	.033	120.0	80.0	.044	240.0	100.0	.055
.0027	36.0	36.0	.024	60.0	60.0	.041	120.0	80.0	.054	240.0	100.0	.068
.0033	36.0	36.0	.030	60.0	60.0	.050	120.0	80.0	.066	240.0	100.0	.083
.0039	36.0	36.0	.035	60.0	60.0	.058	120.0	80.0	.078	240.0	100.0	.097
.0047	36.0	36.0	.042	60.0	60.0	.071	120.0	80.0	.094	240.0	100.0	.12
.005	36.0	36.0	.045	60.0	60.0	.075	120.0	80.0	.10	240.0	100.0	.13
.0056	36.0	36.0	.050	60.0	60.0	.084	120.0	80.0	.11	240.0	100.0	.14
.0068	36.0	36.0	.061	60.0	60.0	.10	120.0	80.0	.14	240.0	100.0	.17
.0075	36.0	36.0	.067	60.0	60.0	.11	120.0	80.0	.15	240.0	100.0	.19
.0082	36.0	36.0	.074	60.0	60.0	.12	120.0	80.0	.16	240.0	100.0	.21
.01	36.0	36.0	.090	60.0	60.0	.15	120.0	80.0	.20	240.0	100.0	.25
.012	36.0	36.0	.11	60.0	59.0	.18	120.0	78.0	.23	240.0	100.0	.30
.015	36.0	36.0	.14	60.0	58.0	.22	120.0	76.0	.29	240.0	94.0	.35
.018	36.0	36.0	.16	60.0	57.0	.26	120.0	74.0	.33	240.0	90.0	.41
.02	36.0	36.0	.18	60.0	55.0	.28	120.0	71.0	.36	240.0	88.0	.44
.022	36.0	36.0	.20	60.0	53.0	.29	120.0	68.0	.37	240.0	85.0	.47
.027	36.0	36.0	.24	60.0	51.0	.34	120.0	65.0	.44	240.0	81.0	.55
.033	36.0	36.0	.30	60.0	50.0	.41	120.0	62.0	.51	240.0	78.0	.65
.039	36.0	36.0	.35	60.0	48.0	.47	120.0	60.0	.59	240.0	75.0	.73
.047	36.0	36.0	.42	60.0	47.0	.55	120.0	57.0	.67	240.0	71.0	.83
.05	36.0	36.0	.45	60.0	46.0	.58	120.0	56.0	.70	240.0	70.0	.88
.056	36.0	36.0	.50	60.0	46.0	.64	120.0	56.0	.78	240.0	67.0	.95
.068	36.0	34.0	.58	60.0	42.0	.71	120.0	50.0	.85	240.0	60.0	1.02
.075	36.0	33.0	.61	60.0	40.0	.75	120.0	47.0	.88	240.0	55.0	1.03
.082	36.0	32.0	.66	60.0	38.0	.78	120.0	44.0	.90	240.0	50.0	1.03
.1	36.0	30.0	.75	60.0	36.0	.90	120.0	42.0	1.10	240.0	46.0	1.20
.12	36.0	30.0	.90	60.0	35.0	1.05	120.0	40.0	1.20	240.0	44.5	1.34
.15	36.0	26.0	.98	60.0	33.0	1.24	120.0	36.0	1.34	240.0	40.0	1.50
.18	36.0	25.0	1.13	60.0	31.0	1.40	120.0	34.0	1.54	240.0	38.0	1.70
.20	36.0	24.0	1.20	60.0	30.0	1.50	120.0	33.0	1.65	240.0	37.0	1.85
.22	36.0	23.0	1.27	60.0	27.0	1.50	120.0	32.0	1.76	240.0	35.0	1.93
.27	36.0	19.0	1.28	60.0	24.0	1.62	120.0	29.0	1.96			
.33	36.0	18.0	1.48	60.0	23.0	1.90	120.0	28.0	2.31			
.39	36.0	17.0	1.66	60.0	22.0	2.15	120.0	27.0	2.63			
.47	36.0	15.7	1.85	60.0	21.0	2.47	120.0	26.0	3.06			
.50	36.0	15.2	1.90	60.0	20.0	2.50	120.0	25.0	3.13			
.56	36.0	14.4	2.01	60.0	19.0	2.64	120.0	23.0	3.17			
.68	36.0	14.0	2.38	60.0	16.0	2.72						
.75	36.0	13.0	2.44	60.0	15.0	2.81						
.82	36.0	12.0	2.46	60.0	14.0	2.87						
1.0	36.0	10.0	2.50	60.0	12.0	3.00						
1.2	36.0	9.1	2.73									

1. THE COMBINED DC AND AC VOLTAGES SHOULD NOT EXCEED THE DC RATINGS, SEE FIGURE.
2. CAPACITORS MAY BE OPERATED AT HIGHER FREQUENCIES, AT REDUCED RMS VOLTAGE SUCH THAT MAX. AC CURRENT RATINGS ARE NOT EXCEEDED.
3. CAPACITORS CAN HANDLE PULSE CURRENTS UP TO 100 TIMES GREATER THAN THE PEAK CURRENTS CALCULATED FROM THE RATED RMS RATING (PROVIDED SLOW REPETITION RATES ARE USED). IF THERE IS ANY DOUBT, A SKETCH OF THE VOLTAGE AND CURRENT WAVE FORMS WITH TIME BASE SHOULD BE SENT TO CRC FOR ANALYSIS.





CRC COMPONENT RESEARCH CO.

POLYSTYRENE K93

ESTABLISHED RELIABILITY CAPACITORS

PRODUCT FEATURES

.056 μF 50VDC ACTUAL SIZE CAPACITOR

5,000,000 MEGOHM MIN. INSULATION RESISTANCE FOR VALUES 0.1uF AND LESS.

0.02% MAXIMUM DIELECTRIC ABSORPTION.

0.1% MAXIMUM SHELF DRIFT FOR 10 YEARS (OR IN NORMAL USE).

UTILIZES CRC UNIQUE PATENTED, RUGGED, LOW LOSS LEAD TERMINATIONS, QUALIFIED FOR ALL HI-REL PROGRAMS.

HERMETICALLY SEALED, HIGH RELIABILITY SCREENED FOR CRITICAL AEROSPACE PROGRAMS.

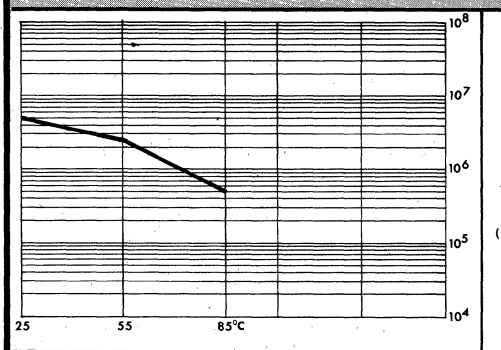
100% RELIABILITY SCREENING, INCLUDES TEMPERATURE CYCLING, FINE LEAK TEST, AC SQUARE WAVE TEST.

SIMILAR GENERIC PARTS HAVE BEEN QUALIFIED FOR TRIDENT PROGRAM.

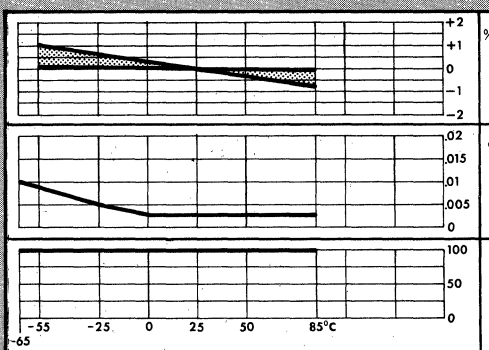
AVAILABLE IN ±0.1% TO ±10% CAPACITANCE TOLERANCE FROM 50VDC TO 400VDC.

AC AND DC RATED.

TYPICAL CURVES



INSULATION RESISTANCE WITH TEMPERATURE IN MEGOHMS (0.1 μF OR LESS)



% CAPACITANCE CHANGE WITH TEMPERATURE

% DISSIPATION FACTOR WITH TEMPERATURE

% VOLTAGE RATING WITH TEMPERATURE

TYPICAL APPLICATIONS

- CRITICAL TIMING CIRCUITS
- FIXED TUNING CIRCUITS
- FILTERING
- TEMPERATURE COMPENSATION
- COUPLING AND DECOUPLING
- FEEDBACK CIRCUITS
- POWER SUPPLY FILTERING
- GYRO CIRCUITS
- PULSE FORMING NETWORKS
- INTEGRATING CIRCUITS

LIFE TEST DATA CRC TEST REPORT #XT1304

TEST RESULTS FOR 75 SERIES N53 CAPACITORS LIFE TESTED FOR 2000 HOURS AT +85°C AT 140% OF RATED DC VOLTAGE. THERE WERE NO FAILURES FOR THIS TEST. N53 CAPACITORS ARE THE SAME CONSTRUCTION AND DESIGN AS K93 SERIES CAPACITORS.

LIST OF CAPACITORS LIFE TESTED			INSULATION RESISTANCE IN MEGOHMS AT 25°C			% CAPACITANCE CHANGE WITH LIFE			% DISSIPATION FACTOR AT 25°C WITH LIFE		
CRC TYPE	μF VALUE	Q'TY TESTED	POST TEST LIMITS (MIN. I.R.)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. △C)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. D.F.)	TEST RESULTS LOW	TEST RESULTS HIGH
N53B	.012	20	$5x10^5$	$2x10^7$	$5x10^7$	0.5	0.00	+.26	.05	.01	.01
N53B	.1	20	$5x10^5$	$1x10^7$	$5x10^7$	0.5	−.03	+.29	.05	.01	.01
N53B	.82	15	$5x10^5$	$5x10^6$	$4x10^7$	0.5	−.02	+.18	.05	.01	.01
N53C	.02	5	$5x10^5$	$3.3x10^7$	$5x10^7$	0.5	−.025	+.245	.05	.01	.01
N53C	.039	5	$5x10^5$	$5.5x10^6$	$1x10^8$	0.5	−.01	+.30	.05	.01	.01
N53C	.068	20	$5x10^5$	$1x10^7$	$2x10^7$	0.5	+.06	+.22	.05	.01	.01

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

CRC COMPONENT RESEARCH CO.

POLYSTYRENE K93

ESTABLISHED RELIABILITY CAPACITORS

K93 SPECIFICATIONS

OPERATING TEMPERATURE	−65°C to 85°C	At full rated voltage.
DIELECTRIC ABSORPTION	0.02% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.02% maximum	At 25°C when measured per MIL-C-83421.
DIELECTRIC STRENGTH	200% rated voltage	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	−80 ±50 PPM/°C −60 ±50 PPM/°C	For values 0.001uF to 0.0082uF For values 0.01uF to 2.7uF Special polystyrene capacitors can be supplied with a temperature coefficient of −20 to −100 PPM/°C that is linear to ±30 PPM/°C and ±10 PPM/°C. A wide selection is available of large uF values in bathtub and custom cases.
CAPACITANCE STABILITY	0.03% maximum Drift	With five cycles from −25°C to +85°C
HERMETIC SEAL	1×10^{-6}atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 1.0uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 2.0uF CAPACITOR AT 25°C IS 1,000,000 ÷ 2 = 500,000 MEGOHMS.

RANGE	25°C	55°C	85°C
0.001 TO 0.1uF	10,000,000 Megohms	5,000,000 Megohms	1,000,000 Megohms
GREATER THAN 0.1uF	1,000,000 Megohms-uF	500,000 Megohms-uF	100,000 Megohms-uF

K93 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	THERMAL AGING	From −65°C to +85°C, 5 cycles min.	4.7.3	There shall be no physical damage	100% Test
2	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1x10⁶atm/cm³/sec. max.	100% Test
3	SEAL TEST (GROSS LEAK)	Place in 85°C hot water for 60 seconds minimum and observe for bubbles	4.7.5	No continuous bubble stream	100% Test
4	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz square wave at a peak to peak voltage of 3 times DC rated voltage for 60 seconds minimum. Do not exceed 800 volts peak to peak.	4.7.6	No shorts	100% Test
5	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test
7	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
8	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measured at 0.1KHz	4.7.9	0.02% max.	100% Test
9	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship as required.	4.7.1	Per specification	1.0% AQL

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343-6864

CRC COMPONENT RESEARCH CO.

POLYSTYRENE K93 CASE DIMENSIONS

ESTABLISHED RELIABILITY CAPACITORS

uF	TYPE K93B 50VDC RATED				TYPE K93C 100VDC RATED				TYPE K93D 200VDC RATED				TYPE K93E 400VDC RATED			
	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C
.001	93B102	.193	.562	.662	93C102	.193	.687	.787	93D102	.235	.687	.787	93E102	.312	.687	.787
.0012	93B122	.193	.562	.662	93C122	.193	.687	.787	93D122	.235	.687	.787	93E122	.312	.687	.787
.0015	93B152	.193	.562	.662	93C152	.193	.687	.787	93D152	.235	.687	.787	93E152	.312	.687	.787
.0018	93B182	.193	.562	.662	93C182	.193	.687	.787	93D182	.235	.687	.787	93E182	.312	.687	.787
.002	93B202	.193	.562	.662	93C202	.193	.687	.787	93D202	.235	.687	.787	93E202	.312	.687	.787
.0022	93B222	.193	.562	.662	93C222	.193	.687	.787	93D222	.235	.687	.787	93E222	.312	.687	.787
.0027	93B272	.193	.562	.662	93C272	.193	.687	.787	93D272	.235	.687	.787	93E272	.312	.687	.787
.0033	93B332	.193	.562	.662	93C332	.193	.687	.787	93D332	.235	.687	.787	93E332	.312	.687	.787
.0039	93B392	.193	.562	.662	93C392	.193	.687	.787	93D392	.235	.687	.787	93E392	.312	.687	.787
.0047	93B472	.193	.562	.662	93C472	.193	.687	.787	93D472	.235	.687	.787	93E472	.312	.687	.787
.005	93B502	.193	.562	.662	93C502	.193	.687	.787	93D502	.235	.687	.787	93E502	.312	.687	.787
.0056	93B562	.193	.562	.662	93C562	.193	.687	.787	93D562	.235	.687	.787	93E562	.312	.687	.787
.0068	93B682	.193	.562	.662	93C682	.193	.687	.787	93D682	.235	.687	.787	93E682	.312	.687	.787
.0075	93B752	.193	.687	.787	93C752	.193	.813	.913	93D752	.235	.813	.913	93E752	.312	.813	.913
.0082	93B822	.193	.687	.787	93C822	.193	.813	.913	93D822	.235	.813	.913	93E812	.312	.813	.913
.01	93B103	.193	.687	.787	93C103	.193	.813	.913	93D103	.235	.813	.913	93E103	.312	.813	.913
.012	93B123	.193	.687	.787	93C123	.193	.813	.913	93D123	.235	.813	.913	93E123	.312	.813	.913
.015	93B153	.235	.687	.787	93C153	.235	.813	.913	93D153	.312	.813	.913	93E153	.400	.813	.913
.018	93B183	.235	.813	.913	93C183	.312	.813	.913	93D183	.400	.813	.913	93E183	.400	1.063	1.163
.02	93B203	.235	.813	.913	93C203	.312	.813	.913	93D203	.400	.813	.913	93E203	.400	1.063	1.163
.022	93B223	.235	.813	.913	93C223	.312	.813	.913	93D223	.400	.813	.913	93E223	.400	1.063	1.163
.027	93B273	.235	.813	.913	93C273	.312	.813	.913	93D273	.400	.813	.913	93E273	.400	1.063	1.163
.033	93B333	.235	.813	.913	93C333	.312	.813	.913	93D333	.400	.813	.913	93E333	.400	1.063	1.163
.039	93B393	.312	.813	.913	93C393	.400	.813	.913	93D393	.400	1.063	1.163	93E393	.500	1.125	1.225
.047	93B473	.312	.813	.913	93C473	.400	.813	.913	93D473	.400	1.063	1.163	93E473	.500	1.125	1.225
.05	93B503	.312	.813	.913	93C503	.400	.813	.913	93D503	.400	1.063	1.163	93E503	.500	1.125	1.225
.056	93B563	.312	.813	.913	93C563	.400	.813	.913	93D563	.400	1.063	1.163	93E563	.500	1.125	1.225
.068	93B683	.400	.813	.913	93C683	.400	1.063	1.163	93D683	.500	1.125	1.225	93E583	.500	1.375	1.475
.075	93B753	.400	.813	.913	93C753	.400	1.063	1.163	93D753	.500	1.125	1.225	93E753	.500	1.375	1.475
.082	93B823	.400	.813	.913	93C823	.400	1.063	1.163	93D823	.500	1.125	1.225	93E823	.500	1.375	1.475
.1	93B104	.400	.813	.913	93C104	.400	1.063	1.163	93D104	.500	1.125	1.225	93E104	.500	1.375	1.475
.12	93B124	.400	.813	.913	93C124	.400	1.063	1.163	93D124	.500	1.125	1.225	93E124	.500	1.375	1.475
.15	93B154	.400	1.063	1.163	93C154	.500	1.125	1.225	93D154	.500	1.375	1.475	93E154	.562	1.375	1.475
.18	93B184	.400	1.063	1.163	93C184	.500	1.125	1.225	93D184	.500	1.375	1.475	93E184	.562	1.375	1.475
.20	93B204	.400	1.063	1.163	93C204	.500	1.125	1.225	93D204	.500	1.375	1.475	93E204	.562	1.375	1.475
.22	93B224	.400	1.063	1.163	93C224	.500	1.125	1.225	93D224	.500	1.375	1.475	93E224	.562	1.375	1.475
.27	93B274	.500	1.125	1.225	93C274	.500	1.375	1.475	93D274	.562	1.375	1.475	93E274	.670	1.375	1.475
.33	93B334	.500	1.125	1.225	93C334	.500	1.375	1.475	93D334	.562	1.375	1.475	93E334	.670	1.375	1.475
.39	93B394	.500	1.375	1.475	93C394	.562	1.375	1.475	93D394	.670	1.375	1.475	93E394	.670	1.875	1.975
.47	93B474	.562	1.375	1.475	93C474	.670	1.375	1.475	93D474	.670	1.875	1.975	93E474	.750	1.875	1.975
.50	93B504	.562	1.375	1.475	93C504	.670	1.375	1.475	93D504	.670	1.875	1.975	93E504	.750	1.875	1.975
.56	93B564	.562	1.375	1.475	93C564	.670	1.375	1.475	93D564	.670	1.875	1.975	93E564	.750	1.875	1.975
.68	93B684	.670	1.375	1.475	93C684	.670	1.875	1.975	93D684	.750	1.875	1.975	93E684	1.000	1.875	1.975
.75	93B754	.670	1.875	1.975	93C754	.750	1.875	1.975	93D754	1.000	1.875	1.975	93E754	1.000	2.375	2.475
.82	93B824	.670	1.875	1.975	93C824	.750	1.875	1.975	93D824	1.000	1.875	1.975	93E824	1.000	2.375	2.475
1.0	93B105	.670	1.875	1.975	93C105	.750	1.875	1.975	93D105	1.000	1.875	1.975	93E105	1.000	2.375	2.475
1.2	93B125	.750	1.875	1.975	93C125	1.000	1.875	1.975								
1.5	93B155	.750	1.875	1.975	93C155	1.000	1.875	1.975								
1.8	93B185	1.000	1.875	1.975	93C185	1.000	2.375	2.475								
2.0	93B205	1.000	1.875	1.975	93C205	1.000	2.375	2.475								
2.2	93B225	1.000	1.875	1.975												
2.5	93B255	1.000	2.375	2.225												
2.7	93B275	1.000	2.375	2.225												

FOR SPECIAL VALUES AND TOLERANCES, PLEASE CONTACT OUR APPLICATION DEPARTMENT.

K93 | B | 104 | J | S | W

STYLE

VOLTAGE
B=50VDC
C=100VDC
D=200VDC
E=400VDC

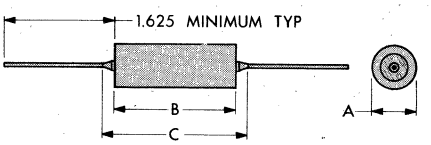
CAPACITANCE TOLERANCE
K=10% F=1% B=¼%
J=5% D=½% A=.1%
G=2%

SLEEVING CODE
S=Mylar sleeve
X=No sleeve

LEAD CODE
W=Tinned copper clad steel: #22 (.025″) for .312″ case dia. & smaller; #20 (.032″) for .400″ & .500″ case dia.
C=Tinned oxygen-free copper: #18 (.040″) for .562″ case dia. & larger.

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±0.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads



COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

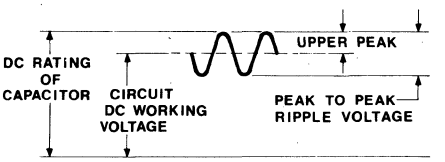
CRC COMPONENT RESEARCH CO.

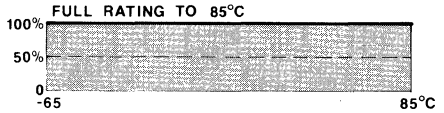
POLYSTYRENE K93 AC RATINGS

ESTABLISHED RELIABILITY CAPACITORS

	TYPE K93B 50VDC			TYPE K93C 100VDC			TYPE K93D 200VDC			TYPE K93E 400VDC		
	MAXIMUM AC RATINGS			MAXIMUM AC RATINGS			MAXIMUM AC RATINGS			MAXIMUM AC RATINGS		
uF	RMS Volts	Freq. In KHz	RMS Amps	RMS Volts	Freq. In KHz	RMS Amps	RMS Volts	Freq. In KHz	RMS Amps	RMS Volts	Freq. In KHz	RMS Amps
.001	36.0	40.0	.009	60.0	40.0	.015	120.0	40.0	.03	240.0	40.0	.06
.0012	36.0	40.0	.011	60.0	40.0	.018	120.0	40.0	.036	240.0	40.0	.072
.0015	36.0	40.0	.013	60.0	40.0	.022	120.0	40.0	.044	240.0	40.0	.088
.0018	36.0	40.0	.016	60.0	40.0	.027	120.0	40.0	.054	240.0	40.0	.108
.002	36.0	40.0	.018	60.0	40.0	.03	120.0	40.0	.06	240.0	40.0	.12
.0022	36.0	40.0	.020	60.0	40.0	.033	120.0	40.0	.066	240.0	40.0	.132
.0027	36.0	40.0	.024	60.0	40.0	.041	120.0	40.0	.082	240.0	40.0	.16
.0033	36.0	40.0	.030	60.0	40.0	.045	120.0	40.0	.09	240.0	40.0	.18
.0039	36.0	40.0	.035	60.0	40.0	.059	120.0	40.0	.12	240.0	40.0	.24
.0047	36.0	40.0	.042	60.0	40.0	.071	120.0	40.0	.14	240.0	40.0	.28
.005	36.0	40.0	.045	60.0	40.0	.075	120.0	40.0	.15	240.0	40.0	.30
.0056	36.0	40.0	.050	60.0	40.0	.084	120.0	40.0	.17	240.0	40.0	.34
.0068	36.0	40.0	.061	60.0	40.0	.102	120.0	40.0	.2	240.0	40.0	.4
.0075	36.0	40.0	.067	60.0	40.0	.11	120.0	40.0	.22	240.0	40.0	.44
.0082	36.0	40.0	.074	60.0	40.0	.12	120.0	40.0	.24	240.0	40.0	.48
.01	36.0	40.0	.090	60.0	40.0	.15	120.0	40.0	.30	240.0	40.0	.60
.012	36.0	40.0	.11	60.0	40.0	.18	120.0	40.0	.36	240.0	40.0	.72
.015	36.0	40.0	.14	60.0	40.0	.22	120.0	40.0	.44	240.0	40.0	.88
.018	36.0	40.0	.16	60.0	40.0	.27	120.0	40.0	.54	240.0	40.0	1.1
.02	36.0	40.0	.18	60.0	40.0	.3	120.0	40.0	.6	240.0	40.0	1.2
.022	36.0	40.0	.20	60.0	40.0	.33	120.0	40.0	.66	240.0	40.0	1.3
.027	36.0	40.0	.24	60.0	40.0	.41	120.0	40.0	.82	240.0	40.0	1.6
.033	36.0	40.0	.30	60.0	40.0	.45	120.0	40.0	.9	240.0	40.0	1.8
.039	36.0	40.0	.35	60.0	40.0	.59	120.0	40.0	1.2	240.0	40.0	2.4
.047	36.0	40.0	.42	60.0	40.0	.71	120.0	40.0	1.4	240.0	40.0	2.9
.05	36.0	40.0	.45	60.0	40.0	.75	120.0	40.0	1.5	240.0	40.0	3.0
.056	36.0	40.0	.50	60.0	40.0	.84	120.0	40.0	1.7	240.0	35.5	3.0
.068	36.0	40.0	.61	60.0	40.0	1.0	120.0	40.0	2.0	240.0	34.1	3.5
.075	36.0	40.0	.67	60.0	40.0	1.1	120.0	40.0	2.2	240.0	30.9	3.5
.082	36.0	40.0	.74	60.0	40.0	1.2	120.0	40.0	2.4	240.0	28.3	3.5
.1	36.0	40.0	.90	60.0	40.0	1.5	120.0	40.0	3.0	240.0	23.2	3.5
.12	36.0	36.9	1.0	60.0	40.0	1.8	120.0	33.1	3.0	240.0	19.3	3.5
.15	36.0	40.0	1.4	60.0	40.0	2.2	120.0	30.9	3.5	240.0	17.7	4.0
.18	36.0	40.0	1.6	60.0	40.0	2.7	120.0	25.8	3.5	240.0	14.7	4.0
.20	36.0	40.0	1.8	60.0	40.0	3.0	120.0	23.2	3.5	240.0	13.2	4.0
.22	36.0	40.0	2.0	60.0	36.2	3.0	120.0	21.1	3.5	240.0	12.0	4.0
.27	36.0	40.0	2.4	60.0	34.4	3.5	120.0	19.6	4.0	240.0	11.0	4.5
.33	36.0	40.0	3.0	60.0	28.1	3.5	120.0	16.1	4.0	240.0	9.0	4.5
.39	36.0	40.0	3.5	60.0	32.6	4.0	120.0	15.3	4.5	240.0	8.5	5.0
.47	36.0	37.6	4.0	60.0	25.4	4.5	120.0	14.1	5.0	240.0	7.0	5.0
.50	36.0	35.4	4.0	60.0	23.8	4.5	120.0	13.2	5.0	240.0	6.6	5.0
.56	36.0	31.6	4.0	60.0	21.3	4.5	120.0	11.8	5.0	240.0	5.9	5.0
.68	36.0	28.6	4.5	60.0	19.5	5.0	120.0	10.7	5.5	240.0	5.8	6.0
.75	36.0	29.5	5.0	60.0	19.4	5.5	120.0	10.6	6.0	240.0	6.2	7.0
.82	36.0	27.0	5.0	60.0	17.8	5.5	120.0	9.7	6.0	240.0	5.6	7.0
1.0	36.0	22.1	5.0	60.0	14.6	5.5	120.0	7.9	6.0	240.0	4.6	7.0
1.2	36.0	20.4	5.5	60.0	13.2	6.0						
1.5	36.0	16.2	5.5	60.0	10.6	6.0						
1.8	36.0	14.7	6.0	60.0	10.3	7.0						
2.0	36.0	13.2	6.0	60.0	9.28	7.0						
2.2	36.0	12.06	6.0									
2.5	36.0	11.5	6.5									
2.7	36.0	10.66	6.5									

1. THE COMBINED DC AND AC VOLTAGES SHOULD NOT EXCEED THE DC RATINGS, SEE FIGURE.
2. CAPACITORS MAY BE OPERATED AT HIGHER FREQUENCIES, AT REDUCED RMS VOLTAGE SUCH THAT MAX. AC CURRENT RATINGS ARE NOT EXCEEDED.
3. CAPACITORS CAN HANDLE PULSE CURRENTS UP TO 100 TIMES GREATER THAN THE PEAK CURRENTS CALCULATED FROM THE RATED RMS RATING (PROVIDED SLOW REPETITION RATES ARE USED). IF THERE IS ANY DOUBT, A SKETCH OF THE VOLTAGE AND CURRENT WAVE FORMS WITH TIME BASE SHOULD BE SENT TO CRC FOR ANALYSIS.





COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

CRC COMPONENT RESEARCH CO.

DOUBLE LAYER A10

ESTABLISHED RELIABILITY CAPACITORS

A10 SPECIFICATIONS

CONSTRUCTION	Type A10 capacitors utilize a dual layer construction as extra assurance that clearings and low resistance faults will not occur. See Index for Capacitor Fault Scanning.	
OPERATING TEMPERATURE	−65°C to +100°C	At full rated voltage, derate linearly to 50% of rated voltage at 125°C.
DIELECTRIC ABSORPTION	0.1% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.15% maximum	At 25°C when measured per MIL-C-83421.
AC SQUARE WAVE	100Hz, 60 seconds minimum	At 25°C at a peak to peak voltage of 3 times rated DC voltage, terminal to terminal per MIL-C-83421.
DIELECTRIC STRENGTH	200% DC volts	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	±1% 0% to −2%	From 25°C to +125°C. From 25°C to −55°C.
CAPACITANCE STABILITY	±0.2%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1×10^{-6} atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 0.18uF CAPACITOR AT 25°C IS 300,000 ÷ 0.18 = 1,666,666 MEGOHMS.

RANGE	25°C	85°C	100°C	125°C
.001 TO 0.1uF	3,000,000 Megohms	500,000 Megohms	200,000 Megohms	20,000 Megohms
GREATER THAN 0.1uF	300,000 Megohms-uF	50,000 Megohms-uF	20,000 Megohms-uF	2,000 Megohms-uF

A10 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	48 hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1x10 ⁶atm/cm³/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz at a peak to peak voltage of 3 times DC rated voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
7	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	300,000 megohm-uF, need not exceed 3,000,000 megohms	100% Test
8	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
9	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.15% max.	100% Test
10	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343-6864

CRC COMPONENT RESEARCH CO.

DOUBLE LAYER A10 CASE DIMENSIONS

ESTABLISHED RELIABILITY CAPACITORS

uF	TYPE A10B 50VDC RATED				TYPE A10C 100VDC RATED				TYPE A10D 200VDC RATED				TYPE A10E 400VDC RATED			
	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C
.001	A10B102	.170	.500	.600	A10C102	.170	.500	.600	A10D102	.170	.562	.662	A10E102	.193	.562	.662
.0012	A10B122	.170	.500	.600	A10C122	.170	.500	.600	A10D122	.170	.562	.662	A10E122	.193	.562	.662
.0015	A10B152	.170	.500	.600	A10C152	.170	.500	.600	A10D152	.170	.562	.662	A10E152	.193	.562	.662
.0018	A10B182	.170	.500	.600	A10C182	.170	.500	.600	A10D182	.170	.562	.662	A10E182	.193	.562	.662
.002	A10B202	.170	.500	.600	A10C202	.170	.500	.600	A10D202	.170	.562	.662	A10E202	.193	.562	.662
.0022	A10B222	.170	.500	.600	A10C222	.170	.500	.600	A10D222	.170	.562	.662	A10E222	.193	.562	.662
.0027	A10B272	.170	.500	.600	A10C272	.170	.500	.600	A10D272	.170	.562	.662	A10E272	.235	.562	.662
.0033	A10B332	.170	.500	.600	A10C332	.170	.500	.600	A10D332	.170	.562	.662	A10E332	.235	.562	.662
.0039	A10B392	.170	.500	.600	A10C392	.170	.500	.600	A10D392	.170	.562	.662	A10E392	.235	.562	.662
.0047	A10B472	.170	.500	.600	A10C472	.170	.500	.600	A10D472	.170	.562	.662	A10E472	.235	.562	.662
.005	A10B502	.170	.500	.600	A10C502	.170	.500	.600	A10D502	.170	.562	.662	A10E502	.235	.562	.662
.0056	A10B562	.170	.500	.600	A10C562	.170	.500	.600	A10D562	.170	.562	.662	A10E562	.235	.562	.662
.0068	A10B682	.170	.500	.600	A10C682	.170	.562	.662	A10D682	.170	.562	.662	A10E582	.235	.687	.787
.0075	A10B752	.170	.562	.662	A10C752	.170	.562	.662	A10D752	.193	.562	.662	A10E752	.235	.687	.787
.0082	A10B822	.170	.562	.662	A10C822	.170	.562	.662	A10D822	.193	.562	.662	A10E822	.235	.687	.787
.01	A10B103	.170	.562	.662	A10C103	.170	.687	.787	A10D103	.193	.562	.662	A10E103	.235	.687	.787
.012	A10B123	.170	.562	.662	A10C123	.170	.687	.787	A10D123	.193	.562	.662	A10E123	.235	.687	.787
.015	A10B153	.170	.562	.662	A10C153	.170	.687	.787	A10D153	.235	.562	.662	A10E153	.235	.813	.913
.018	A10B183	.193	.562	.662	A10C183	.193	.687	.787	A10D183	.235	.687	.787	A10E183	.312	.813	.913
.02	A10B203	.193	.562	.662	A10C203	.193	.687	.787	A10D203	.235	.687	.787	A10E203	.312	.813	.913
.022	A10B223	.193	.562	.662	A10C223	.193	.687	.787	A10D223	.235	.687	.787	A10E223	.312	.813	.913
.027	A10B273	.193	.562	.662	A10C273	.193	.687	.787	A10D273	.312	.687	.787	A10E273	.312	.813	.913
.033	A10B333	.193	.562	.662	A10C333	.193	.687	.787	A10D333	.312	.687	.787	A10E333	.312	.813	.913
.039	A10B393	.170	.687	.787	A10C393	.235	.687	.787	A10D393	.312	.687	.787	A10E393	.312	.813	.913
.047	A10B473	.170	.687	.787	A10C473	.235	.687	.787	A10D473	.312	.687	.787	A10E473	.400	.813	.913
.05	A10B503	.170	.687	.787	A10C503	.235	.687	.787	A10D503	.312	.687	.787	A10E503	.400	.813	.913
.056	A10B563	.193	.687	.787	A10C563	.235	.687	.787	A10D563	.312	.813	.913	A10E563	.400	.813	.913
.068	A10B683	.193	.687	.787	A10C683	.235	.813	.917	A10D683	.312	.813	.913	A10E683	.400	.813	.913
.075	A10B753	.193	.813	.913	A10C753	.312	.687	.787	A10D753	.312	.813	.913	A10E753	.400	1.063	1.163
.082	A10B823	.193	.813	.913	A10C823	.312	.687	.787	A10D823	.312	.813	.913	A10E823	.400	1.063	1.163
.1	A10B104	.193	.813	.913	A10C104	.312	.687	.787	A10D104	.312	.813	.913	A10E104	.400	1.063	1.163
.12	A10B124	.235	.687	.787	A10C124	.312	.687	.787	A10D124	.312	.813	.913	A10E124	.400	1.063	1.163
.15	A10B154	.235	.687	.787	A10C154	.312	.813	.913	A10D154	.400	1.063	1.163	A10E154	.400	1.375	1.475
.18	A10B184	.235	.813	.913	A10C184	.312	.813	.913	A10D184	.400	1.375	1.475	A10E184	.500	1.375	1.475
.20	A10B204	.235	.813	.913	A10C204	.312	.813	.913	A10D204	.400	1.375	1.475	A10E204	.500	1.375	1.475
.22	A10B224	.312	.687	.787	A10C224	.312	.813	.913	A10D224	.400	1.375	1.475	A10E224	.500	1.375	1.475
.27	A10B274	.312	.687	.787	A10C274	.312	1.063	1.163	A10D274	.500	1.375	1.475	A10E274	.562	1.375	1.475
.33	A10B334	.312	.813	.913	A10C334	.312	1.063	1.163	A10D334	.500	1.375	1.475	A10E334	.562	1.375	1.475
.39	A10B394	.312	.813	.913	A10C394	.400	1.063	1.163	A10D394	.500	1.375	1.475	A10E394	.562	1.875	1.975
.47	A10B474	.400	.813	.913	A10C474	.400	1.063	1.163	A10D474	.500	1.375	1.475	A10E474	.562	1.875	1.975
.50	A10B504	.400	.813	.913	A10C504	.400	1.063	1.163	A10D504	.500	1.375	1.475	A10E504	.562	1.875	1.975
.56	A10B564	.400	.813	.913	A10C564	.400	1.063	1.163	A10D564	.500	1.375	1.475	A10E564	.562	1.875	1.975
.68	A10B684	.400	.813	.913	A10C684	.500	1.125	1.225	A10D684	.562	1.375	1.475	A10E684	.750	1.875	1.975
.75	A10B754	.400	1.063	1.163	A10C754	.500	1.125	1.225	A10D754	.562	1.875	1.975	A10E754	.750	1.875	1.975
.82	A10B824	.400	1.063	1.163	A10C824	.500	1.125	1.225	A10D824	.562	1.875	1.975	A10E824	.750	1.875	1.975
1.0	A10B105	.400	1.063	1.163	A10C105	.562	1.125	1.225	A10D105	.562	1.875	1.975	A10E105	.750	1.875	1.975
1.2	A10B125	.500	1.125	1.225	A10C125	.562	1.125	1.225	A10D125	.562	1.875	1.975	A10E125	1.000	1.875	1.975
1.5	A10B155	.500	1.125	1.225	A10C155	.562	1.375	1.475	A10D155	.670	1.875	1.975	A10E155	1.000	2.375	2.475
1.8	A10B185	.500	1.375	1.475	A10C185	.670	1.375	1.475	A10D185	.750	1.875	1.975	A10E185	1.000	2.375	2.475
2.0	A10B205	.500	1.375	1.475	A10C205	.670	1.375	1.475	A10D205	.750	1.875	1.975	A10E205	1.000	2.375	2.475
2.2	A10B225	.500	1.375	1.475	A10C225	.670	1.375	1.475	A10D225	.750	1.875	1.975				
2.5	A10B255	.500	1.375	1.475	A10C255	.670	1.875	1.975	A10D255	.750	1.875	1.975				
3.0	A10B305	.562	1.375	1.475	A10C305	.670	1.875	1.975	A10D305	1.000	1.875	1.975				
3.3	A10B335	.562	1.375	1.475	A10C335	.670	1.875	1.975	A10D335	1.000	1.875	1.975				
4.0	A10B405	.670	1.375	1.475	A10C405	.750	1.875	1.975	A10D405	1.000	2.375	2.475				
4.7	A10B475	.670	1.375	1.475	A10C475	.750	1.875	1.975								
5.0	A10B505	.670	1.375	1.475	A10C505	.750	1.875	1.975								
6.8	A10B685	.670	1.875	1.975	A10C685	1.000	2.375	2.475								
8.0	A10B805	.670	1.875	1.975	A10C805	1.000	2.375	2.475								
10.0	A10B106	.750	1.875	1.975	A10C106	1.000	2.375	2.475								

FOR SPECIAL VALUES AND TOLERANCES, PLEASE CONTACT OUR APPLICATION DEPARTMENT.

A10 | B | 104 | J | S | W

STYLE

VOLTAGE
B=50VDC
C=100VDC
D=200VDC
E=400VDC

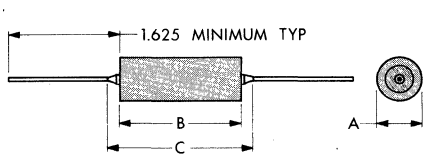
CAPACITANCE TOLERANCE K=10% G=2% J=5% F=1%

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.

SLEEVING CODE
S=Mylar sleeve
X=No sleeve

LEAD CODE
W=Tinned copper clad steel: #22 (.025") for .312" case dia. & smaller; #20 (.032") for .400" & .500" case dia.
C=Tinned oxygen-free copper: #18 (.040") for .562" case dia. & larger.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads.



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CRC COMPONENT RESEARCH CO.

FOIL POLYCARBONATE A52

ESTABLISHED RELIABILITY CAPACITORS

A52 SPECIFICATIONS

CONSTRUCTION	Polycarbonate dielectric, extended foil electrodes, hermetically sealed, leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmental requirements of MIL-C-83421 except vibration and shock. Vibration is at 20g's and shock at 50g's.	
OPERATING TEMPERATURE	−65°C to +100°C	At full rated voltage, derate linearly to 50% of rated voltage at 125°C.
DIELECTRIC ABSORPTION	0.1% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.15% maximum	At 25°C when measured per MIL-C-83421.
AC SQUARE WAVE	100Hz, 60 seconds minimum	At 25°C at a peak to peak voltage of 3 times rated DC voltage, terminal to terminal per MIL-C-83421.
DIELECTRIC STRENGTH	200% DC volts	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	±2% maximum capacitance change	From −55°C to +125°C.
CAPACITANCE STABILITY	±0.25%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1×10^{-6} atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

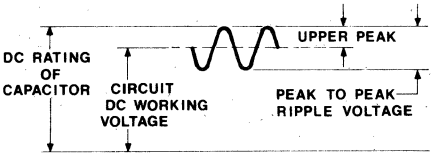
FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A0.18uF CAPACITOR AT 25°C is 100,000 ÷ 0.18 = 555,000 MEGOHMS.

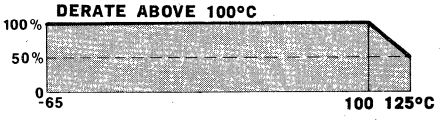
RANGE	25°C	85°C	125°C
.001 TO 0.1uF	1,000,000 Megohms	500,000 Megohms	30,000 Megohms
GREATER THAN 0.1uF	100,000 Megohms-uF	50,000 Megohms-uF	3,000 Megohms-uF

A52 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	48 hours minimum at 100°C, at 120% rated AC voltage at 400Hz not to exceed 240VRMS	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
4	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz at a peak to peak voltage of 3 times DC rated voltage for 60 sec. min. Do not exceed 800 volts peak to peak.	4.7.6	No shorts	100% Test
5	DC HI-POT (TERMINAL TO TERMINAL) AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	100,000 megohms-uF, need not exceed 1,000,000 megohms	100% Test
7	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
8	% DISSIPATION FACTOR	At 25°C at 10KHz	4.7.9	.15 maximum	100% Test
9	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship as required.	4.7.1	Per specification	1.0% AQL

1. THE COMBINED DC AND AC VOLTAGES SHOULD NOT EXCEED THE DC RATINGS, SEE FIGURE.
2. CAPACITORS MAY BE OPERATED AT HIGHER FREQUENCIES, AT REDUCED RMS VOLTAGE SUCH THAT MAX. AC CURRENT RATINGS ARE NOT EXCEEDED.
3. TYPE A52 CAPACITORS CAN HANDLE MUCH HIGHER PULSE REPETITION RATES THAN METALLIZED CAPACITORS.





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CRC COMPONENT RESEARCH CO.

FOIL POLYCARBONATE A52

ESTABLISHED RELIABILITY CAPACITORS

CASE DIMENSIONS • AC RATINGS

	TYPE A52C 100VDC					TYPE A52D 200VDC					TYPE A52V 300VDC					TYPE A52E 400VDC				
			AC RATINGS					AC RATINGS					AC RATINGS					AC RATINGS		
uF	Dia. A	Length B	Max. RMS Volts 20 KHz	Max. RMS Volts 100 KHz	Max. RMS Amps	Dia. A	Length B	Max. RMS Volts 20 KHz	Max. RMS Volts 100 KHz	Max. RMS Amps	Dia. A	Length B	Max. RMS Volts 20 KHz	Max. RMS Volts 100 KHz	Max. RMS Amps	Dia. A	Length B	Max. RMS Volts 20 KHz	Max. RMS Volts 100 KHz	Max. RMS Amps
.001	.193	.562	60	60	.038	.193	.562	120	120	.075	.193	.562	180	180	.113	.193	.687	240	240	.15
.0012	.193	.562	60	60	.045	.193	.562	120	120	.090	.193	.562	180	180	.135	.193	.687	240	240	.18
.0015	.193	.562	60	60	.056	.193	.562	120	120	.112	.193	.562	180	180	.169	.193	.687	240	240	.22
.0018	.193	.562	60	60	.067	.193	.562	120	120	.135	.193	.562	180	180	.202	.193	.687	240	240	.27
.002	.193	.562	60	60	.075	.193	.562	120	120	.150	.193	.562	180	180	.225	.193	.687	240	240	.30
.0022	.193	.562	60	60	.083	.193	.562	120	120	.165	.193	.562	180	180	.248	.193	.687	240	240	.33
.0027	.193	.562	60	60	.101	.193	.562	120	120	.202	.193	.687	180	180	.304	.193	.687	240	240	.4
.0033	.193	.562	60	60	.124	.193	.562	120	120	.247	.193	.687	180	180	.371	.193	.687	240	240	.5
.0039	.193	.562	60	60	.146	.193	.562	120	120	.293	.193	.687	180	180	.439	.193	.687	240	240	.6
.0047	.193	.562	60	60	.176	.193	.687	120	120	.353	.193	.687	180	180	.529	.235	.687	240	240	.7
.005	.193	.562	60	60	.188	.193	.687	120	120	.375	.193	.687	180	180	.562	.235	.687	240	240	.75
.0056	.193	.562	60	60	.210	.193	.687	120	120	.420	.193	.687	180	180	.623	.235	.687	240	240	.85
.0068	.193	.687	60	60	.255	.193	.687	120	120	.511	.235	.687	180	180	.766	.312	.687	240	240	1.0
.0075	.193	.687	60	60	.282	.235	.687	120	120	.563	.235	.687	180	180	.845	.312	.687	240	240	1.13
.0082	.193	.687	60	60	.308	.235	.687	120	120	.615	.235	.687	180	180	.923	.312	.687	240	240	1.23
.01	.235	.687	60	60	.375	.235	.687	120	120	.750	.312	.687	180	180	1.13	.312	.687	240	224	1.4
.012	.235	.687	60	60	.451	.235	.687	120	120	.902	.312	.687	180	172	1.3	.312	.687	240	200	1.5
.015	.235	.687	60	60	.561	.312	.687	120	120	1.12	.312	.687	180	150	1.4	.312	.813	240	190	1.8
.018	.312	.687	60	60	.674	.312	.687	120	120	1.35	.312	.687	180	134	1.5	.312	.813	240	178	2.0
.02	.312	.687	60	60	.750	.312	.687	120	112	1.4	.312	.813	180	132	1.65	.400	.813	240	168	2.1
.022	.312	.687	60	60	.822	.312	.687	120	110	1.5	.312	.813	180	130	1.8	.400	.813	240	158	2.2
.027	.312	.687	60	60	1.02	.312	.813	120	106	1.8	.312	.813	180	118	2.0	.400	.813	240	148	2.5
.033	.312	.687	60	60	1.22	.312	.813	120	98	2.0	.400	.813	180	108	2.2	.400	1.063	240	130	2.7
.039	.312	.813	60	60	1.46	.400	.813	120	90	2.2	.400	.813	180	98	2.4	.400	1.063	240	117	2.9
.047	.312	.813	60	60	1.76	.400	.813	120	82	2.4	.400	.813	180	85	2.5	.400	1.063	240	102	3.0
.05	.400	.813	60	60	1.88	.400	.813	120	80	2.5	.400	1.063	180	83.2	2.6	.500	1.125	240	102	3.2
.056	.400	.813	60	60	2.07	.400	.813	120	73	2.5	.400	1.063	180	78	2.7	.500	1.125	240	100	3.5
.068	.400	.813	60	53	2.2	.400	1.063	120	65	2.7	.400	1.063	180	67	2.8	.500	1.125	240	96	4.0
.075	.400	.813	60	50	2.4	.400	1.063	120	61	2.9	.400	1.063	180	63	3.0	.500	1.375	240	97	4.6
.082	.400	.813	60	49	2.5	.400	1.063	120	59	3.0	.500	1.125	180	61	3.15	.500	1.375	240	98	5.0
.1	.400	1.063	60	44	2.7	.500	1.125	120	55	3.4	.500	1.125	180	56	3.50	.562	1.375	240	85	5.3
.12	.400	1.063	60	37	2.8	.500	1.125	120	48	3.6	.500	1.125	180	53	4.00	.562	1.375	240	75	5.6
.15	.400	1.063	60	37	2.9	.500	1.125	120	43	4.00	.500	1.375	180	48	4.50	.562	1.375	240	53	6.0
.18	.400	1.063	60	27	3.0	.500	1.375	120	40	4.50	.500	1.375	180	45	5.00					
.2	.500	1.125	60	26	3.3	.500	1.375	120	38	4.75	.562	1.375	180	45	5.63					
.22	.500	1.125	60	25	3.4	.500	1.375	120	37	5.00	.562	1.375	180	45	6.00					
.27	.500	1.125	60	22	3.8	.562	1.375	120	33	5.50										
.33	.500	1.125	60	20	4.13	.562	1.375	120	29	6.00										
.39	.500	1.375	60	20	5.00															
.47	.562	1.375	60	20	6.00															

A52 | C | 104 | J | S | W

STYLE

VOLTAGE
C=100VDC
D=200VDC
V=300VDC
E=400VDC

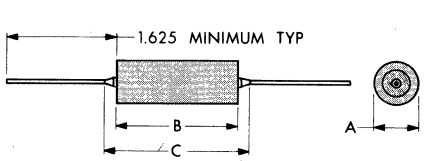
SLEEVING CODE
S=Mylar sleeve
X=No sleeve

LEAD CODE
W=Tinned copper clad steel: #22 (.025″) for .312″ case dia. & smaller; #20 (.032″) for .400″ & .500″ case dia.
C=Tinned oxygen-free copper: #18 (.040″) for .562″ case dia. & larger.

CAPACITANCE TOLERANCE
K=10% G=2%
J=5% F=1%

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±.010 Without Sleeving +0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	"C" Dimension is 0.2″ maximum more than "B" dimension in table



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CRC
COMPONENT RESEARCH CO.

FOIL POLYCARBONATE B52

ESTABLISHED RELIABILITY CAPACITORS

SPECIFICATIONS & QUALITY CONFORMANCE

400VRMS, 600VRMS, RATED FROM −65°C TO +100°C

Series B52 capacitors are designed for continuous duty operation over the full temperature range from −65°C to +100°C at the rated voltage, current and frequency.

The maximum RMS current or peak current can be exceeded with reduced duty cycle or tone burst operation, provided the peak rated voltages are not exceeded, and provided the heat rise measured at the terminals and within ¼" of the hermetic seals does not exceed 20°C.

Heat rise is measured with the capacitor located in a room temperature environment allowing for non-cooled normal convection. Lead size and distance to the power source must be adequate to prevent undue heat sinking or heat generation during measurement.

HIGH CURRENT HANDLING WITH LOW LOSS

Series B52 capacitors have very low series resistance terminations, measuring in the range of several milliohms at 100KHz, and can handle very high peak current discharge currents. Typically it is estimated that a 1uF capacitor can handle over 3000 amperes of peak current at repetition rates up to 10 pulses per second. Testing is now in process to develop meaningful pulse current limits to be added to future specifications for B52 capacitors.

FREEDOM FROM CORONA INCEPTION AND INTERNAL HOT SPOTS

CRC capacitors use a patented low loss termination which remains reliable after years of operation under severe environmental conditions. Whereas commercial type AC rated capacitors may be adequate for 60Hz and possibly 400Hz long term life, the use of CRC terminations enables these capacitors to operate up to 40KHz without abnormal hot spot conditions of corona inception.

40KHz RATED FOR HIGH CURRENT HANDLING UP TO 100°C

CRC capacitors will operate efficiently up to approximately 400KHz at their maximum current rated conditions. Typically a capacitor that is 1uF and is rated at 10 amps at 40KHz will be handling 40VRMS at 40KHz. This capacitor when operated at 400KHz at 4VRMS will handle approximately 10ARMS current.

CRC has higher frequency, lower loss, higher power capacitors in the planning stage for future applications that seek for higher frequency power sources.

HERMETICALLY SEALED, RUGGED AEROSPACE, MILITARY CONSTRUCTION

CRC true hermetic sealing preserves the high quality performance of Series B52 polycarbonate capacitors and protects the dielectric materials from chemical attack. Merely potting non-hermetic type capacitors is poor insurance against long term loss of dielectric strength and life. It has been found that attack by vapor ingestion of chemicals of non-hermetic polycarbonate capacitors has resulted in failure in life or long term operation.

AVAILABLE WITH 400Hz OR 40KHz BURN-IN OPTIONS

AC burn-in options at additional cost are available for critical applications. The most economical AC burn-in is at rated RMS voltage @ 400Hz at 100°C. Burn-in @ 400KHz at maximum rated current is also available for those applications where long term use at high current is anticipated. Group "A" testing is performed 100%. This testing consists of vital capacitor parameters performed after burn-in to tight specification limits. This ensures the high reliability required to assure our customers of fault free operation under harsh operating conditions.

TYPE B52 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METHOD	TEST LIMIT	INSPECTION LEVEL
1	BURN-IN	16 hrs minimum at 120% rated AC voltage at 400Hz at 100°C	4.7.2 MIL-C-83421	No physical damage	100% Test
2	THERMAL AGING	5 cycles minimum −65°C to 125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST	Gross leak Meth. 112 MIL-STD-202 Cond. B		No continuous bubble stream or oil leaks as required	100% Test
	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage or at 600VDC, whichever is less	4.7.7	100,000 megohms-uF, need not exceed 1,000,000 megohms	100% Test
5	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
6	% DISSIPATION FACTOR	At 25°C at 10KHz	4.7.9	0.25% maximum	100% Test
7	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions and workmanship	4.7.1	Per specification	1.0% AQL

CRC COMPONENT RESEARCH CO.

FOIL POLYCARBONATE B52

ESTABLISHED RELIABILITY CAPACITORS

DIMENSIONS & AC RATINGS

TYPE B52F 400VRMS RATED

TYPE B52P 600VRMS RATED

uF	600VDC RATED OR 600 VOLTS PEAK (AC PLUS DC VOLTS)			MAX. AC RATING —65°C TO 100°C				800VDC RATED OR 840 VOLTS PEAK (AC PLUS DC VOLTS)			MAX. AC RATING —65°C TO 100°C			
	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps
.033	B52F333KXD	.400	1.063	400	400	360	3.0	B52P333KXD	.500	1.375	600	600	600	5.0
.039	B52F393KXD	.400	1.063	400	400	308	3.0	B52P393KXD	.500	1.375	600	600	513	5.0
.047	B52F473KXD	.500	1.125	400	400	306	3.6	B52P473KXD	.500	1.375	600	600	426	5.0
.056	B52F563KXD	.500	1.125	400	400	255	3.6	B52P563KXD	.500	1.375	600	600	357	5.0
.068	B52F683KXD	.500	1.125	400	400	235	4.0	B52P683KXD	.562	1.375	600	600	353	6.0
.075	B52F753KXD	.500	1.375	400	400	235	4.4	B52P753KXD	.562	1.375	600	600	320	6.0
.082	B52F823KXD	.500	1.375	400	400	235	4.8	B52P823KXD	.562	1.375	600	600	293	6.0
.092	B52F923KXD	.562	1.375	400	400	230	5.3	B52P923KXD	.670	1.375	600	600	305	7.0
.1	B52F104KXD	.562	1.375	400	400	220	5.5	B52P104KXD	.670	1.375	600	600	280	7.0
.12	B52F124KXD	.562	1.375	400	400	200	6.0	B52P124KXD	.670	1.375	600	600	233	7.0
.15	B52F154KXD	.562	1.375	400	400	160	6.0	B52P154KXD	.670	1.875	600	600	214	8.0
.18	B52F184KXD	.670	1.375	400	400	155	7.0	B52P184KXD	.670	1.875	600	600	178	8.0
.22	B52F224KXD	.670	1.375	400	400	127	7.0	B52P224KXD	.670	1.875	600	600	146	8.0
.27	B52F274KXD	.670	1.875	400	400	118	8.0	B52P274KXD	.750	1.875	600	600	133	9.0
.33	B52F334KXD	.670	1.875	400	400	97	8.0	B52P334KXD	.750	1.875	600	600	109	9.0
.39	B52F394KXD	.670	1.875	400	400	82	8.0	B52P394KXD	.750	2.375	600	600	103	10.0
.47	B52F474KXD	.750	1.875	400	400	77	9.0	B52P474KXD	.750	2.375	600	600	85.1	10.0
.56	B52F564KXD	.750	1.875	400	400	64	9.0							
.68	B52F684KXD	.750	2.375	400	400	53	9.0							
.75	B52F754KXD	.750	2.375	400	400	53	10.0							
.82	B52F824KXD	.750	2.375	400	400	49	10.0							

ORDERING INFORMATION: All part numbers listed in tables have a capacitance tolerance of ±10% and are supplied with bare metal (unsleeved) cases.

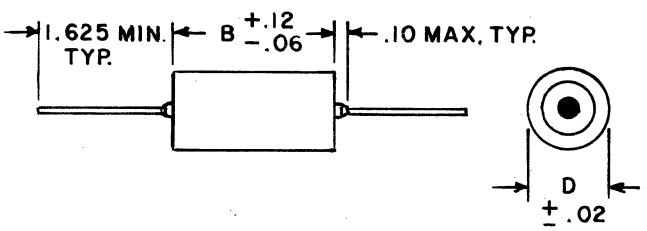
TECHNICAL INFORMATION: These capacitors can be damaged when you solder to the lead wires due to possible overheating that can occur. Place a suitable heat sink on the lead wire between the solder beads on the hermetic seal and the area of wire lead to be soldered.

For initial design, when operating the capacitors at high current levels it is suggested that you monitor the capacitor heat rise on the leads adjacent to the solder beads to verify that it does not exceed 20°C above ambient.

All maximum current ratings shown should result in less than 20°C heat rise with continuous duty operation under normal convection conditions.

Avoid tearing of solder beads when bending wire leads by using a suitable clamping fixture for lead bending.

PART DIMENSIONS AND TOLERANCES



LEAD SIZE

.032 ±.003 (#20AWG) TINNED COPPER FOR CASE DIAMETER .312

.041±.003 (#18AWG) TINNED COPPER FOR CASE DIAMETER .400 THRU .562

.051±.003 (#16AWG) TINNED COPPER FOR CASE DIAMETER .670 & LARGER

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CRC COMPONENT RESEARCH CO.

METALLIZED POLYCARBONATE B12

ESTABLISHED RELIABILITY CAPACITORS

SPECIFICATIONS & QUALITY CONFORMANCE

400VRMS, 600VRMS, RATED FROM −65°C TO +100°C

Series B12 capacitors are designed for continous duty operation over the full temperature range from −65°C to +100°C at the ratings for voltage, current and freguency listed in the specifications.

The maximum RMS current or peak current can be exceeded with reduced duty cycle or tone burst operation, provided the peak rated voltages are not exceeded, and provided the heat rise measured at the terminals and within ¼" of the hermetic seals does not exceed 20°C.

Heat rise is measured with the capacitor located in a room temperature environment allowing for non-cooled normal convection. Lead size and distance to the power source must be adequate to prevent undue heat sinking or heat generation during measurement.

HIGH CURRENT HANDLING WITH LOW LOSS

Series B12 capacitors have terminations slightly higher in resistance than Series B52 capacitors and can be used in pulse applications where the peak currents generally do not exceed 100 times B12 RMS current ratings and where the repetition rate is less than 10 pulses per second.

Testing is now in process to develop pulse current limits to be added to future specifications for B12 capacitors. Series B12 capacitors are smaller in size and lighter in weight than Series B52 foil polycarbaronate capacitors.

FREEDOM FROM CORONA INCEPTION AND INTERNAL HOT SPOTS

Commercial type AC rated capacitors may be adequate for 60Hz and possibly 400Hz long term life. CRC capacitors are designed to operate up to 40KHz without abnormal hot spot conditions, without corona inception, with constant controlled low loss terminations which remain reliable after years of use, after operation during severe environmental conditions.

40KHz RATED FOR HIGH CURRENT HANDLING UP TO 100°C

CRC capacitors will operate efficiently up to approximately 400KHz at their maximum current rated conditions. Typically a capacitor that is 1uF and is rated at 10 amps at 40KHz will be handling 40VRMS at 40KHz. This capacitor when operated at 400KHz at 4VRMS will handle approximately 10ARMS current.

CRC has higher frequency, lower loss, higher power capacitors in the planning stage for future applications that seek for higher frequency power sources.

HERMETICALLY SEALED, RUGGED AEROSPACE, MILITARY CONSTRUCTION

CRC true hermetic sealing preserves the high quality performance of Series B12 polycarbonate capacitors and protects the dielectric materials from chemical attack. Merely potting non-hermetic type capacitors is poor insurance against long term loss of dielectric strength and life. It has been found that attack by vapor ingestion of chemicals of non-hermetic polycarbonate capacitors has resulted in failure in life or long term operation.

AVAILABLE WITH 400Hz OR 40KHz BURN-IN OPTIONS

AC burn-in options at additional cost are available for critical applications. Most economical AC burn-in is generally at rated RMS volts at 400Hz at 100°C. 40KHz burn-in at maximum rated current is also available for those applications where long term use at high current is anticipated. 100% Group "A" testing of vital capacitor characteristics is performed after burn-in to generally tightly controlled specifications to assure ourselves and our customers that these capacitors will operate reliably as intended for use.

TYPE B12 QUALITY CONFORMANCE INSPECION

TEST NO.	TEST	TEST CONDITIONS	TEST METHOD	TEST LIMIT	INSPECTION LEVEL
1	BURN-IN	16 hrs minimum at 120% rated AC voltage at 400Hz at 100°C	4.7.2 MIL-C-83421	No physical damage	100% Test
2	THERMAL AGING	5 cycles minimum −65°C to 125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST	Gross leak Meth. 112 MIL-STD-202 Cond. B		No continuous bubble stream or oil leaks as required	100% Test
	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage or at 600VDC, whichever is less	4.7.7	100,000 megohms-uF, need not exceed 1,000,000 megohms	100% Test
5	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
6	% DISSIPATION FACTOR	At 25°C at 10KHz	4.7.9	0.5% maximum	100% Test
7	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions and workmanship	4.7.1	Per specification	1.0% AGL

CRC COMPONENT RESEARCH CO.

METALLIZED POLYCARBONATE B12

ESTABLISHED RELIABILITY CAPACITORS

DIMENSIONS & AC RATINGS

TYPE B12F 400VRMS RATED

TYPE B12P 600VRMS RATED

uF	600 VDC RATED OR 600 VOLTS PEAK (AC PLUS DC VOLTS) Part No.	D	L	MAX. AC RATING −65°C TO 100°C RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps	800VDC RATED OR 840 VOLTS PEAK (AC PLUS DC VOLTS) Part No.	D	L	MAX. AC RATING −65°C TO 100°C RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps
.01	B12F103KXD	.312	.813	400	400	400	1.0	B12P103KXD	.400	1.063	600	600	600	1.5
.012	B12F123KXD	.312	.813	400	400	400	1.2	B12P123KXD	.400	1.063	600	600	600	1.8
.015	B12F153KXD	.312	.813	400	400	400	1.5	B12P153KXD	.400	1.063	600	600	600	2.3
.018	B12F183KXD	.312	.813	400	400	355	1.6	B12P183KXD	.400	1.063	600	600	600	2.7
.022	B12F223KXD	.400	.813	400	400	309	1.7	B12P223KXD	.400	1.063	600	600	509	2.8
.027	B12F273KXD	.400	.813	400	400	252	1.7	B12P273KXD	.400	1.063	600	600	414	2.8
.033	B12F333KXD	.400	.813	400	400	218	1.8	B12P333KXD	.400	1.063	600	600	339	2.8
.039	B12F393KXD	.400	.813	400	400	205	2.0	B12P393KXD	.400	1.063	600	600	287	2.8
.047	B12F473KXD	.400	1.063	400	400	187	2.2	B12P473KXD	.500	1.125	600	600	272	3.2
.056	B12F563KXD	.400	1.063	400	400	164	2.3	B12P563KX4	.500	1.125	600	600	236	3.3
.068	B12F683KXD	.400	1.063	400	400	159	2.7	B12P683KXD	.500	1.125	600	600	200	3.4
.075	B12F753KXD	.400	1.063	400	400	149	2.8	B12P753KXD	.500	1.375	600	600	200	3.75
.082	B12F823KXD	.500	1.125	400	400	146	3.0	B12P823KXD	.500	1.375	600	600	195	4.0
.092	B12F923KXD	.500	1.125	400	400	140	3.2	B12P923KXD	.562	1.375	600	600	191	4.4
.1	B12F104KXD	.500	1.125	400	400	128	3.2	B12P104KXD	.562	1.375	600	600	180	4.5
.12	B12F124KXD	.500	1.375	400	400	110	3.3	B12P124KXD	.562	1.375	600	600	160	4.8
.15	B12F154KXD	.500	1.375	400	400	110	4.1	B12P154KXD	.562	1.375	600	600	134	5.0
.18	B12F184KXD	.562	1.375	400	400	95	4.3	B12P184KXD	.670	1.375	600	600	120	5.4
.22	B12F224KXD	.562	1.375	400	400	91	5.0	B12P224KXD	.670	1.375	600	600	102	5.6
.27	B12F274KXD	.562	1.375	400	400	74	5.0	B12P274KXD	.670	1.875	600	600	101	6.8
.33	B12F334KXD	.670	1.375	400	400	67	5.5	B12P334KXD	.670	1.875	600	600	82	6.8
.39	B12F394KXD	.670	1.375	400	400	57	5.5	B12P394KXD	.670	1.875	600	600	70	6.8
.47	B12F474KXD	.670	1.875	400	400	47	5.5	B12P474KXD	.750	1.875	600	600	61	7.2
.56	B12F564KXD	.670	1.875	400	400	42	5.9	B12P564KXD	.750	1.875	600	535	53.5	7.5
.68	B12F684KXD	.670	1.875	400	400	40	6.8	B12P684KXD	.750	1.875	600	470	47	8.0
.75	B12F754KXD	.750	1.875	400	400	40	7.5	B12P754KXD	.750	2.375	600	533	53.3	10.0
.82	B12F824KXD	.750	1.875	400	366	36	7.5	B12P824KXD	1.0	2.375	600	488	48.8	11.0
.92	B12F924KXD	.750	2.375	400	370	37	8.5							
1.0	B12F105KXD	.750	2.375	400	340	34	8.5							
1.2	B12F125KXD	.750	2.375	400	333	33.3	10.0							

ORDERING INFORMATION: All part numbers listed in tables have a capacitance tolerance of ±10% and are supplied with bare metal (unsleeved) cases.

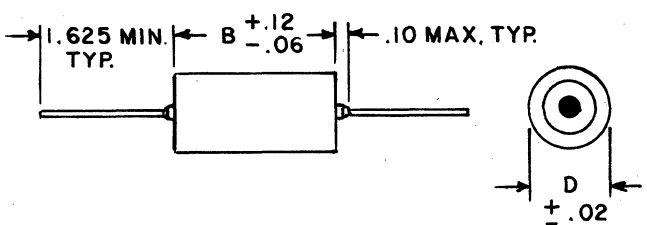
TECHNICAL INFORMATION: These capacitors can be damaged when you solder to the lead wires due to possible overheating that can occur. Place a suitable heat sink on the lead wire between the solder beads on the hermetic seal and the area of wire lead to be soldered.

For initial design, when operating the capacitors at high current levels it is suggested that you monitor the capacitor heat rise on the leads adjacent to the solder beads to verify that it does not exceed 20°C above ambient.

All maximum current ratings shown should result in less than 20°C heat rise with continuous duty operation under normal convection conditions.

Avoid tearing of solder beads when bending wire leads by using a suitable clamping fixture for lead bending.

PART DIMENSIONS AND TOLERANCES



LEAD SIZE

.032 ±.003 (#20AWG) TINNED COPPER FOR CASE DIAMETER .312

.041±.003 (#18AWG) TINNED COPPER FOR CASE DIAMETER .400 THRU .562

.051±.003 (#16AWG) TINNED COPPER FOR CASE DIAMETER .670 & LARGER

CRC COMPONENT RESEARCH CO.

FOIL POLYPROPYLENE B55

ESTABLISHED RELIABILITY CAPACITORS

SPECIFICATIONS & QUALITY CONFORMANCE

400VRMS, 600VRMS, RATED FROM −55°C TO +85°C (HIGHER RATINGS AVAILABLE)

Series B55 capacitors are designed for continuous duty operation over the full temperature range from −55°C to +85°C at the rating for voltage, current and frequency listed in the specifications.

The maximum RMS current or peak current can be exceeded with reduced duty cycle or tone burst operation, provided that peak rated voltages are not exceeded, and provided the heat rise measured at the terminals and within ¼" of the hermetic seals does not exceed 20°C.

Heat rise is generally measured with the capacitor located in a room temperature environment allowing for non-cooled normal convection. Lead size and distance to the power source must be adequate to prevent undue heat sinking or generation during measurement.

HIGH CURRENT HANDLING WITH LOW LOSS

Series B55 capacitors have very low series resistance terminations, in the range of several milliohms at 100KHz, and can handle very high peak current discharge currents. Typically it is estimated that a 1uF capacitor can handle over 3000 amperes of peak current at repetition rates up to 10 pulses per second. Testing is now in process to develop meaningful pulse current limits to be added to future specifications for B55 capacitors.

FREEDOM FROM CORONA INCEPTION AND INTERNAL HOT SPOTS

Commercial type AC rated capacitors may be adequate for 60Hz and possibly 400Hz long term life. CRC capacitors are designed to operate up to 40KHz without abnormal hot spot conditions, without corona inception, with constant controlled low loss terminations which remain reliable after years of use, after operation during severe environmental conditions.

40KHz RATED FOR HIGH CURRENT HANDLING UP TO 85°C

CRC capacitors use a patented low loss termination which remains reliable after years of operation under severe environmental conditions. Whereas commercial type AC rated capacitors may be adequate for 60Hz and possibly 400Hz long term life, the use of CRC terminations enables these capacitors to operate up to 40KHz without abnormal hot spot conditions or corona inception.

HERMETICALLY SEALED, RUGGED AEROSPACE, MILITARY CONSTRUCTION

CRC true hermetic sealing preserves the high quality performance of Series B55 foil polypropylene capacitors and protects the dielectric materials from chemical attack. Merely potting non-hermetic type capacitors is poor insurance against long term loss of dielectric strength and life. It has been found that attack by vapor ingestion of chemicals of non-hermetic polypropylene capacitors has resulted in failure in life or long term operation.

AVAILABLE WITH 400Hz OR 40KHz BURN-IN OPTIONS

AC burn-in options at additional cost are available for critical applications. The most economical AC burn-in is at rated RMS voltage @ 400Hz at 85°C. Burn-in @ 40KHz at maximum rated current is also available for those applications where long term use at high current is anticipated. Group "A" testing is performed 100%. This testing consists of vital capacitor parameters performed after burn-in to tight specification limits. This ensures the high reliability required to assure our customers of fault free operation under harsh operating conditions.

TYPE B55 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METHOD	TEST LIMIT	INSPECTION LEVEL
1	BURN-IN	16 hrs. minimum at 120% rated AC voltage at 400Hz at 85°C	4.7.2 MIL-C-83421	No physical damage	100% Test
2	THERMAL AGING	5 cycles minimum −55°C to 85°C	4.7.3	No physical damage	100% Test
3	SEAL TEST	Gross leak Meth. 112 MIL-STD-202 Cond. B		No continuous bubble stream or oil leaks as required	100% Test
4	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage, or at 600VDC. whichever is less	4.7.7	100,000 megohm-uF, need not exceed 1,000,000 megohms	100% Test
	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
6	% DISSIPATION FACTOR	At 25°C at 10KHz	4.7.9	.05% maximum	100% Test
7	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions and workmanship	4.7.1	*Per specification	1.0% AQL

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

CRC COMPONENT RESEARCH CO.

FOIL POLYPROPYLENE B55

ESTABLISHED RELIABILITY CAPACITORS

DIMENSIONS & AC RATINGS

	TYPE B55F 400VRMS RATED							TYPE B55P 600VRMS RATED						
	600VDC RATED OR 600 VOLTS PEAK (AC PLUS DC VOLTS)			MAX. AC RATING —55°C TO 85°C				800VDC RATED OR 840 VOLTS PEAK (AC PLUS DC VOLTS)			MAX. AC RATING —55°C TO 85°C			
uF	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps
.033	B55F333KXD	.400	1.063	400	400	400	4	B55P333KXD	.500	1.375	600	600	600	6
.039	B55F393KXD	.400	1.063	400	400	400	4	B55P393KXD	.500	1.375	600	600	600	6
.047	B55F473KXD	.500	1.125	400	400	400	5	B55P473KXD	.500	1.375	600	600	511	6
.056	B55F563KXD	.500	1.125	400	400	357	5	B55P563KXD	.500	1.375	600	600	428	6
.068	B55F683KXD	.500	1.125	400	400	294	5	B55P683KXD	.562	1.375	600	600	412	7
.075	B55F753KXD	.500	1.375	400	400	320	6	B55P753KXD	.562	1.375	600	600	373	7
.082	B55F823KXD	.500	1.375	400	400	293	6	B55P823KXD	.562	1.375	600	600	342	7
.092	B55F923KXD	.562	1.375	400	400	305	7	B55P923KXD	.670	1.375	600	600	348	8
.1	B55F104KXD	.562	1.375	400	400	280	7	B55P104KXD	.670	1.375	600	600	360	8
.12	B55F124KXD	.562	1.375	400	400	233	7	B55P124KXD	.670	1.375	600	600	266	8
.15	B55F154KXD	.562	1.375	400	400	187	7	B55P154KXD	.670	1.875	600	600	214	8
.18	B55F184KXD	.670	1.375	400	400	178	8	B55P184KXD	.670	1.875	600	600	200	9
.22	B55F224KXD	.670	1.375	400	400	146	8	B55P224KXD	.670	1.875	600	600	164	9
.27	B55F274KXD	.670	1.875	400	400	133	9	B55P274KXD	.750	1.875	600	600	178	12
.33	B55F334KXD	.670	1.875	400	400	109	9	B55P334KXD	.750	1.875	600	600	145	12
.39	B55F394KXD	.670	1.875	400	400	92.7	9	B55P394KXD	.750	2.375	600	600	144	14
.47	B55F474KXD	.750	1.875	400	400	102.0	12	B55P474KXD	.750	2.375	600	600	119	14
.56	B55F564KXD	.750	1.875	400	400	85.7	12							
.68	B55F684KXD	.750	2.375	400	400	70.6	12							
.75	B55F754KXD	.750	2.375	400	400	74.6	14							
.82	B55F824KXD	.750	2.375	400	400	68.3	14							

ORDERING INFORMATION: All part numbers listed in tables have a capacitance tolerance of ±10% and are supplied with bare metal (unsleeved) cases.

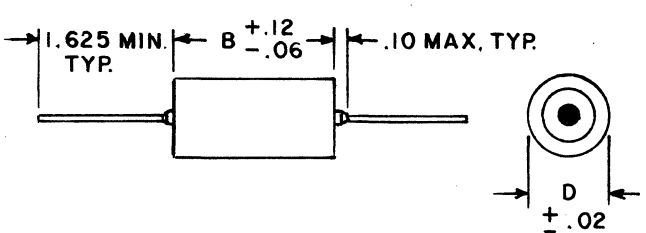
TECHNICAL INFORMATION: These capacitors can be damaged when you solder to the lead wires due to possible overheating that can occur. Place a suitable heat sink on the lead wire between the solder beads on the hermetic seal and the area of wire lead to be soldered.

For initial design, when operating the capacitors at high current levels it is suggested that you monitor the capacitor heat rise on the leads adjacent to the solder beads to verify that it does not exceed 20°C above ambient.

All maximum current ratings shown should result in less than 20°C heat rise with continuous duty operation under normal convection conditions.

Avoid tearing of solder beads when bending wire leads by using a suitable clamping fixture for lead bending.

PART DIMENSIONS AND TOLERANCES



LEAD SIZE

.032 ±.003 (#20AWG) TINNED COPPER FOR CASE DIAMETER .312

.041±.003 (#18AWG) TINNED COPPER FOR CASE DIAMETER .400 THRU .562

.051±.003 (#16AWG) TINNED COPPER FOR CASE DIAMETER .670 & LARGER

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

METALLIZED POLYPROPYLENE B15

ESTABLISHED RELIABILITY CAPACITORS

SPECIFICATIONS & QUALITY CONFORMANCE

400VRMS, 600VRMS, RATED −55°C TO +85°C

Series B15 metallized polypropylene capacitors have lower loss than Series B14 metallized polysulfone capacitors and therefore are superior for power resonating applications requiring minimum loss. The B15 capacitors are however limited for use in 85°C or lower temperature applications. CRC can supply special high temperature low loss teflon capacitors for 200°C power resonating applications if required.

When Series B15 specifications are completed, RMS ratings above 600VRMS will be available together with information covering this product line.

LOW LOSS, HIGH Q, LIGHT WEIGHT, HIGH POWER RATED, HERMETICALLY SEALED

The B15 capacitors are lighter in weight than any other hermetically sealed capacitor with equivalent current and voltage ratings at 40KHz. Typically a 5.6uF, 400VRMS, capacitor in a 1.25″ x 3.440″ case weighs approximately 110 grams and is rated to handle 35 amps at 40KHz.

Polypropylene film like many other dielectrics is affected by chemical attack of solvents, epoxies and contamination. True hermetic sealing of CRC's capacitors protects them from outside chemical attack and assures that long term high quality performance can be maintained.

RUGGED LOW LOSS TERMINATIONS FOR 100% DUTY CYCLE OPERATING LIFE

The large amount of power that B15 capacitors can handle is a result of years of development searching for all possible means of reducing capacitor losses and preserving the integrity of CRC's rugged capacitor terminations. When CRC's metallized polypropylene capacitors are subjected to temperature extremes, they surpass commercial type products in their ability to maintain a constant low loss equivalent series resistance and can maintain their low power factor for critical aerospace applications. Where extremely high pulse currents may be encountered Series B55 should be considered.

AC RATED TO 40KHz UP TO 85°C

Series B15 capacitors are rated up to 40KHz and are ideal for power resonating circuits. Due to a negative temperature coefficient of approximately 200 PPM/°C a 10°C temperature increase due to applied power or applied temperature will cause the capacitance to decrease approximately 0.2%.

AVAILABLE WITH AC BURN-IN AND OTHER SCREENING OPTIONS

CRC manufactures larger capacitors of similar construction to the B15 series in rectangular cases for power inverter applications requiring low loss filtering of several hundreds of amperes of ripple at frequencies 20KHz and higher.

Further developments in lowering capacitor losses are currently being completed at CRC and will result in further improved ratings for B15 and other new model capacitors.

TYPE B15 QUALITY CONFORMANCE INSPECTION

NO. TEST	TEST	TEST CONDITIONS	TEST METHOD	TEST LIMIT	INSPECTION LEVEL
1	BURN-IN	16 hrs. minimum at 120% rated AC voltage at 400Hz at 85°C	4.7.2 MIL-C-83421	No physical damage	100% Test
2	THERMAL AGING	5 cycles minimum −55°C to 85°C	4.7.3	No physical damage	100% Test
3	SEAL TEST	Gross leak Meth. 112 MIL-STD-202 Cond. B		No continuous bubble stream or oil leaks as required	100% Test
4	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage, or at 600VDC, whichever is less	4.7.7	100,000 megohm-uF, need not exceed 1,000,000 megohms	100% Test
5	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
6	% DISSIPATION FACTOR	At 25°C at 10KHz	4.7.9	0.05% maximum	100% Test
7	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions and workmanship	4.7.1	Per specification	1.0% AQL

NOW AVAILABLE: TYPE A15 METALLIZED POLYPROPYLENE LOW LOSS CAPACITORS. 100 VDC RATED .1 TO 22 μF. A.C. RATED TO 40 kHZ. CONTACT OUR APPLICATIONS DEPARTMENT FOR MORE INFORMATION.

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CRC COMPONENT RESEARCH CO.

METALLIZED POLYPROPYLENE B15

ESTABLISHED RELIABILITY CAPACITORS

DIMENSIONS & AC RATINGS

TYPE B15F 400VRMS RATED

uF	600VDC RATED OR 600 VOLTS PEAK (AC PLUS DC VOLTS) Part No.	D	L	MAX. AC RATING −55°C TO 85°C RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps
.01	B15F103KXD	.312	.813	400	400	400	2.5
.012	B15F123KXD	.312	.813	400	400	400	2.5
.015	B15F153KXD	.312	.813	400	400	400	2.5
.018	B15F183KXD	.312	.813	400	400	400	2.5
.022	B15F223KXD	.400	.813	400	400	400	3.0
.027	B15F273KXD	.400	.813	400	400	400	3.0
.033	B15F333KXD	.400	.813	400	400	364	3.0
.039	B15F393KXD	.400	.813	400	400	308	3.0
.047	B15F473KXD	.400	1.063	400	400	298	3.5
.056	B15F563KXD	.400	1.063	400	400	250	3.5
.068	B15F683KXD	.400	1.063	400	400	206	3.5
.075	B15F753KXD	.400	1.063	400	400	187	3.5
.082	B15F823KXD	.500	1.125	400	400	195	4
.092	B15F923KXD	.500	1.125	400	400	174	4
.1	B15F104KXD	.500	1.125	400	400	160	4
.12	B15F124KXD	.500	1.375	400	400	167	5
.15	B15F154KXD	.500	1.375	400	400	134	5
.18	B15F184KXD	.562	1.375	400	400	133	6
.22	B15F224KXD	.562	1.375	400	400	109	6
.27	B15F274KXD	.562	1.375	400	400	88.8	6
.33	B15F334KXD	.670	1.375	400	400	84.7	7
.39	B15F394KXD	.670	1.375	400	400	72.1	7
.47	B15F474KXD	.670	1.875	400	400	68.1	8
.56	B15F564KXD	.670	1.875	400	400	57	8
.68	B15F684KXD	.670	1.875	400	400	47	8
.75	B15F754KXD	.750	1.875	400	400	58.6	11
.82	B15F824KXD	.750	1.875	400	400	53.7	11
.92	B15F924KXD	.750	2.375	400	400	56.6	13
1.0	B15F105KXD	.750	2.375	400	400	52	13
1.2	B15F125KXD	.750	2.375	400	400	43.3	13

TYPE B15P 600VRMS RATED

800VDC RATED OR 840 VOLTS PEAK (AC PLUS DC VOLTS) Part No.	D	L	MAX. AC RATING −55°C TO 85°C RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps
B15P103KXD	.400	1.063	600	600	600	3.5
B15P123KXD	.400	1.063	600	600	600	3.5
B15P153KXD	.400	1.063	600	600	600	3.5
B15P183KXD	.400	1.063	600	600	600	3.5
B15P223KXD	.400	1.063	600	600	600	3.5
B15P273KXD	.400	1.063	600	600	518	3.5
B15P333KXD	.400	1.063	600	600	424	3.5
B15P393KXD	.400	1.063	600	600	369	3.5
B15P473KXD	.500	1.125	600	600	340	4
B15P563KXD	.500	1.125	600	600	286	4
B15P683KXD	.500	1.125	600	600	235	4
B15P753KXD	.500	1.375	600	600	267	5
B15P823KXD	.500	1.375	600	600	244	5
B15P923KXD	.562	1.375	600	600	261	6
B15P104KXD	.562	1.375	600	600	240	6
B15P124KXD	.562	1.375	600	600	200	6
B15P154KXD	.562	1.375	600	600	160	6
B15P184KXD	.670	1.375	600	600	155	7
B15P224KXD	.670	1.375	600	600	127	7
B15P274KXD	.670	1.875	600	600	118	8
B15P334KXD	.670	1.875	600	600	96.8	8
B15P394KXD	.670	1.875	600	600	82.4	8
B15P474KXD	.750	1.875	600	600	93.6	11
B15P564KXD	.750	1.875	600	600	78.5	11
B15P684KXD	.750	1.875	600	600	64.7	11
B15P754KXD	.750	2.375	600	600	69.3	13
B15P824KXD	1.0	2.375	600	600	63.4	15

ORDERING INFORMATION: All part numbers listed in tables have a capacitance tolerance of ±10% and are supplied with bare metal (unsleeved) cases.

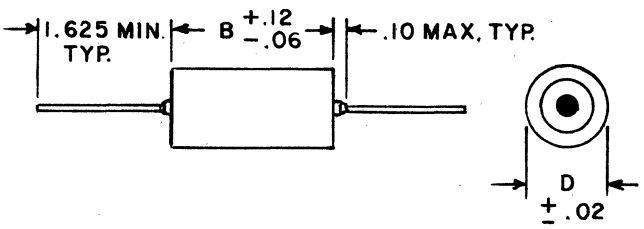
TECHNICAL INFORMATION: These capacitors can be damaged when you solder to the lead wires due to possible overheating that can occur. Place a suitable heat sink on the lead wire between the solder beads on the hermetic seal and the area of wire lead to be soldered.

For initial design, when operating the capacitors at high current levels it is suggested that you monitor the capacitor heat rise on the leads adjacent to the solder beads to verify that it does not exceed 20°C above ambient.

All maximum current ratings shown should result in less than 20°C heat rise with continuous duty operation under normal convection conditions.

Avoid tearing of solder beads when bending wire leads by using a suitable clamping fixture for lead bending.

PART DIMENSIONS AND TOLERANCES



LEAD SIZE

.032 ±.003 (#20AWG) TINNED COPPER FOR CASE DIAMETER .312

.041±.003 (#18AWG) TINNED COPPER FOR CASE DIAMETER .400 THRU .562

.051±.003 (#16AWG) TINNED COPPER FOR CASE DIAMETER .670 & LARGER

C-con™ COMPONENTS

CONCEPT INDUSTRIES
3641 SAN GABRIEL RIVER PKWY / PICO RIVERA, CA 90660 / Tel: (800) 255-2666 or in California (213) 699-0918

ALUMINUM ELECTROLYTIC CAPACITORS, MINIATURE ELECTROLYTICS, RADIAL LEAD, AND AXIAL LEAD

Radial (R)

Axial (A)

Series Type	Features	Operating Temp (°C)	D.C. Leakage Current (μA)	Construction	Rated Voltage Range (V.DC)	Capacitance Range (μF)	Capacitance Tol. (%)
SA	• Smaller Standard Size • Greater CV Density	-40 ~ +85	0.01CV (3μ A Min.) After 1 Min.	Radial (R) Axial (A)	6.3 ~ 100 6.3 ~ 100	0.1 ~ 22,000 0.1 ~ 10,000	± 20(M) ± 20(M)
SV	• Low Profile Design	-40 ~ +85	0.01CV (3μ A Min.) After 1 Min.	Radial (R)	6.3 ~ 50	0.1 ~ 47,000	± 20(M)
RM	• Low ESR • Compact Size, High Voltage • For Switching Regulators	-55 ~ +105 -40 ~ +105 -25 ~ +105	0.002CV (2μ A Min.) After 2 Min.	Radial (R)	DC ~ 63V 100V ~ 160V 200V ~ 250V	1.0 ~ 1,000	± 20(M)
GA	• High Voltage	-25 ~ +85	0.03CV +50MA After 5 Min.	Radial (R) Axial (A)	160 ~ 450 160 ~ 450	1 ~ 330 1 ~ 470	-10 ~ +50(T) -10 ~ +50(T)
LL	• Low Leakage • Good for Tantalum Replacement	-40 ~ +85	0.002CV (0.4μ A Min.) After 5 Min.	Radial (R)	10.0 ~ 63	0.1 ~ 4,700	± 20(M)
ZA	• Low Noise • Epoxy End Seal	-40 ~ +85	0.003CV (0.4μ A Min.) After 2 Min.	Radial (R)	6.3 ~ 100	1.0 ~ 330	± 20(M)
SS	• Super Miniature • For Tantalum Replacement	-40 ~ +85	0.03CV (4μ A Min.) After 1 Min.	Radial (R)	6.3 ~ 50	.047 ~ 47	± 20(M)
NP	• Non-Polarized	-40 ~ +85	0.03CV (3μ A Min.) After 5 Min.	Radial (R)	6.3 ~ 100	1.0 ~ 6,800	± 20(M)
SE	• Super Miniature Low Leakage • For Tantalum Replacement • Smallest Size 4x7	-40 ~ +85	.01CV (0.4μ A Min.) After 1 Min.	Radial (R)	10.0 ~ 63	0.1 ~ 47	± 20(M)
RA	• High Temp. (+105°C)	-40 ~ +105	0.03CV (4μ A Min.) After 1 Min.	Radial (R)	63 ~ 100	0.47 ~ 10,000	± 20(M)
RB	• High Temp. (+125°C)	-40 ~ +125	0.006CV (2μ A Min.) After 1 Min.	Radial (R) Axial (A)	10 ~ 50 10 ~ 50	0.47 ~ 1,000 0.47 ~ 1,000	± 20(M) ± 20(M)
TB	• For Timing Circuits • Very Stable at High Temp.	-40 ~ +85	0.001CV (1μ A Min.) After 2 Min.	Radial (R)	25 ~ 100	1 ~ 470	± 20(M) ± 10(K)
RQ	• Minature Low-ESR For Switching Regulators • High Ripple at High Frequency	-55 ~ +105	.03CV (4μ A Min.) After 1 Min.	Radial (R)	6.3 ~ 63	22 ~ 2,200	± 20(M)
BP	• Bi-Polar For Audio Crossover • Standard of Bi-Polar Series	-40 ~ +85	0.03CV (4μ A Min.) After 5 Min.	Radial (R)	50 ~ 63	1 ~ 100	± 20(M) ± 10(K)
BS	• Bi-Polar For Audio Crossover • Low Dissipation Factor	-40 ~ +85	0.03CV (4μ A Min.) After 5 Min.	Radial (R)	50 ~ 63	1 ~ 33	± 20(M) ± 10(K)
NS	• Minature, Ultra • Bi-Polar For Audio Crossover	-40 ~ +85	0.05CV (10μ A Min.) After 2 Min.	Radial (R)	6.3 ~ 63	0.1 ~ 47	± 20(M)

ALUMINUM ELECTROLYTIC CAPACITORS, CAN-TYPE ELECTROLYTICS—TYPE C

Lug Terminal

Prong (H) Terminal

Snap-in Terminal

Screw Terminal

Series Type	Features	Operating Temp (°C)	D.C. Leakage Current (μA)	Construction	Rated Voltage Range (V.DC)	Capacitance Range (μF)	Capacitance Tol. (%)
LN	• Lug Terminal	-40 ~ +85 (16 ~ 100V) -25 ~ +85 (160V)	.03CV 20μA After 5 Min. 0.03CV + 50μA After 5 Min.	Can (C)	16 ~ 450	33 ~ 100,000	-10 ~ +50(T)
HG	• Snap-in Terminal for P.C.B. Mount	-40 ~ +85 (16 ~ 100V)	.03CV 3mA After 5 Min.	Snap-in Can (C)	6.3 ~ 250	470 ~ 222,000	-10 ~ +30(Q)
HS	• Snap-in Terminals for P.C.B. Mount • Low Profile of HG Series	-25 ~ +85 160 ~ 250V	.03CV 3mA After 5 Min.	Snap-in Can (C)	6.3 ~ 250	470 ~ 220,000	-10 ~ +30(Q)
SN	• Computer Grade • Standard Size and Ripple	-25 ~ +85	3 $\sqrt{CV}$ (μA) After 5 Min.	Can (C)	10 ~ 450	220 ~ 330,000	-10 ~ +30
SB	• Computer Grade • For High Ripple Current Applications	-25 ~ +85	3 $\sqrt{CV}$ (μA) After 5 Min.	Can (C)	10 ~ 450	220 ~ 150,000	-10 ~ +30
SH	• Computer Grade • For Highest Ripple Current Application	-25 ~ +85	3 $\sqrt{CV}$ (μA) After 5 Min.	Can (C)	10 ~ 450	220 ~ 68,000	-10 ~ +30
MS	• For Motor Starting • Lug Terminal	-25 ~ +55	—	Can (C)	125 ~ 250 V. AC	20 ~ 400	-0 ~ +20(A)
HU	• Wide Temp Range • Snap-in Terminals • Low Profile	-40 ~ +105 (6.3V ~ 160V) -25 ~ +150 (200V ~ 250V)	0.02CV or 3mA (After 2 Min.)	Can (C)	10 ~ 250	100 ~ 15,000	± 20(M)
HV	• Snap-in Terminals For P.C. Mount • Wide Temp Range	-40 ~ +105 (6.3V ~ 160V) -25 ~ +105 (200V ~ 250V)	0.02CV or 3mA (After 2 Min.)	Can (C)	10 ~ 250	100 ~ 15,000	± 20(M)
BF	• Photo Flash • P.C. Mounting or Prong (H) Terminals	-10 ~ +55	.003CV(μA) (After 5 Min.)	Can (C)	200 ~ 1,000	330 ~ 360	-10 ~ +20
NF	• Horizontal Deflection Current Correction of TV Set	-40 ~ +85	0.03CV 4mA (After 5 Min.)	Radial (R)	25	1.0 ~ 10	± 10(K) ± 20(M)
RK	• Wide Temp Range • Ultra Miniature	-40 ~ +105	0.01CV or 3mA (After 1 Min.)	Radial (R)	6.3 ~ 63	0.1 ~ 68	± 20(M)
TH	• High Stability • TV Vertical OSC Circuit	-40 ~ +85	0.01CV or 3mA (After 2 Min.)	Radial (R)	16 ~ 50	1.0 ~ 100	± 20(M)

Call for full catalogs on:
- Aluminum Electrolytic Capacitors
- Polyester/Polypropylene Film Capacitors
- Monolithic/Disc Ceramic Capacitors
- SMD Chip Capacitors

TO ORDER — CALL
(800) 255-2666
Or in California:
(213) 699-0918

NOTE — Additional options for C-con™ Aluminum Electrolytic Capacitors are available as follows
- Taping for radial lead units in 8mm diameter (or less) for all series.
- Taping for axial lead units in 13mm diameter (or less) for all series.
- Lead cutting and forming available for all series.
- Safety-vented units are available for all series, except for SM and ML Series.
- Epoxy-end seals are available for all sizes for protection against harmful cleaning agents.
  — Epoxy-end seals are standard on the LN Series.
- — Due to rivet-type construction on axial lead part with 18mm diameters or larger, epoxy-end sealing is not necessary.

C-con™ COMPONENTS

CONCEPT INDUSTRIES

3641 SAN GABRIEL RIVER PKWY / PICO RIVERA, CA 90660 / Tel: (800) 255-2666 or in California (213) 699-0918

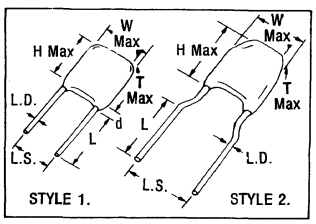
CERAMIC CAPACITORS

CM SERIES

Multi-layer (Monolithic)

Epoxy coated Radial Leaded Type, Temperature Coefficients: NPO, X7R, Z5U, Y5V.
25V, 50V (100V available on request)
Lead Material: Solderable

SHAPE AND SIZE:



(Conforms to EIAJ standards) Unit: mm

	W max	H max	T max	L.S.	L.D.	L	d max
CM 15	3.81	3.81	2.54	5 ±1.0	0.5 ±0.05	7 ±2 or 23 more	2.0
CM 20	5.08	5.08	3.18	5 ±1.0	0.5 ±0.05	7 ±2 or 23 more	2.0

* Any other forming types are available on your request

	W max	H max	T max	L.S.	L.D.	L	d max
CM 25	6.6	5.08	3.81	5 ±1.0	0.5 ±0.05	7 ±2 or 23 more	2.0
CM 30	7.62	7.62	3.81	5 ±1.0	0.5 ±0.05	7 ±2 or 23 more	2.0

ELECTRICAL SPECIFICATIONS

Temperature Coefficient
NPO: "N" Temperature Coefficient — 0 +30 ppm/°C, −55°C to +125°C
X7R: "W" Temperature Coefficient — +15%, −55°C to +125°C
Z5U: "Z" Temperature Coefficient — +22, −56%, +10°C to +85°C
Y5V: "Y" Temperature Coefficient — +22, −82%, −30°C to +85°C
Capacitance Test 25°C
NPO: Measured at 1 VRMS max at 1 KHz (1 MHz for 100 pF or less)
X7R: Measured at 1 VRMS max at 1 KHz
Z5U: Measured at .1 VRMS max at 1 KHz
Y5V: Measured at .1 VRMS max at 1 KHz
Dissipation Factor 25°C
NPO: .15% max at 1 KHz, 1 VRMS max (1 MHz for 100 pF or less)
X7R: 2.5% max at 1 KHz, 1 VRMS max
Z5U: 2.5% max at 1 KHz, .1 VRMS max
Y5V: 2.5% max at 1 KHz, .1 VRMS max.
Dielectric Withstanding Voltage 25°C (Flash Test)
NPO and X7R: 250% rated voltage for 5 seconds with 50 ma. max charging current
Z5U and Y5V: 200% rated voltage for 5 seconds with 50 ma max charging current
Life Test (1000 hrs)
NPO and X7R: 200% rated voltage at +125°C
Z5U and Y5V: 150% rated voltage at +85°C
Moisture Resistance:
NPO, X7R, Z5U, Y5V: Ten cycles with no voltage applied
Insulation Resistance at 25°C
NPO and X7R: 100 GΩ or 1000 MΩ-MFD whichever is less
Z5U and Y5V: 10 GΩ or 100 MΩ-MFD whichever is less

HOW TO ORDER

CM15 C Z 104 M 1

- SIZE STYLE
- VOLTAGE
- TEMPERATURE COEFFICIENT
- CAPACITANCE CODE
- TOLERANCE
- LEADS STYLE

Multi-Layer (Monolithic) Ceramic Capacitors NPO Temperature Characteristics

Size	C-Con type number	CM15	CM20	CM25	CM30
L max mm		3.81	5.08	6.6	7.62
W max mm		3.81	5.08	5.08	7.62
T max mm		2.54	3.18	3.81	3.81
Capacitance value	**Rated voltage**	25V 50V	25V 50V	25V 50V	25V 50V
10 pF	100				
12	120				
15	150				
18	180				
22	220				
27	270				
33	330				
39	390				
47	470				
56	560				
68	680				
82	820				
100	101				
120	121				
150	151				
180	181				
220	221				
270	271				
330	331				
390	391				
470	471				
560	561				
680	681				
820	821				
1000	102				
1200	122				
1500	152				
1800	182				
2200	222				
2700	272				
3300	332				
3900	392				
4700	472				
5600	562				
6800	682				
8200	822				
0.010 μF	103				
0.012	123				
0.015	153				
0.018	183				
0.022	223				
0.027	273				
0.033	333				
0.039	393				
0.047	473				

Multi-Layer (Monolithic) Ceramic Capacitors Z5U Temperature Characteristics

Size	C-con type number	CM15	CM20	CM25	CM30
L max mm		3.81	5.08	6.6	7.62
W max mm		3.81	5.08	5.08	7.62
T max mm		2.54	3.18	3.81	3.81
Capacitance value	**Rated voltage**	25V 50V	25V 50V	25V 50V	25V 50V
1000 pF	102				
1500	152				
2200	222				
3300	332				
4700	472				
6800	682				
0.010 μF	103				
0.015	153				
0.022	223				
0.033	333				
0.047	473				
0.068	683				
0.10	104				
0.15	154				
0.22	224				
0.33	334				
0.47	474				
0.68	684				
1.0	105				
1.5	155				

* Other Capacitance values available upon special request.
= Industry preferred values.

Multi-Layer (Monolithic) Ceramic Capacitors X7R Temperature Characteristics

Size	C-Con type number	CM15	CM20	CM25	CM30
L max mm		3.81	5.08	6.6	7.62
W max mm		3.81	5.08	5.08	7.62
T max mm		2.54	3.18	3.81	3.81
Capacitance value	**Rated voltage**	25V 50V	25V 50V	25V 50V	25V 50V
470 pF	471				
560	561				
680	681				
820	821				
1000	102				
1200	122				
1500	152				
1800	182				
2200	222				
2700	272				
3300	332				
3900	393				
4700	472				
5600	562				
6800	682				
8200	822				
0.010 μF	103				
0.012	123				
0.015	153				
0.018	183				
0.022	223				
0.027	273				
0.033	333				
0.039	393				
0.047	473				
0.056	563				
0.068	683				
0.082	823				
0.10	104				
0.12	124				
0.15	154				
0.18	184				
0.22	224				
0.27	274				
0.33	334				
0.39	394				
0.47	474				
0.56	564				
0.68	684				
0.82	824				
1.0	105				
1.2	125				
1.5	155				
1.8	185				

Multi-Layer (Monolithic) Ceramic Capacitors Y5V Temperature Characteristics

Size	C-con type number	CM15	CM20	CM25	CM30
L max mm		3.81	5.08	6.6	7.62
W max mm		3.81	5.08	5.08	7.62
T max mm		2.54	3.18	3.81	3.81
Capacitance value	**Rated voltage**	25V 50V	25V 50V	25V 50V	25V 50V
1000 pF	102				
1500	152				
2200	222				
3300	332				
4700	472				
6800	682				
0.010 μF	103				
0.015	153				
0.022	223				
0.033	333				
0.047	473				
0.068	683				
0.10	104				
0.15	154				
0.22	224				
0.33	334				
0.47	474				
0.68	684				
1.0	105				
1.5	155				
2.2	225				
3.3	335				
4.7	475				
6.8	685				
10.0	106				
15.0	156				

cem MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The measure of the opposition of a capacitor to accepting a charge and expressed in ohms. When direct current is applied under stated conditions capacitive reactance becomes a constant but, when alternating current is applied the capacitive reactance varies until an equilibrium is achieved and the capacitor appears to have only direct current present. This condition is commonly used in filter applications or in coupling circuits.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The measure of quality of the insulating materials in a capacitor. Dry air has a dielectric constant of one (1). Aluminum oxide used in aluminum electrolytic capacitors has a nominal dielectric constant of ten (10).

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors.

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

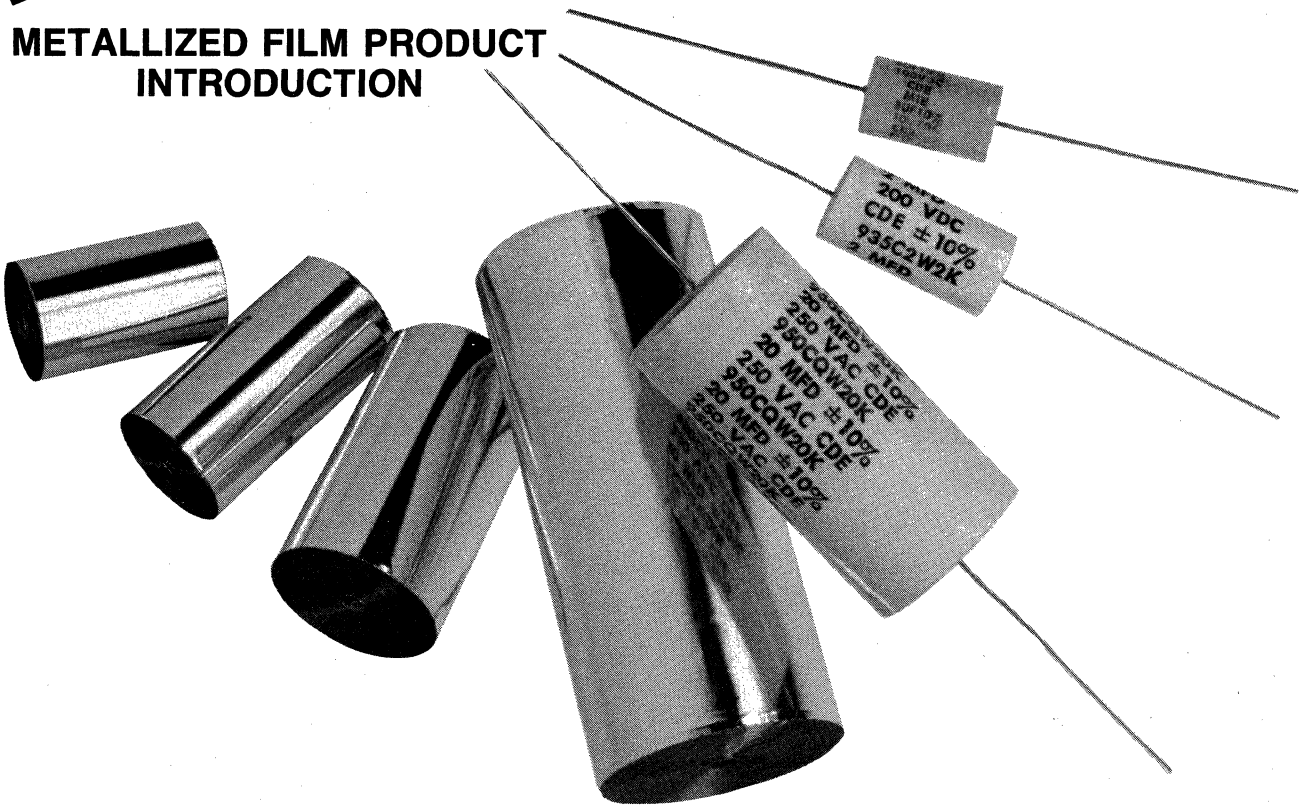
Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

Color	Digit	Multiplier	Tolerance			Temperature Coefficient ppm°C	Significant Figure	Multiplier
			Class 1					
			10pF or less	Over 10pF	Class 2			
Black	0	1	±2.0pF	±20%	±20%	0	0.0	—1
Brown	1	10	±0.1pF	±1%		—33		—10
Red	2	100		±2%		—75	1.0	—100
Orange	3	1000		±3%		—150	1.5	—1000
Yellow	4	10000			+100% —0%	—220	2.0	—10000
Green	5		±0.5pF	±5%	±5%	—330	3.3	+1
Blue	6					—470	4.7	+10
Violet	7					—750	7.5	+100
Gray	8	0.01	±0.25pF		+80% —20%	+150 to —1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to —750		+10000
Silver								
Gold								

NEW CORNELL DUBILIER

METALLIZED FILM PRODUCT INTRODUCTION



As Electronic Technology and Design requirements evolve toward even greater miniaturization, it is critical for electronic equipment manufacturers to stay abreast of "state-of-the-art" miniature component design. In the past few years, a major trend has been established toward the use of metallized film capacitors in order to significantly gain volumetric efficency. Metallized film design reduces capacitor volume by approximately 70% over film foil construction. For low voltage applications, an additional reduction of approximately 75% can be attained by using capacitors designed with dielectrics as thin as 1.5 microns. Overall volume reduction — film foil to metallized thin dielectric — can be as great as 95%.

Metallized film capacitors provide other benefits in addition to volumetric efficiency. They are self healing when exposed to voltage transients, and improved production yileds with "state-of-the-art" manufacturing equpment usually results in a reduced cost per μf.

This new generation of metallized film capacitors is available from CDE now!

MTE
Metallized polyester thin dielectric design, axial lead, 60 to 150 VDC, .047 to 50 μf, subminiature size is an excellent choice for coupling, decoupling, timing, pulse-discharge and ripple suppression applications.

MTC
Metallized polycarbonate thin dielectric design, axial lead, 50 to 150 VDC, .047 to 30 μf, subminiature size and full rating at 125°C make the MTC an excellent choice for hi-temperature and tuning applications.

935
Metallized polypropylene designed for 20-100KHz switcher power applications, 100 to 400 VDC, 1 to 30 μf, low ESR and fully rated at 105°C.

950
Metallized polypropylene, axial lead, 250 VAC, 50 to 80 μf, designed for motor run and HID lighting applications.

CDE CORNELL DUBILIER

Wayne Interchange Plaza • Wayne, New Jersey 07470 • (201) 256-2000

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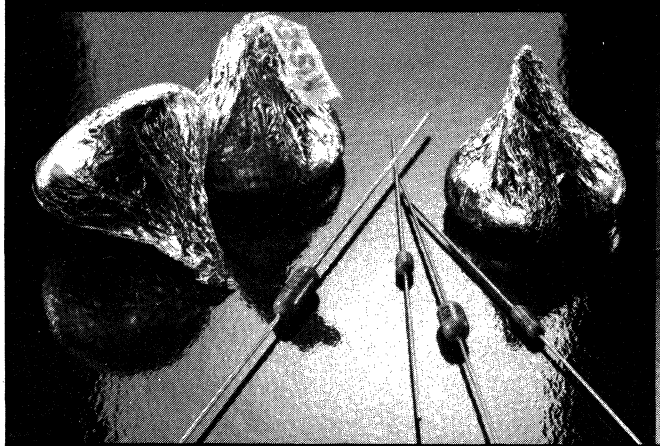
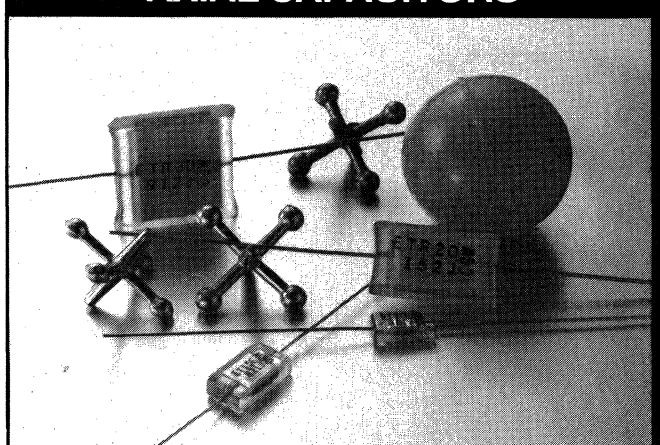
Your Quality Partner

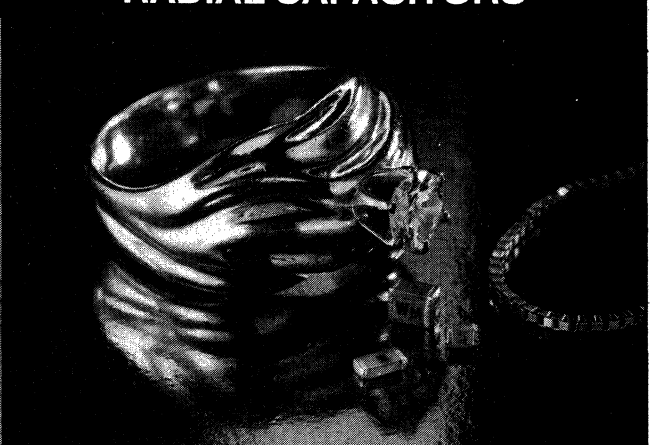


AXIAL CAPACITORS

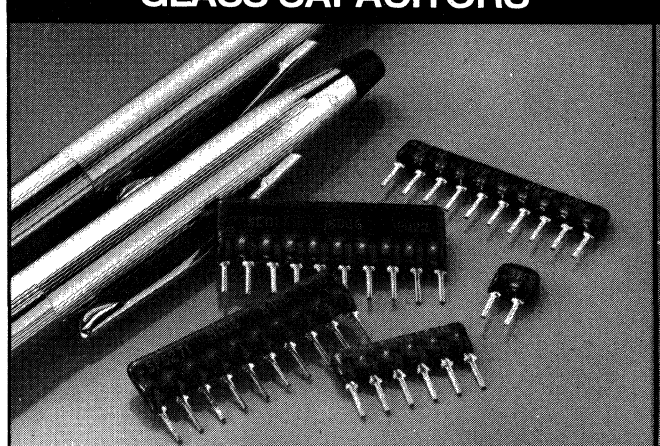
RADIAL CAPACITORS



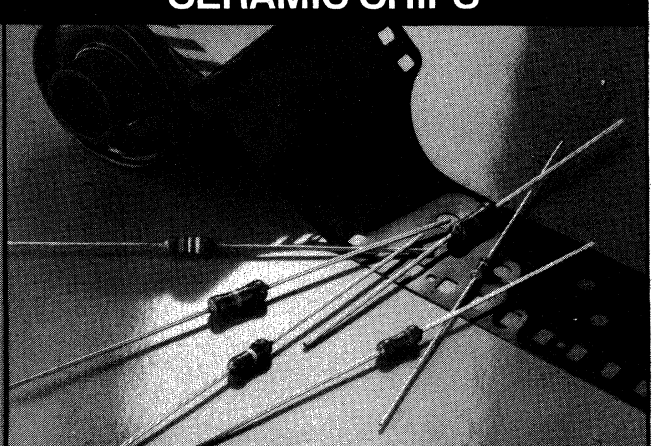
GLASS CAPACITORS



CERAMIC CHIPS



RESISTOR NETWORKS



METAL FILM RESISTORS

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Your Quality Partner

OEM Customer Service and Product Engineering

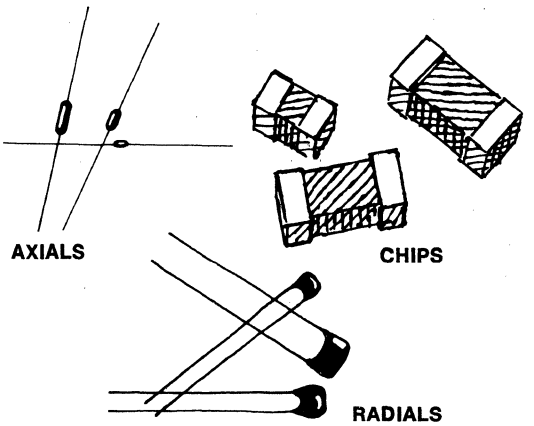
Corning Capacitors

High-Speed Ceramic Decoupling Capacitors

Corning's ceramic decoupling capacitors are ideal for use in every area of digital and analog electronics—even in R.F. circuits up to 750 mHz!
Every Corning ceramic capacitor provides:

- Excellent frequency response
- Low equivalent series resistance
- High reliability

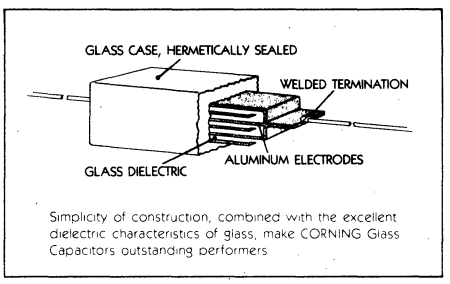
And our unique ACE technology virtually eliminates cofired delaminations.



Corning Glass Capacitors — Nuclear Radiation Hardened

Corning glass capacitors are among the most reliable capacitors available today. Glass capacitors feature:

- Zero aging
- No piezoelectric noise
- Low dielectric absorption
- Axials are nuclear radiation hardened
- QPL Mil-C-23269, Mil-C-11272
- −65°C to 200°C operating range

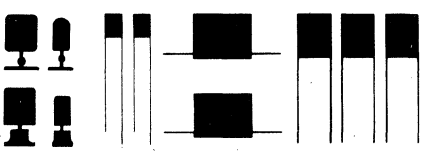


Simplicity of construction, combined with the excellent dielectric characteristics of glass, make CORNING Glass Capacitors outstanding performers

Solid Tantalum Capacitors

Corning offers a broad line of microminiature solid tantalum capacitors which are available in a variety of sizes, shapes, and styles. Corning's tantalum capacitors feature:

- Extremely high capacitance/volume (C/V) ratio
- Polar - nonpolar options
- Specials available



Glass and Ceramic Capacitors

Raleigh, NC
(919) 376-1100

Microminiature Tantalum Capacitors

Biddeford, ME
(207) 282-5111

CSI Capacitors

a division of
CSI Technologies, Inc.

SERIES	TYPE	FEATURE	1nF 10nF 100nF 1uF 10uF 100uF
FT	FILTER	TUBULAR XHV	50 - 250 kV
FM	FILTER	LONG LIFE XMITTER	0.6 - 6 kV 7.5 - 15 kV 20 - 30 kV 35 - 50 kV
CP	FILTER	MIL SPEC	0.6 - 2.5 kV 3.0 - 5.0 kV 6.0 - 12.5 kV
M	FILTER	XMITTER	0.6-40 kV
AE	PULSE	RAILS X LOW L	5 - 40 kV
MED	DEFIB	SMALLEST	2.8 - 8kV
FC	INDUCTOR	LIGHT WEIGHT	.3 mH - 200 mH
WM	PULSE	GENERAL PURPOSE FLASHLAMP	2 - 5 kV 7.5 kV 15 kV 25 kV
WPC	PULSE	RAILS LOW L HIGH E	35 - 100 kV
ES	ENERGY STORAGE	HIGH R.R. WIDE ΔT LOW ESR NON-FLAM.	3300 JOULES 3 - 50 kV 5500 JOULES 4 - 125 kV 8800 JOULES 4 - 125 kV
NB	AC	LOW D.F. BALLAST	1.3 - 4.0 kVAC
MR	AC	MOTOR RUN BALLAST	165-800 VAC
CUSTOM & SCR	ANY WOUND DIELECTRIC	150° C 5 n H 4000 KW 10 KJ	0.6 kVDC - 250 kVDC 100VAC - 180 KVAC

CSI Capacitors

810 RANCHEROS DR, SAN MARCOS, CA 92069 / WUI 697832 / RCA 295433 / (619) 747-4000

HIGH QUALITY CAPACITORS by DSA

ALUMINUM ELECTROLYTIC CAPACITORS

From 0.1mfd through 47,000mfd
6.3wv to 450wv

AXIAL & RADIAL LEAD		ULTRA MINIATURE	(SAA)
GENERAL USE	(SA/ST)	HIGH WORKING VOLTAGE	(SHT)
HIGH GRADE INDUSTRIAL	(SAL/STL)	LUG TERMINAL	(SL)
LOW LEAKAGE	(SAB)	BI-POLARIZED (Also Semi-Bi-Polarized)	

CUT & FORMED LEAD and TAPING in AMMO & REEL PACKAGING AVAILABLE

PLASTIC FILM CAPACITORS

POLYESTER FILM (CQ92)	: 0.001mfd to 0.47mfd	: 50wv to 400wv
METALIZED POLYESTER FILM		
TAPE-WRAPPED (MCT)	: 0.047mfd to 10.0mfd	: 100wv to 630wv
DIPPED (MCD)	: 0.047mfd to 2.2mfd	: 250wv, 400wv, 630wv
POLYSTYRENE FILM (SFC)	: 100pfd to 22,000pfd	: 50wv to 500wv

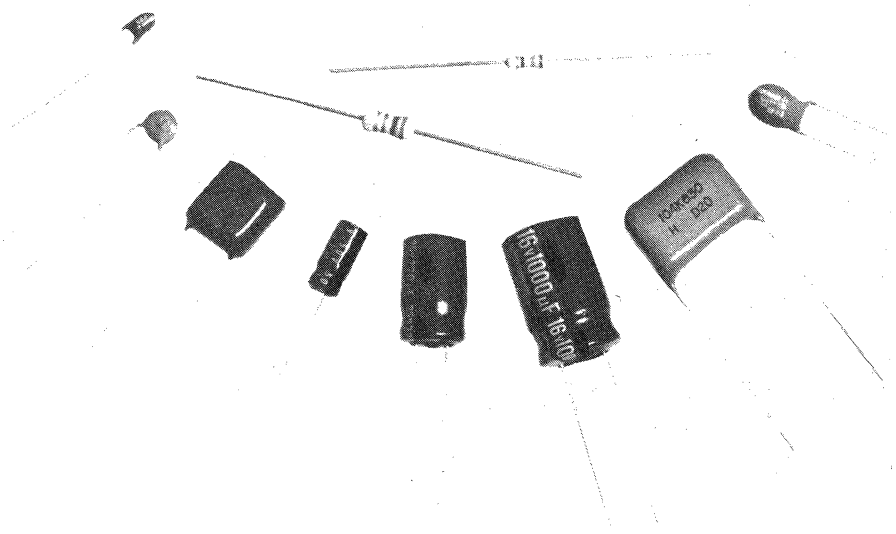
SOLID TANTALUM CAPACITORS

RESIN DIPPED : 0.047mfd to 470mfd
: 3.15wv to 50wv
Anti-solvent/nonflammable

OTHER PRODUCTS:
CERAMIC CAPACITORS
CERAMIC FILTERS
NOISE SUPRESSOR FOR AUTOMOBILE

RESISTORS

CARBON FILM FIXED RESISTORS (RD)
¼W to 1W: 2.2ohm to 10Mohm (J ±5%)
SIZE: L 6.5mm/D 2.3mm
LOW-OHMAGE METAL FILM
RESISTORS (MF) and
METAL OXIDE FILM RESISTORS (MO)
0.22ohm to 180Kohm
TAPE & REEL, AMMO PACK



FOR COMPLETE INFORMATION ON OUR WIDE RANGE OF PRODUCTS PLEASE CONTACT:

DSA-DAI-ICHI SHOJI OF AMERICA, INC.
150 Fifth Avenue, Suite 516, New York, NY 10011, (212) 691-9050.

ELECTRONIC CONCEPTS INC.

TYPE 5MP SWITCH-MODE POWER SUPPLY CAPACITORS METALLIZED POLYPROPYLENE

Type 5MP capacitors have been developed by Electronic Concepts for use in switching power supplies. These metallized polypropylene capacitors are manufactured by using special techniques in order to achieve the optimum characteristics for high current, high capacitance, low ESR applications.

For filter designs where capacitance of 50 mfd or less is suitable for the circuit, type 5MP affords the opportunity to improve general system design. These unique capacitors also exhibit none of the "roll-off" of capacitance with frequency often associated with electrolytics.

In addition to the features which make type 5MP particularly suitable for switching applications, they are also characterized by low losses. Other advantages of polypropylene are long-term stability, retrace, low dielectric absorbtion, and high insulation resistance.

INTERNAL CONSTRUCTION

Extended foil winding (non-inductive)

ENCLOSURE

Mylar tape outerwrap

ENVIRONMENTAL

These capacitors shall meet or exceed the requirements of MIL-C-55514 for all the following:

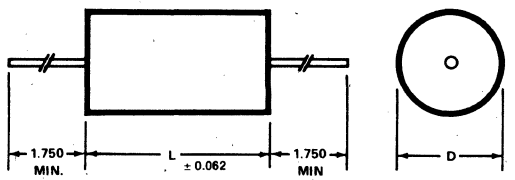
Vibration	(Para. 3.16)
Immersion	(Para. 3.21)
Shock	(Para. 3.17)
Moisture Resistance	(Para. 3.22)
Life	(Para. 3.23)

Electronic Concepts, Inc. is qualified as a supplier for the MIL versions CFR13 and CFR14 capacitors. These capacitors are manufactured to meet the requirements of MIL-C-55514/9. MIL designations are shown in the table above. The last two characters of the MIL designations (CFR13ALB106 - -) specify capacitance tolerance and failure rate respectively (CFR13ALB-106KM).

Capacitance tolerance: M = 20%, K = 10% and J = 5%.

Failure rate level: M, F, R or S

EC Type 5MP12 Military Style CFR13



All dimensions are in inches.

CATALOG NUMBERING SYSTEM

5MP 12 D 106 K

TYPE

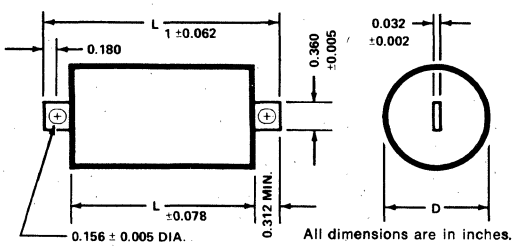
STYLE
Wrap and fill axial leads

VOLTAGE
D = 100 VDC
F = 200 VDC
J = 400 VDC

CAPACITANCE
Expressed in Picofarads, the first two digits are significant figures. The third is the number of zeroes. (e.g., 106 equals 10,000,000 pF).

TOLERANCE
M-20% K-10% J-5%
Closer tolerances upon request

EC Type 5MP16 Military Style CFR14



All dimensions are in inches.

CATALOG NUMBERING SYSTEM

5MP 16 D 106 K

TYPE

STYLE
Wrap and fill lug termination

VOLTAGE
D = 100 VDC
F = 200 VDC
J = 400 VDC

CAPACITANCE
Expressed in Picofarads, the first two digits are significant figures. The third is the number of zeroes. (e.g., 106 equals 10,000,000 pF).

TOLERANCE
M-20% K-10% J-5%
Closer tolerances upon request

OPERATING TEMPERATURE RANGE
−55°C to +105°C without derating.

CAPACITANCE TOLERANCE
Standard tolerance is ±10%. Tolerances of ±20% and ±5% are available.
NOTE: *Capacitance shall be measured at 25°C, and at or referred to a frequency of 1 KHz for all values.*

DIELECTRIC STRENGTH
Capacitors shall withstand a DC potential of twice rated voltage for one minute through a limiting resistance of 100 ohms/volt without damage or breakdown.

DISSIPATION FACTOR
When measured at the frequency specified for capacitance measurement, the dissipation factor shall not exceed 0.1%.

INSULATION RESISTANCE
When measured at the applicable test temperature, and rated voltage, after 2 minutes electrification, the insulation resistance shall equal or exceed the following values:

Megohm X Microfarads Except the insulation resistance in megohms need not exceed	+25°C 300,000	+85°C 30,000	+105°C 3,000
	500,000	50,000	5,000

CAPACITANCE CHANGE
Temperature coefficient −200 ±50 PPM/°C from 25°C to −55°C. −350 ±50 PPM/°C from 25°C to 105°C.

ELECTRONIC CONCEPTS INC.
P.O. BOX 627E EATONTOWN, NEW JERSEY 07724 • (201) 542-7880

ELECTRONIC CONCEPTS INC.

TYPE 5MP SWITCH-MODE POWER SUPPLY CAPACITORS METALLIZED POLYPROPYLENE

EC Type 5MP12 Military Style CFR13

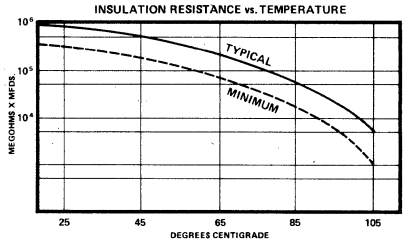
Commercial EC Part Number	Equivalent Military Designation	Capacitance Nominal in MFD	D Diameter	L Length	Lead Dia.	ESR Ohms 20-100 kHz Max	Maximum Ripple Current (AMP RMS) 20-100 kHz Case Temperature +25°C	+35°C	+45°C	+55°C	+65°C	+75°C	+85°C	Resonant Frequency in kHz	I Peak	DVDT
100 VDC																
5MP12D105-	CFR13ALB105--	1.0	.469 ±.062	.750	.032	.015	9.2	8.5	7.8	7.0	6.0	4.9	4.5	1065	407	407
5MP12D205-	CFR13ALB205--	2.0	.534 ±.062	.938	.032	.012	10.8	10.0	9.1	8.2	7.0	5.8	5.3	703	528	264
5MP12D305-	CFR13ALB305--	3.0	.624 ±.093	.938	.040	.011	12.1	11.2	10.3	9.2	8.0	6.5	5.9	574	790	263
5MP12D505-	CFR13ALB505--	5.0	.640 ±.093	1.250	.040	.010	13.8	12.7	11.6	10.4	9.0	7.4	6.7	385	828	166
5MP12D106-	CFR13ALB106--	10.0	.805 ±.093	1.500	.040	.009	15.0	15.0	14.2	12.7	11.0	9.0	8.2	248	1280	128
5MP12D206-	CFR13ALB206--	20.0	.875 ±.125	2.250	.040	.008	15.0	15.0	15.0	15.0	13.6	11.1	10.0	141	1517	76
5MP12D306-	CFR13ALB306--	30.0	1.075 ±.125	2.250	.040	.006	15.0	15.0	15.0	15.0	15.0	12.4	11.4	115	2277	76
5MP12D506-	(Not Available)	50.0	1.375 ±.125	2.250	.040	.004	15.0	15.0	15.0	15.0	15.0	13.6	12.4	89	3795	76
200 VDC																
5MP12F105-	CFR13ALC105--	1.0	.450 ±.062	1.250	.032	.020	7.3	7.3	7.3	7.3	7.2	5.9	5.4	861	250	250
5MP12F205-	CFR13ALC205--	2.0	.605 ±.093	1.250	.032	.015	12.0	12.0	11.3	10.1	8.7	7.1	6.5	609	498	249
5MP12F305-	CFR13ALC305--	3.0	.654 ±.093	1.500	.040	.013	15.0	13.8	12.6	11.3	9.8	8.0	7.3	452	576	192
5MP12F505-	CFR13ALC505--	5.0	.769 ±.093	1.750	.040	.011	15.0	15.0	14.7	13.1	11.4	9.3	8.5	323	782	156
5MP12F106-	CFR13ALC106--	10.0	.905 ±.125	2.250	.040	.009	15.0	15.0	15.0	15.0	13.8	11.3	10.3	200	1139	114
5MP12F206-	CFR13ALC206--	20.0	1.315 ±.125	2.250	.040	.006	15.0	15.0	15.0	15.0	15.0	14.1	12.8	141	2277	114
400 VDC																
5MP12J105-	CFR13ALE105--	1.0	.620 ±.093	1.500	.040	.019	9.5	9.5	9.5	9.5	9.5	7.8	7.1	784	319	319
5MP12J205-	CFR13ALE205--	2.0	.802 ±.093	1.750	.040	.015	15.0	15.0	15.0	13.4	11.6	9.5	8.7	511	521	260
5MP12J305-	CFR13ALE305--	3.0	.961 ±.125	1.750	.040	.012	15.0	15.0	15.0	15.0	13.1	10.7	9.8	417	781	260
5MP12J505-	CFR13ALE505--	5.0	1.067 ±.125	2.250	.040	.010	15.0	15.0	15.0	15.0	15.0	12.5	11.4	283	950	190
5MP12J106-	CFR13ALE106--	10.0	1.543 ±.125	2.250	.040	.006	15.0	15.0	15.0	15.0	15.0	15.0	14.1	200	1898	190

EC Type 5MP16 Military Style CFR14

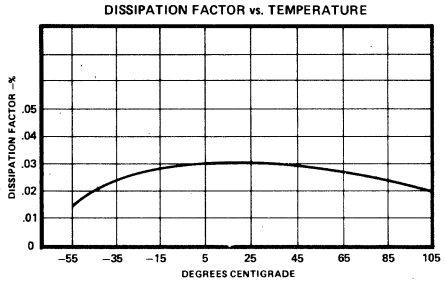
Commercial EC Part Number	Equivalent Military Designation	Capacitance Nominal in MFD	D Diameter	L Length	L_1	ESR Ohms 20-100 kHz Max	Maximum Ripple Current (AMP RMS) 20-100 kHz Case Temperature +25°C	+35°C	+45°C	+55°C	+65°C	+75°C	+85°C	Resonant Frequency in kHz	I Peak	DVDT
100 VDC																
5MP16D105-	CFR14LLB105--	1.0	.469 ±.062	.922	1.640	.015	10.3	9.5	8.7	7.8	6.7	5.5	5.0	949	407	407
5MP16D205-	CFR14LLB205--	2.0	.534 ±.062	1.110	1.828	.012	12.0	11.0	10.0	8.9	7.8	6.3	5.8	617	528	264
5MP16D305-	CFR14LLB305--	3.0	.624 ±.093	1.110	1.828	.011	13.3	12.3	11.2	10.0	8.7	7.1	6.5	504	790	263
5MP16D505-	CFR14LLB505--	5.0	.640 ±.093	1.422	2.140	.010	14.8	13.7	12.5	11.2	9.7	7.9	7.2	347	828	166
5MP16D106-	CFR14LLB106--	10.0	.805 ±.093	1.672	2.390	.009	17.8	16.5	15.0	13.5	11.7	9.5	8.7	227	1280	128
5MP16D206-	CFR14LLB206--	20.0	.875 ±.125	2.422	3.140	.008	21.6	20.0	18.3	16.4	14.2	11.6	10.6	133	1517	76
5MP16D306-	CFR14LLB306--	30.0	1.075 ±.125	2.422	3.140	.006	24.3	22.5	20.5	18.4	15.9	13.0	11.9	108	2277	76
5MP16D506-	(Not Available)	50.0	1.375 ±.125	2.422	3.140	.004	29.6	27.3	25.5	23.6	20.6	20.0	19.7	84	3795	76
200 VDC																
5MP16F105-	CFR14LLC105--	1.0	.450 ±.062	1.422	2.140	.020	7.3	7.3	7.3	7.3	7.3	6.4	5.8	776	250	250
5MP16F205-	CFR14LLC205--	2.0	.605 ±.093	1.422	2.140	.015	14.3	13.3	12.1	10.8	9.4	7.7	7.0	548	498	249
5MP16F305-	CFR14LLC305--	3.0	.654 ±.093	1.672	2.390	.013	15.9	14.7	13.5	12.0	10.4	8.5	7.8	414	576	192
5MP16F505-	CFR14LLC505--	5.0	.769 ±.093	1.922	2.640	.011	18.3	17.0	15.5	13.9	12.0	9.8	8.9	299	782	156
5MP16F106-	CRF14LLC106--	10.0	.905 ±.125	2.422	3.140	.009	22.4	20.7	18.9	16.9	14.6	12.0	10.9	188	1139	114
5MP16F206-	CFR14LLC206--	20.0	1.315 ±.125	2.422	3.140	.006	27.4	25.4	23.2	20.7	17.9	14.7	13.4	133	2277	114
400 VDC																
5MP16J105-	CFR14LLE105--	1.0	.620 ±.093	1.672	2.390	.019	9.5	9.5	9.5	9.5	9.5	8.3	7.5	716	319	319
5MP16J205-	CFR14LLE205--	2.0	.802 ±.093	1.922	2.640	.015	15.0	15.0	15.0	14.2	12.3	10.0	9.1	472	521	260
5MP16J305-	CFR14LLE305--	3.0	.961 ±.125	1.922	2.640	.012	21.1	19.5	17.8	15.9	13.8	11.3	10.3	386	781	260
5MP16J505-	CFR14LLE505--	5.0	1.067 ±.125	2.422	3.140	.010	24.4	22.6	20.6	18.5	16.0	13.1	11.9	265	950	190
5MP16J106-	CFR14LLE106--	10.0	1.543 ±.125	2.422	3.140	.006	30.0	27.8	25.4	22.7	19.7	16.1	14.7	188	1898	190

ELECTRICAL CHARACTERISTICS vs. TEMPERATURE

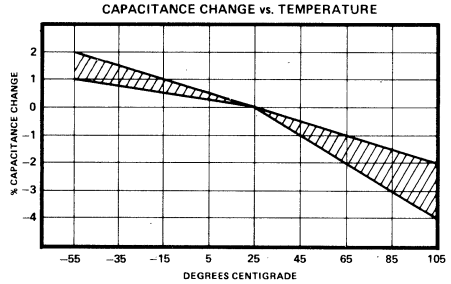
INSULATION RESISTANCE vs. TEMPERATURE



DISSIPATION FACTOR vs. TEMPERATURE



CAPACITANCE CHANGE vs. TEMPERATURE



ELECTRONIC CONCEPTS INC.

P.O. BOX 627E EATONTOWN, NEW JERSEY 07724 • (201) 542-7880

ELECTRONIC CONCEPTS INC.

TYPE 5MC SWITCH-MODE POWER SUPPLY CAPACITORS METALLIZED POLYCARBONATE

A new innovation pioneered by Electronic Concepts, Inc. leads the way to a new era of miniature metallized polycarbonate film capacitors physically designed to minimize circuit board real estate in switch mode power converters while maintaining a low ESR, excellent ripple capability and high resonant frequency. Electronic Concepts offers, in addition to conventional axial leaded termination, a flat tinned copper tab termination for increased current carrying capability and higher resonant frequency.

To aid the best layout potential, the copper tab terminated version is offered in both high and low profiles for each capacitance/voltage rating.

Excellent electrical characteristics and super miniaturization are offered to switch mode power supply designers with his requirements in mind.

CAPACITANCE In MFD	AXIAL LEADS 5MC22			LOW PROFILE 5MC26			HIGH PROFILE 5MC27			TYPE 5MC29			ESR Milliohms 100 KHz	Ripple Current Max @ 25°	Resonant Frequency KHz 5MC22, 5MC26, 5MC27	Resonant Frequency KHz 5MC29
	T	H	L	T	H	L	T	H	L	T	W	H				
50 VDC																
1.0	.250	.343	.687										18	7.8	890	
3.0	.406	.593	.687										15	9.8	550	
5.0	.406	.593	.812										13	10.6	375	
10.0	.562	.812	.812	.812	.562	.750	.562	.812	.750	.562	.862	.750	11	12.6	265	318
20.0	.718	.968	.937	.968	.718	.875	.718	.968	.875	.718	.968	.875	10	14.8	178	214
50.0	1.000	1.375	1.062	1.375	1.000	1.000	1.000	1.375	1.000	1.000	1.375	1.000	6	23.5	108	130
75 VDC																
1.0	.281	.375	.812										19	7.9	840	
3.0	.468	.718	.812							.468	.718	.750	15	10.3	560	672
5.0	.500	.750	.937				.500	.750	.875	.500	.750	.875	13	11.6	356	427
10.0	.718	1.031	.937	1.031	.718	.875	.718	1.031	.875	.718	1.031	.875	12	13.5	251	301
20.0	.937	1.312	1.062	1.312	.937	1.000	.937	1.312	1.000	.937	1.312	1.000	11	16.5	171	205
50.0	1.312	1.687	1.312	1.687	1.312	1.250	1.312	1.687	1.250	1.312	1.687	1.250	6	24.2	100	120
100 VDC																
1.0	.281	.375	.937										20	8.0	780	
3.0	.437	.750	.937							.437	.750	.875	15	10.6	570	684
5.0	.593	.906	.937	.906	.593	.875	.593	.906	.875	.593	.906	.875	13	12.4	356	427
10.0	.781	1.093	1.062	1.093	.781	1.000	.781	1.093	1.000	.781	1.093	1.000	12	14.6	242	290
20.0	.906	1.281	1.312	1.281	.906	1.250	.906	1.281	1.250	.906	1.281	1.250	11	17.1	160	192
50.0	1.437	1.812	1.437	1.812	1.437	1.375	1.437	1.812	1.375	1.437	1.812	1.375	6	23.6	96	115

SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C.

Dissipation Factor: When measured at the frequency specified for capacitance measurements, the dissipation factor shall not exceed 0.3%.

Insulation Resistance: When measured at the applicable test temperature, and rated voltage, the insulation resistance shall equal or exceed the following values:

	25°C	85°C	125°C
Megohm x Microfarads	100,000	7,000	700
Except the insulation resistance in megohms need not exceed	200,000	70,000	7,000

Capacitance Change: The Capacitance change vs. temperature for these capacitors shall not exceed the following:

Temperature Degrees C.	−55	+25	+85	+125
Percent Change	−2.5	0	±1.0	±2.0

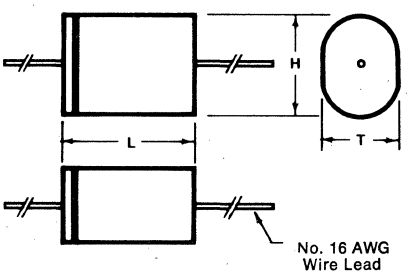
The measurement at each temperature shall be recorded when two successive readings taken at 5-minute intervals indicate no change in capacitance.

Capacitance Tolerance: Standard Tolerance is ±10%. Tolerances of ±20%, ±5%, ±2% and ±1% are available.

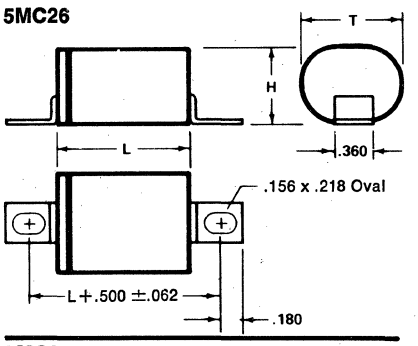
Note: Capacitance shall be measured at 25°C, and at or referred to a frequency of 1 KHz.

DIMENSIONAL DATA

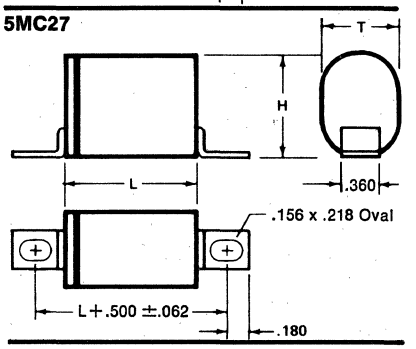
5MC22



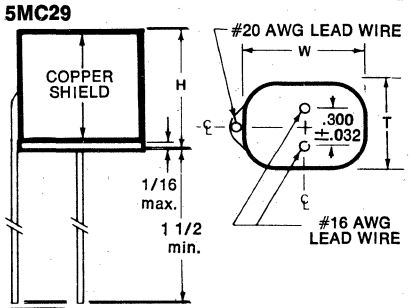
5MC26



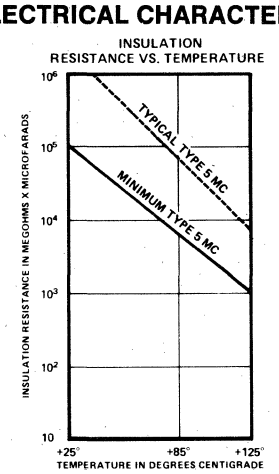
5MC27

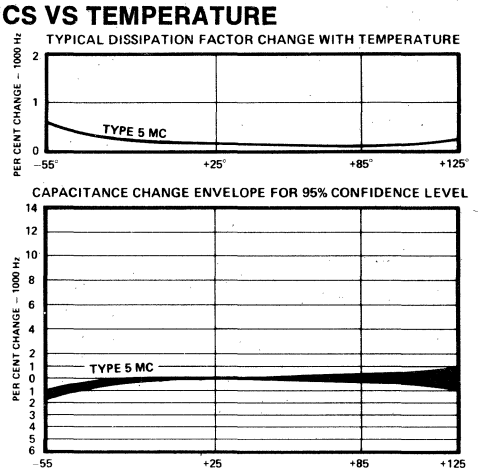


5MC29



ELECTRICAL CHARACTERISTICS VS TEMPERATURE



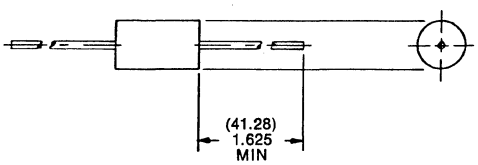


ELECTRONIC CONCEPTS INC. ESTABLISHED RELIABILITY CAPACITORS

FIXED, PLASTIC DIELECTRIC, DC, IN NON-METAL CASES PER MIL-C-55514

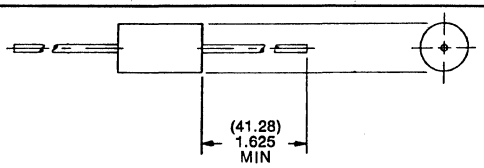
CFR02

ALL DIMENSIONS ARE IN INCHES.



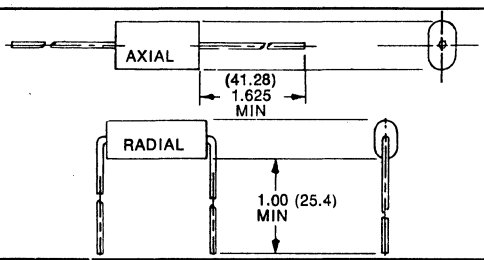
Dielectric: plastic film.
Characteristic "M": polyester film and foil
Characteristic "Q": polycarbonate film and foil
Construction: round configuration, axial leaded.
Capacitance values in MFD:
Characteristic "M": .0068 thru 1.0 100V; .0010 thru 1.0 200V; .0018 thru 1.0 400V; .0010 thru 0.1 600V
Characteristic "Q": .0010 thru 1.0 100V; .0010 thru 1.0 200V
Capacitance tolerance:
"M" ±2%, ±5%, ±10%
"Q" ±1%, ±2%, ±5%, ±10%

CFR05



Dielectric: metallized polycarbonate plastic film. Characteristic "R".
Construction: round configuration, axial leaded.
Capacitance values in MFD:
.0010 thru 50.0 50V .010 thru 10.0 200V
.0010 thru 20.0 100V .010 thru 5.0 400V
Capacitance tolerance: ±1%, ±2%, ±5%, ±10%

CFR06

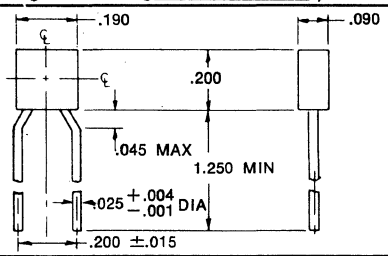


Dielectric: metallized plastic film
Characteristic "R": metallized polycarbonate
"N": metallized polyester
Construction: oval configuration, axial or radial leaded
Capacitance values in MFD:

Characteristic "R"	Characteristic "N"
.0010 thru 50.0 50V	.010 thru 10.0 200V
.0010 thru 20.0 100V	.010 thru 3.3 400V

Capacitance tolerance:
"R" ±1%, ±2%, ±5%, ±10%
"N" ±2%, ±5%, ±10%

CFR12

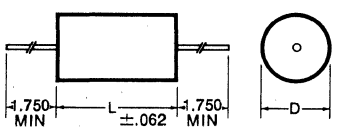


Worlds smallest film capacitor (CKO5 size) now available as CFR12.
Dielectric: metallized polycarbonate plastic film.
Construction: molded rectangular case, radial leaded. See previous page **AVIONICAPS®**.
Capacitance values in MFD:

.0010 thru .10 30V	.0012 thru .0082 150V
.0010 thru .056 50V	.0012 thru .0056 200V
.0010 thru .027 75V	.0012 thru .0033 250V
.0010 thru .018 100V	

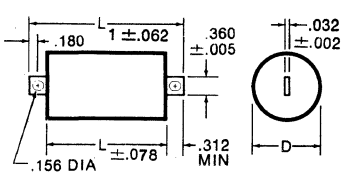
Capacitance tolerance: ±1%, ±2%, ±5%, ±10%

CFR13



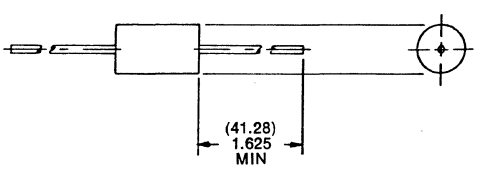
Switch-Mode Power Supply Capacitors.
Dielectric: metallized polypropylene film.
Construction: round configuration, axial leaded.
Capacitance values in MFD:
1.0 thru 30.0 100V
1.0 thru 20.0 200V
1.0 thru 10.0 400V
Capacitance tolerance: ±5%, ±10%, ±20%

CFR14



Switch-Mode Power Supply Capacitors.
Dielectric: metallized polypropylene film.
Construction: round configuration, lug terminal.
Capacitance values in MFD:
1.0 thru 30.0 100V
1.0 thru 20.0 200V
1.0 thru 10.0 400V
Capacitance tolerance: ±5%, ±10%, ±20%

CFR15

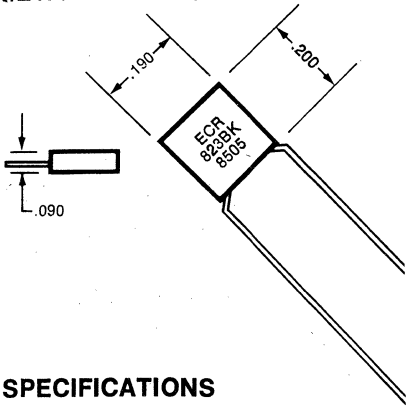


Dielectric: polypropylene plastic film.
Construction: round configuration, film foil, axial leaded.
Capacitance values in MFD:
.012 thru 1.0 200V
.0068 thru 1.0 400V
.001 thru 1.0 600V
.0056 thru 0.56 800V
Capacitance tolerance: ±5%, ±10%, ±20%

ELECTRONIC CONCEPTS INC. P.O. BOX 627E, EATONTOWN, NEW JERSEY 07724 • (201) 542-7880

ELECTRONIC CONCEPTS INC. AVIONICAPS®

METALLIZED POLYCARBONATE



TYPE ECR

- **NO PIEZOELECTRIC EFFECT**
- **NOT FREQUENCY SENSITIVE**
- **NOT VOLTAGE SENSITIVE**

A new innovation pioneered by Electronic Concepts leads the way to a new era of smaller metallized film capacitors. Now a combination of excellent electrical characteristics and compactness is offered the equipment designer in a size equal to a ceramic CK05 capacitor.

Besides the superior electrical characteristics Type ECR are self-healing, as is the case with all metallized capacitors.

Additionally, these capacitors do not exhibit any of the drawbacks inherent in all ceramic capacitors.

SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C.

Dissipation Factor: When measured at the frequency specified for capacitance measurements, the dissipation factor shall not exceed 0.3%.

Insulation Resistance: When measured at the applicable test temperature, and rated voltage, the insulation resistance shall equal or exceed the following values:

	25°C	85°C	125°C
Megohm x Microfarads	100,000	7,000	700
Except the insulation resistance in megohms need not exceed	200,000	70,000	7,000

Capacitance Change: The Capacitance change vs. temperature for these capacitors shall not exceed the following:

Temperature Degrees C.	−55	+25	+85	+125
Percent Change	−2.5	0	±1.0	±2.0

The measurement at each temperature shall be recorded when two successive readings taken at 5-minute intervals indicate no change in capacitance.

Capacitance Tolerance: Standard Tolerance is ±10%. Tolerances of ±20%, ±5%, ±2% and ±1% are available.

Note: Capacitance shall be measured at 25°C, and at or referred to a frequency of 1KHz.

VALUE IN MFD	VDC	PHYSICAL SIZE T	H	L	LEAD SPACING LS	SEE FIGURE
.0010	250	.090	.190	.190	.200	1
.0012	250	.090	.190	.190	.200	1
.0015	250	.090	.190	.190	.200	1
.0018	250	.090	.190	.190	.200	1
.0022	250	.090	.190	.190	.200	1
.0027	250	.090	.190	.190	.200	1
.0033	250	.090	.190	.190	.200	1
.0039	200	.090	.190	.190	.200	1
.0047	200	.090	.190	.190	.200	1
.0056	200	.090	.190	.190	.200	1
.0068	150	.090	.190	.190	.200	1
.0082	150	.090	.190	.190	.200	1
.010	100	.090	.190	.190	.200	1
.012	100	.090	.190	.190	.200	1
.015	100	.090	.190	.190	.200	1
.018	100	.090	.190	.190	.200	1
.022	75	.090	.190	.190	.200	1
.027	75	.090	.190	.190	.200	1
.033	50	.090	.190	.190	.200	1
.039	50	.090	.190	.190	.200	1
.047	50	.090	.190	.190	.200	1
.056	50	.090	.190	.190	.200	1
.068	50	.090	.190	.190	.200	1
.082	50	.090	.190	.190	.200	1
.10	50	.095	.245	.295	.200	2
.12	50	.095	.295	.295	.200	2
.15	50	.095	.295	.295	.200	2
.18	50	.095	.295	.295	.200	2
.22	50	.095	.395	.395	.300	2
.27	50	.095	.395	.395	.300	2
.33	50	.095	.395	.395	.300	2
.39	50	.095	.395	.395	.300	2
.47	50	.145	.395	.395	.300	2
.56	50	.145	.395	.395	.300	2
.68	50	.195	.395	.395	.300	2
.82	50	.195	.395	.395	.300	2
1.0	50	.195	.395	.395	.300	2

DIMENSIONAL DATA

Figure 1

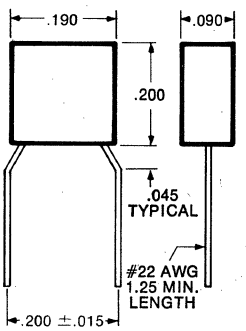
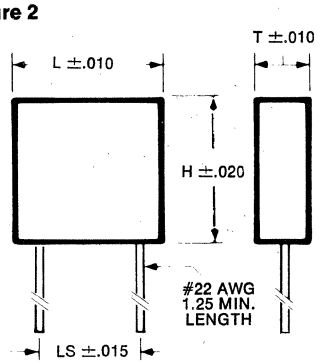
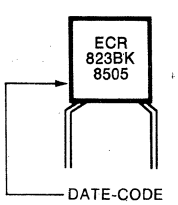


Figure 2

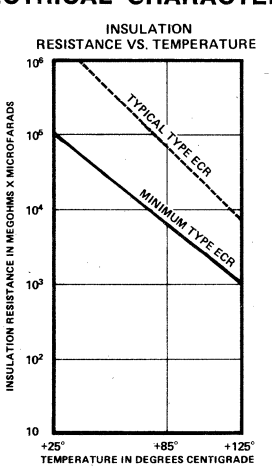


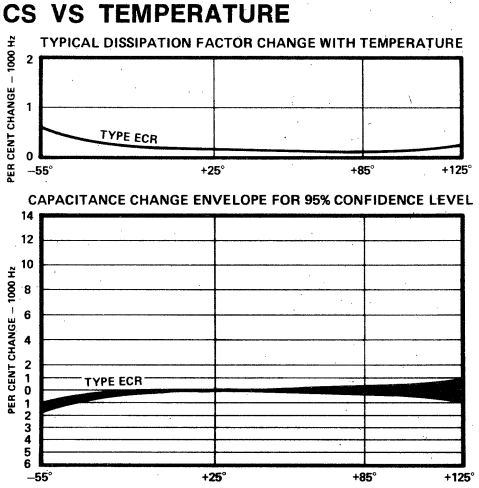
Part Marking



The first two digits represent the year, the second two digits represent the week. ie. 8452 is the 52nd week of 1984, 8512 is the 12th week of 1985.

ELECTRICAL CHARACTERISTICS VS TEMPERATURE

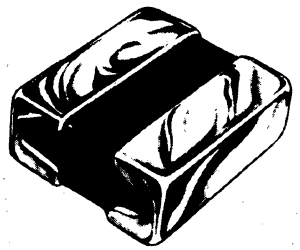




ELECTRONIC CONCEPTS INC.

SURFACE MOUNT FILM CAPACITORS

METALLIZED POLYCARBONATE

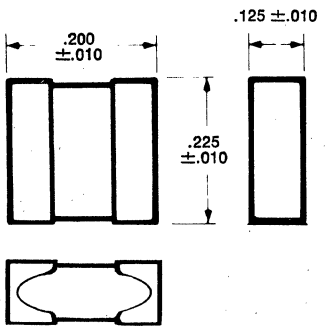


TYPE SECR

Now realize all the benefits of automated solder reflow assembly and greater pc board density — with our new AVIONICAP® TYPE SECR METALLIZED POLYCARBONATE FILM CAPACITOR.
It's the first of its kind in a surface mount configuration — ideal for robotic and other pick and place equipment.
With the smallest package size available —measuring only .125"(T) x .200" x .225". That's as much as ⅓ size reduction. And there's no loss in electrical characteristics!
Surface mounting, a smaller package, excellent electrical/physical characteristics. Our new AVIONICAP® "surface mount" film capacitor...helping to light the way into the future.

VALUE IN MFD	VDC	PART NO.
.0010	250	SECR 102G-
.0012	250	SECR 122G-
.0015	250	SECR 152G-
.0018	250	SECR 182G-
.0022	250	SECR 222G-
.0027	250	SECR 272G-
.0033	250	SECR 332G-
.0039	200	SECR 392F-
.0047	200	SECR 472F-
.0056	200	SECR 562F-
.0068	150	SECR 682E-
.0082	150	SECR 822E-
.010	100	SECR 103D-
.012	100	SECR 123D-
.015	100	SECR 153D-
.018	100	SECR 183D-
.022	75	SECR 223C-
.027	75	SECR 273C-
.033	50	SECR 333B-
.039	50	SECR 393B-
.047	50	SECR 473B-
.056	50	SECR 563B-
.068	30	SECR 683A-
.082	30	SECR 823A-
.10	30	SECR 104A-

DIMENSIONAL DATA



CATALOG NUMBERING SYSTEM

When ordering, please use Electronic Concepts Catalog number.

SECR 104 A K

TOLERANCE
F = ±1%, G = ±2%
J = ±5%, K = ±10%, M = ±20%

VOLTAGE
A = 30 VDC, B = 50 VDC,
C = 75 VDC, D = 100 VDC,
E = 150 VDC, F = 200 VDC,
G = 250 VDC

CAPACITANCE
The first two digits are significant figures, the third digit represents the number of zeros to follow to express the capacitance in picofarads.

TYPE

FOR ADDITIONAL INFORMATION, PLEASE CONTACT ONE OF OUR REGIONAL OFFICES.

U.S. REGIONAL SALES OFFICES:

EASTERN
Eatontown, NJ/201-542-7880
SOUTHEASTERN
Sunrise, FL/305-748-4604
CENTRAL
Wheaton, IL/312-668-8747
WESTERN
Colton, CA/714-824-2525
Los Gatos, CA/408-395-4224

HEADQUARTERS:

P.O. Box 627
Eatontown, NJ 07724
201-542-7880

NATIONAL DISTRIBUTION CENTER:

ELCON Sales
510A Industrial Ave.
Teterboro, NJ 07608
201-288-8170

ELPAC COMPONENTS 25 YEARS OF EXCELLENCE

FILM CAPACITORS MADE EASY

Elpac's film capacitors offer high quality at competitive prices. They are typically available from 0.0001 to 25 microfarads at voltages from 50 to 1,000 VDC with temperatures up to 125°C (teflon is good up to 200°C). Film capacitors are non-polarized and are noted for their low leakage and capacitance stability over variations in voltage, frequency, and temperature. They also provide excellent volumetric efficiency at higher voltage ratings (over 100 volts), and are applicable to high energy filter applications because of their extremely low DF and exceptionally low ESR (the lowest of all capacitor dielectrics). Film capacitors are typically utilized in test and measurement instruments, telecommunication equipment, industrial control systems, and computers or computer peripherals.

... Available in five standard dielectrics.

POLYESTER

This dielectric is the most popular of all film capacitors due to its very low cost. It is available in both metallized and film-and-foil configuration and in values ranging from .001 to 25 microfarads. Polyester capacitors offer capacitance stability over temperature (−55 to +125°C) and a low dissipation factor (DF). In the metallized configuration, they provide the best volumetric efficiency (smallest size) of all film capacitors. Additionally, they are highly reliable due to the self-healing quantities of the metallized dielectric. They are typically used in RF (radio frequency) filtering applications and offer advantages in low frequency (less than 400 Hz) AC circuits where high energy currents are present.

POLYCARBONATE

This dielectric is also popular, especially for applications where it is desirable to maintain a minimum capacitance change over temperature or where lower DF, lower D.A. or high I.R. is important. Polycarbonate capacitors are slightly more expensive than polyester and are available as metallized units in values ranging from 0.001 to 25 microfarads. Their volumetric efficiency approaches that of polyester. They are typically used in timing or frequency determination circuits where precise capacitance tolerance up to a full temperature rating of 125°C is important.

POLYPROPYLENE

This dielectric is available in a metallized or film-and-foil configuration, in values from 0.0001 to 10 microfarads. Polypropylene capacitors exhibit a near linear negative temperature coefficient, excellent insulation resistance and lower DF and dielectric absorption than polycarbonate, but are limited to a maximum temperature of +105°C. They are typically used for high impedance coupling, A-D converters, sample and hold applications and in tuning and timing circuits. They are also utilized in high frequency AC filter applications where their very low DF (and low ESR) yields excellent filtering with minimal self-heating. They are particularly suited for high current, high frequency switching applications such as switching regulator power supplies.

POLYSTYRENE

This dielectric is available from Elpac in film-and-foil configurations only, in values ranging from 0.0001 to 2 microfarads. These capacitors exhibit superior capacitance stability and DF over temperature, but only up to 85°C and in capacitance values less than 2 microfarads. They have broad application to most circuit requirements and in large quantities (greater than 25,000 units) are very inexpensive due to Elpac's off-shore manufacturing facility.

TEFLON

This dielectric is available from Elpac as either metallized or film-and-foil and in values of 0.001 to 1 microfarad. Teflon capacitors are particularly noted for their performance at high temperatures (up to 200°C) and exhibit the best capacitance stability and DF of all film capacitors, over a full temperature range of −55 to +200°C. They are the most expensive of all film capacitor types. They exhibit moderate volumetric efficiency and have typical applications in "down-hole" (petroleum exploration) equipments, military equipments or other high temperature situations.

AC APPLICATIONS

Both polyester and polypropylene film dielectrics are particularly suited to AC circuit applications. At lower frequencies (less than 400 Hz), metallized polyester provides an excellent filter at a small size, especially where high energy currents are present. At current levels greater than approximately 20 amps, a polyester film-and-foil configuration is preferred to improve the current carrying capacity of the conductor and to provide a better cooling path (the foil) for the heat generated by the AC current. For AC applications at frequencies higher than 400 cycles, a metallized polypropylene dielectric will usually be more appropriate since its very low DF (and low ESR) provides excellent filtering with minimal self-heating.

HIGH RELIABILITY

All of the listed film dielectrics can be provided in high reliability configurations for the most demanding applications, including MIL-STD requirements. Some of these applications are best met by a rectangular or tubular hermetic seal configuration with certification of all required Group A and B testing. Additionally, Elpac produces precision capacitors to ±1% or less tolerances, or in matched sets.

CUSTOM APPLICATIONS

Elpac offers a highly trained engineering staff and fully equipped test laboratory to provide customer applications assistance as near as your telephone. During the past 25 years, our capacitor specialists have provided such assistance to thousands of customers to solve their capacitor needs in the most efficient and cost effective manner.

HIGH VOLUME, LOW-COST MANUFACTURING

Elpac compliments its Santa Ana, California manufacturing facility with an off-shore manufacturing site to offer all of the above dielectrics (except teflon) in very high quantities at a low unit cost. Best of all, these products are supported by our Santa Ana, California engineering staff and test laboratory to provide local support throughout the United States for all capacitor and filter product lines.

ELPAC COMPONENTS
A DIVISION OF ELPAC ELECTRONICS, INC.
3131 S. STANDARD AVENUE, SANTA ANA, CA 92705 / TWX 910-595-1513
(714) 979-4440

ELPAC COMPONENTS 25 YEARS OF EXCELLENCE

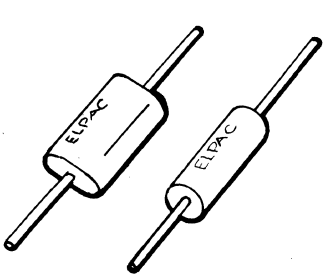
FILM CAPACITORS PRODUCT GUIDE

Application:	Z Metallized Polyester	MD Polyester & Foil	C Metallized Polycarbonate	PD Polystyrene Film & Foil	P Metallized Polypropylene	PSB Metallized Polypropylene	MPS Metallized Polypropylene	PPN/PPF Polypropylene and Foil	MES Metallized Polyester	MEF/MFF Metallized Polyester	MEM Metallized Polyester	MEC Metallized Polyester
Coupling	Yes	Yes	Yes	Yes	Yes	AC Rated Low ESR	AC Rated Low ESR	Yes	AC Rated Low ESR	Yes	Yes	Yes
By-Pass	Yes	Yes	Yes	Yes	Yes			Yes		Yes	Yes	Yes
Filtering	Yes	Yes	Yes	Yes	Yes	Switching Regulators	Switching Regulators	Yes	Switching Regulators	Yes	Yes	Yes
Timing	Occasional	Occasional	Yes	Yes	Yes			Yes		Occasional	Occasional	Occasional
Pulse Discharge	Yes	Yes	Yes	No	Seldom			Seldom		No	No	No
Arc Suppression	Yes	Yes	Yes	No	Yes	Critical	Critical	Yes	Critical	Yes	No	No
Ripple Suppression	Occasional	Yes	Occasional	Seldom	Seldom	Filtering	Filtering	Seldom	Filtering	Yes	No	Yes
Timing	No	Occasional	Yes	Yes	Yes	High Frequency	High Frequency	Yes	High Frequency	No	No	No
Configuration & Capacitance Range:												
Oval, W&F	.001/25.0	.001/5.0	.001/12.0	.001/1.5	.001/4.0	—	—	—	1.0/4.7	—	—	—
Tubular, W&F	.001/25.0	.001/5.0	.001/12.0	.001/1.5	.001/4.0	.47/10.0	1.0/20.0	—	—	—	—	—
Hermetic, Rect.	.001/8.0	.001/2.0	.001/8.0	.001/1.0	.001/.47	—	—	—	—	—	—	—
Hermetic, Tubular	.001/25.0	.001/5.0	.001/12.0	.001/2.0	.001/3.0	—	—	—	—	—	—	—
Radial Epoxy Case	.001/15.0	.001/3.0	.001/12.0	.001/1.5	.001/2.0	—	—	—	—	—	.0047/.47	.01/6.8
Axial Epoxy Case	.001/10.0	.001/2.0	.001/12.0	.001/1.0	.001/1.0	—	—	—	—	—	—	—
Dipped Epoxy	—	—	—	—	—	—	—	.001/.47	—	.01/10.0	—	—
Voltage Range (VDC Nominal)	50 to 600	50 to 600	50 to 600	50 to 400	50 to 600	50 to 400	100 to 400	250 to 630	250 to 400	100 to 630	63 to 100	100 to 630
Temperature Range (°C)	−55/+125	−55/+125	−55/+125	−55/+85	−55/+105	−55/+105	−40/+85	−40/+85	−40/+85	−40/+85	−40/+100	−40/+105
Derate Voltage From	50% +85	50% +85	Not Req'd	Not Req'd	Not Req'd	Not Req'd	Not Req'd	Not Req'd	Not Req'd	Not Req'd	Not Req'd	25% +85
Temperature Coefficient over Temp. Range (ppm/°C)	+960	+960	+120	−90	−300	−300	−300	−300	+960	+960	+960	+960
Disipation Factor (%) @ 1 KHz*	1.0	0.5	0.3	0.1	.01	0.1	0.1	0.1	1.0	1.0	1.0	1.0
Insulation Res.**												
Megohms x Mfds	10,000	50,000	25,000	100,000	50,000	50,000	100,000	3,000	30,000	10,000	3,300	10,000
Need not Exceed	40,000	100,000	50,000	200,000	100,000	100,000	500,000	30,000	30,000	30,000	10,000	30,000
Dielectric Strength* (% of rated voltage)**												
Term. to Term.	150	200	150	200	150	150	200	200	200	160	160	160
Terminal to Case	200	200	200	200	200	200	200	200	200	160	160	160

* Except values over 1.0 MFD measured at 60 Hz.
** Measured at rated voltage or 100 VDC, whichever is less, after 2 minutes electrification.
*** Measured at DC potential for 60 seconds through limiting resistance of 100 ohms/volt.

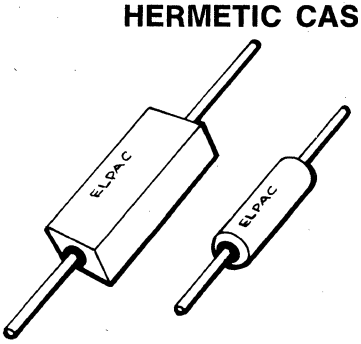
STANDARD CONFIGURATIONS

WRAP & FILL (W&F)



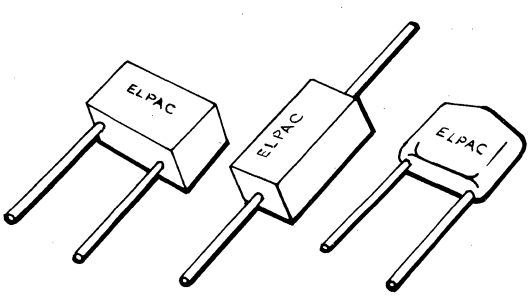
OVAL TUBULAR

HERMETIC CASE



RECTANGULAR TUBULAR

EPOXY CASE



RADIAL AXIAL DIPPED

ELPAC COMPONENTS
A DIVISION OF ELPAC ELECTRONICS, INC.
3131 S. STANDARD AVENUE, SANTA ANA, CA 92705 / TWX 910-595-1513
(714) 979-4440

IEI-ISKRA

• Ceramic Caps, Discs, Feed Thru • Ferrites • Meters • Motors, fractional H.P. • Semiconductors • Switches • Speakers • Trimmer Pots

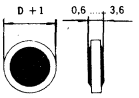
CERAMIC CAPACITORS

DISC — WAFER — TRAPEZOIDAL — TUBULAR — FEED-THROUGH

△ **Exceptionally High Quality Control on Ceramic Materials**
△ **Complete (100%) Testing**
△ **Longer Shelf Life**

DISC CAPACITORS HIGH VOLTAGE TYPES / KV1
From 1 kV to 8 kV — EIA Types (Y5P/25P) (Y5U/25U)

BUTTON DISC CAPACITORS 500V / K2P
EIA Types (Y5P/Z5P) (Y5U/Z5U)



WAFER CAPACITORS 50V / P1
Range 4700 to 4700 pF

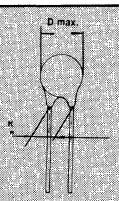
TUBULAR CAPACITORS, HIGH VOLTAGE PULSE TYPE / CIM
1.5 kV to 4 kV

TUBULAR CAPACITORS 500V / C1
0,1 pF to 30,000 pF

SAFETY TYPE DISC CAPACITORS / KZ
For AC Applications

REDUCED TITANATE DISC/KR1
.001 mFd to .18 mFd 50 V for bypass application

SUBMINIATURE DISC CAPACITORS 500V / K1



Tolerances Available: ±1% to −20 and +80%

△ Engineering Note: Type No.'s (I.E. D10) also specifies nominal diameter of the part.

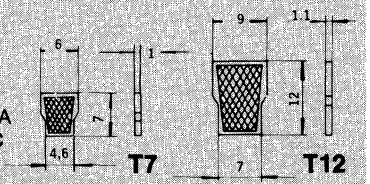
	C (pF)				
D (mm)	**5,5**	**7**	**10**	**14**	**18**
P 100	0,5 3	>3 4,7	>4,7 9,1	>9,1 18	
NP 0	1,0 7,5	>55 15	>15 27	>27 51	
N 150	1,0 8,2	>75 16	>16 33	>33 62	
N 750	2,2 22	>22 33	>33 62	>62 120	>120 160
N 1500	4,7 24	>24 56	>56 100	>100 220	>220 300
M 2000	47 330	>330 510	>510 1200	>1200 2200	
M 3000	150 360	>360 510	>820 1800	>1800 3600	
M 6000	270 680	>680 1200	>1200 3300	>3300 7500	>7500 10000
R (mm)	**2,5**	**5**	**5**	**7,5**	**7,5**

NICKEL PLATED

TRAPEZOIDAL CAPACITORS 500V / T7 / T12

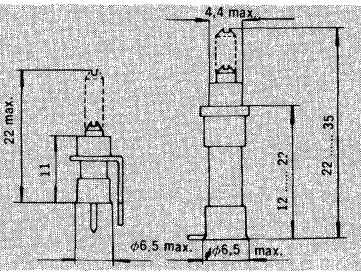
1 ..... 56 pF
P 100 ..... N 1500
150 ..... 3600 pF
M 2000 ..... M 6000
(Y5P/Z5P) (Y5U/Z5U) EIA
(2B4/2A5) (2E4/2D5) IEC
4,7 ..... 91 pF
330 ..... 560 pF

△ All dimensions given in millimeters — tolerances ±0.5.



TUBULAR TRIMMERS / CT

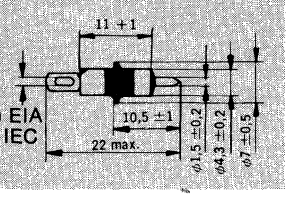
2,0 ..... 62 pF
8 16
470 ..... 1200 pF
0,7/3,7 pF ..... 4/13 pF
0,4/2 pF ..... 1/9 pF



FEED-THROUGH CAPACITORS 500V

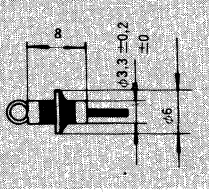
S1

1 ..... 68 pF
P 100 ..... N 1500
180 ..... 2400 pF
M 2000 ..... M 3000 ..... M 6000
(Y5P/Z5P) (Y5T/Z5T) (Y5U/Z5U) EIA
(2B4/2A5) (2D4/2C5) (2E4/2D5) IEC



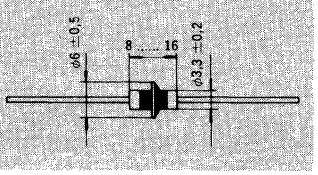
S2

1,5 ..... 270 pF
220 ..... 8200 pF
P 100 ..... N 1500
M 2000 ..... M 6000
(Y5P/Z5P) (Y5U/Z5U) EIA
(2B4/2A5) (2E4/2D5) IEC



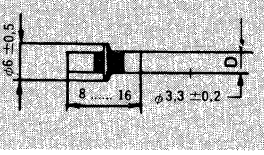
S5

1,5 ..... 100 pF
220 ..... 2700 pF
P 100 ..... N 1500
M 2000 ..... M 6000
(Y5P/Z5P) (Y5U/Z5U) EIA
(2B4/2A5) (2E4/2D5) IEC



S21

P 100 ..... N 1500
M 2000 ..... M 6000
(Y5P/Z5P) (Y5U/Z5U) EIA
(2B4/2A5) (2E4/2D5) IEC



ISKRA ELECTRONICS INC.
222 SHERWOOD AVE., FARMINGDALE, NY 11735 • (516) 753-0400

IEI-ISKRA

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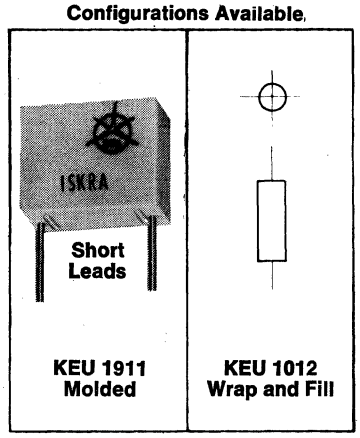
METALLIZED POLYESTER FILM CAPACITORS

Configurations Available



FEATURES

△ High insulation resistance
△ Low dielectric loss
△ Wide temperature range
△ High humidity resistance
△ Very small dimensions
△ Self-healing properties

CONSTRUCTION

△ Metallized polyester foil with excellent electrical characteristics.
△ Plastic coating permits operation under exceptionally humid climatic conditions.
△ Contact surface applied by high pressure spraying and connecting wires are soldered reducing possibility of failures or unsatisfactory contact during operation.
△ Self-healing properties guarantee greater than usual operating efficiency.
△ Flammability per UL 492.
△ Self-extinguishing plastic case and sealed with self-extinguishing epoxy resin.

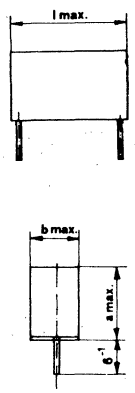
TECHNICAL DATA

Temperature Range: −40°C to +85°C.
Humidity test: Per EIA specifications RS 376
Capacitance tolerance: ±5%, ±10%, ±20%.
Rated voltage Vn: 100V-, 250V-, 400V-, 630V-, 1000V-.
Allowable a.c. voltage to 60 Hz: 63V~, 160V~, 200V~, 220V~, 250V~.
Dielectric loss tg at 20°C: $\leqslant 80\times10^{-4}$ at 1 kHz
$\leqslant 200\times10^{-4}$ at 10 kHz.
Inductance: <20nH measured at terminal length of 6mm.
Test voltage (2s): 1.6×Vn.

Insulation resistance at 20°C and 100V-:

$C \leqslant 0.33\mu F$	$C > 0.33\mu F$
$Vn \leqslant 100V$-	$Vn \leqslant 100V$-
$R = 15\times10^3\ M\Omega$	$R\times C = 5\times10^3 s$
$Vn > 100V$-	$Vn > 100V$-
$R = 30\times10^3\ M\Omega$	$RR\times C = 10^4 s$

The capacitors can be used to a temperature of 100°C, by which the working voltage at a temperature above 85°C is less than the rated voltage by 1.25% for every °C.



CAPACITANCE VALUES	AVAILABLE HOUSING SIZES				
	100V	250V	400V	630V	1000V
0.01	1	1	1	2	4
0.015	1	1	1	3	5
0.022	1	1	1	3	5
0.033	1	1	2	4	7
0.047	1	1	3	5	7
0.068	1	2	4	6	9
0.1	1	3	5	8	10
0.15	2	4	5	9	11
0.22	3	5	7	9	12
0.33	4	6	8	11	
0.47	4	7	10	12	
0.68	5	8	11		
1	6	10	12		
1.5	8	11			
2.2	9	12			
3.3	10				
4.7	11				
6.8	12				

SIZE OF HOUSING	l (LENGTH)		a (HEIGHT)		b (WIDTH)		Lead Spacing ±0.5 ±0.02		Lead Dia. ±0.5 ±0.002	
	INCH	MM	INCH	MM	INCH	MM	INCH	MM	INCH	MM
1	0.512	13	0.413	10.5	0.177	4.5	0.40	10	0.024	0.6
2	0.512	13	0.453	11.5	0.217	5.5	0.40	10	0.024	0.6
3	0.512	13	0.492	12.5	0.256	6.5	0.40	10	0.024	0.6
4	0.709	18	0.472	12	0.236	6	0.60	15	0.031	0.8
5	0.709	18	0.531	13.5	0.295	7.5	0.60	15	0.031	0.8
6	0.709	18	0.610	15.5	0.374	9.5	0.60	15	0.031	0.8
7	1.063	27	0.630	16	0.276	7	0.90	22.5	0.031	0.8
8	1.063	27	0.650	16.5	0.295	7.5	0.90	22.5	0.031	0.8
9	1.063	27	0.728	18.5	0.354	9.0	0.90	22.5	0.031	0.8
10	1.063	27	0.787	20	0.433	11	0.90	22.5	0.031	0.8
11	1.260	32	0.827	21	0.472	12	1.10	27.5	0.031	0.8
12	1.260	32	0.925	23.5	0.551	14	1.10	27.5	0.031	0.8

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VERSION VP2

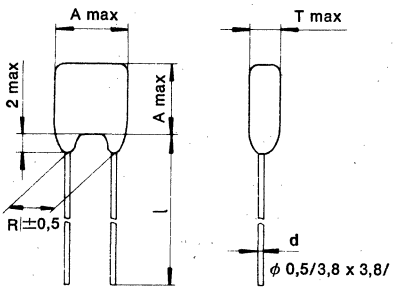
CERAMICS CG (NPO)

TECHNICAL DATA

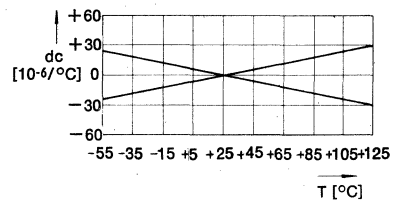
In accordance with	JUS N.R2.301 IEC 384-8 EIA 198B
Temperature coefficient	0 ±30 • 10^{-6}/K
Temperature range	−55°C to +125°C
Rated voltage	50 V_{dc}, 100 V_{dc}, 200 V_{dc}
Test voltage	2.5 U_n
Dissipation factor (tan δ) 5 pF ≤ C < 50 pF C ≥ 50 pF	 ≤ 1.5 (150/C +7) • 10^{-4} ≤ 15 • 10^{-4}
Insulation resistance $C_n \leq$ 10 nf $C_n >$ 10 nf	 ≥ 10,000 MΩ R • C_n ≥ 100 s
Climatic category	55/125/56

Also available in chip surface mounted packages

NPO, X7R & Z5U



TEMPERATURE COEFFICIENT CAPACITANCE



ORDERING EXAMPLE — NPO, X7R & Z5U

VP2 C 381/2 101 K 500

Version
VP2 = with leads

Ceramics
C = CG
B = 2C1
Z = 2F3

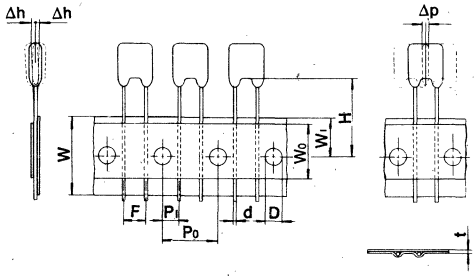
Length of Leads
1 = 6 mm
2 (standard) = 25 mm
3 = Taped

Capacitance
First two places mean value, third place means number of noughts
NPO-101 = 100 pF
X7R-103 = 10000 pF
Z5U-474 = 470000 pF

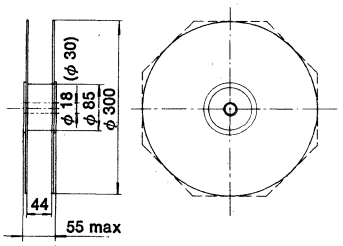
Capacity Tolerance
NPO only
C = ±0,25 pF
D = 0,50 pF
G = ±2%
J = ±5%
NPO & X7R only
K = ±10%
NPO, X7R & Z5U
M = ±20%
XZR & Z5U only
δ = ±20% +50%

Rated Voltage
500 = 50 Vdc
101 = 100 Vdc
201 = 200 Vdc
Z5U only
250 = 25 Vdc

RADIAL TAPE & REELS — NPO, X7R & Z5U



W = 18 +1 −0,5
W_0 = 13 max
W_1 = 9 +0,75 −0,50
t = 0,9 max
P_0 = 12,7 ±0,3
P_1 = 3,85 ±0,7
F = 5 ±0,5
Δp = ±1,3 max
Δh = ±2 max
d = 0,6 ±0.05
D = 4 ±0,3
H = 18 +2



For the production of ceramic multilayer capacitors Iskra uses only up-to-date technological processes and materials of known manufacturers.

Iskra has a long standing tradition in the production of all kinds of ceramic capacitors. Careful testing with modern measuring instruments guarantees high quality products for incorporation in electronic devices and in instruments for reliable operation under heavy operating conditions.

SIZE AND CAPACITANCE SPECIFICATIONS

A (mm)	3,8			3,8			5,0			5,0			7,6			10			12		
T (mm)	2,5			2,5			3,0			3,0			3,2			3,8			4,0		
R (mm)	2,5			5,0			2,5			5,0			5,0			5,0			10		
U_n / C_n	50 V	100 V	200 V	50 V	100 V	200 V	50 V	100 V	200 V	50 V	100 V	200 V	50 V	100 V	200 V	50 V	100 V	200 V	50 V	100 V	200 V
1 pF																					
1,2 pF																					
1,5 pF																					
1,8 pF																					
2,2 pF																					
2,7 pF																					
3,3 pF																					
3,9 pF																					
4,7 pF																					
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56 pF																					
68 pF																					
82 pF																					
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120 pF																					
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180 pF																					
220 pF																					
270 pF																					
330 pF																					
390 pF																					
470 pF																					
560 pF																					
680 pF																					
820 pF																					
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47 nF																					
56 nF																					
68 nF																					
82 nF																					
100 nF																					

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VERSION VP2

CERAMICS 2C1 (X7R), 2F3 (Z5U)

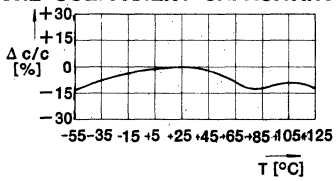
2C1 (X7R)

TECHNICAL DATA

In accordance with	JUS N.R2.305 IEC 384-9 EIA 198B
Temperature characteristics	0 ± 20%
Temperature characteristics of U_n	−30% to +20%
Temperature range	−55°C to +125°C
Rated voltage	25 Vdc, 50 Vdc, 100 Vdc
Test voltage	2,5 U_n
Dissipation factor (tan δ)	≤ 350 × 10-4
Insulation resistance	
$C_n \leq$ 25 nF	≥ 4,000 MΩ
$C_n >$ 25 nF	R • $C_n \geq$ 100 s
Climatic category	25/125/56

Also available in chip surface mounted packages

TEMPERATURE COEFFICIENT CAPACITANCE



SIZE AND CAPACITANCE SPECIFICATIONS

A (mm)	3,8			3,8			5			5			7,6			10			12		
T (mm)	2,5			2,5			3			3			3,2			3,8			4		
R (mm)	2,5			2,5			2,5			5			5			5			10		
C_n \ U_n	25 V	50 V	100 V	25 V	50 V	100 V	25 V	50 V	100 V	25 V	50 V	100 V	25 V	50 V	100 V	25 V	50 V	100 V	25 V	50 V	100 V
100 pF																					
120 pF																					
150 pF																					
180 pF																					
220 pF																					
270 pF																					
330 pF																					
390 pF																					
470 pF																					
560 pF																					
680 pF																					
820 pF																					
1,0 nF																					
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3,3 nF																					
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8,2 nF																					
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680 nF																					
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1,0 µF																					
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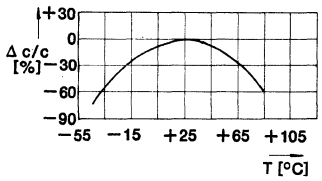
1,5 µF																					
1,8 µF																					
2,2 µF																					
2,7 µF																					
3,3 µF																					

* 10 nF

2F3 (Z5U)

In accordance with	JUS N.R2.305 IEC 384-9 EIA 198B
Temperature characteristics	−80% to +30%
Temperature characteristics of U_n	−90% to +30%
Temperature range	−40°C to +85°C
Rated voltage	25 Vdc, 50 Vdc, 100 Vdc
Test voltage	2,5 U_n
Dissipation factor (tan δ)	≤ 350 × 10-4
Insulation resistance	
$C_n \leq$ 25 nF	≥ 4,000 MΩ
$C_n >$ 25 nF	R • $C_n \geq$ 100 s
Climatic category	40/85/21

Also available in chip surface mounted packages



A (mm)	3,8			3,8			5,0			5,0			7,6			10			12		
T (mm)	2,5			2,5			3,0			3,0			3,2			3,8			4.0		
R (mm)	2,5			5,0			2,5			5,0			5,0			5,0			10		
C_n \ U_n	25 V	50 V	100 V	25 V	50 V	100 V	25 V	50 V	100 V	25 V	50 V	100 V	25 V	50 V	100 V	25 V	50 V	100 V	25 V	50 V	100 V
2,2 nF																					
2,7 nF																					
3,3 nF																					
3,9 nF																					
4,7 nF																					
5,6 nF																					
6,8 nF																					
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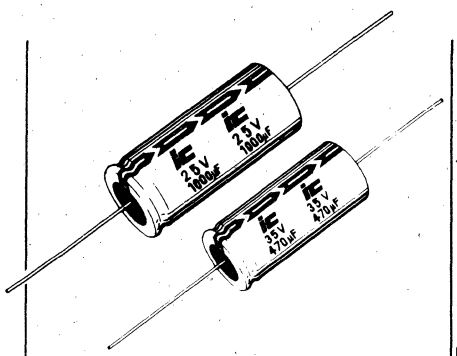
5,6 µF																					
6,8 µF																					

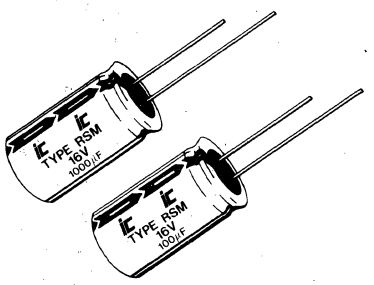
ISKRA ELECTRONICS INC.
222 SHERWOOD AVE., FARMINGDALE, NY 11735 • (516) 753-0400

TODAY'S SOLUTIONS FOR TOMORROW'S PROBLEMS

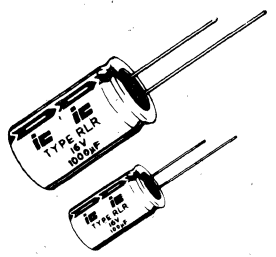
IC® CAPACITORS



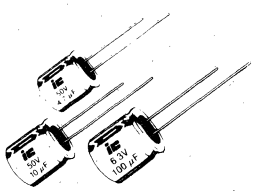
TYPE TTA COMMERCIAL/ INDUSTRIAL ELECTROLYTIC CAPACITORS
0.47 Mfd. To 33,000 Mfd.
6.3 WVDC To 500 WVDC
−40°C To +85°C Min.
2000 HOUR +85°C Rating
EPOXY END SEAL Optional (TTA-PX)
TAPE & REEL Avail.



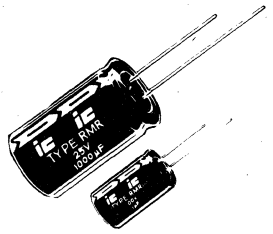
TYPE RSM SUBMINIATURE ELECTROLYTIC CAPACITORS **NEW**
0.47 Mfd. To 10,000 Mfd.
6.3 WVDC To 450 WVDC
−40°C To +85°C Min.
2000 HOUR +85°C Rating
SOLVENT TOLERANT & EPOXY SEAL Optional
TAPE & REEL Avail.



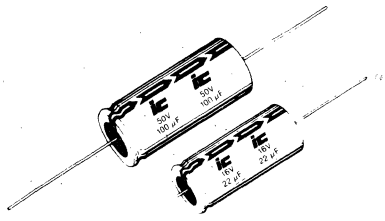
TYPE RLR LOW-LEAKAGE ELECTROLYTIC CAPACITORS
0.1 Mfd. To 2,200 Mfd.
6.3 WVDC To 50 WVDC
−40°C To +85°C Min.
Leakage Current: ≤0.002CV or 0.4 µA min.
EPOXY END SEAL Optional (RLR-PX)
TAPE & REEL Avail.



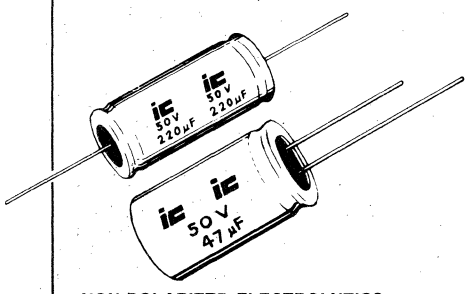
TYPE RSS SUB-SUBMINIATURE ELECTROLYTIC CAPACITORS
0.1 Mfd. To 100 Mfd.
6.3 WVDC To 50 WVDC
Min. Dia. 0.15 in./4.0mm
Max. Length .28 in./7.0mm
−40°C To +85°C Min.
TAPE & REEL Avail.



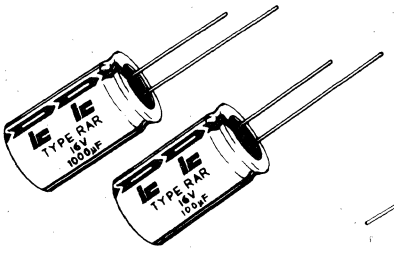
TYPE RMR SUBMINIATURE, +105°C ELECTROLYTIC CAPACITORS
0.47 Mfd. To 10,000 Mfd.
6.3 WVDC To 250 WVDC
−40°C To +105°C Min.
2000 HOUR +105°C Rating
EPOXY END SEAL Optional (RMR-PX)
TAPE & REEL Avail.



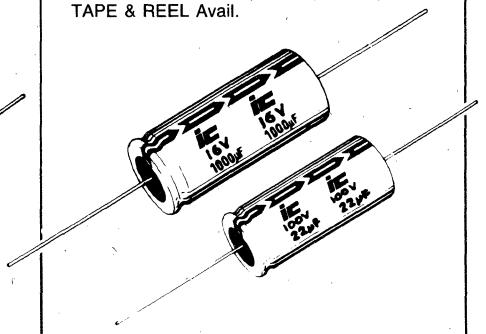
TYPE TLA LOW-LEAKAGE ELECTROLYTIC CAPACITORS
0.1 Mfd. To 100 Mfd.
6.3 WVDC To 50 WVDC
−40°C To +85°C Min.
Leakage Current: ≤0.002CV or 0.4 µA min.
EPOXY END SEAL Optional (TLA-PX)
TAPE & REEL Avail.



NON POLARIZED ELECTROLYTICS
TYPE BPA (AXIAL)
TYPE BPR (RADIAL)
0.47 Mfd. To 1,000 Mfd.
10 WVDC To 200 WVDC
−40°C To +85°C Min.
EPOXY END SEAL Optional



TYPE RAR COMMERCIAL/ INDUSTRIAL ELECTROLYTIC CAPACITORS
0.47 Mfd. To 4,700 Mfd.
6.3 WVDC To 450 WVDC
−40°C To +85°C Min.
2000 HOUR +85°C Rating
EPOXY END SEAL OPTIONAL (RAR-PX)
TAPE & REEL Avail.



TYPE THA +125° OPERATION ELECTROLYTIC CAPACITORS
0.47 Mfd. To 1,000 Mfd.
10 WVDC To 100 WVDC
−40°C To +125°C Min.
EPOXY END SEAL Optional (THA-PX)

Please Call for your specialized capacitor requirements.

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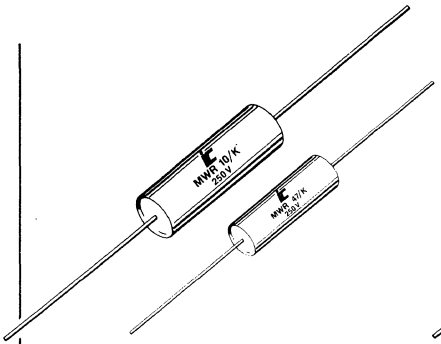
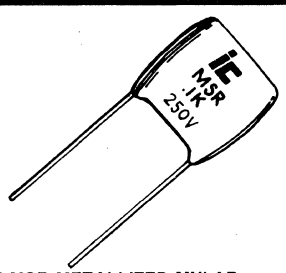
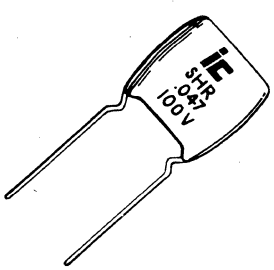
IC® CAPACITORS



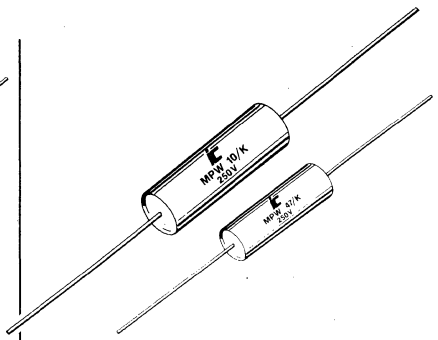
TYPE MWR METALLIZED MYLAR® POLYESTER FILM CAPACITORS
WRAP & FILLED CONSTRUCTION
NON-INDUCTIVE WINDING, +125°C
63 WVDC To 1,000 WVDC
0.001 Mfd. To 22 Mfd.
TOLERANCE: ±10% (±5% Opt.)
NEW



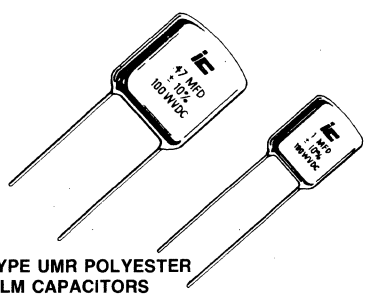
TYPE MSR METALLIZED MYLAR® POLYESTER FILM CAPACITORS
NON-INDUCTIVE WINDING, +125°C
250 WVDC To 1,000 WVDC
0.01 Mfd. To 10 Mfd.
TOLERANCE: ±10% (±5% Opt.)



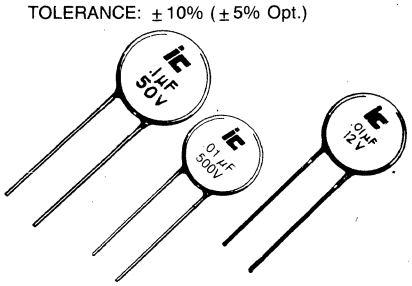
TYPE SHR POLYESTER FILM CAPACITORS
NON-INDUCTIVE WINDING, +125°C
100 WVDC
0.001 Mfd. To .47 Mfd.
TOLERANCE: ±10% (±5% Opt.)



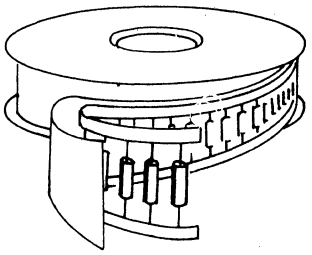
TYPE MPW METALLIZED POLYPROPYLENE FILM CAPACITORS
WRAP & FILLED CONSTRUCTION
SELF HEALING, LOW ESR
NON-INDUCTIVE WINDING, +100°C
160 WVDC To 630 WVDC
0.001 Mfd. To 10 Mfd.
TOLERANCE: ±10% (±1%, ±2.5%, ±5% Opt.)
NEW



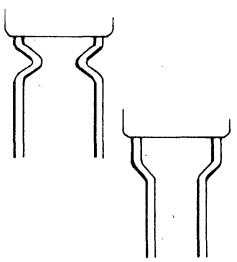
TYPE UMR POLYESTER FILM CAPACITORS
INDUCTIVE WINDING
100 WVDC
0.001 Mfd. To .47 Mfd.
TOLERANCE: ±10% (±5% Opt.)



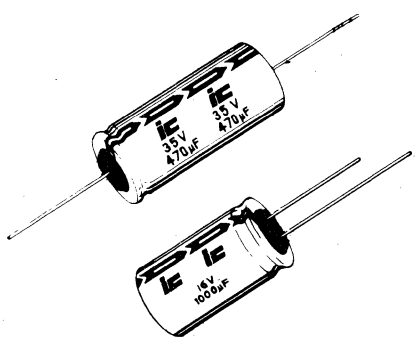
CERAMIC DISC CAPACITORS
TYPE BCR TEMPERATURE STABLE
1 pf To 680 pf, 50 WVDC, ±10% (Y5F)
GENERAL PURPOSE TYPES
TYPE GCR: 50 WVDC
0.001 Mfd. To 0.1 Mfd. (Y5S, Y5V)
TYPE GMR: 12 WVDC
0.047 Mfd. To .47 Mfd. (Y5S, Y5V)
TYPE GQR: 500 WVDC
0.001 Mfd. To 0.01 Mfd. (Z5V)



TAPE & REEL CONFIGURATIONS
FOR AUTOMATIC INSERTION OF AXIAL AND RADIAL LEAD PARTS
AVAILABLE ON SPECIAL ORDER



CUT & FORMED LEADS
AVAILABLE ON SPECIAL ORDER



SOLVENT TOLERANT SEALS
EPOXY END SEALS
AVAILABLE OPTION ON ELECTROLYTIC CAPACITORS FOR USE WITH CHLORINATED OR HALOGENATED CLEANING SOLVENTS

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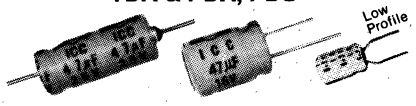
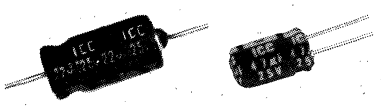
COMMERCIAL & INDUSTRIAL ALUMINUM ELECTROLYTIC CAPACITORS — AXIAL & RADIAL LEADS

General Purpose
TDA & PDA, PDS



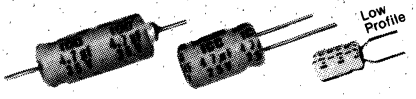
Temp. Range	−40°C to +85°C
Cap. Range	0.47μF−22,000μF Axial 0.47μF−10,000μF Radial
Cap. Tol.	−10% +75%, −10% +50%, ±20%
Volt. Range	6.3VDC−450VDC
Leakage (Max.)	6.3V−80V .02CxV +4μA 100V−450V .02CxV +100μA

Extended Temperature
TDB & PDB (Close Tolerance)



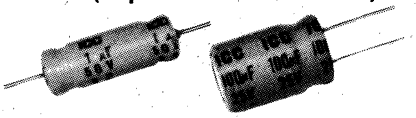
Temp. Range	−40°C to +105°C
Cap. Range	0.47μF−10,000μF
Cap. Tol.	±20%
Volt. Range	6.3VDC−250VDC
Leakage (Max.)	.01CxV +3μA
Life Test	2,000 hrs. @ 105°C

Low Leakage
TDA-L, PDA-L, PDS-L



Temp. Range	−40°C to +85°C
Cap. Range	0.1μF−2200μF
Cap. Tol.	±20%, ±10%
Volt. Range	6.3VDC−63VDC
Leakage (Max.)	0.002CxV or 0.4μA whichever is greater

Non-Polar
NTD (General Purpose)
NTA (Superior Characteristics)

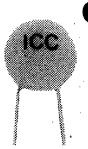


Temp. Range	−25°C to +85°C
Cap. Range	0.47μF−470μF
Cap. Tol.	−10% +50%, ±30%, ±20%, ±10%
Volt. Range	16WV−50WV
Leakage (Max.)	0.06CxV +10μA, 0.1CxV +10μA

Dipped Tantalum
DP (Straight & Snap-In Leads)

Temp. Range	−55°C to +85°C
Cap. Range	0.1μF−33μF
Cap. Tol.	±20%, ±10%
Volt. Range	3.15VDC−50VDC
Leakage (Max.)	.007CxV or .05μA whichever is greater

Ceramic Disc
CD



Various lead forms are available in both bulk and tape & reel packaging.

Temperature Compensating	NPO−N750 100V−1000V
General Purpose	100pF−100,000pF 50V−1000V
Semiconductor	10,000pF−100,000pF 12V−50V

FILM CAPACITORS

Polyester Film
EM (Radial Leads, Welded Construction)

Temp. Range	−55°C to +85°C
Cap. Range	.001μF−0.47μF
Cap. Tol.	±5%, ±10%, ±20%
Volt. Range	100V, 200V, 400V

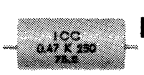
Metalized Polyester Film
PMG

Polyester Film/Foil
FM
(Radial Leads, Welded Construction)

	PMG	FM
Temp. Range	−55°C to +155°C	−40°C to +85°C
Cap. Range	.01μF−4.7μF	.001μF−0.47μF
Cap. Tol	±10% STD	±10% STD
Volt. Range	250V−630V	100V

Metalized Polyester Film
YM

Polyester Film/Foil
YFT



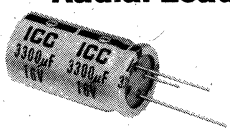
(Axial Leads, Welded Construction)

	YM	YFT
Temp. Range	−40°C to +85°C	−40°C to +85°C
Cap. Range	.01μF−10μF	.001μF−1.0μF
Cap. Tol.	±10%, ±20%	±10%, ±20%
Volt. Range	250V−630V	100V−1000V

Polypropylene Film
PP (Radial Leads, Welded Construction)

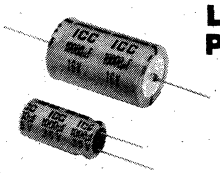
Temp. Range	−40°C to +85°C
Cap. Range	.001μF−0.47μF
Cap. Tol.	±5%, ±10%, ±20%
Volt. Range	250V−630V

Radial Lead — Mechanical Support Third Lead
PDA-T



Temp. Range	−40°C to +85°C	**Volt. Range**	6.3VDC−250VDC
Cap. Range	100μF−33000μF	**Leakage (Max.)**	−0.02CxV
Cap. Tol.	±20%		

Low Impedance Radial Lead for Switching Power Supply Output & Regulator Circuits
PZL



Temp. Range	−55°C to +105°C	**Volt. Range**	7.5VDC−100VDC
Cap. Range	2.2μF−8200μF	**Leakage (Max.)**	≤40V = $0.5\sqrt{CxV}\,\mu A$
Cap. Tol.	−10% +75%		>40V = $\sqrt{CxV}\,\mu A$

Series Features Low Impedance, High E.S.R. & Ripple Current Specifications

Snap-In Capacitors — Switching Power Supply Input Circuit

PST — Standard Height
PSL — Low Profile Construction
PXT — Extra High Ripple — Standard Height
PXL — High Ripple Low Profile

Specifications	PST	PSL	PXT	PXL
Temp. Range	−40°C to +85°C			
Cap. Range	220μF−22000μF	220μF−22000μF	100μF−820μF	100μF−390μF
Cap. Tol.	±20%	±20%	±20%	±20%
Volt. Range	10VDC−250VDC	10VDC−250VDC	200VDC−250VDC	200VDC−250VDC
Leakage (Max.)	.02CxV or 2000μA whichever is smaller		.02CxV or 3000μA whichever is smaller	

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The Inter-Technical Group Inc.
WIMA Division

ONE BRIDGE ST. • P.O.B. 23 — IRVINGTON, NY 10533 • TELEPHONE (914) 591-8822 • TWX: 710-564-0802

Plastic Film Capacitors in Plastic Cases with Radial Leads

Capacitors		Dielectric	Type
Sub-miniature capacitors PCM 2:5 mm		Polyester film metallized	**WIMA MKS 02**
Miniature type capacitors PCM 5 mm	0.01 µF to 1.0 µF	Polyester film metallized	**WIMA MKS 2**
	for pulse duty, low ESR	Polyester film metallized	**WIMA MKS 2-i**
	for pulse duty, low ESR	Polyester film metallized	**WIMA MKS 20**
	0.01 µF to 0.1 µF	Polycarbonate film metallized	**WIMA MKC 2**
available taped and reeled	1000 pF to 0.01 µF	Polyester film with metal foil electrodes	**WIMA FKS 2**
	100 pF to 0.01 µF	Polycarbonate film with metal foil electrodes	**WIMA FKC 2**
	100 pf to 0.015 µF	Polycarbonate film with metal foil electrodes	**WIMA FKC-22**
	100 pF to 0.01 µF	Polypropylene film with metal foil electrodes	**WIMA FKP 2**
Semi-miniature capacitors PCM 7.5 mm		Polyester film metallized	**WIMA MKS 3**
Metallized film capacitors for stringent requirements	CECC approval * certificate Nr. 30 401-030	Polyester film	**WIMA MKS 4**
	CECC approval * certificate Nr. 30 501-005	Polycarbonate film	**WIMA MKC 4**
	High reliability components	Polycarbonate film	**WIMA MKC 4 SV21**
Capacitors for high current ratings	with double metallized film electrodes	Polyester film	**WIMA MKS 10**
		Polycarbonate film	**WIMA MKC 10**
High reliability components		Polypropylene film	**WIMA MKP 10**
with two metal foil electrodes and a metallized plastic film electrode carrier (inner series connection)		Polypropylene film	**WIMA FKP 1**
Film capacitors with metal foil electrodes PCM 7.5 to 22.5 mm		Polyester film	**WIMA FKS 3**
		Polycarbonate film	**WIMA FKC 3**

Capacitors for special applications:

Radio Interference Suppression Capacitors in accordance with VDE 0565, part 1	inner series connection	Polyester film metallized	**WIMA MKS 4-R**
	spark quenching capacitors	Polyester film metallized	**WIMA MKS 5-R**
	epoxy resin impregnated	Paper metallized	**WIMA MP 3**
	class y epoxy resin impregnated	Paper metallized	**WIMA MP3-Y**

See page A•1091 for letter codes and dimensions.

* = Ranges and types with this symbol are approved by the "CECC" Electronic Components Quality Assurance System.
CECC = CENELEC Electronic Components Committee. (CENELEC is the European Committee for Electrotechnical Standardization).
Qualification manufacture and conformity tests are monitored by an independent, internationally recognized National Supervising Inspectorate (NSI) within the framework of the system. In the Federal Republic of Germany this is the VDE Test Office in Offenbach.

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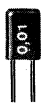
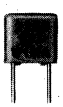
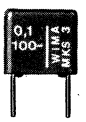
Miniature capacitors
5 mm
PCM/available taped and reeled

	Sub-miniature PCM 2.5 mm									Semi-miniature PCM 7.5 mm
										
	WIMA MKS 02	WIMA MKS 2	WIMA MKS 2-i	WIMA MKS 20	WIMA MKC 2	WIMA FKS 2	WIMA FKC 2	WIMA FKC 22	WIMA FKP 2	WIMA MKS 3
Dielectric	Polyester film	Polyester film	Polyester film	Polyester film	Polycarbonate film	Polyester film	Polycarbonate film	Polycarbonate film	Polypropylene film	Polyester film
Capacitor electrodes	Vacuum deposited aluminum	Vacuum deposited aluminum	Vacuum deposited aluminum	Double sided metallization	Vacuum deposited aluminum	Metal foil	Metal foil	Metal foil	Metal foil	Vacuum deposited aluminum
Temperature ranges	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +85°C	−55°C to +100°C
Insulation resistance at +20°C	≥3.75 x 10^3 MΩ	≥3.75 x 10^3 MΩ >0.33:≥1250 sec.	≥1.5 x 10^4 MΩ	≥1.5 x 10^4 MΩ	≥3.75 x 10^3 MΩ	≥3 x 10^4 MΩ	≥3 x 10^4 MΩ	≥3 x 10^4 MΩ	≥1 x 10^5 MΩ	≥3.75 x 10^3 MΩ >0.33:≥1250 sec.
Power factor tan δ at 1 kHz and +20°C	≤8 x 10^{-3}				≤3 x 10^{-3}	≤8 x 10^{-3}	≤2 x 10^{-3}	≤2 x 10^{-3}	≤4 x 10^{-4}	≤8 x 10^{-3}
Voltage ranges	50 VDC	50 VDC 63 VDC 100 VDC	63 VDC	63 VDC	63 VDC 100 VDC	100 VDC	100 VDC	63 VDC	63 VDC 100 VDC	63 VDC 100 VDC
Capacitance tolerances	±20%	±20% ±10% ± 5%	±20% ±10% ± 5%	±20% ±10%	±20% ±10% ±5%	±20% ±10% ±5%	±20% ±10% ±5%	±10% ±5% ±2.5%	±10% ±5% ±2.5%	±20% ±10% ± 5%
100 pF							H	J	J	
220 pF							H	J	J	
680 pF		*	*	*			H	J	J	
1000 pF	A					H	H	J	J	
1500 pF	A					H	H	J	J	
2200 pF	A					H	H	J	J	
3300 pF	A					H	H	J	J	
4700 pF	A					H	E	K	K	
6800 pF	A					H	E	K	K	
0.01 µF	A	C	C	C	C	C	D	F	L	L	M
0.015 µF	A	C	C	C	C	C		L			M
0.022 µF	A	C	C	C	C	C					M
0.033 µF	A	C	C	C	E	C					M
0.047 µF	A	C	C	C	E	C					M
0.068 µF	B	C	D	C	F	D					M
0.1 µF	B	C	D	E	D	G	F				M
0.15 µF		C	E	F							M
0.22 µF		D	E	G							M
0.33 µF		E	F	QQ							N
0.47 µF		F	G	AK							P
0.68 µF		G									Q
1.0 µF		QQ									R
1.5 µF											

Encapsulation Plastic Cases — All Types

See page A•1091 for letter codes and dimensions.

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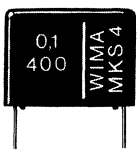
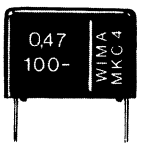
Metallized capacitors for stringent requirements

CECC approved

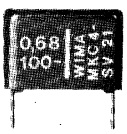


WIMA MKS 4



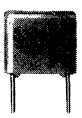
WIMA MKC 4

Frequency limit 21 kHz

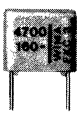


WIMA MKC 4 SV 21

Film capacitors with metal foil electrodes



WIMA FKS 3



WIMA FKC 3

	MKS 4	MKC 4	MKC 4 SV 21	FKS 3	FKC 3
Dielectric	Polyester film	Polycarbonate film	Polycarbonate film flame-retardent	Polyester film	Polycarbonate film
Capacitor electrodes	Vacuum deposited aluminum	Vacuum deposited aluminum	Vacuum deposited aluminum	Metal foil	Metal foil
Temperature ranges	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C
Insulation resistance at +20°C	≥1.5 to 3 • 10^4 MΩ >0.33 µF:5,000 to 10,000 sec.	≥1.5 to 3 • 10^4 MΩ >0.33 µF:5,000 to 10,000 sec.		≥3 x 10^4 MΩ	≥3 x 10^4 MΩ
Power factor tan δ at 1 kHz and +20°C	≤8 x 10^{-3} >1 µF:≤10 x 10^{-3}	≤3 x 10^{-3}	≤3 x 10^{-3}	≤8 x 10^{-3}	≤2 x 10^{-3}
Voltage ranges	63 VDC, 100 VDC, 160 VDC, 250 VDC, 400 VDC, 630 VDC, 1000 VDC	63 VDC, 100 VDC, 250 VDC, 400 VDC	100 VDC, 250 VDC	100 VDC, 160 VDC, 400 VDC	160 VDC, 400 VDC, 1000 VDC
Capacitance tolerances	±20% ±10% ±5%	±20% ±10% ±5%	±20% ±10% ±5%	±20% ±10% ±5%	±20% ±10% ±5%

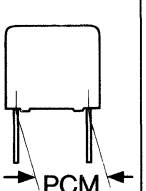
Encapsulation: Plastic Cases — All Types

	63 VDC	100 VDC	160 VDC	250 VDC	400 VDC	630 VDC	1000 VDC	63 VDC	100 VDC	250 VDC	400 VDC	100 VDC	250 VDC	100 VDC	160 VDC	400 VDC	160 VDC	400 VDC	1000 VDC
100 pF																	M	W	
220 pF																	M	W	
680 pF																	M	W	
1000 pF														M		W	M	W	W
1500 pF														M		W	M	W	CC
2200 pF														M		W	M	W	CC
3300 pF														M		W	M	W	CC
4700 pF														M	W	W	N/W	T	Y
6800 pF														M	W	W	N/T	U	Z
0.01 µF		N		S	S	T	Y				S			M/W	W	T	T	X	AA
0.015 µF		N		S	S	T	Z				S			M/W	W	U			
0.022 µF		N		S	S	U	Z				S			M/W	W	V			
0.033 µF		N		S	T	Y	PP			T	T			T	T				
0.047 µF		N		S	Y	Z	KK			T	Y			T	T				
0.068 µF		N		S	Y	AA	LL			U	Y			U					
0.1 µF		N/S	S	T/Y	Z	PP	A/C		T	U/Y	Z		Y	V					
0.15 µF		N/S	T	Y	AA	KK	VV		T	Y	AA		Y						
0.22 µF	N/T	T	U	Y	PP	LL	WW	T	U	Z	KK		Z						
0.33 µF	P/T	Y	Y	Z	KK	ZZ	XX	T	Y	AA	LL	Y	AA						
0.47 µF	Q/T	Y	Z	KK	LL	VV	YY	U	Y	KK	A/C	Y	KK						
0.68 µF	R/U	Z	AA	KK	VV	WW		Y	AA	KK	VV	AA	KK						
1.0 µF	U/Z	AA	KK	LL	VV	YY		Z	AA	LL	WW	AA	LL						
1.5 µF	AA	KK	KK	ZZ	WW			AA	KK	ZZ	XX	KK	ZZ						
2.2 µF	BB	LL	A/C	VV	YY			BB	LL	VV	YY	LL	VV						
3.3 µF	KK	A/C	NN	WW				KK	A/C			A/C							
4.7 µF	LL	VV	WW	YY				LL	VV			VV							
6.8 µF	A/C	WW																	
10 µF																			

Important dielectric characteristics of plastic films:

Polyester = high dielectric strength
Polycarbonate = linear temperature curve
Polypropylene = extremely low losses (tan δ)

The figures in the tables of capacitances refer to the PCM = Printed Circuit Module (lead spacing) at the lead exit points



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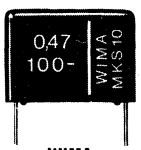
Capacitors for high current ratings* High reliability components

with double metallized film electrodes

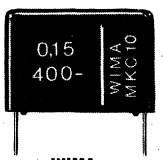
with two metal foil electrodes and a floating electrode of plastic film metallized on both sides (internal series connection)

Radio Interference suppression capacitors

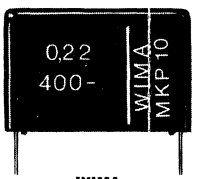
in accordance with VDE 0565-1 class X 2



WIMA MKS 10



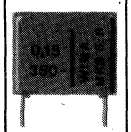
WIMA MKC 10



WIMA MKP 10

WIMA FKP 1

WIMA MKS 4-R



WIMA MKS 5-R

Dielectric	Polyester film	Polycarbonate film	Polypropylene film	Polypropylene film	Polyester film	Polyester film
Capacitor electrodes	Carrier film metallized on both sides, self-healing			Metal foil and carrier film metallized on both sides, self-healing	Vacuum deposited aluminum, self-healing	Vacuum deposited aluminum, self-healing
Temperature ranges	−55°C to +100°C	−55°C to +100°C	−55°C to +85°C	−55°C to +85°C	−40°C to +85°C	−40°C to +85°
Insulation resistance at +20°C	≥3 x 10^4 MΩ >0.33:≥10,000 sec.	≥3 x 10^4 MΩ >0.33:≥10,000 sec.	≥3 x 10^4 MΩ >0.33:≥10,000 sec.	≥1 x 10^5 MΩ >0.1:≥10,000 sec.	≥1.5 x 10^4 MΩ >0.33:≥5,000 sec.	≤0.33 μF: ≥1.5 x 10^4 MΩ >0.33 μF: ≥5,000 sec. (MΩ x μF)
Power factor tan δ at 1 kHz and +20°C	≤6 x 10^{-3} >1 μF:≤8 x 10^{-3}	≤2 x 10^{-3} >1 μF:≤4 x 10^{-3}	≤3 x 10^{-4}	≤3 x 10^{-4} 0.1 μF:≤4 x 10^{-4}	≤8 x 10^{-3}	≤8 x 10^{-3}
Voltage ranges	63 VDC / 100 VDC / 250 VDC	250 VDC / 400 VDC / 630 VDC / 1000 VDC	160 VDC / 250 VDC / 400 VDC / 630 VDC / 1000 VDC; 100 VAC / 180 VAC / 220 VAC / 400 VAC / 400 VAC	400 VDC / 630 VDC / 1000 VDC / 1000 VDC / 1600 VDC / 2000 VDC; 250 VAC / 300 VAC / 350 VAC / 400 VAC / 500 VAC / 600 VAC	250 VAC	350 VDC
Capacitance tolerances	±20% ±10%	±20% ±10% ±5%	±20% ±10% ±5%	±20% ±10% ±5%	±20% ±10%	±20% ±10%

| | | | | |

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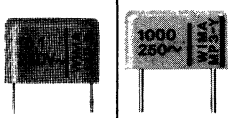
Radio interference suppression capacitors

in accordance with VDE 0565-1 class X 2



	WIMA MP 3**	WIMA MP 3-Y**
Dielectric	Paper, epoxy resin impregnated	Paper, epoxy resin impregnated
Capacitor electrodes	Metallized self-healing	Metallized, self-healing
Temperature ranges	−40°C to +85°C	−40°C to +85°C
Insulation resistance at +20°C	≥6 x 10³ MΩ >0.33:≥2,000 sec.	>12 x 10³ MΩ
Power factor tan δ at 1 kHz and +20°C	≤10 x 10⁻³	≤10 x 10⁻³
Voltage Ranges	250/275 VAC	250 VAC
Capacitance Tolerances	±20%	±20%
100 pF		
220 pF		
680 pF		
1000 pF		A/L
1500 pF		A/L
2200 pF		A/L
3300 pF		A/L
4700 pF		A/M
6800 pF		
0.01 µF	EE	
0.015 µF	EE	
0.022 µF	EE	
0.033 µF	FF	
0.047 µF	GG	
0.068 µF	HH	
0.1 µF	JJ	
0.15 µF	SS	
0.22 µF	TT	
0.33 µF	UU	
0.47 µF	A/D	
0.68 µF		
1.0 µF		
1.5 µF		
2.2 µF		
3.3 µF	**MP3 X and Y**	
4.7 µF	Encapsulation Surface-treated metal foil and epoxy resin	
6.8 µF	Longer leads 14-2mm on request	
10 µF		

	W	H	L	PCM	Capacitor
A	2.5	7	4.6	2.5	MKS 02
B	3	7.5	4.6	2.5	MKS 02
C	2.5	7	7.2	5	MKS 2-1; MKS 20; MKC 2; MKS 2
D	3	7.5	7.2	5	MKS 2; FKS 2; MKS 2-1; MKC 2
E	3.5	8.5	7.2	5	MKS 2; MKS 20; FKC 2; MKC 2
F	4.5	9.5	7.2	5	MKS 2; MKS 20; FKC 2; MKC 2
G	5	10	7.2	5	MKS 2; MKS 20
H	2.5	6.5	7.2	5	FKS 2; FKC 2
J	4.5	6	7.2	5	FKP 2; FKC 22
K	5.5	7	7.2	5	FKP 2; FKC 22
L	6.5	8	7.2	5	FKP 2; FKC 22
M	3	8.5	10	7.5	MKS 3; FKS 3; FKC 3
N	4	9	10	7.5	MKS 3; MKS 4; MKS 10; FKC 3
P	4.5	9.5	10.3	7.5	MKS 3; MKS 4; MKS 10
Q	5	10.5	10.3	7.5	MKS 3; MKS 4
R	5.7	12.5	10.3	7.5	MKS 3; MKS 4
S	4	9	13	10	MKS 4; MKC 4; MKS 10
T	4	9.5	13	10	MKS 4; MKC 4; MKC 10; MKP 10; FKC 3; FKS 3; MKS 10
U	5	11	13	10	MKS 4; MKC 4; MKS 10; MKC 10; MKP 10; FKS 3; FKC 3
V	6	12.5	13	10	MKS 10; MKC 10; MKP 10; FKS 3
W	3	9	13	10	FKS 3; FKC 3
X	6	12	13	10	FKC 3
Y	5	11	18	15	MKS 4; MKC 4; MKC4SV21; MKS 4-R; MKP 10; FKP 1; FKC 3; MKS 10; MKC 10; MKS 5-R
Z	6	12.5	18	15	MKS 4; MKC 4; MKS 10; MKC 10; MKP 10; FKP 1; FKC 3; MKS 4-R; MKC45V21
AA	7	14	18	15	MKC 10; MKS 4; MKC 4; MKC4SV21; FKP 1; FKC 3; MKS 4-R; MKP 10
BB	8	15	18	15	MKS 4-R; MKS 4; MKC 4; MKS 10; MKC 10; MKP 10; FKP 1; MKS5-R
CC	4	10	18	15	FKC 3
DD	9	16	18	15	MKS 4-R
EE	5	13	19	15	MP 3
FF	6	14	19	15	MP 3
GG	7	15	19	15	MP 3
HH	8	17	19	15	MP 3
JJ	10	18	19	15	MP 3; FKP 1
KK	7	16.5	26.5	22.5	MKC 4; MKC4SV21; MKP 10; MKS 10; MKC 10; FKP 1; MKS 4; MKS 5-R
LL	8.5	18.5	26.5	22.5	MKS 4; MKC 4; MKC4SV21; MKP 10; FKP 1; MKC 10; MKS 10; MKS 4-R; MKS 5-R
MM	10.5	20.5	26.5	22.5	MKC 10; MKP 10; FKP 1
NN	11	21	26.5	22.5	MKS 4; MKS 10; MKC 10; MKP 10; MKS 4-R
PP	6	15	26.5	22.5	MKS 4; MKP 10; FKP 1
QQ	5.5	11.5	7.2	5	MKS 2
RR	5	14	26.5	22.5	FKP 1
SS	8	20	28	22.5	MP 3
TT	10	22	28	22.5	MP 3
UU	12	24	28	22.5	MP 3
VV	11	21	31.5	27.5	MKC 10; MKP 10; MKC4SV21; MKS 4-R; MKS 10; FKP 1; MKS 4; MKC 4; MKS 5-R
WW	13	24	31.5	27.5	MKS 4; MKS 4-R; MKS 10; MKC 10; MKP 10; FKP 1; MKC 4; MKS 5-R
XX	15	26	31.5	27.5	MKC 10; MKP 10; MKS 4-R; MKS 10; MKC 4; MKS 4
YY	17	34.5	31.5	27.5	MKS 10; MKP 10; MKS 4-R; MKS 4; MKC 4
ZZ	9	19	31.5	27.5	MKS 4; MKC 4; MKC4SV21; FKP 1
A/B	20	39.5	31.5	27.5	MKP 10; MKS 10
A/C	10.5	19	26.5	22.5	MKS 4; MKP 10; MKC 10; MKC 4; MKC4SV21; MKS 5-R
A/D	13	25	33	27.5	MP 3
A/E	13	24	41.5	37.5	MKP 10; FKP 1
A/F	15	26	41.5	37.5	MKP 10; FKP 1
A/G	19	32	41.5	37.5	MKP 10; FKP 1
A/H	17	29	41.5	37.5	MKP 10; FKP 1
A/J	11	22	41.5	37.5	FKP 1
A/K	7.2	13	7.2	5	MKS 2
A/L	4	8.5	13.5	10	MP 3-Y
A/M	5	10	13.5	10	MP 3-Y
A/N	5	11	17	15	MKS 5-R

The tolerances on dimensions are according to DIN 7168. In practice, this means that unless the catalog specifically states a dimensional tolerance, the following tolerance applies:

Nominal Dimension (MM)	Tolerance (MM)
.5 to 3	±.1
3 to 6	±.1
>6 to 30	±.2

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The Inter-Technical Group Inc.
WIMA Division

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A summary and package units of the taped miniature capacitors

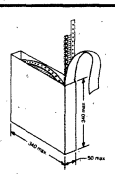
PCM (Printed circuit module) 5 mm

	PCM (Printed circuit module) 2.5 mm metallized		Metallized for pulse duty		for pulse duty minimal ESR		With metal foil electrodes													
	Polyester film		Polyester film				Polycarbonate film				Polyester film		Polycarbonate film		Polypropylene film					
	WIMA MKS 02		WIMA MKS 2				WIMA MKS 2-i		WIMA MKS 20		WIMA MKC 2				WIMA FKS 2		WIMA FKC 2		WIMA FKC 22		WIMA FKP 2			
	50 VDC		50 VDC		63 VDC		100 VDC		63 VDC		63 VDC		100 VDC		100 VDC		100 VDC		63 VDC		63 VDC		100 VDC	
100 pF																	2200	2500	1200	1500			1200	1500
150 pF																	2200	2500	1200	1500			1200	1500
220 pF																	2200	2500	1200	1500			1200	1500
330 pF																	2200	2500	1200	1500			1200	1500
470 pF																	2200	2500	1200	1500			1200	1500
680 pF																	2200	2500	1200	1500			1200	1500
1000 pF	2200	2500													2200	2500	2200	2500	1200	1500			1200	1500
1500 pF	2200	2500													2200	2500	2200	2500	1200	1500			1200	1500
2200 pF	2200	2500													2200	2500	2200	2500	1200	1500	1200	1500	1200	1500
3300 pF	2200	2500													2200	2500	2200	2500	1200	1500				
4700 pF	2200	2500													2200	2500	1500	2000	1000	1200	1000	1200		
6800 pF	2200	2500													2200	2500	1500	2000	1000	1200	1000	1200		
0.01 µF	2200	2500			2200	2500	2200	2500	2200	2500	2200	2500			2200	2500	2000	2300	1200	1500	800	1000	800	1000
0.015 µF	2200	2500			2200	2500	2200	2500	2200	2500	2200	2500			2200	2500					800	1000		
0.022 µF	2200	2500			2200	2500	2200	2500	2200	2500	2200	2500			2200	2500								
0.033 µF	2200	2500			2200	2500	2200	2500	2200	2500	1500	2000	2200	2500										
0.047 µF	2200	2500			2200	2500	2200	2500	2200	2500	1500	2000	2200	2500										
0.068 µF	2000	2300			2200	2500	2200	2300	2200	2500	1200	1500	2000	2300										
0.1 µF	2000	2300	2200	2500	2000	2300	1500	2000	2000	2300	1000	1400	1200	1500										
0.15 µF			2200	2500	1500	2000	1200	1500																
0.22 µF			2000	2300	1500	2000	1000	1400																
0.33 µF			1500	2000	1200	1500	800	1200																
0.47 µF			1200	1500	1000	1400	700	1000																
0.68 µF			1000	1400																				
1.0 µF			800	1200																				

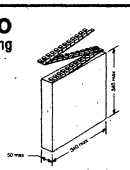
Taped package units for ROLL and AMMO/REEL (number of pieces)

Packaging types:

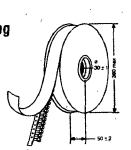
ROLL packaging



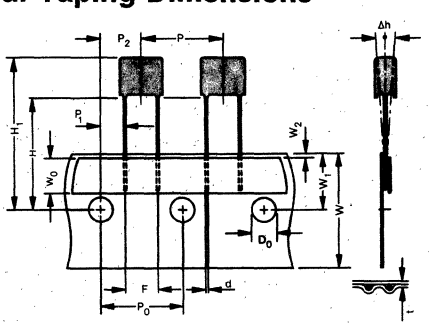
AMMO packaging



REEL packaging



Typical Taping Dimensions



Designation	Symbol	Dimensions in mm	
		PCM 2.5 taping	PCM 5 taping
Carrier tape width	W	18.0 ±0.5	18.0 ±0.5
Hold-down tape width	W_0	6.0 for hot-sealing adhesive tape	6.0 for hot-sealing adhesive tape
Hole position	W_1	9.0 ±0.5	9.0 ±0.5
Hold-down tape position	W_2	0.5 to 3.0 max.	0.5 to 3.0 max.
Feed hole diameter	D_0	4.0 ±0.2	4.0 ±0.2
Pitch of component	P	12.7 ±1.0	12.7 ±1.0
Feed hole pitch	P_0	12.7±0.3 cumulative pitch error max. 1.0 mm•20 pitch	12.7±0.3 cumulative pitch error max. 1.0 mm•20 pitch
Feed hole center to lead	P_1	5.1 ±0.5	3.85 ±0.7
Hole center to component center	P_2	6.35 ±1.3	6.35 ±1.3
Feed hole center to bottom edge of the component	H*	16.5 ±0.3	16.5 ±0.3
		18.5 ±0.5	18.5 ±0.5
Feed hole center to top edge of component	H_1	H + H component <H_1 32.25 max.	H +H component <H_1 32.25 max.
Lead spacing	F	2.5 ±0.5	5.0 +0.8, −0.2
Lead diameter	d	0.4 ±0.05	0.5 ±0.05
Component alignment	Δh	±2.0 max.	±2.0 max.
Total tape thickness	t	0.7 ±0.2	0.7 ±0.2

Please contact us beforehand if your own specification deviates from the data given above.
*When ordering please give dimension "H" and the desired packaging — Suitable for insertion systems, e.g. AVISERT, UNIVERSAL, PANASERT, FUJI.

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MINIGLOSSARY BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\ K\ A}{t_D}$

Metric: $C = \frac{.0884\ K\ A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$E = \frac{1}{2}\ CV^2$

III. Linear charge of a capacitor (Amperes)

$I = C\frac{dV}{dt}$

IV. Total Impedance of a capacitor (ohms)

$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$X_C = \frac{1}{2\pi fC}$

VI. Inductive Reactance (ohms)

$X_L = 2\pi fL$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$DF = \tan\delta\ (\text{loss angle}) = \frac{ESR}{X_c} = (2\pi fC)\ (ESR)$

IX. Power Factor

PF = Sine δ (loss angle) = Cos φ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$Q = \text{Cotan}\ \delta\ (\text{loss angle}) = \frac{1}{DF}$

XI. Equivalent Series Resistance (ohms)

$ESR = (DF)\ (Xc) = (DF)\ (\frac{1}{2}\pi fC)$

XII. Power Loss (watts)

Power loss $= (2\pi fCV^2)\ (DF)$

XIII. KVA (Kilowatts)

$KVA = 2\pi fCV^2 \times 10^{-3}$

XIV. Temperature Characteristic (ppm/°C)

$TC = \frac{Ct - C_{25}}{C_{25}\ (T_t - 25)} \times 10^6$

XV. Cap Drift (%)

$C.D. = \frac{C_1 - C_2}{C_1} \times 100$

XVI. Reliability of Ceramic Capacitors

$\frac{L_o}{L_t} = \left(\frac{V_t}{V_o}\right)^x \quad \left(\frac{T_t}{T_o}\right)^\tau$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \text{---} + \frac{1}{C_N}$

Two: $C_T = \frac{C_1\ C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$C_T = C_1 + C_2 \text{---} + C_N$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$db = 20 \log \frac{V_1}{V_2}$

Metric prefixes:

Pico	X 10^{-12}
Nano	X 10^{-9}
Micro	X 10^{-6}
Milli	X 10^{-3}
Deci	X 10^{-1}
Deca	X 10
Kilo	X 10^3
Mega	X 10^6
Giga	X 10^9
Tera	X 10^{12}

Symbols:

K = Dielectric Constant
A = Area
t_D = Dielectric thickness
V = Voltage
t = time
R_S = Series Resistance
f = frequency
L = Inductance
δ = Loss angle
φ = Phase angle
x + y = Exponent effect of voltage and temp
L_o = Operating life
L_t = Test life
V_t = Test voltage
V_o = Operating voltage
T_t = Test temperature
T_o = Operating temperature

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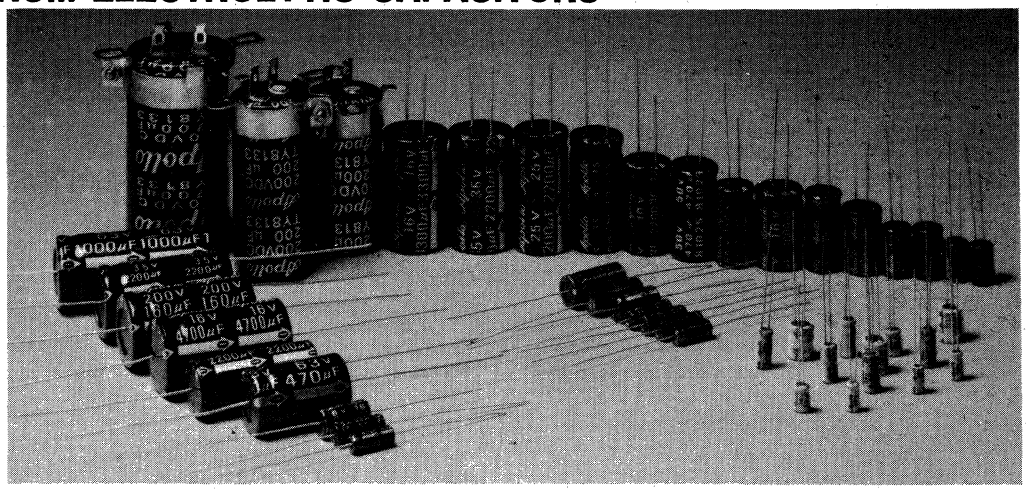
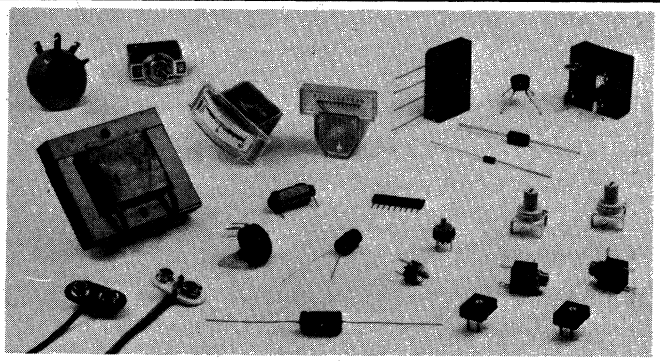
CAPACITORS / SILICON DIODES / CARBON FILM RESISTORS / LEDS / POTENTIOMETERS / TRANSFORMERS ADAPTORS AND POWER SUPPLIES

ALUMINUM ELECTROLYTIC CAPACITORS



Application	Type R-Radial T-Axial	Operating Temperature Range	Rated Voltage Range	Leakage Current @ 25°C i_L μa, C mf, V volts (Rated)	Standard Tolerances
General Uses • Filter • By Pass • Radio • TV • Industrial	RS TS	Under 100V: −40°C +85°C Over 100V: −25°C +85°C	6.3V − 500V	$i_L <$ .03 CV or 4 μa whichever is greater	−10 +75% <4.7 mf <−10 +50%
Sub Miniature Size Low Leakage • Timing Circuits • Pulse Circuits • Substitutes for Tantalums	SMR SMT	−40°C +85°C	6.3V − 50V	$i_L <$ .002 CV or .3 μa whichever is greater	±20%
Epoxy Sealed • Same applications as SM Series, but impervious to chlorinated solvents	LMR LMT	−40°C +85°C	16V − 50V	$i_L <$ .002 CV or .3 μa whichever is greater	±20%
Non Polar •General Use • Small Size	NPR NPT	−40°C +85°C	6.3V − 100V	$i_L <$ .01 CV +3 μa	±30% − 20% & 10% available
Non Polar • Cross Over Networks • High Circulating Currents	BPR BTT	−25°C +85°C	16V − 63V	$i_L <$ .03 CV +4 μa	±20%
Computer Grade • Low ESR values to 550,000 mf • ESR .009 Ω @ 6V & 2500 mf @ 350V ESR .091 Ω	CXR CXT	−40°C +85°C	3.5V − 450V	$i_L <$ .005 $\sqrt{CV}$ i_L in ma	−10 +100% <50V <−10 +75% −10 +75% <50V <−10 +50%
Computer Grade • Very Low ESR with high ripple current typically: .009 Ω, 22 Amps, 6V; 550,000 mf • Extended shelf life • 35,000 mf at 6V axial in less than 3 cu. in.	CXR CXT	−40°C +85°C	3.5V − 450V 6V − 450V	$i_L <$ .005 $\sqrt{CV}$ i_L in ma	−10 +100% <50V <−10 +75% −10 +75% <75V <−10 +50%
Military and Telecommunication • Hi Reliability	MTT	−55°C +125°C	3.5 − 250 VDC	$i_L <$ .01 V$\sqrt{C}$ +2 μa	−10 +75% <75V <−10 +50%
Horizontal Deflection • For "S" Correction in Transistor Circuits • Low Cost Substitutes for Film Capacitors	HD	−25°C +85°C	25 VAC	30 μa max	±20%



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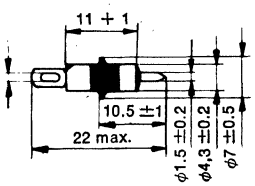
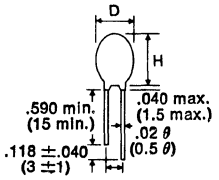
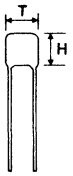
Ceramic Discs **Feed Thru** **Dipped Tantalum** **Monolythic**







DISC CAPACITORS HIGH VOLTAGE TYPES/KV1
From 1 kV to 8 kV—EIA Types (Y5P/25P) (Y5U/25U)

SAFETY TYPE DISC CAPACITORS/KZ
For AC Applications

MONOLITHIC CAPACITORS TO 200V
NPO X7R Z5U

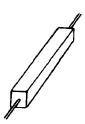
TRAPEZOIDAL CAPACITORS 500V/T7/T12
REDUCED TITANATE DISC/KR1
.001 mFd to .18 mFd 50V for bypass application

SUBMINIATURE DISC CAPACITORS 500V/K1
All TC's starting at 4mm
P100 ..... N56000
HIK Y5P Z5V

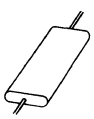
FEED-THROUGH CAPACITORS 500V
3 & 4mm With and Without Pin

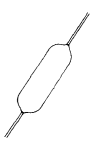
FOIL CAPACITORS

1511 Molded Radial

2710 Molded Axial 

1012 Wrap and Fill Round

1011 Oval 

1010 Axial 

MPE104 Epoxy DIP Radial

Capacitor Type	KSC Polystyrene	KFU Polyester	KKU Polycarbonate	KLI-1511 Polypropylene	KEU Metallized Polyester	KCU Metallized Polycarbonate	KNU Metallized Polypropylene
Cap Range	33 pf to .82 μf	.001 to 1 μf	470 pf to .1 μf	.0022 to .1 μf	.01 μf to 10 μf	.01 to 10 μf	.002 to 1.8 μf
Avail. Tol. ±%	10, 5, 2.5	20, 10, 5	20, 10, 5	20, 10, 5	20, 10, 5	20, 10,5	20, 10, 5
VDC	63V to 1000V	100 to 1000	160, 400	630, 1000, 1500	100 to 1000	100 to 630	400 to 1500
AC Vrms	.4 × Rated DC	63 to 250	100, 200	300, 350, 400	63 to 250	63 to 220	≈ .4 VDC
Pdn Test Voltage	3 × Rated	2 × Rated	2 × Rated	2 × Rated	1.6 × Rated	1.6 × Rated	1.6V Rated
Dielectric Loss @ 1 kHz, 20°C	≤2 × 10^{-4} ≤5 × 10^{-4} Cn <10 μf <Cn	Tan δ ≤60 × 10^{-4}	Tan δ ≤10^{-4}	Tan δ @ 10 kHz ≤5 × 10^{-4}	Tan δ ≤10^{-6}	Tan δ 50 × 10^{-4} Cn <1 μf Tan δ 80 × 10^{-4} Cn ≥1 μf	≤25 × 10^{-4} C >/μf
Insulation Res.	Ri ≥10^{5} Meg Cn ≤.1 μf Ri Cn ≥10^{4} Sec Cn >.1 μf	Ri ≤30,000 Meg Cn ≤.33 μf Ri Cn=10,000 Sec Cn >.33 μf	Ri ≥30,000 Meg	Ri ≥30,000 Meg	Ri ≤3750 Meg Cn≤ .33 μf Ri Cn >1250 Cn ≥.33 μf	Ri ≤3750 Meg Cn .≤33 μf Ri Cn >1250 Cn ≥.33 μf	≥20,000 Meg C ≤.33 μf Ri × Cn >6000 Sec C >.33
Operating °C Temp. Range	−40 to +70	−40 to +100	−40 to +100	−40 to +85	−40 to +85	−40 to +85	−25 to +85
Temp. Coefficient	−(125 ±60) × 10^{-6}/°C	≈ 10^{-4}/°C	Less than 5 × 10^{-5}/°C	−200 × 10^{-6}/°C	≈10^{-4}/°C	Less than 5 × 10^{-5}/°C	−200 × 10^{-6}/°C
Pulse Loading	1000V/μsec	1000 v/μsec	1000V/μsec	750V/μsec	1.5 to 24V/μsec*	1.5 to 24V/μsec*	4 to 125V/μsec†
Inductance at Term Length 6 MM	10 nH/Cm Length of cap	20 nH	15 nH	10 nH	20 nH	20 nH	20 nH

* Varies with Case Size and Voltage Rating. † Depending on Value and Voltage Rating.

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ITT Components
A Unit of ITT Corporation

Aluminum Electrolytic Capacitors

Miniature Radial
Miniature Axial

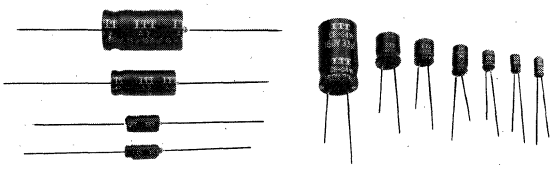
ORDERING INFORMATION:

SM 3.3 M 50 S

Series Designation (SM-Subminiature Radial)
Nominal Capacitance (Micro Farads)
Tolerance Designation (as specified)
Rated Voltage (DC)
Lead Style Designation

(AX-Miniature Axial) (CE04-W-Miniature Radial)
(SSM-Super Subminiature)

NOTE: For tape and reel packaging, use a T for the lead style designation. Available for case diameters through .315 (8.00).
For epoxy end sealing, use an E next to the lead style designation. Available for case diameters through .709 (18.00)

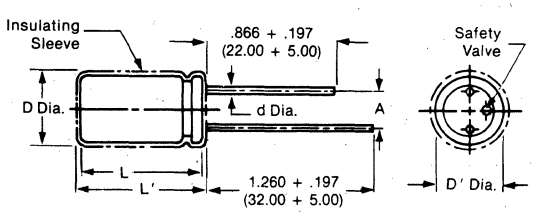


Standard Capacitance Range
(Case Diameters and Lengths in mm)

WV / μf	6.3	10	16	25	35	50	63	100
0.1								5x11
0.22								5x11
0.33								5x11
0.47								5x11
1								5x11
2.2								5x11
3.3								5x11
4.7							5x11	6.3x11
10						5x11	6.3x11	8x11.5
22					5x11	6.3x11	6.3x11	8x11.5	10x12.5
33				5x11	6.3x11	6.3x11	8x11.5	8x11.5	10x16
47			5x11	6.3x11	6.3x11	8x11.5	8x11.5	10x12.5	10x20
100		6.3x11	8x11.5	8x11.5	10x12.5	10x16	10x20	13x20
220		8x11.5	10x12.5	10x16	10x20	13x20	13x20	16x25
330		10x12.5	10x16	10x20	13x20	13x20	13x25	16x31.5
470	10x12.5	10x16	10x20	13x20	13x25	16x25	16x25	18x35.5
1000	10x20	13x20	13x20	13x25	16x25	16x31.5	18x35.5	
2200	13x25	16x20	16x25	16x35.5	18x35.5			
3300	16x25	16x31.5	16x35.5	18x40				
4700	16x31.5	16x35.5	18x35.5					
10000	18x40							

Case Sizes and Dimensions: All dimensions shown in inches (millimeters)

SM Series



D	.197(5.00)	.248(6.30)	.315(8.00)	.394(10.00)	.512(13.00)	.630(16.00)	.709(18.00)
A	.079(2.00)	.099(2.50)	.140(3.50)	.197(5.00)		.295(7.50)	
d	.020(0.50)			.024(0.60)		.026(0.65)	.032(0.80)

D' = [D +.020(0.50)] Max.
L' = [L +.039(1.00)] Max. at D ≤ .315(8.00)
L' = [L +.079(2.00)] Max. at D ≥ .394(10.00)

PERFORMANCE SPECIFICATIONS:

Operating Temperature Range: −40°C to +85°C (−40°F to +185°F)

Leakage Current: Less than 3μa +.01 CV (measured after 3 minutes of applied voltage).
C = Nominal capacitance (μf)
V = Rated voltage

Capacitance Tolerance: ±20% (M) or 10% (K)
(measured at 20°C (68°F), 120Hz)

Dissipation Factor: (measured at 20°C (68°F), 120Hz)

Rated Voltage	6.3	10	16	25	35	50 to 100
0.1μf to 1000μf	0.24	0.20	0.17	0.15	0.12	0.10
1000μf to 10,000μf	Values above plus 0.02 for each 1000μf					

Impedance Ratio at Low Temperature: 120Hz

Rated Voltage	6.3	10	16	25	35	50 to 100
Z −25°C (−13°F)/Z @ 20°C (68°F)	4	3	2	2	2	2
Z −40°C (−40°F)/Z @ 20°C (68°F)	8	6	4	4	4	4

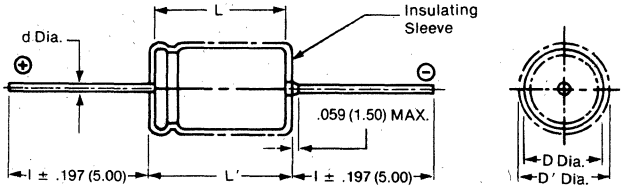
Surge Voltage:

DC Rated Voltage	6.3	10	16	25	35	50	63	100
Surge Voltage	8	13	20	32	44	63	79	125

Load Life: 1000 ±12 hrs @ +85°C (+185°F) and rated voltage.
Leakage Current: Within values specified above
Dissipation Factor: With ±150% of specified value

Shelf Life: 1000 hrs. @ +85°C (+185°F), No voltage applied
Leakage Current: Within ±200% of values specified above
Dissipation Factor: Within ±150% of specified value
Capacitance Change Max.: ±20% from initial value

AX Series



D	d	f
.248 ~ .315 (6.30 ~ 8.00)	.024 (0.60)	1.500 (38.00)
.394 ~ .512 (10.00 ~ 13.00)	.024 (0.60)	1.500 (38.00)
.630 ~ .870 (16.00 ~ 22.00)	.032 (0.80)	1.500 (38.00)
.984 (25.00)	.039 (1.00)	1.500 (38.00)

D' = [D +.020(0.50)] Max.
L' = [L +.039(1.00)] Max. at D ≤ .315(8.00)
L' = [L +.079(2.00)] Max. at D ≥ .394(10.00)

ITT COMPONENTS • 1201 E. McFadden Avenue • Santa Ana, California 92705 • Phone: (714) 836-0351 • TWX: 910-595-1744 • Telex: 69-1389

ITT Components
A Unit of ITT Corporation

Epoxy Dipped Solid Tantalum Capacitors

TAP

- Extremely Low Leakage Current
- High Surge Capability
- Small Size
- High Component Density
- Rugged Construction
- Reliability-Long Term Stability
- Outstanding Performance Over Wide Frequency Range
- Wide Temperature Range

Catalog Ordering Information

TAP F 2.2 M 15

- **General Specifications**
- **Voltage**
- **Tolerance** M ±20%, K ±10%
- **Capacity in μF**
- **Lead Execution**
  - S = 0.100″ Lead Spacing
  - C = 0.200″ with Shoulder
  - D = 0.125″ Lead Spacing
  - B = 0.250″ Lead Spacing
  - F = Lock-In Leads 0.200″ Spacing
  - Y = Special
  - E = Tape and Reel

Packed in the following quantities:

Case Size	Quantity (units per bag)
1—8	500
9—12	100
13—15	50
1—5	1500 pcs/reel
6—8	1000 pcs/reel

Ratings

Capacitance: 0.1 to 330 μF (values up to 680 μF available on request)
Tolerance Range: ±20% (±10%)
Voltage: 3 to 50 volts
Temperature Range: Continuous operation between −55°C to +85°C

Standard Ratings

*Insert Lead Execution Letter & Tolerance Letter in the 2nd and 4th space to complete Ordering Code.

Code*	Cap μF	Case Size	Max Leak μA @ 25°C	Impedance Ω @ 25°C Nom	Impedance Ω @ 25°C Max	Max Diss Fac %
3 Volts — DC; 3.9 Volts — DC Surge @ 85°C						
TAP_10_3	10	1	1	3	9.5	
TAP_15_3	15	2	2	2	8.5	
TAP_22_3	22	3	2	1.5	5	8
TAP_33_3	33	4	3	0.8	3.5	
TAP_47_3	47	5	4	0.6	2	
TAP_68_3	68	6	5	0.5	2	8
TAP_100_3	100	7	10	0.5	1.5	10
TAP_150_3	150	9	10	0.4	0.9	10
TAP_220_3	220	9	15	0.4	0.9	10
TAP_330_3	330	11	20	0.3	0.7	10
6.3 Volts — DC; 8 Volts — DC Surge @ 85°C						
TAP_4.7_6.3	4.7	1	1	5.6	19	6
TAP_6.8_6.3	6.8	2	1	4	10	6
TAP_10_6.3	10	3	2	3	9.5	8
TAP_15_6.3	15	4	2	2.3	6.8	8
TAP_22_6.3	22	5	2	1.5	4	8
TAP_33_6.3	33	6	3	0.8	3.5	8
TAP_47_6.3	47	7	4	0.6	2	8
TAP_68_6.3	68	8	5	0.5	2	8
TAP_100_6.3	100	9	10	0.5	1.5	10
TAP_150_6.3	150	11	10	0.4	0.9	10
TAP_220_6.3	220	12	15	0.4	0.9	10
TAP_330_6.3	330	14	20	0.3	0.7	10
10 Volts — DC; 13 Volts — DC Surge @ 85°C						
TAP_3.3_10	3.3	1	1	8	22	6
TAP_4.7_10	4.7	2	1	5	12	6
TAP_6.8_10	6.8	3	2	3	9.5	6
TAP_10_10	10	4	2	2.4	7	8
TAP_15_10	15	5	2	1.8	4.5	8
TAP_22_10	22	6	3	1	3.5	8
TAP_33_10	33	7	5	0.8	2.2	8
TAP_47_10	47	8	5	0.6	2.2	8
TAP_68_10	68	9	10	0.5	1.8	8
TAP_100_10	100	11	15	0.4	1	10
TAP_150_10	150	13	20	0.4	0.9	10
TAP_220_10	220	14	20	0.3	0.8	10
15(16)† Volts — DC; 20 Volts — DC Surge @ 85°C						
TAP_2.2_15	2.2	1	1	10	25	6
TAP_3.3_16	3.3	2	1	6.5	13.5	6
TAP_4.7_16	4.7	3	2	5.8	12.8	6
TAP_6.8_16	6.8	4	2	5	12	6
TAP_10_16	10	5	2	2.5	5	8
TAP_15_16	15	6	3	1.5	4	
TAP_22_16	22	7	5	1	2.5	
TAP_33_16	33	8	5	0.8	2.2	8
TAP_47_16	47	10	10	0.6	1.5	
TAP_68_16	68	11	10	0.5	1.1	
TAP_100_16	100	13	15	0.4	0.9	10
TAP_150_16	150	15	20	0.3	0.8	10
20 Volts — DC; 26 Volts — DC Surge @ 85°C						
TAP_15_20	15	7	4	1.7	3.5	
TAP_22_20	22	7	5	1.2	2.5	
TAP_33_20	33	9	10	0.8	2	8
TAP_47_20	47	11	15	0.7	1.4	
TAP_68_20	68	12	15	0.6	1.1	
TAP_100_20	100	14	20	0.5	1.1	10
25 Volts — DC; 32 Volts — DC Surge @ 85°C						
TAP_1.5_25	1.5	1	1	12	25	4
TAP_2.2_25	2.2	2	1	9	15	6
TAP_3.3_25	3.3	3	1	6.5	14.5	6
TAP_4.7_25	4.7	4	2	4.5	7.5	6
TAP_6.8_25	6.8	5	3	3	5.5	6
TAP_10_25	10	6	4	2.4	4.2	
TAP_15_25	15	7	5	1.7	2.8	
TAP_22_25	22	9	10	1.2	2.5	8
TAP_33_25	33	10	10	0.8	1.8	
TAP_47_25	47	12	15	0.7	1.4	
TAP_68_25	68	13	15	0.6	1	8
35 Volts — DC; 46 Volts — DC Surge @ 85°C						
TAP_0.1_35	0.1			165	270	
TAP_0.15_35	0.15			110	160	
TAP_0.22_35	0.22	1	1	75	130	4
TAP_0.33_35	0.33			51	85	
TAP_0.47_35	0.47			37	58	
TAP_0.68_35	0.68	1	1	27	40	4
TAP_1.0_35	1.0	1	1	18	28	4
TAP_1.5_35	1.5	2	1	13	20	4
TAP_2.2_35	2.2	3	1	9	13	6
TAP_3.3_35	3.3	4	2	6	10	6
TAP_4.7_35	4.7	5	2	4	7	6
TAP_6.8_35	6.8	6	3	3	4.5	6
TAP_10_35	10	7	5	2.5	3.2	8
TAP_15_35	15	9	5	1.2	2.5	8
TAP_22_35	22	11	10	1	2	8
TAP_33_35	33	12	10	0.8	1.6	8
TAP_47_35	47	14	10	0.6	1.2	8
50 Volts — DC; 65 Volts — DC Surge @ 85°C						
TAP_0.1_50	0.1	1	1	170	270	
TAP_0.15_50	0.15	1	1	105	160	
TAP_0.22_50	0.22	1	1	80	130	4
TAP_0.33_50	0.33	1	1	50	85	
TAP_0.47_50	0.47	2	1	32	55	
TAP_0.68_50	0.68	3	1	25	38	4
TAP_1.0_50	1.0	4	1	16	26	4
TAP_1.5_50	1.5	5	2	13	18	4
TAP_2.2_50	2.2	6	2	8	12	6
TAP_3.3_50	3.3	7	3	6.2	9	6
TAP_4.7_50	4.7	8	3	3.5	6.5	6
TAP_6.8_50	6.8	9	4	2.2	4.2	6
TAP_10_50	10	11	6	1.8	3	8

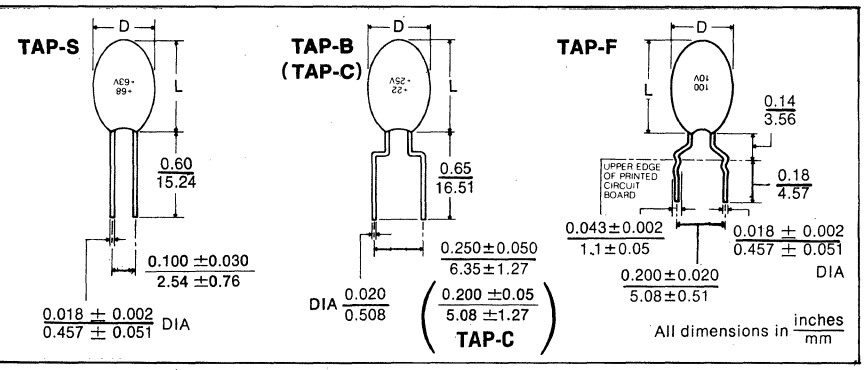
† Branded with voltage value in bracket.

For intermediate capacitance and voltage values, consult your local ITT representative.

Outline Dimensions (Maximum)

Case Size	Diameter-D Inches	Length-L Inches
1	0.157	0.275
2	0.177	0.275
3	0.196	0.314
4	0.196	0.334
5	0.216	0.354
6	0.236	0.374
7	0.255	0.393
8	0.334	0.452
9	0.374	0.531
10	0.374	0.551
11	0.393	0.551
12	0.413	0.591
13	0.413	0.630
14	0.433	0.650
15	0.433	0.669

TAP-S Standard Case Size 1-8
TAP-B Standard Case Size 1-15
TAP-F Standard Case Size 1-15



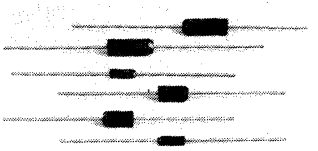
ITT COMPONENTS • 1201 E. McFadden Avenue • Santa Ana, California 92705 • Phone: (714) 836-0351 • TWX: 910-595-1744 • Telex: 69-1389

ITT Components
A Unit of ITT Corporation

Subminiature Epoxy Molded Solid Tantalum Capacitors

TAR

- Axial Leads For Automatic Insertion
- Subminiature Size For High Component Density
- Rugged Precision Molded Construction
- Polarity Positively Identified By Tapered Nose
- Extremely Low Leakage Current
- High Surge Capability
- Reliability-Long Term Stability
- Outstanding Performance Over Wide Temperature Range



Catalog Ordering Information

TAR A 1.0 M 35 — General Specifications

- 35 — Voltage
- M — Tolerance: M ±20%, K ±10%, J ±5%
- 1.0 — Capacity in µF
- A — Case Size

Standard Packaging is Tape and Reel

Case A 3000 pcs/reel
Case B 2000 pcs/reel
Case C 1000 pcs/reel

Ratings

Capacitance: 0.1 to 68 µF
Tolerance Range: ±20%, ±10%, ±5%
Voltage: 6.3 to 35 volts DC
Temperature Range: Continuous operation between −55°C to +85°C
Impedance @ 100 kHz:

Case Size	Impedance maximum
A	≤ 06.8 µF = 26 ohms ≥ 0.68 µF = 10 ohms
B, C	5 ohms

Temperature	−55°C	+85°C
% Change	−8	+12

Capacitance Change With Temperature: The change in capacitance from +25°C to a given temperature.

Standard Ratings

Insert Tolerance Letter in the space to complete Ordering Code.

Code #	Capacitance µF	Case Size	Maximum Leakage µA @ 25°C	Maximum Dissipation Factor %
6.3 Volts — DC; 8 volts — DC Surge @ 85°C				
TARA8.2_6.3	8.2	A	1	6
TARA10_6.3	**10.0**	A	1	6
TARA12_6.3	12.0	A	1	6
TARB22_6.3	**22.0**	B	1	6
TARB27_6.3	27.0	B	2	6
TARB33_6.3	**33.0**	B	2	6
TARC56_6.3	56.0	C	4	6
TARC68_6.3	**68.0**	C	4	6
10 Volts — DC; 13 volts — DC Surge @ 85°C				
TARA4.7_10	**4.7**	A	1	6
TARA5.6_10	5.6	A	1	6
TARA6.8_10	**6.8**	A	1	6
TARA8.2_10	8.2	A	1	6
TARB18_10	**18.0**	B	1	6
TARB22_10	**22.0**	B	2	6
TARC39_10	39.0	C	4	6
TARC47_10	**47.0**	C	4	6
16 Volts — DC; 20 Volts — DC Surge @ 85°C				
TARA3.3_16	**3.3**	A	1	6
TARA3.9_16	3.9	A	1	6
TARA4.7_16	**4.7**	A	1	6
TARB12_16	12.0	B	2	6
TARB15_16	**15.0**	B	2	6
TARC27_16	27.0	C	4	6
TARC33_16	**33.0**	C	4	6
20 Volts — DC; 26 Volts — DC Surge @ 85°C				
TARA2.7_20	2.7	A	1	6
TARA3.3_20	**3.3**	A	1	6
TARA3.9_20	3.9	A	1	6
TARB8.2_20	8.2	B	2	6
TARB10_20	**10.0**	B	2	6
TARC18_20	18.0	C	4	6
TARC22_20	**22.0**	C	4	6

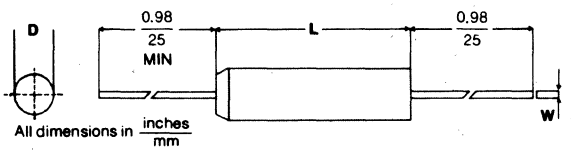
Code #	Capacitance µF	Case Size	Maximum Leakage µA @ 25°C	Maximum Dissipation Factor %
25 Volts — DC; 33 Volts — DC Surge @ 85°C				
TARA1.5_25	**1.5**	A		
TARA1.8_25	1.8	A		
TARA2.2_25	**2.2**	A	1	6
TARB2.7_25	2.7	A		
TARB3.3_25	**3.3**	A		
TARB3.9_25	3.9	B	1	
TARB4.7_25	**4.7**	B	1	
TARB5.6_25	5.6	B	2	6
TARB6.8_25	**6.8**	B	2	
TARC8.2_25	8.2	B	3	
TARC10_25	**10.0**	B	3	
TARC12_25	12.0	C	4	6
TARC15_25	**15.0**		4	
35 Volts — DC; 46 Volts — DC Surge @ 85°C				
TARA0.1_35	**0.1**			
TAR0.12_35	0.12			
TARA0.15_35	**0.15**	A	1	6
TARA0.18_35	0.18			
TARA0.22_35	**0.22**			
TARA0.27_35	0.27			
TARA0.33_35	**0.33**			
TARA0.39_35	0.39	A	1	6
TARA0.47_35	**0.47**			
TARA0.56_35	0.56			
TARA0.68_35	**0.68**	A		
TARA0.82_35	0.82	A		
TARA1.0_35	**1.0**	A	1	6
TARA1.2_35	1.2	A		
TARB1.5_35	**1.5**	A		
TARB1.8_35	1.8		1	
TARB2.2_35	**2.2**		1	
TARB2.7_35	2.7	B	1	6
TARB3.3_35	**3.3**		1	
TARB3.9_35	3.9		2	
TARB4.7_35	**4.7**	B	2	
TARC5.6_35	5.6	C	3	
TARC6.8_35	**6.8**	C	3	6
TARC8.2_35	8.2	C	4	
TARC10_35	**10.0**	C	4	

All capacitors are supplied in the highest voltage available at a given capacitance value and case size.

BOLDFACE items shown are preferred value (E6 range) readily available for delivery.

Outline Dimensions

Case Size	Diameter — D inches ±0.010	Length — L inches ±0.010	Lead Wire Diameter — W inches ±.0.002
A	0.10	0.29	0.02
B	0.17	0.34	0.02
C	0.19	0.53	0.02



ITT Components
A Unit of ITT Corporation

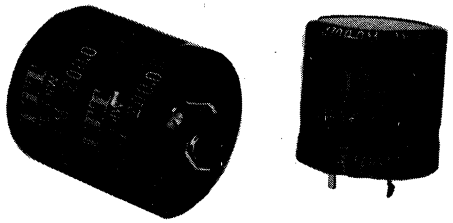
Aluminum Electrolytic Capacitors

PC Mount Power Filtering

ORDERING INFORMATION

FHW	470	M	200

- Series Designation (FHW - Low Profile)
- Nominal Capacitance (Micro Farads)
- Tolerance Designation (as specified)
- Rated Voltage (DC) (FTW - small diameter)

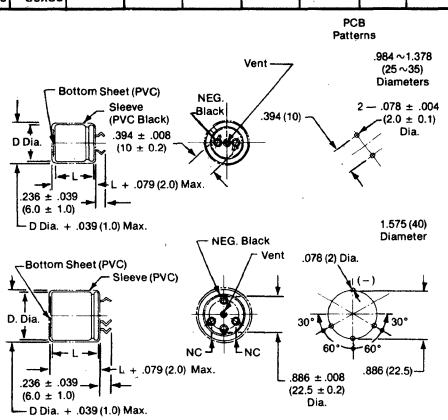


Standard Capacitance Range: FHW Series
(Case Diameters and Lengths in mm)

WV / μF	16	25	35	50	63	80	100	160	180	200	250
100										25x25	25x25
220								25x25	30x25	30x25	30x30
330								30x25	30x30	30x30	35x30
470								30x30	35x30	35x30	40x30
680								35x30	40x30	35x40	40x40
1000				25x25	25x25	30x25	30x30	40x30	40x40	51x40	
2200			25x25	30x25	30x30	30x30	40x30				
3300		25x25	30x25	30x30	35x30	40x30	51x40				
4700	25x25	30x25	30x30	35x30	40x30	51x40	51x40				
6800	30x25	30x30	35x30	40x40	51x40	51x40	63.5x40				
10000	30x30	35x30	40x40	51x40	63.5x40	63.5x40	63.5x40				
15000	35x30	40x40	51x40	63.5x40	63.5x40	63.5x50					
22000	40x40	51x40	63.5x40	63.5x50							

Standard Capacitance Range: FTW Series
(Case Diameters and Length in mm)

WV / μF	16	25	35	50	63	80	100	160	180	200	250
220									25x40	25x40	25x50
330								25x40	25x40	25x50	30x50
470					22.4x25	22.4x30	22.4x30	25x50	25x50	30x50	
680					22.4x30	22.4x40	22.4x40	30x50	30x50		
1000			22.4x25	22.4x25	22.4x30	22.4x40	25x40				
2200		22.4x25	22.4x30	22.4x40	25x40	25x50	30x50				
3300	22.4x25	22.4x30	22.4x40	25x40	25x50	30x50					
4700	22.4x30	22.4x40	25x40	25x50	30x50						
6800	22.4x40	25x40	25x50	30x50							
10000	25x40	25x50	30x50								
15000	30x50	30x50									



PERFORMANCE SPECIFICATIONS:

Operating Temperature Range: −40°C to +85°C (−40°F to +185°F)

Leakage Current: 0.02 CV or 2 mA whichever is less
(measured after 3 minutes of rated voltage)
C = Nominal Capacitance
V = Rated Voltage

Capacitance Tolerance: ±20% (M)
(measured at 20°C (68°F), 120 Hz)

Dissipation Factor: (measured at 20°C (68°F), 120 Hz)

FHW Series:

Rated Voltage	16	25	35	50	63-100	160-250
Up to 2200μF	—	—	0.13	0.10	0.08	0.10
3300μF to 6800μF	0.20	0.18	0.15	0.13	0.15	—
10,000μF	0.25	0.20	0.18	0.18	0.18	—
15,000μF to 22,000μF	0.30	0.25	0.20	0.20	0.20	—

FTW Series:

Rated Voltage	16-25	36-63	80-100	160-250
Up to 2200μF	0.20	0.18	0.15	0.10
3300μF to 6800μF	0.25	0.20	0.20	—
10,000μF to 15,000μF	0.35	0.30	—	—

Impedance Ratio at Low Temperature: 120 Hz

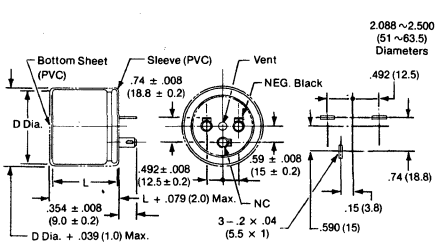
Ratio Z / WV	16	25-35	50-100	160-250
Z @ −25°C (−68°F)/Z @ +20°C (+68°F)	3	2	1.5	2
Z @ −40°C (−40°F)/Z @ +20°C (+68°F)	12	4	3	8

Surge Voltage:

DC Rated Voltage	16	25	35	50	63	80	100	160	180	200	250
Surge Voltage	20	32	44	63	79	100	125	200	225	250	300

Load Life: 1000 hrs @ +85°C (185°F), rated voltage
Capacitance Change Max.: Within ±20% of initial value
Leakage Current: Within specified value
Dissipation Factor: Within ±150% of specified value

Shelf Life: 1000 hrs @ +85°C (+185°F), no voltage applied
Capacitance Change Max.: Within ±20% of initial value
Leakage Current: Within ±200% of specified value
Dissipation Factor: Within ±150% of specified value



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ITT Components
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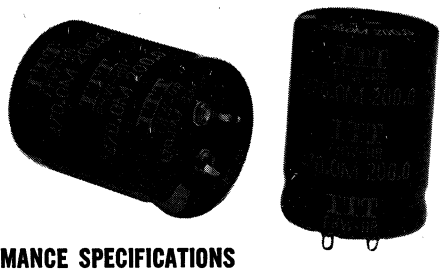
FHR Aluminum Electrolytic Capacitors

Low ESR, High Ripple, PCB Mounting

ORDERING INFORMATION

FHR 470 M 200

- Series Designation (FHR Low Profile PC Mount)
- Nominal Capacitance (Micro Farads)
- Tolerance Designation (As Specified)
- Rated Voltage (DC)



Standard Item of FHR Series
(Case Diameters and Lengths in mm)

WV / D* / Cap (μF)	160			200			250		
	25	30	35	25	30	35	25	30	35
150	25x25			25x25			25x30	30x25	
220	25x30	30x25		25x35	30x25		25x40	30x30	
330	25x35	30x30			30x35		25x50	30x40	35x30
390	25x40			25x50	30x40	35x30			35x35
470	25x50	30x35	35x30		30x40	35x30		30x50	35x40
560		30x40			30x50	35x35			
680		30x50	35x35			35x40			35x50
820			35x40			35x50			
1000			35x50			35x50			

Ripple Current Max.
[In mA rms, 85°C (185°F) 120 Hz]

WV / D* / Cap (μF)	180			200			250		
	25	30	35	25	30	35	25	30	35
150	1000			1230			1300	1330	
220	1570	1610		1610	1610		1750	1700	
330	2000	2080			2200		2300	2300	2250
390	2300			2500	2450	2500			2600
470	2750	2600	2670		2730	2800		2940	2980
560		2980			3210	3060			
680		2500	3370			3600			3800
820			3950			4150			
1000			4200			4500			

ESR Maximum
[In ohms @ 25°C 120 Hz]

Cap.	150	220	330	390	470	560	680	820	1000
ESR	0.88	0.60	0.40	0.34	0.28	0.24	0.20	0.16	0.13

Impedance Ratio at Low Temperature: 120 Hz

Compartment Z / WV	160	200	250
Z @ −25°C (−13°F)/ Z @ +20°C (+68°F)	2	2	2
Z @ −40°C (−40°F)/ Z @ +20°C (+85°F)	8	8	8

MECHANICAL SPECIFICATIONS

Lead Solderability: Meets the requirements of MIL-STD-202, Method 208.

Marking: Consists of series type, nominal capacitance, rated voltage, temperature range, anode and/or cathode identification, vendor identification.

Recommended Cleaning Solvents: Methanol, isopropanol, ethanol, isobutanol, petroleum ether, propanol and/or commercial detergents. Halogenated hydrocarbon cleaning agents such as freon (MF, TF, or TC), trichloroethylene trichloroethane, or methylchloride are not recommended as they may damage the capacitor.

PERFORMANCE SPECIFICATIONS

Operating Temperature Range: −40°C to +85°C (−40°F to +185°F)

Leakage Current: I = 0.02 CV or 2 mA maximum whichever is less (measured 3 minutes after application of rated voltage.)
I = Leakage current (μA)
C = Nominal capacitance (μF)
V = Rated voltage (V)

Capacitance Tolerance: ±20% (M)
[measured at 20°C (68°F), 120 Hz]

Dissipation Factor: 0.1 Max. [measured at 20°C (68°F), 120 Hz]

PERMISSIBLE RMS RIPPLE CURRENT

Where the -HR series capacitors are operated at a temperature other than +85°C, the ripple current may be increased by the following factor.

Maximum RMS Ripple Current (120 Hz)

45°C	60°C	70°C	85°C	105°C
1.36	1.30	1.15	1.0	0.5

Where the FHR series capacitors are operated at frequencies other than 120 Hz, the ripple current may be increased by the following factor.

Maximum RMS Ripple Current (85°C)

Rated Voltage (V DC)	50 Hz	120 Hz	300 Hz	1 KHz	10 KHz	50 KHz
160-200	0.75	1.00	1.18	1.30	1.45	1.50
1.36	0.84	1.00	1.15	1.20	1.30	1.35

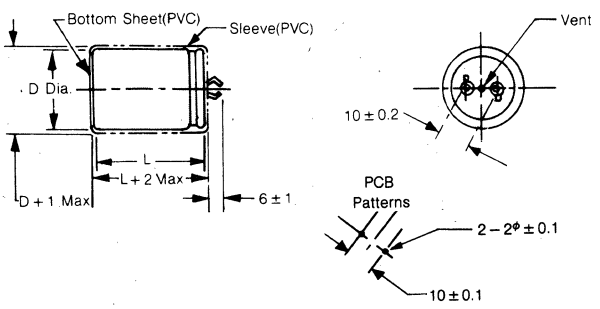
Surge Voltage:

DC Rated Voltage	160	200	250
Surge Voltage	200	250	300

Load Life: 1000 hrs @ +85°C (+185°F) and rated voltage, applied ripple current
Capacitance Change Max.: Within ±20% of initial value
Leakage Current: Within specified value
Dissipation Factor: Within 200% of specified value

Shelf Life: 1000 hrs @ +85°C (+185°F) No voltage applied
Leakage Current: Within ±200% of specified value
Dissipation Factor: Within ±200% of specified value
Capacitance: Within ±20% of initial values

Case Sizes and Dimensions:



ITT Components
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RND, TND Aluminum Electrolytic Capacitors

Bi-Polar Miniature (RND: Radial Leads, TND: Axial Leads)

Standard Items of RND Series
(Radia Lead Type)

Cap (μF) \ WV	10	16	25	50
0.47				5 x 11
1.0				5 x 11
2.2				5 x 11
3.3				5 x 11
4.7			5 x 11	6.3 x 11
10			5 x 11	8 x 11.5
22	5 x 11	6.3 x 11	6.3 x 11	10 x 12.5
33	6.3 x 11	6.3 x 11	8 x 11.5	10 x 16
47	6.3 x 11	8 x 11.5	10 x 12.5	10 x 20
100	8 x 11.5	10 x 12.5	10 x 16	13 x 20
220	10 x 16	10 x 20	13 x 20	
330	10 x 20	13 x 20		
470	13 x 20	13 x 25		
1000	16 x 25	16 x 25		

Ripple Current Maximum
[In mA rms 85°C (185°F) 120 Hz]

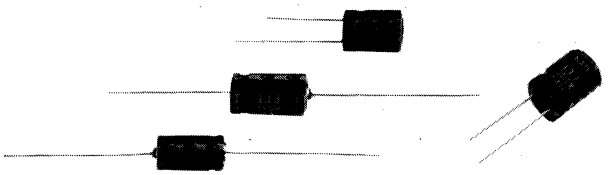
Cap (μF) \ WV	10	16	25	50
0.47				10
1.0				16
2.2				26
3.3				33
4.7			27	42
10			50	70
22	62	75	90	120
33	82	100	115	160
47	105	125	150	200
100	165	200	260	340
220	270	340	420	
330	340	430		
470	440	550		
1000	700	900		

Standard Items of TND Series
(Axial Lead Type)

Cap (μF) \ WV	16	25	50
0.47			6.3 x 20
1.0			6.3 x 20
2.2			6.3 x 20
3.3			6.3 x 20
4.7		6.3 x 20	8 x 20
10		8 x 20	8 x 20
22		8 x 20	10 x 31.5
33	8 x 20	10 x 20	10 x 31.5
47	10 x 25	10 x 25	13 x 31.5
100	10 x 31.5	13 x 31.5	16 x 31.5
220	13 x 31.5	16 x 31.5	
330	13 x 31.5	16 x 40	
470	16 x 31.5		

Ripple Current Maximum
[In mA rms 85°C (185°F) 120 Hz]

Cap (μF) \ WV	16	25	50
0.47			10
1.0			16
2.2			26
3.3			33
4.7		27	42
10		50	70
22		90	120
33	100	115	160
47	125	150	200
100	200	260	340
220	340	420	
330	430		
470	550		



ORDERING INFORMATION

RND 50V 3.3 μF

Series Designation
(RND Bi-Polar Radial Type)
(TND Bi-Polar Axial Type)

Rated Voltage (DC)

Nominal Capacitance (Micro Farads)

PERFORMANCE SPECIFICATIONS

Operating Temperature Range: −40°C to +85°C (−40°F to +185°F)

Leakage Current: I = 0.03 CV +3 μA minimum (measured 3 minutes after application of rated voltage)
I = Leakage current (μA) V = Rated voltage (V)
C = Nominal capacitance (μF)

Capacitance Tolerance: ±20% (M) [measured at 20°C (68°F), 120 Hz]

Dissipation Factor: [measured at 20°C (68°F), 120 Hz]

Rated Voltage	10	16	25	50
0.47 μF to 1000 μF	0.25	0.20	0.17	0.15

Impedance Ratio at Low Temperature: 120 Hz

Comparison Z \ WV	10	16	25	50
Z @ −25°C (−13°F)/ Z @ +20°C (+68°F)	3	2	2	2
Z @ −40°C (−40°F)/ Z @ +20°C (+68°F)	8	6	4	3

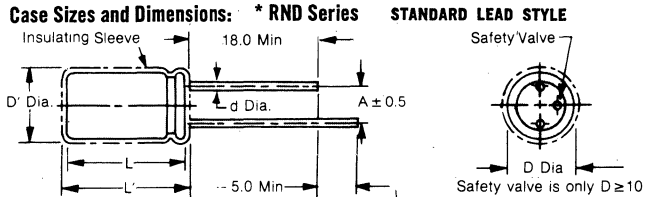
Surge Voltage:

DC Rated Voltage	10	16	25	50
Surge Voltage	13	20	32	63

Load Life: Rated voltage is applied at 85°C 250 hrs. and then rated voltage is applied at 85°C 250 hrs. after polarity inverts, and then return to 20°C
Leakage Current: Within values specified above
Dissipation Factor: Within 200% of specified value
Capacitance: Within 20% of initial values

Shelf Life: 500 hrs @ +85°C (+185°F) No voltage applied
Leakage Current: Within ±200% of values specified above
Dissipation Factor: Within ±150% of specified values
Capacitance Change Max.: Within ±20% from initial value

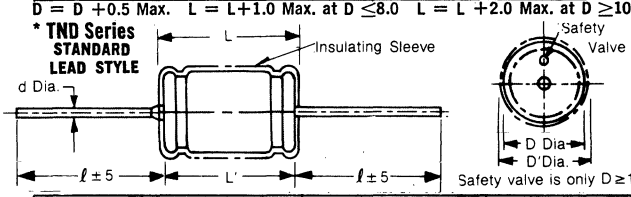
Case Sizes and Dimensions: * RND Series STANDARD LEAD STYLE



D	5.0	6.3	8.0	10.0	13.0	16.0
A	2.0	2.5	3.5	5.0		7.5
d		0.5		0.6		0.65

D = D +0.5 Max. L = L+1.0 Max. at D ≤8.0 L = L +2.0 Max. at D ≥10.0

*** TND Series STANDARD LEAD STYLE**



D	6.3-8.0	10.0-13.0	16.0
d	0.6	0.6	.08
l	38.0	38.0	38.0

D = D +0.5 Max. L = L+1.0 Max. at D ≤8.0 L = L +2.0 Max. at D ≥10.0

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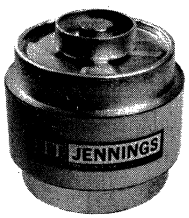
Vacuum Capacitors

Jennings offers the broadest available line of high voltage capacitors for radio frequency applications. Units are available in glass and ceramic envelopes with working voltage ratings of 2 kv to 36 kv, at capacitance values to 5000 pfd, with current ranges tp 420 Amps RMS (air-cooled) and 1,000 Amps RMS (water-cooled), depending upon capacity, frequency, and working voltage. The design of Jennings Vacuum and Gas capacitors allows a number of electrical, mechanical and environmental advantages which include:

1) HIGH VOLTAGE — The high dielectric strength allows maximum voltage levels for a given capacitance rating.
2) HIGH CURRENT — Extremely low losses occur because of the dielectric, low loss glass and ceramic envelopes, and heavy copper construction. Jennings capacitors are able to handle large currents at high RF frequencies that would destroy other types of capacitors.
3) COMPACT DESIGN — Units are quite small for their power handling capabilities.
4) HIGH Maximum to Minimum CAPACITY RATIO — Capacity change ratios are available to 140:1, making them desirable for wide tuning ranges.
5) SELF-HEALING — The design construction permits moderate overloads that would damage other materials.
6) RUGGED OPERATION — Vacuum capacitors are free from internal degradation due to extreme environmental conditions.



VACUUM FIXED CAPACITORS

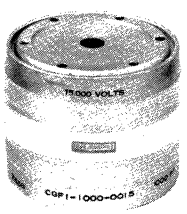
Peak Voltage Kilovolts				Capacity pF	Continuous RMS Amperes[2] (Max.)	Nominal Dimensions[3] (Inches)	
Test 60 Hz	RF Working[1] (Peak)	Type*				Length	Diameter
5	3	G	JCSL	1000, 1500, 2000	75	4.0	2.9
15	9		JCSF	25, 40, 50, 80, 120, 150	40	1.7	1.7
15	9		JCS	250, 400, 500	90	4.0	3.1
15	9		MCI	500, 750, 1000	120	4.1	4.1
15	9		MMC	1500, 2000, 5000	220	13.0	9.3
15	9		MMCI	2000	200	4.9	6.1
15	9	C	CFDP	1500, 2000	200	3.3	5.6
12	7		CFDS	1000	95	4.6	3.6
20	12	G	MC	500, 750, 1000	150	8.4	5.0
30	18		MLC	500, 750, 1000	200	9.3	4.5
30	18	C	CY	1, 2, 3, 5	12	3.3	0.8
35	25		CLF1	6, 12, 25, 50, 75, 100	85	6.5	2.3
30	20		CLF1	150, 200, 250	90	6.5	2.6
25	15		CFED	500, 750, 1000	160	3.8	4.6
35	21		CFFP	2000, 2500	400	5.8	8.2
55	33	G	MMHC	450	210	9.3	6.1
60	36	C	CFHD	12, 25, 50, 100, 200	145	5.2	3.4
55	33		CFHP	450	300	5.5	5.6
50	30		CFHP	1000, 2000	425	6.2	8.2

GAS FIXED CAPACITORS

Peak Voltage Kilovolts				Capacity pF	Continuous RMS Amperes[2] (Max.)	Nominal Dimensions[3] (Inches)	
Test 60 Hz	RF+DC	RF Working	Type*			Length	Diameter
20	18	12	C CGF1-1000	1000	215	3.5	4.8
35	30	21	CGF2-1000	1000	270	4.0	6.0
50	40	25	CGF2-500	500	290	5.5	5.7

VACUUM CAPACITORS, TRIMMABLE

Peak Voltage Kilovolts			Capacity Range (pF)	Continuous RMS Amps, Max.	Nominal Dimensions (Inches)	
Test 60 Hz	RF Working (Peak)	Type			Length	Diameter
10	6	CTV3 (10 models)[4]	338-1377	150	5.3	4.5
20	12	CTV1 (5 models)[4]	76-346	125	5.3	4.5
50	35	CTV2 (6 models)[4]	18-137	85	5.3	4.5



* G = Glass; C = Ceramic

[1] The maximum RF working voltage that can be applied over the 2-32 MHz frequency range while not exceeding the RF current rating.

[2] RF current rating is dependent upon capacity, frequency and working voltage. Write for complete applications data.

[3] Dimensions of largest unit in a series.

[4] Number of models required to cover capacity range.

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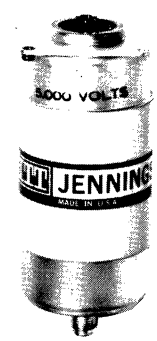
Vacuum Variable Capacitors

Peak Voltage Kilovolts				Capacity pF	Continuous RMS Amperes[2] (Max.)	Nominal Dimensions[3] (Inches)	
Test 60 Hz	RF Working[1] (Peak)		Type*			Length	Diameter
5	3	G	UCSL	4-250, 5-500	35	4.1	2.2
5	3		USL	5-500	35	5.8	2.4
5	3		UCSL	5-750, 7-1000, 10-1500, 20-2000	60	8.3	3.1
3	2		UCSL	50-3000, 100-5000	55	8.8	4.1
5	3	C	CSV1	5-500	45	5.8	2.4
5	5		CMV2	6-500	38	3.6	1.8
5	5		CMV1	8-650	40	4.3	1.7
5	3		CVCE	10-750	80	7.1	3.4
3	3		CVCJ	7-1000	70	7.6	3.1
3	3		CMV1	8-1000	40	4.3	1.7
5	3		CSV1	10-1000	70	5.0	3.1
5	3		CVCD	10-1500, 20-2000, 50-3000	100	8.3	4.6
5	5		CMV2	20-2000	45	5.3	3.8
5	5		CMV1	25-4000	70	6.5	3.3
15	9	G	UCSB	5-100	40	4.9	2.4
15	9		UCS	5-200, 10-300, 25-500	60	9.0	3.1
15	9		UCSXF	12-1000, 15-1200	70	10.0	4.3
15	9		UCSX	25-700, 25-1000	70	9.8	3.7
15	9		VMMC	50-1000, 100-2000	200	15.6	6.1
12	7		UCSXF	20-1500, 50-2300	70	10.0	5.1
15	9	C	CVDP	35-1500, 50-2300	100	9.8	5.6
15	9	C	CVED	100-5000	200	21.3	9.2
15	9	C	CADD	3-30	20	4.1	1.3
15	9		CSVF	12-500	70	7.9	3.6
15	9		CVDD	6.5-50, 10-100	65	6.6	2.4
15	9		CVDD	10-300, 20-500	95	7.5	3.4
20	12		CVEP	25-500, 50-1000, 100-1500	210	10.2	7.2
15	9		CVDD	25-1000	150	8.0	4.6
15	9		CVEP	100-2000	200	10.2	7.2
30	18		CVFA	10-75	50	8.8	2.7
55	33		CVHP	10-250, 25-450, 30-650	240	11.9	7.2
40	24		CVFP	15-250, 25-450	170	9.6	5.6
50	30		CWV2	25-450, 30-650 (water cooled)	800	17.9	7.6
40	24		CAV2	35-1000 (air cooled)	425	11.7	7.6
40	24		CVFP	35-1000	225	11.7	7.2
50	30		CVHP	60-1000	250	14.5	8.0
50	30		CWV1	100-1000 (water cooled)	800	21.6	8.6
50	30		CAV3	40-1000 (air cooled)	500	14.5	8.6
60	36		CWV1	100-1600 (water cooled)	1000	23.0	12.5
40	24		CWV2	100-1600 (water cooled)	790	25.0	8.6
35	21		CVFP	100-1500, 100-2000	220	14.5	8.2



GAS VARIABLE CAPACITORS

Peak Voltage Kilovolts				Capacity pF	Continuous RMS Amperes[2] (Max.)	Nominal Dimensions[3] (Inches)	
Test 60 Hz	RF Working[1]		Type*			Length	Diameter
5	3	C	CHV1	1.5-45	15	2.9	0.9
15	9		CHV1	2.5-50	25	6.4	1.4

* G = Glass; C = Ceramic

[1] RF working voltage is the maximum RF voltage that can be applied to the capacitor over the 2-32 MHz frequency range, provided the RF current rating is not exceeded.

[2] RF current rating is dependent upon capacity, frequency and working voltage. Write for complete applications data.

[3] Dimensions of largest unit in a series.

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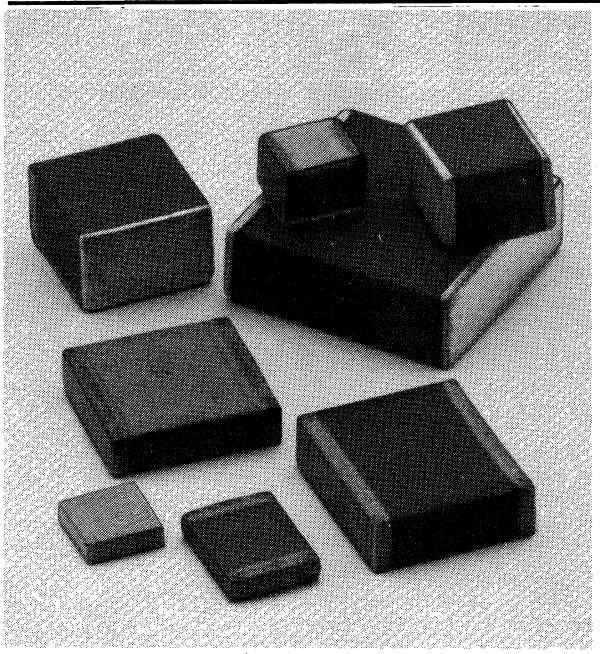

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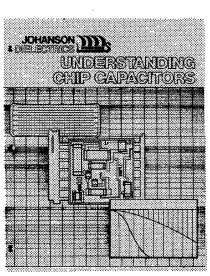
TWX 910-498-2735



Understanding Chip Capacitors

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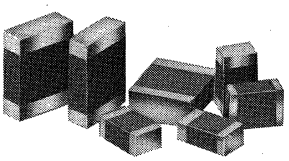
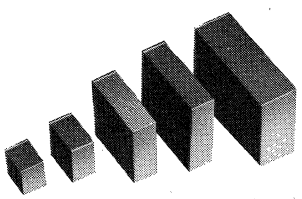
from JOHANSON DIELECTRICS

Ultra High Capacitance Chip Capacitors



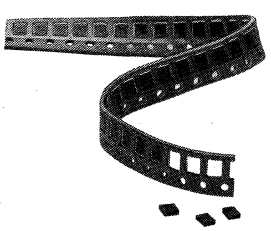
Fourteen configurations are available in four basic dielectrics: NPO/COG, BX/X7R, Z5U, and Y5V characteristics, to meet MIL-C-55681A and EIA 198B specifications. Capacitors feature high volume efficiency of capacitance, and are ideal for hybrid circuit applications.

High Voltage Chip Capacitors



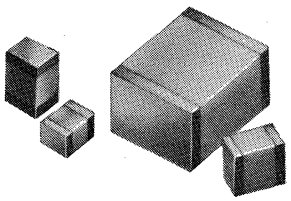
Available in either NPO/COG or BX/X7R dielectric, these units are designed to obtain high voltage values to 4000 VDCW. Typical applications include high voltage power supplies and voltage multiplier circuits.

Multilayer Ceramic Chip Capacitors on Tape & Reel



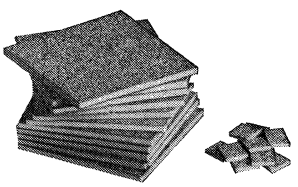
Ceramic chip capacitors designed for automatic placement on ceramic substrates on printed circuit boards in high volume surface mounted applications. Offered in three sizes R15, R18 and S41 they are suited for use with all the popular automatic placement systems. Available in 8mm tape on reel. Larger size units can be provided on 12mm tape on reel.

High Q Microwave Chip Capacitors



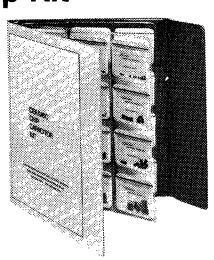
High Q microwave chip capacitors are available in four basic sizes, displaying excellent performance in the VHF, UHF and microwave ranges. The configuration, insertion loss and resonance-free performance make these chips ideal for microstrip and hybrid MIC applications.

Ceramic Capacitor Wafers (Single Layer)

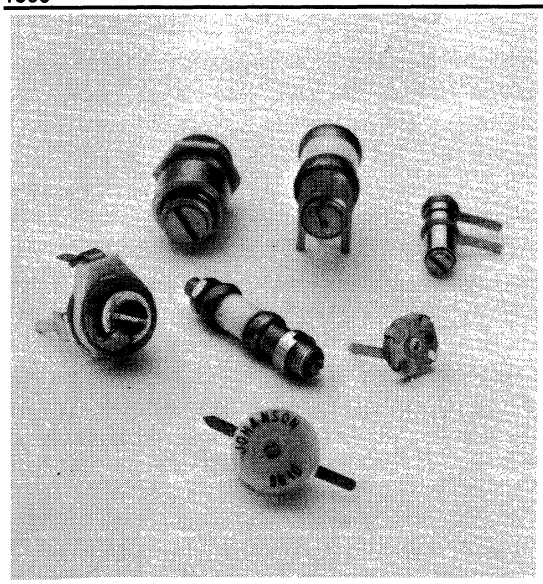


Ideally suited for micromodule and miniature hybrid integrated circuits where low profile requirements preclude the use of conventional multilayer chip capacitors. These units are used as bypass, coupling and filtering elements, (to 18GHz in microwave applications). Custom configurations are also available for high voltage applications to 15 KV.

Chip Kit



Designer kits contain standard size chips in popular capacitance values and dielectric characteristics with palladium silver terminations. Kits are supplied in a special vinyl cover for convenient shelf storage with each chip value individually packaged for easy acesss. Available with NPO/COG dielectric No. S-900, BX/X7R and Y5V dielectric No. S-905 ceramic capacitor wafers (single layer) No. S-910 and High Q S-915.



Johanson Variable Capacitors

For 40 years the name Johanson has been synonymous with leadership in the design and manufacture of high quality variable capacitors. Our application engineers have the know-how to solve your critical application problems . . . we invite your inquiries.

When you specify Johanson, you are specifying the finest in variable capacitors.

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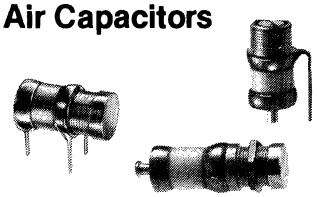
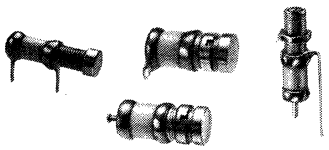
Standard Air Capacitors



- ☐ Capacitance ranges: .8-10pf to 1-30pf
- ☐ Q's to > 10,000
- ☐ Excellent tuning stability and low dynamic noise
- ☐ Patented* self-locking constant torque adjustment mechanism
- ☐ Qualified to MIL-C-14409D, QPL approved
- ☐ Engineering prototype kit JK-500

*U.S. Patent No. Re. 30,406

Miniature Air Capacitors



- ☐ Capacitance ranges: .35-3.5pf to .8-10pf
- ☐ Q's to > 10,000
- ☐ Patented* self-locking constant torque adjustment mechanism
- ☐ Ideal for miniature microwave, VHF and UHF applications
- ☐ Engineering prototype kit JK-500

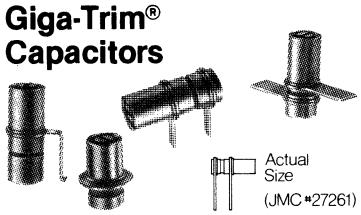
*U.S. Patent No. Re. 30,406

Thin-Trim® /Seal-Trim® Ceramic Capacitors

- ☐ Capacitance ranges: .2-.6pf to 20-100pf
- ☐ Q's to > 3000 at 100 MHz
- ☐ Ideal for sub-miniature hybrid circuit applications
- ☐ Seal-Trims impervious to all standard PCB cleaning solvents
- ☐ Conform to MIL-C-81 requirements
- ☐ Engineering prototype kits available

U.S. Patent No. 4,179,722

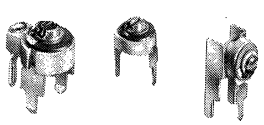
Giga-Trim® Capacitors



- ☐ Capacitance ranges: .3-1.2pf to .8-8pf
- ☐ Q's over 4000 at 250 MHz
- ☐ Ideal for microwave oscillators and filters
- ☐ Qualified to MIL-C-14409D, QPL approved
- ☐ New Zero TC verisons
- ☐ Engineering prototype kit JK-272

U.S. Patent No. Re. 30,406

Variable Ceramic Capacitors



- ☐ Low cost
- ☐ Broad tuning ranges: 1.7-6pf to 6.0-70pf
- ☐ Top, side and bottom tuning styles available
- ☐ Ideal for crystal oscillators, CATV amplifiers and all varieties of test and communication equipment
- ☐ Engineering prototype kit JK-930

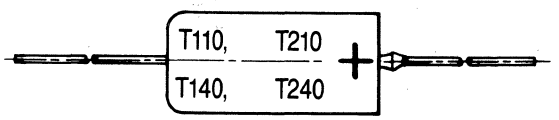
Microwave Tuning Elements

- ☐ Provide a unique money-saving means of introducing a variable reactance into waveguides, cavities, and other microwave structures
- ☐ High resolution
- ☐ Patented* self-locking constant torque adjustment mechanism

*U.S. Patent No. Re. 30,406

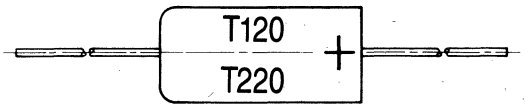
KEMET UNION CARBIDE-ELECTRONICS DIVISION TANTALUM, CERAMIC & FILM CAPACITORS

UNION CARBIDE



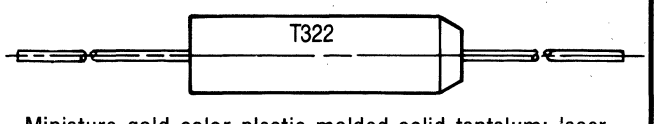
T212(CSR13), T242(CSR23), T252(CSR33), T262(CSR21) per MIL-C-39003 also available.

Standard MIL case; hermetically sealed; leading solid tantalum capacitors in use today; compact; rugged; for coupling bypass, filtering and R-C timing circuits; stable; low DC leakage; dissipation factor and impedance. Cap Values from .0047-330 uF; ±20%, ±10%, and ±5% tol., 6-125VDC. Higher CV values available in T140 series. T212 series per Mil-C39003 also available. 4 case sizes. T110 available in lead tape & reel.

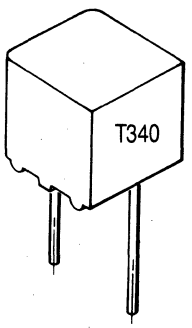


T222(CSR09) per MIL-C-39003 also available.

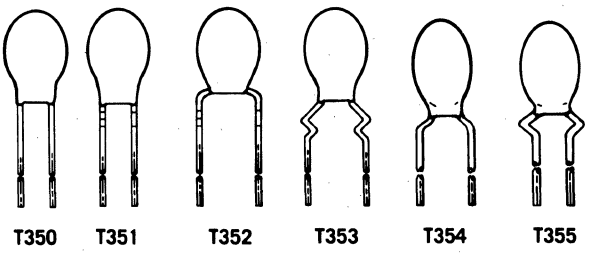
Ultra miniature, hermetically sealed, solid tantalum; ideal for cordwood construction. Hermetically seated; cap. Values from .0047 to 22uF ±20%;10% and ±5% tol., 6-125VDC.



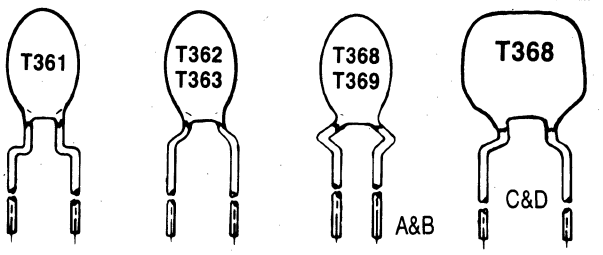
Miniature gold color plastic molded solid tantalum; laser marked; low impedance at high frequencies makes especially suitable for decoupling required by high speed computers. Cap. values from 0.1-330uF, 2-50 VDC. 6 case sizes. T323(CX01 & CX05) per MIL-C-49137 also available. Available in lead tape & reel.



Precision gold color plastic molded; laser marked; solid tantalum rectangular plus a radius on positive side of case. Cap. values from 0.1-330uF, 6-50VDC. 6 case sizes.

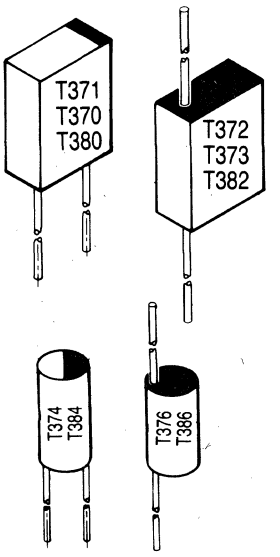


T35X 'UltraDip' II miniature dipped solid tantalum capacitors. New gold color epoxy with laser markings provides outstanding legibility. Compact design, plus low DC leakage and DF makes UltraDip II capacitors ideal for filtering, bypassing, coupling, blocking and RC timing circuits. Cap. values from 0.1-680uF, 3-50VDC. 12 case sizes. T350 also available in ARIS (Automatic Radial Insertion System) for Automatic Insertion Machines.



T363(CX02) & T369(CX12) per MIL-C-49137 also available.

Similar to 'UltraDip' II Series above. Available capacitance ratings (0.1-330uF, 6-50 VDC. New gold color epoxy with laser markings. 4 case sizes. T361 also available in ARIS (Automatic Radial Insertion System) for automatic insertion machines. A, B & C case sizes only.

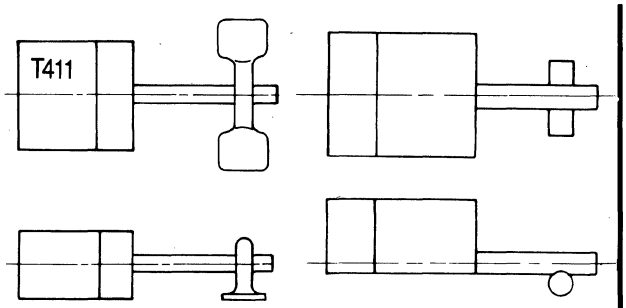


Microns: a complete line of microminiature solid tantalum capacitors designed to provide maximum electrical performance and capacitance-to-volume ratio for micro miniaturized, high density integrated circuits. Microns consist of ultra small anode assemblies encapsulated in epoxy. Cap. values from .0047-220uF, 2-50 VDC. Color coded Cap. value markings.

Union Carbide Corp., Electronics Div., P.O. Box 5928, Greenville, S.C. 29606 (803) 963-6300

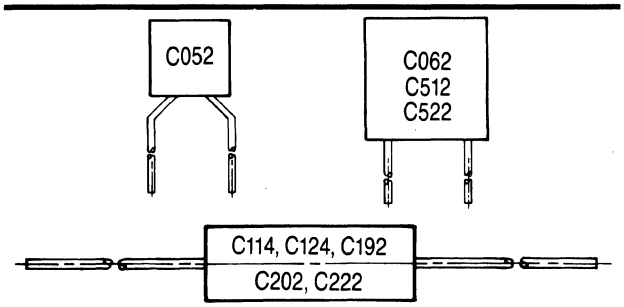
KEMET UNION CARBIDE-ELECTRONICS DIVISION TANTALUM, CERAMIC & FILM CAPACITORS

UNION CARBIDE

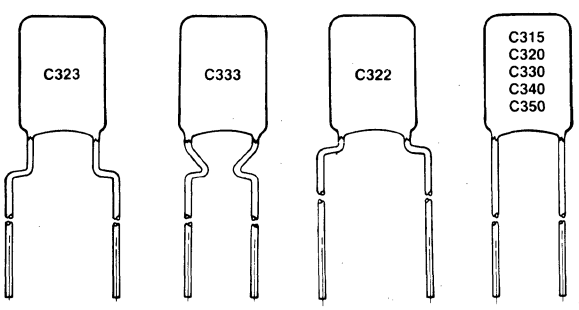


T412(CWR01) & T422(CWR02) per MIL-C-55365 also available.

KEMET Solid Tantalum Chip Capacitors afford maximum volumetric efficiency and high temperature capability at an economical price. Cap. values from 0.1-100uF, 4-50VDC. 5 case sizes.



Gold Color Molded Thermoset Monolithic Multilayer Ceramic Capacitors. Available in ultra-stable (COG), stable (X7R) (Military BX or BR) or general purpose (Z5U) temperature characteristics. Military versions conform to MIL-C-39014, MIL-C-11015 and MIL-C-20 standards. Cap. values from: 10pF to 1,000,000pF. 50, 100 & 200 volts.

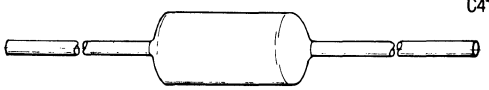


C315, C320, C322, C323, C330 and C333 size also available in KEMET's ARIS (Automatic Radio Insertion System) for automatic insertion machines.

Golden Max Plastic Dipped Monolithic Multilayer Ceramic Capacitors are the designer's choice for reliability at economical prices. Available in COG, X7R, or Z5U temperature characteristics and are dipped in the same new gold color plastic as KEMET's Ultra-Dip series, providing outstanding legibility of Laser markings. Cap. values from 1.0 pF-6.8, 50, 100 & 200 volts; 5 case sizes.

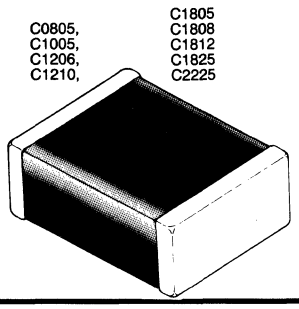
NEW

KEMET AXIMAX Capacitors
C410-C440



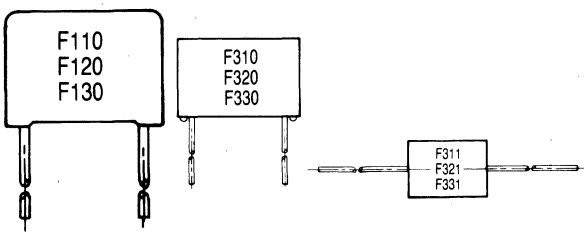
Maximum range, conformally-coated capacitors in three dielectrics—COG Ultra-Stable; X7R Stable and Z5U General Purpose. The 4 case sizes include over 138 CV values in a capacitance range of 10 pF to 1.0μF in 50 and 100 volts. Available in Lead Tape & Reel Configuration. Gold color epoxy with laser markings.

CDR01-CDR06 chips per MIL-C-55681 also available.



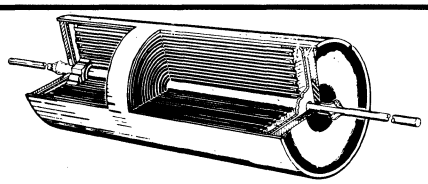
Monolithic Multilayer Ceramic Chips: Available in COG (NPO), X7R or Z5U Temperature Characteristics, MIL Approved, KEMET GR900 or Commercial. Cap. values from 1pF-2,200,000 pF; 50, 100 and 200 volts, 9 chip sizes.

C0805, C1206 & C1210 sizes also available in CoPS (Component Placement System) 8mm tape.



F310(CFR04R) & F311 (CFR04A) per MIL-C-55514 also available.

KEMET Parylene Flat Kaps are small ultra stable film capacitors ideally suited for filters, A/D converters, integrators, mulivibrator timing capacitors, and other applications where capacitance stability is essential, F310 & F311 styles available to MIL-C-55514. F110 is hermetically sealed in metal cases; 6 case sizes Cap. values from .001 uF-0.15uF, 50 volts. F310-F331 are precision plastic molded. Cap. values from 0.001uF-0.12 uF, 50 volts; 8 case sizes.



METALLIZED POLYCARBONATE F241-F248 (CRH01-CHR10) per MIL-C-83421 & MIL-C-39022.

Metallized Polycarbonate Film capacitors are designed for circuits requiring stable performance characteristics over a wide temperature range, small size, and operational reliability. For filtering, by-pass, timing, SCR commutating and 400 Hz AC power circuits. Cap. values from .01 uF-22 uF with a DC voltage rating of 30 to 600 volts. Meet MIL-C-83421 and MIL-C-39022 requirements.

Union Carbide Corp., Electronics Div., P.O. Box 5928, Greenville, S.C. 29606 (803) 963-6300

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KSE Miniature Aluminum Electrolytic Capacitors
- Radial Lead
- Axial Lead
- Solvent Proof
- Wide C/V density range

KSE Metallized Polyester Box Type Capacitors
- High Moisture Resistance
- High Insulation Resistance
- Self-Healing
- Non-Inductive

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CERAMIC CAPACITORS

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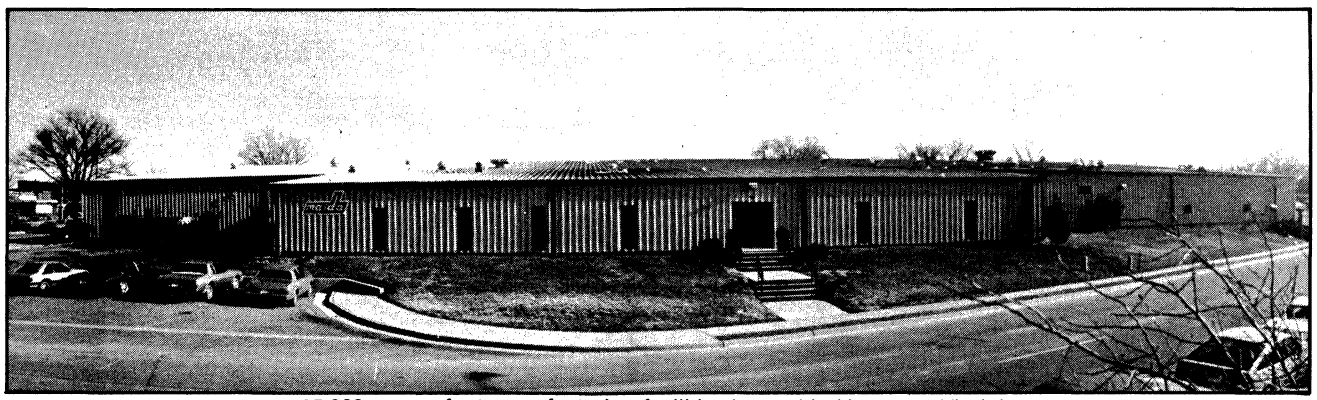
"CERAMIC CAPACITOR MANUFACTURERS SINCE 1947"



85,000 square foot manufacturing facilities located in Hampton, Virginia

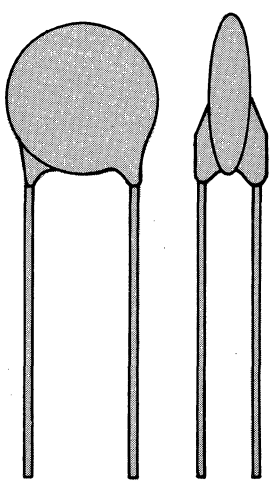
Maida

serving the electronics industry for over thirty-five years.

Maida Development Company, domestically owned and operated, has served the electronics industry with a wide variety of ceramic components. We specialize in custom design and manufacturing, from ceramic powder formulation through finished devices, to meet specific requirements of our customers. Typical capacitor products include (1) high voltage capacitors for power supplies; (2) UL and CSA recognized capacitors for across-the-line, line-by-pass, and antenna coupling uses; (3) reduced titanate capacitors for low-voltage general purpose applications; (4) leadless discs; (5) slot-mounted "trapezoids" for printed circuits; and (6) multi-layer capacitors. Our newest product line - zinc oxide varistors (ZOV) is designed for transient voltage suppression and surge energy absorption and many are UL recognized. Our delivery is timely and reliable - with either bulk packaging or tape and reel. We value with pride the repeat business from such customers as GE, Zenith, RCA, IBM, AT&T, Xerox, Sunbeam, GTE, NAP, Kodak, Harris, Allen-Bradley and many others.

CERAMIC DISC CAPACITORS — 500V THRU 6KV

CLASS	T.C.	Maximum Capacitance, *pF*						
		500V	1KV	2KV	3KV	4KV	5KV	6KV
1	P100	81	68	51	36	27	22	18
	NP0	510	430	330	220	180	130	120
	N030	510	430	330	220	180	130	120
	N080	510	430	330	220	180	130	120
	N150	430	360	270	180	140	120	100
	N220	470	390	300	200	150	120	100
	N330	620	510	390	270	200	160	130
	N470	680	620	470	300	240	200	150
	N750	820	680	510	360	270	220	200
	N1500	1300	1200	910	620	500	390	330
	N2200	2000	1800	1300	910	680	560	500
	N3300	3600	3000	2200	1500	1200	1000	820
	N4700	4700	3900	3000	2000	1500	1300	1000
	N5600	6200	5600	4300	2700	2200	1800	1500
2	X5F	12000	10000	8200	5600	3900	3300	2700
	Z5F	15000	12000	8200	6200	4700	3900	3300
	X7R	15000	12000	8200	6200	4700	3900	3300
	Z5U	56000	50000	27000	20000	15000	12000	10000



APPLICATIONS:

CLASS 1. High-Q. temperature compensating, or stable capacitance requirements.

CLASS 2. General Purpose, line by-pass, coupling, etc.

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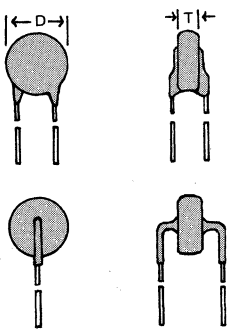
CERAMIC CAPACITORS

MAIDA DEVELOPMENT COMPANY
"DOMESTIC CAPACITOR MANUFACTURERS SINCE 1947"

HIGH VOLTAGE DISCS-10, 12, 15, 20 KVDC-X5R/Z5U

MAX. NOM. CAP. ±20% pF	10KV "T" MAX. 0.360 X5R	10KV "T" MAX. 0.360 Z5U	12KV "T" MAX. 0.400 X5R	12KV "T" MAX. 0.400 Z5U	15KV "T" MAX. 0.460 X5R	15KV "T" MAX. 0.460 Z5U	20KV "T" MAX. 0.360 X5R	20KV "T" MAX. 0.360 Z5U
100	D68	D68	D68	—	D689	—	D689	—
200	D68	D68	D68	—	D619	—	D619	—
250	D68	D61	D61	—	D619	—	D719	—
500	D71	D62	D62	D61	D629	D619	D649	D719
750	D64	D64	D64	D62	D639	D629	D679	D699
1000	D64	D63	D67	D62	D679	D699	D659	D649
1500	D67	D65	D65	D69	D669	D649	—	D679
2200	D65	D66	D66	D63	—	D679	—	D659
2500	D66	D70	D70	D67	D709	D659	—	D669
3000	—	—	—	D65	—	D659	—	—
4300	—	—	—	D66	—	—	—	D709
5600	—	—	—	—	—	D709	—	—
6800	—	—	—	D70	—	—	—	—

STYLE	MAX. "D"
D68/D689	0.406
D61/D619	0.469
D71/D719	0.513
D62/D629	0.552
D69/D699	0.659
D64/D649	0.719
D63/D639	0.781
D67/D679	0.840
D65/D659	0.969
D66/D669	1.100
D70/D709	1.350

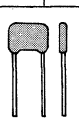


APPLICATIONS:
Voltage Multilpliers, High Voltage Power Supplies

MULTILAYER RADIAL-LEAD DIP CHIPS NPO, X7R, Z5U

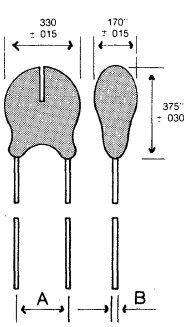
Size, inches L × W × T max.	Maximum Capacitance Value NPO 50V	NPO 100V	X7R 50V	X7R 100V	Z5U 50V	Z5U 100V
.200 × .200 × .125	3300pF	2400pF	.075μF	.056μF	.2μF	.15μF
.300 × .300 × .125	.012μF	9100pF	.27μF	.22μF	.68μF	.51μF
.400 × .400 × .150	.033μF	.022μF	.82μF	.68μF	2.2μF	1.5μF
.500 × .500 × .200	.062μF	.042μF	1.2μF	1.0μF	3.3μF	2.2μF

APPLICATIONS:
High volumetric efficiency in printed circuit boards.



1500 (±300) VDC SPARK GAPS

STYLE NO.	A	B
100	.200" ± .015	22 ga.
100-1	.200" ± .015	20 ga.
100-2	.250" ± .015	22 ga.
100-3	.250" ± .015	20 ga.



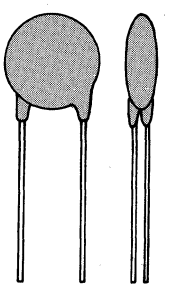
Rugged flame-retardant epoxy coating.
APPLICATIONS:
Protection of low-voltage circuits from high voltage surges.

UNDERWRITERS LABS & CANADIAN STANDARDS ASSOCIATION APPROVED

TYPE	APPROVAL	T.C. EIA	CAP. MAX.
UU2M	UL	U2M	220pF
US3N	UL	S3N	390pF
AUF	UL	Z5P	2700pF
UW	UL/CSA	Z5U	10000pF
* DP	UL/CSA	Z5U	5000pF

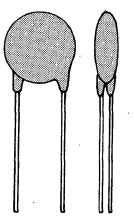
APPLICATIONS:
Line-by-pass, antenna coupling, across-the-line

* "Double Protection" in above uses



250 & 500 VOLT AC POWER LINE CAPACITORS

STYLE CODE	MAX. "D" INCHES	MAX. CAPACITANCE. pF 250VAC	500VAC
60	0.312	1200	680
68	0.375	2500	1200
61	0.470	3600	2000
71	0.530	4300	2200
62	0.590	6800	3600
64	0.720	10000	6200
63	0.780	13000	6800
67	0.840	15000	8200
65	0.970	22000	12000
66	1.10	30000	15000

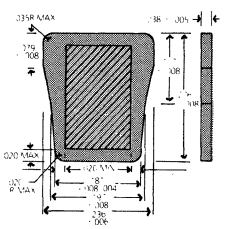


APPLICATIONS:
AC line voltage applications where minimum currents - reactive and resistive - are required.

TOLERANCES AVAILABLE:
±20% or +80 - 20%

500 VOLT TRAPEZOIDS - CLASS 1 and 2

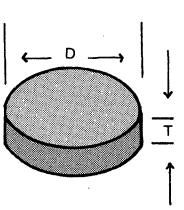
CLASS	T.C.	CAPACITANCE RANGE
1	P100	1.5pF - 3.3pF
	NPO	2.4pF - 18pF
	N030 thru N470	2.7pF - 24pF
	N750	5.6pF - 30pF
	N1500	22pF - 51pF
	N2200 thru N5600	30pF - 130pF
2	X5F	150pF - 220pF
	Z5P/X7R	150pF - 470pF
	Z5U	150pF - 1000pF
	Z5V	200pF - 1900pF



APPLICATIONS:
Solder into slot for minimum lead inductance.

500 VOLT LEADLESS DISCS - CLASS 1

T.C.	CAPACITANCE	"D" NOM.	"T"
NPO	2.2pF - 3.0pF	.250"	.120" max.
N080	3.3pF - 7.5pF	.250"	.062" max.
N150	1.8pF - 5.4pF	.250"	.120" max.
N220	5pF	.250"	.083" max.
N470	18pF	.250"	.032" max.
N750	24pF	.250"	.032" max.
N1500	39pF	.250"	.032" max
N080	7.5pF	.312"	.062" max.
N150	10pF	.312"	.083" max.
N220	10pF	.312'	.090" max.



APPLICATIONS:
UHF circuits with very low inductance

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LOW VOLTAGE DISC CAPACITORS

MAIDA DEVELOPMENT COMPANY
"DOMESTIC CAPACITOR MANUFACTURERS SINCE 1947"

CLASS 1 TEMPERATURE COMPENSATING TYPE

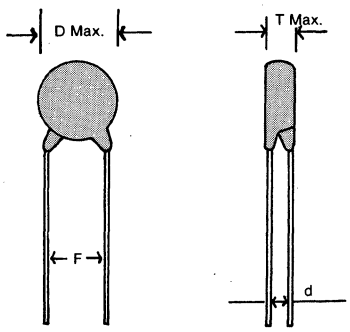
MAXIMUM CAPACITANCE VALUES BY TC TYPE

T.C. / W.V.	CAPACITANCE (pF) NPO	N80	N150	N220	N330	N470	N770	P350 - N1000	DIMENSIONS INCHES (mm) D	T	F	d
50V DC	22	18	16	30	20	22	39	110	.157 (4.0)	.157 (4.0)	.098 (2.5)	.020 (0.5)
	30	30	22	47	39	39	55	130	.197 (5.0)	.118 (3.0)	.098 (2.5)	.020 (0.5)
	56	47	47	91	62	56	100	240	.248 (6.3)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	100	82	91	130	120	130	150	510	.315 (8.0)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	200	130	130	250	200	200	240	680	.394 (10.0)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	—	250	250	370	350	360	390	1000	.492 (12.5)	.118 (3.0)	.197 (5.0)	.020 (0.5)

CLASS 2 GENERAL PURPOSE TYPE

MAX. CAPACITANCE VALUES BY TC TYPE

T.C. / W.V.	CAPACITANCE (pF) Y5P	Y5T	Y5V	DIMENSIONS INCHES (mm) D	T	F	d
50V DC	1200	1200	2200	.155 (4.0)	.157 (4.0)	.098 (2.5)	.020 (0.5)
	1800	1800	4700	.197 (5.0)	.118 (3.0)	.098 (2.5)	.020 (0.5)
	3300	3300	10000	.248 (6.3)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	5600	5600	22000	.315 (8.0)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	8200	8200	40000	.394 (10.0)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	10000	10000	47000	.492 (12.5)	.118 (3.0)	.197 (5.0)	.020 (0.5)

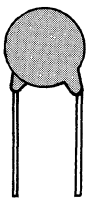


CLASS 3 SEMICONDUCTOR TYPE

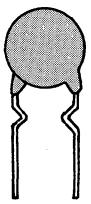
MAX. CAPACITANCE VALUES BY TC TYPES

T.C. / W.V.	CAPACITANCE (pF) Y5P	Y5R	Y5T	Y5U	Y5V	DIMENSIONS INCHES (mm) D	T	F	d
12V DC	—	10000	22000	22000	47000	.197 (5.0)	.118 (3.0)	.098 (2.5)	.020 (0.5)
	—	22000	47000	47000	100000	.248 (6.3)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	—	47000	100000	100000	—	.315 (8.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	—	—	220000	220000	220000	.394 (10.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	—	100000	330000	—	470000	.492 (12.5)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	—	—	470000	—	—	.630 (16.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
25V DC	—	4700	10000	10000 20000	22000	.197 (5.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	10000	15000	22000	—	47000	.248 (6.3)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	—	22000	47000	100000	100000	.315 (8.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	22000	47000	100000	—	22000	.394 (10.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	47000	100000	—	220000	—	.492 (12.5)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	100000	—	—	—	470000	.630 (16.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
50V DC	—	—	—	10000	22000	.197 (5.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	10000	10000	1000	22000	47000	.248 (6.3)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	15000	22000	22000	47000	100000	.315 (8.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	22000	47000	47000	100000	—	.394 (10.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	470000	—	100000	—	—	.492 (12.5)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	100000	100000	—	—	—	.630 (16.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)

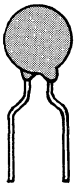
Straight



Inside Kink



Right Angle Kink



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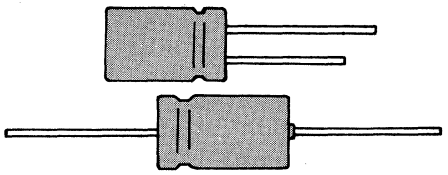
ELECTROLYTIC & FILM CAPACITORS

MAIDA DEVELOPMENT COMPANY

"DOMESTIC CAPACITOR MANUFACTURERS SINCE 1947"

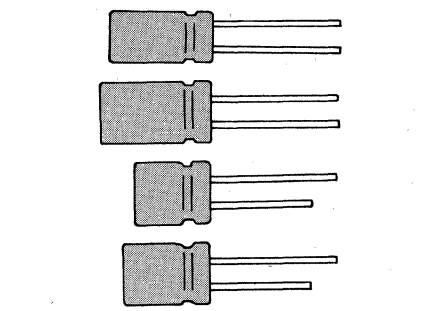
ALUMINUM ELECTROLYTIC CAPACITORS—GENERAL

SERIES	SPECIAL FEATURES	TEMPERATURE RANGE	RATED VOLTAGE RANGE	CAPACITANCE RANGE
SA	Miniature Size	-40°C ~ +85°C	6.3V ~ 100V	0.47μF ~ 10000μF
SE	Ultra miniature size	-40°C ~ +85°C	6.3V ~ 50V	0.1μF ~ 47μF
GA	For high voltage	-25°C ~ +85°C	160V ~ 450V	0.4μF ~ 470μF
SS	Super miniature size	-40°C ~ +85°C	6.3V ~ 63V	0.1μF ~ 470μF
SV	Low profile type	-40°C ~ +85°C	6.3V ~ 50V	0.1μF ~ 4700μF



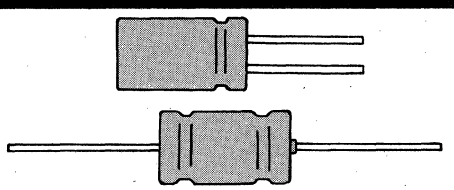
ALUMINUM ELECTROLYTIC CAPACITORS—SPECIAL

SERIES	SPECIAL FEATURES	TEMPERATURE RANGE	RATED VOLTAGE RANGE	CAPACITANCE RANGE
TH	For high stability	-40°C ~ +85°C	16V, 25V, 50V	1.0μF ~ 100μF
LL	For low leakage	-40°C ~ +85°C	6.3V ~ 63V	0.1μF ~ 4700μF
TB	For timer circuit	-40°C ~ +85°C	25V, 50V, 100V	1.0μF ~ 470μF
ZA	For low noise	-40°C ~ +85°C	6.3V ~ 100V	0.47μF ~ 470μF
RA	Wide temp. range	-40°C ~ +105°C	6.3V ~ 100V	0.47μF ~ 10000μF
RB	Wide temp. range	-40°C ~ +125°C	10V ~ 50V	0.47μF ~ 1000μF
RM	For switching regulators	-55°C ~ +105°C	6.3V ~ 63V	1.0μF ~ 1000μF
		-40°C ~ +105°C	100V ~ 160V	1.0μF ~ 47μF
		-25°C ~ +105°C	200V ~ 250V	1.0μF ~ 22μF
RQ	For switching regulators	-55°C ~ +105°C	6.3V ~ 63V	22μF ~ 2200μF
RK	Wide temp. range	-40°C ~ +105°C	6.3V ~ 63V	0.1μF ~ 47μF



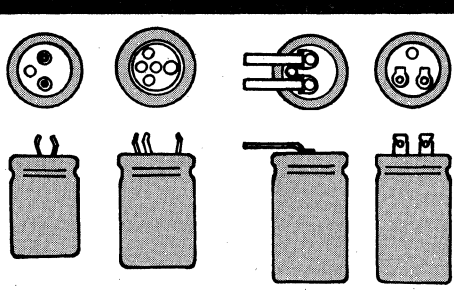
ALUMINUM ELECTROLYTIC CAPACITORS—NON-POLAR

SERIES	SPECIAL FEATURES	TEMPERATURE RANGE	RATED VOLTAGE RANGE	CAPACITANCE RANGE
NP	For reversing polarity circuits	-40°C ~ +85°C	6.3V ~ 100V	1.0μF ~ 6800μF
NF	For horizontal deflection current correction of TV set	-40°C ~ +85°C	25V	1.0μF ~ 10μF
BP	For cross over net-work	-40°C ~ +85°C	50V	1.0μF ~ 100μF
BS	For high output	-40°C ~ +85°C	50V	1.0μF ~ 33μF
NS	For reversing polarity circuits	-40°C ~ +85°C	6.3V ~63V	0.1μF ~ 47μF



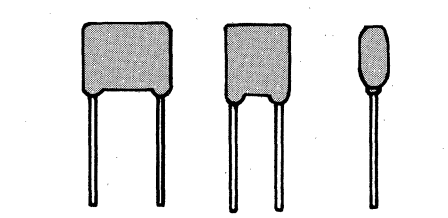
ALUMINUM ELECTROLYTIC CAPACITORS—LARGE

SERIES	SPECIAL FEATURES	TEMPERATURE RANGE	RATED VOLTAGE RANGE	CAPACITANCE RANGE
LN	For general use	-25°C ~ +85°C	16V ~ 450V	33μF ~ 10000μF
HS	Lug snap-in terminal	-40°C ~ +85°C	6.3V ~ 250V	470μF ~ 22000μF
HG	Low profile type	-40°C ~ +85°C	6.3V ~ 250V	470μF ~ 22000μF
SN, SB, SH	Computer grade	-25°C ~ +85°C	10V ~ 250	150μF ~ 150000μF
MS	For motor starting	-25°C ~ +85°C	125V ~ 250V	10μF ~ 400μF
HU	Wide temp. range	-40°C ~ +85°C	10V ~ 160V	330μF ~ 15000μF
HV	Low profile type	-25°C ~ +85°C	200V ~ 250V	
BF	For photo flash	-10°C ~ +55°C	330V	200μF ~ 1000μF



POLYESTER FILM CAPACITORS

SERIES	SPECIAL FEATURES	TEMPERATURE RANGE	RATED VOLTAGE RANGE	CAPACITANCE RANGE
TY	For general use	-40°C ~ +85°C	50V ~ 630V	0.001μF ~ 0.47μF
TX	Non-inductive	-40°C ~ +85°C	50V ~ 400V	0.001μF ~ 0.47μF
TS	Low profile types	-40°C ~ +85°C	50V	0.001μF ~ 0.47μF
TM	Metalized film	-40°C ~ +85°C	100V ~ 630V	0.01μF ~ 3.3μF
PX	Non-inductive polypropylene film	-25°C ~ +85°C	100V ~ 630V	0.001μF ~ 0.47μF
PM	Metalized polypropylene film	-25°C ~ +85°C	200V, 400V	0.1μF ~ 10.0μF
MX	Temperature correction	-40°C ~ +85°C	50V	0.001μF ~ 0.47μF
PY	For general use	-25°C ~ +85°C	100V, 200V	0.001μF ~ 0.1μF
TZ	Low profile type.	-40°C ~ +85°C	50/100V	0.001μF ~ 0.47μF



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VARISTORS

MAIDA DEVELOPMENT COMPANY
"DOMESTIC CAPACITOR MANUFACTURERS SINCE 1947"

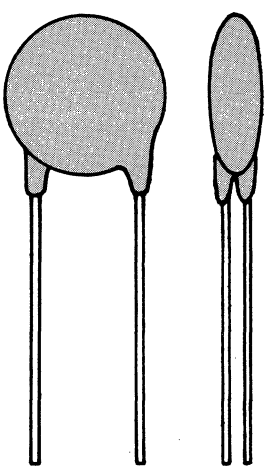
ZINC OXIDE VARISTORS—TRANSIENT VOLTAGE SURGE SUPPRESSION

	MDC-ZOV STYLE NUMBER	MODEL SIZE	CROSS REFERENCE — GE-MOV MODEL NUMBER	CONTINUOUS RMS VOLTAGE VAC	CONTINUOUS DC VOLTAGE VDC	TRANSIENT ENERGY (10×1000μS)	VARISTOR PEAK VOLTAGE @1mADC MIN.	VARISTOR PEAK VOLTAGE @1mADC MAX.	MAX. CLAMPING VOLTAGE @ TEST CURRENT (8×20+μS) V_C	MAX. CLAMPING VOLTAGE @ TEST CURRENT (8×20+μS) I_P	CAP. @1KHZ ±30%
		(mm)		VOLTS	VOLTS	JOULES	VOLTS	VOLTS	VOLTS	AMPS	pF
	D69ZOV950RA06	14	V95LA7A	95	127	30	135	164	255	50	1800
	D73ZOV131RA03	7	V130LA2	130	175	11	184	224	340	10	250
•	D69ZOV131RA09	14	V130LA10A			38		224	340	50	1350
• ★	D65ZOV131RA20	20	V130LA20A			70		224	340	100	2300
• ★	D65ZOV131RB20	20	V130LA20B			70		220	325	100	2300
	D73ZOV151RA03	7	V150LA2	150	200	13	212	259	395	10	220
•	D69ZOV151RA09	14	V150LA10A			45		259	395	50	1200
• ★	D65ZOV151RA20	20	V150LA20A			80		268	395	100	2000
• ★	D65ZOV151RB20	20	V150LA20B			80		243	360	100	2000
	D73ZOV251RA21	7	V250LA4	250	330	21	354	432	650	10	130
•	D69ZOV251RA72	14	V250LA20A			72		432	650	50	550
•	D65ZOV251RA130	20	V250LA40A			130		432	650	100	920
•	D65ZOV251RB130	20	V250LA40B			130		413	620	100	920
	D73ZOV271RA23	7	V275LA4	270	360	23	382	466	710	10	120
•	D69ZOV271RA75	14	V275LA20A			75		466	710	50	510
•	D65ZOV271RA140	20	V275LA40A			140		466	710	100	850
•	D65ZOV271RB140	20	V275LA40B			140		453	680	100	850
	D73ZOV301RA25	7	V300LA4	300	405	25	425	518	775	10	110
•	D69ZOV321RA90	14	V320LA15A	320	420	90	453	553	850	50	400
•	D65ZOV321RA160	20	V320LA40A			160		553	850	100	720
•	D65ZOV321RB160	20	V320LA40B			160		540	810	100	720
•	D69ZOV421RA90	14	V420LA15A	420	560	90	594	725	1120	50	500
•	D65ZOV421RA160	20	V420LA40A			160		725	1120	100	910
•	D65ZOV421RB160	20	V420LA40B			160		690	1060	100	910
•	D69ZOV481RA105	14	V480LA40A	480	640	105	679	829	1240	50	440
•	D65ZOV481RA180	20	V480LA80A			180		829	1240	100	800
•	D65ZOV481RB180	20	V480LA80B			180		790	1160	100	800
•	D69ZOV511RA110	14	V510LA40A	510	675	110	722	881	1350	50	410
•	D65ZOV511RA190	20	V510LA80A			190		881	1350	100	740
•	D65ZOV511RB190	20	V510LA80B			190		860	1280	100	740
•	D69ZOV581RA120	14	V575LA40A	580	735	120	821	1002	1500	50	370
•	D65ZOV581RA220	20	V575LA80A			220		1002	1500	100	670
•	D65ZOV581RB220	20	V575LA80B			220		960	1410	100	670
•	D69ZOV102RA220	14	V1000LA80A	1000	1200	220	1414	1728	2700	50	210
•	D65ZOV102RA360	20	V1000LA160A			360		1728	2700	100	380
•	D65ZOV102RB360	20	V1000LA160B			360		1650	2420	100	380

★ UL Recognized Components for Surge Supression, File E86730
• UL Recognized for Across-The-Line Applications, File E38785

Protection for Voltage Sensitive Equipment.
Transient voltage suppression from sources such as lightning induced transients, switching surges, ground faults and AC power lines.

APPLICATIONS:
Ground fault interrupters, CATV systems, IC's and microprocessor protection, power supplies, industrial control systems, RFI filters, etc.



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MALLORY ELECTRICAL/ELECTRONIC GROUP
EMHART

MALLORY CAPACITOR COMPANY, EMHART ELECTRICAL/ELECTRONIC GROUP
DEPT. EM, P.O. BOX 372, INDIANAPOLIS, IN 46206, U.S.A.
PHONE: (317) 636-5353

TANTALUM SOLID ELECTROLYTIC CAPACITORS

TYPE	DESCRIPTION	TERMINALS	TEMP. RANGE (°C)	VOLT. RANGE (WVDC)	CAP. RANGE (μF)	STD. TOL. (% μF)	CASE SIZES DIA. x LGTH. (Inches) H x W x D (Inches)	FEATURES	TIB *
TAS TXA	Metal Tubular, Axial Lead Hermetic Seal	Wire Leads 22 AWG 24 AWG	−80 to +125	6 to 100	.0047 to 1000	±5 ±10 ±20	.125x.250 .175x.438 .279x.650 .341x.750	Standard Capacitance - TAS Extended Capacitance - TXA Low DC Leakage Temperature Stable High Capacity, Long Shelf Life	4-801A
TFR	Metal Case, Tubular, Axial Lead Hermetic Seal	Wire Leads 22 AWG	−55 to +125	6 to 50	22 to 330	±5 ±10 ±20	.289x.686 .351x.786	MIL-C-39003 CSR21 High Frequency, High Ripple Capability, High Reliability	4-819A
TER TXE TXR	Mylar Sleeved, Metal Tubular, Axial Lead Hermetic Seal	Wire Leads 22 AWG 24 AWG	−55 to +125	6 to 100	.0047 to 1000	±5 ±10 ±20	.135x.286 .185x.474 .289x.686 .351x.786	MIL-C-39003D CSR13, 23, 33 High Reliability	4-813A
TNR	Metal Tubular, Axial Lead Non Polar	Wire Leads 22 AWG 24 AWG	−55 to +125	6 to 100	.0023 to 160	±5 ±10 ±20	.161x .575 .207x .955 .314x1.35 .376x1.55	MIL-C-39003D CSR91 High Reliability, Non-Polar Application	4-815A
THF	Mylar Sleeved, Metal Tubular, Axial Lead Hermetic Seal	Wire Leads 22 AWG	−80 to +125	6 to 50	5.6 to 330	±10 ±20	.289x.686 .351x.786	4.5 Amps Ripple Capability, Low ESR at High Frequency from 1 kHz-100 kHz	4-805B
TAN TXN	Metal Case, Tubular Hermetic Seal	Wire Leads 22 AWG 24 AWG	−55 to +125	6 to 50 VNP	2.8 to 500	±5 ±10 ±20	.161x .575 .207x .955 .314x1.350 .376x1.550	Non-Polar, Standard and Extended Range Capacity	4-817
TIM	Rectangular, Molded Epoxy Radial Lead	Wire Leads Single Ended 22 AWG 24 AWG	−55 to +125	3 to 50	.082 to 220	±10 ±20	.340x.228x.105 .225x.285x.170 .335x.360x.170 .375x.600x.195	High Density Mounting, Automatic Insertion Capability	4-806B
TAC	Molded Epoxy, Tubular, Axial Lead	Wire Leads 22 AWG 24 AWG	−55 to +125	3 to 50	.082 to 68	±10 ±20	.105x.300 .148x.350 .180x.350 .200x.540	Automatic Insertion Capability, High Shock & Vibration Capability	4-807D
TDM	Epoxy Dipped, Rectangular Radial Lead	Wire Leads Single Ended 24 AWG	−55 to +85	6 to 50	.10 to 330	±10 ±20	.27x.27x.18 .33x.32x.21 .37x.40x.22 .40x.40x.25 .46x.48x.32 .56x.58x.32	Low Profile, Low Cost, High Volumetric Efficiency	4-810B
TDC	Plastic Dipped, Radial Lead	Wire Leads LD Spacing .125 & .250	−55 to +85	6 to 50	.10 to 330	±10 ±20	.17x.35 .25x.50 .35x.65 .40x.75	Low Cost, Extended Capacitance, Temperature Stable, Long Storage Life	4-810B
TDL	Plastic Dipped, Radial Lead	Wire Leads LD Spacing .10 & .20	−55 to +85	3 to 50	.10 to 330	±10 ±20	.18x.28 .20x.30 .26x.36 .34x.40 .40x.56 .44x.68	Low Cost, Low Profile, Long Storage Life	4-810B
TDR	Plastic Dipped, Radial Lead	Wire Leads Lead Space .125 & .250	−55 to +85	6 to 50	.10 to 330	±10 ±20	.175x.350 .250x.500 .350x.650 .400x.750	MIL-C-49137/2 CX02 CX12	4-816

TANTALUM WET SLUG CAPACITORS

TYPE	DESCRIPTION	TERMINALS	TEMP. RANGE (°C)	VOLT. RANGE (WVDC)	CAP. RANGE (μF)	STD. TOL. (% μF)	CASE SIZES DIA. x LGTH. (Inches) H x W x D (Inches)	FEATURES	TIB *
TLX TXX	Silver Tubular, Axial Lead, Hermetic Seal Mylar Sleeve	Wire Leads 22 AWG	−55 to +125	6 to 125	1.7 to 2200	±5 ±10 −15 +20 −15 +30 −15 +50	.219x .608 .312x .796 .406x .921 .406x1.217	MIL-C-39006 CLR65 & CLR69 High CV, Long Life, High Reliability	4-612A
CL66 CL67	Silver Tubular, Axial Lead, Hermetic Seal	Wire Leads 22 AWG	−55 to +125	6 to 125	1.7 to 2200	±5 ±10 ±20	.219x .608 .312x .796 .406x .921 .406x1.217	MIL-C-3965 CL66, CL67 Rugged Construction, Long Life	4-613
TLW	Silver Tubular, Axial Lead, Hermetic Seal Kapton Sleeve	Wire Leads 22 AWG	−55 to +175	6 to 100	2.5 to 1200	±5 ±10 ±2	.219x .608 .312x .796 .406x .921 .406x1.217	High Capacity, High Temperature to 175°C	4-611B
TLT	Tantalum Case, Tubular, Axial Lead Hermetic Seal	Nickel Wire Heads 22 AWG	−55 to +125	6 to 100	2.5 to 1200	±5 ±10 ±20	.312x .796 .406x .921 .406x1.217	MIL-C-39006 CLR79 High CV Reverse Voltage Capability, High Reliability	4-616C
TLS TLH	Silver Tubular, Axial Lead Elastomer Seal	Wire Leads 22 AWG	−55 to +125	6 to 125	1.7 to 2200	±5 ±10 −15 +20 −15 +30 −15 +50	.219x .608 .312x .796 .406x .921 .406x1.217	MIL-C-3965 Styles CL64 & CL65, Low DCL, Wide Temperature Range	4-604
CTL	Copper Alloy, Tubular, Axial Lead Elastomer Seal	Wire Leads 22 AWG	−55 to + 125	6 to 125	3.6 to 1200	±10 −15 +20 −15 +30 −15 +50	.219x .608 .312x .796 .406x .921 .406x1.217	Low Cost, Low DCL, Wide Temperature Range	4-610A
CMT	Copper Alloy, Tubular, Red Plastic, Case Insulated	Wire Leads 24 AWG	−55 to +85	6 to 60	1 to 450	±20	.115x.300 .115x.403 .145x.600 .225x.778	Low Cost, High Capacity, Miniature Size	4-609A

* Technical Information Bulletin

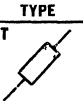
MALLORY ELECTRICAL/ELECTRONIC GROUP
EMHART

MALLORY CAPACITOR COMPANY, EMHART ELECTRICAL/ELECTRONIC GROUP
DEPT. EM, P.O. BOX 372, INDIANAPOLIS, IN 46206, U.S.A.
PHONE: (317) 636-5353

TANTALUM WET SLUG CAPACITORS Continued

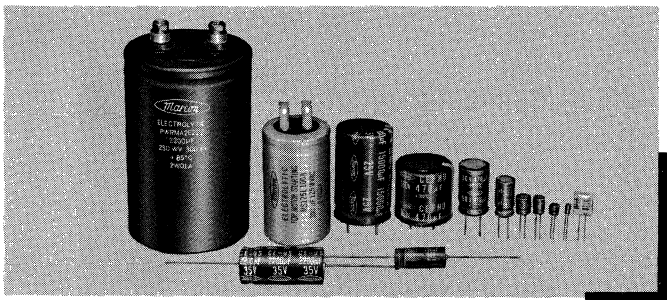
TYPE	DESCRIPTION	TERMINALS	TEMP. RANGE (°C)	VOLT. RANGE (WVDC)	CAP. RANGE (μF)	STD. TOL. (% μF)	CASE SIZES DIA. x LGTH. (Inches) H x W x D (Inches)	FEATURES	TIB *
MTP	Silver Tubular, Red Plastic, Axial Lead Case Insulated	Wire Leads 24 AWG	−55 to +85	6 to 60	3.3 to 470	±20	.115x.300 .115x.403 .145x.600 .225x.778	High Capacity, Miniature Size	4-606A
MTPH	Silver Tubular, Red Plastic, Axial Lead Case Insulated	Wire Leads 24 AWG	−55 to +85	6 to 60	4.7 to 470	±10 ±20	.115x.403 .145x.600 .225x.778	High Reliability, Miniature Size	4-614
TAP	Silver Tubular, Black Plastic, Axial Lead Case Insulated	Wire Leads 24 AWG	−55 to +85	6 to 90	2 to 330	−15 +75 −15 +50 −15 +20 −10 +20 ±10	.226x.504 .226x.560 .226x.847	Low ESR, Miniature Size	4-602
TNT	Silver Tubular, Yellow Plastic, Axial Lead Case Insulated	Wire Leads 24 AWG	−55 to +85	3 to 50	2 to 80	−15 +75	.163x.347 .163x.472	Low DCL, Miniature Size	4-601
TAH	Silver Tubular, Green Plastic, Axial Lead Case Insulated	Wire Leads 24 AWG	−55 to +125	4 to 60	2 to 330	−15 +75 ±10 −10 +20 −15 +20 −15 +50	.238x.470 .238x.600 .238x.810	Miniature Size, Wide Temperature Range, Low DCL	4-603
XTM XTK XTH XTL XTV	Metal Can, Single or Dual Ended, Hermetic Seal	Wire Leads, Screw, Stud, Solder Lug, Turret	−55 to +200	20 to 900	2 to 2200	−15 +75 −15 +50 ±20	.656x.438x1.78 .875x.540x4.06 1.13 x.600x2.81	MIL-C-39006 CLR10, 14 & 17 High Reliability, Rugged Construction Very High Temperature, High Capacity & Voltage	4-84A
TL	Metal Case, Rectangular, Glass to Metal Seal	Solder Lugs	−55 to +125	15 to 150	70 to 2400	±20	1.062x1.275x.690 1.375x1.275x.690 1.625x1.275x.690 2.000x1.275x.690 2.500x1.275x.690	MIL-C-3965 Style CL55 Low DCL, Wide Temperature Range	4-79A

ALUMINUM ELECTROLYTIC CAPACITORS

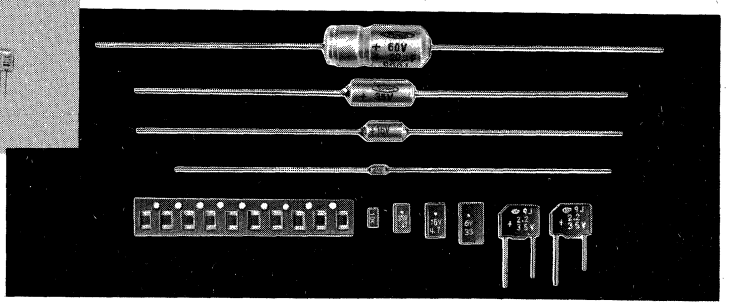
TYPE	DESCRIPTION	TERMINALS	TEMP. RANGE (°C)	VOLT. RANGE (WVDC)	CAP. RANGE (μF)	STD. TOL. (% μF)	CASE SIZES DIA. x LGTH. (Inches) H x W x D (Inches)	FEATURES	TIB *
TT 	Aluminum Tubular, Axial Lead	Wire Leads	−40 to +85	3 to 150	1 to 2400	±20%	.25 x .50 to .68 .312x .687 to .81 .375x .687 to 1.50 .438x1.25 to 1.5 .485x1.25 to 1.75	Miniature, All Welded Construction Low DCL, Low ESR	4-104B
TCW	Aluminum Tubular, Axial Lead	Wire Leads	−20 to +85	3 to 450	2 to 36,000	−10 +75 −10 +50	.50x1.12 to 2.12 .62x1.12 to 2.62 .75x1.12 to 2.75 .87x1.37 to 3.12 1.00x1.37 to 3.89	All Welded Construction	4-103
TCX	Aluminum Tubular, Axial Lead	Wire Leads	−55 to +105	3 to 150	12 to 26,000	−10 +75 −10 +50	.50x1.12 to 2.12 .62x1.12 to 2.62 .75x1.12 to 2.62 .87x1.12 to 3.12 1.00x1.12 to 3.62	High Temperature Computer Grade Low DCL, Low ESR All Welded Construction	0-311
TCG	Aluminum Tubular, Axial Lead	Wire Leads	−40 to +85	6 to 450	3 to 23,000	−10 +75 −10 +50 −10 +100	.50x1.12 to 2.12 .62x1.12 to 2.62 .75x1.12 to 2.62 .87x1.12 to 3.12 1.00x1.12 to 3.62	Computer Grade High Capacity, Low DCL, Low ESR All Welded Construction	4-307
VPR	Aluminum Can, Vertical Mount Single Ended	Wire Leads, Plug-in	−55 to +105	6 to 150	22 to 20,000	−10 +100 −10 +75 −10 +50	.50x1.00 to 1.62 .75x1.12 to 3.62 .87x1.12 to 3.62 1.00x1.12 to 3.62	Miniature, All Welded Construction Low DCL, Low ESR, Low ESL, High Temperature, High Ripple Current	4-106
FP PFP	Aluminum Can, Twist-Tab or PC Vertical Mount	Solder Lugs, Wire Wrap, PC Lugs	−30 to +85	6 to 450	22 to 20,000	−10 +150 −10 +100 −10 +50	.75x1.50 to 3.00 1.00x1.50 to 4.00 1.37x1.50x5.00	Single or Multi-Section	4-101
CGS	Aluminum Can, Bracket Mount	Solder Lugs, Screw Inserts	−40 to +85	3 to 450	10 to 920,000	−10 +75 −10 +50	1.00x1.75 to 4.12 1.37x1.75 to 5.62 1.75x2.12 to 5.62 2.00x2.12 to 5.62 2.50x3.12 to 5.62 3.00x3.62 to 8.62	Computer Grade Low DCL, Low ESR High Performance	4-303
CGR	Aluminum Can, Bracket Mount	Low or High Post Screw Inserts	−55 to +85	3 to 150	140 to 320,000	−10 +75 −10 +50	1.37x1.75 to 5.62 1.75x2.12 to 5.62 2.00x2.12 to 5.62 2.50x3.12 to 5.62 3.00x3.62 to 5.62	Computer Grade Low DCL, Extremely Low ESR High Ripple Current	4-313
CGO	Aluminum Can, Bracket Mount	Low or High Post Screw Inserts	−55 to +85	5 to 55	2800 to 67,000	−20 +20	1.37x2.12 to 5.62	Low, Controlled ESR ±30% Symmetrical Capacitance Tolerance High Ripple Current	4-314
SFC	Aluminum Can, Bracket or Buss-Bar Mount	Buss-Bar Screw	−40 to +85	6 to 50	6800 to 100,000	−0 +100	3.00x4.12 3.00x5.62	Computer Grade Low DCL, Ultra-Low ESR, Ultra-High Ripple Capability Low ESL	4-310
HC NP	Bakelite Case, Single Ended	Screw	−20 to +85	3 to 450 3 to 450NP	65 to 40,000 30 to 32,000	−10 +150 −10 +100 −10 +50 ±25%	1.44x2.75 to 2.06x4.37	Rugged Hi-Pot Case, Versatile Mounting NP—Non-Polar	4-301

* Technical Information Bulletin

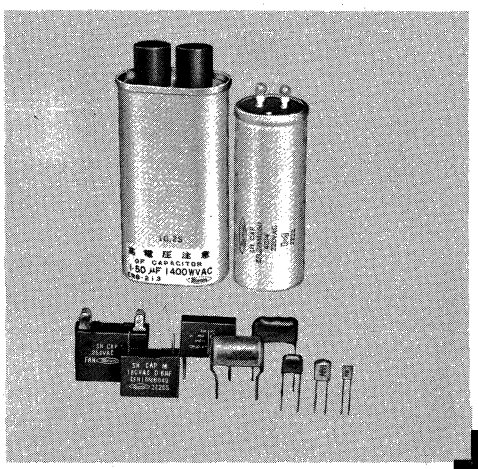
MARCON AMERICA CORP.

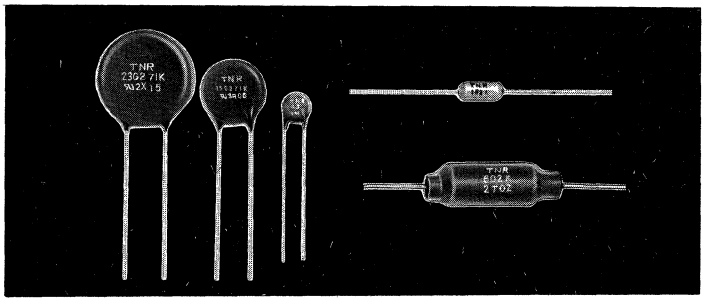


ALUMINUM ELECTROLYTIC CAPACITORS



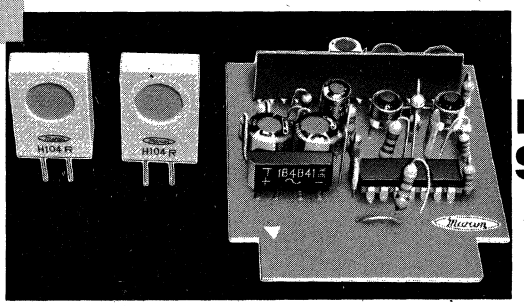
TANTALUM ELECTROLYTIC CAPACITORS





METAL OXIDE VARISTORS "TNR"

FILM AND PAPER CAPACITORS



HUMIDITY SENSOR

MARCON AMERICA CORP.

TOSHIBA GROUP

310 Era Drive
Northbrook, Ill. 60062 USA
Phone (312) 564-2820
Tix: 206351 Marconame, Nbrk.
Fax: (312) 564-1150 GIII

- Switching Power Supply Capacitors
- Miniature Electrolytic Capacitors
- Computer Grade Capacitors
- Metallized Film Capacitors
- AC Film Capacitors
- Tantalum Capacitors
- Humidity Sensor
- Metal Oxide Varistors

Marcon

ALUMINUM ELECTROLYTIC CAPACITORS

Series	Features	Temperature Range (°C)	Rated Voltage Range (Vdc)	Standard Cap. Tol. (%)	DC Leakage Current (μA)
CEUSM CEUST	General Purpose Solvent-proof	−40 ~ +105	6.3 ~ 250	±20	0.01CV +3 after 5 min.
CESHM CESHT	Solvent-proof	−40 ~ +85	6.3 ~ 100	±20	0.01CV +3 after 5 min.
CE04W-MD CE02W-MD	Low Leakage Current Replacement of Tantalum Capacitors	−40 ~ +85	6.3 ~ 50	±20	0.002CV or 0.4 after 2 min.
CELAM CELAT	Low Leakage Current 3,000 Hours Life at 105°C	−40 ~ +105	10 ~ 250	−10 ~ +50	0.002CV or 2 after 3 min
CESHM-MD CESHT-MD	Low Leakage Current Solvent-proof	−40 ~ +85	10 ~ 100	±20	0.002CV or 0.4 after 2 min.
CE04U CE02U	Low Leakage Current High Temperature 3Vdc Reverse Voltage	−40 ~ +125	10 ~ 250	−10 ~ +50	0.002CV or 2 after 2 min.
CE04W CE02W	General Purpose	−40 ~ +85	6.3 ~ 450	−10 ~ +50	0.02CV +4 or 0.02CV +100
CEUFM	Low Leakage Current Low ESR High Ripple Current	−55 ~ +105	6.3 ~ 60	±20	0.002CV or 2 after 5 min.
CESFM	Solvent-proof Low ESR	−55 ~ +105	6.3 ~ 63	±20	0.01CV after 2 min.
CEFTW CEFHW	High CV Low Profile Snap-in Terminals	−40 ~ +85	10 ~ 450	±20	0.02CV or 2000 after 5 min.
CEFTU CEFHU	High CV Low Profile Snap-in Terminals 1,000 Hours Life at 105°C	−40 ~ +105	10 ~ 250	±20	0.02CV or 2000 after 5 min.

* Please refer to individual catalogs about solvent-proof capacitors.
* Ultra small size lytics such as 3x5, 4x7, 5x7 and 5x9 are available.
* Special capacitance tolerance is available upon request.

MARCON AMERICA CORP.
TOSHIBA GROUP

For Film Capacitors ..... call or write use for catalogs
For Metal Oxide Varistors ..... see page **A**•1887

TYPE 202/203 DIPPED TANTALUM CAPACITORS

TYPE 202

Designed to take advantage of high purity tantalum powder resulting in smaller size units and minimum cost, with very low leakage current and excellent stability over both temperature and time, with a very limited distribution. Ideal for by-passing, coupling and timing applications.

SPECIFICATIONS

Capacitance Range: 0.1 to 330 μF
Rated Working Voltage: 3.15 to 35 VDC
Capacitance Tolerance: ±20%; ±10%
Operating Temperature Range: −55°C to +85°C
DC Leakage Current (Rated Voltage, 5 min. 25°C): 0.01 CV (μA) or 0.5 μA, whichever is greater.
Conform to the test method of Capacitor Flame Test in UL 1414.

ALLOWABLE REVERSE VOLTAGE

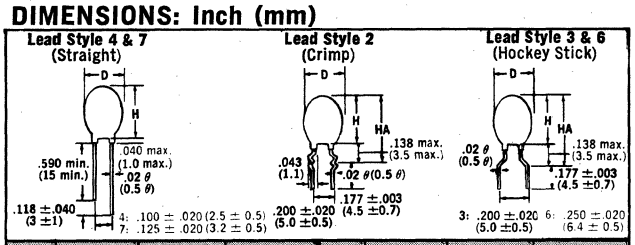
10% of rated voltage or 0.5 V, whichever is greater, at 25°C; 3% of rated voltage or 0.5 V, whichever is greater, at 85°C.

STANDARD RATINGS, SHOWING CASE SIZES

CAP. (μF) \ RV (VDC)	3.15	6.3	10	16	20	25	35
.10							1
.15							1
.22							1
.33							1
.47							1
.68							1
1.0							1
1.5						1	2
2.2					1	2	3
3.3				1	2	3	4
4.7			1	2	3	4	5
6.8		1	2	3	4	5	6
10	1	2	3	4	5	6	7
15	2	3	4	5	6	7	8
22	3	4	5	6	7	8	9
33	4	5	6	7	8	9	10
47	5	6	7	8	9	10	
68	6	7	8	9	10		
100	7	8	9	10			
150	8	9	10				
220	9	10					
330	10						

NOTE: Intermediate non-standard values available. 1000 Pcs. Minimum.

DIMENSIONS: Inch (mm)



Case Size	D Max.	H Max.	HA Max.	Case Size	D Max.	H Max.	HA Max.
1	.142 (3.6)	.236 (6.0)	.374 (9.5)	6	.217 (5.5)	.335 (8.5)	.473 (12)
2	.150 (3.8)	.256 (6.5)	.394 (10)	7	.217 (5.5)	.374 (9.5)	.512 (13)
3	.157 (4.0)	.276 (7.0)	.414 (10.5)	8	.256 (6.5)	.453 (11.5)	.591 (15.0)
4	.189 (4.8)	.295 (7.5)	.433 (11)	9	.295 (7.5)	.512 (13.0)	.650 (16.5)
5	.197 (5.0)	.315 (8.0)	.453 (11.5)	10	.394 (8.0)	.551 (14.0)	.689 (17.5)

ORDERING INFORMATION

202 L 3151 106 M 4

TYPE

FAILURE RATE
L: 2%/1000 Hrs.

VOLTAGE RATING

Code	Volts	Code	Volts	Code	Volts
3151	3.15	1602	16	2502	25
6301	6.3	2002	20	3502	35
1002	10				

CAPACITANCE IN PICOFARADS
First two digits are significant figures.
Third digit is the number of zeros following.

CAPACITANCE TOLERANCE
M = ±20%, K = ±10%

LEAD STYLE

Lead Style	Lead Space Inch	Lead Space mm	Code	Lead Style	Lead Space Inch	Lead Space mm	Code
Straight .100″	.100	2.5	4	Hockey Stick .250″	.250	6.4	6
Straight .125″	.125	3.2	7	Tape & Reel .200″	.200	5.0	C
Crimp .200″	.200	5.0	2	Tape & Reel .100″	.100	2.5	H
Hockey Stick .200″	.200	5.0	3	Tape & Ammo Pack .200″	.200	5.0	B

TYPE 203 Miniature Microdip

SPECIFICATIONS

Combines the efficiency and smaller size of tantalums with the best electrical parameters available.

Operating Temperature Range: −55°C to +85°C
Rated Working Voltage: 3.15, 6.3, 10, 16, 20, 25, 35 VDC
Capacitance Range: 0.022 to 10 MFD
Capacitance Tolerance: ±20% (M)
DC Leakage Current: 0.01 x CV or 0.5 μA, whichever is greater
Conform to the test method of Capacitor Flame Test in UL 1414.

LEAD MATERIAL

Solder plated, nickel-silver alloy.

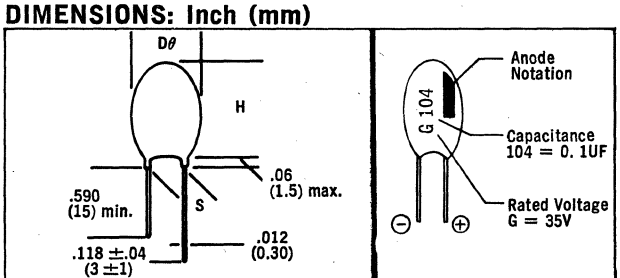
STANDARD RATINGS, SHOWING CASE SIZES

CAP. (μF) \ RV (VDC)	3.15	6.3	10	16	20	25	35
0.022							1
0.033							1
0.047							1
0.068							1
0.1							1
0.15							1
0.22							1
0.33						1	2
0.47					1		2
0.68				1		2	3
1.0			1		2		3
1.5		1		2		3	
2.2	1		2		3		
3.3		2		3			
4.7	2		3				
6.8		3					
10.0	3						

ALLOWABLE REVERSE VOLTAGE

10% of rated voltage or 0.5 V, whichever is greater, at 25°C; 3% of rated voltage or 0.5 V, whichever is greater, at 85°C.

DIMENSIONS: Inch (mm)



Case Code	D Max.	H Max.	S ±.02 (0.5)	R/V	Code	R/V	Code
1	.110 (2.8)	.177 (4.5)	.06 (1.5)	3.15	A	20	E
2	.118 (3.0)	.208 (5.3)	.06 (1.5)	6.3	B	25	F
3	.126 (3.2)	.236 (6.0)	.06 (1.5)	10	C	35	G
				16	D		

ORDERING INFORMATION

203 L 6301 155 M

MATSUO TYPE NUMBER

FAILURE RATE LEVEL
L: 2%/1000 Hrs.

DC RATED VOLTAGE (in millivolts)
First three digits are significant figures.
Fourth digit is the number of zeros following.

CAPACITANCE IN PICOFARADS
First two digits are significant figures.
Third digit is the number of zeros following.

CAPACITANCE TOLERANCE
M: ±20%

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These specifications are subject to change without notice.

TYPE 221 DIPPED TANTALUM CAPACITORS

SEVEN CASE SIZES; 188 STANDARD RATINGS

SPECIFICATIONS

Capacitance Range: 0.1 to 470 μF
Rated Working Voltage: 3.15, 6.3, 10, 16, 20, 25, 35 & 50 VDC
Capacitance Tolerance: ±20% (M); ±10% (K); ±5% (J)
Operating Temperature Range: −55°C to +125°C
DC Leakage Current (Rated Voltage, 5 min., 20°C): 0.01 CV (μA) or 0.5 μA, whichever is greater; special order low leakage: 0.001 CV (μA) or 0.05 μA

SURGE VOLTAGE

Maximum change in capacitance after rated surge voltage is applied in series with a 1000 ohm resistor at the rate of ½ minute on, 4½ minutes off, for 1000 successive test cycles at 85°C: within ±5% of initial value. Dissipation factor and DC leakage: within initial specifications.

DC Rated Voltage at 85°C	3.15	6.3	10	16	20	25	35	50
DC Surge Voltage at 85°C	4.0	8.0	13	20	25	32	44	63

Capacitors shall withstand the surge voltage applied in series with a 100 ohm resistor at the rate of ½ minute on, 4½ minutes off, for 1000 successive test cycles at 85°C. After test, capacitors shall meet the requirements in Table 1.

Table 1

Capacitance Change	Within 5% of initial value
Dissipation Factor	Within initial requirement specified
DC Leakage Current	Within initial requirement specified

CAPACITANCE STABILITY

Maximum change in capacitance after temperature cycling from 25°C; −55°C, within ±12% of initial value; 85°C, within 12% of initial value. DC leakage at 85°C, within ten times the initial value at 25°C.

Dissipation Factor (at 120 Hz)
Max. Dissipation Factor in percent.

Capacitance (MFD)	−55°C	+85°C	+20°C
0.1 to 1.0	5	4	4
1.2 to 5.6	8	6	6
6.8 to 68.0	11	8	8
82.0 to 330.0	12	10	10
470.0	12	10	10

MOISTURE RESISTANCE

Maximum change in capacitance after 500 hours at 40°C, 90/95% R.H.: within ±5% of initial value; dissipation factor and DC-leakage current, within initial requirements.

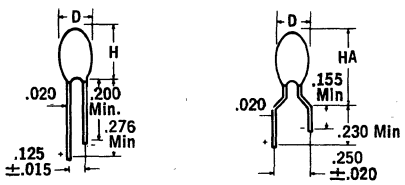
LIFE TEST

Maximum change in capacitance after 1000 hours at 85°C with rated DC voltage applied: within ±10% of initial value. Dissipation factor, within initial requirements; DC leakage, 125% max. of initial specifications.

STANDARD RATINGS, SHOWING CASE SIZES

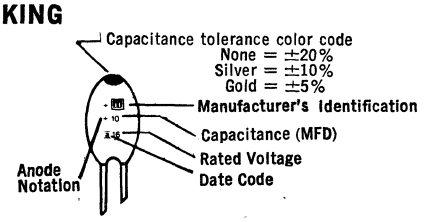
MFD \ WV	3.15	6.3	10	16	20	25	35	50
.1							1	2
.12							1	2
.15							1	2
.18							1	2
.22							1	2
.27							1	2
.33							1	2
.39							1	2
.47							1	2
.56							1	2
.68							1	2
.82							1	2
1.0							1	2
1.2							1	3
1.5						1	2	3
1.8						1	2	3
2.2					1		2	4
2.7					1		2	4
3.3				1		2	3	4
3.9				1		2	3	4
4.7			1		2	3	4	5
5.6			1	2		3	4	5
6.8		1		2	3		4	5
8.2		1	2	3		4	5	6
10	1		2	3		4	5	6
12	1	2	3			4	5	6
15		2	3		4	5	6	7
18	2	3		4		5	6	7
22	2	3		4	5	6	6	7
27	2	3	4	5		6	7	
33	3		4	5	6	6	7	
39	3		4	5	6		7	
47		4	5	6	6		7	
56		4	5	6		7		
68	4		5	6		7		
82	4	5	6		7			
100		5	6		7			
120	5	6		7				
150	5	6		7				
180		6	7					
220		6	7					
270	6	7						
330	6	7						
390	7							
470	7							

DIMENSIONS: Inch (mm)



Lead Style 3 Lead Style 7

MARKING



Case Size	D. Max.	H Max.	HA Max.
1	0.157 (4.0)	0.315 (8.0)	0.335 (8.5)
2	0.177 (4.5)	0.335 (8.5)	0.374 (9.5)
3	0.197 (5.0)	0.374 (9.5)	0.413 (10.5)
4	0.217 (5.5)	0.453 (11.5)	0.472 (12.0)
5	0.256 (6.5)	0.540 (13.7)	0.571 (14.5)
6	0.295 (7.5)	0.630 (16.0)	0.640 (16.1)
7	0.335 (8.5)	——	0.790 (20.0)

ORDERING INFORMATION

221 M 3151 106 M 3

TYPE 221

FAILURE RATE M
M: 1%/1000Hr.

VOLTAGE RATING 3151

Code	Vol	Code	Vol	Code	Vol	Code	Vol
3151	3.15	1002	10	2002	20	3502	35
6301	6.3	1602	16	2502	25	5002	50

CAPACITANCE IN PICOFARADS 106
First two digits are significant figures.
Third digit is the number of zeros following.

CAPACITANCE TOLERANCE M
M = ±20%
K = ±10%
J = ±5%

LEAD STYLE 3

Code	Space
*1	0.100
3	0.125
*5	0.200
7	0.250

* Non Standard. Available upon Request.

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MATSUO® TYPE 265/267 TANTALUM CHIP CAPACITORS

TYPE 265

For PCB and Hybrid Applications
Precision Molded Construction

SPECIFICATIONS

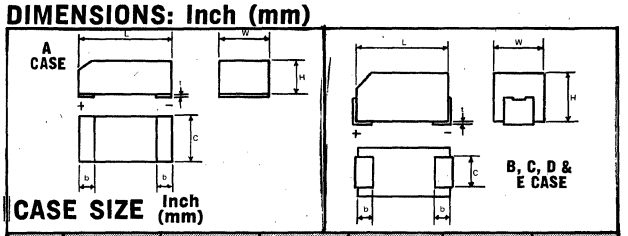
Capacitance Range: 0.1 to 100 μF
Rated Working Voltage: 3.15, 6.3, 10, 16, 20, 25 & 35 VDC
Capacitance Tolerance: ±20% (M); ±10% (K)
Operating Temperature Range: −55°C to +125°C

DC Leakage Current (Rated Voltage, 5 min. 25°C): 0.01 CV (μA) or 0.5 μA, whichever is greater.
Conforms to UL 1414.

STANDARD RATINGS, SHOWING CASE SIZES

CAP. (μF) \ R.V. (VDC)	3.15	6.3	10	16	20	25	35
.1							A, B
.15							A, B
.22							A, B
.33						A	B
.47					A		B
.68				A		B	C
1.0			A		B		C
1.5		A		B			C
2.2	A		B			C	D
3.3		B			C		D
4.7	B			C		D	E
6.8			C		D		E
10		C		D			E
15	C		D			E	
22			D		E		
33		D		E			
47	D		E				
68		E					
100	E						

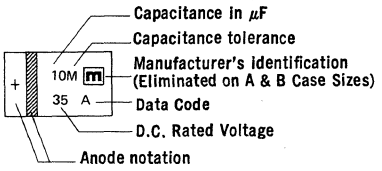
DIMENSIONS: Inch (mm)



CASE SIZE Inch (mm)

Case Code	L ±.008 (0.2)	W ±.012 (0.3)	H ±.008 (0.2)	b ±.012 (0.3)	c ±.012 (0.3)	t
A	.180 (4.6)	.100 (2.5)	.070 (1.7)	.030 (0.8)	.100 (2.5)	.006 (0.15)
B	.180 (4.6)	.100 (2.5)	.100 (2.5)	.030 (0.8)	.063 (1.6)	.004 (0.10)
C	.315 (8.0)	.180 (4.6)	.070 (1.7)	.050 (1.3)	.118 (3.0)	.004 (0.10)
D	.315 (8.0)	.180 (4.6)	.100 (2.5)	.050 (1.3)	.118 (3.0)	.004 (0.10)
E	.315 (8.0)	.180 (4.6)	.195 (5.0)	.050 (1.3)	.118 (3.0)	.006 (0.15)

MARKING



ORDERING INFORMATION

265 L 3502 106 M 1

MATSUO Type Number
FAILURE RATE LEVEL L: 2%/1000 h
RATED VOLTAGE

Code	VDC	Code	VDC
3151	3.15	2002	20
6301	6.3	2502	25
1002	10	3502	35
1602	16		

CAPACITANCE IN PICOFARABS First two digits are significant figures. Third digit is the number of zeros following.
CAPACITANCE TOLERANCE M = ±20% K = ±10%
LEAD STYLE 1: Case Size B, C, D and E 8: Case Size A only

NEW PRODUCT SMALLER CASE SIZES

TYPE 267

Precision Molded Construction Rectangular For Automatic Mounting. PCB or Hybrid

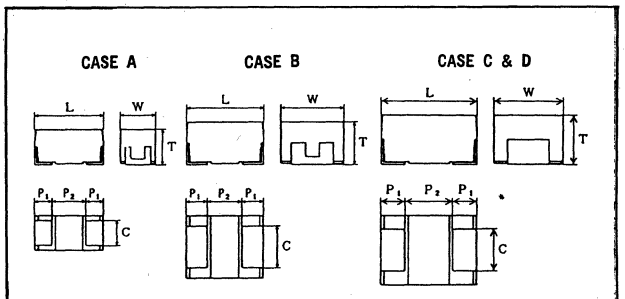
SPECIFICATIONS

Operating Temperature Range: −55°C ~ +125°C
Rated Working Voltage: 4, 6.3, 10, 16, 20, 25, 35 VDC
Capacitance Range: 0.1 to 100 μF
Capacitance Tolerance: ±20% (M); ±10% (K)
Failure Rate Level: 2%/1000 Hrs.
DC Leakage Current (Rated Voltage, 5 min. 25°C): 0.01 CV (μA) or 0.5 μA, whichever is greater.

STANDARD RATINGS, SHOWING CASE SIZES

CAP. (μF) \ R.V. (VDC)	4	6.3	10	16	20	25	35
0.1							A
0.15							A
0.22							A
0.33							A
0.47						A	B
0.68					A		B
1.0				A			B
1.5			A			B	C
2.2		A			B		C
3.3	A			B			C
4.7			B			C	D
6.8		B			C		D
10	B			C		D	
15			C		D		
22		C		D			
33	C		D				
47		D					
68	D	D					
100	D						

DIMENSIONS: Inch (mm)



CASE CODE	L ± .008 (0.2)	W ± .008 (0.2)	T ± .008 (0.2)	P_1 ± .008 (0.2)	P_2 MIN.	C ± .006 (0.15)
A	.126 (3.2)	.063 (1.6)	.063 (1.6)	.030 (0.75)	.050 (1.4)	.047 (1.2)
B	.134 (3.4)	.110 (2.8)	.075 (1.9)	.034 (0.85)	.055 (1.5)	.071 (1.8)
C	.221 (5.6)	.130 (3.3)	.091 (2.3)	.050 (1.3)	.110 (2.8)	.079 (2.0)
D	.221 (5.6)	.181 (4.6)	.126 (3.2)	.050 (1.3)	.110 (2.8)	.126 (3.2)

ORDERING INFORMATION

267 L 3502 105 M

MATSUO Type Number
FAILURE RATE L: 2%/1000 Hrs.
RATED VOLTAGE

Code	VDC	Code	VDC
4001	4	2002	20
6301	6.3	2502	25
1002	10	3502	35
1602	16		

CAPACITANCE IN PICOFARADS First two digits are significant figures. Third digit is the number of zeros following.
CAPACITANCE TOLERANCE M = ±20% K = ±10%
PACKAGING 8mm & 12mm tape and reel

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These specifications are subject to change without notice.

TYPE 242 MOLDED TANTALUM CAPACITORS

TYPE 242

For High Density Packaging

SPECIFICATIONS

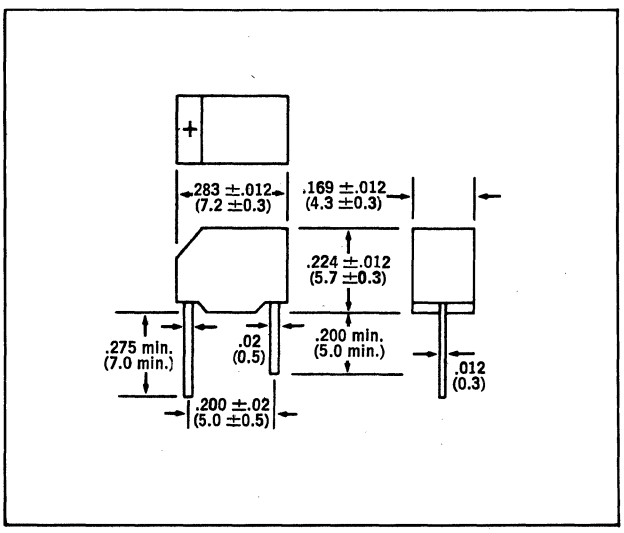
Capacitance Range: 0.1 to 47 μF
Rated Working Voltage: 6.3, 10, 16, 20, 25, 35 & 50 VDC
Capacitance Tolerance: ±20% (M); ±10% (K)
Operating Temperature Range: −55°C to +125°C
DC Leakage Current (Rated Voltage, 5 min. 20°C): 0.01 CV (μA) or 0.5 μA, whichever is greater: (85°): 0.5 CV 5.0 μA, whichever is greater.
Conforms to UL 1414.
Available on tape in ammo-pack or reel.

Impact resistant rectangular molded case. Uniform lead location for automatic insertion. Low impedance at high frequencies. Ideal for noise bypassing in high speed logical circuits. High capacitance in miniature case.

STANDARD RATINGS

CAP. (μF) \ R.V. (VDC)	6.3	10	16	20	25	35	50
0.1						•	•
0.15						•	•
0.22						•	•
0.33						•	•
0.47						•	•
0.68						•	•
1.0						•	•
1.5						•	•
2.2						•	•
3.3						•	•
4.7					•	•	
6.8				•		•	
10			•		•		
15		•		•			
22	•		•				
33		•					
47	•						

DIMENSIONS: Inch (mm)



ORDERING INFORMATION

242 M 1602 106 M 2

TYPE — 242

FAILURE RATE LEVEL — M
M: 1%/1000 Hrs.

VOLTAGE RATING — 1602

Code	Volts	Code	Volts
6301	6.3	2502	25
1002	10	3502	35
1602	16	5002	50
2002	20		

CAPACITANCE IN PICOFARADS — 106
First two digits are significant figures. Third digit is the number of zeros following.

CAPACITANCE TOLERANCE — M
M = ±20%
K = ±10%

LEAD STYLE — 2

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These specifications are subject to change without notice.

TYPE 244/245 MOLDED TANTALUM CAPACITORS

TYPE 244

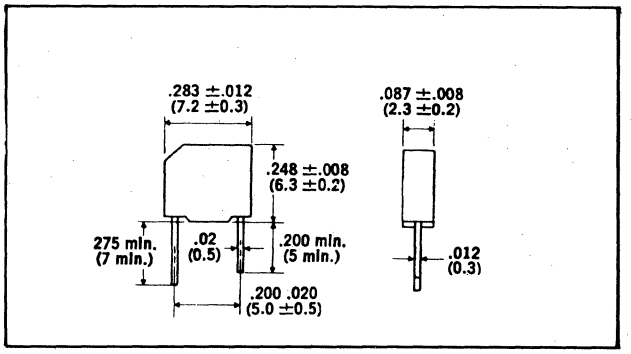
FOR NOISE BYPASSING

Impact resistant rectangular molded case. Eliminating the noise generated at the rise time of pulse in ultra-high speed logical circuits such as TTL and ECL.

SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C (for temperature above 85°C, derate voltage to 67% of R.V.)
Failure Rate Level: M (1%/1000 Hrs.)
Rated Voltage: 16, 35, 50 VDC
Capacitance: 1, 3.3 MFD
Capacitance Tolerance: ±20% (M)
DC Leakage Current (Rated Voltage, 5 min. 25°C): 0.01 CV (μA) or 0.5 μA, whichever is greater.
Conforms to UL 1414
Available on tape in ammo-pack or reel.

DIMENSIONS: Inch (mm)



STANDARD RATING

CATALOG NO.	DC RATED VOLTAGE (VDC)	CAPACITANCE (μF)
244M 1602-335M	16	3.3
244M 3502-105M	35	1.0
244M 5002-105M	50	1.0

TYPE 245

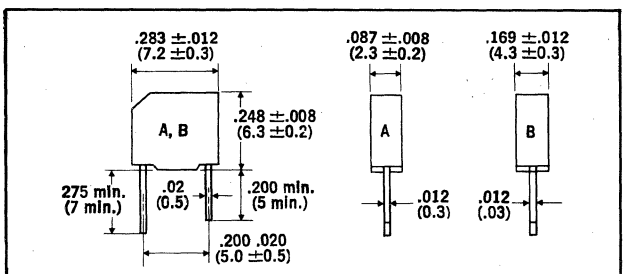
Hybrid Capacitor — Fuse

Eliminates the noise generated at rise time in ultra-high speed logical circuits such as TTL and ECL. Built-in fuse functions either as thermal fuse under small current or as electric fuse under larger currents.

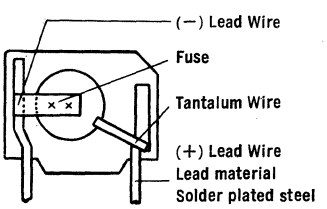
SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C (For temperature above 85°C, derate voltage to 67% of R.V.)
Rated Voltage: 10 VDC to 50 VDC
Capacitance Range: 1.0 to 33 MFD
Capacitance Tolerance: ±20% (M)
DC Leakage Current: (Rated voltage, 5 minutes, 25°C) 0.01 CV (μA) or 0.5 μA whichever is greater.
Conforms to UL 1414.
Circuit Breaking Performance
Built-in fuse functions as a thermal fuse at current of less than 5 amperes. At current of more than 5 amperes, built-in fuse functions by the current flowing through fuse.
Available on tape in ammo-pack or reel.

DIMENSIONS: Inch (mm)



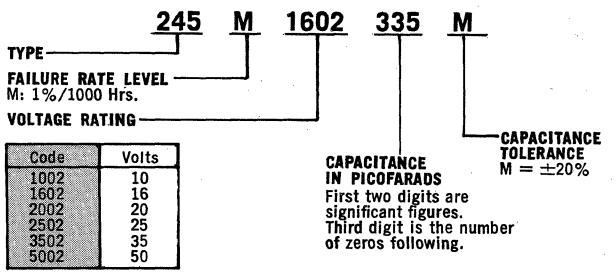
CONSTRUCTION



STANDARD RATINGS, SHOWING CASE SIZES

CAP. (μF) \ R.V. (VDC)	10	16	20	25	35	50
1.0					A	A
2.2					B	B
3.3		A			B	B
4.7				B	B	
6.8			B		B	
10		B		B		
15	B		B			
22		B				
33	B					

ORDERING INFORMATION



Code	Volts
1002	10
1602	16
2002	20
2502	25
3502	35
5002	50

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TYPE 501/553/602 FILM CAPACITORS

TYPE 501 POLYESTER

Highly stable resin dipped film capacitor with superior performance.

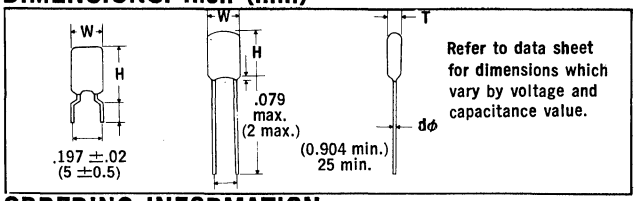
SPECIFICATIONS

Operating Temperature: −40°C ~ +125°C
Maximum Operating Temperature for DC Rated Voltage: +85°C.
DC Rated Voltage: 50, 100, 200 VDC. (For operation at 125°C the voltage is 50% of 85°C ratings).
Capacitance Range: 0.001 ~ 0.22 μF
Capacitance Tolerance: ±5%, ±10%
Failure Rate Levels: P: 0.1%/1000 h. N: 0.5%/1000 h.
Available on tape and reel.

STANDARD RATINGS

50 VOLT	100 VOLT	200 VOLT
.001 to .47 MFD	.001 to .22 MFD	.001 to .1 MFD

DIMENSIONS: Inch (mm)



Refer to data sheet for dimensions which vary by voltage and capacitance value.

ORDERING INFORMATION

501 N 5002 104 K 2

- TYPE
- FAILURE RATE — N: 0.5%/1000 Hrs. P: 0.1%/1000 Hrs.
- RATED VOLTAGE

Code	Volts
5002	50
1003	100
2003	200

- CAPACITANCE IN PICOFARADS
- CAPACITANCE TOLERANCE — K = ±10%, J = ±5%
- LEAD STYLE — 1: Straight, 2: Hockey stick (50 volt only)

TYPE 553 POLYESTER

Super Miniature metallized polyester film capacitor with high ratio of capacitance/voltage in a small package. Low impedance and high stability. Plastic case.

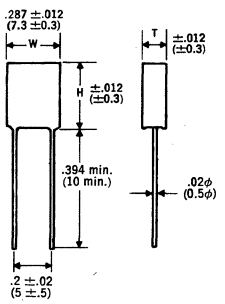
SPECIFICATIONS

Operating Temperature: −40°C ~ +105°C
DC Rated Voltage Range: 50 VDC*, 63 VDC*
Nominal Capacitance Range: .01 μF to 1.0 μF
Capacitance Tolerance: ±5%, ±10%
* For operation at 105°C the voltage shall be derated to 50% of R.V.
Available on tape and reel.

inch (mm)

MFD	VOLTS 50	VOLTS 63	DIMENSIONS H	DIMENSIONS T
0.01		•	.275 (7.0)	.102 (2.6)
0.015		•	.276 (7.0)	.102 (2.6)
0.022		•	.276 (7.0)	.102 (2.6)
0.033		•	.276 (7.0)	.102 (2.6)
0.047		•	.276 (7.0)	.102 (2.6)
0.068		•	.276 (7.0)	.102 (2.6)
0.1		•	.276 (7.0)	.102 (2.6)
0.15		•	.335 (8.5)	.142 (3.6)
0.22		•	.335 (8.5)	.142 (3.6)
0.33		•	.374 (9.5)	.181 (4.6)
0.47		•	.413 (10.5)	.205 (5.2)
0.68	•		.413 (10.5)	.205 (5.2)
1.0	•		.453 (11.5)	.244 (6.2)

DIMENSIONS: Inch (mm)



ORDERING INFORMATION

553 M 6302 104 K

- TYPE
- FAILURE RATE — M: 1%/1000 Hrs.
- RATED VOLTAGE

Code	VDC
6302	63
5002	50

- CAPACITANCE IN PICOFARADS
- CAPACITANCE TOLERANCE — K = ±10%, J = ±5%

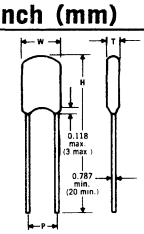
TYPE 602 POLYPROPYLENE

602 capacitors were designed for applications requiring high accuracy, excellent stability, low dielectric absorption, very high insulation resistance and low temperature coefficient. Available on tape and reel.

SPECIFICATIONS

Operating Temperature Range: −40°C to +85°C
D.C. Rated Voltage: 100 VDC
Capacitance Range: 0.001 to 0.22 MFD, E-12 series
Capacitance Tolerance: ±2% (G), ±1% (F), ±5% (J) available on special order
Dielectric Withstanding Voltage: 2 times D.C. rated voltage for 1 minute
Insulation Resistance: 100,000 MΩ at 20°C
10,000 MΩ min. at 85°C
Dissipation Factor: <0.15 MFD 0.1% max.
≥0.15 MFD 0.2% max.
at 20°C, 1000 Hz

DIMENSIONS: Inch (mm)



Refer to data sheet for dimensions which vary by capacitance value.

ORDERING INFORMATION

602 M 1003 103 G 1

- TYPE
- FAILURE RATE — M: 1%/1000 Hrs.
- RATED VOLTAGE
- CAPACITANCE IN PICOFARADS
- CAPACITANCE TOLERANCE — F = ±1%, G = ±2%, J = ±5%
- LEAD STYLE OR PACKAGING — 1: Straight, 4: Crimp, C: Tape & reel

MATSUO ELECTRONICS 2134 Main St., Ste. 200 / Huntington Beach, CA 92648 / Tel. (714) 969-2491 / FAX (714) 960-6492 / TWX 910-596-1828

These specifications are subject to change without notice.

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TANTALUM SOLID, WET AND CHIP CAPACITORS

5900 Australian Avenue, West Palm Beach, FL 33407 (305) 842-3201 TWX: 510-952-7618 Telex: 387217

MIL SLASH NO.	DESIGNATION		M/E STYLE	DESCRIPTION	CAPACITANCE RANGE	VOLT. RANGE
WET SLUG MIL-C-3965						
/1	CL14	CL16	43XW	Hermetic Seal, Screw Mount, Cylindrical Case	3.5- 200 µf	20-630v
/19	CL17	CL18	43XW	Hermetic Seal, Stud Mount, Cylindrical Case	12-1300 µf	30-630v
/21	CL55		43JW	Hermetic Seal, Rectangular Module	70-2400 µf	15-150v
/4	CL64	CL65	40LW	Elastomer Seal, Axial Lead, Tubular Case	1.7- 560 µf	6-125v
/24	CL66	CL67	40SW	Hermetic Seal, Axial Lead, Tubular Case	1.7- 560 µf	6-125v
MIL-C-39006				Established Reliability		
/18	CLR10		43XW	Extended Range, Axial Lead, Tubular Case	2.0- 140 µf	8-360v
/19	CLR14		43XW	Extended Range, Cylindrical Case, Solder Lug Terminal	3.5- 200 µf	20-630v
/20	CLR17		43XW	Extended Range, Cylindrical Case, Solder Lug Terminal	12-1300 µf	30-630v
/09D	CLR65-	8000	40SW	Glass-to-Tantalum Hermetic Seal, Axial Lead, Tubular Case	1.7-1200 µf	6-125v
/22C	CLR79		40AW	Hermetic Seal, Non-Silver Case, Axial Lead, Tubular Case	1.7-1200 µf	6-125v
SOLID SLUG MIL-C-26665B						
	CS12	CS13	40SS	Hermetic Seal, Axial Lead, Tubular Case	.0047- 330 µf	6-100v
MIL-C-39003				Established Reliability		
/02	CSR09		40TS	Polar, Miniature, Hermetic Seal, Axial Lead, Tubular Case	.047- 18 µf	6- 75v
/01	CSR13		40SS	Polar, Extended Range, Hermetic Seal, Axial Lead, Tubular Case	.0047- 330 µf	6-100v
/09	CSR21		40ZS	Polar, High Frequency Hermetic, Tubular Case, Axial Lead	5.6- 330 µf	6- 50v
/03	CSR23		40XS	Polar, Hermetic Seal, Axial Lead, Tubular Case	1.2-1000 µf	6- 50v
/06	CSR33		40YS	Polar, Extended Range, Hermetic Seal, for Low Impedance Application	1.2-1000 µf	6- 50v
/04	CSR91		40NS	Non-Polar, Hermetic Seal, Axial Lead, Tubular Case	.0023- 160 µf	6-100v
SOLID CHIP MIL-C-55365/4				Established Reliability		
	CWR06		49BC	Polar Hybrid Tantalum Chip	.1- 100 µf	4- 50v
WET SLUG						
			40AW	Hermetic, Non-Silver Case, Axial Lead, Tubular Case	1.7-1200 µf	6-125v
			40CW	Miniature, Polar, Non-Hermetic, Tubular, Axial Lead	3.3- 450 µf	6- 60v
			40EW	Extended Range, Polar, Non-Hermetic, Tubular, Axial	6.8-1800 µf	6-125v
			43JW	Hermetic, Rectangular Module, Spade Lugs	35-22,000 µf	6-150v
			40LW	Polar, Non-Hermetic, Tubular, Axial Lead	1.7-1100 µf	6-125v
			40PW	Polar, Non-Hermetic, Tubular, Axial Lead	1.7-1100 µf	6-125v
			40SW	Hermetic, Polar, Glass to Tantalum Seal, Tubular, Axial	1.7-1200 µf	6-125v
			40TW	Hermetic, Non-Silver Case, Tubular, Axial, High Temp.	1.7-1200 µf	6-125v
			43XW	Hermetic, Cylindrical Case, Stud or Screw Mount	3.5-1300 µf	20-630v
			40YW	Miniature, Non-Acid Electrolyte, Polar, Tubular, Non-Hermetic	0.1- 320 µf	6- 60v
SOLID CHIP						
			49BC	Polar, Hybrid Tantalum Chip	0.1- 100 µf	4- 50v
			49SC	Polar, Hybrid Tantalum Chip	0.1- 100 µf	4- 50v
SOLID MOLDED MIL-C-49137/5						
	CX05		40MS	Polar, Molded, Non-Hermetic, Axial Lead	0.1- 68 µf	2- 50v
SOLID SLUG						
			40CS	Polar, Miniature Non-Hermetic, Tubular Metal Case, Axial Lead	.0047- 68 µf	2- 50v
			41DS	Polar, Dipped, Non-Hermetic, Radial Lead	0.1- 330 µf	6- 50v
			40ES	Polar, Non-Hermetic, Tubular Metal Case, Axial Lead	.0047- 330 µf	6-100v
			47ES	Polar, Hermetic, Feed-Thru, Screw Mount	3.9- 60 µf	6- 75v
			41GS	Polar, Dipped, Non-Hermetic, Miniature, Radial Lead	0.1- 680 µf	3- 50v
			41KS	Polar, Dipped, Low Profile, Non-Hermetic, Radial Lead	0.1- 270 µf	6- 35v
			40MS	Polar, Molded, Non-Hermetic, Axial Lead	0.1- 68 µf	2- 50v
			40NS	Non-Polar, Hermetic, Tubular Case, Axial Lead	.0023- 160 µf	6-100v
			41PS	Polar, Non-Hermetic, Rectangular Plastic Case, Radial Lead	0.1- 220 µf	6- 50v
			40SS	Polar, Standard Hermetic, Tubular Case, Axial Lead	.0047- 330 µf	6-100v
			40TS	Polar, Miniature Hermetic, Tubular Case, Axial Lead	.0047- 39 µf	4-100v
			40XS	Polar, Extended Range, Hermetic Tubular, Axial Lead	0.82-1000 µf	6- 60v
			40YS	Polar, Extended Range, Hermetic, For Low Impedance Applications	1.2-1000 µf	6- 50v
			40ZS	Polar, High Frequency Hermetic, Tubular Case, Axial Lead	5.6- 330 µf	6- 50v

TANTALUM WET FOIL CAPACITORS

6071 St. Andrews Road, Columbia, SC 29210 (803) 772-2500 TWX: 810-666-2622 Telex: 820676

MIL SLASH NO.	DESIGNATION		M/E STYLE	DESCRIPTION	CAPACITANCE RANGE	VOLT. RANGE
WET FOIL MIL-C-3965						
/17	CL20	CL21	40AF	Polar, Etched Foil, Tubular Case, Axial Lead	1- 580 µf	15-150v
/18	CL22	CL23	40BF	Non-Polar, Etched Foil, Tubular Case, Axial Lead	0.5- 350 µf	15-150v
/15	CL30	CL31	40AG	Polar, Plain Foil, Tubular Case, Axial Lead	0.27- 300 µf	3-300v
/16	CL32	CL33	40BG	Non-Polar, Plain Foil, Tubular Case, Axial Lead	0.12- 400 µf	3-300v
/9	CL51		43KG	Polar, Plain Foil, KSR, Hermetic Rectangular Module	40- 960 µf	15-150v
/10	CL52		43JG	Non-Polar, Plain Foil, KSR, Hermetic Rectangular Module	20- 600 µf	15-150v
/11	CL53		43KF	Polar, Etched Foil, KSR, Hermetic Rectangular Module	70-3500 µf	15-150v
/12	CL54		43JF	Non-Polar, Etched Foil, KSR, Hermetic Rectangular Module	35-2100 µf	15-150v
/22	CL70	CL71	40RF	Polar, High Etched Foil, Tubular Case, Axial Lead	16- 920 µf	15-150v
/23	CL72	CL73	40SF	Non-Polar, High Etched Foil, Tubular Case, Axial Lead	0.75- 590 µf	15-150v
MIL-C-39006				Established Reliability		
/01	CLR25		40EF	Polar, Etched Foil, Hermetic and Non-Hermetic, Axial Lead	1.0- 580 µf	15-150v
/02	CLR27		40FF	Non-Polar, Etched Foil, Hermetic and Non-Hermetic, Axial Lead	0.5- 350 µf	14-150v
/03	CLR35		40EG	Polar, Plain Foil, Hermetic and Non-Hermetic, Axial Lead	0.35- 160 µf	15-200v
/04	CLR37		40FG	Non-Polar, Plain Foil, Hermetic and Non-Hermetic, Axial Lead	0.15- 100 µf	15-200v
/16	CLR71		40TF	Polar, High Etched Foil, Hermetic and Non-Hermetic, Axial Lead	1.6- 920 µf	15-150v
/17	CLR73		40VF	Non-Polar, High Etched Foil, Hermetic and Non-Hermetic, Axial Lead	0.75- 590 µf	15-150v

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ALUMINUM ELECTROLYTIC CAPACITORS

6071 St. Andrews Road, Columbia, SC 29210 (803) 772-2500 TWX: 810-666-2622 Telex: 820676

Mepco/Electra Series	Operating Temp.	D.C.V. Range	Capacitance Range (μf)	Standard Cap. Tolerance	Min. Case Size In Inches	Max. Case Size In Inches	Min. Case Size In MM	Max. Case Size In MM	Life*
3070 Miniature Axial	−40 to +85°C	6.3V to 385V	.33 to 10,000	−10 +50% ±20	.177X .394	.827X 1.575	4.5X 10.0	21.0X 40.0	2000 Hrs.
3120 Computer Grade	−55 to +105°C	6V to 300V	110 to 700,000	−10 +50% −10 +75%	1.375X 2.125	3.0X 8.625	34.92X 53.97	76.2X 219.07	2000 Hrs.
3126 Computer Grade	Per Mil-C-39018/04	5V to 150V	220 to 220,000	−10 +50%	1.375X 2.125	3.0X 5.625	34.92X 53.97	76.2X 142.88	Per M39018/04
3186 Computer Grade	−40 to +85°C	5V to 450V	75 to 650,000	−10 +50% −10 +75%	1.375X 2.125	3.0X 8.625	34.92X 53.97	76.2X 219.07	1000 Hrs.
3188 Computer Grade	−40 to +85°C	3V to 400V	100 to 590,000	−10 +50% −10 +75%	1.375X 2.125	3.0X 8.625	34.92X 53.97	76.2X 219.07	2000 Hrs.
3189 Computer Grade	−40 to +85°C	5V to 75V	3200 to 760,000	−10 +50% −10 +75%	1.375X 3	2.125X 8.625	34.92X 76.20	53.97X 219.07	1000 Hrs.
3190 Computer Grade	−40 to +85°C	3V to 75V	2700 to 650,000	−10 +50% −10 +75%	1.375X 3	2.125X 8.625	34.92X 76.20	53.97X 219.07	2000 Hrs.
3191 Computer Grade	−55 to +85°C	5V to 55V	2800 to 200,000	+20%	1.375X 2.125	2.0X 5.625	34.92X 53.97	50.8X 142.87	2000 Hrs.
3194 Computer Grade	−55 to +105°C	150V to 250V	290 to 11,000	−10 +50%	1.375X 3	2.125X 8.625	34.92X 76.20	53.97X 219.07	2000 Hrs.
3195 Computer Grade	−40 to +85°C	5V to 100V	2800 to 1,200,000	−10 +50% −10 +75%	1.375X 3	2.125X 8.625	34.92X 76.20	53.97X 219.07	1000 Hrs.
3196 Computer Grade	−40 to +85°C	3V to 100V	1600 to 1,000,000	−10 +50% −10 +75%	1.375X 3	2.125X 8.625	34.92X 76.20	53.97X 219.07	2000 Hrs.
3427 Radial	−40 to +85°C	6.3V to 450V	12 to 35,000	−10 +50% −10 +75%	.750X 1.125	1.0X 3.625	19.1X 28.6	25.4X 92.1	2000 Hrs.
3428 Radial	−55 to +105°C	6.3V to 250V	19 to 17,000	−10 +50% −10 +75%	.750X 1.125	1.0X 3.625	19.1X 28.6	25.4X 92.1	2000 Hrs.
3476 Miniature Radial	−40 to +85°C for 100V or less −25 to +85°C for 160V or greater	6.3V to 450V	0.47 to 10,000	±20%	.197X .433	.709X 1.399	5X 11	18X 40	1000 Hrs.
3477 Miniature Radial	−40 to +85°C	6.3V to 100V	0.1 to 4,700	±20%	.197X .433	.709X 1.399	5X 11	18X 40	1000 Hrs.
3478 Miniature Radial	−40 to +80°C	6.3V to 50V	0.1 to 100	±20%	.197X .55	.394X .591	5X 14	10x 15	1000 Hrs.
3479 Miniature Radial	−40 to +85°C	10V to 100V	470 to 22,000	±20%	.866X 1.181	1.181X 2.008	22X 30	30X 51	1000 Hrs.
3480 Miniature Radial	−55 to +105°C	6.3V to 250V	0.47 to 10,000	±20%	.197X .433	.709X 1.399	5X 11	18X 40	1000 Hrs.
3481 Miniature Radial	−55 to +105°C	10V to 100V	2.2 to 1000	−10 +100%	.315X .453	.492X 1.673	8X 11.5	12.5X 42.5	2000 Hrs.
3482 Miniature Radial	−55 to +105°C	7.5V to 250V	15 to 16,500	−10 +75%	.752X 1.252	1.000X 3.626	19.1X 31.8	25.4X 92.1	2000 Hrs.
3487 Snap-In	−40 to +85°C	6.3V to 250V	22 to 100,000	±20%	.866X 1.0	1.575X 3.15	22X 25	40X 80	1000 Hrs.
3500 A.C. Motor Start	−20 to +65°C	110V to 330V	21 - 1200	±20%	1.44X 2.75	2.56X 4.38	3.66X 6.99	6.50X 17.75	40K to 75K Starts

* Life: If capacitors are operated properly, life should exceed 10 yrs. Measured at max. temp. with full applied voltage.

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FILM CAPACITORS

6071 St. Andrews Road, Columbia, SC 29210 (803) 772-2500 TWX: 810-666-2622 Telex: 820676

MEPCO/ELECTRA SERIES NEW	PREVIOUS	12 NC	CONSTRUCTION	ENCLOSURE	LEAD	VOLTAGE VDC/VAC	CAPACITANCE RANGE (μF)	TOLERANCE ±%
POLYESTER								
708D1	61F & AE	—	FILM/FOIL	WRAP & POT	AXIAL	80-200 VDC AVAILABLE TO 600	.001 THRU 1.0 AVAILABLE TO 2.0	2, 5, 10
708D2	63F (CTM)	—	FILM/FOIL	WRAP & POT	AXIAL	50-300 VDC (125°C)	.001 THRU 1.0	5, 10
711D1	75F	—	FILM/FOIL	MOLDED	RADIAL	50-600 VDC	.001 THRU 1.0	5, 10
713D1	C350	347	FILM/FOIL	CONFORMAL	RADIAL	VDC 100, 250, 400, 630 / VAC 50, 80, 125, 200	.001 THRU 1.0	10
719D1	65F	—	FILM/FOIL	POTTED	RADIAL	50 VDC	.001 THRU 1.0	5, 10
701A1	C281A	341	METALIZED	MOLDED	AXIAL	VDC 100, 250, 400 / VAC 63, 160, 220	.01 THRU 4.7	5, 10
708A1	BA	—	METALIZED	WRAP & POT	AXIAL	100-200 VDC	.10 THRU 10.0	5, 10
713A1	C280	342/352	METALIZED	CONFORMAL	RADIAL	VDC 100, 250, 400, 630 / VAC 63, 160, 220, 220	.001 THRU 6.8	10, 20
712A1	—	365-369	METALIZED	EPOXY	RADIAL	VDC 63, 100, 250, 400 / VAC 40, 63, 160, 220	.001 THRU 6.8	5, 10
719A1	C280MA	370, 371 344, 364	METALIZED	POTTED	RADIAL	VDC 63, 100, 250, 400 / VAC 40, 63, 160, 220	.01 THRU 10.0	5, 10
POLYCARBONATE								
708G1	74F51	—	FILM/FOIL	WRAP & POT	AXIAL	100-200 VDC	.001 THRU 1.0	5, 10
701B1	C281C	341	METALIZED	MOLDED	AXIAL	VDC 100, 250, 400, 630, 1000 / VAC 63, 160, 220, 220, 250	.01 THRU 4.7	5, 10
708B1	74F01	—	METALIZED	WRAP & POT	AXIAL	100-200 VDC	.10 THRU 10.0	5, 10
719B1	C280MC	344	METALIZED	POTTED	RADIAL	100-630 VDC / 63-220 VAC	.01 THRU 6.8	5, 10
POLYSTYRENE								
703C1	—	424-431	FILM/FOIL	CONFORMAL	AXIAL	VDC 63, 160, 250, 630 / VAC 25, 63, 125, 200	51 PF THRU .039	1, 2, 5
704C1	POCO	424-431	FILM/FOIL	WRAPPED	AXIAL	VDC 63, 160, 250, 630 / VAC 25, 63, 125, 200	51PF THRU .039	1, 2, 5
708C1	—	444-447	FILM/FOIL	WRAP & POT	AXIAL	VDC 63, 160, 250, 630 / VAC 25, 63, 125, 250	.0068 THRU .160	1, 2, 5
719C1	—	443	FILM/FOIL	POTTED	RADIAL	VDC 63 / VAC 25	100 PF THRU .033	1% ONLY
POLYPROPYLENE								
703E1	—	460-463	FILM/FOIL	CONFORMAL	AXIAL	VDC 63, 160, 250 / VAC 25, 63, 125	47 PF THRU .022	2, 5
704E1	—	455-459	FILM/FOIL	WRAPPED	AXIAL	VDC 63 160, 250 / VAC 25, 63, 125	47 PF THRU .022	2, 5
719E1	—	357-5	FILM/FOIL	POTTED	RADIAL	VDC 250 / VAC 160	.39 THRU .82	5, 10
719H1	—	357-6/9	METALIZED	POTTED	RADIAL	VDC 630, 1000, 1500, 2000 / VAC 300, 400, 600, 700	.001 THRU .33	5, 10
711H	—	—	METALIZED	MOLDED (CAN)	TERMINAL	VAC 240, 330, 370	3 THRU 5 MFD	3, 6, 10
POLYESTER & PAPER — CLASS X VDE APPROVED								
701J1	—	330	METALIZED	MOLDED	AXIAL	250 VAC	.01 THRU .47	10, 20
719J1	—	330	METALIZED	POTTED	RADIAL	250 VAC	.01 THRU 1.0	10, 20

VARIABLE CAPACITORS

Columbia Road, Morristown, NJ 07960 (201) 539-2000 TWX: 710-986-7437 Telex: 136461

FILM DIELECTRIC (LEADED)

Mepco/Electra Part Number	Capacitance Range (pf)	Dielectric Material	Operating Temp. Range
2800C (808/HT 10/C010)	1-5 to 12-120	PTFE Teflon® Polypropylene Polycarbonate Polyethylene	−40°C to +85°C or −40°C to +70°C
2800D (809)	1-3.5 to 7-100	PTFE Teflon® or Polyimide/FEP	−40°C to +125°C

FILM DIELECTRIC (SMD®)

Mepco/Electra Part Number	Capacitance Range (pf)	Dielectric Material	Operating Temp. Range
2800S	0.3-5 to 0.5-15	Teflon®	−40°C to +85°C

For information on Mepco/Electra's RESISTORS/POTENTIOMETERS/MILITARY COMPONENTS, B•1008-1009, A•1890-1891 and A•2029.

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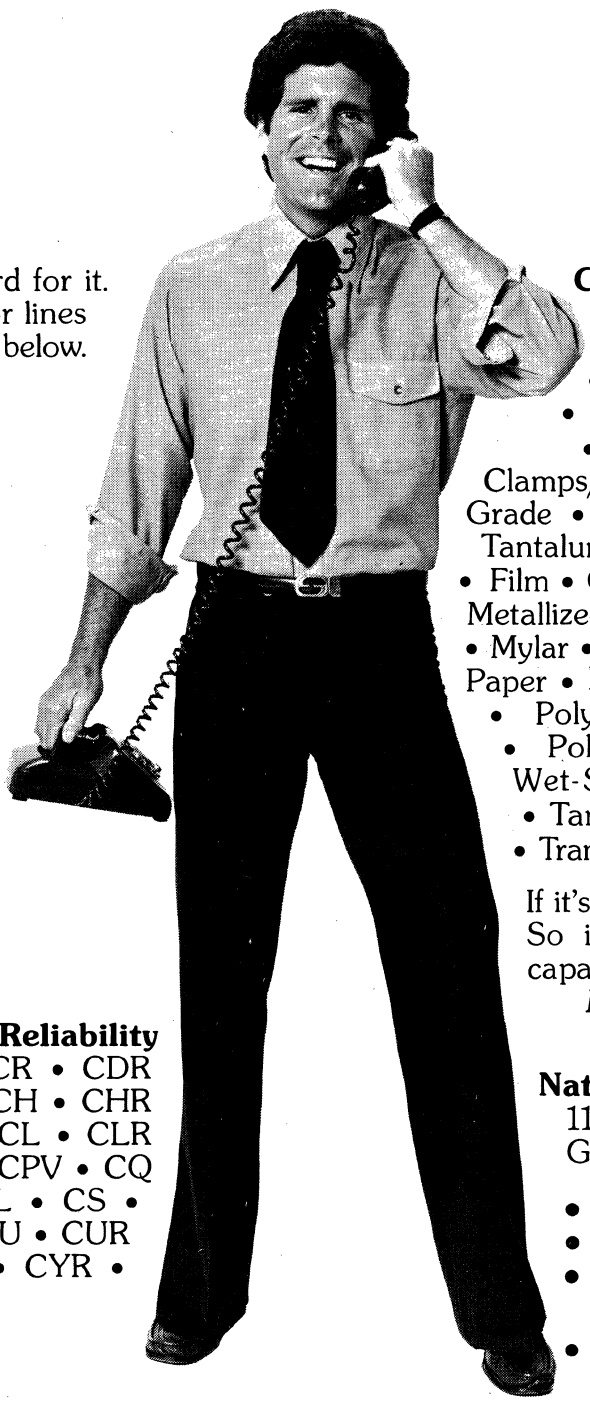

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- TANSITOR
- THOMSON-CSF
- UNITED CHEMICON
- WEST-CAP

CAPACITOR TYPES

Military/Established Reliability
CA • CB • CC • CCR • CDR • CE • CFR • CG • CH • CHR • CJ • CK • CKR • CL • CLR • CM • CMR • CP • CPV • CQ • CQR • CRH • CRL • CS • CSR • CT • CTM • CU • CUR • CV • CWR • CY • CYR • CZ • CZR • PC

Commercial/Industrial
AC Motor Start/Run • Aluminum Electrolytic • Bathtub • Button Mica • Chip • Ceramic Disc • Ceramic Monolithic • Clamps/Brackets • Computer Grade • Dipped Mica • Dipped Tantalum • Feed-Thru/Filters • Film • Glass • High Voltage • Metallized Film • Mica Trimmers • Mylar • Nonpolar • Oil Filled • Paper • Piston • Polycarbonate • Polyester • Polypropylene • Polysulfone • Tantalum Wet-Slug • Tantalum-Solid • Tantalum-Foil • Trimmers • Transmitting Mica • Variables

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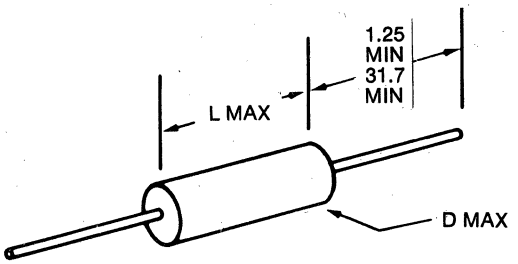
NPO, X7R, & Z5U Glass Sealed Axial-Leaded Ceramic Capacitors

RUGGED, RELIABLE, AND IDEAL FOR AUTOMATIC INSERTION



MECHANICAL SPECIFICATIONS

BODY CONSTRUCTION: Glass to metal seal

LEAD MATERIAL: .020 Dia. — Solderable tinned copper

MARKING:

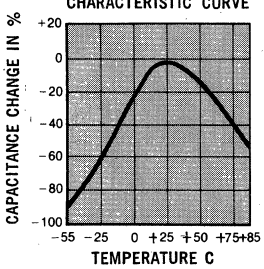
Parts will be marked with the following:

Trademark — Capacitance — Tolerance Letter Designation Voltage (size permitting)

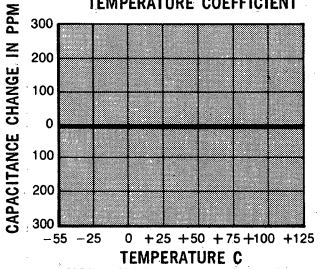
EIA specifications apply regarding Q, TC tol and CAP tol on all units of 10 pF or less

TYPICAL TEMPERATURE CHARACTERISTIC CURVES

Z5U TYPICAL TEMPERATURE CHARACTERISTIC CURVE



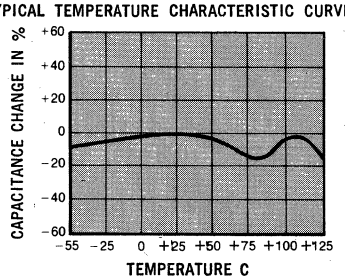
NPO TEMPERATURE COEFFICIENT



NOTE: IPPM equals 0.0001%

TYPICAL TEMPERATURE CHARACTERISTIC CURVE

X7R



HOW TO ORDER

GT07 B CG 101 J

- **SIZE:**
- **WVDC:** (B = 50V)[1] (D = 100V) (F = 200V)
- **CHARACTERISTIC:** (CG = NPO) (BM = X7R) (BN = Z5U)
- **CAPACITANCE CODE:**[2]
- **TOLERANCE:**[3]

1. **WVDC AVAILABLE:** 50 VDC, 100 VDC, 200 VDC
2. 101 = 100 pF i.e., the third digit signifies number of zeroes
3. **MINIMUM AVAILABLE CAPACITANCE TOLERANCES:**
   B = ±.1 pF (10 pF and below) J = ±5% (10 pF and above)
   C = ±.25 pF (10 pF and below) K = 10% (5.6 pF and above)
   D = ±.5 pF (10 pF and below) M = 20% (2.7 pF and above)
   F = ±1% (10 pF and above) Z = +80%, −20% (all values)
   G = 2% (10 pF and above) P = +100%, −0% (GMV — all values)

NPO (COG) CHARACTERISTICS

WORKING VOLTAGE: 50/100/200 VDC
Higher voltages available on request

TEMPERATURE COEFFICIENT: 0 ±30 PPM/°C, −55°C to +125°C (EIA Characteristic COG)

INSULATION RESISTANCE: 100 K megohms or 1000 megohm-microfarads, whichever is less at 25°C, at rated voltage

DIELECTRIC STRENGTH: 250% rated voltage with 50 mA maximum charging current

CAPACITANCE TOLERANCES AVAILABLE: ±1%, ±2%, ±5%, ±10%, ±20%

Meets or exceeds requirements of MIL-C-20

DISSIPATION FACTOR: Min. Q of 1000 at 1 MHz. Meets provisions of EIA standard for capacitance less than 30 pF and greater than 1000 pF

X7R & Z5U characteristics not shown. Please contact factory for sizes.

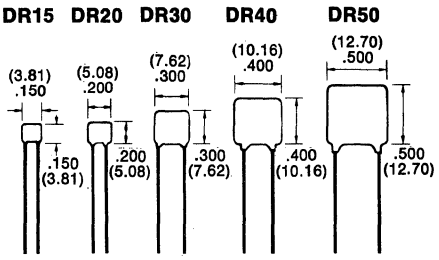
MCI PART NO.	GT07		GT10		GT14		
	In.	mm	In.	mm	In.	mm	
L MAX	.170	4.32	.260	6.60	.400	10.16	
D MAX	.100	2.54	.100	2.54	.150	3.81	
Capacitance in pF	WVDC 100	50	WVDC 100	50	WVDC 100	50	Capacitance Characteristic EIA
1.0							109
1.2							129
1.5							159
1.8							189
2.2							229
2.7							279
3.3							339
3.9							399
4.7							479
5.6							569
6.8							689
8.2							829
10							100
12							120
15							150
18							180
22							220
27							270
33							330
39							390
47							470
56							560
68							680
82							820
100							101
120							121
150							151
180							181
220							221
270							271
330							331
390							391
470							471
560							561
680							681
820							821
1000							102
1200							122
1500							152
1800							182
2200							222
2700							272
3300							332
3900							392
4700							472
5600							562
6800							682
8200							822
10,000							103

Metuchen Capacitors Inc. / Dept. EM, 420 Park Avenue, Perth Amboy, NJ 08861 / (201) 442-0500 / TWX 710-998-0892

METUCHEN CAPACITORS INC.

Epoxy Coated Sub-Miniature Radial-Leaded Ceramic Capacitors

MCI PART NUMBERS



MAXIMUM PHYSICAL DIMENSIONS

MCI PART NO.	DR15	DR20	DR30	DR40	DR50
S ±.030	.100 (2.54)	.100 (2.54)	.200 (5.08)	.200 (5.08)	.400 (10.16)
D +.004 −.001	.016 (.406)	.020 (.508)	.020 (.508)	.020 (.508)	.025 (.635)
T MAX	.100 (2.54)	.125 (3.18)	.150 (3.81)	.150 (3.81)	.200 (5.08)
AWG#	26	24	24	24	22

S = Lead spacing D = Lead size T = Body thickness mm are in parentheses

MECHANICAL SPECIFICATIONS

BODY CONSTRUCTION: Dipped epoxy

LEAD MATERIAL: Solderable tinned copper

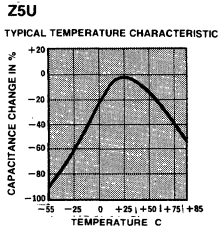
MARKING:
Parts will be marked with the following:

Trademark — Capacitance — Tolerance Letter Designation Voltage (size permitting)

EIA specifications apply regarding Q. TC tol and CAP tol on all units 10 pF or less

TYPICAL TEMPERATURE CHARACTERISTIC CURVES

Z5U



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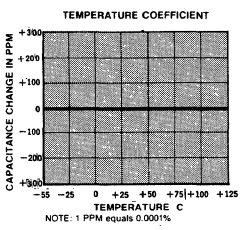
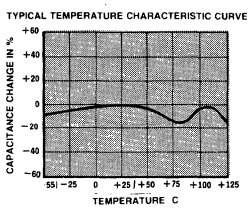
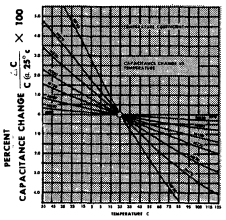


X7R





HOW TO ORDER

DR15 B CG 101 J

SIZE:

WVDC: (B = 50V)[1] (D = 100V)

CHARACTERISTIC: (CG = NPO) (BM = X7R) (BN = Z5U)

CAPACITANCE CODE:[2]

TOLERANCE:[3]

1. **WVDC AVAILABLE:** 50 VDC, 100 VDC, 200 VDC
2. 101 = 100pF i.e., the third digit signifies number of zeroes
3. **MINIMUM AVAILABLE CAPACITANCE TOLERANCES:**
   B = ±.1 pF (10 pF and below) J = ±5% (10 pF and above)
   C = ±.25 pF (10 pF and below) K = ±10% (5.6 pF and above)
   D = ±.5 pF (10 pF and below) M = ±20% (2.7 pF and above)
   F = ±1% (10 pF and above) Z = +80%, −20% (all values)
   G = ±2% (10 pF and above) P = +100%, −0% (GMV — all values)

Z5U CHARACTERISTICS

CAPACITANCE RANGE: .001 MFD to 4.7 MFD

WORKING VOLTAGE: 50/100/200 VDC
Higher voltages available on request

TEMPERATURE COEFFICIENT: +22%, −56% from +10°C to +85°C (EIA Characteristic Z5U)

DISSIPATION FACTOR: 3% maximum at 1 kHz, 25°C

INSULATION RESISTANCE: 100 K megohms or 500 megohm-microfarad, whichever is less at 25°C, at rated voltage

DIELECTRIC STRENGTH: 250% rated voltage with 50 mA maximum charging current

CAPACITANCE TOLERANCES AVAILABLE: ±20%, +80% −20%, or +100% −0%

MCI offers a complete range of temperature coefficients. Contact factory for sizes and ordering information.

MCI PART NO.	DR15		DR20		DR30		DR40		DR50		Capacitance Characteristic EIA
Capacitance in pF	WVDC 50	100	WVDC 50	100	WVDC 50	100	WVDC 50	100	WVDC 50	100	
1000	■	■	■	■	■	■	■	■	■	■	102
1200	■	■	■	■	■	■	■	■	■	■	122
1500	■	■	■	■	■	■	■	■	■	■	152
1800	■	■	■	■	■	■	■	■	■	■	182
2200	■	■	■	■	■	■	■	■	■	■	222
2700	■	■	■	■	■	■	■	■	■	■	272
3300	■	■	■	■	■	■	■	■	■	■	332
3900	■	■	■	■	■	■	■	■	■	■	392
4700	■	■	■	■	■	■	■	■	■	■	472
5600	■	■	■	■	■	■	■	■	■	■	562
6800	■	■	■	■	■	■	■	■	■	■	682
8200	■		■	■	■	■	■	■	■	■	822
10,000	■		■	■	■	■	■	■	■	■	103
12,000	■		■	■	■	■	■	■	■	■	123
15,000	■		■	■	■	■	■	■	■	■	153
18,000	■		■	■	■	■	■	■	■	■	183
22,000	■		■	■	■	■	■	■	■	■	223
27,000			■	■	■	■	■	■	■	■	273
33,000			■	■	■	■	■	■	■	■	333
39,000			■	■	■	■	■	■	■	■	393
47,000			■	■	■	■	■	■	■	■	473
56,000			■	■	■	■	■	■	■	■	563
68,000			■		■	■	■	■	■	■	683
82,000			■		■	■	■	■	■	■	823
100,000			■		■	■	■	■	■	■	104
120,000			■		■	■	■	■	■	■	124
150,000			■		■	■	■	■	■	■	154
180,000			■		■	■	■	■	■	■	184
220,000			■		■	■	■	■	■	■	224
270,000					■	■	■	■	■	■	274
330,000					■	■	■	■	■	■	334
390,000					■	■	■	■	■	■	394
470,000					■	■	■	■	■	■	474
560,000					■	■	■	■	■	■	564
680,000					■	■	■	■	■	■	684
820,000					■	■	■	■	■	■	824
1,000,000					■	■	■	■	■	■	105
1,200,000					■	■	■	■	■	■	125
1,500,000					■	■	■		■	■	155
1,800,000					■	■	■		■		185
2,200,000					■	■	■		■		225
2,700,000					■	■	■		■		275
3,300,000					■	■	■		■		335
3,900,000					■	■	■		■		395
4,700,000					■	■	■		■		475

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METUCHEN CAPACITORS INC.

Epoxy Coated Sub-Miniature Radial-Leaded Ceramic Capacitors

NPO (COG) CHARACTERISTICS

WORKING VOLTAGE: 50/100/200 VDC
Higher voltages available on request
TEMPERATURE COEFFICIENT: 0 ±30 PPM/°C, −55° to 125°C (EIA Characteristic COG)
DISSIPATION FACTOR: Min. Q of 1000 at 1 MHz. Meets provisions of EIA standard for capacitance less than 30 pF and greater than 1000 pF
INSULATION RESISTANCE: 100 K megohms or 1000 megohm-microfarads, whichever is less at 25°C, at rated voltage
DIELECTRIC STRENGTH: 250% rated voltage with 50 mA maximum charging current
CAPACITANCE TOLERANCES AVAILABLE: ±1%, ±2%, ±5%, ±10%, ±20%
Meets or exceeds requirements of MIL-C-20

MCI PART NO	DR15			DR20			DR30			DR40			DR50			Cap. Char. EIA
Cap. in pF	WVDC 50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	
1.0	■	■	■													109
1.2	■	■	■													129
1.5	■	■	■													159
1.8	■	■	■													189
2.2	■	■	■													229
2.7	■	■	■													279
3.3	■	■	■													339
3.9	■	■	■													399
4.7	■	■	■													479
5.6	■	■	■													569
6.8	■	■	■													689
8.2	■	■	■													829
10	■	■	■	■	■	■										100
12	■	■	■	■	■	■										120
15	■	■	■	■	■	■										150
18	■	■	■	■	■	■										180
22	■	■	■	■	■	■										220
27	■	■	■	■	■	■										270
33	■	■	■	■	■	■										330
39	■	■	■	■	■	■										390
47	■	■	■	■	■	■										470
56	■	■	■	■	■	■										560
68	■	■	■	■	■	■										680
82	■	■	■	■	■	■										820
100	■	■	■	■	■	■										101
120	■	■	■	■	■	■										121
150	■	■	■	■	■	■										151
180	■	■	■	■	■	■										181
220	■	■	■	■	■	■										221
270	■	■	■	■	■	■										271
330	■	■	■	■	■	■										331
390	■	■	■	■	■	■										391
470	■	■	■	■	■	■										471
560	■	■	■	■	■	■										561
680				■	■	■										681
820				■	■	■										821
1000				■	■	■										102
1200				■	■	■	■	■	■							122
1500				■	■	■	■	■	■							152
1800				■	■	■	■	■	■							182
2200				■	■	■	■	■	■							222
2700				■	■		■	■	■							272
3300				■	■	■	■	■	■	■	■	■				332
3900				■	■	■	■	■	■	■	■	■				392
4700				■	■	■	■	■	■	■	■	■				472
5600				■	■		■	■	■	■	■	■				562
6800							■	■	■	■	■	■				682
8200							■	■	■	■	■	■				822
10,000							■	■	■	■	■	■	■	■	■	103
12,000							■	■		■	■	■	■	■	■	123
15,000							■	■	■	■	■	■	■	■	■	153
18,000							■	■	■	■	■	■	■	■	■	183
22,000							■	■	■	■	■	■	■	■	■	223
27,000										■	■	■	■	■	■	273
33,000										■	■	■	■	■	■	333
39,000										■	■	■	■	■	■	393
47,000										■	■	■	■	■	■	473
56,000													■	■	■	563
68,000													■	■	■	683
82,000													■	■	■	823
100,000													■	■	■	104

X7R CHARACTERISTICS

TEMPERATURE COEFFICIENT: ±15% from −55°C to +125°C (EIA Characteristic X7R)
DISSIPATION FACTOR: 2.5% maximum at 1 kHz, 25°C
CAPACITANCE TOLERANCES AVAILABLE: ±5%, ±10%, ±20%, +80% −20%, or +100% −0%
Meets or exceeds requirements of MIL-C-39014
Working Voltage, Insulation Resistance and Dielectric Strength same as NPO Radial

MCI PART NO.	DR15			DR20			DR30			DR40			DR50			Cap. Char. EIA
Cap. in pF	WVDC 50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	
10	■	■	■													100
12	■	■	■													120
15	■	■	■													150
18	■	■	■													180
22	■	■	■													220
27	■	■	■													270
33	■	■	■													330
39	■	■	■													390
47	■	■	■													470
56	■	■	■													560
68	■	■	■													680
82	■	■	■													820
100	■	■	■	■	■	■										101
120	■	■	■	■	■	■										121
150	■	■	■	■	■	■										151
180	■	■	■	■	■	■										181
220	■	■	■	■	■	■										221
270	■	■	■	■	■	■										271
330	■	■	■	■	■	■										331
390	■	■	■	■	■	■										391
470	■	■	■	■	■	■										471
560	■	■	■	■	■	■										561
680	■	■	■	■	■	■										681
820	■	■	■	■	■	■										821
1000	■	■	■	■	■	■	■	■	■							102
1200	■	■	■	■	■	■	■	■	■							122
1500	■	■		■	■	■	■	■	■							152
1800	■	■	■	■	■	■	■	■	■							182
2200	■	■	■	■	■	■	■	■	■							222
2700	■	■	■	■	■	■	■	■	■							272
3300	■	■	■	■	■	■	■	■	■							332
3900	■	■	■	■	■	■	■	■	■							392
4700	■	■	■	■	■	■	■	■	■							472
5600	■	■		■	■	■	■	■	■							562
6800	■			■	■	■	■	■	■							682
8200	■			■	■	■	■	■	■							822
10,000	■			■	■	■	■	■	■	■	■	■	■	■	■	103
12,000				■	■	■	■	■	■	■	■	■	■	■	■	123
15,000				■	■	■	■	■	■	■	■	■	■	■	■	153
18,000				■	■	■	■	■	■	■	■	■	■	■	■	183
22,000				■	■	■	■	■	■	■	■	■	■	■	■	223
27,000				■	■	■	■	■	■	■	■	■	■	■	■	273
33,000				■	■	■	■	■	■	■	■	■	■	■	■	333
39,000				■	■	■	■	■	■	■	■	■	■	■	■	393
47,000				■	■	■	■	■	■	■	■	■	■	■	■	473
56,000				■	■	■	■	■	■	■	■	■	■	■	■	563
68,000				■	■	■	■	■	■	■	■	■	■	■	■	683
82,000				■	■	■	■	■	■	■	■	■	■	■	■	823
100,000				■	■	■	■	■	■	■	■	■	■	■	■	104
120,000				■	■		■	■	■	■	■	■	■	■	■	122
150,000							■	■	■	■	■	■	■	■	■	154
180,000							■	■	■	■	■	■	■	■	■	184
220,000							■	■	■	■	■	■	■	■	■	224
270,000							■	■	■	■	■	■	■	■	■	274
330,000							■	■	■	■	■	■	■	■	■	334
390,000							■	■	■	■	■	■	■	■	■	394
470,000							■	■	■	■	■	■	■	■	■	474
560,000							■	■		■	■	■	■	■	■	564
680,000							■	■	■	■	■	■	■	■	■	684
820,000							■	■	■	■	■	■	■	■	■	824
1,000,000							■	■	■	■	■	■	■	■	■	105
1,200,000							■	■	■	■	■	■	■	■	■	125
1,500,000							■	■	■	■	■	■	■	■	■	155
1,800,000							■	■	■	■	■	■	■	■	■	185
2,200,000							■	■	■	■	■	■	■	■	■	225
2,700,000													■	■	■	275
3,300,000													■	■	■	335
3,900,000													■	■	■	395
4,700,000													■	■	■	475

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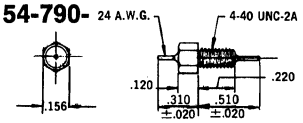
METUCHEN CAPACITORS INC.

Feed-Thru Ceramic Capacitors RESIN SEAL

TYPES 54-790-



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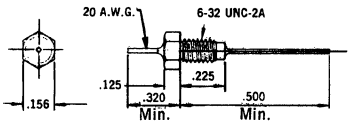
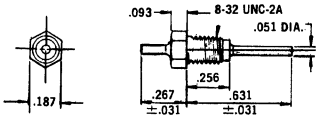


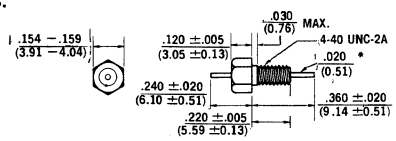
54-713-



Working Voltage +85°C	Working Voltage +125°C	Cap. pF	Ordering Number
200	100	10	54-790-001-100M
200	100	100	54-790-001-101M
200	100	500	54-790-001-501Z
200	100	1000	54-790-001-102P
200	100	22,000	54-790-001-223Z
200	100	10	54-779-001-100M
200	100	100	54-779-001-101M
200	100	500	54-779-001-501P
200	100	1000	54-779-001-102P
200	100	22,000	54-779-001-223Z
200	100	10	54-713-001-100M
200	100	100	54-713-001-101M
200	100	1000	54-713-001-102Z
200	100	5000	54-713-001-502P

SERIES SCI 910X/911X/912X

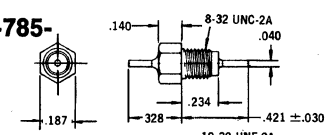
* For 24 gauge tinned copper leads, replace "X" with "0"; for 26 gauge tinned steel leads (.016 Dia.) replace "X" with "2." When steel lead is used, maximum DC current is 5 amps. 24 AWG (.020) leads are available, contact factory for part numbers.



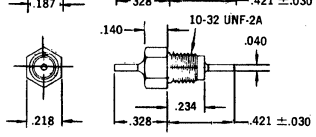
Series	SCI 910X	SCI 911X	SCI 912X
VOLTAGE	50 WVDC	100 WVDC	200 WVDC 115 VAC 60 Hz
DC AMPS. MAX.	10	10	10
CAPACITANCE (GMV)	100 pF 1000 5000	100 pF 1000 5000	100 pF 1000 5000
	.01 μF .027 .05	.01 μF .027 .05	.01 μF

HIGH CAPACITY MULTI-LAYER FEED-THRU CAPACITORS

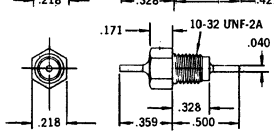
TYPES 54-785-



54-786-013

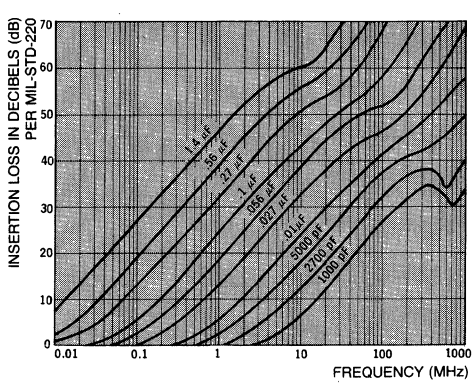


54-786-021 014



Working Voltage @ 125°C	Cap. μF	Ordering Number
100	.05	54-785-005-503P
100	.3	54-786-013-304Z
50	.5	54-786-021-504Z
50	1.0	54-786-014-105Z

FEED-THROUGH CAPACITORS — TYPICAL INSERTION LOSS



All Feed-thru Capacitors and RFI Filters stocked by MCI are manufactured in the U.S.A. by **Spectrum Control Inc. . .**
The world's leading manufacturer of Electro-Magnetic Components. Distributed for Spectrum Control, Inc.

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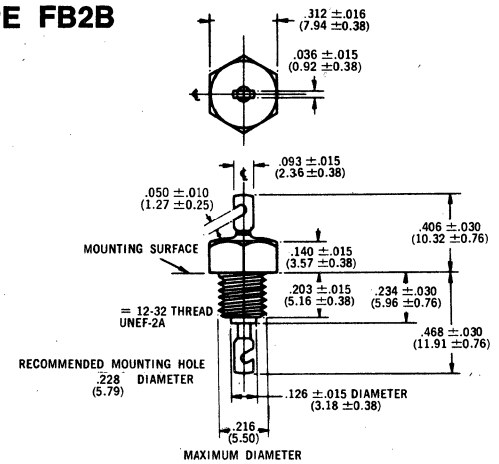
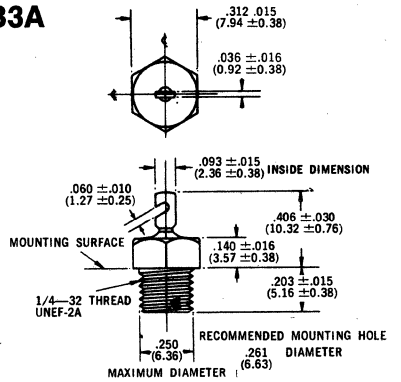
METUCHEN CAPACITORS INC.

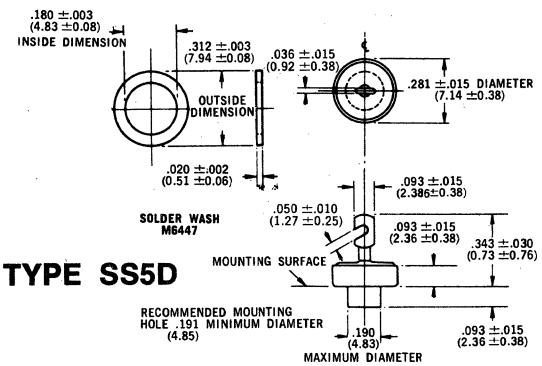
Feed-Thru Ceramic Capacitors

TYPE FB2B

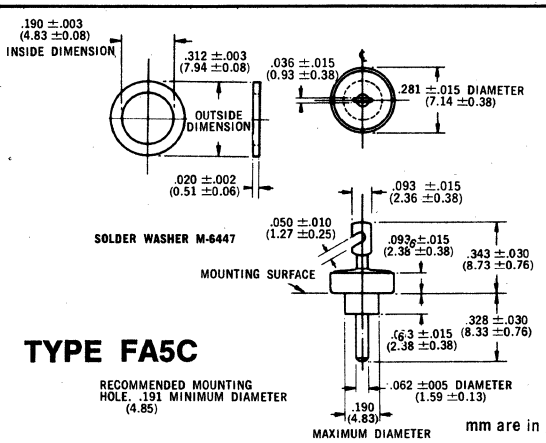


TYPE SB3A





TYPE SS5D



TYPE FA5C

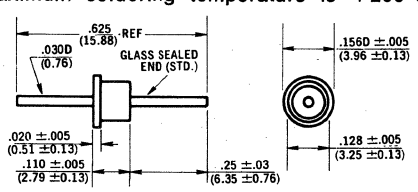
mm are in parentheses

Ordering Number	Type	Tolerance %	Capacitance pF
54-794-002-101M	FA5C-1012	20	100
54-794-002-471M	FA5C-4712	20	470
54-794-002-102P	FA5C-102W	GMV	1000
54-804-002-101M	FB2B-1012	20	100
54-804-002-471M	FB2B-4712	20	470
54-804-002-102P	FB2B-102W	GMV	1000

Ordering Number	Type	Tolerance %	Capacitance pF
54-803-004-101M	SS5D-1012	20	100
54-803-004-471M	SS5D-4712	20	470
54-803-004-102P	SS5D-102W	GMV	1000
54-807-002-101M	SB3A-1012	20	100
54-807-002-471M	SB3A-4712	20	470
54-807-002-102P	SB3A-102W	GMV	1000

SERIES SCI 9900/9910/9920

All units are hermetically sealed (glass to metal) on one end, while the other end is epoxy sealed. These units are also available reversed with the hermetic seal at the opposite end. To order, add "R" to the end of the part number; e.g. 9900-502R. Installation: Series 9900 units are designed to be soldered in place. Maximum soldering temperature is +200°C (400°F).



Series	SCI 9900	SCI 9910	SCI 9920
VOLTAGE	50 WVDC	100 WVDC	200 WVDC 115 VAC 60 Hz
DC AMPS. MAX.	5	5	5
CAPACITANCE (GMV)	100 pF 500 1000 1200 2700 5000 .015 μF	100 pF 500 1000 1200 2700 5000	100 pF 500 1000 1200

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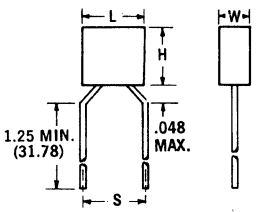
METUCHEN CAPACITORS INC.

NPO Ceramic Capacitors QUALIFIED TO MIL-C-20

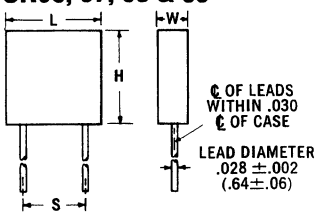
- 0 ±30 ppm/°C Per MIL-C-20
- .1 to 100,000 Pf −55°C +125°C
- Low Dissipation Factor
- Tight Tolerances

RADIAL LEAD CAPACITORS

CCR05



CCR06, 07, 08 & 09



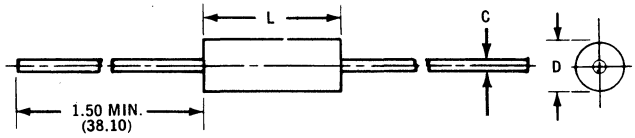
Mil. Equiv.	H & L	W	S
CCR05	.190 ±.010	.090 ±.010	.200 ±.015
CCR09	.190 ±.010	.090 ±.010	.100 ±.015
CCR06	.290 ±.010	.090 ±.010	.200 ±.015
CCR07	.480 ±.020	.140 ±.010	.400 ±.020
CCR08	.480 ±.020	.240 ±.010	.400 ±.020

ER	Slash Sheet	Volt	Cap. Range pF
CCR05 CCR09	35	200 100 50	1-330 360-1800 2200-3300
CCR06	36	200 100 50	360-1800 2000-4700 5100-18,000
CCR07	37	200 100 50	2200-4700 5600-12,000 15,000-100,000
CCR08	38	200 100 50	3900-4700 15,000-18,000 56,000-68,000

All dimensions shown in inches.

AXIAL LEAD CAPACITORS

CCR75, 76, 77, 78 & 79



Mil. Equiv.	L	D	Lead Size
CCR75	.160 ±.010	.090 ±.010	.016
CCR76	.250 ±.010	.090 ±.010	.016
CCR77	.390 ±.010	.140 ±.010	.025
CCR78	.500 ±.020	.250 ±.015	.025
CCR79	.690 ±.020	.350 ±.015	.025

ER	Slash Sheet	Volt	Cap. Range pF
CCR75	27	200 100 50	.1-75 82-240 270-680
CCR76	28	200 100 50	82-130 270-680 750-1000
CCR77	29	200 100 50	150-680 750-2200 2400-5600
CCR78	30	200 100 50	820-3300 3900-12,000 15,000-27,000
CCR79	31	200 100 50	3900-10,000 15,000-39,000 47,000-82,000

Fixed Capacitors, Ceramic Dielectric (Temperature Compensating), Established Reliability

ER **CCR05** **CG** (0±30ppm/°C) **102** **G** **R**

STYLE

05 = Radial .190x.190 75 = Axial .160x.090
09 = Radial .190x.190 76 = Axial .250x.090
06 = Radial .290x.290 77 = Axial .390x.140
07 = Radial .480x.480 78 = Axial .500x.250
08 = Radial .480x.480 79 = Axial .690x.350

CAPACITANCE

Nominal capacitance expressed in picofarads (uF) by three-digit number, first two digits represent significant figures, last digit specifies number of zeroes to follow. When the nominal value is less than 10 pF, the letter 'R' indicates the decimal point and the succeeding digit(s) represent significant figure(s). For example: IRO indicates 1.0 pF; R75 indicates 0.75 pF and OR5 indicates 0.5 pF.

FAILURE RATE LEVEL

M = 1.0%
P = 0.1%
R = 0.01%
Expressed in % per 1000 hours

CAPACITANCE TOLERANCE

C = ±.25 pF
D = ±.5 pF
F = ±1%
G = ±2%
J = ±5%
K = ±10%

Metuchen Capacitors Inc. / Dept. EM, 420 Park Avenue, Perth Amboy, NJ 08861 / (201) 442-0500 / TWX 710-998-0892

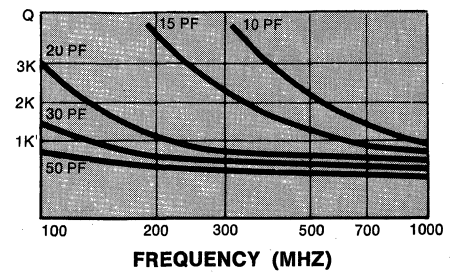
Ultra-Q Miniature Microwave Ceramic Capacitors QUALIFIED TO MIL-C-55681B

A state of the art ceramic capacitor designed for use at microwave frequencies. The superior dielectric properties of the ceramic material furnish extremely high Q and lowest loss of any type capacitor available. A minimum Q of 10,000 is guaranteed at 1 MHz. Units are available in either chip form or various leaded configurations. Typical applications include low noise FET circuits, high frequency, low noise receiver front ends and UHF microwave hybrids.

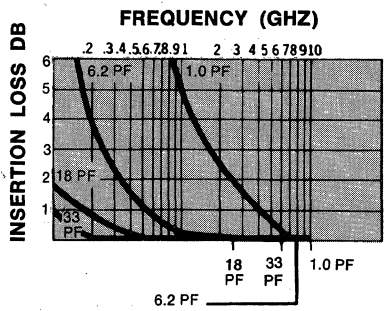
GENERAL SPECIFICATIONS

CAPACITANCE RANGE: .1 pF through 1000 pF
WORKING VOLTAGE: 50 through 500 VDC (see tables)
Q @ 1 MHz: 10,000 minimum
DISSIPATION FACTOR @ 1 MHz: less than .0001
INSULATION RESISTANCE: more than 100,000 megohms @ 25°C, 10,000 meg @ 125°C
TEMPERATURE COEFFICIENT: +90 ±20 ppm/°C
OPERATING TEMPERATURE RANGE: −55°C to +125°C
CAPACITANCE TOLERANCE: B = ±.1 pF, C = ±.25 pF, D = ±.5 pF (values <5 pF), F = ±1%, G = ±2%, J = ±5%, K = ±10% (values ≥5 pF)
CHIP TERMINATION: Palladium silver
DIELECTRIC STRENGTH: 250% of WVDC rating
CAPACITANCE DRIFT: ±.1% or .1 pF, whatever is greater

TYPICAL FREQUENCY CHARACTERISTICS



FREQUENCY (GHZ)



SIZE	MIL STYLE	L + W	T. max.
01	CDR11	.050″ ±.015	.050″
013	CDR13	.110″ ±.015	.100″

MIL-STYLE	WVDC	CAP. RANGE pF
CDR11 & CDR12	50	.1-1000
CDR13 thru CDR25	500	.1-100
	300	110-200
	200	220-470
	100	510-620
	50	680-1000

LEAD STYLES AVAILABLE

Add .020″ to "L" dim.
Add following suffix to part number

MIL STYLE

MICRO STRIP — MS CDR 21

AXIAL RIBBON — AR CDR 22

RADIAL RIBBON — RR CDR 24

Leads size: 013 .093″x.004″ silver

RADIAL WIRE — RW CDR 23

AXIAL WIRE — AW CDR 25

Leads: #26 AWG tinned copper

SIZE 01 .050 x .050 x .050			SIZE 01 .050 x .050 x .050			SIZE 013 .110 x .110 x .100			SIZE 013 .110 x .110 x .100			SIZE 013 .110 x .110 x .100		
Cap. pF	Part Number	WVDC	Cap. pF	Part Number	WVDC	Cap. pF	Part Number	WVDC	Cap. pF	Part Number	WVDC	Cap. pF	Part Number	WVDC
0.1	01Q108B	50V	6.2	01Q629J	50V	0.1	013Q108B	500V	5.6	013Q569J	500V	110	013Q111J	300V
0.2	01Q208B	50V	6.8	01Q689J	50V	0.2	013Q208B	500V	6.2	013Q629J	500V	120	013Q121J	300V
0.3	01Q308B	50V	7.5	01Q759J	50V	0.3	013Q308B	500V	6.8	013Q689J	500V	130	013Q131J	300V
0.4	01Q408B	50V	8.2	01Q829J	50V	0.4	013Q408B	500V	7.5	013Q759J	500V	150	013Q151J	300V
0.5	01Q508B	50V	9.1	01Q919J	50V	0.5	013Q508B	500V	8.2	013Q829J	500V	160	013Q161J	300V
0.6	01Q608B	50V	10	01Q100J	50V	0.6	013Q608B	500V	9.1	013Q919J	500V	180	013Q181J	300V
0.7	01Q708B	50V	11	01Q110J	50V	0.7	013Q708B	500V	10	013Q100J	500V	200	013Q201J	300V
0.8	01Q808B	50V	12	01Q120J	50V	0.8	013Q808B	500V	11	013Q110J	500V			
0.9	01Q908B	50V	13	01Q130J	50V	0.9	013Q908B	500V	12	013Q120J	500V			
1.0	01Q109C	50V	15	01Q150J	50V	1.0	013Q109C	500V	13	013Q130J	500V			
1.1	01Q119C	50V	16	01Q160J	50V	1.1	013Q119C	500V	15	013Q150J	500V	220	013Q221J	200V
1.2	01Q129C	50V	18	01Q180J	50V	1.2	013Q129C	500V	16	013Q160J	500V	240	013Q241J	200V
1.3	01Q139C	50V	20	01Q200J	50V	1.3	013Q139C	500V	18	013Q180J	500V	270	013Q271J	200V
1.4	01Q149C	50V	22	01Q220J	50V	1.4	013Q149C	500V	20	013Q200J	500V	300	013Q301J	200V
1.5	01Q159C	50V	24	01Q240J	50V	1.5	0130159C	500V	22	013Q220J	500V	330	013Q331J	200V
1.6	01Q169C	50V	27	01Q270J	50V	1.6	013Q169C	500V	24	013Q240J	500V	360	013Q361J	200V
1.7	01Q179C	50V	30	01Q300J	50V	1.7	013Q179C	500V	27	013Q270J	500V	390	013Q391J	200V
1.8	01Q189C	50V	33	01Q330J	50V	1.8	013Q189C	500V	30	013Q300J	500V	430	013Q431J	200V
1.9	01Q199C	50V	36	01Q360J	50V	1.9	013Q199C	500V	33	013Q330J	500V	470	013Q471J	200V
2.0	01Q209C	50V	39	01Q390J	50V	2.0	013Q209C	500V	36	013Q360J	500V			
2.1	01Q219C	50V	43	01Q430J	50V	2.1	013Q219C	500V	39	013Q390J	500V			
2.2	01Q229C	50V	47	01Q470J	50V	2.2	013Q229C	500V	43	013Q430J	500V			
2.7	01Q279C	50V	51	01Q510J	50V	2.7	013Q279C	500V	47	013Q470J	500V	510	013Q511J	100V
3.0	01Q309C	50V	56	01Q560J	50V	3.0	013Q309C	500V	51	013Q510J	500V	560	013Q561J	100V
3.3	01Q339C	50V	62	01Q620J	50V	3.3	013Q339C	500V	56	013Q560J	500V	620	013Q621J	100V
3.6	01Q369C	50V	68	01Q680J	50V	3.6	013Q369C	500V	62	013Q620J	500V	680	013Q681J	100V
3.9	01Q399C	50V	75	01Q750J	50V	3.9	013Q399C	500V	68	013Q680J	500V	750	013Q751J	100V
4.3	01Q439C	50V	82	01Q820J	50V	4.3	013Q439C	500V	75	013Q750J	500V	820	013Q821J	100V
4.7	01Q479C	50V	91	01Q910J	50V	4.7	013Q479C	500V	82	013Q820J	500V	910	013Q911J	100V
5.1	01Q519J	50V	100	01Q101J	50V	5.1	013Q519J	500V	91	013Q910J	500V	1000	013Q102J	100V
5.6	01Q559J	50V							100	013Q101J	500V			

HOW TO ORDER

CDR13 BG 101 E G M M

STYLE
CDR11 — Chip .055″ x .055″
CDR12 — Tinned Chip .055″ x .055″
CDR13 — Chip .110″ x .110″
CDR14 — Tinned Chip .110″ x .110″
CDR21 — Micro Strip .135″ x .110″
CDR22 — Axial Ribbon .135″ x .110″
CDR23 — Radial Wire .135″ x .110″
CDR24 — Radial Ribbon .135″ x .110″
CDR25 — Axial Wire .135″ x .110″

CAPACITANCE
Nominal capacitance expressed in picofarads (pF) by three-digit number, first two digits represent significant figures, last digit specifies number of zeros to follow. When the nominal value is less than 10 pF, the letter 'R' indicates the decimal point and the succeeding digit(s) represent significant figure(s). For example: IR0 indicates 1.0 pF; R75 indicates 0.75 pF and OR5 indicates 0.5 pF.

WVDC
A = 50
B = 100
C = 200
D = 300
E = 500

CAPACITANCE TOLERANCE
B = ±.1 pF
C = ±.25 pF
D = ±.5 pF
F = ±1%
G = ±2%
J = ±5%
K = ±10%
M = ±20%

FINISH
CDR11 = M
CDR12 = S
CDR13 = M
CDR14 = S
CDR21 = T
CDR22 = T
CDR23 = S
CDR24 = T
CDR25 = S

FAILURE RATE LEVEL
Expressed in % per 1000 hours
M = 1.0%
P = .1%
R = .01%

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SPECIALISTS IN CERAMIC CAPACITORS

DISC CERAMIC CAPACITORS

SPECIFICATIONS

Temperature Characteristics: Available in characteristics shown in table (below-right) as standard.

Operating Temperature: −55°C to +85°C.

Test Voltage: 2.5 times working voltage for 1 second.

Insulation Resistance:
7500 Megohms or an RC product of 75-ohms F, whichever is less.
RC product of .04-ohms F for 12 VDCW Y5T.
RC product of .1-ohm F for 16 VDCW Y5T.
10,000 Megohms for NPO.

Q (Ratio of Reactance to Equivalent Series Resistance):
Capacitance ≤ 30 pf Q ≥ 400 + 20 x Cpf
Capacitance > 30 pf Q ≥ 1000

Dissipation Factor:
For Z5F, X5R, Z5U, Z5P (@ 1 KC and 25°C) 2.5%
For Z4V, Z5V 5% For Y5U 8.0%
For S2L, S3N 0.6% For NPO, N750, N1500: 0.2%

Encapsulation: Phenolic coated, wax impregnated.

Marking: MP, Value, Tolerance, Voltage.

HOW TO ORDER

Type CF-104Z4

Voltage Rating
Temperature Characteristic
Capacitance
(In picofarads.) The 1st two digits indicate significant digits. The 3rd digit indicates the number of zeroes following. R denotes decimal.
Tolerance
Lead Variation

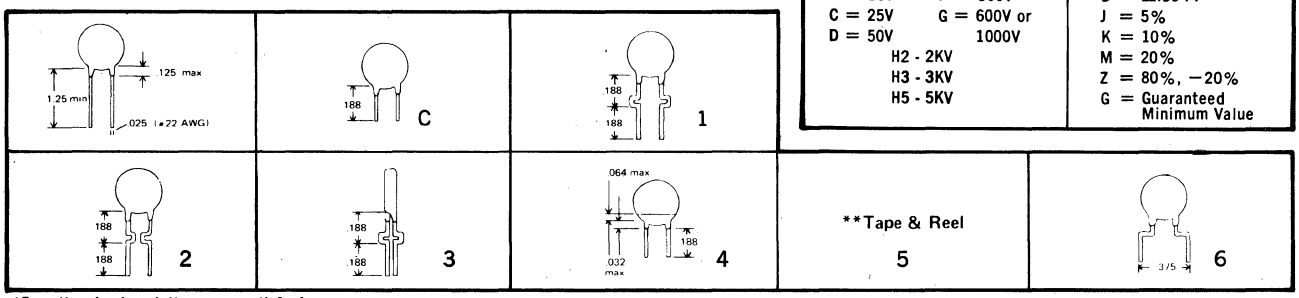
Note: The digit "4" representing lead variation may be 1, 2, 3 or 6 as shown in the diagrams below. The letter "C" and a blank space may also represent lead variations as shown in the diagrams.

TEMPERATURE CHARACTERISTIC			
A = Y5U	F = Z5V	M = P100	S = N470
B = Z5F	G = S2L	N = NPO	T = N750
C = Z5R	H = S3N	P = N150	V = N1500
D = Z5P	J = Z4V	Q = N220	W = N2200
E = Z5U	K = Z5T	R = N330	X = N3300

Other temp. char. available.

VOLTAGE RATING (WDC)	TOLERANCE
A = 12V	C = ±.25 PF
B = 16V	D = ±.50 PF
C = 25V	J = 5%
D = 50V	K = 10%
E = 100V	M = 20%
F = 500V	Z = 80%, −20%
G = 600V or 1000V	G = Guaranteed Minimum Value
H2 - 2KV	
H3 - 3KV	
H5 - 5KV	

*LEAD VARIATIONS



*For other lead variations, consult factory.
**Disc Ceramic Capacitors can be mounted on continuous tape for automatic board insertion. These may be supplied for use in machines such as Matsushita, "Panasert", TDK "Avisert", or Universal 6341. Check the specifications of the particular capacitor(s) required by your application. To order tape and reel packaging, add numeral "5" to part number. Consult factory for details.

MULTILAYER CHIPS

SPECIFICATIONS

- **Temperaure Characteristics: NPO/COG** — 0 ±30ppm/°C, −55°C to +125°C; **BX/X7R** — △C 0 ± 15% Max. over −55°C to +125°C; **Z5U** — △C +22, −56% Max. over +10°C to +85°C
- **Capacitance: NPO/COG** — Measured at 1 Vrms Max., 1MHz ±50KHz, 25°C, below 100PF — 1 Vrms Max., 1KHz ±50Hz, 25°C, above 100PF; **BX/X7R** — Measured at 1KHz ±50Hz, 1.0 ±0.2V, 25°C; **Z5U** — Measured at 1KHz ±50Hz, 0.5V Max., 25°C
- **Dielectric Withstanding Voltage: NPO/COG, BX/X7R, Z5U** — 200% rated voltage for 5 seconds, 50mA Max. charging current, 25°C
- **Insulation Resistance: — NPO/COG** — Greater than 100 G Ω below .01 UF, 25°C, VDCW — Greater than 1000 Ω F above .01 UF, 25°C, VDCW; **BX/X7R** — Greater than 100 G Ω for capacitance below .01 UF, 25°C, VDCW; **Z5U** — Greater than 10,000M Ω for capacitance below .05 UF,25°C, VDCW — Greater than 500 Ω F for capacitance above .05 UF, 25°C, VDCW
- **Dissipation Factor (D.F.): NPO/COG** — 0.1% Max., at 1 Vrms Max., 1KHz, 25°C; **BX/X7R** — .025 (2.5%) Max. at 1KHz ±50Hz, 1.0 ±0.2V, 25°C; **Z5U** — .025 (2.5%) Max., at 1KHz ±50Hz, 0.5V Max., 25°C

ORDERING TERMINOLOGY:

MA — R30 — CG — 331 — J — S — 201

SERIES CODE

SIZE CODE see chart

TEMPERATURE COEFFICIENT CODE
CG = NPO/COG
XR = X7R
ZU = Z5U

CAPACITANCE CODE
For example:
331 = 330 PF
561 = 560 PF
102 = 1000 PF
223 = 22,000 PF = .022 UF
154 = 150,000 PF = .15 UF
8R2 = 8.2 PF
3R3 = 3.3 PF

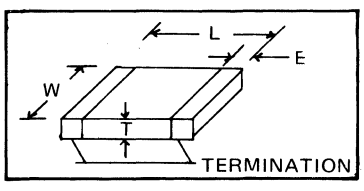
TOLERANCE CODE
*B = ±0.1 PF
*C = ±0.25 PF
*D = ±0.5 PF
F = ±1%
G = ±2%
J = ±5%
K = ±10%
M = ±20%
*For Capacitance value below 10 PF only.

TERMINATION CODE
S = Silver
G = Gold
P = Palladium — Silver
T = Palladium — Gold

RATED VOLTAGE
6R0 = 6 VDCW
120 = 12 VDCW
250 = 25 VDCW
500 = 50 VDCW
101 = 100 VDCW
201 = 200 VDCW

SIZE CODE

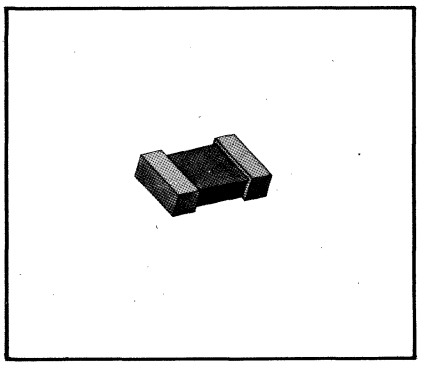
SIZE (in.)	R01	R03	R05	R07	R09	R11	R13	L01	S02	L02	L05	S04	L07
*L	.055	.080	.100	.110	.125	.130	.150	.175	.175	.180	.185	.200	.225
*W	.050	.050	.050	.105	.095	.095	.055	.065	.130	.080	.080	.260	.075
**T (max.)	.050	.050	.050	.070	.070	.070	.060	.070	.070	.060	.070	.070	.070
E	.005	.015	.020	.020	.020	.020	.020	.020	.020	.020	.020	.020	.020



*Tolerance ±0.010, ±7%, whichever is greater, +0.030-0.010 for soldered units.
**For soldered units allow +0.020.

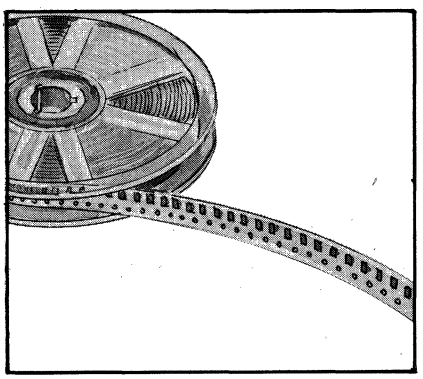
monolithic ceramic capacitors

MURATA ERIE NORTH AMERICA, INC.



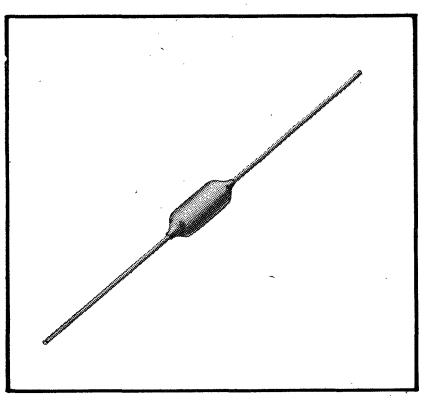
Chips

Capacitance Range:	0.5 pF to 1.5 mF
Voltage Ratings:	50 and 100 VDC
Temperature Characteristics:	NPO, X7R, Z5U, Y5V
Dimensions:	.060″ x .030″ to .220″ x .200″



Chips for Tape and Reel

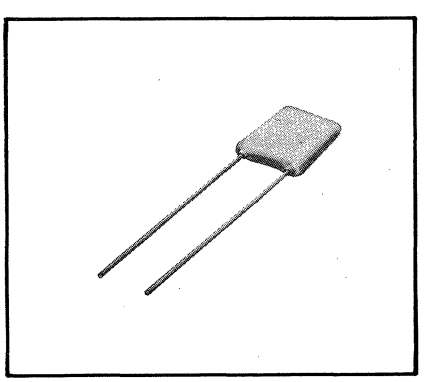
Capacitance Range:	0.5pF to 1.5mF
Voltage Ratings:	25, 50 & 100 VDC
Temperature Characteristics:	NPO, X7R, Y5V, Z5U
Dimensions:	.080″ x .050″ to .220″ x .200″
Carrier Tape:	Standard 8 & 12 MM



Axial Leaded Conformal Epoxy Coated

Capacitance Range:	1pF to 1mF
Voltage Ratings:	50 and 100 VDC
Temperature Characteristics:	NPO, X7R, Z5U
Dimensions:	.170″ x .100″ to .400″ x .150″

Available in standard packaging for auto-insertion



Radial Leaded Conformal Epoxy Coated

Capacitance Range:	1pF to 4.7mF
Voltage Ratings:	50, 100, 200 and 500 VDC
Temperature Characteristics:	NPO, X7R, Z5U
Dimensions:	.138″ x .100″ to .500″ x .500″

Available taped and reeled for auto-insertion

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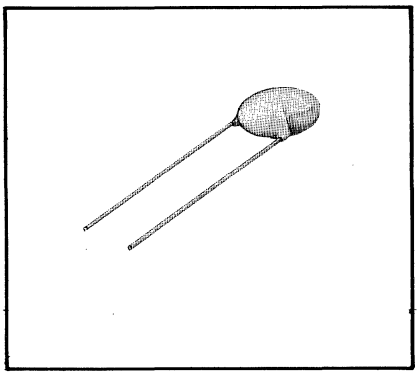
disc ceramic capacitors

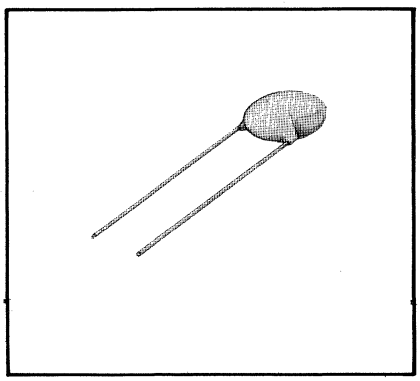
MURATA ERIE NORTH AMERICA, INC.



Low Voltage

Capacitance Range:	1pF to .5mF
Voltage Ratings:	12 VDC to 100 VDC
Temperature Characteristics:	Y5R, Y5P, Y5U, Y5V, Z5U NPO thru N750
Dimensions:	.157″ to .690″ Dia.

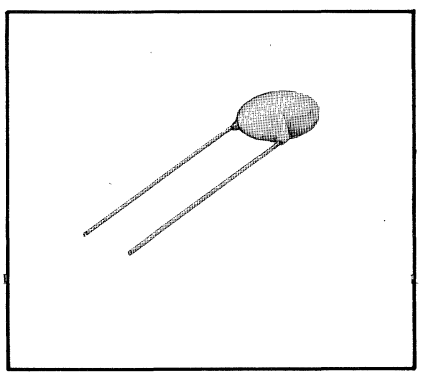
Available in standard packaging for auto-insertion



Medium Voltage

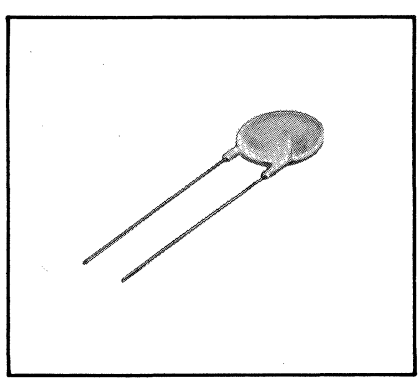
Capacitance Range:	1pF to .02mF
Voltage Ratings:	2,000; 3,000, 6,000 VDC
Temperature Characteristics:	Y5F, Y5P, Y5U, Z5U NPO, N750, N1500
Dimensions:	.275″ to .708″ Dia.

Available in standard packaging for auto-insertion



High Voltage

Capacitance Range:	100pF to 2,200pF
Voltage Ratings:	7,500; 10,000; 15,000 VDC
Temperature Characteristics:	Y5P, Z5U, N4700
Dimensions:	.354″ to .870″ Dia.



Safety Recognized UL, CSA, etc.

Capacitance Range:	100pF to .01mF
Voltage Ratings:	400 VAC
Temperature Characteristics:	B, F, FZ
Dimensions:	.394″ to .669″ Dia.
Approval Types:	UL, CSA, VDE, SEMKO, BS, SEV

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high voltage ceramic capacitors

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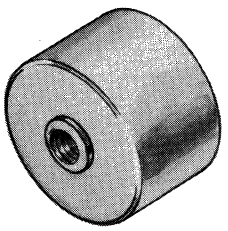


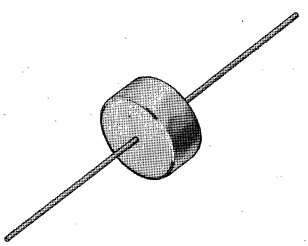
10 to 40 KVDC, DHS Series

For AC and DC Pulse Applications

Capacitance Ranges:	190pF to 8000pF
Voltage Ratings:	10, 15, 20, 30, 40 KVDC
Temperature Characteristics:	N4700
Size:	.63″ x .79″ Dia. to 1.42″ x 2.36″ Dia.

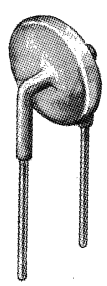
For General Purpose Applications

Capacitance Ranges:	180pF to 9300pF
Voltage Ratings:	10, 15, 20, 30, 40 KVDC
Temperature Characteristics:	Z5V
Size:	.75″ x .79″ Dia. to 1.61″ x 2.36″ Dia.



10 and 15 KVDC—DHL Series

Capacitance Ranges:	750pF and 1000pF
Voltage Ratings:	10 and 15 KVDC
Temperature Characteristics:	Y5P
Size:	.39″ x .79″ Dia. to .47″ x .79″ Dia.



10 and 15 KVDC—DHD Series

Capacitance Ranges:	500pF and 2000pF
Voltage Ratings:	10 and 15 KVDC
Temperature Characteristics:	Y5P
Size:	.295″ x .630″ Dia. to .295″ x .945″ Dia.

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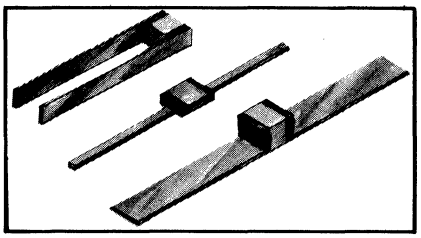
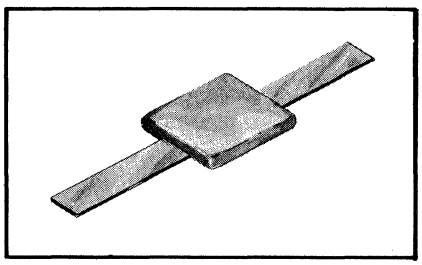
fixed and variable capacitors for microwave applications

MURATA ERIE NORTH AMERICA, INC.



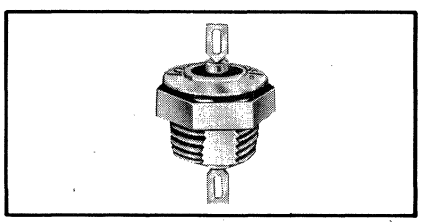
Monolithic Chips—MA Series

Capacitance Ranges:	0.3pF to .1μF
Voltage Ratings:	50, 100, 200, 300, 500 VDC
Tolerances:	B, ±0.1pF thru M, ±20%
Q:	10,000 @ 1 MHz
Temperature Characteristics:	P90, ±20ppm/°C, NPO, X7R
Size:	.055″ x .055″ to .110″ x .110″



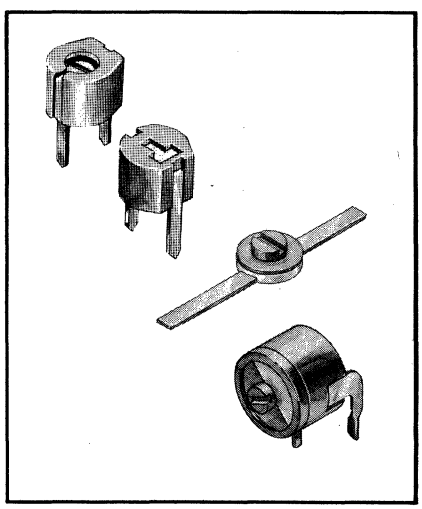
Glass Encapsulated Monolithic RF Power—UFP Series

Capacitance Ranges:	10pF to 3000pF
Voltage Ratings:	300 to 3600 VDC
Q:	5000 @ 1 MHz
RF Current Ratings:	8 Amperes
Temperature Characteristics:	P90, ±20ppm/°C
Size:	37/64″ x 35/64″ to 1 1/16″ x 1 1/16″



Button Mica

Capacitance Ranges:	15pF to 1000pF
Voltage Ratings:	500 VDC
Q:	Per MIL-C-10950
Configurations:	Stand-off and Feed-thru
Size:	.457″ Dia. x .730″ and .515″ Dia x .815″



Ceramic Trimmers

TZ03

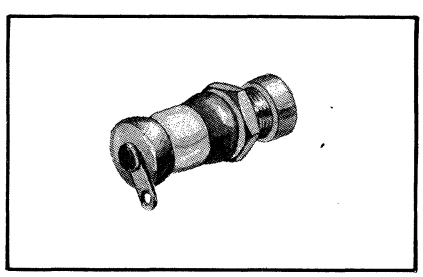
Capacitance Ranges:	1.25pF — 2.3pF to 10pF to 120pF
Voltage Ratings:	50 and 100 VDC
Temperature Characteristics:	NPO thru N1200
Size:	.236 Dia.

DVS3

Capacitance Ranges:	1.5pF — 6pF to 5pF to 35pF
Voltage Ratings:	25 VDC
Temperature Characteristics:	NPO and N750
Size:	.126″ Dia.

DV11

Capacitance Ranges:	2pF — 8pF to 15pF — 60pF
Voltage Ratings:	200 and 350 VDC
Temperature Characteristics:	NPO thru N1500
Size:	3/8″ Dia.



Air Trimmers

MVM

Capacitance Ranges:	0.8pF — 10pF to 1pF — 20pF
Voltage Ratings:	250 VDC
Temperature Characteristics:	0, ±15 and 0, ±25ppm/°C
Size:	.281″ Dia. x .484″ to .281″ Dia. x .900″

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NIC COMPONENTS CORPORATION

NORTH AMERICAN OPERATIONS NIPPON INDUSTRIES COMPANY LTD.

ALUMINUM ELECTROLYTIC CAPACITORS

ITEM NO.	SERIES	DESCRIPTION	OPERATING TEMPERATURE (°C)	CAPACITANCE RANGE	TOLERANCE	RATED VOLTAGE RANGE
1	NAE	Axial—General Purpose, Miniature Size	-40~+ 85°C	0.47~15,000 mfd	±20% (M)	6.3~100WVDC
2	NAE-H	Axial—High Voltage	-40~+85°C	0.47~1000 mfd	-10+50% ±20% (M)	160~500WVDC
3	NAE-WT	Axial—Wide Temperature	-40~+105°C	0.47~15,000 mfd	±20% (M)	6.3~100WVDC
4	NLE-A	Axial—Low Leakage	-40~+85°C	0.1~470 mfd	±10% (K) ±20% (M)	6.3~100WVDC
5	NNA	Axial—Non-Polarized	-40~+85°C	0.47~1000 mfd	±10% (K) ±20% (M)	6.3~100WVDC
6	NRE	Radial—General Purpose	-40~+85°C	0.47~10,000 mfd	±20% (M)	6.3~100WVDC
7	NRE-LP	Radial-Low Profile	-40~85°C	100~4700 mfd	±20% (M)	6.3~100WVDC
8	NRE-H	Radial—High Voltage	-40~+85°C	0.47~1000 mfd	-10+50% ±20% (M)	160~450WVDC
9	NRE-WT	Radial—Wide Temperature	-40~+105°C	0.47~10,000 mfd	±20% (M)	6.3~100WVDC
10	NSR	Radial-Low Profile (5mm Height Max)	-40~85°C	0.1~22 mfd	±20% (M)	6.3~50WVDC
11	NLE-L	Radial—Low Leakage	-40~+85°C	0.1~4700 mfd	±10% (K) ±20% (M)	6.3~100WVDC
12	NLE-LWT	Radial—Low Leakage, Wide Temperature	-40~+105°C	0.1~4700 mfd	±10% (K) ±20% (M)	6.3~100WVDC
13	NLE	Radial—Super Subminiature, Low Leakage, Tantalum Replacement	-40~+85°C	1.0~100 mfd	±10% (K) ±20% (M)	6.3~63WVDC
14	NNR	Radial—Non-Polarized	-40~+85°C	0.47~470 mfd	±10% (K) ±20% (M)	6.3~100WVDC
15	NRX	Radial—Low ESR for Switching Regulators	-55~+105°C	1.0~2200 mfd	-10+50% ±20% (M)	10~100WVDC
16	NRL	Snap-In Terminal	-40~+85°C	47~22,000 mfd	-10+50% ±20% (M)	10~450WVDC
17	NRLP	Snap-In Terminal, Low Profile	-40~+85°C	47~22,000 mfd	-10+50% ±20% (M)	10~450WVDC
18	NRL-W	Snap-In Terminal, Wide Temperature	-40~+110°C	47~22,000 mfd	-10+50% ±20% (M)	10~450WVDC
19	NRLP-W	Snap-In Terminal, Low Profile, Wide Temperature	-40~+110°C	47~22,000 mdf	-10+50% ±20% (M)	10~450WVDC

OPTIONS AVAILABLE

EPOXY END SEAL (-E)
ANTI-SOLVENT END SEAL (-AS)
RADIAL TAPING (TB)
AXIAL TAPING (TR)
CUT LEADS (C)
FORMED LEADS (F)

TANTALUM CAPACITORS

ITEM NO.	SERIES	DESCRIPTION	OPERATING TEMPERATURE (°C)	CAPACITANCE RANGE	TOLERANCE	RATED VOLTAGE RANGE
20	NDT	Radial—Resin Dipped	-55~+85°C	0.1~330 mfd	±10% (K)	3.15~50WVDC
21	NTC	Chip Type, Surface Mounted	-55~+125°C	0.1~47 mfd	±20% (M)	4~35WVDC

NIC COMPONENTS CORPORATION

NORTH AMERICAN OPERATIONS NIPPON INDUSTRIES COMPANY LTD.

FILM CAPACITORS

ITEM NO.	SERIES	DESCRIPTION	OPERATING TEMPERATURE (°C)	CAPACITANCE RANGE	TOLERANCE	RATED VOLTAGE RANGE
22	NEM	Radial, Inductive Dipped Polyester	-40~+85°C	.001~0.47 mfd	±10% (K) ±5% (J)	100~400WVDC
23	NRP	Radial, Non-Inductive Dipped Polyester	-55~+85°C	.001~1.0 mfd	±10% (K) ±5% (J) ±2% (G)	50~630WVDC
24	NAP	Axial, Wrap and Fill Polyester, Non-Inductive	-55~+85°C	.001~2.0 mfd	±10% (K) ±5% (J) ±2% (G)	50~630WVDC
25	NRM	Radial, Metalized Polyester, Dipped	-55~+85°C	.01~6.8 mfd	±10% (K) ±5% (J)	100~630WVDC
26	NAM	Axial, Metalized Polyester, Wrap and Fill, Flat Oval	-55~+85°C	.01~10 mfd	±10% (K) ±5% (J)	100~630WVDC
27	NTM	Axial, Metalized Polyester, Wrap and Fill, Tubular	-55~+85°C	.01~10 mfd	±10% (K) ±5% (J)	100~630WVDC
28	NPRM	Radial Metalized Polypropylene, Dipped	-55~+85°C	.01~3.3 mfd	±10% (K) ±5% (J) ±2% (G)	100~630WVDC
29	NPAM	Axial Metalized Polypropylene, Wrap and Fill, Flat Oval	-55~+85°C	.01~10 mfd	±10% (K) ±5% (J) ±2% (G)	100~630WVDC
30	NPTM	Axial Metalized Polypropylene, Wrap and Fill, Tubular	-55~+85°C	.01~10 mfd	±10% (K) ±5% (J) ±2% (G)	100~630WVDC
31	NPR	Radial Polypropylene	-55~+85°C	100pf~2.0 mfd	±1% (F) ±5% (J) ±2% (G) ±10% (K)	160~630WVDC
32	NPA	Axial Polypropylene	-55~+85°C	100pf~2.0 mfd	±1% (F) ±5% (J) ±2% (G) ±10% (K)	160~630WVDC
33	NPST	Axial Polystyrene, Film Foil	-55~+85°C	100 pf ~1 mfd	±5% (J) ±2% (G) ±1% (F)	100~630WVDC

CERAMIC CAPACITORS

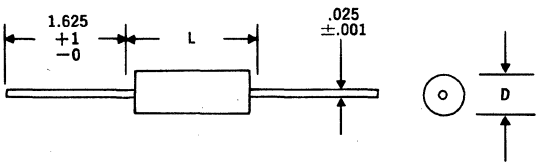
ITEM NO.	SERIES	DESCRIPTION	OPERATING TEMPERATURE (°C)	CAPACITANCE RANGE	TOLERANCE	RATED VOLTAGE RANGE
34	NCD	Radial Disc, HI-K Type Y5F, Y5P, Z5U, Z5V	-30~+85°C	100 pfd~.22 mfd	±10% (K) ±20% (M) +80-20% (Z)	16~6000WVDC
35	NCD-TC	Radial Disc, Temperature Compensating Type, NPO, SL, N750, N1500	-30~+85°C	1.0 pfd~1000 pfd	±5% (J) ±10% (K)	16~1000WVDC
36	NCD-SC	Radial Disc, Semi-Conductive Type Y5S, Y5T, Y5V	-30~+85°C	.01 mfd~.47 mfd	±20% (M) +80-20% (Z)	12~50WVDC
37	NCM	Radial, Multi-Layer, Epoxy Dip NPO, X7R, Z5U	-55~125°C	10 pfd~2.2 mfd	±5% (J) ±10% (K) ±20% (M)	50~100WVDC
38	NMC	Chip Type Multi-Layer NPO, X7R, Y5V, Z5U	-55~125°C	0.5 pfd~2.2 mfd	±2% (G) ±5% (J) ±10% (K) ±20% (M)	25~50WVDC
39	NAD	Axial Single Layer	-30~85°C	1 pfd~.1 mfd	±5% (J), ±20% (M) ±10% (K) +80-20% (Z)	16~50WVDC

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

MOLDED MYLAR* CAPACITORS TYPE 111

MOLDED IN RUGGED FLAME-RETARDANT MOLDING COMPOUND

TINNED COPPERWELD LEADS



Nytronics Type 111 Capacitors were developed for applications requiring excellent capacitance stability, superior humidity, superior humidity resistance and high insulation resistance. The Capacitor element is non-inductively wound with mylar dielectric and extended foil. Molded construction is ideally suited for automatic insertion. Available either reel packaged or ammo packaged.

CAPACITANCE
Shall be within the specified limits when measured at a frequency of 1 kHz at +25°C.

DISSIPATION FACTOR
Shall not exceed 1% when measured as above.

INSULATION RESISTANCE
Shall be a minimum of 50,000 megohms when measured at +25°C and with rated voltage applied for 2 minutes.

DIELECTRIC STRENGTH
Shall withstand 2.5X rated voltage for one minute.

OPERATING TEMPERATURE
Is −55°C to +85°C at full rated voltage; derated linearly to 50% of rated voltage at 125°C.

LIFE TEST
Is 250 hours at +85°C and 150% of rated voltage or, at +125°C with 85°C rated voltage applied. One failure in twelve allowed.

MOISTURE RESISTANCE
Capacitors shall meet the humidity requirements of MIL-STD-202E, Method 106D, 5 cycles.

CAPACITY TOLERANCE SUFFIX
J = ±5%; K = ±10%; M = ±20%. Other tolerances available on request.

Intermediate Capacitance Values Available.

* Dupont Trade Name

** Available in alternate A-B size. To order prefix number with AB. Example: AB111B123, 100 VDC only.

TYPE 111 MOLDED POLYESTER CAPACITORS

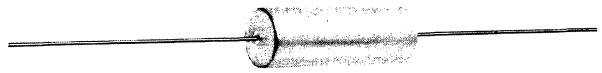
CAPACITANCE μF	CASE SIZE	CATALOG NUMBER
100 VOLTS DC WORKING		
.001	A	111B102K
.0012	A	111B122K
.0015	A	111B152K
.0018	A	111B182K
.0022	A	111B222K
.0027	A	111B272K
.0033	A	111B332K
.0039	A	111B392K
.0047	A	111B472K
.0056	A	111B562K
.0068	A	111B682K
.0082	A	111B822K
.01	A	111B103K
.012**	B or A-B	111B123K
.015**	B or A-B	111B153K
.018**	B or A-B	111B183K
.022**	B or A-B	111B223K
.027**	C or A-B	111B273K
.033**	C or A-B	111B333K
.039	C	111B393K
.047	C	111B473K
200 VOLTS DC WORKING		
.001	A	111C102K
.0012	A	111C122K
.0015	A	111C152K
.0018	A	111C182K
.0022	A	111C222K
.0027	A	111C272K
.0033	A	111C332K
.0039	A	111C392K
.0047	A	111C472K
.0056	A	111C562K
.0068	A	111C682K
.0082	A	111C822K
.01	B	111C103K
.012	B	111C123K
.015	B	111C153K
.018	B	111C183K
.022	B	111C153K
.027	C	111C273K
.033	C	111C333K
400 VOLTS DC WORKING		
.001	A-B	111E102K
.0012	A-B	111E122K
.0015	A-B	111E152K
.0018	A-B	111E182K
.0022	A-B	111E222K
.0027	A-B	111E272K
.0033	A-B	111E332K
.0039	A-B	111E393K
.0047	A-B	111E472K
.0056	C	111E562K
.0068	C	111E682K
600 VOLTS DC WORKING		
.001	A-B	111F102K
.0012	A-B	111F122K
.0015	A-B	111F152K
.0018	A-B	111F182K
.0022	C	111F222K
.0027	C	111F272K
.0033	C	111F332K

CASE SIZE	D MAX	L MAX
A	.188	.440
B	.188	.697
C	.219	.697
A-B	.219	.572

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE 107 POLYESTER FILM CAPACITORS

POLYESTER FILM CAPACITORS EXTENDED FOIL/FILM WRAP/EPOXY END FILL STYLE 107 −55°C TO +125°C



ELECTRICAL AND ENVIRONMENTAL CHARACTERISTICS

CAPACITANCE MEASUREMENTS

Capacitors of 1.0 μF or less shall be measured at a frequency of 1000 Hz. Capacitors greater than 1.0 μF shall be measured at 60 Hz. The standard capacitance tolerance is 20%. Other tolerances are available upon request.

Reference: MIL-STD-202, Method 305.

TEMPERATURE CHARACTERISTICS

The maximum change in capacitance from the measured value at +25°C shall be −6% at −55°C, and +15% at +125°C.

DISSIPATION FACTOR

When measured as specified in Paragraph 1, the dissipation factor at +25°C shall not exceed 0.6% for values up to 1.0 μF and shall not exceed 1.0% for greater capacitance values.

INSULATION RESISTANCE

When measured at +25°C, and rated voltage (or 500 VDC, whichever is less), the insulation resistance shall be a minimum of 50,000 megohm-microfarads, but need not exceed 100,000 megohms. The period of electrification shall not exceed two minutes.

Reference: MIL-STD-202, Method 302.

VOLTAGE DERATING

The capacitors may be operated at full rated voltage from −55°C to +85°C, or with linear derating to 50% of rated voltage above +85°C with a maximum temperature of +125°C.

VOLTAGE TEST

When tested at +25°C, the capacitors shall withstand the indicated DC test voltages for a period of one minute:

Terminal to terminal	200% of DC rating
Terminal to case (less than .235 diameter)	200% of DC rating
Terminal to case (greater than .235 diameter)	400% of DC rating or 2,000 VDC, whichever is less

Reference: MIL-STD-202, Method 301.

LIFE TESTING

When tested for 1000 hours at 150% of the appropriate rated voltage for the test temperature, the capacitors shall exhibit no more than one failure in twelve pieces tested. Alternatively, an accelerated +125°C test may be performed at the +85°C voltage rating for a period of 250 hours. A failure is defined as:

a) A capacitance change of more than 10% of its initial value;
b) A dissipation factor greater than that specified in Paragraph 3;
c) An insulation resistance less than ⅓ that specified in Paragraph 4; or
d) A permanent open or short.

VIBRATION

The capacitors will meet or exceed in the vibration requirements of MIL-STD-202, Method 201.

NYTRONICS CATALOG NUMBERING SYSTEM

107 B 103 M

- **107** — Nytronics Style
- **B** — D.C. Voltage Rating: B = 100V, C = 200V, E = 400V, F = 600V
- **103** — Capacitance: In μμf. The first two digits are the significant figures, the third is the number of zeros.
- **M** — Capacitance Tolerance: F = ±1%, P = ±2%, J = ±5%, K = ±10%, M = ±20%

Note: Special capacitance values, voltage ratings and sizes available to customer requirements.

PHYSICAL SIZE TOLERANCES

	100 Volts DC & 200 Volts DC		400 Volts DC	
DIAMETER	Up to .158	+.032 −.000	Up to .218	±.032
	.159 to .200	+.040 −.000	.219 to .500	±.046
	Over .200	+.050 −.000	Over .500	±.062
LENGTH		+1/16 −0		+3/32 −1/16

TINNED COPPERWELD LEADS

No. 22 AWG. (.025) for cases up to .325 Dia.
No. 20 AWG. (.032) for cases .326 thru 1.0 Dia.
No. 18 AWG. (.040) for cases above 1.0 Dia.

Lead Length: 1⅝" Min.

Also available are the following styles with characteristics similar to Type 107.

STYLE 103
Flat Press with Axial Leads
Extended Foil Construction
Polyester Film Dielectric
Film Wrap-Epoxy Endfill
−55°C to +125°C Operation

STYLE 118
Round Body with Axial Leads
Extended Foil Construction
Polyester Film Dielectric
Polyethylene Case-Epoxy Endfill
−55°C to +100°C Operation

STANDARD RATINGS

Capacitance μf	Dia. x Length		Cat. No.
100 VOLTS DC WORKING			
.001	.138	3/8	107B102M
.0015	.138	3/8	107B152M
.0022	.138	3/8	107B222M
.0033	.138	3/8	107B332M
.0047	.138	3/8	107B472M
.0068	.138	3/8	107B682M
.0082	.138	3/8	107B822M
.01	.158	3/8	107B103M
.015	.158	21/32	107B153M
.022	.158	21/32	107B223M
.027	.158	21/32	107B273M
.033	.158	21/32	107B333M
.047	.190	21/32	107B473M
.068	.220	21/32	107B683M
.082	.265	21/32	107B823M
.1	.265	11/16	107B104M
.12	.300	3/4	107B124M
.15	.330	3/4	107B154M
.22	.350	15/16	107B224M
.27	.350	1 1/16	107B274M
.33	.385	1 1/16	107B334M
.39	.415	1 1/16	107B394M
.47	.450	1 1/16	107B474M
.56	.490	1 1/16	107B564M
.68	.540	1 1/16	107B684M
.82	.570	1 1/16	107B824M
1.	.590	1 3/16	107B105M
1.5	.670	1 5/16	107B155M
1.8	.730	1 5/16	107B185M
2.0	.700	1 1/2	107B205M
200 VOLTS DC WORKING			
.001	.138	3/8	107C102M
.0015	.138	3/8	107C152M
.0022	.138	3/8	107C222M
.0033	.138	3/8	107C332M
.0047	.138	3/8	107C472M
.0068	.138	3/8	107C682M
.0082	.138	3/8	107C822M
.01	.158	3/8	107C103M
.015	.158	21/32	107C153M
.022	.158	21/32	107C223M
.027	.158	21/32	107C273M
.033	.158	21/32	107C333M
.047	.190	21/32	107C473M
.068	.220	21/32	107C683M
.082	.265	21/32	107C823M
.1	.265	11/16	107C104M
.12	.285	13/16	107C124M
.15	.315	13/16	107C154M
.22	.325	1 1/16	107C224M
.27	.350	1 3/16	107C274M
.33	.390	1 3/16	107C334M
.39	.415	1 3/16	107C394M
.47	.450	1 3/16	107C474M
.56	.490	1 3/16	107C564M
.68	.540	1 3/16	107C684M
.82	.580	1 3/16	107C824M
1.	.590	1 5/16	107C105M
1.5	.680	1 7/16	107C155M
1.8	.740	1 7/16	107C185M
2.0	.750	1 9/16	107C205M
400 VOLTS DC WORKING			
.001	.156	5/8	107E102M
.0015	.156	5/8	107E152M
.0022	.156	5/8	107E222M
.0033	.156	5/8	107E332M
.0047	.187	5/8	107E472M
.0068	.218	5/8	107E682M
.0082	.234	5/8	107E822M
.01	.250	5/8	107E103M
.015	.296	5/8	107E153M
.022	.312	3/4	107E223M
.027	.281	7/8	107E273M
.033	.312	7/8	107E333M
.047	.343	7/8	107E473M
.068	.375	1	107E683M
.082	.406	1	107E823M
.1	.421	1	107E104M
.12	.468	1	107E124M
.15	.468	1 1/4	107E154M
.22	.546	1 3/8	107E224M
.27	.609	1 3/8	107E274M
.33	.593	1 5/8	107E334M
.39	.625	1 5/8	107E394M
.47	.671	1 5/8	107E474M
.56	.718	1 3/4	107E564M
.68	.796	1 3/4	107E684M
.82	.812	1 7/8	107E824M
1.	.812	2	107E105M
1.5	.921	2 1/4	107E155M
1.8	1.015	2 1/4	107E185M
2.0	1.093	2 1/4	107E205M

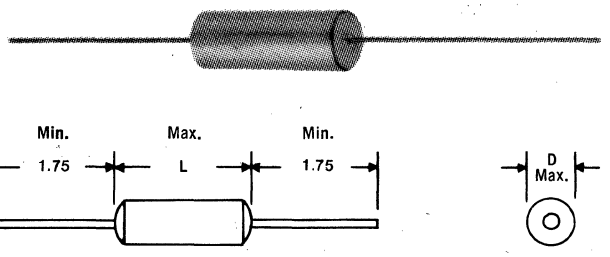
Special capacitance values, tolerances and sizes are available on request.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE 187 POLYPROPYLENE CAPACITORS

TYPE 187 POLYPROPYLENE CAPACITORS

EXTENDED FOIL/FILM WRAP/ EPOXY ENDFILL



ELECTRICAL SPECIFICATIONS

CAPACITANCE
Shall be within the specified limits when measured at 1 kHz at +25°C.

DISSIPATION FACTOR
Shall not exceed .1% when measured as above.

INSULATION RESISTANCE
When measured at +25°C and with rated voltage applied for 2 minutes, shall be a minimum 250,000 megohms/mfd; need not exceed 500,000 megohms.

DIELECTRIC STRENGTH
Shall withstand 200% of rated voltage for 1 minute.

OPERATING TEMPERATURE
−55°C to +105°C at full rated voltage.

LIFE TEST
250 hours, at 105°C with 140% of rated voltage applied. One failure in twelve shall be permitted.

HUMIDITY RESISTANCE
Meets the requirements of MIL-STD-202, Method 103B, Test Condition B. After test the I.R. will be equal to or greater than 1/3 of the initial requirement.

LEAD PULL & BEND TEST
Capacitors will withstand a 5 pound pull test and bend test as described in RS-164.

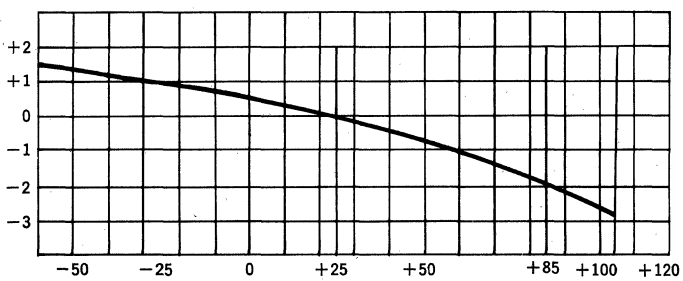
LEAD WIRE SIZE

AWG	DIAMETER MAX.
#22	.40 & Under
#20	.401 Thru 1.0
#18	Above 1.0

CAPACITY TOLERANCE SUFFIX

F = ± 1%
P = ± 2%
J = ± 5%
K = ±10%
M = ±20%

TYPICAL CAPACITANCE CHANGE WITH TEMPERATURE IN PERCENT



TEMPERATURE IN DEGREES CENTIGRADE

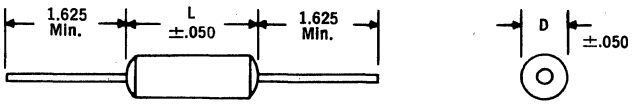
Other capacitance values and voltage ratings available upon request.

CAPACITY MFD.	100 VDC CATALOG NO.	D MAX.	L MAX.	200 VDC CATALOG NO.	D MAX.	L MAX.	400 VDC CATALOG NO.	D MAX.	L MAX.
.001	187B102___	.218	.625	187C102___	.218	.625	187E102___	.218	.625
.0012	187B122___	.218	.625	187C122___	.218	.625	187E122___	.218	.625
.0015	187B152___	.218	.625	187C152___	.218	.625	187E152___	.218	.625
.0018	187B182___	.218	.625	187C182___	.218	.625	187E182___	.218	.625
.0022	187B222___	.218	.625	187C222___	.218	.625	187E222___	.218	.625
.0027	187B272___	.218	.625	187C272___	.218	.625	187E272___	.218	.625
.0033	187B332___	.218	.625	187C332___	.218	.625	187E332___	.218	.625
.0039	187B392___	.218	.625	187C392___	.218	.625	187E392___	.218	.625
.0047	187B472___	.218	.625	187C472___	.218	.625	187E472___	.218	.625
.0056	187B562___	.218	.625	187C562___	.218	.625	187E562___	.240	.625
.0068	187B682___	.218	.625	187C682___	.218	.625	187E682___	.255	.625
.0082	187B822___	.218	.625	187C822___	.218	.625	187E822___	.235	.687
.01	187B103___	.218	.625	187C103___	.232	.625	187E103___	.255	.687
.012	187B123___	.218	.625	187C123___	.245	.625	187E123___	.280	.687
.015	187B153___	.235	.625	187C153___	.242	.687	187E153___	.310	.687
.018	187B183___	.250	.625	187C183___	.255	.687	187E183___	.340	.687
.022	187B223___	.265	.625	187C223___	.265	.687	187E223___	.360	.687
.027	187B273___	.285	.625	187C273___	.316	.687	187E273___	.395	.687
.033	187B333___	.320	.625	187C333___	.320	.687	187E333___	.370	.812
.039	187B393___	.345	.625	187C393___	.358	.687	187E393___	.395	.812
.047	187B473___	.300	.750	187C473___	.330	.812	187E473___	.435	.812
.056	187B563___	.325	.750	187C563___	.354	.812	187E563___	.465	.812
.068	187B683___	.345	.812	187C683___	.385	.812	187E683___	.450	.937
.082	187B823___	.345	.812	187C823___	.415	.812	187E823___	.480	.937
.1	187B104___	.410	.812	187C104___	.415	.937	187E104___	.530	.937
.12	187B124___	.425	.812	187C124___	.450	.937	187E124___	.495	1.250
.15	187B154___	.425	.937	187C154___	.495	.937	187E154___	.545	1.250
.18	187B184___	.425	.937	187C184___	.530	.937	187E184___	.605	1.250
.22	187B224___	.450	.937	187C224___	.520	1.125	187E224___	.655	1.250
.27	187B274___	.460	1.125	187C274___	.575	1.125	187E274___	.630	1.500
.33	187B334___	.490	1.125	187C334___	.635	1.125	187E334___	.690	1.500
.39	187B394___	.490	1.250	187C394___	.635	1.250	187E394___	.740	1.500
.47	187B474___	.540	1.250	187C474___	.690	1.250	187E474___	.810	1.500
.56	187B564___	.585	1.250	187C564___	.660	1.500	187E564___	.870	1.500
.68	187B684___	.635	1.250	187C684___	.720	1.500	187E684___	.860	1.750
.82	187B824___	.685	1.250	187C824___	.720	1.750	187E824___	.950	1.750
1.	187B105___	.760	1.250	187C105___	.770	1.750	187E105___	1.040	1.750

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE 184 METALLIZED POLYESTER

SUBMINIATURE CAPACITORS 50, 80, 100 VDC



LEAD WIRE SIZE

AWG	Diameter
#24	.280 & Under
#22	.281-.532
#20	Above .533

CAPACITANCE TOLERANCE SUFFIX

G = ±2%
J = ±5%
K = ±10%

OUTSTANDING FEATURES

- Excellent Electrical Characteristics
- Subminiature, Space Saving Sizes
- Excellent Moisture Resistance
- Self Healing
- Excellent Shelf Life
- Wide Operating Temperature Range

CAPACITANCE

Shall be measured at +25°C. For capacitance values of less than 1 μF, the test frequency is 1 kHz, above 1 μF use 120 Hz.

DISSIPATION FACTOR

Shall not exceed .75% when measured as above.

INSULATION RESISTANCE

Shall be a minimum of 10,000 megohm X microfarads, need not exceed 30,000 megohms when measured at +25°C and with rated voltage applied for two minutes.

DIELECTRIC STRENGTH

Shall withstand 1.8 times rated voltage for 2 minutes without permanent breakdown.

OPERATING TEMPERATURE

−55°C to +85°C at full rated voltage; derated linearly to 50% of rated voltage at +125°C.

LIFE TEST

250 hours at +85°C and 150% of rated voltage. One failure in 18 allowed.

MOISTURE RESISTANCE

Capacitors shall be subjected to 95% R.H. at +40°C for 500 hours.
Capacitors shall be removed from the humidity chamber on completion. Surface of units shall be wiped dry then exposed to circulating air for four hours. No more than one failure in 12 units tested.

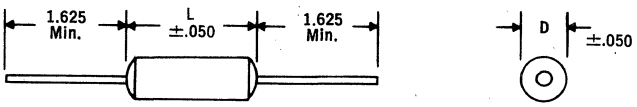
CAP. MFD	CATALOG NUMBER	DIA.	LENGTH
100 VDC			
0.047	184B473	.140	.400
0.056	184B563	.140	.400
0.068	184B683	.140	.400
0.082	184B823	.140	.400
0.10	184B104	.140	.400
0.12	184B124	.150	.400
0.15	184B154	.165	.400
0.18	184B184	.180	.400
0.22	184B224	.195	.400
0.27	184B274	.215	.400
0.33	184B334	.180	.530
0.39	184B394	.205	.530
0.47	184B474	.210	.530
0.56	184B564	.225	.530
0.68	184B684	.250	.530
0.82	184B824	.270	.530
1.00	184B105	.295	.530
1.2	184B125	.265	.680
1.5	184B155	.300	.680
1.8	184B185	.330	.680
2.0	184B205	.345	.680
2.2	184B225	.335	.780
3.0	184B305	.390	.780
3.3	184B335	.410	.780
4.0	184B405	.380	.900
4.7	184B475	.410	.900
5.0	184B505	.425	.900
6.0	184B605	.465	.900
6.8	184B685	.495	.900
8.0	184B805	.535	.900
10.0	184B106	.595	.900

CAP. MFD	CATALOG NUMBER	DIA.	LENGTH
50 VDC			
0.047	184A473	.140	.400
0.056	184A563	.140	.400
0.068	184A683	.140	.400
0.082	184A823	.140	.400
0.10	184A104	.140	.400
0.12	184A124	.140	.400
0.15	184A154	.140	.400
0.18	184A184	.140	.400
0.22	184A224	.140	.400
0.27	184A274	.140	.400
0.33	184A334	.150	.400
0.39	184A394	.160	.400
0.47	184A474	.175	.400
0.56	184A564	.185	.400
0.68	184A684	.205	.400
0.82	184A824	.220	.400
1.00	184A105	.240	.400
1.2	184A125	.200	.530
1.5	184A155	.220	.530
1.8	184A185	.240	.530
2.0	184A205	.255	.530
2.2	184A225	.265	.530
3.0	184A305	.260	.680
3.3	184A335	.270	.680
4.0	184A405	.295	.680
4.7	184A475	.320	.680
5.0	184A505	.330	.680
6.0	184A605	.335	.780
6.8	184A685	.355	.780
8.0	184A805	.385	.780
10.0	184A106	.425	.780
12.0	184A126	.395	.900
15.0	184A156	.440	.900
18.0	184A186	.480	.900
20.0	184A206	.505	.900
25.0	184A256	.520	1.08
30.0	184A306	.565	1.08
35.0	184A356	.610	1.08
50.0	184A506	.730	1.08
80 VDC			
0.047	184Y473	.140	.400
0.056	184Y563	.140	.400
0.068	184Y683	.140	.400
0.082	184Y823	.140	.400
0.10	184Y104	.140	.400
0.12	184Y124	.140	.400
0.15	184Y154	.140	.400
0.18	184Y184	.140	.400
0.22	184Y224	.160	.400
0.27	184Y274	.175	.400
0.33	184Y334	.190	.400
0.39	184Y394	.160	.530
0.47	184Y474	.175	.530
0.56	184Y564	.185	.530
0.68	184Y684	.205	.530
0.82	184Y824	.220	.530
1.00	184Y105	.240	.530
1.2	184Y125	.260	.530
1.5	184Y155	.290	.530
1.8	184Y185	.305	.680
2.0	184Y205	.280	.680
2.2	184Y225	.290	.680
3.0	184Y305	.340	.680
3.3	184Y335	.355	.680
4.0	184Y405	.390	.680
4.7	184Y475	.420	.680
5.0	184Y505	.430	.680
6.0	184Y605	.470	.680
6.8	184Y685	.395	.900
8.0	184Y805	.430	.900
10.0	184Y106	.480	.900
12.0	184Y126	.525	.900
15.0	184Y156	.585	.900
18.0	184Y186	.635	.900

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE 194 METALLIZED POLYCARBONATE

SUBMINIATURE CAPACITORS 50, 80, 100 VDC



LEAD WIRE SIZE

AWG	Diameter
#24	.280 & Under
#22	.281-.532
#20	Above .533

CAPACITANCE TOLERANCE SUFFIX

G = ±2%
J = ±5%
K = ±10%

OUTSTANDING FEATURES

- Excellent Electrical Characteristics
- Subminiature, Space Saving Sizes
- Excellent Moisture Resistance
- Self Healing
- Excellent Shelf Life
- Wide Operating Temperature Range

CAPACITANCE

Shall be measured at +25°C. For capacitance values of less than 1 μF, the test frequency is 1 kHz, above 1 μF use 120 Hz.

DISSIPATION FACTOR

Shall not exceed .50% when measured as above.

INSULATION RESISTANCE

Shall be a minimum of 50,000 megohm X microfarads, need not exceed 200,000 megohms when measured at +25°C and with rated voltage applied for two minutes.

DIELECTRIC STRENGTH

Shall withstand 1.8 times rated voltage for 2 minutes without permanent breakdown.

OPERATING TEMPERATURE

−55°C to +125°C at full rated voltage.

LIFE TEST

250 hours at +125°C and 150% of rated voltage. One failure in 18 allowed.

MOISTURE RESISTANCE

Capacitors shall be subjected to 95% R.H. at +40°C for 500 hours.
Capacitors shall be removed from the humidity chamber on completion. Surface of units shall be wiped dry then exposed to circulating air for four hours. No more than one failure in 12 units tested.

CAP. MFD	CATALOG NUMBER	DIA.	LENGTH
100 VDC			
0.047	194B473	.140	.400
0.056	194B563	.140	.400
0.068	194B683	.140	.400
0.082	194B823	.140	.530
0.10	194B104	.140	.530
0.12	194B124	.140	.530
0.15	194B154	.160	.530
0.18	194B184	.175	.530
0.22	194B224	.190	.530
0.27	194B274	.210	.530
0.33	194B334	.230	.530
0.39	194B394	.210	.680
0.47	194B474	.230	.680
0.56	194B564	.250	.680
0.68	194B684	.270	.680
0.82	194B824	.295	.680
1.00	194B105	.325	.680
1.2	194B125	.330	.780
1.5	194B155	.365	.780
1.8	194B185	.340	.900
2.0	194B205	.360	.900
2.2	194B225	.375	.900
3.0	194B305	.435	.900
3.3	194B335	.455	.900
4.0	194B405	.430	1.205
4.7	194B475	.465	1.205
5.0	194B505	.475	1.205
6.0	194B605	.520	1.205
6.8	194B685	.555	1.205
8.0	194B805	.600	1.205
9.0	194B905	.635	1.205
10.0	194B106	.670	1.205

CAP. MFD	CATALOG NUMBER	DIA.	LENGTH
50 VDC			
0.047	194A473	.140	.400
0.056	194A563	.140	.400
0.068	194A683	.140	.400
0.082	194A823	.140	.400
0.10	194A104	.140	.400
0.12	194A124	.160	.400
0.15	194A154	.160	.400
0.18	194A184	.160	.400
0.22	194A224	.170	.400
0.27	194A274	.190	.400
0.33	194A334	.200	.400
0.39	194A394	.170	.530
0.47	194A474	.180	.530
0.56	194A564	.200	.530
0.68	194A684	.220	.530
0.82	194A824	.240	.530
1.00	194A105	.260	.530
1.2	194A125	.240	.680
1.5	194A155	.260	.680
1.8	194A185	.290	.680
2.0	194A205	.305	.680
2.2	194A225	.320	.680
3.0	194A305	.345	.780
3.3	194A335	.360	.780
4.0	194A405	.340	.900
4.7	194A475	.365	.900
5.0	194A505	.375	.900
6.0	194A605	.410	.900
6.8	194A685	.435	.900
8.0	194A805	.430	1.08
9.0	194A905	.460	1.08
10.0	194A106	.480	1.08
12.0	194A126	.530	1.08
15.0	194A156	.550	1.08
20.0	194A206	.630	1.08
25.0	194A256	.710	1.08
30.0	194A306	.770	1.08
80 VDC			
0.047	194Y473	.140	.400
0.056	194Y563	.140	.400
0.068	194Y683	.140	.400
0.082	194Y823	.140	.400
0.10	194Y104	.140	.400
0.12	194Y124	.165	.400
0.15	194Y154	.180	.400
0.18	194Y184	.195	.400
0.22	194Y224	.215	.400
0.27	194Y274	.235	.400
0.33	194Y334	.255	.400
0.39	194Y394	.210	.530
0.47	194Y474	.230	.530
0.56	194Y564	.250	.530
0.68	194Y684	.270	.530
0.82	194Y824	.250	.680
1.00	194Y105	.275	.680
1.2	194Y125	.300	.680
1.5	194Y155	.330	.680
1.8	194Y185	.335	.780
2.0	194Y205	.355	.780
2.2	194Y225	.370	.900
3.0	194Y305	.365	.900
3.3	194Y335	.385	.900
4.0	194Y405	.420	.900
4.7	194Y475	.455	.900
5.0	194Y505	.430	1.08
6.0	194Y605	.470	1.08
6.8	194Y685	.500	1.08
8.0	194Y805	.540	1.08
9.0	194Y905	.570	1.08
10.0	194Y106	.600	1.08
12.0	194Y126	.610	1.205
15.0	194Y156	.685	1.205

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE 192 METALLIZED POLYPROPYLENE CAPACITORS

POLYESTER TAPE WRAP CASE/EPOXY ENDFILL

Type 192 Capacitors feature small size, excellent stability, high insulation resistance, low dissipation factor and good humidity resistance. These properties make them ideal for use in timing and integrating circuitry.

CAPACITANCE
Shall be within specified tolerance when measured at 1 KHz for values thru 1 MFD and at 60 Hz for values above 1 MFD.

DISSIPATION FACTOR
Less than .1% when measured as above at 25°C.

DIELECTRIC STRENGTH
1.5 X rated voltage for one minute through a limiting resistance of 100 ohms/volt.

INSULATION RESISTANCE
Minimum values.

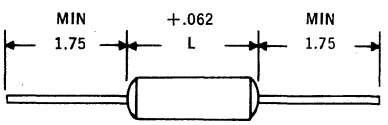
Temperature	+25°C	+85°C	+105°C
Megohms X Microfarads	100,000	5,000	500
Need Not Exceed (Megohms)	200,000	10,000	1000

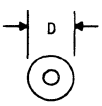
Measured After Two Minutes Electrification At Rated Voltage

TEMPERATURE RANGE
−55°C to +85°C at rated voltage to 105°C with 50% voltage derating.

HUMIDITY
Will meet the test requirements of MIL-STD-202, Method 103B, Test Condition B. After testing the I.R. will be equal to or greater than ⅓ of the initial requirements. One failure in 12 permitted.

LIFE TEST
250 hours at 85°C with 140% of rated voltage applied. A resistance of one ohm per volt shall be inserted in series with each capacitor. One failure in 12 shall be permitted.





D TOLERANCE

.249 and Under	+.032
.250 thru .500	+.046
.501 thru 1.000	+.062

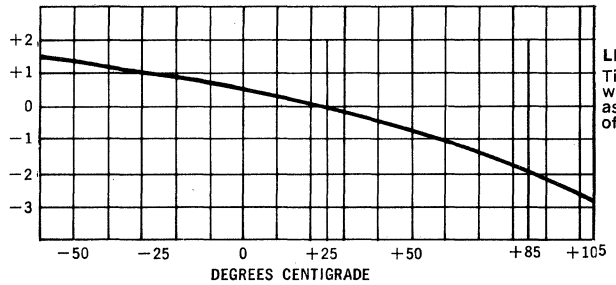
LEAD GAUGE

Body Length	AWG
.530 and Less	24
.650 thru 1.062	22
1.187 thru 2.00	20
Greater Than 2.00	18

CAPACITY TOLERANCE SUFFIX

F = ± 1%
P = ± 2%
J = ± 5%
K = ±10%
M = ±20%

TYPICAL CAPACITANCE CHANGE WITH TEMPERATURE IN PERCENT



LEAD MATERIAL:
Tinned copperweld wire shall withstand mechanical test as specified in Paragraph 3.4 of EIA Standard RS-164A

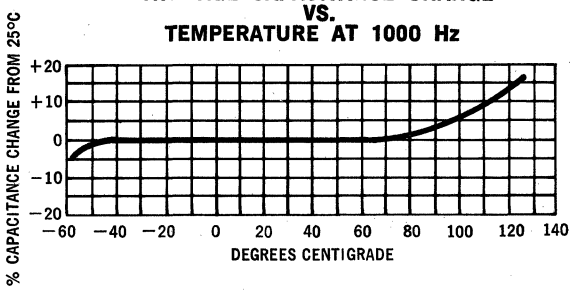
CAP MFD	CAT. No.	DIA.	LENGTH
150 VOLTS DC WORKING			
.010	192V103	.160	.400
.012	192V123	.170	.400
.015	192V153	.190	.400
.018	192V183	.165	.470
.022	192V223	.180	.470
.027	192V273	.188	.470
.033	192V333	.178	.470
.039	192V393	.188	.470
.047	192V473	.203	.470
.056	192V563	.190	.530
.068	192V683	.205	.530
.082	192V823	.225	.530
.10	192V104	.245	.530
.12	192V124	.265	.530
.15	192V154	.240	.650
.18	192V184	.260	.650
.22	192V224	.285	.650
.27	192V274	.315	.650
.33	192V334	.315	.780
.39	192V394	.325	.780
.47	192V474	.355	.780
.56	192V564	.385	.780
.68	192V684	.380	.900
.82	192V824	.380	1.062
1.0	192V105	.415	1.062
1.2	192V125	.450	1.062
1.5	192V155	.500	1.062
2.0	192V205	.535	1.187
3.0	192V305	.575	1.437
4.0	192V405	.660	1.437
5.0	192V505	.665	1.750
6.0	192V605	.725	1.750
8.0	192V805	.770	2.000
10.0	192V106	.860	2.000
200 VOLTS DC WORKING			
.010	192C103	.160	.400
.012	192C123	.170	.400
.015	192C153	.190	.400
.018	192C183	.165	.470
.022	192C223	.180	.470
.027	192C273	.195	.470
.033	192C333	.210	.470
.039	192C393	.195	.530
.047	192C473	.215	.530
.056	192C563	.230	.530
.068	192C683	.250	.530
.082	192C823	.225	.650
.10	192C104	.245	.650
.12	192C124	.265	.650
.15	192C154	.295	.650
.18	192C184	.285	.780
.22	192C224	.310	.780
.27	192C274	.340	.780
.33	192C334	.370	.780
.39	192C394	.360	.900
.47	192C474	.395	.900
.56	192C564	.425	.900
.68	192C684	.465	.900
.82	192C824	.440	1.187
1.0	192C105	.480	1.187
1.2	192C125	.525	1.187
1.5	192C155	.580	1.187
2.0	192C205	.670	1.187
3.0	192C305	.720	1.500
4.0	192C405	.825	1.500
5.0	192C505	.830	1.750
6.0	192C605	1.000	1.750
8.0	192C805	.960	2.000
10.0	192C106	1.070	2.000
400 VOLTS DC WORKING			
.010	192E103	.205	.400
.012	192E123	.220	.400
.015	192E153	.195	.470
.018	192E183	.210	.470
.022	192E223	.230	.470
.027	192E273	.220	.530
.033	192E333	.240	.530
.039	192E393	.255	.530
.047	192E473	.230	.650
.056	192E563	.245	.650
.068	192E683	.270	.650
.082	192E823	.290	.650
.10	192E104	.285	.780
.12	192E124	.305	.780
.15	192E154	.340	.780
.18	192E184	.370	.780
.22	192E224	.365	.900
.27	192E274	.400	.900
.33	192E334	.440	.900
.39	192E394	.475	.900
.47	192E474	.440	1.187
.56	192E564	.475	1.187
.68	192E684	.525	1.187
.82	192E824	.570	1.187
1.0	192E105	.560	1.500
1.2	192E125	.610	1.500
1.5	192E155	.680	1.500
2.0	192E205	.710	1.750
3.0	192E305	.860	1.750
4.0	192E405	.860	2.250
5.0	192E505	.950	2.250

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

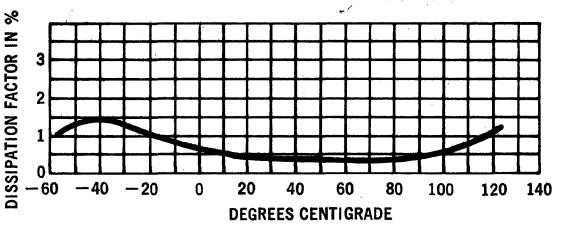
METALLIZED POLYCARBONATE

TYPICAL TEMPERATURE CHARACTERISTICS FOR METALLIZED POLYESTER CAPACITORS — TYPE 184

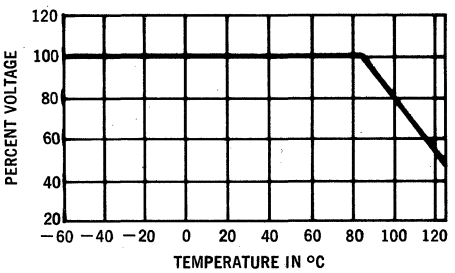
AVERAGE CAPACITANCE CHANGE VS. TEMPERATURE AT 1000 Hz



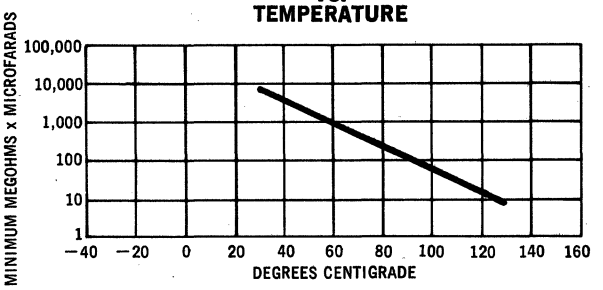
AVERAGE DISSIPATION FACTOR VS. TEMPERATURE AT 1000 Hz



VOLTAGE RATING AS A FUNCTION OF TEMPERATURE

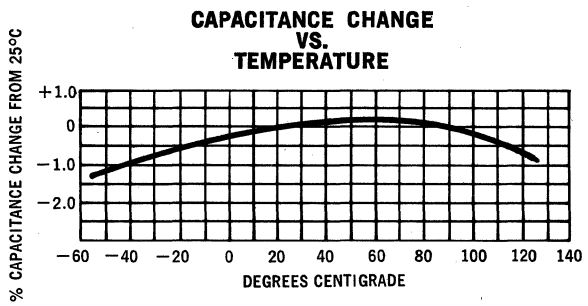


INSULATION RESISTANCE VS. TEMPERATURE

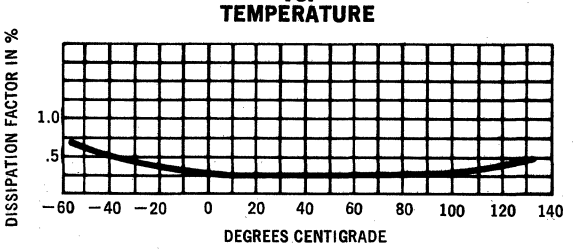


TYPICAL TEMPERATURE CHARACTERISTICS FOR METALLIZED POLYCARBONATE CAPACITORS — TYPE 194

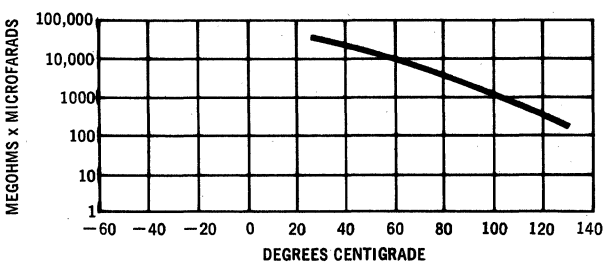
CAPACITANCE CHANGE VS. TEMPERATURE



DISSIPATION FACTOR VS. TEMPERATURE



INSULATION RESISTANCE VS. TEMPERATURE



Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE 188 POLYESTER CAPACITORS

METALLIZED POLYESTER CAPACITORS TYPE 188 FILM WRAP / EPOXY END FILL −55°C TO +125°C

Type 188 Capacitors features extremely small size, light weight and self clearing metallized construction which virtually eliminates catastrophic failures. Well suited for Voltage Multiplier Circuits in TV power supplies and Electrostatic copiers. Also ideal for Potting or encapsulating in Electronic Sub assemblies, Power supplies, etc.

CAPACITANCE
Measurements shall be made at 1000 cycles per second for capacitance values thru 1. MFD and at 60 cycles per second for values over 1. MFD.

CAPACITANCE TOLERANCE
Standard capacitance tolerance is ±20% (M). Closer tolerances available upon request.

DISSIPATION FACTOR
The dissipation factor shall not exceed 1% when measured at 25°C. Measurements shall be made at 1000 Hz for capacitance values thru 1. MF and at 60 Hz for higher values.

TEST VOLTAGE
Capacitors shall withstand 200% of rated DC voltage for one minute at 25°, with the charging and discharge current limited to a maximum of 1. Ampere.

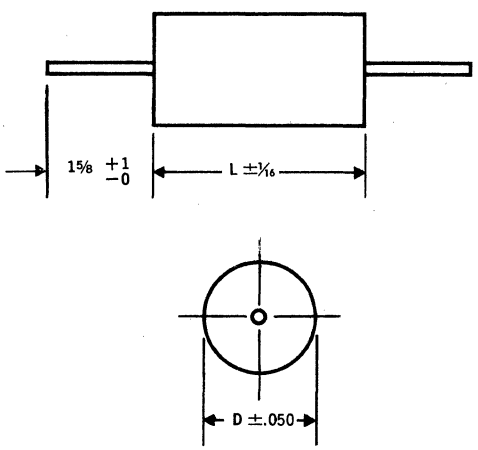
OPERATING TEMPERATURES
−55°C to +125°C.

LIFE TEST
Capacitors shall withstand a life test of 250 hours at 125°C, with 140% of the 125°C rated DC voltage applied. A resistance of one ohm per volt of applied voltage shall be inserted in series with the capacitor.

VOLTAGE DERATING
These capacitors will operate as full DC voltage ratings at 85°C. For operation at temperatures above 85°C, see Figure 4.

VIBRATION
Capacitors shall withstand a vibration test per Method 204, Test condition B of MIL-STD-202B as modified by MIL-C-27287. After test, the I.R. will be equal to or greater than ⅓ of the initial requirement.

HUMIDITY TEST
These capacitors shall meet the humidity test requirements of MIL-STD-202 Method 103B, test condition B. After testing the I.R. will be equal to or greater than ⅓ of the initial requirement.



Lead Sizes
.160 dia. — .250 = .020
.251 dia. — .500 = .025
.501 dia. & over = .032

Capacitance	Diameter	Length	Cat. No.
600 VOLTS DC WORKING			
.010	.20	.53	188F103M
.012	.18	.65	188F123M
.015	.20	.65	188F153M
.018	.22	.65	188F183M
.022	.23	.65	188F223M
.027	.25	.65	188F273M
.033	.28	.65	188F333M
.039	.26	.78	188F393M
.047	.28	.78	188F473M
.056	.30	.78	188F563M
.068	.32	.78	188F683M
.082	.35	.78	188F823M
.10	.33	.97	188F104M
.12	.35	.97	188F124M
.15	.39	.97	188F154M
.18	.44	.97	188F184M
.22	.42	1.17	188F224M
.27	.45	1.17	188F274M
.33	.50	1.17	188F334M
.39	.55	1.17	188F394M
.47	.54	1.45	188F474M
.56	.58	1.45	188F564M
.68	.63	1.45	188F684M
.82	.63	1.68	188F824M
1.0	.69	1.68	188F105M
1.2	.75	1.68	188F125M
1.5	.84	1.68	188F155M
2.0	.83	2.25	188F205M
2.5	.92	2.25	188F255M
3.0	1.00	2.25	188F305M

Capacitance	Diameter	Length	Cat. No.
100 VOLTS DC WORKING			
.010	.16	.40	188B103M
.012	.16	.40	188B123M
.015	.16	.40	188B153M
.018	.16	.40	188B183M
.022	.16	.40	188B223M
.027	.16	.40	188B273M
.033	.16	.40	188B333M
.039	.18	.40	188B393M
.047	.20	.40	188B473M
.056	.16	.53	188B563M
.068	.16	.53	188B683M
.082	.17	.53	188B823M
.10	.19	.53	188B104M
.12	.20	.53	188B124M
.15	.19	.65	188B154M
.18	.21	.65	188B184M
.22	.23	.65	188B224M
.27	.25	.65	188B274M
.33	.27	.65	188B334M
.39	.29	.65	188B394M
.47	.26	.78	188B474M
.56	.28	.78	188B564M
.68	.30	.78	188B684M
.82	.33	.78	188B824M
1.0	.36	.78	188B105M
1.2	.34	.97	188B125M
1.5	.37	.97	188B155M
2.0	.42	.97	188B205M
2.5	.42	1.17	188B255M
3.0	.45	1.17	188B305M
3.5	.49	1.17	188B355M
4.0	.52	1.17	188B405M
4.5	.49	1.45	188B455M
5.0	.52	1.45	188B505M
200 VOLTS DC WORKING			
.010	.16	.40	188C103M
.012	.17	.40	188B123M
.015	.19	.40	188C153M
.018	.21	.40	188C183M
.022	.16	.53	188C223M
.027	.17	.53	188C273M
.033	.19	.53	188C333M
.039	.20	.53	188C393M
.047	.18	.65	188C473M
.056	.20	.65	188C563M
.068	.21	.65	188C683M
.082	.23	.65	188C823M
.10	.25	.65	188C104M
.12	.27	.65	188C124M
.15	.30	.65	188C154M
.18	.27	.78	188C184M
.22	.30	.78	188C224M
.27	.32	.78	188C274M
.33	.35	.78	188C334M
.39	.33	.97	188C394M
.47	.35	.97	188C474M
.56	.38	.97	188C564M
.68	.42	.97	188C684M
.82	.46	.97	188C824M
1.0	.45	1.17	188C105M
1.2	.49	1.17	188C125M
1.5	.54	1.17	188C155M
2.0	.56	1.45	188C205M
2.5	.61	1.45	188C255M
3.0	.67	1.45	188C305M
3.5	.65	1.68	188C355M
4.0	.69	1.68	188C405M
4.5	.73	1.68	188C455M
5.0	.77	1.68	188C505M
400 VOLTS DC WORKING			
.010	.20	.40	188E103M
.012	.16	.53	188E123M
.015	.17	.53	188E153M
.018	.19	.53	188E183M
.022	.20	.53	188E223M
.027	.18	.65	188E273M
.033	.20	.65	188E333M
.039	.21	.65	188E393M
.047	.23	.65	188E473M
.056	.25	.65	188E563M
.068	.27	.65	188E683M
.082	.25	.78	188E823M
.10	.27	.78	188E104M
.12	.29	.78	188E124M
.15	.32	.78	188E154M
.18	.35	.78	188E184M
.22	.33	.97	188E224M
.27	.36	.97	188E274M
.33	.39	.97	188E334M
.39	.42	.97	188E394M
.47	.46	.97	188E474M
.56	.44	1.17	188E564M
.68	.48	1.17	188E684M
.82	.54	1.17	188E824M
1.0	.53	1.45	188E105M
1.2	.57	1.45	188E125M
1.5	.63	1.45	188E155M
2.0	.65	1.68	188E205M
2.5	.73	1.68	188E255M
3.0	.79	1.68	188E305M
3.5	.85	1.68	188E355M
4.0	.78	2.25	188E405M
4.5	.83	2.25	188E455M
5.0	.87	2.25	188E505M

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE 189 POLYESTER CAPACITORS

METALLIZED POLYESTER CAPACITORS TYPE 189 FILM WRAP / EPOXY END FILL −55°C TO +125°C

Type 189 Capacitors features extremely small size, light weight and self clearing metallized construction which virtually eliminates catastrophic failures. Well suited for Voltage Multiplier Circuits in TV power supplies and Electrostatic copiers. Also ideal for Potting or encapsulating in Electronic Sub assemblies, Power supplies, etc.

CAPACITANCE
Measurements shall be made at 1000 cycles per second for capacitance values thru 1. MFD and at 60 cycles per second for values over 1. MFD.

CAPACITANCE TOLERANCE
Standard capacitance tolerance is ±20% (M). Closer tolerances available upon request.

DISSIPATION FACTOR
The dissipation factor shall not exceed 1% when measured at 25°C. Measurements shall be made at 1000 Hz for capacitance values thru 1. MF and at 60 Hz for higher values.

TEST VOLTAGE
Capacitors shall withstand 200% of rated DC voltage for one minute at 25°, with the charging and discharge current limited to a maximum of 1. Ampere.

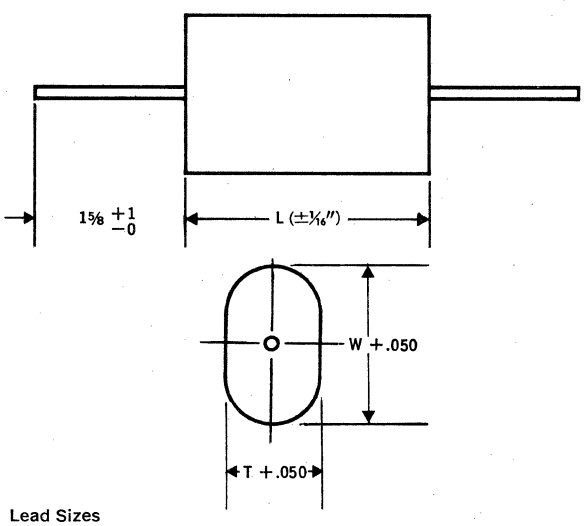
OPERATING TEMPERATURES
−55°C to +125°C.

LIFE TEST
Capacitors shall withstand a life test of 250 hours at 125°C, with 140% of the 125°C rated DC voltage applied. A resistance of one ohm per volt of applied voltage shall be inserted in series with the capacitor.

VOLTAGE DERATING
These capacitors will operate as full DC voltage ratings at 85°C. For operation at temperatures above 85°C, see Figure 4.

VIBRATION
Capacitors shall withstand a vibration test per Method 204, Test condition B of MIL-STD-202B as modified by MIL-C-27287.

HUMIDITY TEST
These capacitors shall meet the humidity test requirements of MIL-STD-202 Method 103B, test condition B. After testing the I.R. will be equal to or greater than ⅓ of the initial requirement.



Lead Sizes

Nom. Body Length	Lead Dia.
Thru .530	.020
.650 thru .970	.025
Above .970	.032

Capacitance	Thickness	Width	Length	Cat. No.
600 VOLTS DC WORKING				
.010	.12	.25	.53	189F103M
.012	.13	.26	.53	189F123M
.015	.15	.28	.53	189F153M
.018	.17	.30	.53	189F183M
.022	.19	.32	.53	189F223M
.027	.21	.34	.53	189F273M
.033	.24	.37	.53	189F333M
.039	.21	.34	.65	189F393M
.047	.24	.37	.65	189F473M
.056	.22	.35	.78	189F563M
.068	.25	.38	.78	189F683M
.082	.27	.40	.78	189F823M
.10	.30	.43	.78	189F104M
.12	.32	.48	.78	189F124M
.15	.36	.52	.78	189F154M
.18	.33	.49	.97	189F184M
.22	.37	.53	.97	189F224M
.27	.36	.52	1.17	189F274M
.33	.40	.56	1.17	189F334M
.39	.44	.60	1.17	189F394M
.47	.49	.65	1.17	189F474M
.56	.41	.57	1.68	189F564M
.68	.45	.61	1.68	189F684M
.82	.51	.67	1.68	189F824M
1.0	.58	.74	1.68	189F105M
1.2	.64	.80	1.68	189F125M
1.5	.73	.89	1.68	189F155M
2.0	.69	.89	2.25	189F205M
2.5	.80	1.00	2.25	189F225M
3.0	.87	1.07	2.25	189F305M

INTERMEDIATE VALUES AVAILABLE.

Capacitance	Thickness	Width	Length	Cat. No.
100 VOLTS DC WORKING				
.010	.10	.20	.40	189B103M
.012	.10	.20	.40	189B123M
.015	.10	.20	.40	189B153M
.018	.10	.20	.40	189B183M
.022	.10	.20	.40	189B223M
.027	.10	.20	.40	189B273M
.033	.10	.20	.40	189B333M
.039	.10	.20	.40	189B393M
.047	.10	.22	.40	189B473M
.056	.11	.24	.40	189B563M
.068	.10	.20	.53	189B683M
.082	.10	.20	.53	189B823M
.10	.10	.20	.53	189B104M
.12	.10	.23	.53	189B124M
.15	.12	.25	.53	189B154M
.18	.14	.27	.53	189B184M
.22	.17	.30	.53	189B224M
.27	.19	.32	.53	189B274M
.33	.21	.34	.53	189B334M
.39	.24	.37	.53	189B394M
.47	.21	.34	.65	189B474M
.56	.23	.36	.65	189B564M
.68	.27	.40	.65	189B684M
.82	.24	.37	.78	189B824M
1.0	.26	.42	.78	189B105M
1.2	.29	.45	.78	189B125M
1.5	.33	.49	.78	189B155M
2.0	.32	.48	.97	189B205M
2.5	.36	.52	.97	189B255M
3.0	.35	.51	1.17	189B305M
3.5	.38	.54	1.17	189B355M
4.0	.41	.57	1.17	189B405M
4.5	.44	.60	1.17	189B455M
5.0	.47	.63	1.17	189B505M
6.0	.52	.68	1.17	189B605M
8.0	.46	.62	1.68	189B805M
10.0	.53	.69	1.68	189B106M
200 VOLTS DC WORKING				
.010	.10	.20	.40	189C103M
.012	.10	.20	.40	189C123M
.015	.10	.20	.40	189C153M
.018	.13	.23	.40	189C183M
.022	.13	.26	.40	189C223M
.027	.10	.20	.53	189C273M
.033	.12	.22	.53	189C333M
.039	.12	.25	.53	189C393M
.047	.13	.26	.53	189C473M
.056	.14	.27	.53	189C563M
.068	.16	.29	.53	189C683M
.082	.18	.31	.53	189C823M
.10	.20	.33	.53	189C104M
.12	.22	.35	.53	189C124M
.15	.26	.39	.53	189C154M
.18	.24	.37	.65	189C184M
.22	.26	.39	.65	189C224M
.27	.24	.37	.78	189C274M
.33	.27	.40	.78	189C334M
.39	.30	.43	.78	189C394M
.47	.33	.46	.78	189C474M
.56	.37	.50	.78	189C564M
.68	.32	.48	.97	189C684M
.82	.35	.51	.97	189C824M
1.0	.35	.51	1.17	189C105M
1.2	.38	.54	1.17	189C125M
1.5	.43	.59	1.17	189C155M
2.0	.52	.68	1.17	189C205M
2.5	.46	.62	1.68	189C255M
3.0	.49	.65	1.68	189C305M
3.5	.54	.70	1.68	189C355M
4.0	.58	.74	1.68	189C405M
4.5	.62	.78	1.68	189C455M
5.0	.64	.84	1.68	189C505M
6.0	.70	.90	1.68	189C605M
8.0	.84	1.04	1.68	189C805M
10.0	.75	.95	2.25	189C106M
400 VOLTS DC WORKING				
.010	.14	.24	.40	189E103M
.012	.10	.23	.53	189E123M
.015	.11	.21	.53	189E153M
.018	.12	.22	.53	189E183M
.022	.12	.25	.53	189E223M
.027	.13	.26	.53	189E273M
.033	.15	.28	.53	189E333M
.039	.17	.30	.53	189E393M
.047	.19	.32	.53	189E473M
.056	.21	.34	.53	189E563M
.068	.23	.36	.53	189E683M
.082	.26	.39	.53	189E823M
.10	.23	.36	.65	189E104M
.12	.25	.38	.65	189E124M
.15	.24	.37	.78	189E154M
.18	.26	.39	.78	189E184M
.22	.30	.43	.78	189E224M
.27	.33	.46	.78	189E274M
.33	.36	.52	.78	189E334M
.39	.33	.49	.97	189E394M
.47	.37	.53	.97	189E474M
.56	.34	.50	1.17	189E564M
.68	.38	.54	1.17	189E684M
.82	.43	.59	1.17	189E824M
1.0	.48	.64	1.17	189E105M
1.2	.54	.70	1.17	189E125M
1.5	.46	.62	1.68	189E155M
2.0	.54	.70	1.68	189E205M
2.5	.60	.80	1.68	189E255M
3.0	.67	.87	1.68	189E305M
3.5	.73	.93	1.68	189E355M
4.0	.78	.98	1.68	189E405M
4.5	.69	.89	2.25	189E455M
5.0	.75	.95	2.25	189E505M

Nytronics Components Group, Inc.
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(803) 393-5421 — TWX 810-665-2182

TYPE 231 POLYSTYRENE FILM CAPACITORS

POLYSTYRENE FILM CAPACITORS HERMETICALLY SEALED TYPE 231 —65°C to +85°C

ELECTRICAL AND ENVIRONMENTAL CHARACTERISTICS

1. CAPACITANCE MEASUREMENTS

Capacitors of 1.0 μF or less shall be measured at a frequency of 1000 Hz. Capacitors greater than 1.0 μF measured at 60 Hz.
Tolerances of ±20%, ±10%, ±5%, ±2%, ±1% are standard. Tolerances closer than ±1% are available upon request.
Reference: MIL-STD-202, Method 305.

2. TEMPERATURE/CHARACTERISTICS AND STABILITY

When measured over the full operating range, the Temperature Coefficient shall be −120 ppm/°C ±30 ppm/°C.
There shall be less than 0.1% change per year in capacitance when operated between +20°C and +50°C. When cycled from −55°C to +75°C, the capacitance shall not vary more than 0.2% from its initial measurement.

3. DISSIPATION FACTOR

When measured as specified in Paragraph 1, the dissipation factor at +25°C shall not exceed 0.1%.

4. INSULATION RESISTANCE

When measured at +25°C, and rated voltage (or 500 VDC, whichever is less), the insulation resistance shall be a minimum of 200,000 megohm-microfarads, but need not exceed 500,000 megohms. The period of electrification shall not exceed two minutes.
Reference: MIL-STD-202, Method 302.

5. VOLTAGE DERATING

The capacitors may be operated at full rated voltage from −55°C to +85°C.

6. VOLTAGE TEST

When tested at +25°C, the capacitors shall withstand the indicated DC test voltages for a period of one minute:
Terminal to terminal 200% of DC rating
Terminal to case 200% of DC rating
Reference: MIL-STD-202, Method 301.

7. LIFE TESTING

When tested at 85°C for 250 hours at 140% of the rated voltage, the capacitors shall exhibit no more than one failure in twelve pieces tested. A failure is defined as:
a) A capacitance change of more than 6% of its initial value;
b) A dissipation factor greater than that specified in Paragraph 3;
c) An insulation resistance less than 60% that specified in Paragraph 4; or
d) A permanent open or short.

8. VIBRATION

The capacitors will meet or exceed the vibration requirements of MIL-STD-202, METHOD 201.

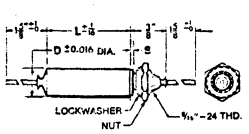
NYTRONICS CATALOG NUMBERING SYSTEM

231 A 3 E 104 M 2

- 231 — NYTRONICS TYPE: 231 Polystyrene
- A — TERMINALS: Wire Leads; No. 22 AWG. (.025) for case Dia. .312 and under; No. 20 AWG. (.032) for case Dia. over .312
- 3 — CIRCUIT: Circuit 1, Circuit 3
- E — DC RATED VOLTAGE: B = 100, C = 200, E = 400, F = 600
- 104 — CAPACITANCE: In uuf. The first two digits are the significant figures, the third is the number of zeroes.
- M — CAPACITANCE TOLERANCE: M = ±20%, K = ±10%, J = ±5%, G = ±2%, F = ±1%
- 2 — STYLE

CONFIGURATIONS

Circuit 1

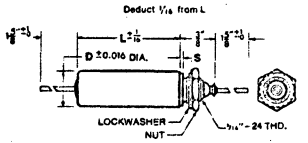


STYLE 3

D	S
.400	.020
.562 and up	.031

Minimum D=.400"

Circuit 3



STANDARD RATINGS

Nytronics Part No.	Capacitance μf	Dia. ±.016	Length ±1/16
100 VOLTS DC WORKING			
231A1B822K	.0082	.235	15/16
231A1B103K	.01	.235	15/16
231A1B123K	.012	.235	15/16
231A1B153K	.015	.235	15/16
231A1B183K	.018	.312	15/16
231A1B223K	.022	.312	15/16
231A1B273K	.027	.312	15/16
231A1B333K	.033	.312	15/16
231A1B393K	.039	.312	15/16
231A1B473K	.047	.400	15/16
231A1B563K	.056	.400	15/16
231A1B683K	.068	.400	15/16
231A1B823K	.082	.562	15/16
231A1B104K	.10	.562	15/16
231A1B124K	.12	.562	15/16
231A1B154K	.15	.562	15/16
231A1B184K	.18	.562	1 5/16
231A1B224K	.22	.562	1 5/16
231A1B274K	.27	.670	1 5/16
231A1B334K	.33	.670	1 5/16
231A1B394K	.39	.670	1 1/16
231A1B474K	.47	.670	1 1/16
231A1B564K	.56	.670	1 1/16
231A1B684K	.68	.750	1 1/16
231A1B824K	.82	1.000	1 1/16
231A1B105K	1.0	1.000	1 1/16
231A1B125K	1.2	1.000	1 1/16
200 VOLTS DC WORKING			
231A1C472K	.0047	.235	15/16
231A1C562K	.0056	.235	15/16
231A1C682K	.0068	.235	15/16
231A1C822K	.0082	.312	15/16
231A1C103K	.01	.312	15/16
231A1C123K	.012	.312	15/16
231A1C153K	.015	.312	15/16
231A1C183K	.018	.312	15/16
231A1C223K	.022	.400	15/16
231A1C273K	.027	.400	15/16
231A1C333K	.033	.400	15/16
231A1C393K	.039	.400	15/16
231A1C473K	.047	.562	15/16
231A1C563K	.056	.562	15/16
231A1C683K	.068	.562	15/16
231A1C823K	.082	.562	15/16
231A1C104K	.10	.562	1 5/16
231A1C124K	.12	.562	1 5/16
231A1C154K	.15	.670	1 5/16
231A1C184K	.18	.670	1 5/16
231A1C224K	.22	.670	1 1/16
231A1C274K	.27	.670	1 1/16
231A1C334K	.33	.750	1 1/16
231A1C394K	.39	1.000	1 1/16
231A1C474K	.47	1.000	1 1/16
231A1C564K	.56	1.000	1 1/16
400 VOLTS DC WORKING			
231A1E222K	.0022	.235	15/16
231A1E272K	.0027	.235	15/16
231A1E332K	.0033	.235	15/16
231A1E392K	.0039	.235	15/16
231A1E472K	.0047	.312	15/16
231A1E562K	.0056	.312	15/16
231A1E682K	.0068	.312	15/16
231A1E822K	.0082	.312	15/16
231A1E103K	.01	.312	15/16
231A1E123K	.012	.312	15/16
231A1E153K	.015	.400	15/16
231A1E183K	.018	.400	15/16
231A1E223K	.022	.400	15/16
231A1E273K	.027	.562	15/16
231A1E333K	.033	.562	15/16
231A1E393K	.039	.562	15/16
231A1E473K	.047	.562	15/16
231A1E563K	.056	.562	15/16
231A1E683K	.068	.562	1 5/16
231A1E823K	.082	.670	1 5/16
231A1E104K	.10	.670	1 5/16
231A1E124K	.12	.562	1 1/16
231A1E154K	.15	.670	1 1/16
231A1E184K	.18	.670	1 1/16
231A1E224K	.22	.750	1 1/16
231A1E274K	.27	.750	1 1/16
231A1E334K	.33	1.000	1 1/16
231A1E394K	.39	1.000	1 1/16
231A1E474K	.47	1.000	1 1/16
600 VOLTS DC WORKING			
231A1F102K	.001	.235	15/16
231A1F122K	.0012	.235	15/16
231A1F152K	.0015	.235	15/16
231A1F182K	.0018	.235	15/16
231A1F222K	.0022	.312	15/16
231A1F272K	.0027	.312	15/16
231A1F332K	.0033	.312	15/16
231A1F392K	.0039	.312	15/16
231A1F472K	.0047	.312	15/16
231A1F562K	.0056	.312	15/16
231A1F682K	.0068	.312	15/16
231A1F822K	.0082	.312	15/16
231A1F103K	.01	.400	15/16
231A1F123K	.012	.400	15/16
231A1F153K	.015	.562	15/16
231A1F183K	.018	.562	15/16
231A1F223K	.022	.562	15/16
231A1F273K	.027	.562	15/16
231A1F333K	.033	.562	1 5/16
231A1F393K	.039	.562	1 5/16
231A1F473K	.047	.670	1 5/16
231A1F563K	.056	.670	1 5/16
231A1F683K	.068	.562	1 1/16
231A1F823K	.082	.670	1 1/16
231A1F104K	.10	.670	1 1/16
231A1F124K	.12	.750	1 1/16
231A1F154K	.15	1.000	1 1/16
231A1F184K	.18	1.000	1 1/16
231A1F224K	.22	1.000	1 1/16

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

MIL TYPE CP04 - CP08
MIL-C-25
HERMETICALLY SEALED CAPACITORS

HERMETICALLY SEALED CAPACITORS CP04 THRU CP09 TO MIL-C-25

μF	WVDC	CP04A1 — (Uninsulated) Char. K −55°C to +125°C	CP05A1 (Insulated) Size* D. x L.
.001	600	CP04A1KF102K3	.235 x ¾
.0015	600	CP04A1KF152K3	.235 x ¾
.0022	600	CP04A1KF222K3	.235 x ¾
.0033	600	CP04A1KF332K3	.235 x ¾
.0047	600	CP04A1KF472K3	.235 x ¾
.0068	600	CP04A1KF682K3	.235 x ¾
.01	400	CP04A1KE103K3	.235 x ¾
	600	CP04A1KF103K3	.312 x ⅞
.015	200	CP04A1KC153K3	.235 x ¾
	600	CP04A1KF153K3	.312 x ⅞
.022	200	CP04A1KF223K3	.235 x ¾
	600	CP04A1KF223K3	.312 x ⅞
.033	100	CP04A1KB333K3	.235 x ¾
	400	CP04A1KE333K3	.312 x ⅞
	600	CP04A1KF333K3	.400 x ⅞
.047	200	CP04A1KC473K3	.312 x ⅞
	400	CP04A1KE473K3	.400 x ⅞
	600	CP04A1KF473K3	.400 x 1⅛
.068	200	CP04A1KC683K3	.312 x ⅞
	400	CP04A1KE683K3	.400 x 1⅛
	600	CP04A1KF683K3	.400 x 1⅜
.1	100	CP04A1KB104K3	.312 x ⅞
	200	CP04A1KC104K3	.400 x ⅞
	400	CP04A1KE104K3	.400 x 1⅜
	600	CP04A1KF104K3	.562 x 1⅛
.15	100	CP04A1KB154K3	.400 x ⅞
	200	CP04A1KC154K3	.400 x 1⅛
	400	CP04A1KE154K3	.562 x 1⅛
	600	CP04A1KF154K3	.562 x 1⅜
.22	100	CP04A1KB224K3	.400 x 1⅜
	200	CP04A1KC224K3	.400 x 1⅜
	400	CP04A1KE224K3	.562 x 1⅜
	600	CP04A1KF224K3	.562 x 1⅞
.33	100	CP04A1KB334K3	.400 x 1⅜
	200	CP04A1KC334K3	.562 x 1⅛
	400	CP04A1KE334K3	.562 x 1⅞
	600	CP04A1KF334K3	.670 x 1⅞
.47	100	CP04A1KB474K3	.562 x 1⅛
	200	CP04A1KC474K3	.562 x 1⅜
	400	CP04A1KE474K3	.670 x 1⅞
	600	CP04A1KF474K3	.750 x 2⅛
.68	100	CP04A1KB684K3	.562 x 1⅜
	200	CP04A1KC684K3	.562 x 1⅞
	400	CP04A1KE684K3	.750 x 2⅛
	600	CP04A1KF684K3	1.0 x 1⅞
1.0	100	CP04A1KB105K3	.562 x 1⅞
	200	CP04A1KC105K3	.670 x 1⅞
	400	CP04A1KE105K3	1.0 x 1⅞

μF	WVDC	CP08A1 — (Uninsulated) Char. K −55°C to +125°C	CP09A1 (Insulated) Size* D. x L.
.001	600	CP08A1KF102K3	.235 x ¾
.0015	600	CP08A1KF152K3	.235 x ¾
.0022	600	CP08A1KF222K3	.235 x ¾
.0033	400	CP08A1KE332K3	.235 x ¾
	600	CP08A1KF332K3	.312 x ⅞
.0047	200	CP08A1KC472K3	.235 x ¾
	600	CP08A1KF472K3	.312 x ⅞
.0068	200	CP08A1KC682K3	.235 x ¾
	600	CP08A1KF682K3	.312 x ⅞
.01	100	CP08A1KB103K3	.235 x ¾
	600	CP08A1KF103K3	.312 x ⅞
.015	100	CP08A1KB153K3	.235 x ¾
	400	CP08A1KE153K3	.312 x ⅞
	600	CP08A1KF153K3	.400 x ⅞
.022	200	CP08A1KC223K3	.312 x ⅞
	600	CP08A1KF223K3	.400 x ⅞
.033	200	CP08A1KC333K3	.312 x ⅞
	400	CP08A1KE333K3	.400 x ⅞
	600	CP08A1KF333K3	.400 x 1⅛
.047	100	CP08A1KB473K3	.312 x ⅞
	200	CP08A1KC473K3	.400 x ⅞
	400	CP08A1KE473K3	.400 x 1⅛
	600	CP08A1KF473K3	.400 x 1⅜
.068	200	CP08A1KC683K3	.400 x ⅞
	400	CP08A1KE683K3	.400 x 1⅜
	600	CP08A1KF683K3	.562 x 1⅛
.1	100	CP08A7KB104K3	.400 x ⅞
	200	CP08A1KC104K3	.400 x 1⅛
	400	CP08A1KE104K3	.562 x 1⅛
	600	CP08A1KF104K3	.562 x 1⅜
.15	100	CP08A1KB154K3	.400 x 1⅛
	200	CP08A1KC154K3	.400 x 1⅜
	400	CP08A1KE154K3	.562 x 1⅜
	600	CP08A1KF154K3	.562 x 1⅝
.22	100	CP08A1KB224K3	.400 x 1⅜
	200	CP08A1KC224K3	.562 x 1⅛
	400	CP08A1KE224K3	.562 x 1⅝
	600	CP08A1KF224K3	.670 x 1⅝
.33	100	CP08A1KB334K3	.562 x 1⅛
	200	CP08A1KC334K3	.562 x 1⅜
	400	CP08A1KE334K3	.670 x 1⅝
	600	CP08A1KF334K3	.750 x 2⅛
.47	100	CP08A1KB474K3	.562 x 1⅜
	200	CP08A1KC474K3	.562 x 1⅝
	400	CP08A1KE474K3	.750 x 2⅛
	600	CP08A1KF474K3	.750 x 2⅜
.68	100	CP08A1KB684K3	.562 x 1⅝
	200	CP08A1KC684K3	.670 x 1⅝
1.0	100	CP08A1KB105K3	.670 x 1⅝
	200	CP08A1KC105K3	.750 x 2⅛

NOTE: The capacitors listed in this table have a capacitance tolerance of ±10%.
* For case grounded reduce L dimension by 1/16". Above listing are ratings listed in Mil-C-25C. Other values are available in Nytronics Commercial Equivalents.
** For CP05 and CP09 add .0625 to Diameter and 1/16" to Length.

NYTRONICS CATALOG NUMBERING SYSTEM

CP — MILITARY TYPE CAPACITORS Fixed, Paper dielectric, Direct current, Hermetically sealed in metallic cases

04 — SUBMINIATURE CAPACITORS: CP05 CP09 CP10 CP12 CP11 CP13

A — TERMINALS: A = axial leads

1 — CIRCUIT: 1 = 3 =

K — CHARACTERISTIC: K = −55°C to +125°C

B — DC VOLTAGE RATING

273 — CAPACITANCE: In uuf. The first two digits are the significant figures, the third is the number of zeros.

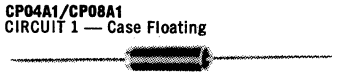
K — CAPACITANCE TOLERANCE: K = ±10%

1 — VIBRATION GRADE: 1 = 10 to 55 cps; 3 = 10 to 2000 cps

RATED VOLTAGE DESIGNATIONS
(DC working at 40°C, except for characteristic K which is 85°C)
B = 100 C = 200 E = 400 F = 600 G = 1000

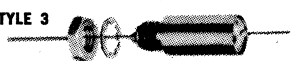
BASIC STYLE

CP04A1/CP08A1
CIRCUIT 1 — Case Floating

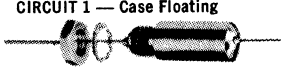


CP04A3/CP08A3
CIRCUIT 3 — Case Grounded

STYLE 3



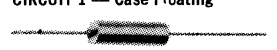
CP11A1/CP13A1
CIRCUIT 1 — Case Floating



CP11A3/CP13A3
CIRCUIT 3 — Case Grounded

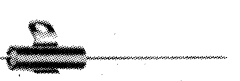
STYLE V (Insulated)

CP05A1/CP09A1
CIRCUIT 1 — Case Floating



CP05A3/CP09A3
CIRCUIT 3 — Case Grounded

STYLE 7



CP10A1/CP12A1
CIRCUIT 1 — Case Floating

CP10A3/CP12A3
CIRCUIT 3 — Case Grounded

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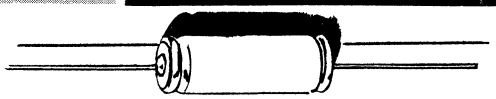
MIL TYPE CP25 - CP29 MIL-C-25 CAPACITORS

MIL-C-25 (LATEST REVISION) CP25 TO CP29

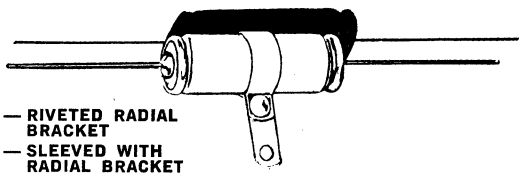
Available in capacitances from .003 thru 0.1 mf and voltages of 1500 VDC.

Type Designation[1]	Rated Voltage	Capacitance μf
CP2-A-EC104-	200	.1
CP2-A-EC254-	200	.25
CP2-A-EC504-	200	.5
CP2-A-EF302-	600	.003
CP2-A-EF602-	600	.006
CP2-A-EF103-	600	.01
CP2-A-EF203-	600	.02
CP2-A-EF503-	600	.05
CP2-A-EF104-	600	.1
CP2-A-EF254-	600	.25
CP2-A-EF504-	600	.5
CP2-A-EG302-	1,000	.003
CP2-A-EG602-	1,000	.006
CP2-A-EG103-	1,000	.01
CP2-A-EG203-	1,000	.02
CP2-A-EG503-	1,000	.05
CP2-A-EG104-	1,000	.1
CP2-A-EG254-	1,000	.25
CP2-A-EH302-	1,500	.003
CP2-A-EH602-	1,500	.006
CP2-A-EH103-	1,500	.01
CP2-A-EH203-	1,500	.02
CP2-A-EH503-	1,500	.05
CP2-A-EH104-	1,500	.1

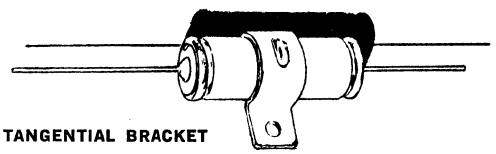
[1] Complete type designation will include additional symbols to complete style designation and to indicate circuit and capacitance tolerance.



CP25 — UNINSULATED BODY
CP26 — INSULATED BODY

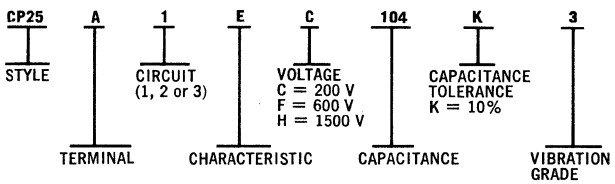


CP27 — RIVETED RADIAL BRACKET
CP28 — SLEEVED WITH RADIAL BRACKET



CP29 — TANGENTIAL BRACKET

TYPE - DESIGNATION EXAMPLE (CP25A1EC104K)

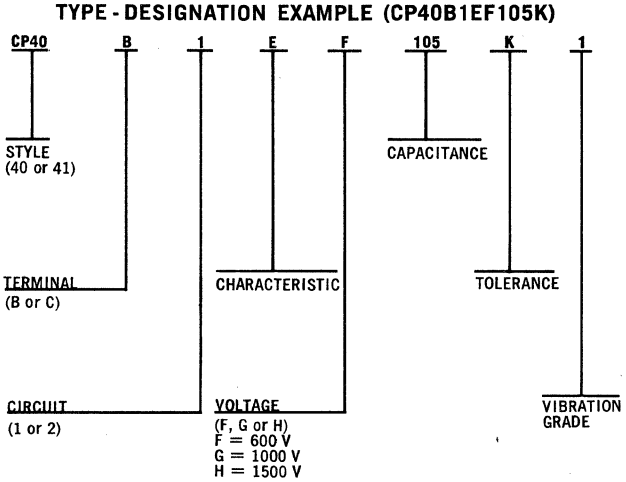


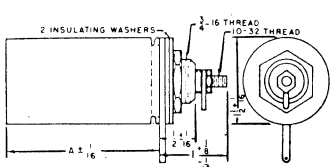
CP40, CP41 (TYPES PCM, PCIM)

Available in capacitances from .25 mf thru 4.0 mf and voltages of 600 VDC thru 1500 VDC.

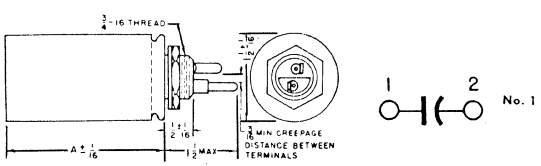
Type Designation 1/	DC Voltage Rating (see fig. 2) Volts	Capacitance μf
CP4----F105K1	600	1
CP4----F205K1	600	2
CP4----F405K1	600	4
CP4----G105K1	1,000	1
CP4----G205K1	1,000	2
CP4----H254K1	1,500 3/	0.25
CP4----H504K1	1,500	0.5
CP4----H105K1	1,500	1

TYPE - DESIGNATION EXAMPLE (CP40B1EF105K)





CIRCUIT DIAGRAM — CP40
Available with (C) or (B) Terminals



CIRCUIT DIAGRAM — CP41
Available only with (B) Terminal

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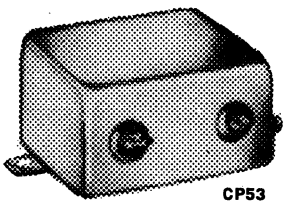
**MIL TYPE CP53 - CP55
MIL-C-25
CAPACITORS**

CAPACITORS MIL TYPE CP53, CP54, CP55

Section assembled in hermetically sealed tin-coated drawn-shell container. Mineral-oil impregnated and filled. Lug-type terminal seals. Meets requirements of MIL-C-25.

Temperature Rating: −55°C to +85°C.

Standard Tolerance: −10% to +20%.


CP53

PDM VARIATIONS

MIL Type CP53, with terminals on side.

PDMT (CP54) With terminals on top.

PDMB (CP55) With terminals on the bottom.

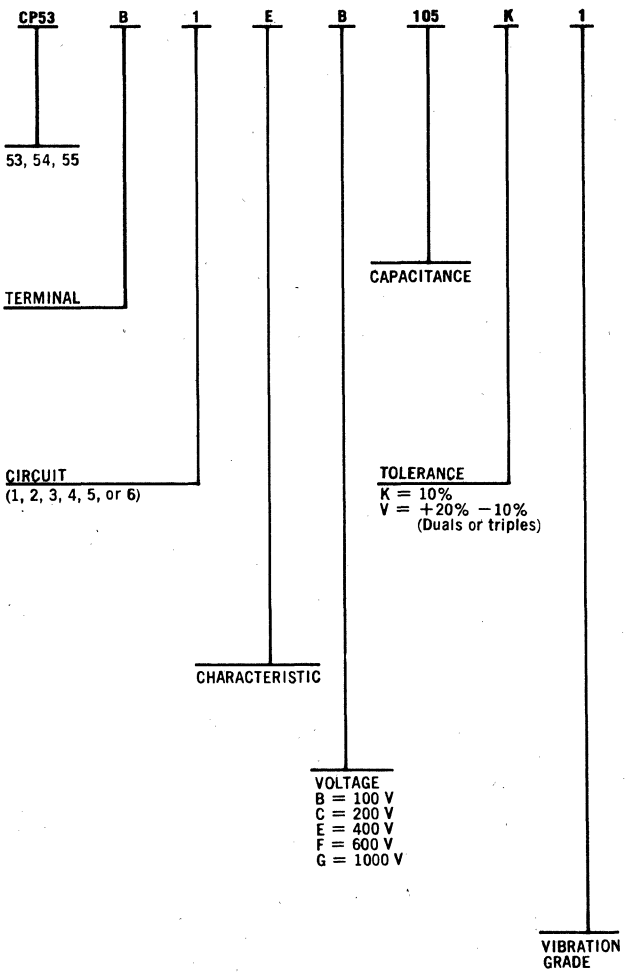
CP53 — Side Terminals

CP54 — Top Terminals

CP55 — Bottom Terminals

Type Designation	DC Voltage Rating Volts	Capacitance μf
CP5-B- - B105K1	100	1
CP5-B-EB205K1	100	2
CP5-B- - B405K1	100	4
CP5-B-FC504K1	200	0.5
CP5-B-EC105K1	200	1
CP5-B-EC205K1	200	2
CP5-B-EF254K1	600	0.25
CP5-B- - F504K1	600	0.5
CP5-B- - F105K1	600	1
CP5-B-EF205K1	600	2
CP5-B-EG503K1	1,000	0.05
CP5-B-EG104K1	1,000	0.1
CP5-B- - G254K1	1,000	0.25
CP5-B-EG504K1	1,000	0.5
CP5-B-EG105K1	1,000	1
CP5-B-EF503V1	600	0.05-0.05
CP5-B-EF104V1	600	0.1 -0.1
CP5-B- - F254V1	600	0.25-0.25
CP5-B- - F504V1	600	0.5 -0.5
CP5-B-EF105V1	600	1 -1
CP5-B-EG503V1	1,000	0.05-0.05
CP5-B- - G104V1	1,000	0.1 -0.1
CP5-B-EG254V1	1,000	0.25-0.25
CP5-B-EG504V1	1,000	0.5 -0.5
CP5-B5-E504V1	400	0.5 -0.5 -0.5
CP5-B5-F104V1	600	0.1 -0.1 -0.1
CP5-B5EF254V1	600	0.25-0.25-0.25
CP5-B5EF504V1	600	0.5 -0.5 -0.5
CP5-B5EG503V1	1,000	0.05-0.05-0.05
CP5-B5EG104V1	1,000	0.1 -0.1 -0.1
CP5-B5EG254V1	1,000	0.25-0.25-0.25

TYPE - DESIGNATION EXAMPLE (CP53B1EB105K)



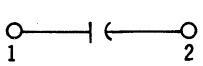
Vibration grade: 1 (10 to 55 Hz, incl.)

Terminal:

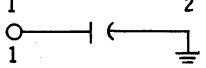
Symbol B ---------- Solder lug (nonremovable).

Circuit diagram:

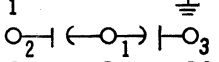
Symbol 1 ----------



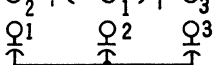
Symbol 2 ----------



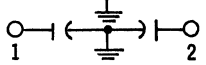
Symbol 4 ----------



Symbol 5 ----------



Symbol 6 ----------



Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
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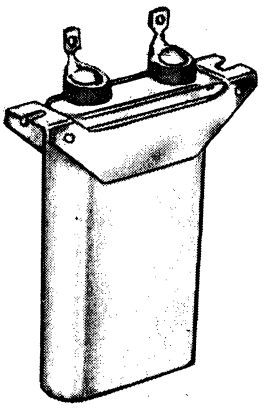
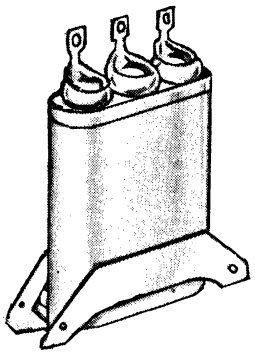
MIL TYPE CP69, CP67, CP91 MIL-C-25

CAPACITORS MIL TYPE CP67, CP69

Type Designation	DC Voltage Rating Volts	Capacitance μf
CP6-B-EF503K1	600	0.05
CP6-B-EF104K1	600	0.1
CP6-B-EF254K1	600	0.25
CP6-B-EF504K1	600	0.5
CP6-B--F105K1	600	1
CP6-B-EG103K1	1,000	0.01
CP6-B-EG203K1	1,000	0.02
CP6-B-EG503K1	1,000	0.05
CP6-B--G104K1	1,000	0.1
CP6-B-EG254K1	1,000	0.25
CP6-B--G504K1	1,000	0.5
CP6-B-EF503V1	600	0.05-0.05
CP6-B-EF104V1	600	0.1 -0.1
CP6-B-EF254V1	600	0.25-0.25
CP6-B--F504K1	600	0.5 -0.5
CP6-B-EG103V1	1,000	0.01-0.01
CP6-B-EG203V1	1,000	0.02-0.02
CP6-B--G503V1	1,000	0.05-0.05
CP6-B--G104V1	1,000	0.1 -0.1
CP6-B--G254V1	1,000	0.25-0.25
CP6-B-5-F503V1	600	0.05-0.05-0.05
CP6-B5EFP04V1	600	0.1 -0.1 -0.1
CP6-B5-F254V1	600	0.25-0.25-0.25
CP6-B5EG103V1	1,000	0.01-0.01-0.01
CP6-B5EG203V1	1,000	0.02-0.02-0.02
CP6-B5EG503V1	1,000	0.05-0.05-0.05
CP6-B5EG104V1	1,000	0.1 -0.1 -0.1



CP69

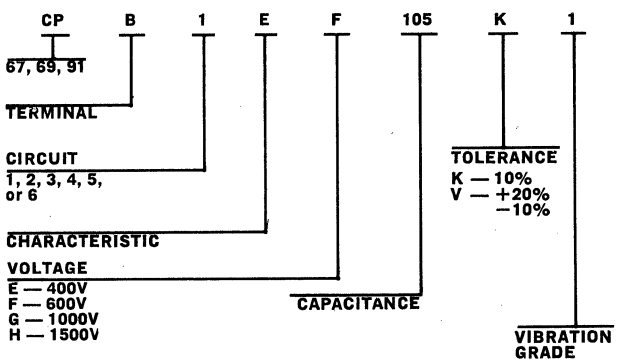


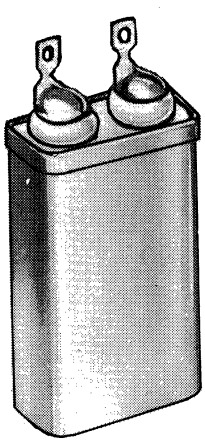
CP67

CAPACITORS MIL TYPE CP91 SERIES

Type Designation	DC Voltage Rating Volts	Capacitance μf	Capacitance Tolerance
CP91B-E105K1	400	1	K
CP91B-EF503K1	600	0.05	K
CP91B-EF254K1	600	0.25	K
CP91B-EF504K1	600	0.5	K
CP91B-F105K1	600	1	K
CP91B-EG103K1	1,000	0.01	K
CP91B-EG203K1	1,000	0.02	K
CP91B-EG503K1	1,000	0.05	K
CP91B-EG104K1	1,000	0.1	K
CP91B-EG254K1	1,000	0.25	K
CP91B-G504K1	1,000	0.5	K
CP91B6EE503V1	400	0.05-0.05	V
CP91B6EE104V1	400	0.1 -0.1	V
CP91B6EE504V1	400	0.5 -0.5	V
CP91B6EF503V1	600	0.05-0.05	V
CP91B6-F104V1	600	0.1 -01	V
CP91B6EF254V1	600	0.25-0.25	V
CP91B6-F504V1	600	0.5 -0.5	V
CP91B6EG103V1	1,000	0.01-0.01	V
CP91B6EG203V1	1,000	0.02-0.02	V
CP91B6EG503V1	1,000	0.05-0.05	V
CP91B6-G104V1	1,000	0.1 -0.1	V
CP91B6-G254V1	1,000	0.25-0.25	V
CP91B6EH103V1	1,500	0.01-0.01	V
CP91B6EH503V1	1,500	0.05-0.05	V

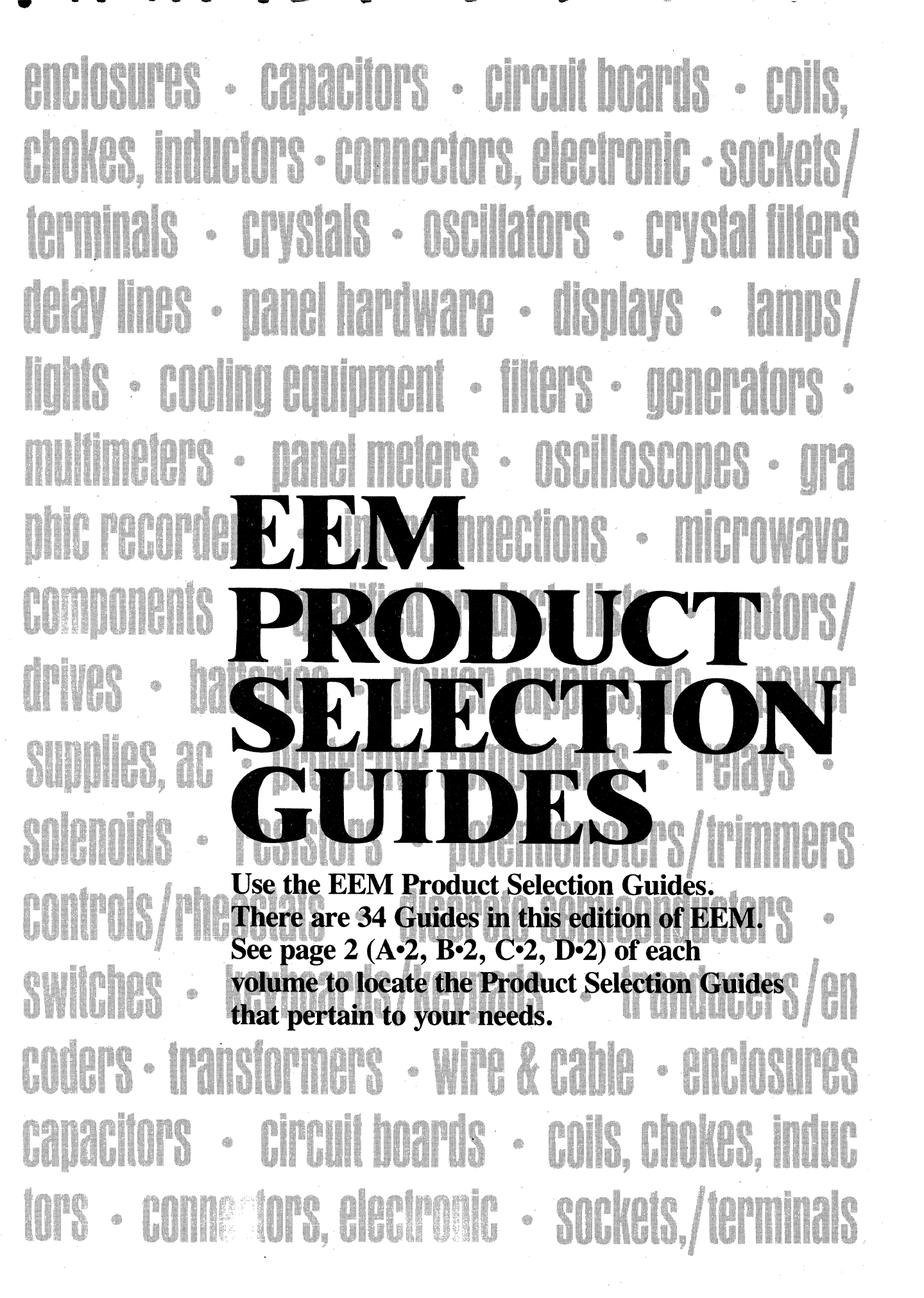
TYPE DESIGNATION EXAMPLE





CP91

NOTE: AVAILABLE WITH SPADE-LUG OR FOOTED BRACKET

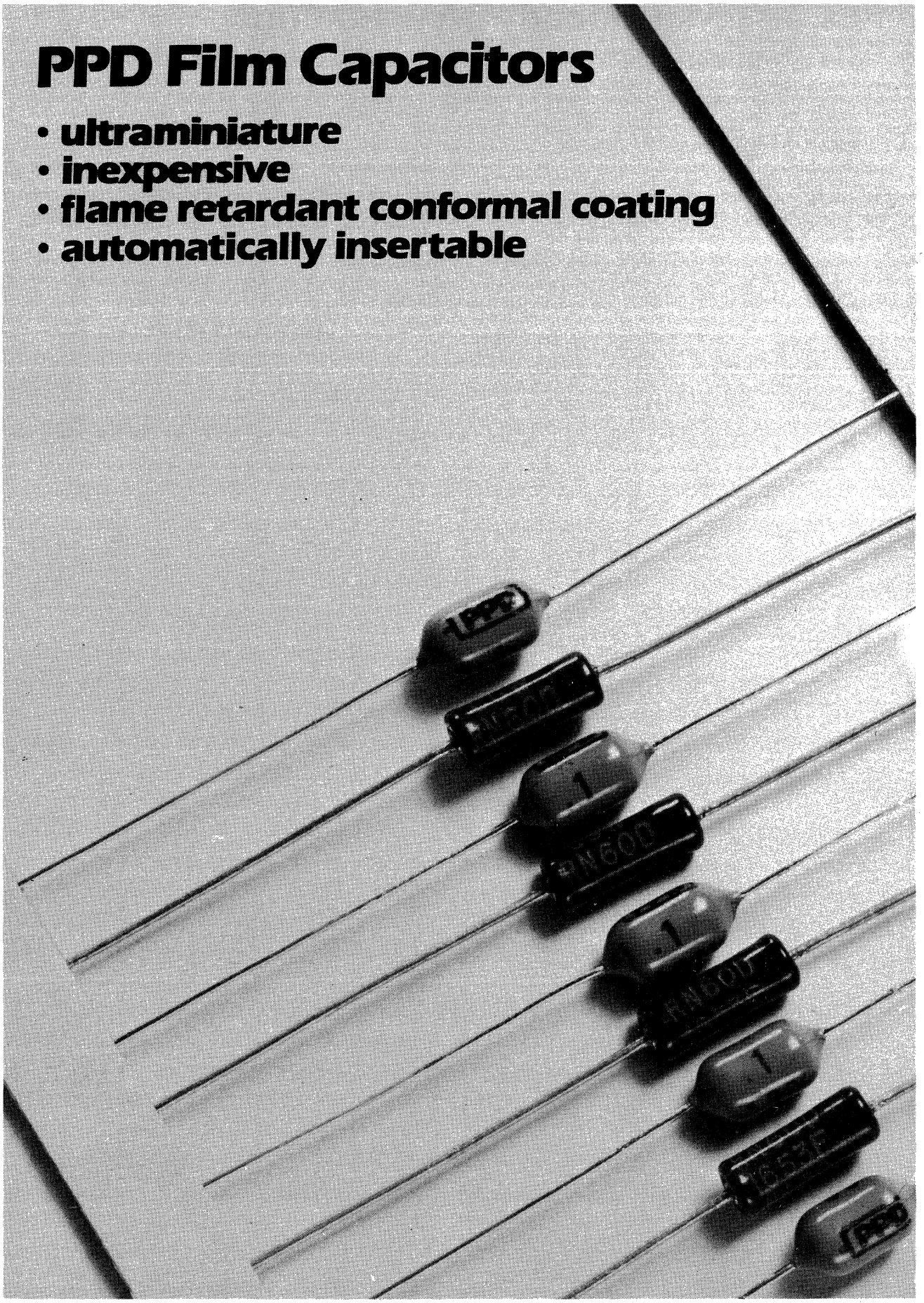


EEM PRODUCT SELECTION GUIDES

Use the EEM Product Selection Guides. There are 34 Guides in this edition of EEM. See page 2 (A•2, B•2, C•2, D•2) of each volume to locate the Product Selection Guides that pertain to your needs.

PPD Film Capacitors

- ultraminiature
- inexpensive
- flame retardant conformal coating
- automatically insertable



PEC 831 Metallized Polyester Film

General Characteristics

The PEC 831 is manufactured using a unique packaging process which allows the production of a compact body size for a given capacitance. This allows the designer to specify an automatically insertable, axial lead capacitor allowing higher circuit board densities than were previously possible. The general characteristics of the PEC 831 make it an ideal choice for general coupling, decoupling and filtering applications. All PPD capacitors are made in the U.S. and are available taped and reeled for automatic insertion.

Physical and Electrical Characteristics.

Capacitance range	1000 pF to 6.8 μF
Capacitance tolerance	±5%, ±10%, ±20%
Voltage Ratings AC ratings are at 60Hz	40VDC/24VAC, 100VDC/63VAC, 200VDC/125VAC, 400VDC/200VAC
Temperature range	−55°C to +125° C. Over 85°C the voltage is derated linearly to 50% at 125°C.
Moisture resistance	After 72 hours at 75°C and 95%RH, the IR shall exceed 30% of the initial requirement.
Dielectric and electrodes	Polyester film vacuum metallized with aluminum.
Coating	Conformally coated with epoxy. Coating material meets UL 94V-0.
Leads	Solder coated copper clad steel wire.
Temperature coefficient	See capacitance vs. temperature curve
Capacity stability	±2% over period of 2 years
Dielectric strength	160% rated DC voltage for 2 seconds.
Life test	140% rated DC voltage at 85°C for 250 hours.

Insulation resistance	C≤.33μF and V>100VDC: 30,000MΩ Min.
2 Min. Electrification, 25°C	C>.33μF and V ≥100VDC: 10,000 MΩ × μF Min.
10 VDC for V<100 VDC	C≤.1μF and V≤100VDC: 10,000 MΩ Min.
100VDC for V≥100VDC	C>.1μF and V<100VDC: 1,000 MΩ × μF Min.
Dissipation Factor	C≤1μF 0.8% max. (0.5% average) at 1KHz
	C>1μF 1.0% max. (0.6% average) at 1KHz
Self Inductance	10nH/cm along length of body and leads

MAXIMUM PULSE RISE TIME

	V/μs					
	CASE					
VDC	A	B	C	D	E	F
40V	6.2	3.6	1.9	1.5	1.1	0.84
63V	7.3	4.6	2.3	1.8	1.4	1.0
100V	12.1	7.3	3.8	2.9	2.3	1.7
200V	16.2	9.7	5.1	3.9	3.0	2.2
400V	51.0	25.0	11.6	8.6	6.5	4.7

Pulse Current = Cap. (μF) × Pulse Rise Time

CAP. μF	CASE A	B	C	D	E	F
.001	400					
.0012	400					
.0015	400					
.0018	400					
.0022	400					
.0027	400					
.0033	400					
.0039	400					
.0047	400					
.0056	200	400				
.0068	200	400				
.0082	200	400				
.01	200	400				
.012	200	—	400			
.015	200	—	400			
.018	200	—	400			
.022	200	—	—	400		
.027	200	—	—	400		
.033	100	200	—	400		
.039	100	200	—	400		
.047	100	200	—	400		
.056	63	200	—	400		
.068	63	100	200	—	400	
.082	63	100	200	—	400	
.1	63	100	200	—	400	
.12	40	100	—	200	400	
.15	40	63	100	200	400	
.18	40	63	100	200	400	
.22	40	63	—	200	—	400
.27		63	—	200	—	400
.33			63	100	200	400
.39			63	100	200	—
.47				100	200	—
.56				100	200	—
.68				63	200	—
.82				63	200	—
1.0				63	100	200
1.5					100	200
2.2					63	100
3.3					63	—
4.7						63
6.8			VOLTS			63

CASE SIZE

	A D×L	B D×L	C D×L	D D×L	E D×L	F D×L
IN.	.177×.250	.177×.355	.195×.497	.247×.610	.345×.745	.347×.970
MM.	4.5×6.4	4.5×9.0	5.0×12.6	6.3×15.5	8.8×18.9	8.8×24.6

CAP. μF	VOLTAGE (DC) 40V	63V	100V	200V	400V
.001					A
.0012					A
.0015					A
.0018					A
.0022					A
.0027					A
.0033					A
.0039					A
.0047					A
.0056				A	B
.0068				A	B
.0082				A	B
.01				A	B
.012				A	C
.015				A	C
.018				A	C
.022				A	D
.027				A	D
.033			A	B	D
.039			A	B	D
.047			A	B	D
.056		A	B	B	D
.068		A	B	C	E
.082		A	B	C	E
.1		A	B	C	E
.12	A	B	B	D	E
.15	A	B	C	D	E
.18	A	B	C	D	E
.22	A	B	D	D	F
.27	B	B	D	D	F
.33	C	C	D	E	F
.39	C	C	D	E	
.47	D	D	D	E	
.56	D	D	D	E	
.68	D	D	E	E	
.82	D	D	E	E	
1.0	D	D	E	F	
1.5	E	E	E	F	
2.2	E	E	F		
3.3	E	E			
4.7	F	F			
6.8	F	F			

PPD
FILM CAPACITORS
Rt. 8, Box 116B, Raleigh, N.C. 27612
(919) 781-3955

Specifications subject to change without notice.

PPC 830 Polypropylene Film/Foil

General Characteristics.

The PPC 830 is an axial lead, polypropylene film capacitor that features small size, low price and flame retardant coating. The electrical stability of polypropylene and its characteristic high resistance to moisture allow these units to retain their original capacitance over long periods of time without degradation due to changing environmental conditions. The PPC 830 has the excellent characteristics previously found only in polystyrene capacitors but offers a higher temperature rating and, of course, flame resistance. The low negative TC and very low dissipation factor of the PPC 830 provide for a stable frequency response curve and high Q in resonant and filtering circuit applications. Since the PPC 830 also exhibits high insulation resistance (I.R.) and low dielectric absorption (D.A.), it is a good choice for storage and timing circuit applications. All PPD capacitors are made in the U.S. and are available taped and reeled for automatic insertion.

Physical and Electrical Characteristics

Capacitance range	150pF to .56μF
Capacitance tolerance	±1% thru ±10%
Voltage ratings AC ratings are at 60Hz (higher voltages available upon request)	160VDC/90VAC, 400VDC/160VAC, 630VDC/200VAC
Temperature range	−55°C to 105°C. Over 85°C the voltage is derated linearly to 50% at 105°C.
Humidity range	95% RH max., 85% yearly average
Dielectric	Polypropylene film
Electrodes	Aluminum foil
Coating	Conformally coated with epoxy. Coating material meets UL 94V-0
Leads	Solder coated copper clad steel wire.
Temperature coefficient of capacitance	−150 ± 100 ppm/°C
Capacitance stability	<± 0.5% drift over period of 2 years
Test voltage/Dielectric strength	2.5 x rated voltage for 2 seconds
Insulation resistance	> 100,000 MΩ after 2 mins. at 100V, 25°C
Life test	140% rated voltage at 105°C for 250 hrs.
Dissipation factor	≤ .07% at 10KHz
Dielectric absorption	< .05%
Self inductance	10nH/cm along length of body and leads
Max pulse rise time	500V/μ sec

	160VDC/90VAC				400VDC/160VAC				630VDC/200VAC			
	mm		in		mm		in		mm		in	
PF	**D**	**L**	**D**	**L**	**D**	**L**	**D**	**L**	**D**	**L**	**D**	**L**
150	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
220	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
330	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
470	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
680	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
735	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
820	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
1000	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
1500	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
2200	4.8	10	.188	.394	4.8	10	.188	.394	5.2	10	.205	.394
3300	4.8	10	.188	.394	4.8	10	.188	.394	6.1	10	.240	.394
4100	4.8	10	.188	.394	5.2	10	.205	.394	6.5	10	.255	.394
4300	4.8	10	.188	.394	5.2	10	.205	.394	6.6	10	.260	.394
4700	4.8	10	.188	.394	5.3	10	.210	.394	5.8	12	.230	.475
4900	5	10	.195	.394	5.5	10	.215	.394	6	12	.235	.475
5600	5	10	.195	.394	5.6	10	.220	.394	6.2	12	.245	.475
6800	5	10	.195	.394	6	10	.235	.394	6.7	12	.265	.475
8200A	6	10	.235	.394	—	—	—	—	—	—	—	—
8200B	5	12	.195	.475	5.6	12	.220	.475	7.1	12	.280	.475
MFD												
.01A	6.2	10	.245	.394	—	—	—	—	—	—	—	—
.01B	5	12	.195	.475	6.4	12	.250	.475	7.7	12	.305	.475
.013	5.5	12	.215	.475	6.9	12	.270	.475	8.5	12	.335	.475
.015	5.7	12	.225	.475	7.1	12	.280	.475	7.9	14.7	.310	.580
.018	6	12	.235	.475	7.5	12	.295	.475	8.3	14.7	.325	.580
.022	6.5	12	.255	.475	8	12	.315	.475	8.8	14.7	.345	.580
.025	6.9	12	.270	.475	7.9	14.7	.310	.580	9.5	14.7	.375	.580
.027	7.1	12	.280	.475	8.1	14.7	.320	.580	9.9	14.7	.390	.580
.033	7.6	12	.300	.475	8.9	14.7	.350	.580	9	18.3	.355	.720
.047	7.9	14.7	.310	.580	10.3	14.7	.405	.580	9.9	18.3	.390	.720
.056	8.8	14.7	.345	.580	11	14.7	.435	.580	10.4	18.3	.410	.720
.060	9	14.7	.355	.580	9.1	18.3	.360	.720	10.8	22	.425	.865
.068	9.4	14.7	.370	.580	10.3	18.3	.405	.720	11.4	22	.450	.865
.082	8.4	18.3	.330	.720	11.4	18.3	.450	.720	12.4	22	.490	.865
.1A	9.1	18.3	.360	.720	11.9	18.3	.470	.720	—	—	—	—
.1B	8.1	22	.320	.865	10.3	22	.405	.865	13.5	22	.530	.865
.15	9.5	22	.375	.865	11.8	22	.465	.865	13.9	25.1	.548	.990
.22	11.4	22	.450	.865	13	22	.510	.865				
.27	12.4	22	.490	.865								
.33	11.9	22	.470	.865								
.47	12.7	25.1	.500	.990								
.56	14	25.1	.550	.990								

PPD
FILM CAPACITORS
Rt. 8, Box 116B, Raleigh, N.C. 27612
(919) 781-3955

Specifications subject to change without notice.

PPC 831 Metallized Polypropylene Film

General Characteristics

The PPC 831 is an axial lead, metallized polypropylene film capacitor featuring small size, high performance, low price and conformal encapsulation with a flame retardant coating.

The physical and electrical characteristics of polypropylene as a dielectric are commendable. Polypropylene is relatively impervious to moisture. It is also extremely stable. The PPC 831 will, therefore, retain its original properties over extended periods of time in a fluctuating environment.

Other noteworthy attributes of the PPC 831 are high insulation resistance (IR) and a low dielectric absorption (DA) factor. Both of these parameters are of critical importance in the selection of a sample-and-hold capacitor in data acquisition applications. The DA of polypropylene is about 10 times less than that of polyester and is significantly less than that of polycarbonate or polystyrene.

Also to be considered are the gently sloping curves for temperature coefficient (TC), dissipation factor (DF) and capacitance variation with frequency. The relatively flat response of the PPC 831 assures dependable, stable performance when incorporated into critical resonant and filtering circuit applications.

Physical and electrical characteristics:

Capacitance — Measured at 1,000 Hz

Capacitance range — 1000 pF to 1.0 μF

Capacitance tolerance — 1%, 2.5%, 5%, 10%, 20%

Voltage ratings AC ratings at 60 Hz — 160 VDC/ 90 VAC, 250 VDC/ 220 VAC, 400 VDC/ 250 VAC, 630 VDC/ 300 VAC

Temperature range — −55°C to 105°C. Over 85°C the voltage is derated linearly to 50% at 105°C.

Dielectric — Aluminum metallized polypropylene film

Coating — Conformally coated with epoxy. Coating material meets UL 94V-0

Leads — Solder coated copper clad steel wire

Dissipation factor Measured at 25°C, 1 KHz — Less than .1%, Figures I & II

Dielectric absorption Per MIL-C-19978 — Less than .05%, Figure III

Insulation resistance Rated voltage, 2 min. electrification

	+25°C	+85°C	+105°C
MΩ × μF	100,000	5,000	500
≤MΩ	200,000	10,000	1,000

Life test 1Ω/ Volt in series — 1000 hours, 85°C, 140% voltage

Humidity — 72 hours, 75°C, 95% R.H. (Ref. EIA RS377, IR shall exceed 30% of minimum)

Dielectric strength 100Ω/ Volt in series — 200% rated voltage, 1 min.

Capacitance drift — ± .5% over 2 years 20°C to 40°C, 40% to 60% R.H.

Temperature coefficient — Figure IV

Self inductance — 10nH/cm along leads and body

MAXIMUM PULSE RISE TIME

	V/μs				
	CASE				
VDC	B	C	D	E	F
160V	8.3	4.6	3.5	2.7	2
250V	15.7	8	5.8	4.3	3.1
400V	21	10.7	7.8	5.8	4.2
630V	43	18.5	13	9.6	6.7

Pulse Current = Cap. (μF) × Pulse Rise Time

CAP.	CASE				
μF	B	C	D	E	F
.001	630				
.0012	630				
.0015	630				
.0018	630				
.0022	630				
.0027	400	630			
.0033	400	630			
.0039	400	630			
.0047	400	630			
.0056	400	630			
.0068	400	630			
.0082	400	—	630		
.01	250	400	630		
.012	250	400	630		
.015	250	400	630		
.018	160	250	630		
.022	160	250	630		
.027	160	250	400	630	
.033	160	—	400	630	
.039	160	—	400	630	
.047	160	—	400	630	
.056		160	250	630	
.068		160	250	400	630
.082		160	250	400	630
.1		160	250	400	630
.12			160	400	630
.15			160	400	630
.18			160	250	400
.22			160	250	400
.27				250	400
.33				160	250
.39				160	250
.47				160	250
.56				160	250
.68				160	—
.82		VOLTS			160
1.0					160

CASE SIZE

	B	C	D	E	F
	D x L	D x L	D x L	D x L	D x L
IN.	.177×.355	.195×.497	.247×.610	.345×.745	.347×.970
MM.	4.5×9.0	5.0×12.6	6.3×15.5	8.8×18.9	8.8×24.6

CAP.	VOLTAGE (DC)			
μF	160V	250V	400V	630V
.001				B
.0012				B
.0015				B
.0018				B
.0022				B
.0027			B	C
.0033			B	C
.0039			B	C
.0047			B	C
.0056			B	C
.0068			B	C
.0082			B	D
.01		B	C	D
.012		B	C	D
.015		B	C	D
.018	B	C	D	D
.022	B	C	D	D
.027	B	C	D	E
.033	B	D	D	E
.039	B	D	D	E
.047	B	D	D	E
.056	C	D	E	E
.068	C	D	E	F
.082	C	D	E	F
.1	C	D	E	F
.12	D	E	E	F
.15	D	E	E	F
.18	D	E	F	
.22	D	E	F	
.27	E	E	F	
.33	E	F		
.39	E	F		
.47	E	F		
.56	E	F		
.68	E			
.82	F			
1.0	F			

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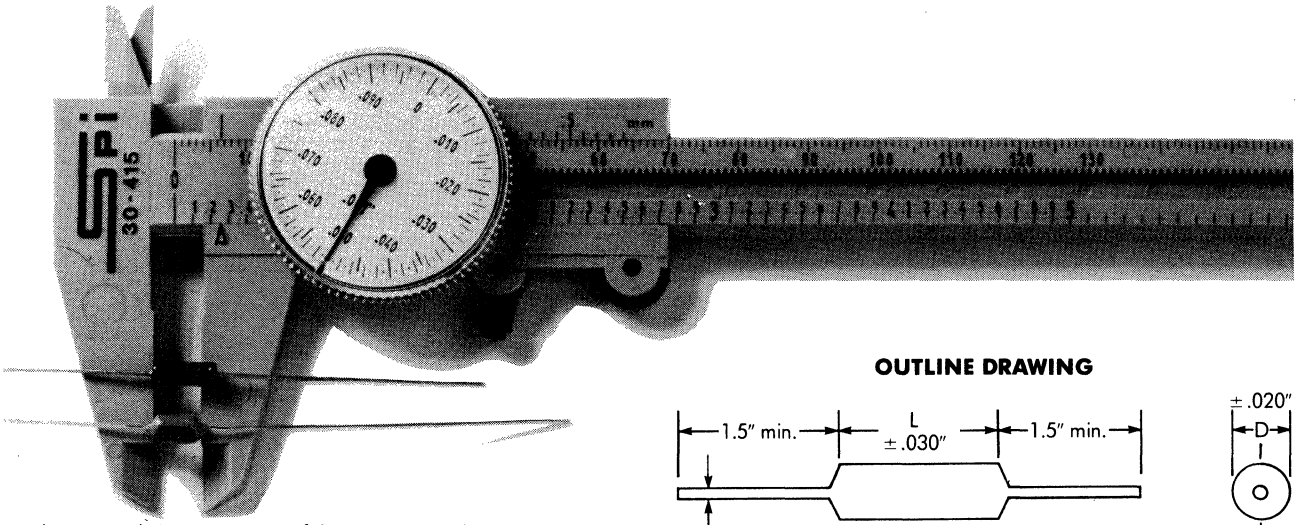
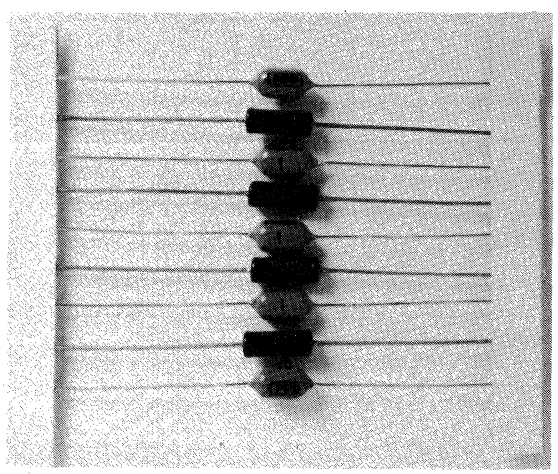


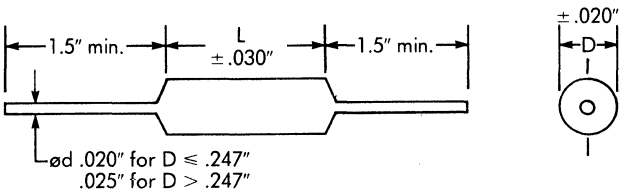
The "A" and "B" case sizes of the PPC 831 and PEC 831 style capacitors are computer designed with today's manufacturing and design criteria firmly in mind — namely, automation.

Until now, the most useful configuration for automated assembly, with respect to general bypassing, filtering and timing requirements, has been the box style capacitor. This is because the corresponding axial style devices are of physical proportions incompatible with automatic insertion equipment. Unfortunately, the box capacitor presents the modern factory with its own unique problems. An expensive radial insertion machine must be obtained. Box insertion requires an additional step in the assembly process which adds both direct and indirect production costs. In comparison, axials insert 3 times faster than radials.

PPD has been studying this situation for some time now. The culmination of this work has been the development of the "A" and "B" case film capacitors. The designer is now presented with the capability of specifying axial lead, automatically insertable, metallized film capacitors in the range of .001 μF to .27 μF. Examination of the dimensions of the "A" and "B" cases will reveal that, in length, they closely approximate the dimensions of RN55 and RN60 style resistors. Both "A" and "B" cases have a .177" ± .020" diameter. They can, therefore, be taped on 0.2" centers. Ultimately, these devices can be sequenced on standard axial lead insertion machinery to provide high volume, low cost production.



OUTLINE DRAWING



CASE SIZE

	A	B	C	D	E	F
	D x L	D x L	D x L	D x L	D x L	D x L
IN.	.177×.250	.177×.355	.195×.497	.247×.610	.345×.745	.347×.970
MM.	4.50×6.35	4.50×9.02	4.95×12.62	6.27×15.49	8.76×18.92	8.81×24.64

PART NUMBERING INFORMATION

PPC 830

PPC830 / 1003 B / 400 / 2.5

- 2.5 — Tolerance
- 400 — Voltage (DC)
- B — A or B where alternate sizes available
- 1003 — Capacitance in pF, 3 significant figures and multiplier, ex. .1uF = 100, 000pF = 1003
- PPC830 — Type: PPC 830

PPC831 and PEC 831

PEC831 / .001 / 250 / 5

- 5 — Tolerance
- 250 — Voltage (VDC)
- .001 — Capacitance in uF
- PEC831 — Type: PEC 831 or PPC 831

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Specifications subject to change without notice.

Typical Performance Characteristics

— — — Polypropylene ——— Polyester

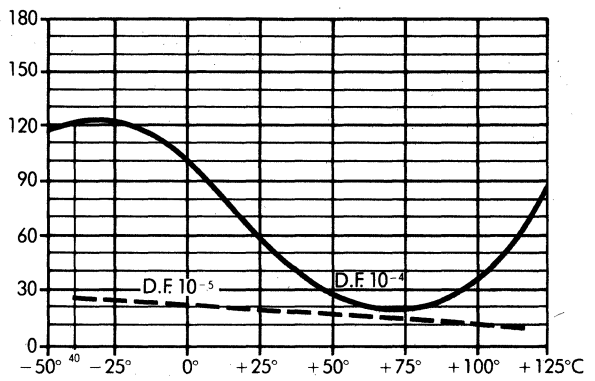

Fig. I *Dissipation factor variation with temperature*

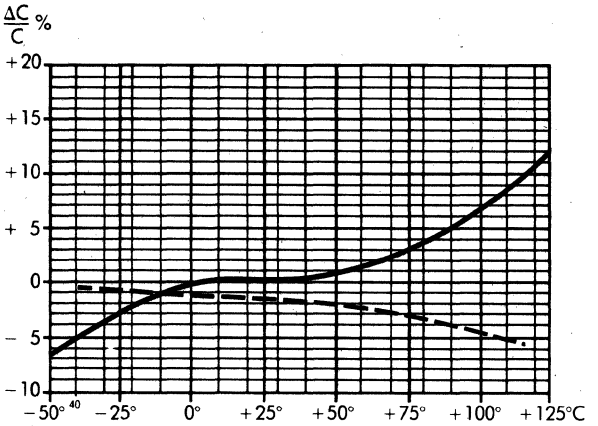

Fig. IV *Capacitance variation with temperature*

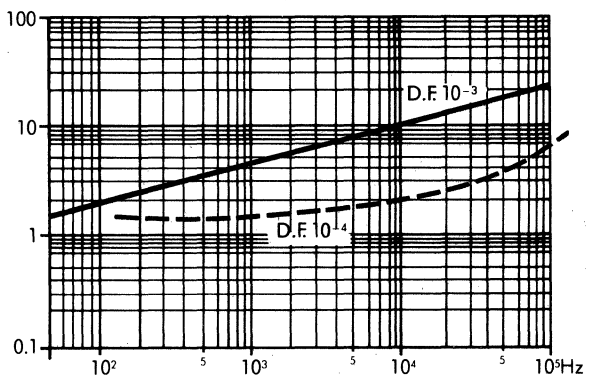

Fig. II *Dissipation factor variation with frequency*

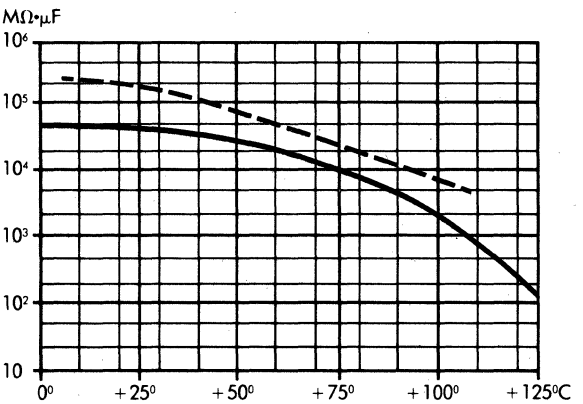

Fig. V *Insulation resistance variation with temperature*

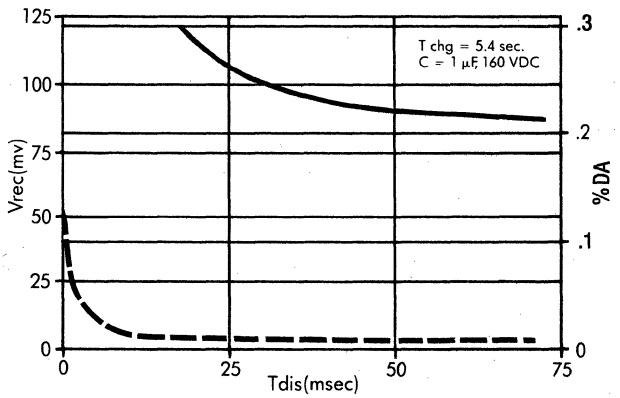

Fig. III *Dielectric absorption*

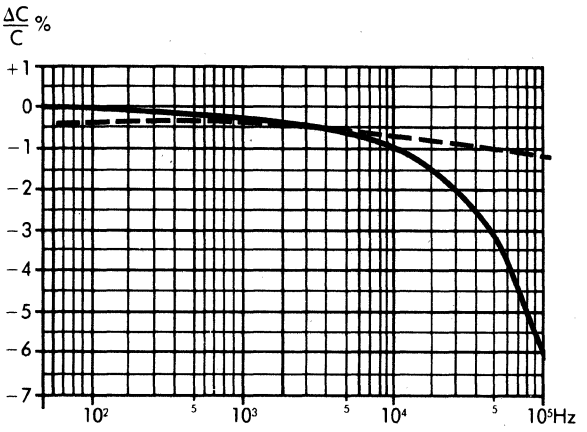

Fig. VI *Capacitance variation with frequency*

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Printed in U.S.A.

Specifications subject to change without notice.

PEB 731 Metallized Polyester "Box" Capacitors

Physical and Electrical Characteristics*

Capacitance range	1000 pF to 1.0 µF
Capacitance tolerance	±5%, ±10%, ±20%
Voltage Ratings AC ratings are at 60Hz	50VDC/24VAC, 100VDC/63VAC, 200VDC/125VAC, 400VDC/200VAC
Temperature range	−55°C to +125°C. Over 85°C the voltage is derated linearly to 50% at 125°C
Moisture resistance	After 72 hours at 75°C and 95% RH, the IR shall exceed 30% of the initial requirement
Dielectric and electrodes	Polyester film vacuum metallized with aluminum
Leads	Solder coated copper clad steel wire
Capacity stability	±2% over period of 2 years
Dielectric strength	160% rated DC voltage for 2 seconds
Life test	140% rated DC voltage at 85°C for 250 hours

Dissipation Factor C≤1 uF 0.8% max. (0.5% average) at 1kHz
C>1 uF 1.0% max. (0.6% average) at 1kHz

MAXIMUM PULSE RISE TIME (V/µs)

Voltage VDC	Lead Spacing .200"	Lead Spacing .400"
50	4	—
63	8	3
100	10	6
250	—	11
400	—	20
630	—	30

Pulse current = Cap. (µf) × Rise Time (V/µs)

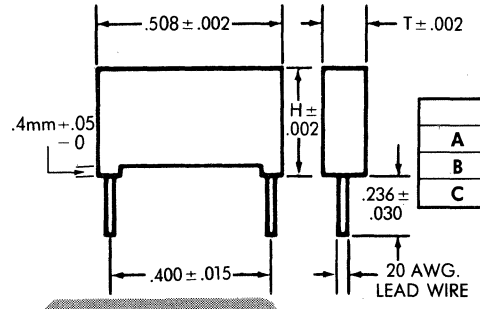
PRELIMINARY

*Additional Information Available on Request

CAP µf	.400" (10 mm) Lead Spacing 63V D.C./ 40V A.C. Case code	100V D.C./ 63V A.C. Case code	250V D.C./ 160V A.C. Case code	400V D.C./ 200V A.C. Case code	630V D.C./ 220V A.C. Case code	.200" (5 mm) Lead Spacing 50V D.C. Case code	63V D.C. Case code	100V D.C. Case code
.001								A
.0012								A
.0015								A
.0018								A
.0022								A
.0027								A
.0033								A
.0039					A			A
.0047					A			A
.0056					A			A
.0068					A			A
.0082					A			A
.01					A			A
.012				A	*B			A
.015				A	*B			A
.018				A	*B			A
.022				A	*C			A
.027				A				A
.033			A	*B			A	
.039			A	*B			A	
.047			A	*C			A	
.056			A				A	
.068			A				A	
			A				A	
.1		A	*B/C			A	B	
.12		A	*C			A	B	
.15		A	*C			B	C	
.18		A	*C			B	C	
.22	A	*B				C	*D	
.27	A	*B				C	*D	
.33	A	*C				*D	*E	
.39	A					*D	*E	
.47	*B					*E	*F	
.68						*E	*F	
1.0						*F	*F	

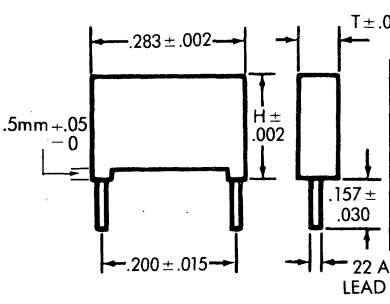
*Additional sizes also available

.400" (10 MM) C.T.S. CASE



CASE SIZE	H	T
A	.354	.157
B	.433	.197
C	.472	.236

.200" (5 MM) C.T.S. CASE



CASE SIZE	H	T
A	.256	.098
B	.256	.118
C	.295	.138
D	.335	.177
E	.394	.197
F	.433	.236

PPD
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(919) 781-3955

Specifications subject to change without notice.

SAC 931 Metallized Polypropylene Capacitors For AC Applications

SERIES-WOUND CONSTRUCTION

Engineered to reduce or eliminate corona problems

PRELIMINARY

General Characteristics

The SAC931 is an axial lead, premium quality capacitor designed for 50-60 Hz AC applications. It is wound from metallized polypropylene with heavy, spray deposited end construction for low ESR and reliable operation. The tight, series-wound sections are sealed with a tough flame-retardant outer wrap and epoxy end seals.

Physical and Electrical Characteristics*

Capacitance	Measured at 1 KHz
Capacitance range	0.18 μF to 3.0 μF
Capacitance tolerance	± 5%, ± 10%, ± 20%
AC voltage ratings (50-60Hz)	400, 480, 540, 600VAC
Temperature range	−55 to +85°C
Dielectric	Metallized polypropylene film
Case insulation	Flame retardant outer wrap
Leads	Solded coated copper clad steel wire
DF at +25° C, 1 KHz	Less than 0.07%

Insulation resistance (100VDC, 2 minute electrification)

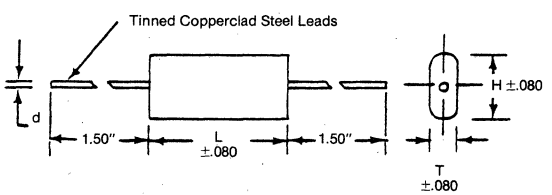
	+25° C	+85° C
MΩ × μF	100,000	5,000
≤MΩ	200,000	10,000

*Additional Information Available on Request

STANDARD RATINGS

Dimensions in Inches — Voltage Ratings at +85° C

CAP	400VAC @ 60 Hz (600VDC)				480VAC @ 60 Hz (800VDC)				540VAC @ Hz (1000VDC)				600VAC @ 60 Hz (1200VDC)			
μF	T	H	L	d	T	H	L	d	T	H	L	d	T	H	L	d
.18					.350	.597	1.50	.032	.460	.707	1.50	.032	.572	.819	1.50	.040
.22					.396	.643	1.50	.032	.519	.766	1.50	.032	.380	.980	1.75	.040
.27					.447	.694	1.50	.032	.584	.831	1.50	.040	.440	1.031	1.75	.040
.33	.355	.600	1.50	.032	.504	.751	1.50	.032	.644	.841	1.50	.040	.531	1.120	1.75	.040
.47	.440	.687	1.50	.032	.620	.867	1.50	.040	.510	1.100	1.75	.032	.650	1.240	1.75	.040
.68	.547	.794	1.50	.032	.480	1.070	1.75	.032	.650	1.240	1.75	.040	.830	1.410	1.75	.040
1.0	.419	1.000	1.75	.032	.620	1.210	1.75	.040	.830	1.430	1.75	.040				
1.5	.554	1.140	1.75	.032	.810	1.400	1.75	.040								
2.0	.671	1.260	1.75	.040												
2.7	.815	1.400	1.75	.040												
3.0	.905	1.500	1.75	.040												



Order by complete part number

SAC931 / .47 / 400 / K

- K — Capacitance Tolerance (J ± 5%, K ± 10%, M ± 20%)
- 400 — Voltage (VAC) rms @ 50-60 Hz
- .47 — Capacitance in μF
- SAC931 — Type: SAC931

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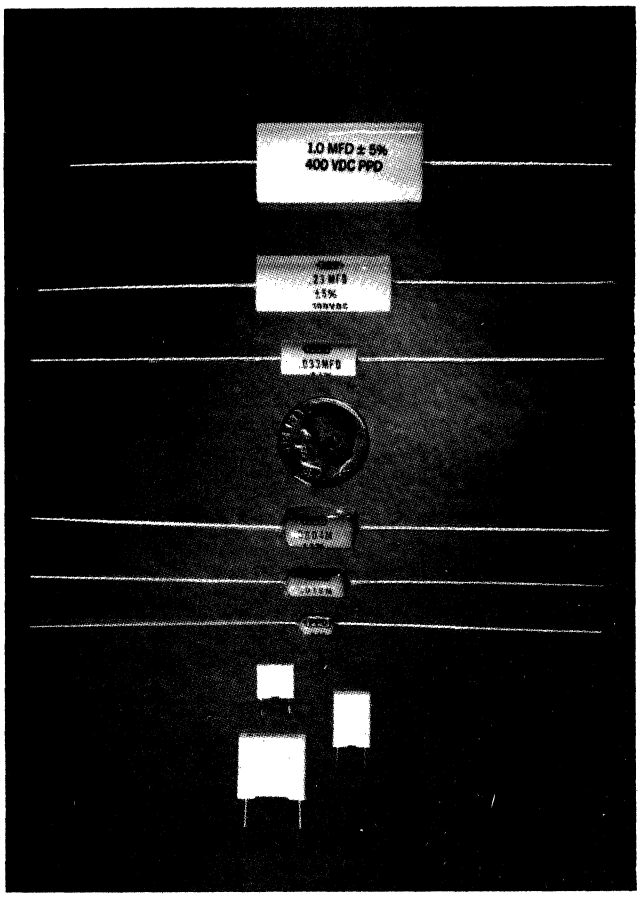
Metallized polyester
Metallized polypropylene
Film/Foil polypropylene



Features that you need . . .

Very small sizes
Axial, conformal coated (coating material meets UL 94V-0)
Box, cylindrical and oval shapes
Series windings for AC applications
Wide capacitance range (150 pf to 6.8 μF)
Tight capacitance tolerance
Non-standard ratings, sizes and characteristics available
Surface mounted units (available 4th quarter, 1985)
Reliability by design
Ship-to-stock
Tape & Reel
Tight TC
High IR
Low DF
And more

Film capacitors for . . .

Decoupling
Snubber
Ballast
Bypassing
Timing
Filtering
Coupling
Energy storage
Tuning
Small motor run

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Specifications subject to change without notice.

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K
kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L
LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microforad
MHz megahertz
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOSIGT metal-oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM nuclear instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLL phased lock loop
PPI plan position indicator
PROM programmable read only memory
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

Ceramic Capacitors

Manufacturing quality ceramics for over thirty years.
We invite you to sample any of our fine ceramic capacitors.

βeta Caps– Parallel plate capacitors for use in microwaves and broad band frequencies up through 50 GHZ.

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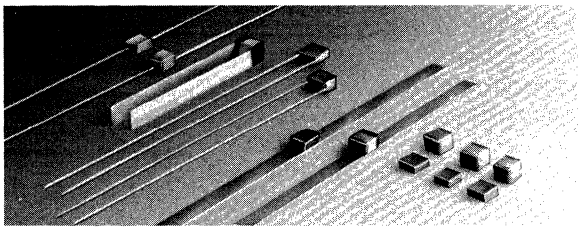
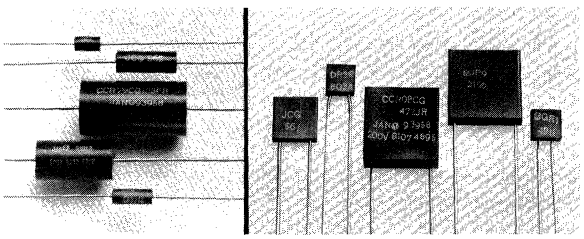
- Ultra high Q's
- Precise Tolerances
- Microwave Characterized



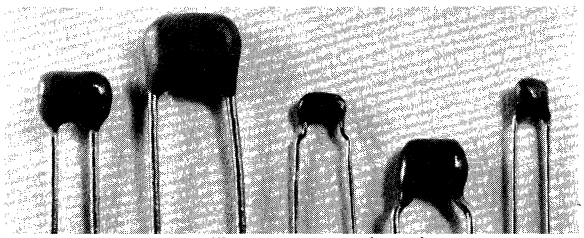
ULTRA-Q/ULTRA STABLE — Miniature microwave capacitors for use in microwave frequencies

- QPL — MIL-C-55681B R Level
- BG & BP characteristics
- Sizes CDR11-CDR14, CDR21-CDR25
- QPL — MIL-C-11272C



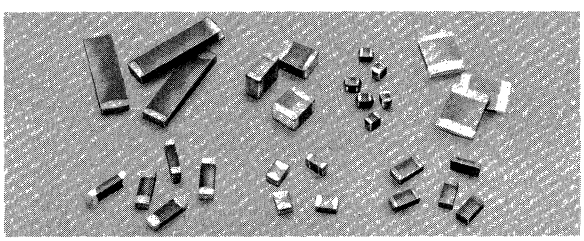
QPL — MIL-C-20 R Level

- Sizes CCR05-CCR09, CCR75-CCR79
- NPO characteristic



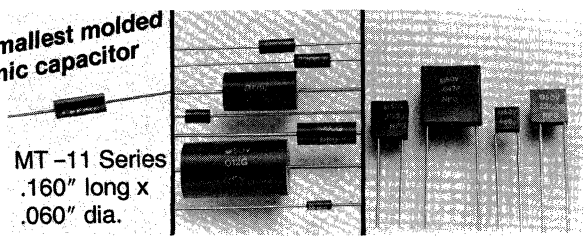
NPO — Smallest military approved package

- QPL — MIL-C-20 P Level
- Sizes CCR13 thru CCR19



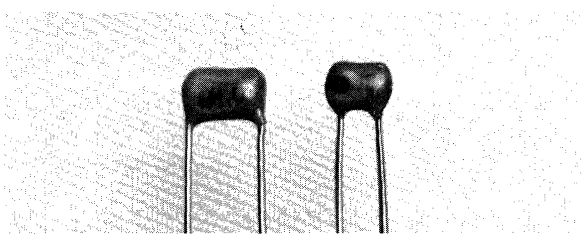
SURFACE MOUNTABLE CHIPS

- Single or multilayer
- Terminations: PdAg; Au; Tin nickel barrier



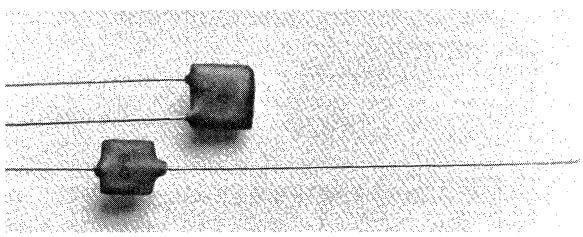
MU CAPS — Most stable miniature capacitor available

- NPO Ultra stable
- Capacitor values of .22Mf



M-CAPS — Miniature monolithic capacitors

- NPO Ultra Stable and BX characteristic
- .100" square to .300" square



THINLINE — Temperature Compensating

- NPO thru N5600 and general purpose

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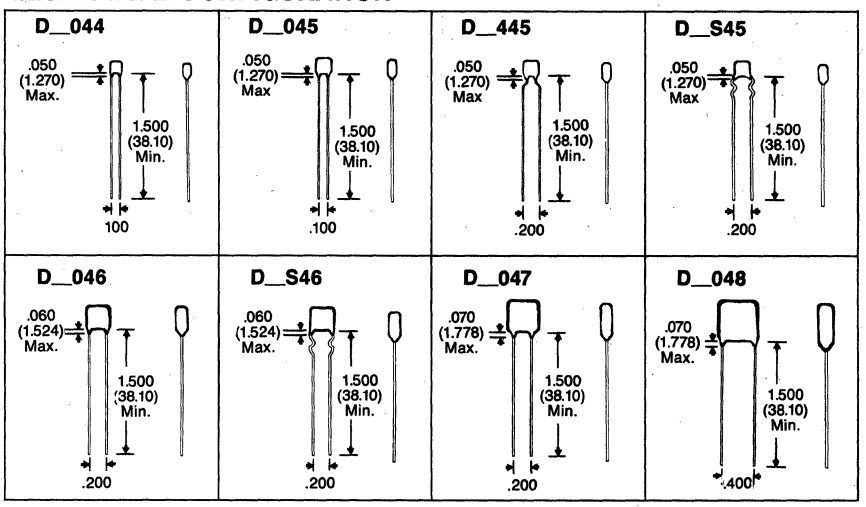
Skinny Dip®

MECHANICAL CONFIGURATION



LEAD MATERIAL AND FINISH

Both copper clad steel and oxygen free copper solder coated leads are available. We reserve the right to supply either lead. Should oxygen free copper be required, it must be specified with suffix "A" following the tolerance symbol. (Cut heads available on request.)

VOLTAGE TEMPERATURE CHARACTERISTIC

Generic Group	△C With Rated Voltage	△C Without Rated Voltage	Temperature Range	EIA Type
BY	0 ± 30PPM/°C	0 ± 30PPM/°C	−55°C to +125°C	(COG)
BA	N080 ± 30PPM/°C	N080 ± 30PPM/°C	−55°C to +125°C	(U1G)
BB	N150 ± 30PPM/°C	N150 ± 30PPM/°C	−55°C to +125°C	(P2G)
BX	+15% −25%	±15%	−55°C to +125°C	(X7R)
BZ	Not applicable	+22% −56%	+10°C to +85°C	(Z5U)

(BY) COG DIELECTRIC

SFE Series	Capacitance pF				Dimensions		
	25 Volts	50 Volts	100 Volts	200 Volts	W	H	T
D_044	10 − .4700	10 − 3900	10 − 2200	10 − 1200	.150	.150	.100
D__45	10 − .01μF	10 − 6800	10 − 4700	10 − 2200	.200	.200	.125
D__46	560 − .068μF	560 − .047μF	560 − .018μF	560 − .010μF	.300	.300	.150
D_047	1200 − .100μF	1200 − .068μF	1200 − .033μF	1200 − .022μF	.400	.400	.150
D_048	1800 − .220μF	1800 − .180μF	1800 − .082μF	1800 − .047μF	.500	.500	.200

BX (X7R) DIELECTRIC

SFE Series	Capacitance pF				Dimensions		
	25 Volts	50 Volts	100 Volts	200 Volts	W	H	T
D_044	100 − .100	100 − .068μF	100 − .039μF	100 − .022μF	.150	.150	.100
D__45	100 − .150μF	100 − .100μF	100 − .082μF	100 − .047μF	.200	.200	.125
D__46	1200 − 1.20μF	1200 − 1.00μF	1200 − .390μF	1200 − .180μF	.300	.300	.150
D_047	.010μF − 1.80μF	.010μF − 1.50μF	.010μF − .680μF	.010μF − .390μF	.400	.400	.150
D_048	.010μF − 4.70μF	.010μF − 3.90μF	.010μF − 1.20μF	.010μF − .560μF	.500	.500	.200

BZ (Z5U) DIELECTRIC

SFE Series	Capacitance pF			Dimensions		
	25 Volts	50 Volts	100 Volts	W	H	T
D_044	1000 − .220μF	1000 − .150μF	1000 − .056μF	.150	.150	.100
D__45	1000 − .330μF	1000 − .270μF	1000 − .100μF	.200	.200	.125
D__46	.010μF − 3.30μF	.010μF − 1.80μF	.010μF − .820μF	.300	.300	.150
D_047	.010μF − 4.70μF	.010μF − 3.30μF	.010μF − 1.00μF	.400	.400	.150
D_048	.010μF − 10.0μF	.010μF − 6.80μF	.010μF − 3.90μF	.500	.500	.200

ELECTRICAL PARAMETERS

Manufactured to applicable portions of MIL-C-39014, MIL-C-55681, MIL-C-20 and EIA Standard RS-198.

Dielectric strength 250% of rated voltage for five (5) seconds, with 50 mA. max. current.

Capacitance and dissipation factor measurements are made at 25°C. For values 100 pf or less, test frequency is 1 MHz ± 100KHz. For values above 100 pf, test frequency is 1 KHz ± 100 Hz. Test voltage is 1.0 ± .2 Vrms, except characteristic BZ, which is 0.5 ± .1 Vrms.

Dissipation Factor at 25°C.

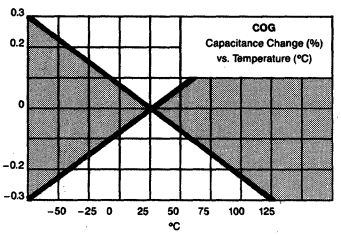
Generic Group "BY-BA-BB"—0.15% max.
Generic Group "BX"—2.5% max.
Generic Group "BZ"—3.0% max.

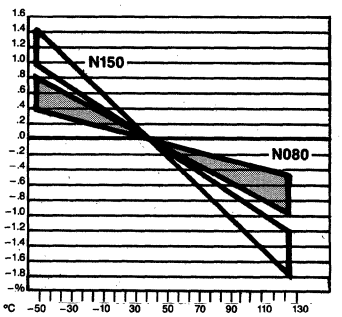
Insulation Resistance.

Generic Group "BY-BA-BB-BX," 1,000 megohms × microfarads, but need not exceed 100,000 megohms at 25°C.

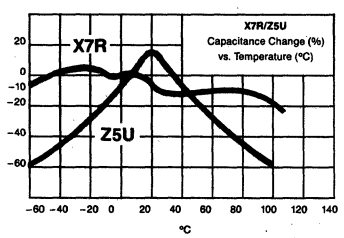
Generic Group "BZ," 1,000 megohms × microfarads, but need not exceed 50,000 megohms at 25°C.

CLASS I Dielectric (COG)





CLASS II and III Dielectric X7R and Z5U



MARKING

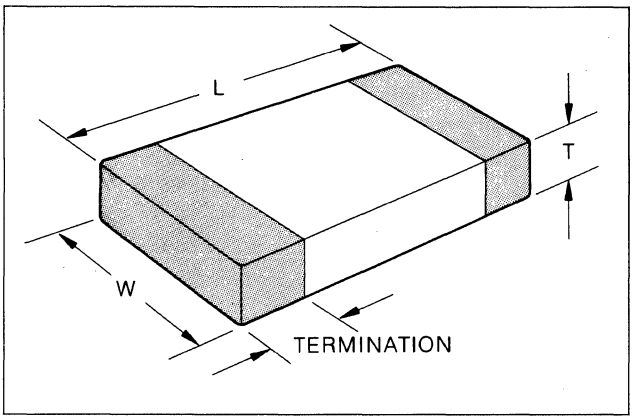
Marking shall be in the order shown, as space permits: "A" Capacitance Code, "B" Tolerance Symbol Code, "C" Voltage Symbol, "D" Manufacturers Designation, "E" Complete part Number.

SFE TECHNOLOGIES

San Fernando Electric

1501 First Street, San Fernando, California 91340-2793 • 818/365-9411 • TWX 910-496-1535

INDUSTRIAL MULTILAYER CERAMIC CAPACITOR CHIPS X7R, NPO-COG, Z5U DIELECTRIC



PERFORMANCE SPECIFICATIONS

NPO-COG DIELECTRIC • Temperature Coefficient: <30ppm/°C, −55°C to +125°C. • **Dissipation Factor:** <0.1% @ 1KHz, 25°C. • **Insulation Resistance:** 1000ΩF or 100GΩ, whichever is less @ rated voltage 25°C. At 125°C IR is 10% of 25°C value. • **Dielectric Strength:** 2.5 times rated voltage D.C.—2 times rated voltage for 500V devices. • **Quality Factor:** >1000 @ 1KHz, 25°C. • **Test Parameters:** 1MHz ± 50KHz, 1.0 ± .25 Vrms, < 100 pF 25°C.—1KHz ± 50Hz, 1.0 ± .25 Vrms, >100 pF 25°C. • **Capacitance Tolerances Available:** C, D, F, G, J, K, M—Close tolerance parts may be trimmed. • Meets or exceeds applicable portions of MIL-C-55681 and EIA 198B.

X7R DIELECTRIC • Temperature Coefficient: ± 15% ΔC, −55°C to 125°C. • **Dissipation Factor:** <2% @ 1KHz, 25°C. • **Insulation Resistance:** 1000ΩF or 100GΩ, whichever is less @ rated voltage 25°C.—At 125°C IR is 10% of 25°C value. • **Dielectric Strength:** 2.5 times rated voltage D.C.—2.0 times rated voltage for 500V devices. • **Ageing:** Approximately 2.5% per decade hour. • **Test Parameters:** 1KHz ± 50KHz, 1.0 ± .25 Vrms, 25°C. • **Capacitance Tolerances Available:** J, K, M, V and Z. • Meets or exceeds applicable portions of MIL-C-55681 and EIA 198B.

Z5U DIELECTRIC • Temperature Coefficient: +22% −56% ΔC, +10°C to +85°C. • **Dissipation Factor:** <3% @ 1KHz, 25°C. • **Insulation Resistance:** 1000ΩF or 50GΩ, whichever is less @ rated voltage 25°C. • **Dielectric Strength:** 2.5 times rated voltage D.C. • **Ageing:** Approximately 3% per decade hour. • **Test Parameters:** 1KHz ± 50KHz, .5 ± .1 Vrms, 25°C. • **Capacitance Tolerances Available:** M, V, and Z. • Meets or exceeds applicable portions of EIA 198B.

NPO-COG DIELECTRIC

	Capacitance of					Dimensions		
	25 Volts	50 Volts	100 Volts	200 Volts	500 Volts	L*	W**	TMAX
0805	10 – 1500	10 – 1000	10 – 680	10 – 330	10 – 27	.080	.050	.050
1005	82 – 2200	82 – 1800	82 – 1000	82 – 470	22 – 56	.100	.050	.050
1206	10 – 3900	10 – 3300	10 – 1800	10 – 820	10 – 100	.126	.063	.050
1210	10 – 8200	10 – 6800	10 – 4700	10 – 2200	10 – 330	.125	.100	.075
1505	150 – 3300	150 – 2200	150 – 1200	150 – 560	56 – 100	.150	.050	.050
1805	220 – 4700	220 – 3900	220 – 1800	220 – 1000	82 – 150	.180	.050	.050
1808	330 – .010μF	330 – 8200	330 – 5600	330 – 2700	120 – 390	.180	.080	.075
1812	680 – .018μF	680 – .015μF	680 – 8200	680 – 5600	470 – 680	.175	.125	.075
1825	1500 – .047μF	1500 – .039μF	1500 – .027μF	1500 – .012μF	820 – 1800	.185	.250	.075
2225	1800 – .047μF	1800 – .039μF	1800 – .027μF	1800 – .012μF	1800 – 2200	.225	.250	.075

X7R DIELECTRIC

	Capacitance of					Dimensions		
	25 Volts	50 Volts	100 Volts	200 Volts	500 Volts	L*	W**	TMAX
0805	220 – .022μF	220 – .018μF	220 – .012μF	220 – 5600	220 – 680	.080	.050	.050
1005	1500 – .039μF	1500 – .027μF	1500 – .015μF	1500 – 8200	470 – 1000	.100	.050	.050
1206	220 – .068μF	220 – .056μF	220 – .033μF	220 – .015μF	220 – 1800	.126	.063	.050
1210	5600 – .150μF	5600 – .120μF	5600 – .082μF	5600 – .047μF	2200 – 6800	.125	.100	.075
1505	3300 – .056μF	3300 – .039μF	3300 – .022μF	3300 – .012μF	1200 – 2200	.150	.050	.050
1805	3900 – .082μF	3900 – .068μF	3900 – .033μF	3900 – .018μF	2200 – 2700	.180	.050	.050
1808	6800 – .180μF	6800 – .150μF	6800 – .100μF	6800 – .056μF	2700 – 8200	.180	.080	.075
1812	.015μF – .330μF	.015μF – .270μF	.015μF – .180μF	.015μF – .100μF	.010μF – .012μF	.175	.125	.075
1825	.033μF – .820μF	.033μF – .680μF	.033μF – .470μF	.033μF – .220μF	.015μF – .039μF	.185	.250	.075
2225	.039μF – 1.00μF	.039μF – .680μF	.039μF – .470μF	.039μF – .270μF	.033μF – .039μF	.225	.250	.075

Z5U DIELECTRIC

	Capacitance of			Dimensions		
	25 Volts	50 Volts	100 Volts	L*	W**	TMAX
0805	1000 – .068μF	1000 – .039μF	1000 – .012μF	.080	.050	.050
1005	2700 – .100μF	2700 – .056μF	2700 – .022μF	.100	.050	.050
1206	1000 – .180μF	1000 – .120μF	1000 – .039μF	.126	.063	.050
1210	.010μF – .390μF	.010μF – .330μF	.010μF – .120μF	.125	.100	.075
1505	4700 – .150μF	4700 – .082μF	4700 – .027μF	.150	.050	.050
1805	6800 – .220μF	6800 – .120μF	6800 – .039μF	.180	.050	.050
1808	.015μF – .560μF	.015μF – .390μF	.015μF – .120μF	.180	.080	.075
1812	.022μF – 1.00μF	.022μF – .820μF	.022μF – .270μF	.175	.125	.075
1825	.047μF – 2.20μF	.047μF – 1.20μF	.047μF – .560μF	.185	.250	.075
2225	.068μF – 2.70μF	.068μF – 1.80μF	.068μF – .680μF	.225	.250	.075

*Tolerance ± .010 or 7% whichever is greater—for solder coated units +.030 – .010.
**For solder coated units allow +.020.

CAPACITOR VALUES listed for chips are also available in standard package configurations of 2 pin dip, radial molded and axial molded configurations.

SFE TECHNOLOGIES

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MILITARY QUALIFIED MULTILAYER CERAMIC CAPACITORS

Service second to none.
You can choose from a full range of established reliability (ER) MLCs. We can provide you with our proven "NiBar"® barrier-end termination to endure the most demanding soldering temperatures, chips with marking identification and tape-and-reel packaging for automatic insertion.

FIG. 1

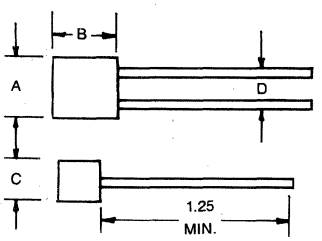


FIG. 2

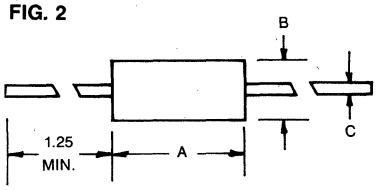


FIG. 3

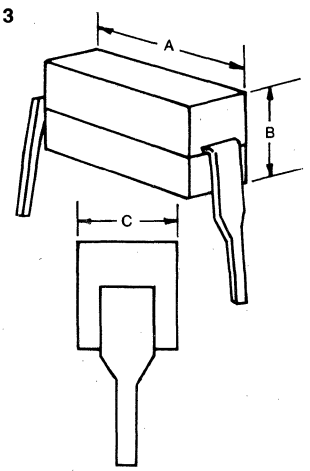
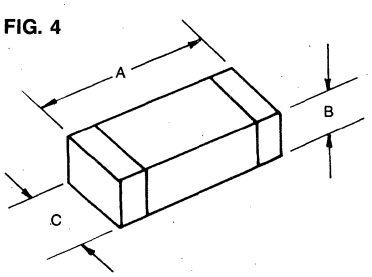


FIG. 4



Mil Spec No.	Design-nation	Cap Range pF	Failure Rate	F I G	Dimensions A	B	C	D
MIL-C-20/27D	CC75	0.10 – 680	N/A	2	.160 ± .010	.090 ± .010	.016 + .005/ – .001	–
MIL-C-20/28A	CC76	82 – 1000	N/A	2	.250 ± .010	.090 ± .010	.015/.027	–
MIL-C-20/29B	CC77	150 – 5600	N/A	2	.390 ± .010	.140 ± .010	.015/.027	–
MIL-C-20/30A	CC78	820 – 27000	N/A	2	.500 + .020	.250 ± .015	.015/.027	–
MIL-C-20/31A	CC79	3900 – 82,000	N/A	2	.690 ± .020	.350 ± .015	.015/.027	–
MIL-C-30/35E	CC05	1.0 – 3300	N/A	1	.190 ± .010	.190 ± .010	.090 ± .010	.200 ± .015
MIL-C-20/35E	CC09	1.0 – 3300	N/A	1	.190 ± .010	.190 ± .010	.090 ± .010	.100 ± .015
MIL-C-20/36D	CC06	360 – 18,000	N/A	1	.290 ± .010	.290 ± .010	.090 ± .010	.200 ± 0.15
MIL-C-20/37C	CC07	2,200 – 100,000	N/A	1	.480 ± .020	.480 ± .020	See note*	.400 ± .020
MIL-C-20/38	CC08	3,900 – 68,000	N/A	1	.480 ± .020	.480 ± .020	.240 ± .010	.400 ± .020
MIL-C-20/27D	CCR75	.010 – 680	MPR	2	.160 ± .010	.090 ± .010	.016 + .005/ – .001	–
MIL-C-20/28A	CCR76	82 – 1,000	MPR	2	.250 ± .010	.090 ± .010	.015/.027	–
MIL-C-20/29B	CCR77	150 – 5,600	MPR	2	.390 ± .010	.140 ± .010	.015/.027	–
MIL-C-20/30A	CCR78	820 – 27,000	MPR	2	.500 ± .020	.250 ± .015	.015/.027	–
MIL-C-20/31A	CCR79	3,900 – 82,000	M	2	.690 ± .020	.350 ± .015	.015/.027	–
MIL-C-20/35E	CCR05	1.0 – 3,300	MPRS	1	.190 ± .010	.190 ± .010	.090 ± .010	.200 ± .015
MIL-C-20/35E	CCR09	1.0 – 3,300	MPRS	1	.190 ± .010	.190 ± .010	.090 ± .010	.100 ± .015
MIL-C-20/36D	CCR06	360 – 18,000	MPRS	1	.290 ± .010	.290 ± .010	.090 ± .010	.200 ± .015
MIL-C-20/37C	CCR07	2,200 – 100,000	MPRS	1	.480 ± .020	.480 ± .020	See note*	.400 ± .020
MIL-C-20/38	CCR08	3,900 – 68,000	MPRS	1	.480 ± .020	.480 ± .020	.240 ± .010	.400 ± .020
MIL-C-11015-18D	CK05	10 – 100,000	N/A	1	.190 ± .010	.190 ± .010	.090 ± .010	.200 ± .015
MIL-C-11015-19D	CK06	1,200 – 1,000,000	N/A	1	.290 ± .010	.290 ± .010	.090 ± .010	.200 ± .015
MIL-C-11015-20C	CK12	10 – 10,000	N/A	2	.160 ± .010	.090 ± .010	.016 + .006/ – .001	–
MIL-C-11015-20C	CK13	5,600 – 47,000	N/A	2	.250 ± .010	.090 ± .010	.016 + .006/ – .001	–
MIL-C-11015-20C	CK14	12,000 – 270,000	N/A	2	.390 ± .010	.140 ± .010	.025 + .004/ – .001	–
MIL-C-11015-20C	CK15	100,000 – 1,000,000	N/A	2	.500 ± .020	.250 ± .015	.025 + .004/ – .001	–
MIL-C-11015-20C	CK16	470,000 – 3,300,000	N/A	2	.690 ± .030	.350 ± .020	.025 + .004/ – .001	–
MIL-C-11015-26B	CK18 (Glass)	10 – 10,000	N/A	2	.275 + .015/ – .030	.090 ± .010	.020 + .004/ – .001	–
MIL-C-39014/1D	CKR05	10 – 100,000	MPRS	1	.190 ± .010	.190 ± .010	.090 ± .010	.200 ± .015
MIL-C-39014/2F	CKR06	1,200 – 1,000,000	MPRS	1	290 ± .010	.290 ± .010	.090 ± .010	.200 ± .015
MIL-C-39014/2D	CKR07	470,000 – 1,000,000	MPRS	1	.290 ± .010	.290 ± .010	.185 ± .010	.200 ± .015
MIL-C-39014/5E	CKR11	10 – 10,000	MPRS	2	.160 ± .010	.090 ± .010	.019 ± .002	–
MIL-C-39014/5E	CKR12	5,600 – 47,000	MPRS	2	.250 ± .010	.090 ± .010	.019 ± .002	–
MIL-C-39014/5E	CKR14	12,000 – 270,000	MPRS	2	.390 ± .010	.140 ± .010	.025 + .002	–
MIL-C-39014/5E	CKR15	56,000 – 1,000,000	MPRS	2	.500 ± .020	.250 ± .015	.025 ± .002	–
MIL-C-39014/5E	CKR16	470,000 – 3,300,000	MPRS	2	.690 ± .030	.350 ± .020	.025 ± .002	–
MIL-C-39014/6B	CKR13**		MPRS		–	–	–	–
MIL-C-39014/9B	CKR19**		MPRS		–	–	–	–
MIL-C-39014/13B	CKR17 (Glass)	5,600 – 22,000	MPRS	2	.250 ± .015	.090 ± .010	.019 ± .002	–
MIL-C-39014/13B	CKR18 (Glass)	12,000 – 180,000	MPRS	2	.390 ± .015	.145 ± .015	.025 ± .002	–
MIL-C-39014/13B	CKR20 (Glass)	10 – 10,000	MPRS	2	.160 ± .010	.090 ± .010	.019 ± .002	–
MIL-C-39014/20B	CKR08	1,200,000 – 2,000,000	MPRS	2	.290 ± .010	.290 ± .010	.145 ± .015	.200 ± .015
MIL-C-39014/22B	CKR22	1.0 – 100,000	MPRS	3	.260 ± .020	.128 ± .007	.092 ± .006	–
MIL-C-39014/22B	CKR23	560 – 220,000	MPRS	3	.260 ± .020	.155 ± .007	.092 ± .006	–
MIL-C-39014/22B	CKR24	120,000 – 1,000,000	MPRS	3	.260 ± .020	.283 ± .007	.092 ± .006	–
MIL-C-39014/23	CKR04	10 – 100,000	MPRS	2	.190 ± .010	.190 ± .010	.090 ± .010	.100 ± .015
MIL-C-55681-1A	CDR01†	10 – 4,700	MPRS	4	.080 ± .015	.050 ± .015	.020/.055	–
MIL-C-55681-1A	CDR02	220 – 22,000	MPRS	4	.180 ± .015	.050 ± .015	.020/.055	–
MIL-C-55681-1A	CDR03†	330 – .068μF	MPRS	4	.180 ± .015	.080 ± .015	.020/.080	–
MIL-C-55681-1A	CDR04†	1,200 – .180μF	MPRS	4	.180 ± .015	.125 ± .015	.020/.080	–
MIL-C-55681-2A	CDR05†	3,900 – .330μF	MPRS	4	.180 + .020/ – .015	.250 + .020/ – .015	.020/.080	–
MIL-C-55681-3B	CDR06†	6,800 – .470μF	MPRS	4	.225 ± .020	.250 ± .020	.020/.080	–
MIL-F-15733/24	FL12	–	N/A		–	–	–	–

*Case thickness "C" .140 ± .010 for all values except 100,000 pF value, which can be .200 max.
**Obsolete part but available on request.
†M, N, S, U Terminations.

SFE TECHNOLOGIES

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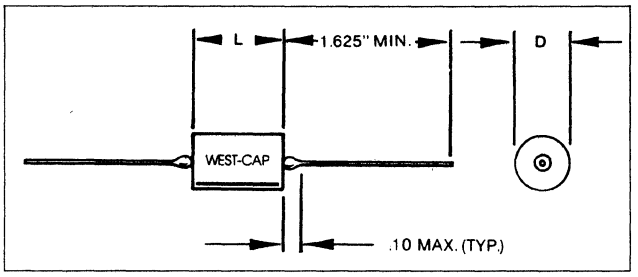
MIL-C-83421/1 ESTABLISHED RELIABILITY
METALLIZED POLYCARBONATE WOUND CAPACITORS

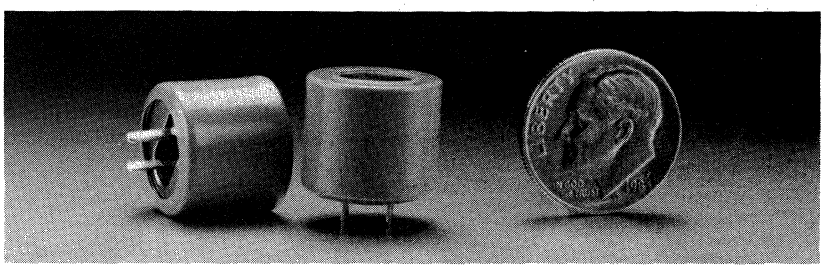


- **Capacitance Tol. Range (%):** ±.5, ±2.0, ±5.0, ±10.0.
- **Failure Rates: M, P, R, and S.**
- **Operating Temperature Range:** −65°C to 100°C; 125°C with 50% voltage deviating.
- **Dielectric Strength:** AC test at 100 Hz. PP square wave, 3 times DC volt. rating for 1 min.
- **Dissipation Factor:** Less than 0.15% @ 1000 Hz for values up to 40 Mfd. Cap values greater than 1.0 Mfd measured @ 100 Hz.
- **Insulation Resistance:** Styles CRH01-CRH05, the product of the insulation resistance in megohms and capacitance in microfarads shall be 300,000 megohm-microfarads min. Styles CRH06-CRH00 100,000 megohm-microfarads min.

Capacitance Value (Nom in μf)	L Inches (mm) ± .03 (.76)	D Inches (mm) ± .02 (.51)
CRH01 AND CRH06—30 Volts (DC Rating)		
0.001 thru 0.022	0.500 (12.70)	0.170 (4.32)
0.027 thru 0.056	0.562 (14.27)	0.170 (4.32)
0.068 thru 0.082	0.687 (17.45)	0.170 (4.32)
0.01 thru 0.12	0.687 (17.45)	0.193 (4.90)
0.15	0.562 (14.27)	0.235 (5.97)
0.18 thru 0.39	0.687 (17.45)	0.235 (5.97)
0.47 thru 0.68	0.687 (17.45)	0.312 (7.92)
0.82 thru 1.2	0.813 (20.65)	0.312 (7.92)
1.5 thru 2.2	0.813 (20.65)	0.400 (10.16)
2.7 thru 3.3	1.063 (27.00	0.400 (10.16)
3.9	1.375 (34.93)	0.400 (10.16)
4.7 thru 5.6	1.375 (34.93)	0.500 (12.20)
6.8 thru 10.0	1.375 (34.93)	0.562 (14.27)
12.0 thru 15.0	1.875 (47.63)	0.562 (14.27)
20.0 thru 22.0	1.875 (47.63	0.670 (17.02)
CRH02 AND CRH07—50 Volts (DC Rating)		
0.001 thru 0.0068	0.500 (12.70)	0.170 (4.32)
0.0082 thru 0.015	0.562 (14.27)	0.170 (4.32)
0.018 thru 0.033	0.562 (14.27)	0.193 (4.90)
0.039 thru 0.05	0.687 (17.45)	0.170 (4.32)
0.056 thru 0.068	0.687 (17.45)	0.193 (4.90)
0.082 thru 0.1	0.813 (20.65)	0.193 (4.90)
0.12 thru 0.15	0.687 (17.45)	0.235 (5.97)
0.18 thru 0.22	0.813 (20.65)	0.235 (5.97)
0.27 thru 0.33	0.687 (17.45)	0.312 (7.92)
0.39 thru 0.50	0.813 (20.65)	0.312 (7.92)
0.56 thru 0.68	0.813 (20.65)	0.400 (10.16)
0.82 thru 1.8	1.063 (27.00)	0.400 (10.16)
2.0 thru 2.2	1.125 (28.58)	0.500 (12.70)
2.7 thru 3.3	1.375 (34.93)	0.500 (12.70)
3.9	1.375 (34.93)	0.562 (14.27)
4.7 thru 5.6	1.375 (34.93)	0.670 (17.02)
6.8 thru 10.0	1.875 (47.63)	0.670 (17.02)
CRH03 AND CRH08—100 Volts (DC Rating)		
0.001 thru 0.0056	0.500 (12.70)	0.170 (4.32)
0.0068 thru 0.0082	0.562 (14.27)	0.170 (4.32)
0.01 thru 0.015	0.687 (17.45)	0.170 (4.32)
0.018 thru 0.033	0.687 (17.45)	0.193 (4.90)
0.039 thru 0.056	0.687 (17.45)	0.235 (5.97)
0.068	0.813 (20.65)	0.235 (5.97)
0.082 thru 0.12	0.687 (17.45)	0.312 (7.92)
0.15 thru 0.22	0.813 (20.65)	0.312 (7.92)
0.27 thru 0.33	1.063 (27.00)	0.312 (7.92)
0.39 thru 0.56	1.063 (27.00)	0.400 (10.16)
0.68 thru 0.82	1.125 (28.58)	0.500 (12.70)
1.00 thru 1.20	1.125 (28.58)	0.562 (14.72)
1.50	1.375 (34.93)	0.562 (14.72)
2.0 thru 2.2	1.375 (34.93)	0.670 (17.02)
2.7 thru 3.3	1.875 (47.63)	0.670 (17.02)
3.9 thru 5.6	1.875 (47.63)	0.750 (19.05)
6.8	2.375 (60.33)	0.000 (25.40)
8.0 thru 10.0	2.375 (60.33)	1.000 (25.40)
CRH04 AND CRH09—200 Volts (DC Rating)		
0.001 thru 0.0068	0.562 (14.27)	0.170 (4.32)
0.0082 thru 0.012	0.562 (14.27)	0.193 (4.90)
0.015	0.562 (14.27)	0.235 (5.97)
0.018 thru 0.022	0.687 (17.45)	0.235 (5.97)
0.027 thru 0.050	0.687 (17.45)	0.312 (7.92)
0.056 thru 0.12	0.813 (20.65)	0.312 (7.92)
0.15	1.063 (27.00)	0.400 (10.16)
0.18 thru 0.22	1.375 (34.93)	0.400 (10.16)
0.27 thru 0.56	1.375 (34.93)	0.500 (12.70)
0.68	1.375 (34.93)	0.562 (14.27)
0.82 thru 1.2	1.875 (47.63)	0.562 (14.27)
1.5	1.875 (47.63)	0.670 (17.02)
1.8 thru 2.7	1.875 (47.63)	0.750 (19.05)
3.0 thru 3.3	1.875 (47.63)	1.000 (25.40)
3.9	2.375 (60.33)	1.000 (25.40)
CRH05 AND CRH00—400 Volts (DC Rating)		
0.001 thru 0.0022	0.562 (14.27)	0.193 (4.90)
0.0027 thru 0.0056	0.562 (14.27)	0.235 (5.97)
0.0068 thru 0.012	0.687 (17.45)	0.235 (5.97)
0.015	0.813 (20.65)	0.235 (5.97)
0.018 thru 0.039	0.813 (20.65)	0.312 (7.92)
0.047 thru 0.068	0.813 (20.65)	0.400 (10.16)
0.082 thru 0.12	1.063 (27.00)	0.400 (10.16)
0.15	1.375 (34.93)	0.400 (10.16)
0.18 thru 0.22	1.375 (34.93)	0.500 (12.70)
0.27 thru 0.33	1.375 (34.93)	0.562 (14.27)
0.39 thru 0.56	1.875 (47.63)	0.562 (14.27)
0.68 thru 1.0	1.875 (47.63)	0.750 (19.05)
1.2	1.875 (47.63)	1.000 (25.40)
1.5 thru 2.0	2.375 (60.33)	1.000 (25.40)

Maxcap™ Double Layer Capacitor

New High Energy Storage Device



The ideal backup power source for microprocessors and memories. Maxcap DLC, the high-energy power source you never have to replace.

Maxcap Double Layer Capacitors (DLCs) combine extremely long life with many of the desirable electrical characteristics of traditional capacitors (such as rapid and frequent discharge/recharge capability), with energy densities and low leakage currents which approach those of batteries. One farad can be stored in a 1.1" x 0.6" package. Maxcap DLCs are ideal for providing the needed backup power for volatile semiconductor memories.

Conventional energy storage devices such as batteries and aluminum electrolytic capacitors must be replaced during the life of a product. Maxcap DLCs never need replacing because, unlike batteries, they do not undergo life limiting, irreversible chemical reactions, and unlike aluminum electrolytic capacitors, they do not experience dry-up problems.

Product Features

Very high capacity in small size. Circuit board space and equipment size can be reduced.

Ultra long life. Maxcap DLCs have no parasitic chemical reactions, no dry-up problems, and can be fully charged and discharged indefinitely.

Maintenance free. Maxcap DLCs can be placed in sealed or remote locations because they require no access ports. Warranty claims are minimized.

Five-volt output. Maxcap DLCs are ideally suited for powering integrated circuits in all types of equipment. Additional voltages are available.

Wide operating temperature range. -25°C to +70°C (-13°F to 158°F).

Long shelf life. Tests indicate performance is the same after ten years in storage.

Nonpolar. Assembly errors and costs are minimized.

Simple, low cost circuitry. Since Maxcap DLCs do not require current limiting resistors or special over-voltage protection, design and assembly times are reduced.

Safer than batteries. These capacitors will not explode or be damaged if short circuited. They can be installed with wave soldering equipment.

Comparison with Batteries

When the energy of a battery is not needed, Maxcap DLCs have many attributes which make them the best solution to your backup requirements.

State of Charge. Unlike batteries, the charge state of Maxcap DLCs can be easily determined by measuring the voltage.

Simple Circuit. Unlike battery backup circuits, special current limiting charge resistors and over-voltage protection are not required with Maxcap DLCs. You save design time, assembly material and labor costs.

Installation/Assembly. Because Maxcap DLCs are non-polar, they can be inserted into electrical systems without creating reverse connection errors. Unlike batteries, they can be short circuited or have reverse current applied without damage or explosion. These features allow more freedom in using high speed assembly methods such as wave soldering.

Equipment Design Flexibility. The unlimited cycle life and long life characteristics of Maxcap DLCs assure greater freedom in selecting their location in your product since access ports do not have to be provided for replacement. This feature, along with their small size, can result in a smaller end product and reduced usage of expensive printed circuit board space.

Product Value/Pricing. Since your product will not require battery replacement, reduced maintenance costs, smaller size, and higher reliability can result in higher profits.

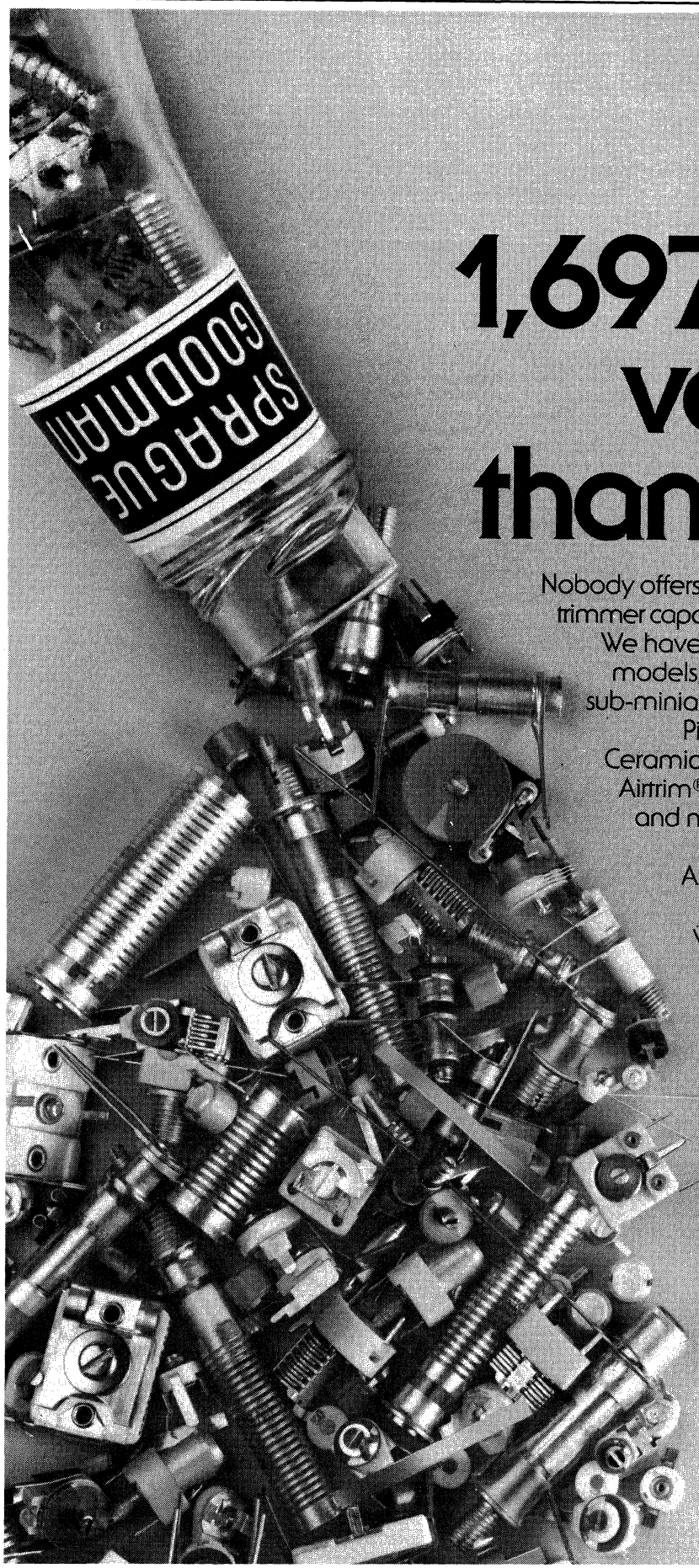
Warranty costs. Your product will not have to be opened to replace batteries; warranty costs may be reduced.

Typical Maxcap DLC Backup Power Application

Type of Load	Appliance or Equipment
CMOS, NMOS, PMOS Rams and microprocessors Timers for integrated circuits	Home appliances, e.g., TVs, microwave ovens, dishwashers, refrigerators; energy management controls, thermostats, vending machines, point of sale terminals, telephone autodialers, programmable controllers.
Relays, solenoids	Starters, igniters, actuators
Small motors, alarms	Disc drives, coin metering devices, security systems, toys.

SOHIO **Sohio Engineered Materials Company**

Sohio Engineered Materials Company
Semiconductor Products Division
P.O. Box 664
Niagara Falls, New York 14302
Telephone 716-278-3954



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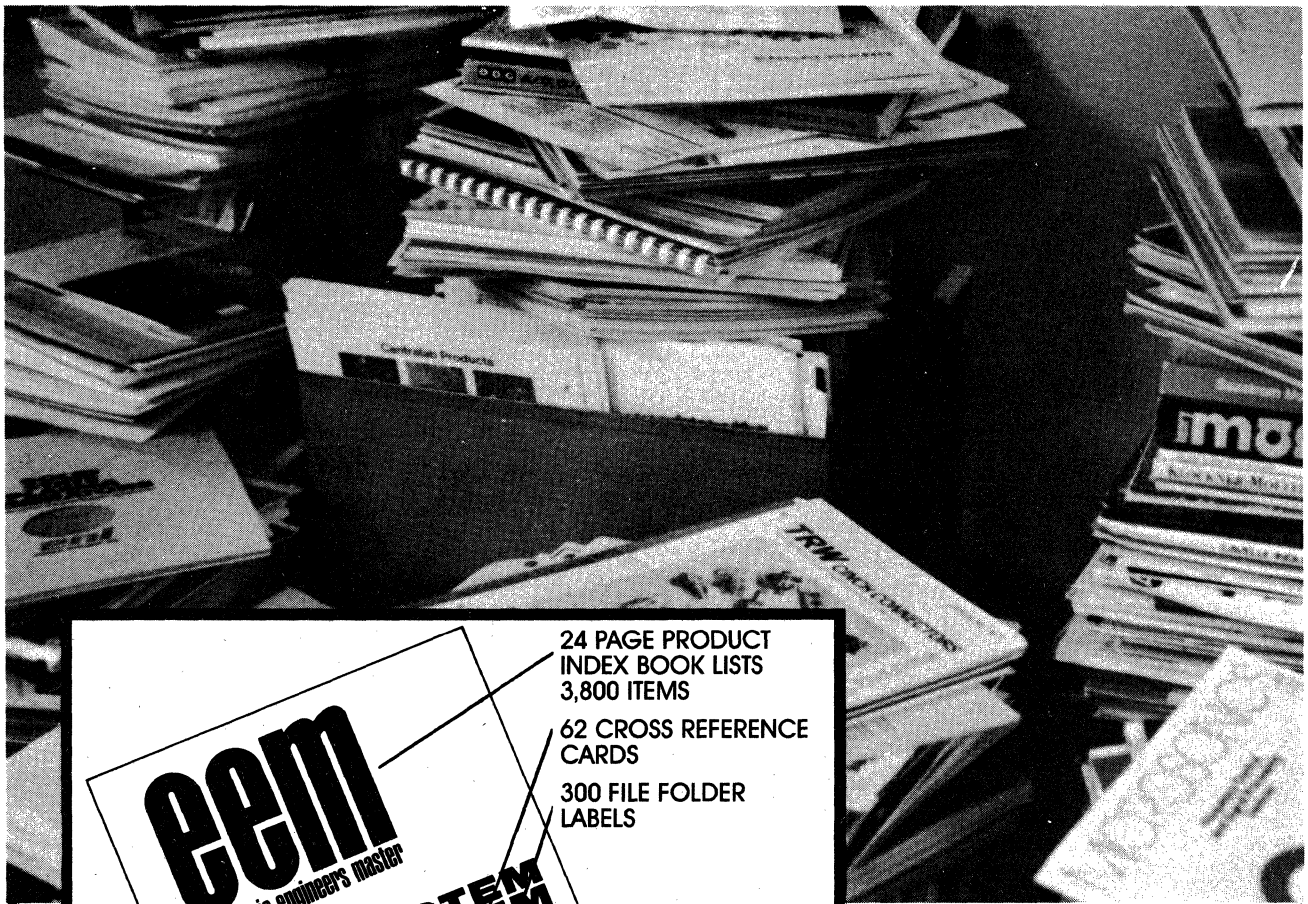

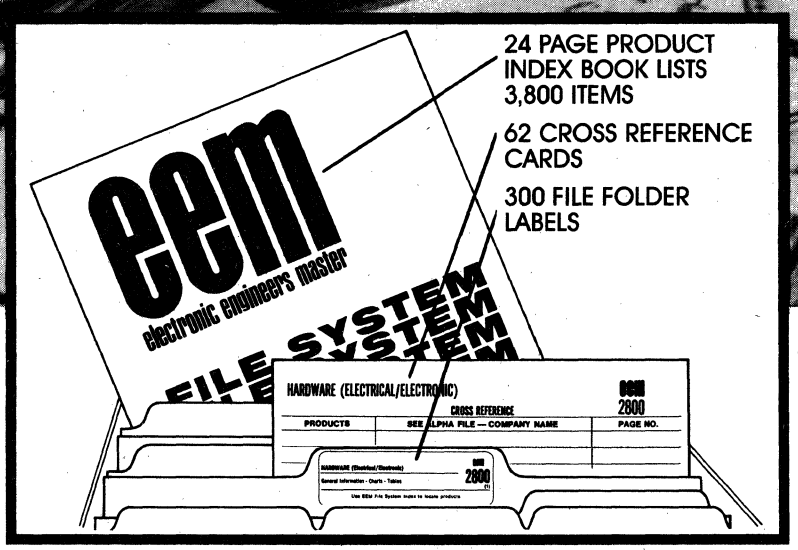

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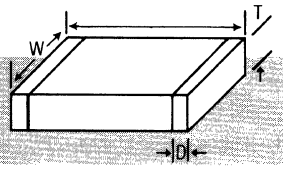
Surface Mounted Devices

Ceramic Multilayer Capacitors



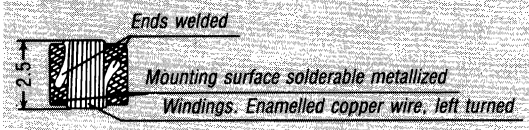
Material	C-VALUE (pF) KEFQ 40 (0805)	KEFQ 42 (1210)	KEFQ 46 (1206)
**NPO	10-1000	100-3300	10-1500
X7R	680-15,000	3300-100,000	1500-33,000
*Z5U	4700-100,000	22,000-1,000,000	10,000-330,000

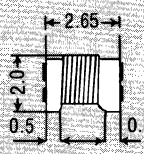
*Available in 50V DC only. **Other TC material available.
For information concerning sizes and values consult Factory.

Style	*Rated voltage	DIMENSIONS L (mm)	(in)	W (mm)	(in)	D (mm)	(in)	T (mm)	(in)
KEFQ 40 (0805)	50 V	2.0 ±0.3	.08	1.27 ±0.3	.05	.51	.02	1.27	.05
	100 V								
KEFQ 42 (1210)	50 V	3.17 ±0.4	.125	2.54 ±0.3	.10	.51	.02	1.5	.059
	100 V								
KEFQ 46 (1206)	50 V	3.17 ±0.4	.125	1.6 ±0.15	.063	.51	.02	.63	.025
	100 V								
KEFQ 46 (1206)	50 V	3.17 ±0.4	.125	1.6 ±0.15	.063	.51	.02	1.27	.050
	100 V								

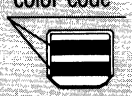
*Higher voltages upon request. Available on 8mm tape

Miniature Chip Inductors





color code



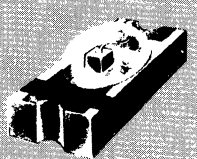
Also Available in 1206 style.

Inductance range	10 nH . . . 10 µH
Inductance tolerance	5%/10%/20%
Q factor	50 . . . 25
Self-resonant frequency	> 1250 MHz . . . 100 MHz
max. direct-current load	1 A . . . 0.14 A
Direct-current resistance	60 mΩ . . . 6.8 Ω

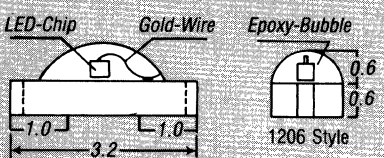
CERLED®

CR10 Series (clear epoxy lens)
CR12 Series (diffused epoxy lens)
CR10SR Series (120 mcd 180°)
INFRARED AVAILABLE

CERAMIC CHIP LED orange red – R, yellow – Y, green – G, yellowgreen – YG



actual size



Description

LED on a ceramic substrate and can be used like a single LED-chip in any customer's configuration.

Easy to handle during – soldering or bonding with conductive epoxy.

Also for molded displays any shapes, for arrays and circles.

Wide floating light area.

End-to-end and side-to-side stackable.

CR10 and CR12 OPTO-ELECTRONIC CHARACTERISTICS (at 25°C)

		min.	typ.	
Luminous intensity — 1p 20 mA	orange red	2.5	3.0	mcd
	yellow	3.0	3.5	mcd
	green	2.8	4.0	mcd
	yellowgreen	4.0	6.0	mcd
Forward voltage — orange red				2.2 V
yellow				2.5 V
green				2.3 V
yellowgreen				2.1 V
Emission peak wavelength — orange red				635 nm
yellow				590 nm
green				560 nm
yellowgreen				568 nm
Reverse leakage				10 µA max.
Viewing angle				min. 180 degrees

MAXIMUM RATINGS

Power dissipation (25°C)	180 mW
Derating linearly from 25°C	1.7 mW/°C
Storage & operating temperature	−55 to +100 °C
Soldering temperature	1 sec at 250 °C
Temperature for heat treatment	180 sec at 220 °C
Peak inverse voltage	3.0 V
Peak forward current	75 mA

STCO

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MULTILAYER CERAMIC CAPACITORS

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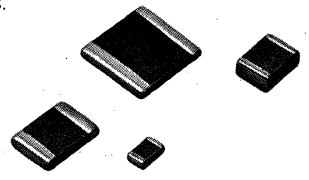
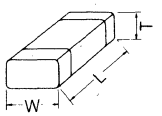
CHIP CAPACITORS-C1508, C2012, C3225, C4532, C5650

Multilayer chip capacitors having a low residual inductance, an excellent frequency response and minimal stray capacitance since there are no leads. These characteristics enable specifications to be very close to the theoretical values of the chips.





Shapes and dimensions

Dimensions in mm (inches)

Type	L	W	T max.
C1508	1.5±0.2 (.059)	0.8±0.2 (.032)	1.0 (.039)
C2012	2.0±0.3 (.079)	1.25±0.2 (.049)	1.25 (.049)
C3225	3.2±0.4 (.126)	2.5±0.3 (.098)	1.9 (.075)
C4532	4.5±0.5 (.177)	3.2±0.4 (.126)	1.9 (.075)
C5650	5.6±0.5 (.220)	5.0±0.5 (.197)	1.9 (.075)

Temperature compensating

Class I

C0G 50V, 100V

Type	Capacitance (pF) 50V (1H)	100V (2A)
C1508C0G	0.5 to 180	0.5 to 120
C2012C0G	0.5 to 560	0.5 to 390
C3225C0G	10 to 3,300	10 to 2,200
C4532C0G	1,000 to 5,600	1,000 to 3,900
C5650C0G	1,000 to 10,000	1,000 to 6,800
Capacitance tolerance	Up to 10pF: ±1pF (F) ±0.5pF (D), ±0.25pF (C)	Over 10pF: ±10% (K) ±5% (J)

SL 50V, 100V

Type	Capacitance (pF) 50V (1H7)	100V (2A)
C1508SL*	0.5 to 470	0.5 to 330
C2012SL	0.5 to 1,800	0.5 to 1,200
C3225SL	100 to 8,200	100 to 5,600
C4532SL	1,000 to 18,000	1,000 to 12,000
C5650SL	1,000 to 33,000	1,000 to 22,000
Capacitance tolerance	Up to 10_pF: $\pm1_pF$ (F) $\pm0.5_pF$ (D), $\pm0.25_pF$ (C)	Over 10_pF: ±10% (K) ±5% (J)

SL: Temperature coefficient, +350 to −1000 ppm/°C, Temperature range, −30 to 85°C

Class II

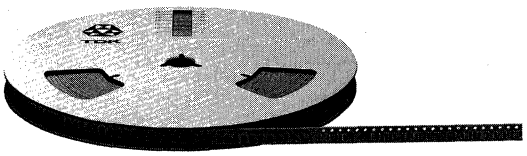
X7R 50V, 100V

Type	Capacitance (pF) 50V (1H)	100V (2A)
C1508X7R	47 to 5,600	47 to 3,900
C2012X7R	47 to 18,000	47 to 12,000
C3225X7R	1,000 to 150,000	1,000 to 82,000
C4532X7R	10,000 to 220,000	10,000 to 150,000
C5650X7R	100,000 to 470,000	100,000 to 330,000
Capacitance tolerance	±10% (K), ±20% (M)	

Y5V 50V, 100V

Type	Capacitance (pF) 50V (1H)	100 (2A)
C1508Y5V	2,200 to 22,000	2,220 to 10,000
C2012Y5V	2,200 to 100,000	2,200 to 47,000
C3225Y5V	10,000 to 470,000	10,000 to 220,000
C4532Y5V	22,000 to 1,000,000	22,000 to 470,000
C5650Y5V	470,000 to 1,500,000	470,000 to 1,000,000
Capacitance tolerance	$+80_{-20}$ % (Z)	

CHIP CAPACITORS FOR AUTOMATIC MOUNTING-C3216, C2012



Dimensions in mm (inches)

Type	L	W	T
C3216	3.2±0.2 (.126)	1.6±0.15 (.063)	0.6±0.15 (.024) 0.85±0.15 (.034) 1.1±0.2 (.043)
C2012	$2.0^{+0.3}_{-0.1}$ (.079)	$1.25^{+0.3}_{-0.1}$ (.049)	0.6±0.15 (.024) 0.85±0.15 (.034) 1.1±0.2 (.043)

Temperature compensating, Class I

50V

Type	TC	Capacitance T = 0.6	T = 0.85	T = 1.1
C3216CHIH	C0H	0.5 to 330	390 to 470	650 to 680
C3216PHIH	P2H	0.5 to 330	390 to 560	680 to 820
C3216RHIH	R2H	0.5 to 390	470 to 680	820 to 1,000
C3216SHIH	S2H	0.5 to 470	560 to 680	820 to 1,200
C3216THIH	T2H	0.5 to 560	680 to 820	1,000 to 1,200
C3216UJIH	U2J	0.5 to 560	680 to 1,000	1,200 to 1,500
C3216SLIH	SL*	0.5 to 1,200	1,500 to 1,800	2,200 to 2,700
C2012CHIH	C0H	0.5 to 180	200 to 330	360 to 430
C2012PHIH	P2H	0.5 to 220	240 to 390	430 to 560
C2012RHIH	R2H	0.5 to 240	270 to 510	560 to 680
C2012SHIH	S2H	0.5 to 270	300 to 560	620 to 750
C2012THIH	T2H	0.5 to 330	360 to 680	750 to 820
C2012UJIH	U2J	0.5 to 390	430 to 750	820 to 1,000
C2012SLIH	SL*	0.5 to 820	1,000 to 1,300	1,500 to 1,800
Capacitance tolerance		Up to 5_pF $\pm0.5_pF$ (D) $\pm0.25_pF$ (C)	Up to 10_pF $\pm1_pF$ (F) $\pm0.5_pF$ (D)	Over 10_pF ±10% (K) ±5% (J)

Temperature coefficient, +350 to −1000 ppm/°C Temperature range, −30 to 85°C

Class II

50V, 25V

Type	TC	WV (V)	Capacitance (pF) T = 0.6	T = 0.85	T = 1.1
C3216BIH	B	50	1,000 to 15,000	18,000	22,000 to 27,000
C3216BIE		25	12,000 to 27,000	33,000 to 39,000	47,000
C3216DIH	D	50	1,000 to 22,000	33,000	47,000
C3216DIE		25	33,000 to 47,000	68,000	100,000
C3216FIH	F	50	4,700 to 47,000	68,000	100,000
C3216FIE		25	47,000 to 100,000	150,000	220,000
C2012BIH	B	50	470 to 5,600	6,800 to 10,000	12,000 to 15,000
C2012BIE		25	6,800 to 10,000	12,000 to 18,000	22,000 to 27,000
C2012DIH	D	50	1,000 to 6,800	8,200 to 15,000	18,000 to 22,000
C2012DIE		25	10,000 to 15,000	22,000 to 27,000	33,000 to 39,000
C2012FIH	F	50	3,300 to 15,000	22,000 to 33,000	47,000
C2012FIE		25	22,000 to 33,000	47,000	100,000

Capacitance tolerance		Temperature coefficient	
	TC: B, ±10% (K), ±20% (M)		TC: B, ±15% (−55 to 125°C)
	TC: D, ±20% (M)		TC: D, $^{+22}_{-33}$ % (−30 to 85°C)
	TC: F, $^{+80}_{-20}$ % (Z)		TC: F, $^{+22}_{-82}$ % (−30 to 85°C)

MULTILAYER CERAMIC CAPACITORS

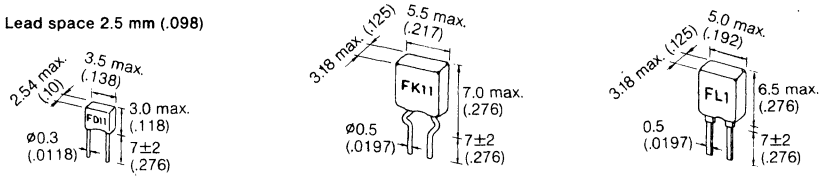
TDK®

TDK CORPORATION OF AMERICA 4711 West Golf Road, Suite 300, Skokie, Illinois 60076, U.S.A. Phone: (312) 679-8200 **CHICAGO SALES OFFICE** (312) 679-8200 **LOS ANGELES SALES OFFICE** (213) 539-6631 **SAN FRANCISCO SALES OFFICE** (408) 943-9325 **NEW YORK SALES OFFICE** (516) 625-0100 **INDIANAPOLIS SALES OFFICE** (317) 872-0370 **DETROIT BRANCH** (313) 353-9393 **ALABAMA BRANCH** (205) 539-4551 **TDK CORPORATION** Tokyo, Japan

DIPPED RADIAL LEADS-FD11, FK11, FL-1, FK20, FK22, FD23, FL-2

Multilayer capacitors having internal electrodes covered by ceramic dielectric to give them excellent resistance to dampness and humidity. Dipped radial leads, however, are further coated by a fluidized bed process so that they maintain high levels of stability and reliability under stringent environmental conditions.

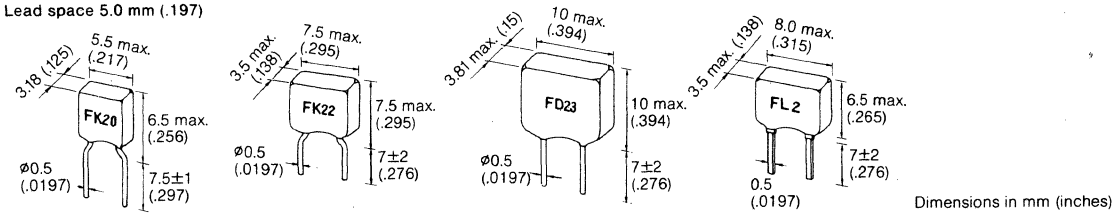
Lead space 2.5 mm (.098)



Dimensions in mm (inches)

Type	Capacitance (pF)							
	TC C0G		SL		X7R		Y5V	
	WV 50V (1H)	100V (2A)	50V (1H)	100V (2A)	50V (1H)	100V (2A)	50V (1H)	100V (2A)
FD11	0.5 to 560	0.5 to 390	0.5 to 1,800	0.5 to 1,000	1,000 to 18,000	1,000 to 12,000	10,000 to 100,000	10,000 to 47,000
FK11	10 to 3,300	10 to 2,200	100 to 8,200	100 to 4,700	1,000 to 150,000	1,000 to 82,000	10,000 to 470,000	10,000 to 220,000
FL1	10 to 2,700	10 to 1,800	100 to 6,800	100 to 3,900	1,000 to 100,000	1,000 to 68,000	10,000 to 220,000	10,000 to 100,000
Capacitance tolerance	Up to 10_pF ±0.5$_p$F (D), ±0.25$_p$F (C)		Over 10_pF ±10% (K), ±5% (J)		±10% (K), ±20% (M)		$^{+80}_{-20}$ % (Z)	

Lead space 5.0 mm (.197)

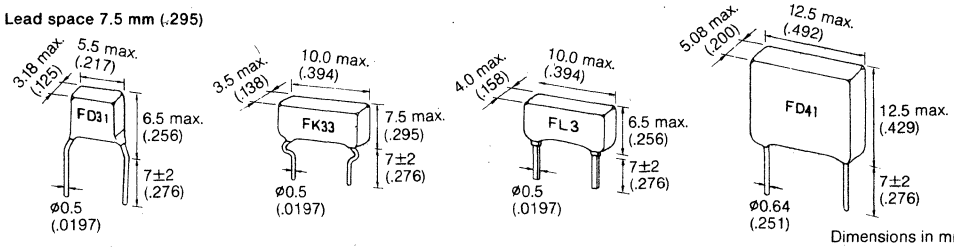


Dimensions in mm (inches)

Type	Capacitance (pF)							
	TC C0G		SL		X7R		Y5V	
	WV 50V (1H)	100V (2A)	50V (1H)	100V (2A)	50V (1H)	100V (2A)	50V (1H)	100V (2A)
FK20	10 to 3,300	10 to 2,200	100 to 8,200	100 to 4,700	1,000 to 150,000	1,000 to 82,000	10,000 to 470,000	10,000 to 220,000
FK22	1,000 to 5,600	1,000 to 3,900	1,000 to 18,000	1,000 to 10,000	10,000 to 220,000	10,000 to 150,000	22,000 to 1,000,000	22,000 to 470,000
FD23	6,800 to 27,000	4,700 to 15,000	22,000 to 68,000	12,000 to 39,000	270,000 to 680,000	180,000 to 470,000	1,500,000 to 4,700,000	1,000,000 to 2,200,000
FL2	1,000 to 3,900	1,000 to 2,700	1,000 to 10,000	1,000 to 5,600	10,000 to 180,000	10,000 to 100,000	22,000 to 470,000	22,000 to 220,000
Capacitance tolerance	Up to 10pF ±0.5pF (D), ±0.25 pF (C)		Over 10pF ±10% (K), ±5% (J)		±10% (K), ±20% (M)		$^{+80}_{-20}$ % (Z)	

DIPPED RADIAL LEADS-FD31, FK33, FL3, FD41

Lead space 7.5 mm (.295)



Dimensions in mm (inches)

Type	Capacitance (pF)							
	TC C0G		SL		Y5R		Y5V	
	WV 50V (1H)	100V (2A)	50V (1H)	100V (2A)	50V (1H)	100V (2A)	50V (1H)	100V (2A)
FD31	330 to 3,900	330 to 2,200	33 to 8,200	33 to 4,700	2,200 to 120,000	2,200 to 68,000	10,000 to 470,000	100,000 to 220,000
FK33	1,000 to 5,600	1,000 to 3,900	1,000 to 22,000	1,000 to 12,000	10,000 to 330,000	10,000 to 180,000	22,000 to 1,000,000	22,000 to 470,000
FL3	1,000 to 12,000	1,000 to 6,800	1,000 to 4,700	1,000 to 3,300	10,000 to 220,000	10,000 to 120,000	22,000 to 470,000	22,000 to 220,000
FD41	1,000 to 33,000	1,000 to 15,000	10,000 to 82,000	10,000 to 47,000	100,000 to 1,000,000	100,000 to 680,000	1,000,000 to 6,800,000	1,000,000 to 4,700,000
Capacitance tolerance	±10% (K) ±5% (J)				±20% (M) ±10% (K)		$^{+80}_{-20}$ % (Z)	

MULTILAYER CERAMIC CAPACITORS

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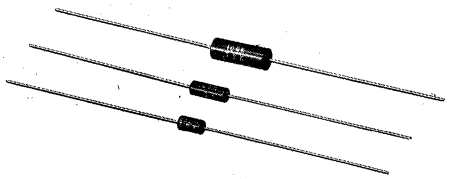
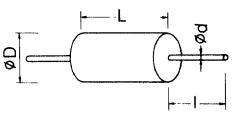
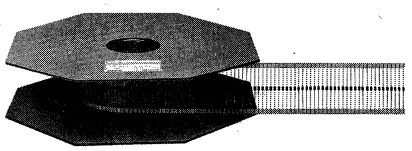
MOLDED AXIAL LEADS-MA12, MA13, MA14

Molded axial leads are molded by an epoxy resin so that they maintain high levels of stability and reliability under stringent environmental conditions. In particular, they are characterized by a high mechanical strength.



Shape and dimensions





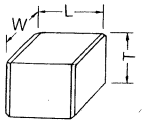
Type	Dimensions, mm (inches)			
	L	D	d	l
MA12	4.06±0.25 (.16)	2.29±0.25 (.09)	0.5 (.02)	25 max. (.984)
MA13	6.35±0.25 (.25)	2.29±0.25 (.09)	0.5 (.02)	25 max. (.984)
MA14	9.91±0.25 (.39)	3.56±0.25 (.14)	0.64 (.025)	25 max. (.984)

Type	Capacitance (pF)							
	TC C0G		SL		X7R		Y5V	
	WV 50V (1H)	100V (2A)	50V (1H)	100V (2A)	50V (1H)	100V (2A)	50V (1H)	100V (2A)
MA12	0.5 to 560	0.5 to 390	0.5 to 1,800	0.5 to 1,200	100 to 18,000	100 to 12,000	10,000 to 100,000	10,000 to 47,000
MA13	100 to 1,500	100 to 1,000	100 to 5,600	100 to 3,900	1,000 to 56,000	1,000 to 39,000	10,000 to 220,000	10,000 to 100,000
MA14	1,000 to 4,700	1,000 to 3,300	1,000 to 12,000	1,000 to 8,200	10,000 to 220,000	10,000 to 150,000	100,000 to 470,000	100,000 to 220,000
Capacitance tolerance	Up to 10pF ±0.5pF (D), ±0.25pF (C)		Over 10pF ±10% (K), ±5% (J)		±20% (K), ±10% (K)		$^{+80}_{-20}$ % (Z)	

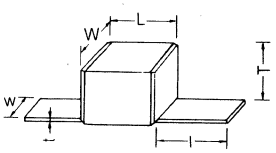
LOW-LOSS CAPACITORS FOR HIGH FREQUENCIES-FC, FR, HR

Low-loss capacitors for high frequencies are designed for application in 100 to 1000MHz high-frequency power circuits. They are characterized by an excellent frequency response, a high Q factor, low noise, high self resonance and superior resistance solder heat.

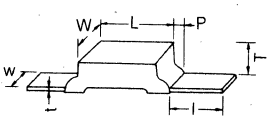
FC1414·FC2828

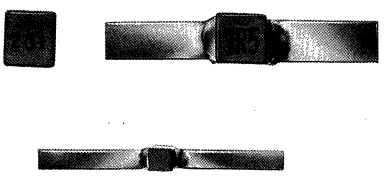


FR1414·FR2828



HR3225





Dimensions in mm (inches)

Type	L	W	T	l	w	t	p
FC1414	1.4±0.4 (.055)	1.4±0.3 (.055)	1.6 max. (.063)	–	–	–	–
FC2828	$2.8^{+0.5}_{-0.3}$ (.11)	2.8±0.4 (.11)	3.0 max. (.12)				
FR1414	1.4±0.4 (.055)	1.4±0.3 (.055)	1.6 max. (.063)	5 min. (.2)	1.3±0.3 (.05)	$0.1^{+0.3}_{-0.01}$ (.004)	–
FR2828	$2.8^{+0.5}_{-0.3}$ (.11)	$2.8^{+0.5}_{-0.3}$ (.11)	3.0 max. (.12)	5 min. (.2)	2.2±0.3 (.09)	$0.1^{+0.3}_{-0.01}$ (.004)	–
HR3225	$3.5^{+0.5}_{-0.3}$ (.14)	$2.8^{+0.5}_{-0.3}$ (.055)	2.0 max. (.08)	5 min. (.2)	2.2±0.3 (.09)	$0.1^{+0.3}_{-0.01}$ (.004)	1.5 max. (.06)

Type	Rated voltage	Capacitance (pF)		
		C0G		X7R
FC1414 FR1414	50V (1H)	0.5 to 100		150 to 3,300
FC2828 FR2828	500V (2H)	0.5 to 100		–
	300V (2F)	120 to 180		–
	200V (2D)	220 to 470		–
	100V (2A)	560		–
	50V (1H)	680 to 1,000		470 to 22,000
HR3225	220V (2D)	0.5 to 82		–
	100V (2A)	100 to 220		–
	50V (1H)	270 to 1,000		680 to 22,000
Capacitance tolerance		Up to 10pF ±0.5pF (D) ±0.25pF (C)	Over 10pF ±10% (K) ±5% (J)	±10% (K) ±20% (M)

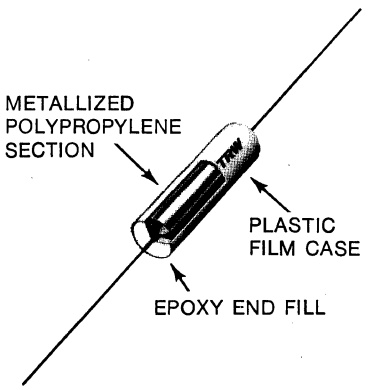
Metallized Polypropylene Dielectric

Type X363UW

Subminiature... Instrument Grade

- **Long stable life**
- **Very high insulation resistance**
- **Lowest dissipation factor**
- **Humidity resistant**
- **Saves on size and weight**
- **Capacitance tolerance to 1%**

CUT-AWAY SHOWS CONSTRUCTION



Used for a number of years in the non-precision power capacitor field, polypropylene has now been developed by TRW Capacitors as a dielectric for miniaturized precision capacitors exhibiting unique and outstanding electrical and environmental characteristics. Particularly worthy of note is its stability. The X363UW exhibits negligible shift in capacitance under long term exposure to humidity, operating life, and temperature cycling. Insulation resistance, dielectric absorption and dissipation factor properties are all the equivalent of or superior to those of polystyrene.

SPECIFICATIONS

Insulation Resistance: Shall be greater than 300,000 megohms for capacitance values .33 mfd and less or 100,000 megohms x mfd for capacitance values greater than .33 mfd; when measured after 2 minutes electrification at 100 VDC and 25°C.

Voltage Range: 100, 200, 400 VDC.

Dielectric Strength: 200% rated voltage for one minute through a limiting resistance of 100 ohms/volt at 25°C.

Dissipation Factor: Shall not be greater than .10% when measured at or referred to 1000 ±20 Hz for capacitance values up to and including 1.0 mfd at 25 ±5°C. Capacitance values greater than 1.0 mfd shall be measured or referred to 120 ±20 Hz.

Dielectric Absorption: When tested per MIL-C-19978 the dielectric absorption shall not exceed .05%. Shorter test methods produce lower results. For further information, consult TRW Engineering.

Capacitance: Shall be within specified tolerance when measured at or referred to 1000 ±20 Hz for values up to and including 1.0 mfd at 25 ±5°C. Capacitance values greater than 1.0 mfd shall be measured or referred to 120 ±20 Hz.

Temperature Range: −55° to +105°C at full rated voltage.

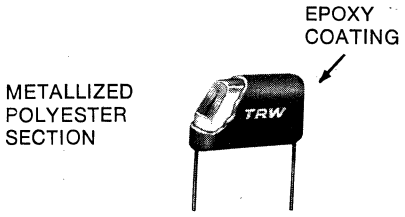
Capacitance Range: 0.010 thru 15.0 mfd.

Metallized Polyester

Type X601PE-X601CPE

Dipped Epoxy Coating

- **Ultra miniature, lightweight**
- **Tough, Rugged Case**
- **Styled for maximum packaging efficiency**
- **Capacitance values to 10 mfd**
- **Tolerances to ±5%**



CUT-AWAY SHOWS CONSTRUCTION

The X601PE was designed for quality capacitor applications utilizing the advance technology of TRW. It is ideally designed for "Space Age" applications requiring the best the industry has to offer in minimum size and weight, consistent with maximum reliability. The X601PE line is now available in a full range of value from 0.01 to 10.0 mfd in 100 and 200 VDC. The unit is excellent in electrical and environmental performance throughout this range.

SPECIFICATIONS

Insulation Resistance: Shall be greater than 25,000 megohms for capacitance values .4 mfd and less or 10,000 megohms x mfd for capacitance values greater than .4 mfd; when measured after 2 minutes electrification at rated voltage and 25°C.

Dissipation Factor: Shall not be greater than 1.0% when measured at or referred to 1000 ±20 Hz for capacitance values up to and including 1.0 mfd at 25 ±5°C. Capacitance values greater than 1.0 mfd shall be measured or referred to 120 ±20 Hz.

Dielectric Strength: 200% rated voltage for one minute through a limiting resistance of 100 ohms/volt at 25°C.

Humidity Resistance: Capable of withstanding 96 hrs. of 90 to 95% relative humidity at 40°C and no voltage applied with no more than one failure (catastrophic: open or short) out of 12 samples.

Life Test: Capable of withstanding 125% of rated voltage for 250 hrs. at 85°C with no more than one failure (catastrophic: open or short) out of 12 samples.

Temperature Range: −55 to +85°C at full rated voltage, to 125°C with 50% voltage derating.

Construction: Metallized Polyester, non-inductive winding.

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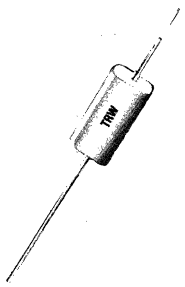
Metallized Polyester

Type X663F and X663FR

- **Axial or Radial Leads**
- **Ultra-miniature, Lightweight**
- **High Insulation Resistance**
- **Instrument Quality**
- **Self-healing • Long Stable Life**
- **Capacitance Range — .01 thru 10.0 mfd**



TRW types X663F and X663FR greatly improve flexibility in fitting capacitors into crowded chassis layouts. Choice between axial or radial leads plus thin oval designs often results in saving of valuable chassis space.

These advanced designs do not sacrifice reliability to obtain ultra-miniature dimensions. The significant size-saving over conventional construction is secured by using metallized Polyester — thereby eliminating two layers of heavy-gauge foil in every layer of the winding.

SPECIFICATIONS

Insulation Resistance: Shall be greater than 25,000 megohms for capacitance values .40 mfd and less or 10,000 megohms x mfd for capacitance values greater than .40 mfd; when measured after 2 minutes electrification at rated voltage and 25°C.

Dissipation Factor: Shall not be greater than 1.0% when measured at or referred to 1000 ±20 Hz for capacitance values up to and including 1.0 mfd at 25 ±5°C; except for capacitors having a thickness less than .170, then df shall not be greater than 1.5%. Capacitance values greater than 1.0 mfd shall be measured or referred to 120 ±20 Hz.

Life Test: Capable of withstanding 125% of rated voltage for 250 hrs. at 85°C with no more than one failure (catastrophic: open or short) out of 12 samples.

Dielectric Strength: 200% rated voltage for one minute through a limiting resistance of 100 ohms/volt at 25°C.

Humidity Resistance: Capable of withstanding 96 hrs. of 90 to 95% relative humidity at 40°C and no voltage applied with no more than one failure (catastrophic: open or short) out of 12 samples.

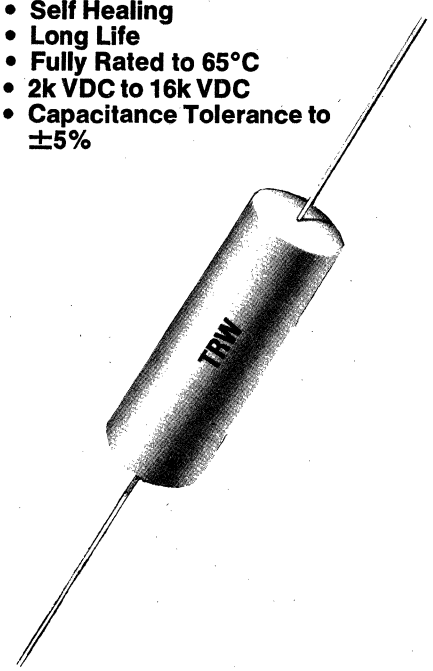
Temperature Range: −55 to +85°C at full rated voltage, to 125°C with 50% voltage derating.

Voltage Range: 50 VDC thru 600 VDC.

Metallized Polyester

Type X675 HV (High Voltage)

- **Small Size, Lightweight**
- **Self Healing**
- **Long Life**
- **Fully Rated to 65°C**
- **2k VDC to 16k VDC**
- **Capacitance Tolerance to ±5%**



The X675 HV capacitor is a high voltage capacitor designed to meet the needs of voltage multipliers and high voltage filters required in today's high density, high voltage, power supplies. Uses are found in CRT displays of all types, copiers and laboratory instruments and power supplies.

In keeping with the state of the art in construction of silicon high voltage rectifiers, the physical design of the X675 HV lends itself to this demanding application. The dry winding and skin tight polyester case offer considerable size and weight reductions from former high voltage designs.

SPECIFICATIONS

Insulation Resistance: Shall be greater than 25,000 megohms for capacitance values .4 mfd and less or 10,000 megohms x mfd for capacitance values greater than .4 mfd; when measured after 2 minutes electrification at 500 VDC and 25°C.

Dissipation Factor: Shall not be greater than 1.0% when measured at or referred to 1000 ±20 Hz and 25 ±5°C.

Dielectric Strength: 140% rated voltage for 10 seconds through a limiting resistance of 100 ohms/volt at 25°C.

Humidity Resistance: Capable of withstanding 96 hrs. of 90 to 95% relative humidity at 40°C and no voltage applied with no more than one failure (catastrophic: open or short) out of 12 samples.

Life Test: Capable of withstanding 125% of 85°C rated voltage for 250 hrs. at 85°C with no more than one failure (catastrophic: open or short) out of 12 samples.

Capacitance Tolerance: Shall be within specified tolerance when measured at or referred to 1000 ±20 Hz and 25 ±5°C.

Temperature Range: −55° to +65°C at full rated voltage, to 85°C with 25% voltage derating.

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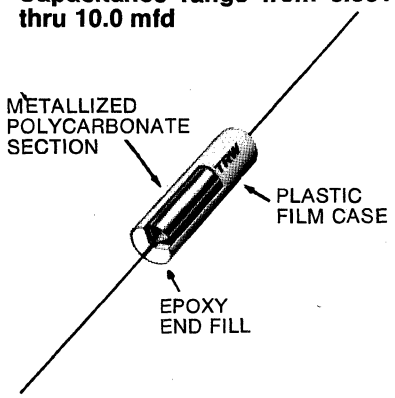
Metallized Polycarbonate

Type X463UW

- **Small size — Lightweight**
- **Very low temperature coefficient**
- **Fully rated from −55°C to +125°C**
- **High insulation resistance**
- **Excellent retrace**
- **Tolerances to ±1%**
- **Capacitance range from 0.001 thru 10.0 mfd**



The increasing demand for reduction in size and weight coupled with requirements for enhanced circuit performance, requires capacitors which incorporate the latest developments in component technology. TRW has now introduced a capacitor which combines the improved electrical performance of polycarbonate and the size and weight reductions associated with a metallized dielectric.

SPECIFICATIONS

Insulation Resistance: Shall be greater than 100,000 megohms for capacitance values .5 mfd and less or 50,000 megohms x mfd for capacitance values greater than .5 mfd; when measured after 2 minutes electrification at rated voltage and 25°C.

Dissipation Factor: Shall not be greater than .3% when measured at or referred to 1000 ±20 Hz for capacitance values up to and including 1.0 mfd at 25 ±5°C. Capacitance values greater than 1.0 mfd shall be measured or referred to 120 ±20 Hz.

Dielectric Strength: 200% rated voltage for one minute through a limiting resistance of 100 ohms/volt at 25°C.

Life Test: Capable of withstanding 125% of rated voltage for 250 hrs. at 85°C with no more than one failure (catastrophic: open or short) out of 12 samples.

Temperature Range: −55° to +125°C at full rated voltage.

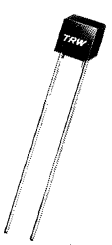
Humidity Resistance: Capable of withstanding 96 hrs. of 90 to 95% relative humidity at 40°C and no voltage applied with no more than one failure (catastrophic: open or short) out of 12 samples.

Voltage Ranges: 50, 100, 200, 400 VDC.

Metallized Polycarbonate

Type X441

- **Minimum possible size — Lightweight**
- **Very low temperature coefficient**
- **Fully rated from −55°C to +125°C**
- **High insulation resistance**
- **Tolerances to ±1%**
- **Capacitance Range 0.001 thru 0.10 mfd**



The X441 has been specifically designed to be a real help in the ever increasing problem of fitting components in today's miniaturized designs. Its absolute minimum size, precision dimensions, and the close tolerance lead spacing permit space savings impossible before. Additionally, the highly impressive electrical properties of polycarbonate are of immense value in modern high performance circuitry.

Standoffs on the bottom of the premolded case provide for rigid, secure mounting and facilitate cleaning of the printed circuit boards. Leads are uniformly and accurately spaced on 0.200″ centers.

SPECIFICATIONS

Voltage Rating: 50 VDC from −55°C to +125°C.

Insulation Resistance: Shall be greater than 100,000 megohms when measured after 2 minutes electrification at rated voltage and 25°C.

Dissipation Factor: Shall not be greater than 0.3% when measured at or referred to 1000 ±20 Hz and 25 ±5°C.

Capacitance: Shall be within specified tolerance when measured at or referred to 1000 ±20 Hz and 25 ±5°C.

Dielectric Strength: 200% rated voltage for one minute through a limiting resistance of 100 ohms/volt at 25°C.

Life Test: Capable of withstanding 125% of rated voltage for 250 hrs. at 85°C with no more than one failure (catastrophic: open or short) out of 12 samples.

Humidity Resistance: Capable of withstanding 96 hrs. of 90 to 95% relative humidity at 40°C and no voltage applied with no more than one failure (catastrophic: open or short) out of 12 samples.

Construction: Metallized polycarbonate dielectric, non-inductive winding Epoxy case with standoffs.

Leads: 22 AWG solder coated or tinned solid wire on .200″ centers.

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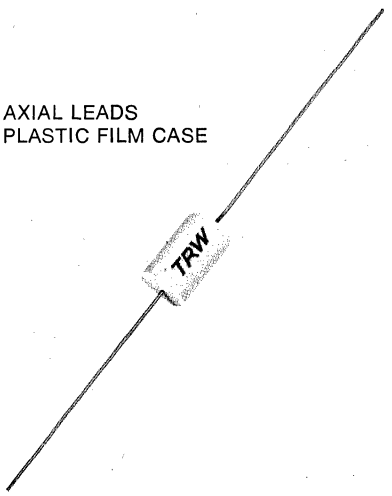
Metallized Polyester Flattened

Type X659F

- **Smallest possible size**
- **High insulation resistance**
- **Self-healing — Long stable life**
- **Full voltage range — 50 thru 400W VDC**
- **Capacitance values to 20.0 mfd**

AXIAL LEADS
PLASTIC FILM CASE



TRW Type X659F adds a complete new dimension to circuit board layout by providing a metallized polyester, wound flattened capacitor, in sizes never before available. This advance design which utilizes the very thin gauges of metallized polyester, coupled with TRW's advanced manufacturing technology and in-house metallizing capability and control, offers the same rugged durability and reliability as all TRW Capacitors.

This basic reliability and the proven performance record of metallized polyester makes the X659F the ideal choice where freedom in equipment design and durability is required.

SPECIFICATIONS

Insulation Resistance: Shall be greater than 25,000 megohms for capacitance values .40 mfd and less or 10,000 megohms x mfd for capacitance values greater than .40 mfd; when measured after 2 minutes electrification at rated voltage and 25°C.

Dissipation Factor: Shall not be greater than 1.0% when measured at or referred to 1000 ±20 Hz for capacitance values up to and including 1.0 mfd at 25 ±5°C; except for capacitors having a thickness less than .170, then df shall not be greater than 1.5%. Capacitance values greater than 1.0 mfd shall be measured or referred to 120 ±20 Hz.

Temperature Range: −55° to +85°C at full rated voltage, to 125°C with 50% voltage derating.

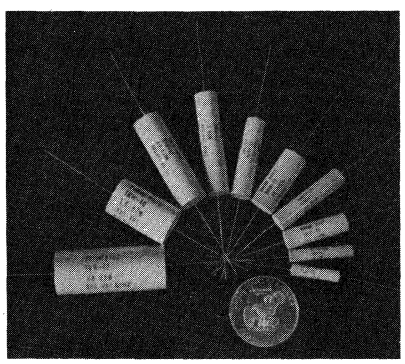
Humidity Resistance: Capable of withstanding 96 hrs. of 90 to 95% relative humidity at 40°C and no voltage applied with no more than one failure (catastrophic: open or short) out of 12 samples.

Dielectric Strength: 200% rated voltage for one minute through a limiting resistance of 100 ohms/volt at 25°C.

Metallized Polyester Dielectric

Types TRW-38, -40, -41 and -42

- **AC voltage ratings from 220 to 460 volts, 50/60 Hz**
- **Capacitance values to 10.0 mfd**
- **Flame-retardant tape wrap case**



APPLICATIONS

Type TRW-38, -40, -41 and -42 capacitors can be utilized for applications such as motor run, motor speed control, and noise filtering, as found in computer peripherals such as terminals, printers and disc drives; in large and small cooling fans and small motors of all types. Special terminals such as stranded insulated leads or quick disconnects are available on a customized basis. Consult the factory for details.

SPECIFICATIONS

Type	TRW-38	TRW-40	TRW-41	TRW-42
Capacitance Range	0.500 to 10.000 mfd	0.047 to 2.0 mfd	0.047 to 2.0 mfd	0.01 to 2.0 mfd
Dielectric Strength *	400 VDC	900 VDC	1500 VDC	2100 VDC
AC Voltage Rating	220 Vrms, 50/60 Hz	330 Vrms, 50/60 Hz	370 Vrms, 50/60 Hz	460 Vrms, 50/60 Hz
Corona Onset (min.)	—	480 Vrms, 60 Hz	460 Vrms, 60 Hz	600 Vrms, 60 Hz

* For one minute through a limiting resistance of 100 ohms/volt

Insulation Resistance: Shall be greater than 10,000 megohms x mfd when measured after 2 minutes electrification at 200 VDC and 25°C.

Dissipation Factor: Shall not be greater than 1.0% when measured at or referred to 1000 ±20 Hz for capacitance values up to and including 1.0 mfd at 25 ±5°C. Capacitance values greater than 1.0 mfd shall be measured or referred to 120 ±20 Hz.

Capacitance: Shall be within specified tolerance when measured at or referred to 1000 ±20 Hz for values up to and including 1.0 mfd at 25 ±5°C. Capacitance values greater than 1.0 mfd shall be measured or referred to 120 ±20 Hz.

Humidity Resistance: Capable of withstanding 96 hrs. of 90 to 95% relative humidity at 40°C and no voltage applied with no more than one failure (catastrophic: open or short) out of 12 samples.

Life Test: Capable of withstanding 125% of rated voltage for 250 hrs. at 85°C with no more than one failure (catastrophic: open or short) out of 12 samples.

Case: Flame retardant polyester tape wrap with flame retardant epoxy endfill.

Lead Material: Solder coated or tinned solid wire.

Temperature Range: −55°C to +85°C.

PERFORMANCE

Type TRW-38, -40, -41 and -42 capacitors are constructed from metallized polyester film and offer small size, less weight and long reliable life without the use of impregnants. The flame retardant tape wrap and end fill provides both physical and environmental protection.

The full range of capacitance values available gives these capacitors broad usage in the electrical and electronic fields.

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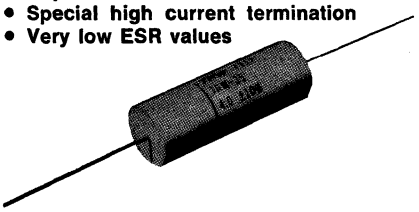
Metallized Polypropylene Dielectric

Type TRW-35

- **Designed for switching power supply applications**
- **Rated for 20 KHz usage**
- **High current — up to 9A rms**
- **Capacitance to 30 mfd**
- **Special high current termination**
- **Very low ESR values**



PERFORMANCE

The TRW-35 is designed specifically for switching power supply applications where high current, high capacitance range and low ESR values are important.

The Metallized polypropylene TRW-35 shows negligible shift in capacitance under long term exposure to humidity, operating life and temperature cycling. Insulation resistance, dielectric absorption and dissipation factor properties are all superior to those of electrolytic capacitors presently used by switching power supply manufacturers. Added to these features are size and weight savings.

APPLICATIONS

The TRW-35 is used for input filtering, hi-frequency transformer D.C. blocking, and output filtering. As an input filter it provides EMI protection back into the line (generated by the switch) and serves as a quasi-constant current source (turn on for the switch). As a D.C. blocking capacitor it prevents D.C. saturation of the hi-frequency transformer caused by switch unbalance while passing the AC square wave with little loss. As an output filter it provides a low impedance path for high frequency ripple filtering.

Unlike the electrolytic capacitor often used for such applications, the TRW-35 exhibits little or no capacitance roll-off with increasing frequency. The TRW-35 features ESR typically an order of magnitude or more under the ESR of equivalent electrolytic capacitance values.

In filter designs where capacitance values of 30 mfd or smaller are adequate for system performance, the TRW-35 offers impedance characteristics that can significantly enhance the overall system design.

SPECIFICATIONS

Dissipation Factor: Shall not be greater than .10% when measured at or referred to 1000 ±20 Hz and 25 ±5°C.

Capacitance: Shall be within specified tolerance when measured at or referred to 1000 ±20 Hz mfd and 25 ±5°C.

Insulation Resistance: Shall be greater than 100,000 megohms x mfd when measured after 2 minutes electrification at 100 VDC and 25°C.

Lead Material: Solder coated or tinned solid copper wire.

Construction: Non-inductive winding, polypropylene dielectric, metallized electrodes with special high current termination.

Case: Polyester tape wrap with epoxy endseals.

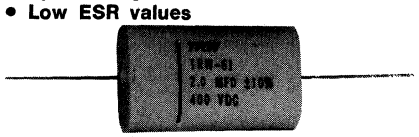
Temperature Rating: −55° to +90°C at full rated current/optional (−55° to +105°C/ storage).

Voltage: 100 thru 400 VDC.

Metallized Polyester

Type TRW-61

- **Rated for 60 KHz usage**
- **High current — up to 4A rms**
- **Capacitance to 4.7 mfd**
- **White polyester tape wrap case**
- **Special high current termination**
- **Low ESR values**



PERFORMANCE

The TRW-61 is designed specifically for switching power supply applications where current and low ESR Values are important. The metallized polyester TRW-61 shows negligible shift in capacitance under long exposure to humidity, operating life and temperature cycling. Insulation resistance, dielectric absorption and dissipation factor properties are all superior to those of electrolytic capacitors presently used by switching power supply manufacturers.

These features, plus size and weight savings in SPS designs, make the TRW-61 the logical capacitor for performance and design of switching power supplies requiring medium current ratings.

SPECIFICATIONS

Insulation Resistance: Shall be greater than 10,000 megohms x mfd when measured after 2 minutes electrification at rated voltage and 25°C.

Dissipation Factor: Shall not be greater than 1.0% when measured at or referred to 1000 ±20 Hz and 25 ±5°C.

Temperature Range: −55° to +85°C at full rated voltage.

Humidity Resistance: Capable of withstanding 96 hrs. of 90 to 95% relative humidity at 40°C and no voltage applied with no more than one failure (catastrophic: open or short) out of 12 samples.

Capacitance: Shall be within specified tolerance when measured at or referred to 1000 ±20 Hz and 25 ±5°C.

Capacitor Tolerance: Standard Tolerance ±20%; also available in ±10% and ±5%.

Case: Polyester tape wrap with epoxy end seals.

Lead Material: Solder coated or tinned solid copper wire.

DIMENSIONS

Capacitance In Mfds.	250 VDC T Max	W Max	+.094 L −.063	Lead Gauge	I RMS	I Peak amps	100 KHz ESR Max Milliohms
1	0.360	0.560	1.063	20	2	7	41
1.5	0.450	0.650	1.063	20	2	11	34
2.2	0.500	0.800	1.063	20	3	16	28
3.3	0.550	0.840	1.188	20	4	19	23
4.7	0.620	1.010	1.188	18	4	26	19
	400 VDC						
1	0.550	0.850	1.125	20	2	10	41
1.5	0.690	0.990	1.125	18	3	14	34
2.2	0.630	1.020	1.500	18	4	16	28
3.3	0.790	1.180	1.500	18	4	23	23
4.7	0.960	1.350	1.500	18	4	33	19

Type TRW-39A

- **Resistor: 3.9 ohm ½ watt ±10% carbon composition**
- **Capacitor: 0.1 mfd ±20%, 50 VDC**
- **White polyester tape wrap case**
- **Low inductance, extended foil construction**
- **Rugged polyester-foil design**
- **RC = 0.39 micro second nominal**

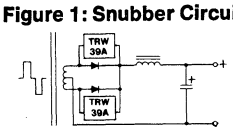
PERFORMANCE

This rugged RC network is designed for snubber applications across Schottky diodes operating in 20 KHz switching power supplies and provides critical damping of the ringing encountered in many circuits.

APPLICATIONS

Specifically designed for applications in 20 KHz switching power supplies, the TRW-39A provides critical damping and reverse voltage protection for the Schottky diode. The leakage inductance of the high frequency power transformer causes ringing of the reverse voltage when diode conduction abruptly ceases. This can cause Schottky diode failure. Figure 1 shows the snubber used across each diode. For other RC values contact TRW Capacitors, Application Engineer.

Figure 1: Snubber Circuit



SPECIFICATIONS

Insulation Resistance: Shall be greater than 100,000 megohms when measured after 2 minutes electrification at rated voltage and 25°C.

Dissipation Factor: Shall not be greater than 1.8% when measured at or referred to 1000 ±20 Hz and 25 ±5°C.

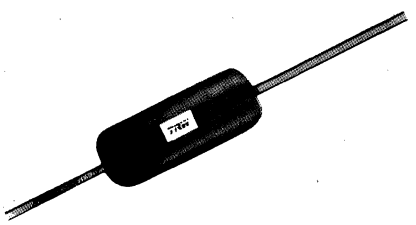
Leads: Solder coated or tinned solid wire .024 to .032 diameter (20 AWG max.).

Metallized Polyester Dielectric

Type X600

Molded Epoxy Case

- **Capacitance Tolerances to ±5%**
- **Extremely Stable**
- **High Insulation Resistance**
- **Auto Insertable**



The TRW Type X600 features the size and weight savings of highly dependable metallized polyester construction encased in rugged molded epoxy. The case, available in flame retardant epoxy meeting UL requirements, provides precision dimensions and accurate lead centering, thereby making the X600 highly adaptable for automatic insertion.

The metallized polyester construction of the Type X600 results in superior electrical properties and in reliable long life. Such advantages are reflected in its widespread, long term use.

SPECIFICATIONS

Construction: Non-inductive wound metallized polyester.

Case: Molded epoxy encasement.

Lead Material: Solder coated or tinned solid wire.

Lead Strength: Capable of withstanding four (4#) pound pull force on lead axis.

Humidity Resistance: Capable of withstanding 96 hrs. of 90 to 95% relative humidity at 40°C and no voltage applied with no more than one failure (catastrophic: open or short) out of 12 samples.

Life: Capable of withstanding 125% of rated voltage for 250 hrs. at 85°C with no more than one failure (catastrophic: open or short) out of 12 samples.

Temperature Range: −55 to +85°C at full rated voltage, to 125°C with 50% voltage derating.

Voltage Range: 100, 200, 400, 600 Vdc.

Capacitance Range: .010 through 4.500 mfd.

Capacitance: Shall be within specified tolerance when measured at or referred to 1000 ±20Hz for values up to and including 1.0 mfd at 25 ±5°C. Capacitance values greater than 1.0 mfd shall be measured or referred to 120 ±20Hz.

Dissipation Factor: Shall not be greater than 1.0% when measured at or referred to 1000 ±20Hz for capacitance values up to and including 1.0 mfd at 25 ±5°C. Capacitance values greater than 1.0 mfd shall be measured or referred to 120 ±20Hz.

Insulation Resistance: Shall be greater than 25,000 megohms for capacitance values .4 mfd and less or 10,000 megohms × mfd for capacitance values greater than .4 mfd; when measured after 2 minutes electrification at rated voltage (or 500 Vdc, whichever is less) and 25°C.

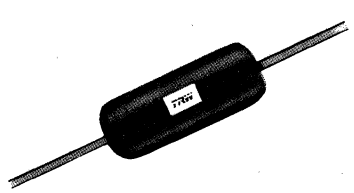
Dielectric Strength: 200% rated voltage for one minute through a limiting resistance of 100 ohms/volt at 25°C.

Polyester Dielectric

Type 630

Precision Molded Case

- **Capacitance Tolerances to ±5%**
- **High Insulation Resistance**
- **Extremely Stable**
- **Auto Insertable**



The TRW Type 630 features a rugged, precision dimensional molded epoxy case, highly adaptable for automatic sequential and automatic insertable assembly into printed circuit boards.

The polyester/foil winding construction has a long record of reliable, long lived operation. Long term stability and excellent electrical properties are inherent with this construction.

SPECIFICATIONS

Construction: Non-inductive wound polyester and foil.

Case: Molded epoxy encasement.

Lead Material: Solder coated or tinned solid wire.

Lead Strength: Capable of withstanding a four (4#) pound pull force on lead axis.

Humidity Resistance: Capable of withstanding 96 hrs. of 90 to 95% relative humidity at 40°C and no voltage applied with no more than one failure (catastrophic: open or short) out of 12 samples.

Life: Capable of withstanding 125% of rated voltage for 250 hrs. at 85°C with no more than one failure (catastrophic: open or short) out of 12 samples.

Temperature Range: −55 to +85°C at full rated voltage, to 125°C with 50% voltage derating.

Capacitance: Shall be within specified tolerance when measured at or referred to 1000 ±20Hz and 25 ±5°C.

Dissipation Factor: Shall not be greater than 1.0% when measured at or referred to 1000 ±20Hz and 25 ±5°C.

Insulation Resistance: Shall be greater than 100,000 megohms for capacitance values .25 mfd and less or 25,000 megohms × mfd for capacitance values greater than .25 mfd; when measured after 2 minutes electrification at rated voltage (or 500 Vdc, whichever is less) and 25°C.

Dielectric Strength: 200% rated voltage for one minute through a limiting resistance of 100 ohms/volt at 25°C.

Voltage Range: 50, 100, 200, 400, 600 1000, 1600 Vdc.

Capacitance Range: .001 through .8200 mfd.

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Wound Film-Foil Capacitors

GENERAL-PURPOSE, WELDED TAB CONSTRUCTION

Polystyrene Film-Foil

TRW Designation	Capacitance Range	Standard Tolerances (±%)	Rated Voltage (VDC)	Temperature Range (°C)	Lead Configuration	Case Style
Type 611	20-100,000 pF	1 through 20	33-630	−40 to +70	Axial Offset Leads	Tubular, Heat Shrunk
Type 616	20-100,000 pF	1 through 20	33-630	−40 to +70	Axial Centered Leads	Tubular, Heat Shrunk
Type 619	20-30,000 pF	1 through 20	33-630	−40 to +70	Preformed	Tubular, Heat Shrunk

Polypropylene Film-Foil

TRW Designation	Capacitance Range	Standard Tolerances (±%)	Rated Voltage (VDC)	Temperature Range (°C)	Lead Configuration	Case Style
Type 636	220-27,000 pF	1 through 20	160 and 630	−40 to +85	Axial Centered Leads	Tubular, Heat Shrunk
Type 639	220-27,000 pF	1 through 20	160 and 630	−40 to +85	Preformed	Tubular, Heat Shrunk

PROFESSIONAL STYLE, EXTENDED FOIL CONSTRUCTION

Polystyrene Film-Foil

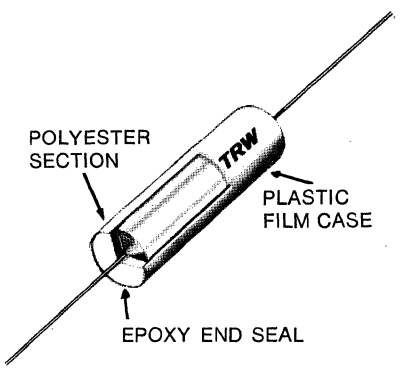
TRW Designation	Capacitance Range	Standard Tolerances (±%)	Rated Voltage (VDC)	Temperature Range (°C)	Lead Configuration	Case Style
Type 602	100 pF to 600 nF	0.625 through 5.0	63-1000	−40 to +70	Radial	Epoxy-filled Tubular Plastic
Type 604	47 to 250,000 pF	1.0, 2.5, 5.0	100, 200, 500	−40 to +85	Radial	Epoxy-filled Rect. Plastic
Type 605	100 pF to 30 nF	0.625 through 5.0	63	−40 to +70	Radial	Epoxy-filled Square Plastic
Type 607	100 pF to 680 nF	0.625 through 5.0	63-750	−40 to +70	Radial	Tubular Tape Wrap

Polyester Dielectric

Type 663UW

- **For maximum space saving**
- **"Instrument" quality**
- **Tough, moisture resisting case**
- **Conservatively rated**
- **Tolerances to ±5%**
- **Capacitance Range 0.001 thru 2.0 mfd**

CUT-AWAY SHOWS CONSTRUCTION



Type 663UW capacitors are compatible in size with other subminiature transistor components. In addition, they are conservatively designed and rated for long life and reliable service in high quality equipment and instrument applications. The Polyester winding is covered with a thin, tough plastic case adding less than 1/64" to the body diameter. The dense thermosetting epoxy endfill bonds securely to the lead and case. This line is designed and rated for long life and reliable service.

SPECIFICATIONS

Insulation Resistance: Shall be greater than 100,000 megohms for capacitance values .25 mfd and less or 25,000 megohms x mfd for capacitance values greater than .25 mfd; when measured after 2 minutes electrification at rated voltage (or 200 VDC, whichever is less) and 25°C.

Dissipation Factor: Shall not be greater than 1.0% when measured at or referred to 1000 ±20 Hz for capacitance values up to and including 1.0 mfd at 25 ±5°C. Capacitance values greater than 1.0 mfd shall be measured or referred to 120 ±20 Hz.

Life Test: Capable of withstanding 125% of rated voltage for 250 hrs. at 85°C with no more than one failure (catastrophic: open or short) out of 12 samples.

Lead Pull Test: Steady force of 4 lbs. applied axially.

Dielectric Strength: 200% rated voltage for one minute through a limiting resistance of 100 ohms/volt at 25°C.

Humidity Resistance: Capable of withstanding 96 hrs. of 90 to 95% relative humidity at 40°C and no voltage applied with no more than one failure (catastrophic: open or short) out of 12 samples.

Temperature Range: −55° to +85°C at full rated voltage, to 125°C with 50% voltage derating.

Voltage Range: 100 thru 1000 VDC.

Winding Design: Extended foil construction.

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K
kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L
LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microforad
MHz megahertz
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOSIGT metal-oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM nuclear instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLL phased lock loop
PPI plan position indicator
PROM programmable read only memory
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

TUSONIX SLC™*

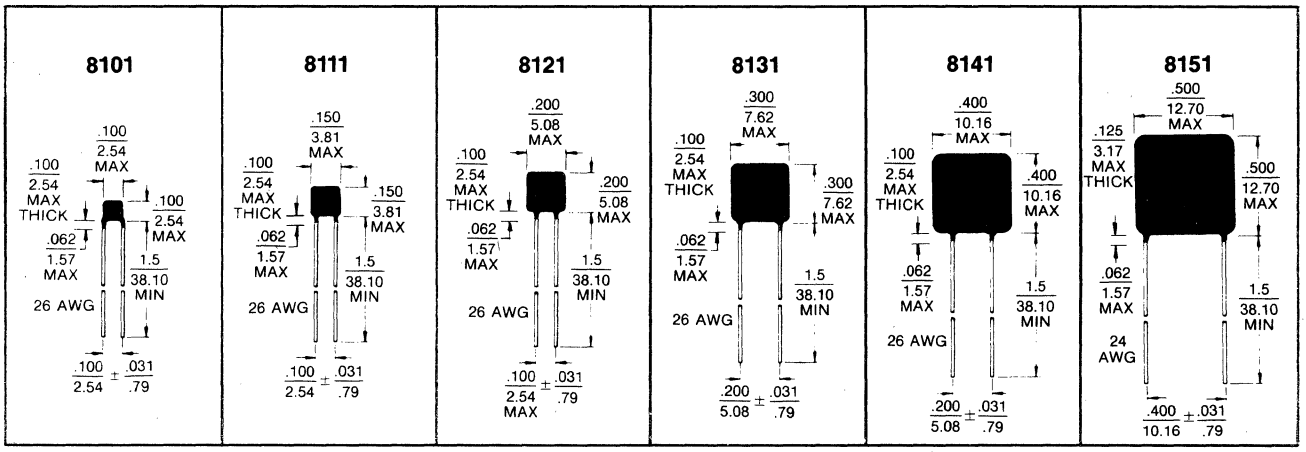
Ceramic Capacitors— WEECON® Plate

Applications and Features

TUSONIX WEECON Plate Ceramic Capacitors offer the broadest selection of ceramic formulations and package sizes available. Capacitance values range from 1 pF through .082Mfd; a variety of TC materials and tolerances is available. The range of temperature characteristics adapts these capacitors from the ultra stable requirements of tuned circuits to the general purpose needs for coupling and by-pass applications. Voltages are from 25V to 500V. (For complete details, consult our WEECON® Ceramic Capacitor catalog.)

Physical Characteristics

Weecon **Temperature Compensating** Ceramic Capacitors are ideal for applications demanding precisely controlled capacitance changes with temperature variation. They are well suited for high Q circuits requiring optimum frequency stability and have excellent retrace characteristics. **Extended Temperature Compensating** Weecons are indicated where large controlled capacitance change with temperature variation is a factor. For applications where volumetric efficiency is of prime importance, **Stable** Weecons will provide higher capacitance values, in smaller packages with better reliability. TUSONIX **General Purpose** Weecons are ideal for circuits requiring the utmost in volumetric efficiency at rated temperatures.



	EIA Code	Dielectric	Min.* Tol.	Min. Cap.	MAXIMUM CAPACITANCE 8101 50/100V	8101 200V	8101 500V¹	8111 50/100V	8111 200V	8111 500V¹	8121 50/100V	8121 200V	8121 500V¹	8131 50/100V	8131 200V	8131 500V¹	8141 50/100V	8141 200V	8141 500V¹	8151 50/100V	8151 200V	8151 500V¹
TEMP COMP TYPES	COG	NPO	1%	1.0	20	10	N/A	51	24	11	100	51	20	240	120	47	430	220	91	680	360	130
	B1G	N030	1%	1.6	10	5.1	N/A	27	13	5.6	51	24	11	130	62	24	220	110	47	360	180	75
	U1G	N0080	1%	1.8	12	6.2	N/A	30	15	6.2	56	27	12	130	68	27	240	130	51	390	200	82
	P2G	N0150	1%	2.2	13	6.2	N/A	33	16	6.8	62	30	13	160	75	30	270	130	56	430	220	91
	R2G	N0220	1%	2.4	13	6.8	N/A	36	18	7.5	68	36	13	160	82	33	300	150	62	510	240	100
	S2H	N0330	1%	2.7	16	8.2	N/A	43	20	8.2	82	39	16	200	100	39	360	180	68	560	270	110
	T2H	N0470	1%	3.3	18	9.1	N/A	51	24	10	91	47	18	220	110	43	390	200	82	620	330	130
	U2J	N0750	2%	4.7	24	13	N/A	68	36	13	130	68	27	300	150	62	560	300	110	910	470	180
	P3K	N1500	2%	10	47	24	N/A	130	68	27	240	120	51	560	300	110	1000	510	220	1600	820	330
EXTEND TEMP COMP TYPES	R3A	N2200	2%	13	62	30	N/A	160	82	33	300	150	62	750	360	150	1300	680	270	2000	1000	430
	S3B	N3300	5%	22	100	51	N/A	270	130	56	560	270	110	1200	680	270	2200	1100	510	3600	1800	750
	G3C	N4200	5%	33	160	82	N/A	430	200	91	820	390	160	1800	910	390	3300	1600	750	5600	2700	1200
	T3D	N4700	5%	39	180	91	N/A	510	240	100	910	470	200	2200	1100	430	3900	2000	820	6200	3000	1300
	H3M	N5600	5%	56	270	130	N/A	750	360	150	1300	680	270	3300	1600	680	5600	2700	1200	9100	4700	1800
STABLE TYPES	Z5DY5F X5FX7F	—	5%	20	100	51	N/A	270	130	51	510	270	100	1200	620	240	2200	1100	470	3600	1800	750
	Z5DY5D X5EX7R	—	5%	51	270	130	N/A	680	360	130	1300	620	270	3000	1500	620	5600	2700	1100	9100	4700	1800
	Z5EY5F X5RX7R	—	5%	62	300	180	N/A	820	390	160	1600	820	300	3600	1800	750	6800	3300	1300	10,000	5100	2200
	Z5FY5F X5FX7R	—	5%	68	360	180	N/A	910	470	180	1800	910	360	4300	2000	820	7500	3900	1500	12,000	6200	2400
	Z5PY5P X5PX7R	—	10%	130	680	330	N/A	1800	910	360	3300	1600	680	7500	3900	1500	15,000	7500	3000	24,000	12,000	4700
	Z5FY5T X5TX7T	—	10%	150	750	390	N/A	2000	1000	390	3900	1800	750	9100	4300	1800	16,000	8200	3300	27,000	13,000	5100
GENERAL PURPOSE TYPES	Z5UY5U X5UX7U	—	20%	240	1300	620	N/A	3300	1600	680	6800	3300	1300	15,000	7500	3000	27,000	13,000	5600	47,000	22,000	9100
	Z5UY5V X5V651	—	20%	300	1600	820	N/A	3900	2000	820	10,000	3900	1600	18,000	9100	3600	36,000	18,000	6800	56,000	27,000	10,000

*Tolerances shown in table are minimum for 10 pF and above.
±0.1 pF is closest tolerance available for 10 pF and less.

NOTES: 1. When ordering 500 Volt parts, allow additional .050" thickness.
2. Other lead spacings and wire diameter available upon request.

*SLC stands for Single-layer Ceramic Technology

TUSONIX SLC™*

Ceramic Capacitors—Trimmers

TUSONIX leads the way in the miniaturization of trimmers, or variable ceramic capacitors. Developments such as those illustrated below have established TUSONIX as a leader in the state of the art. More than 30 years of experience in Trimmer design and technology have enabled TUSONIX to offer engineers the world's most complete line of ceramic trimmer capacitors.

During the past 10 years the ceramic trimmer capacitor has become the most popular trimmer in the electronics industry. The inherent reliability, small size, low cost and wide selection of available electrical characteristics are major factors in the ceramic capacitor's continuing popularity among design engineers.

TUSONIX produces a broad range of fixed and variable (trimmer) ceramic capacitors. Complete research, development and manufacturing of the ceramic dielectric itself and the finished capacitor is performed by TUSONIX. Today TUSONIX is recognized as one of the world's leading suppliers of quality ceramic capacitors.

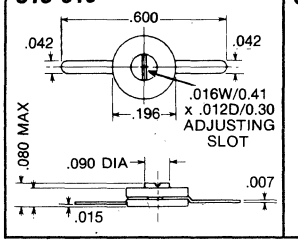
(For complete details consult Trimmer catalog.)

Series 513 —

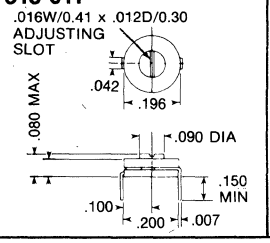
First True Ultraminiature Quality Trimmer

Working Voltage ..... A: 100 WVdc to 85°C.
G: 50 WVdc to 85°C.
Dielectric Strength ..... 2 times WVdc for 1 to 5 seconds
Operating Temperature Range ... -55°C to +85°C.
Q Factor @ 1MHz .... 500 Min. (Dielectric Code A)
200 Min. (Dielectric Code G)
Torque .....0.3 to 2.0 oz. in.
Qualification Specification ... TUSONIX Spec. 513
Dimensions in inches .... For dimensions ≤ 125" tol. is ±.005"
For dimensions ≥ 126" tol. is ±.015"

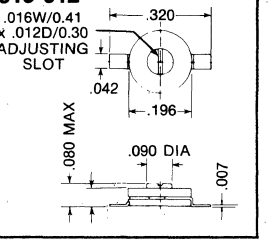
513-010



513-011



513-012



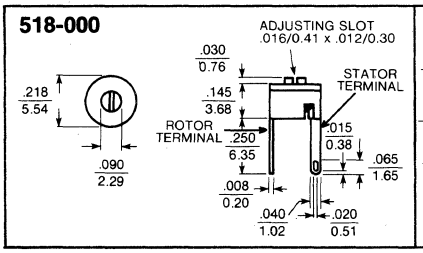
TUSONIX Part No.	TUSONIX Part No.	TUSONIX Part No.	Working Voltage (Vdc) 85°	Capacitance Range in pF
513-010 A 1-5	**513-011** A 1-5	**513-012** A 1-5	100	1-5
513-010 A 2-10	**513-011** A 2-10	**513-012** A 2-10	100	2-10
513-010 A 3.5-20	**513-011** A 3.5-20	**513-012** A 3.5-20	100	3.5-20
513-010 A 5-30	**513-011** A 5-30	**513-012** A 5-30	100	5-30
513-010 G 7-40	**513-011** G 7-40	**513-012** G 7-40	50	7-40

Series 518 —

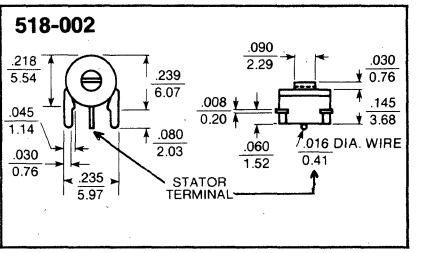
First Small Size Quality Trimmer

Working Voltage ..... A: 100 WVdc to 85°C; 50 WVdc to 85°C.
G: 50WVdc to 125°C; 25WVdc to 125°C.
Dielectric Strength ..... 2 times WVdc for 1 to 5 seconds
Operating Temperature Range .. -55°C to +125°C.
Torque ..... 0.3 to 3 oz. in.
Q Factor @ 1MHz .. 500 Min. (Dielectric Code A)
200 Min. (Dielectric Code G)

518-000



518-002



TUSONIX Part No.	MIL-C-81 Desig. 518-016	Capacitance Range in pF	TUSONIX Part No.	MIL-C-81 Desig. 518-017	Capacitance Range in pF
518-000 A 1-3	CV35 A 030	1-3	**518-002** A 1.25-3	CV36 A 030	1.25-3
518-000 A 2-5	CV35 A 050	2-5	**518-002** A 2-3	CV36 A 050	2-5
518-000 A 2.5-9	CV35 A 090	2.5-9	**518-002** A 2.5-3	CV36 A 090	2.5-9
518-000 A 3.5-20	CV35 A 200	3.5-20	**518-002** A 3.5-20	CV36 A 200	3.5-20
518-000 A 5-15	CV35 A 150	5-15	**518-002** A 5-15	CV36 A 150	5-15
518-000 A 5-25	CV35 A 250	5-25	**518-002** A 5-25	CV36 A 250	5-25
518-000 G 7-40	CV35 G 400	7-40	**518-002** G 7-40	CV36 G 400	7-40

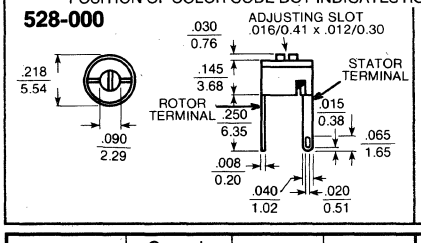
Series 528 —

Quality Low Cost Trimmer

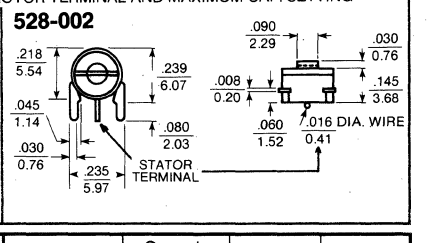
Working Voltage ..... A: 100 WVdc to 125°C.
Dielectric Strength ..... 2 times WVdc for 1 to 5 seconds
Operating Temperature Range ... -55°C to +125°C.
Torque ..... 0.3 to 3 oz. in.
Q Factor @ 1MHz...500 Min. (Dielectric Code A,E,C)
200 Min. (Dielectric Code F)

POSITION OF COLOR CODE DOT INDICATES ROTOR TERMINAL AND MAXIMUM CAP. SETTING

528-000



528-002



TUSONIX Part No.	Capacitance Range (pF)	Dielectric Type Code	Color Code	TUSONIX Part No.	Capacitance Range (pF)	Dielectric Type Code	Color Code
528-000	1 - 3	A	Black	**528-002**	1 - 3	A	Black
528-000	2 - 5	A	Black	**528-002**	2 - 5	A	Black
528-000	3 - 8	A	Black	**528-002**	3 - 8	A	Black
528-000	3.5 - 10	A	Black	**528-002**	3.5 - 10	A	Black
528-000	3.5 - 10	C	Blue	**528-002**	3.5 - 10	C	Blue
528-000	4 - 14	A	Black	**528-002**	4 - 14	A	Black
528-000	4.5 - 15	E	Violet	**528-002**	4.5 - 15	E	Violet
528-000	3.5 - 17	F	Orange	**528-002**	3.5 - 17	F	Orange
528-000	6 - 22	F	Orange	**528-002**	6 - 22	F	Orange

*SLC stands for Single-layer Ceramic Technology

TUSONIX SLC™*

Ceramic Capacitors—Trimmers

Series 538 —

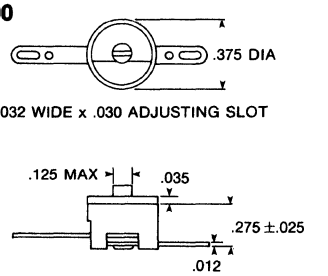
First ⅜" Dia. Trimmer in the Industry

Working Voltage ..... A, B, C: 350 WVdc to 85°C; 200 WVdc to 125°C; D&F: 200 WVdc to 85°C; 100 WVdc to 125°C.
Dielectric Strength ..... 500 Vdc for 1 to 5 seconds
Operating Temperature Range ... -55°C to +125°C.
Q Factor @ 1MHz ..... 500 Minimum
Torque ..... 1-6 oz. in.
Qualification Specification ... TUSONIX Spec. 538
For dimensions ..... ≤ 125" tol. is ±.015"
For dimensions ..... ≥ 126" tol. is ±.030"
Except where noted.

Dielectric Type Code	PERCENT CAPACITANCE CHANGE FROM VALUE @ 25°C					
	−55°C Min.	−55°C Max.	+85°C Min.	+85°C Max.	+125°C Min.	+125°C Max.
For Spec 500						
A	−4.5	+2.0	−2.5	+2.0	−4.2	+3.4
B	−1.0	+3.5	−2.5	−0.5	−4.2	−0.8
C	−1.0	+6.5	−4.0	−1.0	−6.7	−1.7
D	+1.5	+7.0	−5.0	−1.5	−8.5	−2.5
E	+1.75	+8.0	−5.75	−1.75	−9.5	−2.8
F	+6.0	+16.0	−11.0	−6.0	−15.0	−9.0
G	0.0	+14.0	−8.0	−3.0	−14.0	−5.0
For Spec 513						
A	−2.1	+4.2	−3.8	+1.1		
G	0.0	+14.0	−8.0	−3.0		

TUSONIX Part No.	TUSONIX Part No.	TUSONIX Part No.	TUSONIX Part No.	MIL-C-81 Desig. 538-054	Capacitance Range in pF
538-000 A 2-8	**538-002** A 2-8	**538-006** A 2-8	**538-011** A 2-8	CV31 A 080	2 to 8
538-000 A 5.5-18	**538-002** A 5.5-18	**538-006** A 5.5-18	**538-011** A 5.5-18	CV31 A 180	5.5 to 18
538-000 B 2.5-11	**538-002** B 2.5-11	**538-006** B 2.5-11	**538-011** B 2.5-11	CV31 B 110	2.5 to 11
538-000 B 7-25	**538-002** B 7-25	**538-006** B 7-25	**538-011** B 7-25	CV31 B 250	7 to 25
538-000 C 3-10	**538-002** C 3-10	**538-006** C 3-10	**538-011** C 3-10	CV31 C 100	3 to 10
538-000 C 8-25	**538-002** C 8-25	**538-006** C 8-25	**538-011** C 8-25	CV31 C 250	8 to 25
538-000 D 3-15	**538-002** D 3-15	**538-006** D 3-15	**538-011** D 3-15	CV31 D 150	3 to 15
538-000 D 9-35	**538-002** D 9-35	**538-006** D 9-35	**538-011** D 9-35	CV31 D 350	9 to 35
538-000 F 15-60	**538-002** F 15-60	**538-006** F 15-60	**538-011** F 15-60	CV31 E 600	15 to 60

538-000



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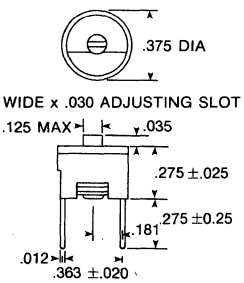

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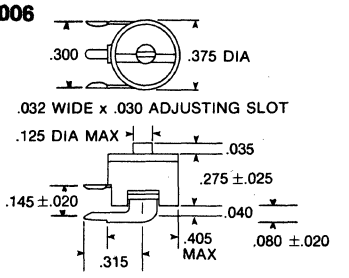
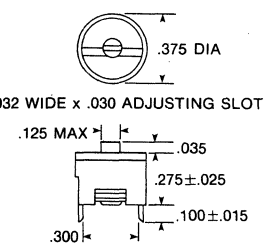


538-011



TUSONIX SLC™*

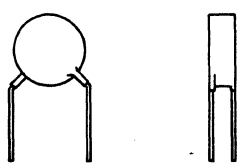
Ceramic Capacitors—High Voltage

High Voltage Ceramic Capacitors have been one of Tusonix outstanding component capabilities for many years. These high quality components are used in a broad variety of applications: electric utility transformers, power supplies and voltage multipliers for CRT displays, navigation equipment, electro-optic equipment and image intensifiers for night vision apparatus.

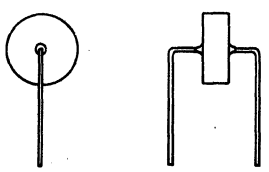
Recent material and design development have allowed Tusonix to dramatically reduce size in many instances, with improved % D.F., IR, TC and DC/TC characteristics. Best of all, the Tusonix high quality standards remain intact.

SPECIALS

Nonstandard or special design part
Available in: 3, 5, 10, 15, 20, 25, 30kV
Note: Can be manufactured with virtually any special terminal to meet specific needs.

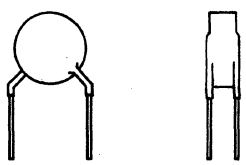


Radial wire leads, 20 ga., 1.25" (31.75) min. length
Available in: 3, 5, 10kV

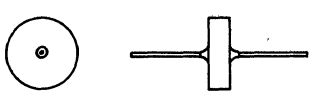


Radial formed leads attached axially, 20 ga., 2.0" (50.80) min. length
Available in: 3, 5, 10, 15kV
1" min. lead spacing required for 15kV

Potted female threaded stud terminals. 8-32 threads
Availabe in: 3, 5, 10, 15, 20, 25, 30kV



Offset wire leads, 20 ga., 1.25" (31.75) min. length
Available in: 3, 5, 10kV



Axial wire leads, 20 ga., 2.0" (50.80) min. length
Available in: 3, 5, 10, 15, 20, 25, 30kV
1.250" max. dia. for over 10kV

Female threaded stud terminals, 8-32 threads
Available in: 3, 5, 10, 15, 20, 25, 30kV

*SLC stands for Single-layer Ceramic Technology

TUSONIX SLC™*

Ceramic Capacitors—Disc

Applications and Features

TUSONIX Ceramic Disc Capacitors offer high performance in a complete range of ratings, values, and sizes. The complete line of voltage ratings offers the designer the convenience of selecting the exact capacitor rating required for his application. TUSONIX Discs are available in 100-200-500 VDC; 1-2-3-4-5 and 6 KV. Capacity increases per size for voltages less than 500 volts and decreases per size for voltages greater than 500 volts. Where voltage rating is not critical, we recommend our standard 500 volt line. (For complete details, consult our Ceramic Disc Capacitor catalog.)

General Electrical Specifications

Ceramic Disc Capacitors are available in a broad range of dielectric constants. This allows a wide selection of capacitance values.

Temperature Compensating

Ceramic Capacitors (NPO Thru N750) are ideal for applications requiring very precisely controlled capacitance change with temperature, high Q and very small capacitance tolerance.

Extended Temperature Compensating

Disc Capacitors (N1000 thru N5600) are capacity sensitive to temperature in varying degrees, and are useful as temperature compensating elements for stabilization over a wide temperature range.

General Purpose or Hi-K Specials

Special disc products are available from TUSONIX upon request, including details on TUSONIX's approval for U.L. line by-pass capacitors and approval to Mil-C-20 and Mil-C-11015.

Physical Characteristics

Leads—All values up to and including 2 KV are available with 20, 22 and 24 AWG leads, except body sizes. 655" max. and larger available with 20 or 22 AWG only. All values up to and including 6 KV are available with 20 or 22 AWG leads.

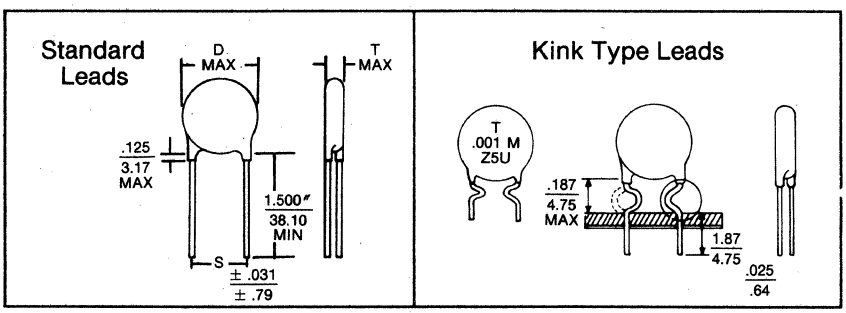
Body insulation—conformal coating.

Standard max. coating on leads is .125"; closer control is optional at extra cost.

Marking—Trademark, Cap, Tol., T.C., and Voltage (Voltage omitted on 500V).

TUSONIX also offers inside kink leads, outside kink leads and short pin leads to the electronic industry for use in printed wiring board applications.

Special physical requirements are also available. Special lead spacing requirements are optional upon request, in addition to standard nominal lead spacings.



TUSONIX Part No.	861	831	801	851	871	811	841	821	3841	3851	3871	3881
Max. Diameter (D)	.235/5.96	.290/7.37	.360/9.14	.437/12.45	.490/12.45	.593/15.06	.675/17.15	.750/19.05	.800/20.32	875/22.23	.937/23.80	1.100/27.94
Lead Spacing (S)	.200/5.08	.250/6.35	.250/6.35	.250/6.35	.375/9.52	.375/9.52	.375/9.52	.375/9.52	.375/9.52	.375/9.52	.375/9.52	.375/9.52
Wire Gauge (AWG)	22	22	22	22	22	22	22	22	22	22	22	22

	Temp. Char. Code		Min. Cap Tol. (%)	Min. TC Tol.	Max. DF (%)	Min. Q	500 V MAXIMUM NOMINAL CAPACITANCE (pF) Thickness .156" Max. 861	831	801	851	871	811	841	821	3841	3851	3871	3881
GENERAL PURPOSE (HI-K)	Z5D Y5E X5F X7F		±5		2		120	200	350	500	720	1000	1300	1400	1450	1500	1600	1700
	Z5D Y5E X5F X7F		±5		2		400	680	1100	1800	2400	3400	4600	4700	4800	5300	5400	5600
	Z5F Y5F X5F X7R		±10		2		600	900	1500	2500	3500	5000	6500	7000	7400	8000	8200	5600
	Z5F Y5F X5R X7S		±10		2		800	1300	2300	3500	4700	7000	9000	10000	10300	11000	11500	12000
	Z5U Y5U X5U X7V		±20		2		1600	2000	3500	5400	7300	12000	16000	18000	19000	20000	21000	22000
	Z5U Y5V X5W X7W		±20		3		2400	3300	5600	8600	11000	20000	22000	25000	30000	32000	34000	35000
	GP7		±20		3		2400	4400	7500	11000	15000	25000	35000	43000	52000	55000	58000	60000
TEMPERATURE COMPENSATING EXTENDED TEMPERATURE COMPENSATING	NP0	C0G	±1	±30		1000	20	1-30	60	90	120	150	210	240	250	270	280	290
	N030	B1G	±1	±30		1000	8	1.6-18	31	48	64	80	110	120	130	135	140	150
	N080	U1G	±1	±30		1000	10	1.8-21	36	55	75	95	120	135	150	155	160	180
	N150	P2G	±1	±30		1000	11	1.9-24	40	60	85	100	140	155	170	175	180	200
	N220	R2G	±1	±30		1000	12	2-26	45	65	90	110	160	175	190	195	200	220
	N330	S2H	±1	±60		1000	14	2.2-29	50	75	100	130	170	185	200	220	230	240
	N470	T2H	±1	±60		1000	20	2.6-35	60	90	125	150	210	230	250	260	270	290
	N750	U2J	±2	±120		1000	40	3.5-60	110	170	230	340	450	470	480	520	540	560
	N1500	P3K	±2	±250		1000	40	6-82	140	210	290	360	490	550	580	600	640	690
	N2200	R3A	±2	±400		500	45	7-90	160	240	330	410	560	630	670	700	730	790
	N3300	S3B	±5	±650		500	80	12-160	280	430	580	720	990	1050	1100	1200	1300	1400
	N4200	G3C	±5	±850		500	86	23-170	300	460	620	1000	1400	1600	2000	2200	2300	2500
	N4700	T3D	±5	±900		200	100	25-210	360	550	750	1200	1600	2000	2500	2700	2800	3000
	N5600	H3M	±5	±1000		200	150	40-310	540	830	1100	1800	2500	3000	3700	3900	4100	4500

TUSONIX SLC™*

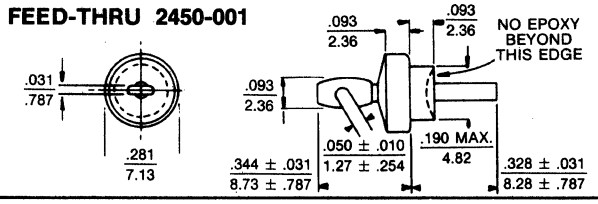
Ceramic Capacitors—Discoidal

inches / mm	inches/mm

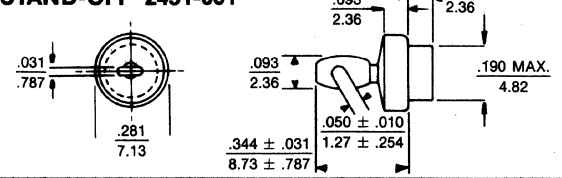
Dimension tolerance ±.015" unless otherwise specified.

STANDARD SPECIFICATIONS Finish—Silver Plated Marking—Capacitance Value—Stamped or EIA Color Code							
EIA Code	Voltage (WVdc)	Cap. (pF)	Tol. %	EIA Code	Voltage (WVdc)	Cap. (pF)	Tol. %
X5U	500	1000	+100 −0	X5R	500	100	±10
				X5E	500	6.8	±20
X5R	500	470	±20	X5S	500	33	±20

FEED-THRU 2450-001



STAND-OFF 2451-001



*SLC stands for Single-layer Ceramic Technology

TUSONIX SLC™*

Ceramic Capacitors—Feed-Thru
Solder Mount

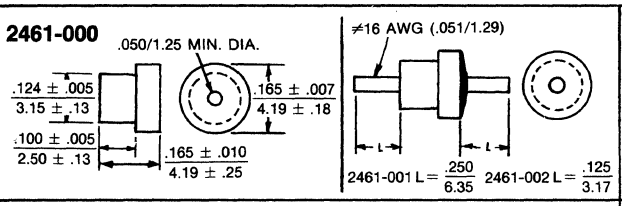
inches / mm	inches/mm

Dimension tolerance ±.015" unless otherwise specified.

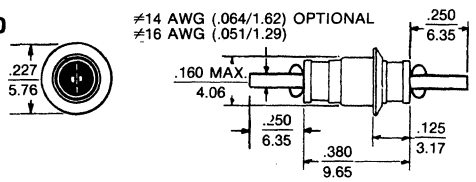
STANDARD SPECIFICATIONS
Finish—Tinned Marking—EIA Color Code, Capacitance Only

TUSONIX Part No.	Char.	Voltage (WVdc)	MAX. Cap. (pF)	Tol. %	TUSONIX Part No.	Char.	Voltage (WVdc)	MAX. Cap. (pF)	Tol. %
2461-000	X7V (W5V)	100	1000	GMV	**2404-000**	S2L	500	72	±10
					2404-007	U2M	500	124	±10
2482-012	S2L	300	47	±10	**2404-014**	X5U	500	4200	±20
2482-001	U2M	300	81	±10		X5W	500	6000	+80–20
	X5U	300	2700	±20		X7R (W5R)	250	870	±20
	X5W	300	3900	+80–20					
	X7R (W5R)	150	580	±20					

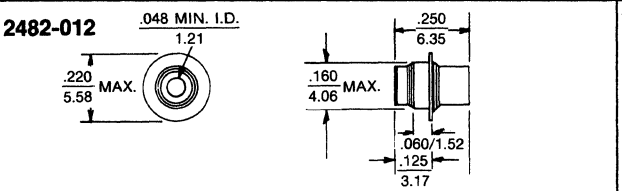
2461-000



2404-000



2482-012



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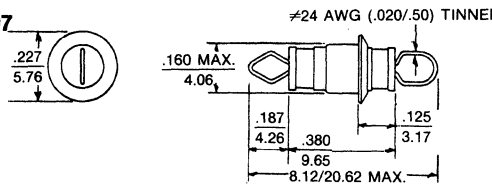

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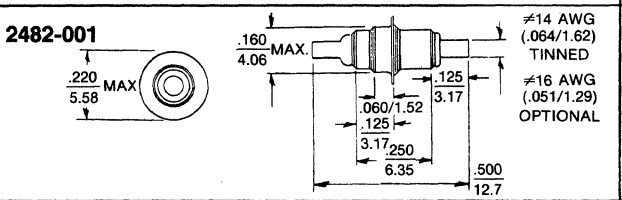

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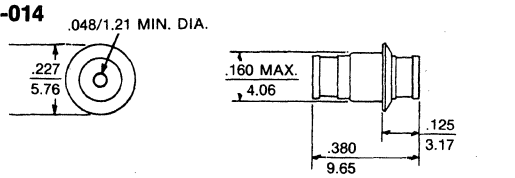


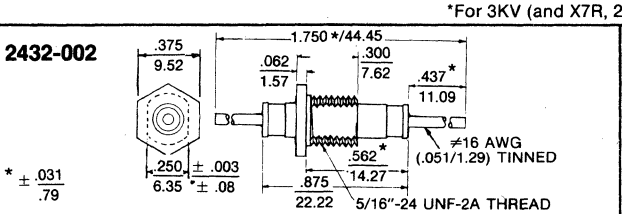
Ceramic Capacitors—Feed-Thru
Hi-Volt

STANDARD SPECIFICATIONS
Finish—Silver Plated except 2416 (tinned)
Marking—EIA Color Code except 320 (Capacitance Code-Stamped)

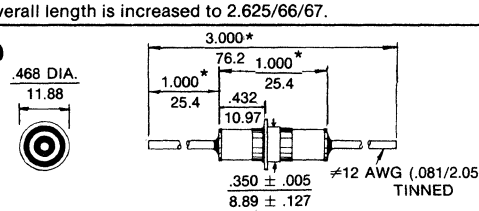
TUSONIX Part No.	Char.	Voltage (WVdc)	MAX. Cap. (pF)	Tol. %	TUSONIX Part No.	Char.	Voltage (WVdc/Flash)	MAX. Cap. (pF)	Tol. %
2432-002	S2L	2KV	90	±10	**2416-000**	S2L	3KV	96	±20
	U2M	2KV	160	±10		U2M	3KV	136	±20
	X5U	2KV	5000	±20		X5U	3KV	5000	±20
	X5W	2KV	7500	+80–20		X5W	3KV	8000	+80–20
	X7R (W5R)	1KV	1100	±20		X7R (W5R)	1.5KV	1000	±20
320-005	S2L	2KV & 3KV*	234	±20	**2498-000**	S2L	4KV/6KV	156	±20
	U2M	2KV & 3KV	332	±20		X5R	4KV/6KV	4000	±20
	X5U	2KV & 3KV	10000	+80–20		X5U	3KV/4.5KV	7000	±20
	X5W	2KV & 3KV*	15000	+80–20		X5W	3KV/4.5KV	10000	+80–20
	X7R (W5R)	1KV & 2KV*	2800	+80–20		X7R (W5R)	3KV/4.5KV	1800	+80–20

*For 3KV (and X7R, 2KV) rating, overall length is increased to 2.625/66/67.

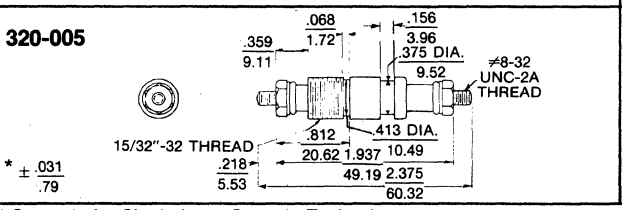
2432-002



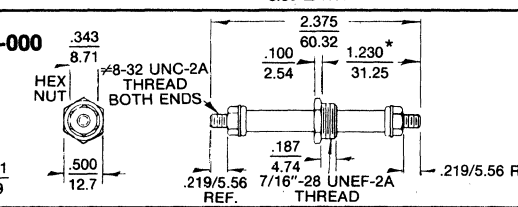
2416-000



320-005



2498-000



*SLC stands for Single-layer Ceramic Technology

TUSONIX SLC™*

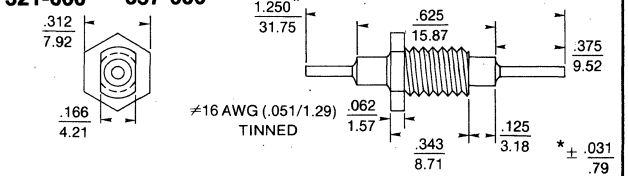
Ceramic Capacitors—Feed-Thru

Bushing Mount

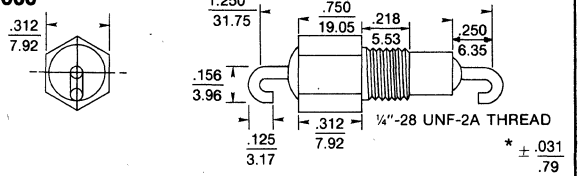
Dimension tolerance ±.015" unless otherwise specified. inches / mm | inches/mm

500 WVdc (Derate 50% at 125°C)				500 WVdc (Derate 50% at 125°C)				200 WVdc (Derate 50% at 125°C)			
TUSONIX Part No.	Char.	Cap. (pF)	% Tol.	TUSONIX Part No.	Char.	Cap. (pF)	% Tol.	TUSONIX Part No.	Char.	Cap. (pF)	% Tol.
321-000 X5U0 102M (000 Nut Only) (010 Nut and Washer) (Straight Leads)	X5U	1000	±20	**2443-000 X5S0 102M**	X5S	1000	±20	**2425-001 X5U0 101AA**	X5U	100	GMV
				2443-000 X5S0 152M (000 No Hardware) (008 Nut and Washer) (Straight Leads)	X5S	1500	±20	**2425-001 X5U0 102AA**	X5U	1000	GMV
								2425-001 X5U0 152AA	X5U	1500	GMV
								2425-001 X5U0 202AA	X5U	2000	GMV
357-000 X5U0 102M	X5U	1000	±20					**2425-001 X5U0 501AA**	X5U	500	GMV
357-000 X5U0 152M (000 Nut Only) (001 Nut and Washer) (Curved Leads)	X5U	1500	±20	**2443-001 X5S0 102M**	X5S	1000	±20	**2425-001 X5W0 502AA** (001 Nut Only)	X5W	5000	GMV
				2443-001 X5S0 152M (001 Nut Only) (007 Nut and Washer) (Curved Leads)	X5S	1500	±20				
								2425-003 W5U0 101AA	W5U	100	GMV
								2425-003 W5U0 102AA	W5U	1000	GMV
								2425-003 W5U0 152AA	W5U	1500	GMV
327-000 X5U0 102M	X5U	1000	±20					**2425-003 W5U0 202AA**	W5U	2000	GMV
327-000 X5U0 152M (000 No Hardware) (005 Nut Only) (010 Nut and Washer)	X5U	1500	±20	**2499-003 X5S0 102M**	X5S	1000	±20	**2425-003 W5U0 501AA**	W5U	500	GMV
				2499-003 X5S0 152M (Nut and Washer)	X5S	1500	±20	**2425-003 W5W0 502AA** (003 Nut Only)	W5W	5000	GMV
362-000 X5U0 102M	X5U	1000	±20								
362-000 X5U0 152M (000 Nut Only) (013 Nut and Washer)	X5U	1500	±20								

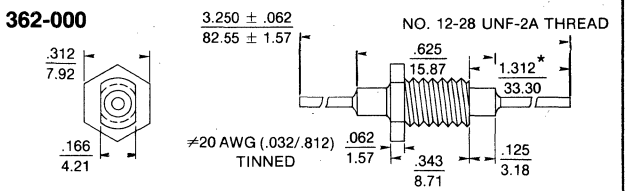
321-000 357-000



327-000



362-000



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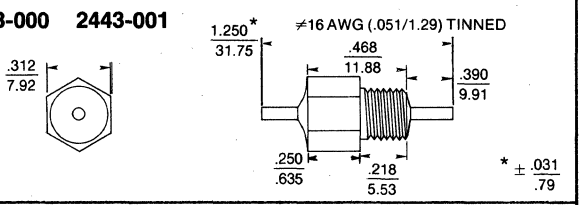

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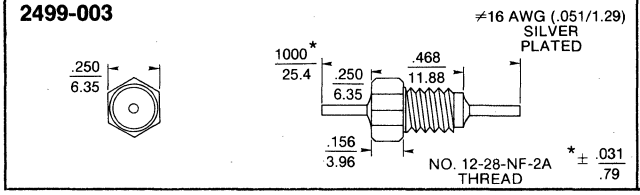

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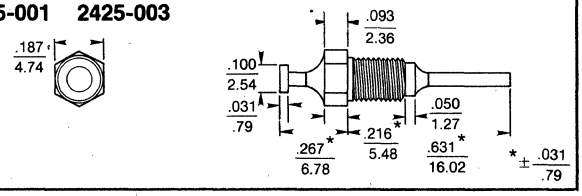
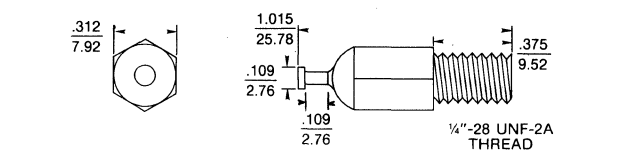


TUSONIX SLC™

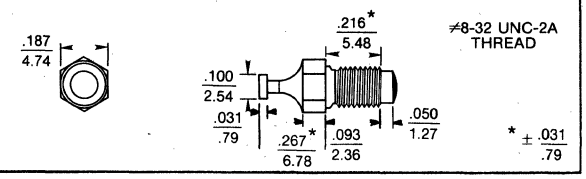
Ceramic Capacitors—Stand-Off

500 WVdc (Derate 50% at 125°C)				200 WVdc (Derate 50% at 125°C)			
TUSONIX Part No.	Char.	Cap. (pF)	% Tol.	TUSONIX Part No.	Char.	Cap. (pF)	% Tol.
326-000 X5U0 102M	X5U	1000	±20	**2425-063 W5U0 101AA**	W5U	100	GMV
326-000 X5U0 152M (000 No Hardware) (013 Nut and Washer)	X5U	1500	±20	**2425-063 W5U0 102AA**	W5U	1000	GMV
				2425-063 W5U0 152AA	W5U	1500	GMV
				2425-063 W5U0 202AA	W5U	2000	GMV
				2425-063 W5U0 501AA	W5U	500	GMV
				2425-063 W5U0 502AA (063 Nut Only)	W5U	5000	GMV
200 WVdc (Derate 50% at 125°C)							
2425-061 X5U0 101AA	X5U	100	GMV				
2425-061 X5U0 102AA	X5U	1000	GMV				
2425-061 X5U0 152AA	X5U	1500	GMV				
2425-061 X5U0 202AA	X5U	2000	GMV				
2425-061 X5U0 501AA	X5U	500	GMV				
2425-061 X5U0 502AA (061 Nut Only)	X5U	5000	GMV				

326-000



2425-061 2426-063



*SLC stands for Single-layer Ceramic Technology

TUSONIX SLC™*

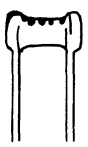
Ceramic Capacitors—Tubular

Applications and Features

TUSONIX offers a complete line of ceramic tubular, feed-thru, and stand-off capacitors for general purpose, temperature compensation, and high stability applications. All forms feature compact package sizes, many different lead and mounting options, rugged construction, and proven high reliability in a variety of demanding applications such as RF by-passing and filtering. MIL types are also available in each form. (For complete details, consult our Ceramic Tubular, Feed-thru, and Stand-off Capacitor Catalog.)

inches / mm	inches/mm

ENAMEL COATED



Style	Body Dia. Max.	Body Length Max.	Lead Space ±.060	Min. Lead Length	Lead Dia.
301	.200 / 5.08	.400 / 10.16	.250 / 6.35	1.25 / 31.75	.025 / .64
302	.200 / 5.08	.656 / 16.66	.375 / 9.52	1.25 / 31.75	.025 / .64
308	.230 / 5.84	.460 / 11.68	.250 / 6.35	1.25 / 31.75	.025 / .64
374	.125 / 3.17	.320 / 8.12	.250 / 6.35	1.25 / 31.75	.013 / .33

MAXIMUM CAPACITANCE (pF)						
TUSONIX Style			**374**		**301**	**302**
Voltage			100V	200V	500V	500V
	EIA Code	Min. Cap. Tol.	Max.	Max.	Max.	Max.
STABLE TYPES (HI-K)	Z5D	±5%	1000	1000	910	1800
	Y5D		1000	1000	910	1800
	Z5F		1600	1600	1600	3000
	Y5F	±10%	910	910	1300	2400
	X5F		910	910	1300	2400
	X7F (W5F)		240	—	240	430
	Z5P		1600	1600	1600	3000
	Y5P	±10%	910	910	1300	2400
	X5P		910	910	1300	2400
	X7P (W5P)		240	—	240	1800
	Z5R		1600	1600	1600	3000
	Y5R	±10%	1300	1300	1300	2400
	X5R		1300	1300	1300	2400
	X7R (W5R)		240	—	820	1600
	Z5S		1600	1600	1600	3000
	Y5S	±10%	1300	1300	1300	2400
	X5S		1300	1300	1300	2400
	X7S (W5S)		1000	—	910	1800
	Z5T		1600	1600	1600	3000
	Y5T	±10%	1600	1600	1600	3000
	X5T		1600	1600	1600	3000
	X7T (W5T)		1600	—	1600	3000
GENERAL PURPOSE TYPES	Z5U		3900	3900	5100	10000
	Y5U	±20%	3900	3900	3600	6800
	X5U		3900	3900	3600	6800
	X7U (W5U)		1600	—	1600	3000
	Z5V		5600	5600	5100	10000
	Y5V	±20%	5600	5600	5100	10000
	X5V		3900	3900	5100	10000

Qualified Products List (QPL) Approved on TUSONIX Tubular Products

MIL Specification	MIL Style	TUSONIX Style	MIL Specification	MIL Style	TUSONIX Style
MIL-C-20			MIL-C-11015		
/01	CC20	**301-651**	/02	CK22	**331-052**
/03	CC22	**331-051**	/04	CK27	**332-052**
/04	CC25	**302-651**	/13 (1000 V)	CK70	**327-062**
/06	CC27	**332-051**	/13 (500 V)	CK70	**327-042**
/07	CC30	**308-651**	/14	CK80	**326-010**
/08	CC31	**338-051**	/23	CK72	**2432-012**
MIL-C-39014			/29	CK74	**2404-613**
/16	CKR75	**2499-032**	/29	CK75	**2404-614**
/17	CKR82	**2499-035**	/29	CK78	**2482-030**
/18	CKR76	**2425-049**	/29	CK79	**2482-029**
/19	CKR83	**2425-074**			

CAPACITANCE RANGE (pF)												
TUSONIX Style			**301**		**302**		**374**		**301**		**302**	
Voltage			500 WVdc @ 85°C		500 WVdc @ 85°C		200 WVdc @ 85°C		500 WVdc @ 125°C		500 WVdc @ 125°C	
	EIA Code	Temp. Coef. (ppm/C) T.C. Tol.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
TEMPERATURE COMPENSATING TYPES	M7G	P100 ±30	.42	13	14	23	2.5	12	.42	9.5	10	23
	COG	NPO ±30	.52	49	25	88	3	49	.52	49	25	88
	B1G	N030 ±30	.63	25	26	47	5	26	.63	26	19	47
	U1G	N080 ±30	.63	29	30	53	5.5	29	.63	29	22	53
	P2G	N150 ±30	.63	34	35	60	6.5	33	.63	34	25	60
	R2G	N220 ±30	.66	37	38	66	6	36	.66	37	28	66
	S2H	N330 ±60	.66	41	42	73	7	40	.66	41	31	73
	T2H	N470 ±60	.66	49	50	88	9.5	49	.66	36	37	88
	U2J	N750 ±120	.66	68	69	120	13.5	67	.66	51	52	120
EXTENDED TEMPERATURE COMPENSATING TYPES	P3K	N1500 ±250	.89	83	84	147	23	122	.89	83	84	147
	R3A	N2200 ±400	1.5	133	134	235	24	131	1.5	52	96	170
	S3B	N3300 ±650	2.9	208	209	368	39	213	2.9	81	101	200
	G3C	N4200 ±850	3.2	330	323	588	61	327	—	—	—	—
	T3D	N4700 ±900	4.0	450	456	810	79	425	4.0	179	180	440
	H3M	N5600 ±1000	5.4	660	664	1180	106	573	—	—	—	—

*SLC stands for Single-layer Ceramic Technology

TUSONIX

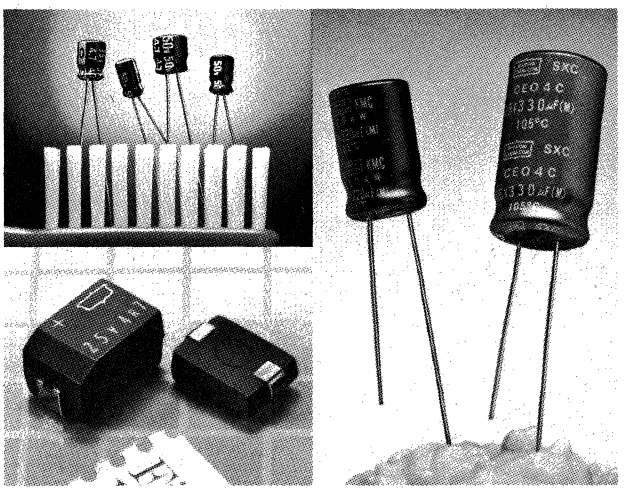
For complete ordering information, write or call TUSONIX, Inc., P.O. Box 37144, Tucson, Arizona 85740-7144, (602) 744-0400, TX 299-640 (RCA)

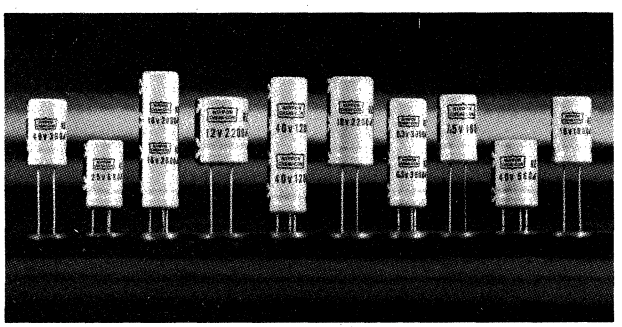
UNITED CHEMI-CON

The LEADER in Aluminum Electrolytic Capacitors for over 50 Years. Today, More Popular Than Ever!

Wider Product Range

The latest technology enables United Chemi-Con to offer a wider choice of capacitors than ever before. High gain foil increases our capacitors' volumetric efficiency. We can build smaller and smaller capacitors without diminishing performance. We also are designing more capacitors that meet special needs, such as low leakage current, without sacrificing other electrical characteristics. And our expanding series of solvent-proof capacitors can be inserted on PC boards along with other components before soldering and cleaning with halogenated solvents. Whatever your needs, we have the capacitors to meet them.





Expanded Facilities

In 1983 United Chemi-Con opened a new 54,000 square foot warehouse in Compton, California. The most advanced computer systems link this warehouse with our Corporate Headquarters in Rosemont, Illinois. In 1984 we opened a Western Region Branch Sales Office in Compton. It provides full-scale services to our Western customers.

Engineering & Technical Support

A team of applications engineers at Corporate Headquarters answers engineering questions, cross-references parts and reviews drawings. They are readily accessible to our customers by telephone. Our product data sheets, newsletters and catalogs set the standard for the industry. Send for our 256-page *Full Line Catalog* detailing the widest variety of aluminum electrolytic capacitors available from any one manufacturer *in the world.*

UNITED CHEMI-CON

UNITED CHEMI-CON INC.
9801 West Higgins Road, Rosemont, Illinois 60018
312-696-2000 TWX 910-253-2964 TLX 28-3557
Western Region Branch Sales Office:
213-636-3216 TWX 910-997-8025 TLX 66-4707

WORLD LEADER OVER 50 YEARS OF CAPACITOR QUALITY

UNITED CHEMI-CON

Product Selection Guide for Aluminum Electrolytic Capacitors

Purpose	Application/ Type	Maximum Temperature	Series
General Purpose	General Application	85°C	**SL**
			SM
			SMC
		105°C	**KM**
			KMC
			KML
		110°C	**KX**
			KXC
		130°C	**GX**
Tantalum Replacement	Low Leakage	85°C	**LL**
			LR
		105°C	**KM**
			KMC
		110°C	**KX**
			KXC
		130°C	**GX**
	Small Case Size	85°C	**SRA**
			SRE
		105°C	**KMA**
Output of Power Supply	General Application	105°C	**RX**
			RXC
			RZ
			RZA
			SXA
			SXC
			SXE
		110°C	**KX**
			KXC
Input of Power Supply	General Application	85°C	**BK**
			BKA
			CE
			NM
			NMA
			NMHR
			SME Plug-in
		105°C	**KM Plug-in**
			KME Plug-in
		110°C	**KX**
			KXC
		130°C	**GX-VH**
Invertor of Power Supply	Miniature	105°C	**KXB**
Low Profile	Miniature	85°C	**SR**
			SRC
			SRA
			SRE
			SRF
		105°C	**SXE**
	Small Can	85°C	**BK**
			BKA

Purpose	Application/ Type	Maximum Temperature	Series
Long Life	General Application	85°C/2,000 Hrs.	**SME**
		105°C/1,000 Hrs.	**KM**
			KMC
			KML
		110°C/1,000 Hrs.	**KX**
			KXC
		130°C/1,000 Hrs.	**GX**
	Power Supply Application	105°C/2,000 Hrs.	**RX**
			RXC
			RZ
			SXA
			SXC
		105°C/5,000 Hrs.	**RZA**
Solvent Proof*	General Application Without Epoxy End Seal	85°C	**SMC**
			SME
			SRC
		105°C	**KMA**
			KMC
			KME
			KRE
			KRF
			LX
			RXC
			SXC
			SXE
		110°C	**KXC**
	Epoxy End Seal	85°C	**LR**
		105°C	**RZ**
			RZA
High CV	Miniature	85°C	**SME**
			SRA
			SRE
		105°C	**SXE**
	Small Can	85°C	**SL-VP**
			SM-LUG
			SM-VP
			SME Plug-in
		105°C	**KME Plug-in**
	Large Can	85°C	**MWU**
Bi-Polar	General Audio, TV	85°C	**SMBP-D**
			SMBP-P
		70°C	**BP-S**
Computer Grade	General and Power Supply	85°C	**MWU**
			UW
		105°C	**KMU**
			KWU
Special	Chip	85°C	**Alchip-S**
	Multi-Unit	85°C	**Array**
	Flat Shape	85°C	**FLS**
	Strobe	55°C	**PH**
	Microphone	—	**Microphone**

*Solvent proof capacitors can be used with either (1) Freon® TE/TES/TMS for a minimum of 5 minutes by ultrasonic, vapor or immersion or (2) Chlorothene® for a maximum of 5 minutes by immersion at room temperature. For Chlorothene,® use polyester sleeve only.

®Freon is a registered trademark of DuPont, Inc. ®Chlorothene is a registered trademark of Dow Chemical Co.

UNITED CHEMI-CON Product Specifications for Aluminum Electrolytic Capacitors

	Series†	Capacitance Range in μF	Voltage Range in Volts	Temperature Range	Leakage Current in μA	Standard Capacitance Tolerance	Minimum Case Size (mm)	Terminal Type
Miniature	BP-S	2.2 to 10	25 Only	−25 to +70°C	100	±20%	16 x 25.5	Radial
	GX	.47 to 1000	10 to 63	−40 to +130°C	.002CV or 2	−10 to +50%	8 x 11.5 6.3 x 13	Radial Axial
	GX-VH	56 to 18,000	10 to 100 160 to 250	−40 to +130°C −25 to +130°C	.02CV or 3000	±20%	22 x 30	Radial
	KM	47 to 10,000	6.3 to 100 160 to 250	−55 to +105°C −40 to +105°C	.002CV or 2 .03CV +15	±20%	5 x 11 5 x 12.5	Radial Axial
	KMA*	0.1 to 100	6.3 to 63	−55 to +105°C	.01CV or 3	±20%	4 x 7	Radial
	KMC*	.47 to 10,000	6.3 to 100 160 to 250	−55 to +105°C −40 to +105°C	.002CV or 2 .03CV +15	±20%	5 x 11 5 x 12.5	Radial Axial
	KME*	.47 to 22,000	6.3 to 100 160 to 250	−55 to +105°C −40 to +105°C	.01CV or 3 .03CV +15	±20%	5 x 11 5 x 12.5	Radial Axial
	KML	0.1 to 10,000	6.3 to 100 160 to 250	−55 to +105°C −40 to +105°C	.01CV + 3 .03CV + 15	±20%	5 x 11	Radial
	KRE*	0.1 to 100	4 to 50	−55 to +105°C	.01CV or 3	±20%	3 x 5	Radial
	KX	.47 to 3300	10 to 100 160 to 400	−55 to +110°C −25 to +105°C	.002CV or 2 .02CV + 10	±20%	8 x 11.5 6.3 x 13	Radial Axial
	KXB	1.0 to 10	160 to 400	−40 to +105°C	.03CV + 30	±20%	10 x 20	Radial
	KXC*	.47 to 3300	10 to 100	−55 to +110°C	.002CV or 2	±20%	8 x 11.5 6.3 x 13	Radial Axial
	LL	0.1 to 4700	6.3 to 100	−40 to +85°C	.002CV or 0.2	±20%	5 x 11	Radial
	LR*	0.1 to 100	6.3 to 50	−40 to +85°C	.002CV or 0.2	±20%	5 x 14	Radial
	LX*	.47 to 2200	10 to 100 160 to 250	−40 to +105°C	.01CV + 2 .04CV + 100	±20%	8 x 14	Radial
	RX	2.2 to 1000	10 to 100	−55 to +105°C	.002CV or 2	−10 to +100%	8 x 11.5	Radial
	RXC*	2.2 to 1000	10 to 100	−55 to +105°C	.002CV or 2	−10 to +100%	8 x 11.5	Radial
	RZ*	15 to 16,500	7.5 to 100 150 to 250	−55 to +105°C −25 to +105°C	$\sqrt{CV}$ .02CV + 10	−10 to +75%	19.1 x 31.8	Radial
	RZA*	56 to 33,000	6.3 to 100 160 to 250	−55 to +105°C −25 to +105°C	$2\sqrt{CV}$ .02CV or 3000	−10 to +75% ±20%	19 x 31	Radial and Radial/Axial
	SL	.47 to 10,000	6.3 to 100 160 to 500	−40 to +85°C −25 to +85°C	.03CV or 4 .03CV + 100	−10 to +50% (−10 to +75%)	5 x 11 5 x 13	Radial Axial
	SM	.47 to 10,000	6.3 to 100 160 to 450	−40 to +85°C −25 to +85°C	.01CV or 3 .03CV + 15	±20%	5 x 11 5 x 12.5	Radial Axial
	SMBP-D	.47 to 2200	6.3 to 100	−40 to +85°C	.03CV or 3	±20%	5 x 11 6.3 x 16	Radial Axial
	SMBP-P	1.0 to 100	25 to 63	−40 to +85°C	.03CV or 3	±20%	10 x 12.5 8 x 20	Radial Axial
	SMC*	.47 to 10,000	6.3 to 100	−40 to +85°C	.03CV or 4 .01CV or 3	±20%	5 x 11 5 x 12.5	Radial Axial
	SME*	.47 to 22,000	6.3 to 100 160 to 250	−40 to +85°C	.01CV or 3 .03CV + 15	±20%	5 x 11 5 x 12.5	Radial Axial
	SR	0.1 to 3300	6.3 to 50	−40 to +85°C	.03CV or 4 .01CV or 3	±20%	5 x 9	Radial
	SRA	0.1 to 100	6.3 to 63	−40 to +85°C	.01CV or 3	±20%	4 x 7	Radial

*Solvent Proof

†For details, individual series data sheets available upon request.

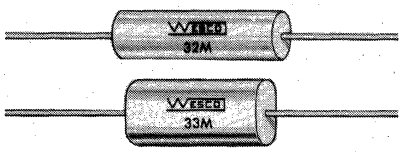
UNITED CHEMI-CON Product Specifications for Aluminum Electrolytic Capacitors

	Series†	Capacitance Range in μF	Voltage Range in Volts	Temperature Range	Leakage Current in μA	Standard Capacitance Tolerance	Minimum Case Size (mm)	Terminal Type
Miniature	SRC*	0.1 to 3300	6.3 to 50	−40 to +85°C	.01CV or 3000	±20%	5 x 9	Radial
	SRE	0.1 to 100	4 to 50	−40 to +85°C	.01CV or 3	±20%	3 x 5	Radial
	SRF	270 to 15,000	6.3 to 100	−40 to +85°C	.01CV	±20%	18 x 20	Radial
	SXA	22 to 2200	6.3 to 63	−55 to +105°C	.01CV	±20%	10 x 12.5	Radial
	SXC*	1.0 to 2200	6.3 to 63	−55 to +105°C	.01CV	±20%	6.3 x 11	Radial
	SXE*	1.5 to 15,000	6.3 to 100	−55 to +105°C	.01CV	±20%	4 x 7	Radial
Small Can	BK	47 to 22,000	16 to 200 400	−40 to +85°C −25 to +85°C	.03CV or 3000 .06CV or 5000	±20% or −10 to +30%	25.4 x 25	Plug-in
	BKA	220 to 15,000	10 to 200 250	−40 to +85°C −25 to +85°C	.02CV or 3000	±20%	25.4 x 25	Plug-in
	KM PLUG-IN	47 to 33,000	10 to 100 160 to 400	−40 to +105°C −25 to +105°C	.02CV or 3000	±20%	22 x 25	Plug-in
	KME PLUG-IN	39 to 47,000	10 to 100 160 to 400	−40 to +105°C −25 to +105°C	.02CV or 3000	±20%	22 x 25	Plug-in
	KRF*	68 to 39,000	10 to 100 160 to 250	−40 to +105°C −25 to +105°C	.02CV or 3000	±20%	22 x 20	Radial
	NM	47 to 22,000	10 to 200 400	−40 to +85°C −25 to +85°C	.03CV or 3000 .06CV or 5000	±20% or −10 to +30%	22 x 26	Plug-in
	NMA	220 to 15,000	10 to 200 250	−40 to +85°C −25 to +85°C	.02CV or 3000	±20%	22 x 30	Plug-in
	NMHR	100 to 1000	160 to 250	−25 to +85°C	.02CV or 3000	±20%	25.4 x 25	Plug-in
	SL-VP	220 to 10,000	10 to 100	−25 to +85°C	.03CV or 5000	−10 to +50%	22 x 30	Radial 3 Lead
	SM-LUG	22 to 100,000	6.3 to 100 160 to 450	−40 to +85°C −25 to +85°C	.04CV or 5000 .06CV or 5000	−10 to +50% −10 to +100%	22.4 x 31.5	Lug and PC Board
	SM-VP	470 to 22,000	10 to 100	−40 to +85°C	.02CV or 3000	±20%	22 x 30	Radial 3 Lead
	SME PLUG-IN	82 to 22,000	10 to 100 160 to 400	−40 to +85°C −25 to +85°C	.02CV or 3000 .06CV or 5000	±20%	22 x 30	Plug-in
Large Can	KMU	220 to 390,000	10 to 100 160 to 400	−40 to +105°C −25 to +105°C	.02CV or 5000	−10 to +50%	35 x 41	Screw
	KWU	1000 to 100,000	10 to 100	−40 to +105°C	.02CV or 5000	−10 to +50%	35 x 41	Screw
	MWU	75 to 1,600,000	6 to 100 150 to 450	−40 to +85°C −25 to +85°C	.02CV or 5000	−10 to +75% −10 to +50%	35 x 41	Screw
	UW	80 to 390,000	10 to 100 200 to 450	−40 to +85°C −25 to +85°C	.02CV or 5000	−10 to +75% −10 to +50%	35 x 41	Screw
Specials	Alchip-S	0.1 to 22	6.3 to 50	−40 to +85°C	.01CV or 3	±20%	4.6 x 6.4 x 2.5	Leadless
	Array	0.1 to 10	6.3 to 50	−40 to +85°C	.01CV or 3	±20%	17.0 x 6.8 x 8.6	Radial Axial
	FLS	470 to 33,000	10 to 100	−40 to +85°C	.02CV or 3000	±20%	70 x 50 x 6.5	Flat with 2 Pins
	PH	50 to 500 100 to 1500	200 to 330 330 to 360	−10 to +55°C	.003CV or 100	−10 to +20%	12.5 x 20 18 x 30	Radial Lug
	Micro-phone	Electret Condenser Microphones Data Sheet, Bulletin No. U123N, available upon request.						

*Solvent Proof

†For details, individual series data sheets available upon request.

WESCO® POLYESTER FILM-FOIL CAPACITORS



SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE

200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

TEMPERATURE RANGE

−55°C to +85°C with full rated voltage applied. To +125°C with 50% of rated voltage.

INSULATION RESISTANCE

At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 100,000 megohms-microfarads, but need not exceed 100,000 megohms.

DISSIPATION FACTOR

Shall not exceed 0.75% when measured at 25°C and 1000 Hz, ±20 Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE

Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz ±20 Hz.

LIFE TEST

Shall withstand 140% of rated voltage at 85°C for 250 hours. One failure in twelve shall be permitted.

CAPACITANCE STABILITY (DRIFT)

Less than 0.50% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 80°C, and room to −55°C. The mathematical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in percent.

HUMIDITY RESISTANCE

Meets requirements of Mil-C-27287,, Para. 3.12 when tested in accordance with Mil-STD.-202C, Method 103 B, Condition B.

LEAD PULL AND BEND TEST

Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90° in the opposite direction with no evidence of breakage.

FEATURES

Wrap and fill construction.

Tubular or oval configuration for optimum space savings.

Extended foil design.

Quality control procedures per Mil-Q-9858.

Will meet or exceed Mil-C-27287.

APPLICATIONS

Computers

Data Processing Equipment

Peripheral Equipment

Aircraft and Missile Systems

Industrial Instrumentation

Navigation and Distance Measuring Equipment

Communications Equipment

Filters

TYPE 32M RATINGS AND DIMENSIONS

Capacity In Mfds.	100 VOLTS D	L	Cat. No. 32M — K-1	200 VOLTS D	L	Cat. No. 32M — K-2	400 VOLTS D	L	Cat. No. 32M — K-4	600 VOLTS D	L	Cat. No. 32M — K-6
.001	.187	.40	1001	.187	.40	1001	.187	.53	1001	.187	.53	1001
.0012	.187	.40	1201	.187	.40	1201	.187	.53	1201	.187	.53	1201
.0015	.187	.40	1501	.187	.40	1501	.187	.53	1501	.187	.53	1501
.0018	.187	.40	1801	.187	.40	1801	.187	.53	1801	.187	.53	1801
.0022	.187	.40	2201	.187	.40	2201	.187	.53	2201	.187	.53	2201
.0027	.187	.40	2701	.187	.40	2701	.187	.53	2701	.203	.53	2701
.0033	.187	.40	3301	.187	.40	3301	.187	.53	3301	.218	.53	3301
.0039	.187	.40	3901	.187	.40	3901	.187	.53	3901	.218	.53	3901
.0047	.187	.40	4701	.187	.40	4701	.187	.53	4701	.187	.65	4701
.0056	.187	.40	5601	.187	.40	5601	.187	.53	5601	.203	.65	5601
.0068	.187	.40	6801	.187	.40	6801	.187	.53	6801	.203	.65	6801
.0082	.187	.40	8201	.187	.40	8201	.203	.53	8201	.218	.65	8201
.01	.187	.40	1002	.203	.40	1002	.218	.53	1002	.234	.65	1002
.012	.187	.40	1202	.234	.40	1202	.234	.53	1202	.265	.65	1202
.015	.203	.40	1502	.250	.40	1502	.265	.53	1502	.281	.65	1502
.018	.218	.40	1802	.203	.53	1802	.218	.65	1802	.265	.78	1802
.022	.234	.40	2202	.218	.53	2202	.250	.65	2202	.281	.78	2202
.027	.265	.40	2702	.234	.53	2702	.234	.78	2702	.312	.78	2702
.033	.218	.53	3302	.218	.65	3302	.265	.78	3302	.296	.90	3302
.039	.187	.65	3902	.234	.65	3902	.281	.78	3902	.328	.90	3902
.047	.203	.65	4702	.250	.65	4702	.312	.78	4702	.359	.90	4702
.056	.218	.65	5602	.281	.65	5602	.296	.90	5602	.375	.90	5602
.068	.250	.65	6802	.312	.65	6802	.328	.90	6802	.421	.90	6802
.082	.265	.65	8202	.296	.78	8202	.343	.90	8202	.375	1.18	8202
.1	.265	.78	1003	.328	.78	1003	.390	.90	1003	.421	1.18	1003
.12	.281	.78	1203	.328	.90	1203	.359	1.18	1203	.453	1.18	1203
.15	.312	.78	1503	.359	.90	1503	.390	1.18	1503	.500	1.18	1503
.18	.312	.90	1803	.359	1.03	1803	.437	1.32	1803	.515	1.32	1803
.22	.343	.90	2203	.390	1.03	2203	.484	1.32	2203	.562	1.32	2203
.27	.343	1.03	2703	.406	1.18	2703	.468	1.56	2703	.562	1.56	2703
.33	.375	1.03	3303	.437	1.18	3303	.515	1.56	3303	.578	1.70	3303
.39	.375	1.18	3903	.468	1.18	3903	.562	1.56	3903	.625	1.70	3903
.47	.406	1.18	4703	.515	1.18	4703	.609	1.56	4703	.687	1.70	4703
.56	.437	1.18	5603	.531	1.32	5603	.640	1.70	5603	.750	1.70	5603
.68	.484	1.18	6803	.515	1.56	6803	.703	1.70	6803	.796	1.82	6803
.82	.531	1.18	8203	.578	1.56	8203	.734	1.82	8203	.828	1.94	8203
1.0	.546	1.32	1004	.593	1.70	1004	.781	1.94	1004	.921	1.94	1004
1.25	.578	1.45	1254	.671	1.70	1254	—	—	—	—	—	—
1.50	.625	1.45	1504	.734	1.70	1504	—	—	—	—	—	—
2.0	.687	1.56	2004	.812	1.82	2004	—	—	—	—	—	—

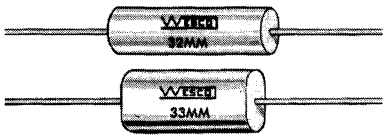
TYPE 33M RATINGS AND DIMENSIONS

Capacity In Mfds.	100 VOLTS T	W	L	Cat. No. 33M — K1	200 VOLTS T	W	L	Cat. No. 33M — K2	400 VOLTS T	W	L	Cat. No. 33M — K4	600 VOLTS T	W	L	Cat. No. 33M — K6
.001	.125	.234	.40	1001	.125	.234	.40	1001	.109	.203	.53	1001	.109	.203	.53	1001
.0012	.125	.234	.40	1201	.125	.234	.40	1201	.109	.203	.53	1201	.109	.203	.53	1201
.0015	.125	.234	.40	1501	.125	.234	.40	1501	.125	.234	.53	1501	.125	.234	.53	1501
.0018	.125	.234	.40	1801	.125	.234	.40	1801	.125	.234	.53	1801	.125	.234	.53	1801
.0022	.125	.234	.40	2201	.125	.234	.40	2201	.125	.234	.53	2201	.125	.234	.53	2201
.0027	.125	.234	.40	2701	.125	.234	.40	2701	.125	.234	.53	2701	.125	.234	.53	2701
.0033	.125	.234	.40	3301	.125	.234	.40	3301	.125	.234	.53	3301	.140	.281	.53	3301
.0039	.125	.234	.40	3901	.125	.234	.40	3901	.125	.234	.53	3901	.140	.265	.53	3901
.0047	.125	.234	.40	4701	.125	.234	.40	4701	.125	.234	.53	4701	.125	.265	.65	4701
.0056	.125	.234	.40	5601	.125	.234	.40	5601	.125	.234	.53	5601	.125	.250	.65	5601
.0068	.125	.234	.40	6801	.125	.234	.40	6801	.125	.234	.53	6801	.125	.250	.65	6801
.0082	.125	.234	.40	8201	.125	.234	.40	8201	.140	.234	.53	8201	.140	.265	.65	8201
.01	.125	.234	.40	1002	.140	.250	.40	1002	.156	.250	.53	1002	.156	.281	.65	1002
.012	.125	.234	.40	1202	.171	.265	.40	1202	.171	.265	.53	1202	.171	.312	.65	1202
.015	.140	.234	.40	1502	.187	.281	.40	1502	.187	.312	.53	1502	.203	.328	.65	1502
.018	.156	.250	.40	1802	.140	.234	.53	1802	.140	.281	.65	1802	.171	.312	.78	1802
.022	.171	.281	.40	2202	.156	.250	.53	2202	.171	.296	.65	2202	.203	.343	.78	2202
.027	.203	.296	.40	2702	.171	.281	.53	2702	.156	.281	.78	2702	.234	.359	.78	2702
.033	.140	.250	.53	3302	.156	.250	.65	3302	.171	.312	.78	3302	.218	.343	.90	3302
.039	.125	.234	.65	3902	.171	.265	.65	3902	.203	.328	.78	3902	.250	.375	.90	3902
.047	.140	.250	.65	4702	.171	.312	.65	4702	.203	.375	.78	4702	.281	.406	.90	4702
.056	.156	.265	.65	5602	.203	.328	.65	5602	.187	.359	.90	5602	.281	.453	.90	5602
.068	.187	.281	.65	6802	.218	.359	.65	6802	.218	.390	.90	6802	.312	.500	.90	6802
.082	.187	.312	.65	8202	.218	.343	.78	8202	.250	.421	.90	8202	.281	.453	1.18	8202
.1	.187	.312	.78	1003	.234	.375	.78	1003	.281	.453	.90	1003	.312	.500	1.18	1003
.12	.203	.328	.78	1203	.218	.390	.90	1203	.250	.421	1.18	1203	.343	.515	1.18	1203
.15	.234	.359	.78	1503	.250	.421	.90	1503	.281	.484	1.18	1503	.390	.578	1.18	1503
.18	.218	.328	.90	1803	.234	.437	1.03	1803	.312	.515	1.32	1803	.406	.578	1.32	1803
.22	.250	.359	.90	2203	.265	.468	1.03	2203	.359	.562	1.32	2203	.468	.640	1.32	2203
.27	.234	.406	1.03	2703	.281	.484	1.18	2703	.343	.546	1.56	2703	.437	.640	1.56	2703
.33	.265	.437	1.03	3303	.328	.515	1.18	3303	.390	.593	1.56	3303	.468	.671	1.70	3309
.39	.265	.453	1.18	3903	.359	.562	1.18	3903	.437	.640	1.56	3903	.500	.703	1.70	3903
.47	.296	.500	1.18	4703	.406	.593	1.18	4703	.484	.687	1.56	4703	.562	.765	1.70	4703
.56	.328	.531	1.18	5603	.406	.609	1.32	5603	.515	.718	1.70	5603	.625	.828	1.70	5603
.68	.375	.562	1.18	6803	.406	.609	1.56	6803	.578	.781	1.70	6803	.656	.875	1.82	6803
.82	.421	.609	1.18	8203	.453	.656	1.56	8203	.609	.812	1.82	8203	.703	.906	1.94	8203
1.0	.437	.625	1.32	1004	.484	.687	1.70	1004	.656	.859	1.94	1004	.781	.984	1.94	1004
1.25	.453	.656	1.45	1254	.453	.859	1.70	1254	—	—	—	—	—	—	—	—
1.50	.515	.718	1.45	1504	.515	.906	1.70	1504	—	—	—	—	—	—	—	—
2.0	.468	.875	1.56	2004	.578	.984	1.82	2004	—	—	—	—	—	—	—	—

STANDARD LEAD SIZES: #24 AWG TCW: up to and including .203″ Dia., #22 AWG TCW: from .204″ thru .312″ Dia., #20 AWG TCW: /313″ Dia. and over. **CAPACITY TOLERANCE STANDARD** . . . ±10% / OTHER . . . from ±20% to ±1%. Other values as well as voltage ratings are available on request.
MARKING: For marking see metallized polyester data sheet opposite page.

J K ELECTRONICS, INC. d/b/a
WESCO® ELECTRICAL COMPANY
201 MUNSON STREET • GREENFIELD • MASSACHUSETTS • 01301

WESCO® METALIZED POLYESTER CAPACITORS



SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE

200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

TEMPERATURE RANGE

−55°C to +85°C with full rated voltage applied. To +125°C with 50% of rated voltage.

INSULATION RESISTANCE

At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 30,000 megohms-microfarads, but need not exceed 30,000 megohms.

DISSIPATION FACTOR

Shall not exceed 1.0% when measured at 25°C and 1000 Hz, ±20 Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE

Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz, ±20 Hz.

LIFE TEST

Shall withstand 140% of rated voltage at 85°C for 250 hours. One failure in twelve shall be permitted.

CAPACITANCE STABILITY (DRIFT)

Less than 0.3% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 85°C, and room to −55°C. The mathematical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in percent.

HUMIDITY RESISTANCE

Meets requirements of Mil-C-27287, Para. 3.12 when tested in accordance with Mil-STD.-202C, Method 103 B, Condition B.

LEAD PULL AND BEND TEST

Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90° in the opposite direction with no evidence of breakage.

FEATURES

Wrap and fill construction
Tubular and oval configuration for optimum space savings
Extended foil design
Miniature size — lightweight
Low dissipation factor
Excellent stability
Quality control procedures per Mil-Q-9858

APPLICATIONS

Data Processing Equipment
Aircraft and Missile Systems
Industrial Instrumentation
Navigation and Distance Measuring Equipment
Communications Equipment
Tachometers
Filters
Peripheral Equipment

32MM RATINGS AND DIMENSIONS

Capacitance in Mfds.	35 VDC T	W	L	50 VDC T	W	L	100 VDC T	W	L	200 VDC T	W	L	400 VDC T	W	L	600 VDC T	W	L
.0068	—	—	—	—	—	—	—	—	—	—	—	—	.218	.53	.312	.53		
.0082	—	—	—	—	—	—	—	—	—	—	—	—	.234	.53	.171	.65		
.01	—	—	—	—	—	—	—	—	—	—	—	—	.265	.53	.250	.65		
.012	—	—	—	—	—	—	—	—	—	—	—	—	.203	.65	.265	.65		
.015	—	—	—	—	—	—	—	—	—	—	—	—	.218	.65	.296	.65		
.018	—	—	—	—	—	—	—	—	—	.203	.40		.234	.65	.328	.65		
.022	—	—	—	—	—	—	—	—	—	.218	.40		.250	.65	.375	.65		
.027	—	—	—	—	—	—	.171	.40		.234	.40		.265	.65	.390	.65		
.033	—	—	—	—	—	—	.187	.40		.265	.40		.296	.65	.437	.65		
.039	—	—	—	—	—	—	.187	.40		.203	.53		.234	.90	.328	.90		
.047	—	—	—	—	—	—	.203	.40		.218	.53		.265	.90	.375	.90		
.056	—	—	—	—	—	—	.218	.40		.234	.53		.265	.90	.390	.90		
.068	—	—	—	—	—	—	.250	.40		.250	.53		.296	.90	.437	.90		
.082	—	—	—	—	—	—	.187	.53		.265	.53		.328	.90	.468	.90		
.1	—	—	—	—	—	—	.203	.53		.281	.53		.343	.90	.515	.90		
.12	—	—	—	—	—	—	.218	.53		.312	.53		.328	1.18	.453	1.18		
.15	—	—	—	—	—	—	.234	.53		.343	.53		.343	1.18	.515	1.18		
.18	—	—	—	.187	.40		.250	.53		.296	.65		.375	1.18	.562	1.18		
.22	—	—	—	.203	.40		.234	.65		.328	.65		.406	1.18	.625	1.18		
.27	.171	.40		.218	.40		.250	.65		.359	.65		.453	1.18	.687	1.18		
.33	.187	.40		.234	.40		.265	.65		.406	.65		.437	1.45	.656	1.45		
.39	.203	.40		.250	.40		.281	.65		.437	.65		.468	1.45	.703	1.45		
.47	.218	.40		.187	.53		.312	.65		.468	.65		.515	1.45	.781	1.45		
.56	.250	.40		.203	.53		.343	.65		.406	.90		.546	1.45	.843	1.45		
.68	.171	.53		.218	.53		.375	.65		.437	.90		.609	1.45	.921	1.45		
.82	.187	.53		.250	.53		.359	.78		.406	1.18		.593	1.70	.906	1.70		
1.00	.203	.53		.218	.65		.390	.78		.437	1.18		.656	1.70	1.000	1.70		
1.25	.234	.53		.234	.65		.421	.78		.500	1.18		.734	1.70	1.171	1.70		
1.50	.250	.53		.265	.65		.421	.90		.531	1.18		.796	1.70	1.265	1.70		
1.80	.218	.65		.281	.65		.453	.90		.593	1.18		.875	1.70	1.375	1.70		
2.00	.234	.65		.312	.65		.484	.90		.625	1.18		.921	1.70	1.406	1.70		
3.00	.281	.65		.312	.78		.484	1.18		.656	1.45		—	—	—	—		
4.00	.343	.65		.375	.78		.562	1.18		.750	1.45		—	—	—	—		
5.00	.375	.65		.421	.78		.625	1.18		.765	1.70		—	—	—	—		
8.00	.390	.78		.453	.90		.703	1.45		.828	2.06		—	—	—	—		
10.00	.390	.90		.453	1.03		.781	1.45		.921	2.06		—	—	—	—		
15.00	.468	.90		.546	1.03		—	—		—	—		—	—	—	—		
20.00	.546	.90		.593	1.18		—	—		—	—		—	—	—	—		
25.00	.500	1.18		.656	1.18		—	—		—	—		—	—	—	—		
30.00	.562	1.18		.718	1.18		—	—		—	—		—	—	—	—		

LEAD MATERIAL: TINNED COPPER SOLID WIRE. **STANDARD LEAD SIZES:** #24 AWG: Up to and including .203" Dia.; #22 AWG: from .204" thru .312" Dia.; #20 AWG: .313" Dia. and over. **CAPACITY TOLERANCE:** STANDARD . . . ±10%/OTHER . . . from ±20% to ±2%. Other values as well as voltage ratings are available on request. **MARKING:** WESCO Logo, Capacity Tolerance, VDC Rating and Date Code. (Note: On smaller units, Ⓣ trademark will be substituted for WESCO logo.)

33MM RATINGS AND DIMENSIONS

Capacitance in Mfds.	35 VDC T	W	L	50 VDC T	W	L	100 VDC T	W	L	200 VDC T	W	L	400 VDC T	W	L	600 VDC T	W	L
.0068	—	—	—	—	—	—	—	—	—	—	—	—	.140	.281	.53	.234	.359	.53
.0082	—	—	—	—	—	—	—	—	—	—	—	—	.156	.296	.53	.078	.218	.65
.01	—	—	—	—	—	—	—	—	—	—	—	—	.187	.312	.53	.171	.296	.65
.012	—	—	—	—	—	—	—	—	—	—	—	—	.125	.250	.65	.140	.281	.65
.015	—	—	—	—	—	—	—	—	—	—	—	—	.140	.265	.65	.203	.343	.65
.018	—	—	—	—	—	—	—	—	—	—	—	—	.156	.281	.65	.218	.421	.65
.022	—	—	—	—	—	—	—	—	—	.140	.281	.40	.171	.312	.65	.250	.437	.65
.027	—	—	—	—	—	—	.109	.203	.40	.156	.296	.40	.203	.328	.65	.281	.484	.65
.033	—	—	—	—	—	—	.125	.218	.40	.187	.312	.40	.218	.359	.65	.312	.531	.65
.039	—	—	—	—	—	—	.125	.234	.40	.125	.250	.53	.156	.296	.90	.218	.421	.90
.047	—	—	—	—	—	—	.140	.250	.40	.140	.265	.53	.171	.312	.90	.250	.437	.90
.056	—	—	—	—	—	—	.156	.265	.40	.156	.281	.53	.187	.328	.90	.265	.468	.90
.068	—	—	—	—	—	—	.187	.281	.40	.171	.296	.53	.218	.343	.90	.312	.515	.90
082	—	—	—	—	—	—	.109	.234	.53	.187	.312	.53	.218	.390	.90	.343	.562	.90
.1	—	—	—	—	—	—	.125	.250	.53	.203	.343	.53	.250	.421	.90	.390	.593	.90
.12	—	—	—	—	—	—	.140	.265	.53	.234	.359	.53	.218	.390	1.18	.343	.546	1.18
.15	—	—	—	—	—	—	.156	.281	.53	.265	.390	.53	.250	.421	1.18	.390	.596	1.18
.18	—	—	—	.125	.218	.40	.187	.312	.53	.234	.359	.65	.281	.453	1.18	.437	.640	1.18
.22	—	—	—	.140	.234	.40	.156	.281	.65	.250	.390	.65	.296	.500	1.18	.500	.687	1.18
.27	.109	.203	.40	.156	.250	.40	.171	.296	.65	.281	.406	.65	.343	.531	1.18	.562	.765	1.18
.33	.125	.218	.40	.187	.265	.40	.187	.312	.65	.281	.484	.65	.312	.515	1.45	.531	.734	1.45
.39	.140	.234	.40	.218	.296	.40	.218	.343	.65	.312	.515	.65	.343	.546	1.45	.578	.781	1.45
.47	.156	.250	.40	.125	.218	.53	.234	.359	.65	.359	.562	.65	.390	.578	1.45	.640	.843	1.45
.56	.187	.265	.40	.156	.250	.53	.250	.406	.65	.281	.484	.90	.437	.625	1.45	.718	.921	1.45
.68	.218	.296	.53	.187	.265	.53	.281	.437	.65	.328	.515	.90	.484	.687	1.45	.796	1.000	1.45
.82	.140	.234	.53	.187	.296	.53	.250	.421	.78	.296	.484	1.18	.468	.671	1.70	.781	.984	1.70
1.0	.156	.250	.53	.156	.250	.65	.281	.453	.78	.328	.531	1.18	.531	.734	1.70	.875	1.078	1.70
1.25	.187	.265	.53	.187	.281	.65	.312	.515	.78	.375	.578	1.18	.609	.812	1.70	1.062	1.265	1.70
1.50	.187	.281	.53	.203	.296	.65	.296	.500	.90	.421	.625	1.18	.671	.875	1.70	1.156	1.359	1.70
1.80	.187	.250	.65	.218	.312	.65	.328	.515	.90	.406	.687	1.18	.750	.953	1.70	1.265	1.484	1.70
2.0	.187	.265	.65	.234	.343	.65	.359	.562	.90	.421	.718	1.18	.796	1.000	1.70	1.281	1.484	1.70
3.0	.218	.312	.65	.234	.359	.78	.375	.578	1.18	.460	.765	1.45	—	—	—	—	—	—
4.0	.265	.359	.65	.281	.406	.78	.406	.703	1.18	.625	.828	1.45	—	—	—	—	—	—
5.0	.296	.406	.65	.328	.453	.78	.453	.750	1.18	.640	.828	1.70	—	—	—	—	—	—
8.0	.312	.437	.78	.375	.500	.90	.531	.828	1.45	.656	.953	2.06	—	—	—	—	—	—
10.0	.312	.437	.90	.375	.500	1.03	.609	.906	1.45	.750	1.046	2.06	—	—	—	—	—	—
15.0	.390	.515	.90	.468	.593	1.03	—	—	—	—	—	—	—	—	—	—	—	—
20.0	.453	.578	.90	.500	.640	1.18	—	—	—	—	—	—	—	—	—	—	—	—
25.0	.437	.562	1.18	.578	.703	1.18	—	—	—	—	—	—	—	—	—	—	—	—
30.0	.468	.593	1.18	.656	.781	1.18	—	—	—	—	—	—	—	—	—	—	—	—

STANDARD LEAD SIZES: Refer to equivalent rating in type 32MM above. **CAPACITY TOLERANCE:** STANDARD . . . ±10%/OTHER . . . from ±20% to ±2%. Other values as well as voltage ratings are available on request. **MARKING:** For marking and lead material see type 32MM above.

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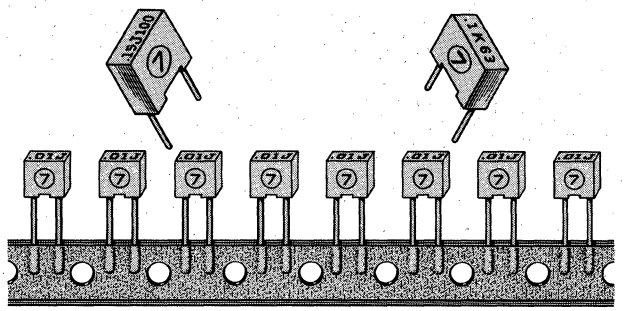
Telephone: 413-774-4358

WESCO® METALIZED POLYESTER CAPACITORS "BOX" CAPACITORS



SPECIFICATIONS

TEMPERATURE RANGE
−55°C to +85°C. To +100°C with 50% voltage derating.

DIELECTRIC WITHSTANDING VOLTAGE
160% of rated voltage for 2 seconds at 25°C.

DISSIPATION FACTOR
Shall not exceed 1.0% when measured at 25°C at 1KHz ±20Hz.

CAPACITANCE TOLERANCE
Standard ±20%. ±10% and ±5% available upon request. Measurements will be made at 25°C and 1KHz ±20Hz.

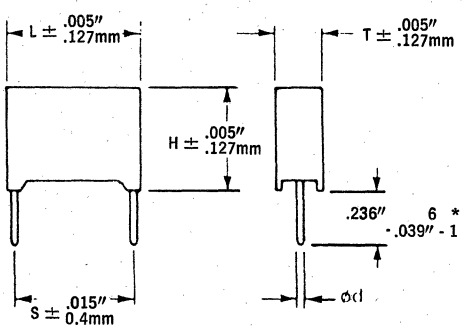
LIFE TEST
Shall withstand 125% of rated voltage at 85°C for 1000 hours.

HUMIDITY RESISTANCE
Meets requirements of MIL-STD-202, Method 103B, condition B.

TERMINALS
Tinned solid copper wire.

MARKING
Capacitance, tolerance, voltage (VDC), WESCO trademark (7).
(Exception: Certain values due to size limitation, will display capacitance, tolerance and (7) only.)
Tolerance Codings: M = ±20%, K = ±10%, J = ±5%.

RESISTANCE TO SOLDERING HEAT
During soldering operation, maximum heat of +260°C may be applied to leads for no longer than 6 seconds.



* Except for type 68MM which is: 0.157" ± .04" 4mm + 1

TYPE 60MM

Capacity in MFD.	63 VDC 40 VAC Case Code	100 VDC 63 VAC Case Code	250 VDC 160 VAC Case Code	400 VDC 200 VAC Case Code	630 VDC 220 VAC Case Code
.001-.01	—	—	—	—	G
.022	—	—	—	G	O
.047	—	—	G	L	P
.1	—	—	L	P	R
.22	G	K	L	R	W
.47	K	L	R	W	—
1.0	L	U	W	Z	—

TYPE 67MM

Capacity in MFD.	63 VDC 40 VAC Case Code	100 VDC 63 VAC Case Code	250 VDC 160 VAC Case Code	400 VDC 200 VAC Case Code	630 VDC 250 VAC Case Code
.001-.0033	—	—	—	—	C
.0047	—	—	—	C	F
.01	—	—	C	F	J
.047	—	C	F	J	—
.1	C	F	J	—	—
.22	F	J	—	—	—
.47	J	—	—	—	—
1.0	N	—	—	—	—

TYPE 68MM

Capacity in MFD.	50 VDC 30 VAC Case Code	63 VDC 40 VAC Case Code	100 VDC 63 VAC Case Code
.001-.022	—	—	A
.033-.068	—	A	—
.1	A	B	—
.22	D	E	—
.47	H	I	—
1.0	M	—	—

DIMENSIONS

Case Code	T mm	T in	H mm	H in	L mm	L in	S mm	S in	d mm	d in
A	2.5	.098	6.5	.256	7.2	.284	5	.197	0.6	.025
B	3	.118	6.5	.256	7.2	.284	5	.197	0.6	.025
C	3.5	.138	6.5	.256	10.5	.414	7.5	.295	0.6	.025
D	3.5	.138	7.5	.295	7.2	.284	5	.197	0.6	.025
E	3.5	.138	8.5	.335	7.2	.284	5	.197	0.6	.025
F	4	.158	9	.355	10.5	.414	7.5	.295	0.6	.025
G	4	.158	9	.355	13	.512	10	.394	0.8	.032
H	4.5	.177	9.5	.374	7.2	.284	5	.197	0.6	.025
I	5	.197	10	.394	7.2	.284	5	.197	0.6	.025
J	5	.197	11	.433	10.5	.414	7.5	295	0.8	.032
K	5	.197	11	.433	13	.512	10	.394	0.8	.032
L	5	.197	11	.433	18	.709	15	.591	0.8	.032
M	6	.236	11	.433	7.2	.284	5	.197	0.6	.025
N	6	.236	12	.473	10.5	.414	7.5	.295	0.8	.032
O	6	.236	12	.473	13	.512	10	.394	0.8	.032
P	6	.236	12	.473	18	.709	15	.591	0.8	.032
Q	6	.236	15	.591	26.5	1.044	20	.788	0.8	.032
R	6	.236	15	.591	26.5	1.044	22.5	.886	0.8	.032
S	7	.276	16	.630	26.5	1.044	20	.788	0.8	.032
T	7	.276	16	.630	26.5	1.044	22.5	.886	0.8	.032
U	7.5	.295	13.5	.532	18	.709	15	.591	0.8	.032
V	8.5	.335	14.5	.571	18	.709	15	.591	0.8	.032
W	8.5	.335	17	.670	26.5	1.044	22.5	.886	0.8	.032
X	9	.355	17	.670	32	1.26	27.5	1.083	0.8	.032
Y	10	.394	18.5	.729	26.5	1.044	22.5	.886	0.8	.032
Z	11	.433	20	.788	32	1.26	27.5	1.083	0.8	.032

J.K ELECTRONICS, INC d/b/a
WESCO® ELECTRICAL COMPANY
201 MUNSON STREET • GREENFIELD • MASSACHUSETTS • 01301

WESCO POLYSTYRENE CAPACITORS

SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE
200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

INSULATION RESISTANCE
At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 500,000 megohms-microfarads, but need not exceed 500,000 megohms.

DISSIPATION FACTOR
Shall not exceed .05% when measured at 25°C and 1000 Hz, ± Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE
Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz, ±20 Hz.

LIFE TEST
Shall withstand 140% of rated voltage at 85°C for 250 hours. One failure in twelve shall be permitted.

TEMPERATURE COEFFICIENT
Capacitance shall change linearly over operating temperature range at rate of −105, ±30 parts per million/°C.

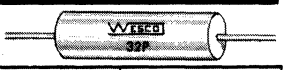
CAPACITANCE STABILITY (DRIFT)
Less than .05% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 85°C, and room to −55°C. The mathematical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in percent.

HUMIDITY RESISTANCE
Meets requirements of Mil-C-27287, Para. 3.12 when tested in accordance with Mil-STD.-202C, Method 103 B, Condition B.

LEAD PULL AND BEND TEST
Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90° in the opposite direction with no evidence of breakage.

TEMPERATURE RANGE
−55°C to +85°C with full rated voltage applied.

TYPE 32P RATINGS & DIMENSIONS



Capacity in Mfds.	100 VOLTS D	L	Cat. No. 32P — J-1	200 VOLTS D	L	Cat. No. 32P — J-2	400 VOLTS D	L	Cat. No. 32P — J-4
.001	.187	.53	1001	.187	.53	1001	.187	.53	1001
.0012	.187	.53	1201	.187	.53	1201	.187	.53	1201
.0015	.187	.53	1501	.187	.53	1501	.187	.53	1501
.0018	.187	.65	1801	.187	.65	1801	.187	.65	1801
.0022	.187	.65	2201	.187	.65	2201	.187	.65	2201
.0027	.187	.65	2701	.187	.65	2701	.187	.65	2701
.0033	.187	.65	3301	.187	.65	3301	.187	.65	3301
.0039	.187	.65	3901	.187	.65	3901	.187	.65	3901
.0047	.187	.65	4701	.187	.65	4701	.234	.65	4701
.0056	.187	.65	5601	.187	.65	5601	.250	.65	5601
.0068	.187	.65	6801	.187	.65	6801	.234	.78	6801
.0082	.187	.65	8201	.203	.65	8201	.250	.78	8201
.01	.203	.65	1002	.234	.65	1002	.265	.78	1002
.012	.218	.65	1202	.218	.78	1202	.296	.78	1202
.015	.234	.65	1502	.250	.78	1502	.328	.78	1502
.018	.234	.78	1802	.265	.78	1802	.359	.78	1802
.022	.250	.78	2202	.281	.78	2202	.343	.90	2202
.027	.265	.78	2702	.312	.78	2702	.375	.90	2702
.033	.296	.78	3302	.343	.78	3302	.406	.90	3302
.039	.328	.78	3902	.375	.78	3902	.453	.90	3902
.047	.343	.78	4702	.359	.90	4702	437	1.03	4702
.056	.375	.78	5602	.390	.90	5602	.484	1.03	5602
.068	.375	.90	6802	.421	.90	6802	.484	1.18	6802
.082	.406	.90	8202	.421	1.03	8202	.531	1.18	8202
.1	.453	.90	1003	.468	1.03	1003	.578	1.18	1003
.12	.484	.90	1203	.515	1.03	1203	.625	1.18	1203
.15	.500	1.03	1503	.531	1.18	1503	.656	1.32	1503
.18	.531	1.03	1803	.578	1.18	1803	.671	1.45	1803
.22	.546	1.18	2203	.640	1.18	2203	.671	1.70	2203
.27	.609	1.18	2703	.656	1.32	2703	.734	1.70	2703
.33	.625	1.32	3303	.687	1.45	3303	.812	1.70	3303
.39	.671	1.32	3903	.750	1.45	3903	—	—	—
.47	.703	1.45	4703	.734	1.70	4703	—	—	—

STANDARD LEAD SIZES: #24 AWG TCW: up to and including .203″ Dia.
#22 AWG TCW: from .204″ thru .312″ Dia.
#20 AWG TCW: .313″ Dia.and over

CAPACITY TOLERANCE: STANDARD . . . ±5% / OTHER . . . from ±20% to ±1%
Other values as well as voltage ratings are available upon request.

METALIZED POLYCARBONATE CAPACITORS

SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE
200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

TEMPERATURE RANGE
−55°C to +85°C with full rated voltage applied. To +125°C with 50% of rated voltage.

INSULATION RESISTANCE
At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 50,000 megohms-microfarads, but need not exceed 50,000 megohms.

DISSIPATION FACTOR
Shall not exceed 0.3% when measured at 25°C and 1000 Hz, ±20 Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE
Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz, ±20 Hz.

LIFE TEST
Shall withstand 140% of rated voltage at 85°C for 250 hours. One failure in twelve shall be permitted.

CAPACITANCE STABILITY (DRIFT)
Less than 0.3% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 85°C, and room to −55°C. The mathematical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in percent.

HUMIDITY RESISTANCE
Meets requirements of Mil-C-27287, Para. 3.12 when tested in accordance with Mil-STD.-202C, Method 103B, Condition B.

LEAD PULL AND BEND TEST
Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90 ° in the opposite direction with no evidence of breakage.

TYPE 32MPC RATINGS & DIMENSIONS

Capacity in Mfds.	50 VOLTS D	L	Cat. No. 32MPC — K-05	100 VOLTS D	L	Cat. No. 32MPC — K-1	200 VOLTS D	L	Cat. No. 32MPC — K-2
.012	—	—	—	—	—	—	.171	.40	1202
.015	—	—	—	—	—	—	.187	.40	1502
.018	—	—	—	—	—	—	.203	.40	1802
.022	—	—	—	.156	.40	2202	.218	.40	2202
.027	—	—	—	.171	.40	2702	.234	.40	2702
.033	—	—	—	.171	.40	3302	.250	.40	3302
.039	—	—	—	.187	.40	3902	.187	.53	3902
.047	—	—	—	.203	.40	4702	.203	.53	4702
.056	—	—	—	.218	.40	5602	.218	.53	5602
.068	—	—	—	.234	.40	6802	.234	.53	6802
.082	.156	.40	8202	.187	.53	8202	.265	.53	8202
.1	.171	.40	1003	.203	.53	1003	.234	.65	1003
.12	.187	.40	1203	.218	.53	1203	.250	.65	1203
.15	.203	.40	1503	.234	.53	1503	.281	.65	1503
.18	.218	.40	1803	.250	.53	1803	.296	.65	1803
.22	.171	.53	2203	.265	.53	2203	.328	.65	2203
.27	.187	.53	2703	.250	.65	2703	.312	.78	2703
.33	.203	.53	3303	.265	.65	3303	.343	.78	3303
.39	.203	.53	3903	.281	.65	3903	.359	.78	3903
.47	.218	.53	4703	.312	.65	4703	.406	.78	4703
.56	.250	53	5603	.328	.65	5603	.390	.90	5603
.68	.218	.65	6803	.328	.78	6803	.421	.90	6803
.82	.234	.65	8203	.343	.78	8203	.468	.90	8203
1.0	.265	.65	1004	.375	.78	1004	.515	.90	1004
1.25	.296	.65	1254	.421	.78	1254	.484	1.18	1254
1.50	.312	.65	1504	.453	.78	1504	.531	1.18	1504
1.80	.328	.78	1804	.453	.90	1804	.578	1.18	1804
2.0	.343	.78	2004	.468	.90	2004	.609	1.18	2004
3.0	.390	.78	3004	.484	1.18	3004	.656	1.45	3004
4.0	.437	.78	4004	.546	1.18	4004	.750	1.45	4004
5.0	.437	.90	5004	.531	1.45	5004	.734	1.78	5004
8.0	.468	1.18	8004	.593	1.78	8004	.859	2.06	8004
10.0	.515	1.18	1005	.656	1.78	1005	.953	2.06	1005

STANDARD LEAD SIZES: #24 AWG TCW: up to and including .203″ Dia.
#22 AWG TCW: from .204″ thru .312″ Dia.
#20 AWG TCW: .313″ Dia.and over

CAPACITY TOLERANCE: STANDARD . . . ±10% / OTHER . . . from ±20% to ±2%
Other values as well as voltage ratings are available upon request.

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WESCO®

METALIZED POLYPROPYLENE CAPACITORS

SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE
200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

INSULATION RESISTANCE
At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 100,000 megohms-microfarads, but need not exceed 100,000 megohms.

DISSIPATION FACTOR
Shall not exceed 0.1% when measured at 25°C and 1000 Hz, ±20 Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE
Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz, ±20 Hz.

LIFE TEST
Shall withstand 140% of rated voltage at 105°C for 250 hours. One failure in twelve shall be permitted.

TEMPERATURE COEFFICIENT
Capacitance shall change linearly over operating temperature range of −55°C to +85°C at rate of −290, ±75 parts per million/°C.

CAPACITANCE STABILITY (DRIFT)
Less than .2% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 105°C, and room to −55°C. The mathematical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in precent.

HUMIDITY RESISTANCE
Meets requirements of Mil-C-27287, Para. 3.12 when tested in accordance with Mil-STD.-202C, Method 103 B, Condition B.

LEAD PULL AND BEND TEST
Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90° in the opposite direction with no evidence of breakage.

TEMPERATURE RANGE
−55°C to +105°C with full rated voltage applied.

DIELECTRIC ABSORPTION
Shall not exceed .05% when tested in accordance with Mil-C-19978.

TYPE 32MPL RATINGS AND DIMENSIONS

Capacity In Mfds.	100 VDC D	L	Cat No. 32MPL —K-1	200 VDC D	L	Cat No. 32MPL —K-2	400 VDC D	L	Cat No. 32MPL —K-4
.01	.171	.406	1002	.171	.406	1002	.187	.531	1002
.012	.171	.406	1202	.171	.406	1202	.203	.531	1202
.015	.171	.406	1502	.187	.406	1502	.234	.531	1502
.018	.171	.406	1802	.203	.406	1802	.250	.531	1802
.022	.171	.406	2202	.171	.531	2202	.265	.531	2202
.027	.171	.406	2702	.171	.531	2702	.296	.531	2702
.033	.187	.406	3302	.187	.531	3302	.312	.531	3302
.039	.203	.406	3902	.203	.531	3902	.343	.531	3902
.047	.218	.406	4702	.218	.531	4702	.281	.656	4702
.056	.234	.406	5602	.234	.531	5602	.312	.656	5602
.068	.187	.531	6802	.250	.531	6802	.343	.656	6802
.082	.187	.531	8202	.275	.531	8202	.375	.656	8202
.1	.218	.531	1003	.250	.656	1003	.343	.781	1003
.12	.234	.531	1203	.265	.656	1203	.375	.781	1203
.15	.250	.531	1503	.296	.656	1503	.421	.781	1503
.18	.275	.531	1803	.328	.656	1803	.453	.781	1803
.22	.312	.531	2203	.359	.656	2203	.437	.906	2203
.27	.328	.531	2703	.359	.781	2703	.484	.906	2703
.33	.281	.656	3303	.375	.781	3303	.546	.906	3303
.39	.312	.656	3903	.406	.781	3903	.578	.906	3903
.47	.343	.656	4703	.390	.906	4703	.531	1.187	4703
.56	.375	.656	5603	.437	.906	5603	.578	1.187	5603
.68	.375	.781	6803	.484	.906	6803	.625	1.187	6803
.82	.390	.781	8203	.515	.906	8203	.687	1.187	8203
1.0	.421	.781	1004	.484	1.187	1004	.671	1.437	1004
1.25	.421	.906	1254	.531	1.187	1254	.750	1.437	1254
1.50	.453	.906	1504	.578	1.187	1504	.812	1.437	1504
1.80	.500	.906	1804	.640	1.187	1804	.796	1.687	1804
2.00	.515	.906	2004	.671	1.187	2004	.843	1.687	2004
3.00	.531	1.187	3004	.718	1.437	3004	1.03	1.687	3004
4.00	.609	1.187	4004	.828	1.437	4004	—	—	—
5.00	.671	1.187	5004	.828	1.687	5004	—	—	—
8.00	.750	1.437	8004	.937	2.062	8004	—	—	—
10.00	.843	1.437	1005	1.03	2.062	1005	—	—	—
12.00	.828	1.687	1205	—	—	—	—	—	—
15.00	.921	1.687	1505	—	—	—	—	—	—

STANDARD LEAD SIZES: #24 AWG: up to and including .203" Dia.
#22 AWG: from .204" thru .312" Dia.
#20 AWG: .313" Dia. and over

STANDARD LEAD MATERIAL: SOLID TINNED COPPER WIRE.

CAPACITY STANDARD: STANDARD . . . ±5%/OTHER . . . FROM ±20% TO ±1%.

OTHER VALUES AS WELL AS VOLTAGE RATINGS ARE AVAILABLE UPON REQUEST.

LIMITED WARRANTY

Seller warrants the products sold shall conform to specifications and be free from defects in material and workmanship furnished by Seller, which develop under normal and intended use. The **sole liability** of Seller, whether based upon breach of warranty or contract or negligence, shall be limited to repair or replacement, at Seller's election, of all such defective or nonconforming products, upon return f.o.b. to Seller's factory, provided Buyer has given Seller notice in writing of such defect or nonconformity within ninety days after delivery by Seller of such items to Buyer.

Seller assumes no liability for 1) incidental, collateral or consequential damages; 2) applications in combination with any electrical or electronic components other than as intended by Seller; 3) damages of any kind incurred by Buyer from modifications made to the products without written consent of Seller.

The foregoing constitutes the sole and exclusive remedy of Buyer and the exclusive liability of Seller and IS IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, DESCRIPTION, QUALITY OR PRODUCTIVENESS.

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WESCO® POLYPROPYLENE CAPACITORS

SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE
200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

INSULATION RESISTANCE
At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 250,000 megohms-microfarads, but need not exceed 250,000 megohms.

DISSIPATION FACTOR
Shall not exceed .05% when measured at 25°C and 1000 Hz, ±20 Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE
Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz, ±20 Hz.

LIFE TEST
Shall withstand 140% of rated voltage at 105°C for 250 hours. One failure in twelve shall be permitted.

TEMPERATURE COEFFICIENT
Capacitance shall change linearly over operating temperature range of −55°C to +85°C at rate of −290, ±75 parts per million/°C.

CAPACITANCE STABILITY (DRIFT)
Less than .2% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 105°C, and room to −55°C. The mathematical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in percent.

HUMIDITY RESISTANCE
Meets requirements of Mil-C-27287, Para 3.12 when tested in accordance with Mil-STD.-202C, Method 103 B, Condition B.

LEAD PULL AND BEND TEST
Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90° in the opposite direction with no evidence of breakage.

TEMPERATURE RANGE
−55°C to +105°C with full rated voltage applied.

TYPE 32PL RATINGS & DIMENSIONS

Capacity in Mfds.	100 VOLTS D	L	Cat. No. 32PL — K-1	200 VOLTS D	L	Cat. No. 32PL — K-2	400 VOLTS D	L	Cat. No. 32PL — K-4
.0010	.187	.406	1001	.187	.406	1001	.187	.406	1001
.0015	.187	.406	1501	.187	.406	1501	.203	.406	1501
.0022	.187	.406	2201	.187	.406	2201	.234	.406	2201
.0033	.187	.406	3301	.187	.406	3301	.187	.531	3301
.0039	.187	.406	3901	.203	.406	3901	.187	.531	3901
.0047	.187	.406	4701	.187	.531	4701	.203	.531	4701
.0056	.187	.406	5601	.187	.531	5601	.218	.531	5601
.0068	.187	.406	6801	.187	.531	6801	.234	.531	6801
.0082	.187	.406	8201	.187	.531	8201	.203	.656	8201
.0100	.203	.406	1002	.203	.531	1002	.218	.656	1002
.015	.219	.531	1502	.203	.656	1502	.265	.656	1502
.022	.250	.531	2202	.234	.656	2202	.312	.656	2202
.027	.265	.531	2702	.265	.656	2702	.328	.656	2702
.033	.234	.656	3302	.281	.656	3302	.328	.781	3302
.039	.250	.656	3902	.312	.656	3902	.359	.781	3902
.047	.281	.656	4702	.296	.781	4702	.390	.781	4702
.056	.281	.656	5602	.312	.781	5602	.421	.781	5602
.068	.296	.656	6802	.343	.781	6802	.406	.906	6802
.082	.312	.781	8202	.375	.781	8202	.437	.906	8202
.10	.344	.781	1003	.375	.906	1003	.484	.906	1003
.12	.375	.781	1203	.406	.906	1203	.453	1.156	1203
.15	.375	.906	1503	.453	.906	1503	.500	1.156	1503
.18	.406	.906	1803	.484	.906	1803	.546	1.156	1803
.22	.437	.906	2203	.484	1.031	2203	.687	1.156	2203
.27	.437	1.031	2703	.531	1.031	2703	.578	1.406	2703
.33	.500	1.031	3303	.593	1.031	3303	.640	1.406	3303
.39	.531	1.031	3903	.593	1.156	3903	.687	1.406	3903
.47	.531	1.156	4703	.656	1.156	4703	.750	1.406	4703
.56	.578	1.156	5603	.625	1.406	5603	.825	1.406	5603
.68	.625	1.156	6803	.687	1.406	6803	.825	1.656	6803
.82	.625	1.406	8203	.687	1.656	8203	.906	1.656	8203
1.0	.687	1.406	1004	.734	1.656	1004	1.000	1.656	1004

STANDARD LEAD SIZES: #24 AWG TCW: up to and including .203" Dia.
#22 AWG TCW: from .204" thru .312" Dia.
#20 AWG TCW: .313" Dia.and over

CAPACITY TOLERANCE: STANDARD . . . ±10% / OTHER . . . from 20% to ±1%
Other values as well as voltage ratings are available upon request.

FEATURES

32P
- Wrap and fill construction
- Excellent long-term stability
- Superior "Q" for tuned circuits
- High insulation resistance
- Linear temperature coefficient
- Quality control procedures per Mil-Q-9858
- Extended foil design

32MPC
- Wrap and fill construction
- Micro-miniature — lightweight
- Low dissipation factor
- Zero TC ±50 ppm/°C from +25°C to +55°C
- Extended foil design
- Excellent stability
- Quality control procedures per Mil-Q-9858

32PL & 32MPL
- Wrap and fill construction
- Excellent long-term stability
- Superior "Q" for tuned circuits
- High insulation resistance
- Linear temperature coefficient (−55°C to +85°C)
- Quality control procedures per Mil-Q-9858
- Extended foil design

APPLICATIONS

32P, 32PL & 32MPL
- Computers
- Data Processing Equipment
- Aircraft and Missile Systems
- Industrial Instrumentation
- Navigation and Distance Measuring Equipment
- Communications Equipment
- Timing and Retrace Circuits
- Integrating Networks
- High "Q" Low Loss Filters
- Peripheral Equipment

32MPC
- Data Processing Equipment
- Aircraft and Missile Systems
- Industrial Instrumentation
- Navigation and Distance Measuring Equipment
- Communications Equipment
- Tachometers
- Filters
- Peripheral Equipment

EXPLANATION OF CATALOG NUMBER

32 P 1002 K-1

32 — Round, Wrap and Fill, with epoxy seals.

P — Polystyrene — Foil, Axial Leads*

1002 — In Picofarads — first three digits are significant. Last digit specifies number of zeros, i.e., 1002 = 10,000 pfd. or 0.01 mfd.

K — Capacity Tolerance:
K = ±10% H = ±3% F = ±1%
M = ±20% J = ±5% G = ±2%

1 — DC Voltage Rating:
05 = 50 VDC 2 = 200 VDC 6 = 600 VDC
1 = 100 VDC 4 = 400 VDC etc.

***** — For Radial Leads, add letter "R" at end of part number.

J K ELECTRONICS, INC d/b/a
WESCO® ELECTRICAL COMPANY
201 MUNSON STREET • GREENFIELD • MASSACHUSETTS • 01301
Telephone: 413-774-4358

Nytronics Components Group, Inc.

Orange Street, Darlington, S.C. 29532

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Inductors
page A•1244-1263
Capacitors
page A•1142-1155
Delay Lines
page A•1550-1554
Resistors
page A•1911

coils, chokes, inductors-1800

COILS & CHOKES

Manufacturer	AF	RF	IF	High Q	Shielded	Variable (Adjustable)	Choke/Filter	Chip	Toroidal Inductors	Other	Type
Automatic Coil		A•1207-A•1209*	A•1207-A•1209*		A•1207-A•1209*						
Bell Industries		A•1210-A•1217*		A•1214 A•1216 A•1217	A•1213*	A•1213* A•1214	A•1210-A•1215*		A•1210* A•1217		
Caddell-Burns	A•1218-A•1229*	A•1218-A•1229*	A•1218-A•1229*		A•1218-A•1229*	A•1218-A•1229*	A•1218-A•1229*		A•1218-A•1229*		
Dale Electronics		A•1231-A•1237*		A•1231-A•1237*	A•1231-A•1237*		A•1231-A•1237*		A•1231-A•1237*	A•1232	Bobbins
Delevan		A•1238			A•1238	A•1238			A•1238	A•1238	Bobbins
Endicott Coil									A•1239		
Gowanda		A•1240*		A•1240*	A•1240*				A•1240*		
Microtran	A•1241			A•1241					A•1241		
North Hills		A•1243		A•1243	A•1243	A•1243					
Nytronics		A•1244-A•1263*		A•1262*	A•1245* A•1262* A•1248-A•1253*	A•1262* A•1263*					
Pan-Magnetics		A•1265		A•1265					A•1265		
Penn-Tran		A•1266								A•1266	Yokes, Deflection
Pico Electronics	A•1267-A•1271*			A•1267-A•1271*				A•1270* A•1271*			
Piconics		A•1273*				A•1273*	A•1223*	A•1273*			
Renco Electronics	A•1274-A•1276*				A•1274	A•1276	A•1274-A•1276*		A•1275 A•1276		
SFE Technologies		A•1277	A•1277	A•1277		A•1277		A•1277	A•1277		
TDK Corp.						A•1278	A•1278				
Toko America	A•1279	A•1279	A•1279				A•1279	A•1279			
Torotel Prods.	A•1282* A•1284-A•1295*	A•1281* A•1283*							A•1284* A•1285* A•1288-A•1295		
Wilco Corp.					A•1296		A•1296 A•1297			A•1296	Coil Kits

* Mil. Spec.

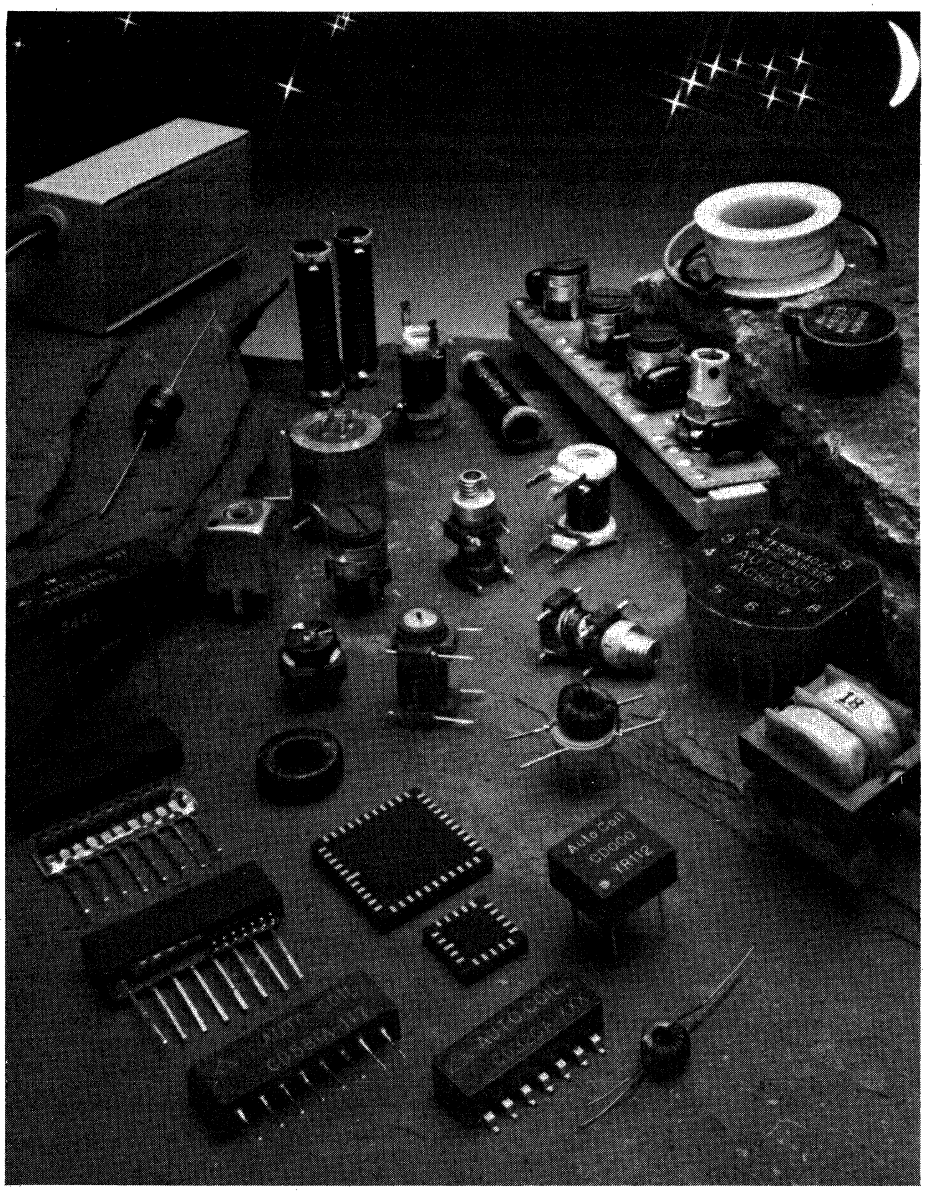
MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 85/86 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1166, **B**•1012, **C**•1028, **D**•1016
ASCII Code ..... **D**•1087
Batteries, Product Selection Guide ..... **D**•1413
Batteries & Fuel Cells, Characteristics ..... **D**•1430
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide ..... **A**•1003
Circuit Boards (Printed) Product Selection Guide ..... **C**•1099
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1205
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1863
Connectors, Miniglossary ..... **C**•1129
Connectors, Terminals, & Sockets, Product Selection Guide ..... **C**•1105
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Gude ..... **A**•1309
Delay Lines, Product Selection Guide ..... **A**•1459
Discrete Semiconductors, Product Selection Guide ..... **A**•2067
Displays, Readouts, Lamps, & Lights, Product Selection Guide ..... **B**•1015
EBCDIC Code ..... **D**•1092
Encapsulation, Miniglossary ..... **C**•1086
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide .. **C**•1623
Filters, Product Selection Guide ..... **A**•1583
Instruments, Graphic Recording Product Selection Guide ..... **D**•1401
Instruments, Panel Meters, Product Selection Guide ..... **D**•1329
Instruments, Test & Measuring Product Selection Guide ..... **D**•1175
Interconnection Systems, Product Selection Guide ..... **C**•1699
Keyboards & Keypads, Product Selection Guide ..... **B**•1705
Logofinder & Trademark Directories ..... **B**•901
Microwave Components, Product Selection Guide ..... **A**•1701
Military Qualified Products Lists ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1129
Opto Semiconductors, Miniglossary ..... **B**•1214
Oscilloscopes, Product Selection Guide ..... **D**•1385
Panel Hardware, Product Selection Guide ..... **C**•1589
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide ..... **A**•1991
Power Supplies, Miniglossary ..... **D**•1462
Power Supplies, AC, Product Selection Guide ..... **D**•1877
Power Supplies, DC, Product Selection Guide ..... **D**•1447
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide .... **B**•1225
Relay Contact Forms ..... **B**•1317
Relays, Electromechanical, Miniglossary ..... **B**•1308
Relays, Product Selection Guide ..... **B**•1261
Resistor Color Codes ..... **A**•1828
Resistors, Product Selection Guide ..... **A**•1785
Servo Components, Miniglossary ..... **D**•1985
Solenoids, Product Selection Guide ..... **B**•1463
Switches, Product Selection Guide ..... **B**•1477
Thermal Components, Product Selection Guide ..... **B**•1741
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1744
Thyristors/High Power Diodes, Miniglossary ..... **A**•2076
Transducers & Encoders, Product Selection Guide ..... **B**•1777
Transformers, Product Selection Guide ..... **A**•2099
Wire & Cable, Product Selection Guide ..... **C**•1743
Wire Gauges—Diameter, Area, Copper Weight ..... **C**•1844

Automatic Coil Corp.



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With its reputation for quality and service for over 30 years the Automatic Coil Corporation has firmly established itself as a leading manufacturer of custom designed inductive components. We offer a complete line of IF-RF coils, transformers, toroids, baluns, bobbins, delay lines, and related windings for commercial and military applications.

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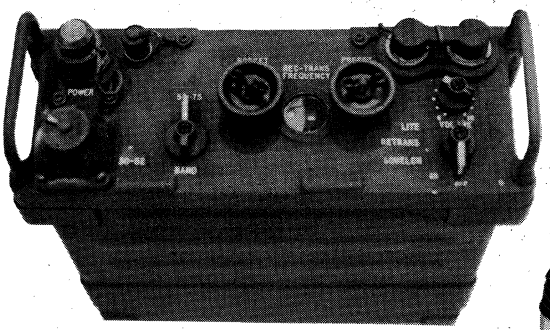
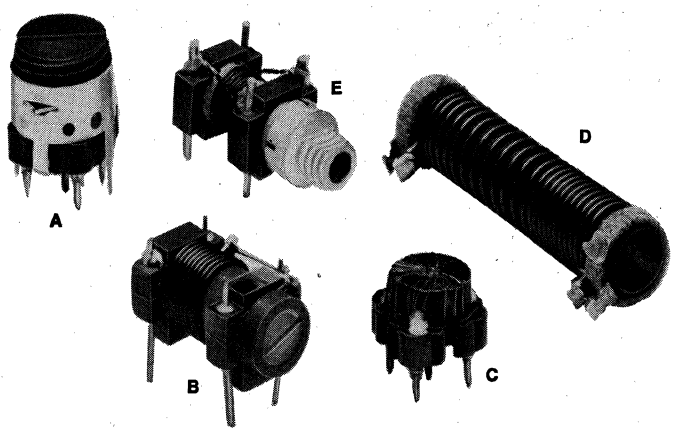
AN/PRC—77 COILS





Automatic Coil is recognized as the world's leading manufacturer of coils and transformers for U.S. Military Radios including the AN/PRC77 Manpack. The AN/PRC77 radio set is a tactical manpack FM transceiver. It is capable of operating in a wideband mode from 30 to 76 MHz. The AN/PRC77 is compatible with FM radio sets operating in the same frequency range.

Module Number	Signal Corps Coil Part Numbers Used	Module Number	Signal Corps Coil Part Numbers Used
A11A	SMD447522 (2)	A34	SMD448932, SMD448933, SMD449009
A12A	SMD447523 (2), SMD447524 (2)	A35A	SMD448607, SMD447636
A17A	SMD447521	A36	SMD449007, SMD449011, SMD449013, SMD449057
A18A	SMD447525, SMD447526 (2), SMD447527	A37	SMD449043, SMD449041
A21A	SMD447518, SMD447519, SMD447520	A38	SMD449033 (2), SMD449035, SMD449037
A28	SMD447801, SMD447802, SMD447803, SMD447804	A39A	SMD447805, SMD447530
A31	SMD448919, SMD448921, SMD448923, SMD448925, SMD448927 (2), SMD449053	A40A	SMD447531, SMD447532, SMD447538
		A43	SMD447533, SMD447534, SMD447535, SMD447536
A32	SMD448942, SMD448944	A44A	SMD621281, SMC621282, SMD621285
A33	SMD448931, SMD448933, SMD449009	A45A	SMD447528, SMD911079

Signal Corps Part Number	Automatic Coil Part Number	AN/PRC-77 Module Used In	Style	Signal Corps Part Number	Automatic Coil Part Number	AN/PRC-77 Module Used In	Style
SMD447518	CB2C01	A21A	A	SMD448607	CB2B02	A35A	A (w/o cup & shield)
SMD447519	CB2C02	A21A	A	SMD448919	CB2C17	A31	A
SMD447520	CB1C01	A21A	A	SMD448921	CB2C18	A31	A
SMD447521	CB2C03	A17A	A	SMD448923	CB2C19	A31	A
SMD447522	CB2C04	A11A	A	SMD448925	CB2C20	A31	A
SMD447523	CB2C05	A12A	A	SMD448927	CB2C21	A31	A
SMD447524	CB1C02	A12A	A	SMD448931	CB2N08	A33 & A34	B
SMD447525	CB2C06	A18A	A	SMD448933	CB2N09	A33 & A34	B
SMD447526	CB1C03	A18A	A	SMD448942	CB2N10	A32	B
SMD447527	CB2C07	A18A	A	SMD448944	CB2N11	A32	B
SMD447528	CB2C08	A45A	A	SMD449007	CB2N12	A36	B
SMD447530	CB2B03	A39A	A (w/o cup & shield)	SMD449009	CB2D01	A33 & A34	C
SMD447531	CB2C10	A40A	A	SMD449011	CB2N13	A36	B
SMD447532	CB2C11	A40A	A	SMD449013	CB2N14	A36	B
SMD447533	CB1N01	A43	B	SMD449033	CB2D02	A38	Not shown
SMD447534	CB2N01	A43	B	SMD449035	CB2N15	A38	B
SMD447535	CB2N02	A43	B	SMD449037	CB2N16	A38	B
SMD447536	CB2N03	A43	B	SMD449041	CB2D03	A37	C
SMD447538	CB2N05	A40A	B	SMD449043	CB2D04	A37	C
SMD447636	CB2C14	A35A	A	SMD449053	CB1C05	A31	A
SMD447801	CB1N02	A28	B	SMD449057	CB2N17	A36	B
SMD447802	CB1G01	A28	D	SMD621281	CB2N18	A44A	B
SMD447803	CB1G02	A28	D	SMC621282	CB3A01	A44A	Encapsulated network
SMD447804	CB1G03	A28	D	SMD621285	CB2N19	A44A	B
SMD447805	CB2M01	A39A	E	SMD911079	CB2C24	A45A	A

Complete technical specifications shown in catalog AC-36, available free upon request.

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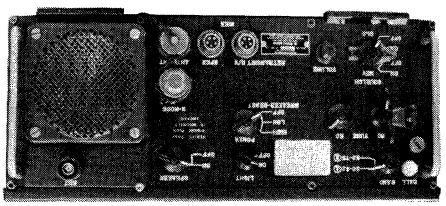
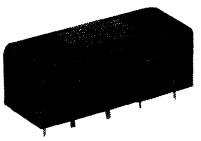
AN/VRC–12 COILS



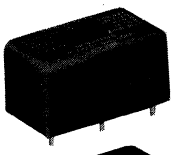
The VRC-12 is a combat-proven vehicle radio. Automatic Coil is currently fulfilling long term contracts for the full complement of VRC-12 coils and transformers for U.S. and free world manufacturers.

Toroid G

Coil K


Filter O

Toroid L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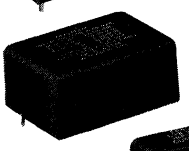
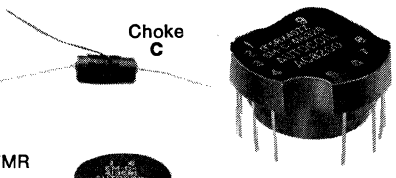
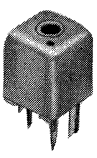
Toroid H


Filter Q

Dogbone M


Choke C

Toroid E


Can I

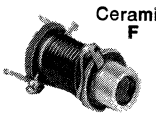
RFXFMR A

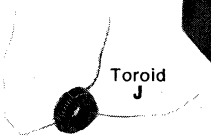
Toroid D

Filter N

Filter S

Ceramic B


Ceramic F


Toroid J

Filter R

Module Number	Signal Corps Coil Part Numbers Used	Module Number	Signal Corps Coil Part Numbers Used
A1100	SMC416321-1 (2), SMC416327-1	A3700	SMC413577, SMD413712, SMD413714
A1200	SMC416321-1 (2), SMC416327-1	A4100	SMD413735, SMD413740, SMD413742
A1300	SMC416321-1 (2), SMC416327-1	A4200	SMD413735, SMD413740, SMD413768, SMD413770, SMC413779 (2), SMB413782
A1400	SMC416328, SMC416329		
A1500	SMC416321-1, SMC416310, SMC416387, SMC416385	A6100	SMC414091 (2), SMC414093, SMC414096
A1600	SMC416323, SMC416326	A6300	SMC416332, SMC416321-2, SMC416352-1, SMC416327-2
Y2100	SMC413577, SMD414452, SMD414454	A6400	SMC416332, SMC416321-2, SMC416352-2, SMC416327-3, SMC416400
Y2200	SMC413577, SMD414461		
A3100	SMC413577, SMC413582	A6500	SMC619625, SMC619630, SMC619632, SMC619638
A3200	SMC413604, SMC413608, SMC414142	A8100	SMC414189
A3300	SMD413623, SMD413625, SMD413627	A8200	SMC413577, SMC414805, SMC414228, SMD414231, SMD414233, SMD414235
A3400	SMD413645, SMD413647		
A3500	SMC413577, SMD413663, SMD413665, SMD413667	A8300	SMD414208, SMD414210, SMD414212
A3600	SMC413577, SMD413681, SMD413690, SMD413692, SMD413694	A8400	SMC414266

Signal Corps Part Number	Automatic Coil Part Number	VRC-12 Module Used In	Style	Signal Corps Part Number	Automatic Coil Part Number	VRC-12 Module Used In	Style
SMC413577	CF1A01	Y2100, Y2200, A3100, A3500, A3600, A3700, A8200	C	SMD414233	CF2C24	A8200	A
				SMD414235	CF2C25	A8200	A
SMC413582	CF2C01	A3100	A	SMC414266	CF2E04	A8400	G
SMC413604	CF2A01	A3200	C	SMD414452	CF2C26	Y2100	A
SMC413608	CF2A02	A3200	C	SMD414454	CF1C01	Y2100	A
SMD413623	CF2C02	A3300	A	SMD414461	CF2C27	Y2200	A
SMD413625	CF2C03	A3300	A	SMC414805	CF1A04	A8200	C
SMD413627	CF2C04	A3300	A	SMC416310	CF1M02	A1500	B
SMD413645	CF2C05	A3400	A	SMC416321-1	CF1M03	A1100 (2), A1200 (2)	B
SMD413647	CF2C06	A3400	A			A1300 (2), A1500	
SMD413663	CF2C07	A3500	A	SMC416321-2	CF1M04	A6300, A6400	B
SMD413665	CF2C08	A3500	A	SMC416323	CF1E01	A1600	H
SMD413667	CF2C09	A3500	A	SMC416326	CF2E05	A1600	E
SMD413681*	CF2E01	A3600	D	SMC416327-1	CF1M05	A1100, A1200, A1300	B
SMD413690	CF2C10	A3600	A	SMC416327-2	CF1M06	A6300	B
SMD413692	CF2C11	A3600	A	SMC416327-3	CF1M07	A6400	B
SMD413694*	CF2E02	A3600	D	SMC416327-4	CF1M08	Silicone Version	B
SMD413712	CF2C12	A3700	A	SMC416328	CF2M03	A1400	B
SMD413714	CF2C13	A3700	A	SMC416329	CF2M02	A1400	B
SMD413735	CF2C14	A4100, A4200	A	SMC416332	CF1M09	A6300, A6400	B
SMD413740	CF2C15	A4100, A4200	A	SMC416352-1	CF1M10	A6300	B
SMD413742	CF2C16	A4100	A	SMC416352-2	CF1M11	A6400	B
SMD413768	CF2C17	A4200	A	SMC416385	CF2D01	A1500	J
SMD413770	CF2C18	A4200	A	SMC416387	CF2A04	A1500	C
SMC413779	CF2M01	A4200 (2)	B	SMC416400	CF2A05	A6400	C
SMB413782	CF1A02	A4200	C	SMC619625	CF2D03	A6500	J
SMC414091	CF2C19	A6100 (2)	C	SMC619630	CF2D04	A6500	J
SMC414093	CF1M12	A6100	F	SMC619632	CF2D05	A6500	J
SMC414096	CF1M13	A6100	F	SMC619638	CF2D06	A6500	J
SMC414142	CF1A03	A3200	C	SMD921099	CF2D02	Silicone Version	L
SMC414189*	CF2E03	A8101	D	SMD921100	CF2A06	Silicone Version	C
SMC414194	CF1M01	Silicone Version	B	SMD921128	CF2O34	Silicone Version	I
SMD414208	CF2C20	A8300	A	SMD921136	CF2G01	Silicone Version	K
SMD414210	CF2C21	A8300	A	SMD921188	CF2N01	Silicone Version	M
SMD414212	CF2C22	A8300	A	SMD921203	CF2C29	Silicone Version	A
SMC414228	CF2A03	A8200	C	SMD921455	CF2C33	Silicone Version	A
SMD414231	CF2C23	A8200	A				

Complete technical specifications shown in catalog AC-36, available free upon request.

*** Molded construction shown. Metal can version available.**

Automatic Coil Corp.
SUBSIDIARY OF DESIGNATRONICS, INC.

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Telephone: (305) 883-5311, TWX: 810-848-8097, FAX: (305) 885-2449

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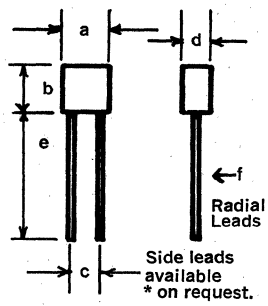

Closer inductance tolerances
* available on request.

ENCAPSULATED SUBMINIATURE AND MINIATURE TOROIDAL INDUCTORS

Features

- Applications: printed circuits and modules
- Environmental: designed to meet MIL-C-15305, Grade 1, Class B (−55°C to +125°C)
- Moisture and shock resistant, immersion proof
- Powdered iron toroidal core, low external magnetic field
- Identification: part number and inductance value printed in contrasting color

General Specifications (All Series)

Maximum operating temperature: 125°C
Rated temperature rise (at 90°C): 35°C
Dielectric withstanding voltage: 700 v rms
Terminal pull: 5 pounds
Altitude rating: 70,000 feet
Overload current: 1.4 times the rated current

T1 SERIES

Part Number	Apparent Induc., uH	Max. DC Resist., Ohms	Rated DC Current mA
100066	0.01	0.02	3000
100067	0.012	0.02	3000
100068	0.015	0.02	3000
100069	0.018	0.02	3000
100070	0.022	0.02	3000
100071	0.027	0.02	3000
100072	0.033	0.02	3000
100073	0.039	0.02	3000
100074	0.047	0.02	3000
100075	0.056	0.02	3000
100076	0.068	0.03	2500
100077	0.082	0.04	2200
100078	0.10	0.04	2200
100079	0.12	0.05	2000
100080	0.15	0.06	1800
100081	0.18	0.07	1600
100082	0.22	0.08	1500
100083	0.27	0.10	1400
100084	0.33	0.12	1300
100085	0.39	0.15	1150
100086	0.47	0.20	1000
100087	0.56	0.25	900
100088	0.68	0.30	800
100089	0.82	0.35	750
100090	1.0	0.40	700

a	b	c	d	e	f
.2	.2	.1	.1	1.0	#24

Inductance Tolerances: 0.01 to 0.082 uH, ±20%; 0.10 to 1.0 uH, ±10%.

T2 SERIES

Part Number	Apparent Induc., uH	Max. DC Resist., Ohms	Rated DC Current mA
100092	0.10	0.04	2200
100093	0.12	0.05	2000
100094	0.15	0.06	1800
100095	0.18	0.07	1600
100096	0.22	0.08	1500
100097	0.27	0.10	1400
100098	0.33	0.11	1300
100099	0.39	0.14	1200
100100	0.47	0.17	1100
100101	0.56	0.22	1000
100102	0.68	0.27	900
100103	0.82	0.30	800
100104	1.0	0.35	750
100105	1.2	0.40	700
100106	1.5	0.50	630
100107	1.8	0.70	530
100108	2.2	0.90	470
100109	2.7	1.1	420
100110	3.3	1.3	390
100111	3.9	1.5	360
100112	4.7	1.8	330
100113	5.6	2.0	310
100114	6.8	2.2	300
100115	8.2	2.4	290
100116	10	2.6	280

a	b	c	d	e	f
.2	.2	.1	.1	1.0	#24

Inductance Tolerances: 0.10 to 0.82 uH, ±10%; 1.0 to 10 uH, ±5%.

T3 SERIES

Part Number	Apparent Induc., uH	Max. DC Resist., Ohms	Rated DC Current mA
100117	10	1.1	550
100118	12	1.3	500
100119	15	1.5	450
100120	18	1.9	410
100121	22	2.3	380
100122	27	2.7	350
100123	33	3.3	320
100124	39	3.9	290
100125	47	4.7	260
100126	56	5.6	240
100127	68	6.8	220
100128	82	8.1	200
100129	100	9.7	180
100130	120	12	160
100131	150	14	150
100132	180	17	140
100133	220	20	130
100134	270	24	120
100135	330	19	130
100136	390	22	120
100137	470	27	110
100138	560	32	100
100139	680	19	130
100140	820	23	120
100141	1000	27	110

a	b	c	d	e	f
.27	.27	.2	.15	1.0	#22

Inductance Tolerance: ±5%.

T4 SERIES

Part Number	Apparent Induc., uH	Max. DC Resist., Ohms	Rated DC Current mA
100142	100	6	280
100143	120	7	260
100144	150	8	240
100145	180	10	220
100146	220	12	200
100147	270	14	180
100148	330	17	160
100149	390	20	150
100150	470	24	140
100151	560	28	130
100152	680	33	120
100153	820	39	110
100154	1000	45	100
100155	1200	31	120
100156	1500	37	110
100157	1800	44	100
100158	2200	52	90
100159	2700	61	85
100160	3300	71	80
100161	3900	82	75
100162	4700	93	70
100163	5600	105	65
100164	6800	140	60
100165	8200	160	55

a	b	c	d	e	f
.375	.375	.2	.187	1.0	#22

Inductance Tolerance: ±5%.

SERIES S, M, L MOLDED R.F. CHOKES

Series	Lengths	Diameter	Lead Size	Lead Length
S	.44 max.	.188 max.	#22 AWG	1.3 min.
M	.60 max.	.25 max.	#21 AWG	1.3 min.
L	.90 max.	.31 max.	#21 AWG	1.3 min.

Physical and Environmental Characteristics
Operating temperature −55° to +125°C
terminal strength—meets five pound pull test per MIL-C-15305
All Series meet requirements of MIL-C-15305, Grade 1, Class B

Inductance Tolerance: 0.1 to 22 uH, ±10% on Q-meter / 27 uH to 10,000, ±5% 1 kHz bridge

SERIES S				SERIES M				SERIES L			
Part Number	-L- Micro-Henries	Max DC Res, Ohms	Max I mA	Part Number	-L- Micro-Henries	Max DC Res, Ohms	Max I mA	Part Number	-L- Micro-Henries	Max DC Res, Ohms	Max I mA
100170	0.10	0.02	4000	100207	1.0	0.04	2700	100244	10.0	0.15	1800
100171	0.12	0.025	3500	100208	1.2	0.04	2700	100245	12.0	0.23	1600
100172	0.15	0.03	3000	100209	1.5	0.04	2700	100246	15.0	0.3	1300
100173	0.18	0.03	3000	100210	1.8	0.05	2500	100247	18.0	0.4	1150
100174	0.22	0.03	3000	100211	2.2	0.05	2500	100248	22.0	0.5	1000
100175	0.27	0.04	2700	100212	2.7	0.05	2500	100249	27.0	0.6	900
100176	0.33	0.05	2500	100213	3.3	0.05	2500	100250	33.0	0.7	850
100177	0.39	0.08	2000	100214	3.9	0.07	2100	100251	39.0	1.1	720
100178	0.47	0.08	2000	100215	4.7	0.09	1800	100252	47.0	1.3	620
100179	0.56	0.10	1700	100216	5.6	0.14	1550	100253	56.0	1.8	540
100180	0.68	0.12	1500	100217	6.8	0.17	1300	100254	68.0	2.4	453
100181	0.82	0.18	1300	100218	8.2	0.25	1150	100255	82.0	2.8	425
100182	1.0	0.24	1100	100219	10.0	0.32	1000	100256	100.0	3.2	400
100183	1.2	0.35	1000	100220	12.0	0.47	870	100257	120.0	4.8	360
100184	1.5	0.43	850	100221	15.0	0.62	730	100258	150.0	6.4	280
100185	1.8	0.65	720	100222	18.0	0.72	660	100259	180.0	9.5	240
100186	2.2	0.80	610	100223	22.0	0.8	600	100260	220.0	12.0	200
100187	2.7	0.12	1600	100224	27.0	1.2	520	100261	270.0	13.0	195
100188	3.3	0.15	1400	100225	33.0	1.5	450	100262	330.0	14.0	190
100189	3.9	0.23	1200	100226	39.0	2.3	380	100263	390.0	15.5	180
100190	4.7	0.30	1000	100227	47.0	3.0	300	100264	470.0	17.0	170
100191	5.6	0.45	900	100228	56.0	4.2	270	100265	560.0	18.5	165
100192	6.8	0.55	800	100229	68.0	5.2	250	100266	680.0	20.0	155
100193	8.2	0.65	720	100230	82.0	6.2	220	100267	820.0	22.0	150
100194	10.0	0.73	650	100231	100.0	7.0	200	100268	1000.0	24.0	145
100195	12.0	1.1	590	100232	120.0	7.5	200	100269	1200.0	27.0	137
100196	15.0	1.4	500	100233	150.0	8.0	190	100270	1500.0	29.0	130
100197	18.0	1.6	460	100234	180.0	9.0	185	100271	1800.0	32.0	125
100198	22.0	1.8	430	100235	220.0	10.0	180	100272	2200.0	35.0	120
100199	27.0	2.7	360	100236	270.0	11.0	172	100273	2700.0	40.0	112
100200	33.0	3.5	300	100237	330.0	12.0	165	100274	3300.0	45.0	105
100201	39.0	3.8	290	100238	390.0	13.0	157	100275	3900.0	49.0	100
100202	47.0	4.0	275	100239	470.0	14.0	150	100276	4700.0	53.0	95
100203	56.0	4.4	265	100240	560.0	16.0	145	100277	5600.0	60.0	90
100204	68.0	4.7	250	100241	680.0	17.0	140	100278	6800.0	67.0	85
100205	82.0	5.3	235	100242	820.0	19.0	132	100279	8200.0	75.0	82
100206	100.0	6.0	220	100243	1000.0	21.0	125	100280	10000.0	80.0	80

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MOLDED SHIELDED MINIATURE R F CHOKES

Part Number	MS Type	Induct. Micro-henries ±10%	D.C. Resist. Max.	Milli-amp Rating Max.
9250-101	75087-1	0.10	.025	1790
9250-121	75087-2	.12	.034	1530
9250-151	75087-3	.15	.037	1470
9250-181	75087-4	.18	.047	1300
9250-221	75087-5	.22	.067	1100
9250-271	75087-6	.27	.11	855
9250-331	75087-7	.33	.13	780
9250-391	75087-8	.39	.18	670
9250-471	75087-9	.47	.25	565
9250-561	75087-10	.56	.33	490
9250-681	75087-11	.68	.45	420
9250-821	75087-12	.82	.59	370
9250-102	75088-1	1.00	.07	1070
9250-122	75088-2	1.20	.10	895
9250-152	75088-3	1.50	.12	815
9250-182	75088-4	1.80	.14	775
9250-222	75088-5	2.20	.19	650
9250-272	75088-6	2.70	.28	535
9250-332	75088-7	3.30	.35	480
9250-392	75088-8	3.90	.40	450
9250-472	75088-9	4.70	.55	380
9250-562	75088-10	5.60	.72	335
9250-682	75088-11	6.80	1.02	280
9250-822	75088-12	8.20	1.32	250
9250-103	75088-13	10.0	1.62	220
9250-123	75088-14	12.0	2.00	200
9250-153	75089-1	15.0	.80	315
9250-183	75089-2	18.0	.89	300
9250-223	75089-3	22.0	.96	290
9250-273	75089-4	27.0	1.19	260
9250-333	75089-5	33.0	1.37	240
9250-393	75089-6	39.0	1.93	205
9250-473	75089-7	47.0	2.11	195
9250-563	75089-8	56.0	2.23	190
9250-683	75089-9	68.0	2.70	170
9250-823	75089-10	82.0	2.44	180
9250-104	75089-11	100.0	3.12	160
9250-124	75089-12	120.0	3.60	150
9250-154	75089-13	150.0	4.10	140
9250-184	75089-14	180.0	4.40	135
9250-224	75089-15	220.0	5.00	125
9250-274	75089-16	270.0	5.80	115
9250-334	75089-17	330.0	6.40	110
9250-394	75089-18	390.0	7.40	105
9250-474	75089-19	470.0	9.50	92
9250-564	75089-20	560.0	10.5	90
9250-684	75089-21	680.0	11.8	80
9250-824	75089-22	820.0	13.0	80
9250-105	75089-23	1,000.0	17.5	70
9250-125	75089-24	1,200.0	22.1	60
9250-155	75089-25	1,500.0	26.5	55
9250-185	75089-26	1,800.0	29.9	50
9250-225	75089-27	2,200.0	33.8	50
9250-275	75089-28	2,700.0	47.3	40
9250-335	75089-29	3,300.0	53.0	40
9250-395	75089-30	3,900.0	73.8	35
9250-475	75089-31	4,700.0	81.6	31
9250-565	75089-32	5,600.0	98.9	28
9250-685	75089-33	6,800.0	111.0	27
9250-825	75089-34	8,200.0	119.0	26
9250-106	75089-35	10,000.0	137.0	24
9250-126	75089-36	12,000.0	143.0	23
9250-156	75089-37	15,000.0	157.0	22
9250-186	75089-38	18,000.0	175.0	21
9250-226	75089-39	22,000.0	274.0	17
9250-276	75089-40	27,000.0	308.0	16
9250-336	75089-41	33,000.0	343.0	15
9250-396	75089-42	39,000.0	376.0	15
9250-476	75089-43	47,000.0	473.0	13
9250-566	75089-44	56,000.0	512.0	13
9250-686	75089-45	68,000.0	580.0	12
9250-826	75089-46	82,000.0	618.0	11
9250-107	75089-47	100,000.0	678.0	11

0.10 thru 0.82 uh — Phenolic Core.
1.00 thru 12 uh — Iron Core.
15 + uh — Ferrite Core.
Mold Size: .162 ±.010 Diameter; .410 ±.020 length.
Leads: AWG #22TCW; 1.438±.188 Length.

See General Catalog for Complete Off The Shelf Coverage

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MICRO MITE MOLDED RF CHOKES

Miller Part Number	MS Type	Induct. Micro-henries ±5%	D.C. Resist. Max.	Milli-amp Rating Max.	Mold Size
9210-54	90538-01	36	2.50	180	D
9210-56	90538-02	39	2.60	176	D
9210-58	90538-03	43	2.70	172	D
9210-60	90538-04	47	2.75	170	D
9210-62	90538-05	51	2.85	167	D
9210-64	90538-06	56	3.00	164	D
9210-66	90538-07	62	3.15	160	D
9210-68	90538-08	68	3.30	156	D
9210-70	90538-09	75	3.70	147	D
9210-72	90538-10	82	3.90	143	D
9210-74	90538-11	91	4.30	136	D
9210-76	90538-12	100	4.50	133	D
9210-78	90538-13	110	4.90	128	D
9210-80	90538-14	120	5.20	124	D
9210-82	90538-15	130	5.45	121	D
9210-84	90538-16	150	6.05	114	D
9210-86	90538-17	160	6.40	111	D
9210-88	90538-18	180	6.75	108	D
9210-90	90538-19	200	7.10	106	D
9210-92	90538-20	220	7.45	103	D
9210-94	90538-21	240	7.80	101	D
9220-00	90539-01	270	8.2	110	A
9220-02	90539-02	300	8.7	107	A
9220-04	90539-03	330	9.1	105	A
9220-06	90539-04	360	9.6	102	A
9220-08	90539-05	390	10.0	100	A
9220-10	90539-06	430	10.6	97	A
9220-12	90539-07	470	11.1	95	A
9220-14	—	500	11.6	93	A
9220-15	90539-08	510	11.6	92	A
9220-16	90539-09	560	12.3	91	A
9220-18	90539-10	620	13.0	88	A
9220-20	90539-11	680	13.7	85	A
9220-22	90539-12	750	14.4	83	A
9220-24	90539-13	820	15.1	81	A
9220-26	90539-14	910	15.8	79	A
9220-28	90539-15	1000	16.5	78	A
9220-30	90540-01	1100	21.0	78	B
9220-32	90540-02	1200	22.0	76	B
9220-34	90540-03	1300	23.0	75	B
9220-36	90540-04	1500	25.0	72	B
9220-38	90540-05	1600	26.0	70	B
9220-40	90540-06	1800	28.0	68	B
9220-42	90540-07	2000	29.0	67	B
9220-44	90540-08	2200	30.0	66	B
9220-46	90540-09	2400	31.0	64	B
9220-48	90540-10	2700	33.0	62	B
9220-50	90540-11	3000	35.0	61	B
9220-52	90540-12	3300	38.0	58	B
9220-54	90540-13	3600	40.0	57	B
9220-56	90541-01	3900	44.0	61	C
9220-58	90541-02	4300	46.0	59	C
9220-60	90541-03	4700	48.0	58	C
9220-62	90541-04	5000	50.0	57	C
9220-64	90541-05	5600	53.0	56	C
9220-66	90541-06	6200	56.0	54	C
9220-68	90541-07	6800	59.0	52	C
9220-70	90541-08	7500	62.0	51	C
9220-72	90541-09	8200	65.0	50	C
9220-74	90541-10	9100	68.0	49	C
9220-76	90541-11	10000	72.0	47	C

Mold Size	Mold Diameter	Mold Length	Lead Size	Lead Length
A	.190±.010	.440±.010	AWG #22	1.44±.188
B	.215±.010	.560±.010	AWG #21	1.44±.188
C	.240±.010	.740±.010	AWG #20	1.44±.188
D	.155±.010	.375±.010	AWG #22	1.44±.188

MOLDED RF CHOKES

Part No.	MS Type	L uH	Res. Max.	mA Max.
9360-01	91189-1	1.1±20%	0.09	2800
9360-02	91189-2	2.2±20%	.20	1800
9360-03	91189-3	3.3±10%	.32	1500
9360-04	91189-4	4.7±10%	.60	1100
9360-05	91189-5	6.8±10%	1.10	800
9360-06	91189-6	10.0±10%	1.80	600
9360-07	91189-7	15.0±10%	3.00	500
9360-08	91189-8	22.0±10%	.30	1500
9360-09	91189-9	33.0±10%	.60	1100
9360-10	91189-10	47.0±10%	1.20	700
9360-11	91189-11	82.0±10%	2.20	600
9360-12	91189-12	100.0±10%	2.80	500
9360-13	91189-13	120.0±10%	4.00	400

Mold Size: .281±.031 Diameter; .937±.0625 Length.
Leads: 1.500±.125.

MOLDED RF CHOKES

Miller Part Number	MS Type	Induct. Micro-henries*	D.C. Re-sist. Max.	Milli-amp Rating Max.
9310-00	18130-1	.15*	.03	2450
9310-02	18130-2	.22*	.055	1900
9310-04	18130-3	.33*	.09	1400
9310-06	18130-4	.47*	.12	1225
9310-07	18130-5	.56	.135	1220
9310-08	18130-6	.68	.15	1100
9310-10	18130-7	.82	.22	900
9310-12	18130-8	1.00	.29	830
9310-14	18130-9	1.20	.42	650
9310-16	18130-10	1.50	.50	600
9310-18	18130-11	1.80	.65	525
9310-20	18130-12	2.20	.95	435
9310-22	18130-13	2.70	1.20	385
9310-24	18130-14	3.30	2.00	300
9310-26	18130-15	3.90	2.30	280
9310-28	18130-16	4.70	2.60	260
9310-30	18130-17	5.60	.32	750
9310-32	18130-18	6.80	.50	600
9310-34	18130-19	8.20	.60	545
9310-36	18130-20	10.0	.90	445
9310-38	18130-21	12.0	1.10	404
9310-40	18130-22	15.0	1.40	370
9310-42	18130-23	18.0	2.25	280
9310-44	18130-24	22.0	2.50	265
9310-46	—	24.0	2.50	265
9310-48	18130-25	27.0	2.60	260
9310-50	—	30.0	2.80	255
9310-52	18130-26	33.0	3.00	250

Mold Size: .156±.010 Diameter; .375±.010 Lgth. Leads: AWG #22 TCW; 1.437±.188 Lgth.

9320-00	75008-21	.15*	.030	3000
9320-02	75008-22	.22*	.035	2800
9320-04	75008-23	.33*	.065	2000
9320-06	75008-24	.47*	.085	1700
9320-07	75008-25	.56	.125	1450
9320-08	75008-26	.68	.150	1300
9320-09	75008-27	.82	.205	1100
9320-10	75008-28	1.00	.290	930
9320-11	75008-29	1.20	.400	785
9320-12	75008-30	1.50	.485	700
9320-13	75008-31	1.80	.740	580
9320-14	75008-32	2.20	.970	505
9320-16	75008-33	2.70	1.20	460
9320-18	75008-34	3.30	.140	1350
9320-20	75008-35	3.90	.155	1250
9320-22	75008-36	4.70	.210	1100
9320-24	75008-37	5.60	.280	935
9320-26	75008-38	6.80	.375	810
9320-28	75008-39	8.20	.440	750
9320-30	75008-40	10.0	.605	640
9320-32	75008-41	12.0	1.05	490
9320-34	75008-42	15.0	1.20	460
9320-35	75008-43	18.0	1.95	360
9320-36	75008-44	22.0	2.20	335
9320-38	75008-45	27.0	2.75	300

Mold Size: .188±.031 Diameter; 0.437±.031 Lgth. Leads: AWG #22 TCW; 1.437±.188 Lgth.

9330-00	90542-01	.47	.06	1970
9330-01	90542-02	.56	.08	1850
9330-02	90542-03	.68	.08	1700
9330-03	90542-04	.82	.11	1520
9330-04	90542-05	1.00	.14	1290
9330-05	90542-06	1.20	.19	1120
9330-06	90542-07	1.50	.28	925
9330-07	90542-08	1.80	.37	790
9330-08	90542-09	2.20	.50	680
9330-10	90542-10	2.70	.65	600
9330-12	90542-11	3.30	1.00	480
9330-14	90542-12	3.90	1.20	440
9330-16	90542-13	4.70	1.80	360
9330-18	90542-14	5.60	.13	1340
9330-20	90542-15	6.80	.20	1080
9330-22	90542-16	8.20	.22	1030
9330-24	90542-17	10.0	.26	950
9330-26	90542-18	12.0	.45	720
9330-28	90542-19	15.0	.52	670
9330-30	90542-20	18.0	.70	580
9330-32	90542-21	22.0	1.00	480
9330-34	90542-22	27.0	1.30	420
9330-36	90542-23	33.0	1.50	390
9330-38	90542-24	39.0	2.00	340

Mold Size: .22±.03 Diameter; 0.560±.010 Length. Leads: AWG #22 TCW; 1.437±.19 Length.
*Inductance Tolerance: ±20%.
All Others 10%.

SUB-MINIATURE RF CHOKES

An extremely versatile series of iron core R.F. chokes designed to meet the industries' demand for high reliability, ultra-miniature components. The coils are ideally suited to network and filter design, delay lines and computer applications. The coils are impregnated with a moisture resistant lacquer and on special order they can be fungus-proofed per JAN-T-152 using varnish per MIL-V-173A. They can also be encapsulated in epoxy resin to conform to Grade 1, Class B of MIL-C-15305. Note: L measured on 260A Q Meter except 120 thru 500 mH which are measured on 1 kHz Bridge.

Miller Part No.	Inductance Nominal*	D.C. Resistance Max.	Milliamp Rating Max.	Max. Winding Diam.	Form Length ±1/32
70F107AP	.10 uh★	.013	3922	.156	5/16
70F157AP	.15 uh★	.025	2828	.141	5/16
70F227AP	.22 uh★	.038	2294	.141	5/16
70F337AP	.33 uh★	.070	1690	.125	5/16
70F477AP	.47 uh★	.125	1264	.125	5/16
70F687AP	.68 uh★	.200	1000	.125	5/16
70F757AP	.75 uh★	.264	870	.125	5/16
70F827AP	.82 uh★	.290	830	.125	5/16
70F106AI	1.0 uh	.048	2041	.165	1/4
70F126AI	1.2 uh	.072	1666	.160	1/4
70F156AI	1.5 uh	.096	1443	.160	1/4
70F186AI	1.8 uh	.096	1443	.160	1/4
70F226AI	2.2 uh	.156	1132	.160	1/4
70F276AI	2.7 uh	.168	1091	.160	1/4
70F336AI	3.3 uh	.240	912	.150	1/4
70F396AI	3.9 uh	.264	870	.150	1/4
70F476AI	4.7 uh	.457	661	.150	1/4
70F566AI	5.6 uh	.492	637	.150	1/4
70F686AI	6.8 uh	.624	566	.150	1/4
70F756AI	7.5 uh	.624	566	.150	1/4
70F826AI	8.2 uh	.744	518	.150	1/4
70F916AI	9.1 uh	1.44	288	.160	1/4
70F105AI	10 uh	1.56	277	.160	1/4
70F125AI	12 uh	1.68	267	.160	1/4
70F155AI	15 uh	1.92	250	.165	1/4
70F185AI	18 uh	2.28	229	.165	1/4
70F225AI	22 uh	2.28	229	.165	1/4
70F255AI	25 uh	2.64	213	.170	1/4
70F275AI	27 uh	2.64	213	.170	1/4
70F335AI	33 uh	2.76	208	.170	1/4
70F395AI	39 uh	3.36	188	.175	1/4
70F475AI	47 uh	3.36	188	.175	1/4
70F565AI	56 uh	3.84	176	.180	1/4
70F685AI	68 uh	4.20	169	.180	1/4
70F755AI	75 uh	4.56	162	.185	1/4
70F825AI	82 uh	4.80	158	.185	1/4
70F915AI	91 uh	4.92	156	.185	1/4
70F104AI	100 uh	7.68	139	.165	1/4
70F124AI	120 uh	8.16	135	.165	1/4
70F154AI	150 uh	8.16	135	.165	1/4
70F184AI	180 uh	8.16	135	.170	1/4
70F204AI	200 uh	10.3	120	.170	1/4
70F224AI	220 uh	11.5	114	.170	1/4
70F254AI	250 uh	12.1	111	.170	1/4
70F274AI	270 uh	13.2	106	.175	1/4
70F304AI	300 uh	13.2	106	.175	1/4
70F334AI	330 uh	13.9	103	.175	1/4
70F354AI	350 uh	14.4	102	.180	1/4
70F394AI	390 uh	15.8	97	.180	1/4
70F474AI	470 uh	16.3	95	.185	1/4
70F504AI	500 uh	18.0	91	.195	1/4
70F564AI	560 uh	19.2	88	.195	1/4
70F684AI	680 uh	19.8	87	.200	1/4
70F754AI	750 uh	22.9	80	.210	1/4
70F824AI	820 uh	22.9	80	.210	1/4
70F914AI	910 uh	24.0	79	.220	1/4
70F103AI	1.00 mh	24.0	79	.225	1/4
70F123AI	1.20 mh	33.6	66	.220	1/4
70F153AI	1.50 mh	37.2	63	.225	1/4
70F183AI	1.80 mh	42.0	59	.235	1/4
70F223AI	2.20 mh	45.6	57	.240	1/4
70F253AI	2.50 mh	45.6	57	.260	3/8
70F273AI	2.70 mh	45.6	57	.260	3/8
70F333AI	3.30 mh	51.6	53	.260	3/8
70F393AI	3.90 mh	57.6	51	.275	3/8
70F473AI	4.70 mh	64.8	48	.285	3/8
70F563AI	5.60 mh	69.6	46	.300	3/8
70F683AI	6.80 mh	78.0	43	.310	3/8
70F753AI	7.50 mh	85.2	41	.310	3/8
70F823AI	8.20 mh	92.4	40	.330	3/8
70F913AI	9.10 mh	98.4	39	.330	3/8
70F102AI	10.0 mh	101	38	.335	3/8
70F122AI	12 mh	100	50	.300	1/2
70F152AI	15 mh	113	47	.300	1/2
70F182AI	18 mh	128	44	.325	1/2
70F222AI	22 mh	144	41	.330	1/2
70F252AF	25 mh	115	46	.340	5/8
70F272AF	27 mh	120	45	.353	5/8
70F332AF	33 mh	134	43	.353	5/8
70F392AF	39 mh	147	41	.370	5/8
70F472AF	47 mh	168	38	.384	5/8
70F502AF	50 mh	175	37	.400	5/8
70F562AF	56 mh	189	36	.400	5/8
70F682AF	68 mh	215	34	.415	5/8
70F752AF	75 mh	222	33	.430	5/8
70F822AF	82 mh	238	32	.430	5/8
70F912AF	91 mh	250	31	.430	5/8
70F101AF	100 mh	278	29	.446	5/8
70F121AF	120 mh	288	48	.485	7/8
70F151AF	150 mh	328	44	.505	7/8
70F181AF	180 mh	374	41	.525	7/8
70F221AF	220 mh	424	39	.540	7/8
70F251AF	250 mh	468	37	.555	7/8
70F271AF	270 mh	490	36	.570	7/8
70F331AF	330 mh	540	34	.580	7/8
70F391AF	390 mh	617	33	.600	7/8
70F471AF	470 mh	704	30	.615	7/8
70F501AF	500 mh	736	30	.635	7/8

* Tolerance 0.1 to 1.0 uh ±20%, 1.1 to 15 uh ±10%, over 15 uh ±5%. ★ Measured with leads 1/4" long from Q Meter binding posts.

PHENOLIC CORE SINGLE LAYER WINDINGS

Dimensions of core: 3/16" diameter x 3/4" long. Leads are 1 1/2" long.

Miller Part Number	Inductance Nominal*	D. C. Resistance Maximum	Milliamp Rating Maximum	Diameter over Winding
4602	1.0 uh	.050	2000	.270
4604	1.5 uh	.093	1800	.270
4606	2.4 uh	.190	1500	.270
4608	3.9 uh	.450	1000	.270
4609	5 5 uh	.670	850	.270
4610	6.2 uh	.830	700	.270
4611	8.2 uh	1.20	600	.270
4612	10.0 uh	1.50	500	.270

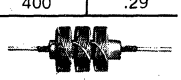
*Tolerance 1.0 uh ±20%, 1.1 to 10 uh ±10%

IRON CORE SINGLE LAYER WINDINGS

Dimensions of core: 7/32" diameter x 7/8" long. Leads are 1 1/2" long.

4622	10 uh ±5%	.11	1500	.29
4624	15 uh ±5%	.17	1000	.29
4626	24 uh ±5%	.34	800	.29
4628	39 uh ±5%	.65	600	.29
4629	55 uh ±5%	1.0	500	.29
4630	62 uh ±5%	1.2	475	.29
4631	82 uh ±5%	1.9	450	.29
4632	100 uh ±5%	3.0	400	.29

PHENOLIC CORE 3-SECTION WINDINGS



Dimensions of core: 3/16" diameter x 3/4" long. Leads are 1 1/2" long.

4642	.10 mh ±5%	5.4	160	.406
4644	.15 mh ±5%	6.5	160	.406
4646	.24 mh ±5%	8.5	160	.438
4648	.39 mh ±5%	11	160	.500
4649	.55 mh ±5%	13	160	.500
4650	.62 mh ±5%	15	160	.531
4651	.75 mh ±5%	16	160	.531
4652	1.0 mh ±5%	19	160	.563

IRON CORE 3-SECTION WINDINGS

Dimensions of core: 7/32" diameter x 7/8" long. Leads are 1 1/2" long.

Miller Part Number	Inductance @ 1000 Hertz	D. C. Resistance Maximum	Milliamp Rating Maximum	Diameter over Winding
4662	1.0 mh ±5%	8.6	160	.469
4664	1.5 mh ±5%	11	160	.469
4666	2.4 mh ±5%	15	160	.531
4668	3.9 mh ±5%	20	160	.563
4669	5.5 mh ±5%	25	160	.594
4670	6.2 mh ±5%	37	100	.531
4671	8.2 mh ±5%	46	100	.563
4672	10 mh ±5%	50	100	.594

FERRITE CORE 3-SECTION WINDINGS

Dimensions of core: 1/4" diameter x 7/8" long. Leads are 1 1/2" long.

6302	2.5 mh ±5%	9.0	160	.469
6304	5.0 mh ±5%	14	160	.531
6306	10 mh ±5%	31	100	.531
6308	25 mh ±5%	82	65	.531
6310	50 mh ±5%	127	65	.625

SINGLE LAYER COLOR CODED RF CHOKES

The following solenoid wound R.F. Chokes are impregnated with a thermosetting varnish and are color coded to EIA standards. Form Dimensions .156 x 1/2".

Part No.	L*	R Ohms Max.	I Ma. Max.	Part No.	L*	R Ohms Max.	I Ma. Max.
74F106AP	1.0 uh	.20	1000	74F125AP	12 uh	3.60	200
74F126AP	1.2 uh	.22	950	74F155AP	15 uh	6.00	150
74F156AP	1.5 uh	.25	900	74F185AP	18 uh	7.50	100
74F186AP	1.8 uh	.28	850	74F225AI	22 uh	2.00	500
74F226AP	2.2 uh	.30	800	74F275AI	27 uh	1.85	450
74F276AP	2.7 uh	.50	700	74F335AI	33 uh	2.00	450
74F336AP	3.3 uh	.70	600	74F395AI	39 uh	2.60	400
74F396AP	3.9 uh	.80	500	74F475AI	47 uh	3.50	350
74F476AP	4.7 uh	1.00	400	74F565AI	56 uh	3.75	300
74F566AP	5.6 uh	1.80	350	74F685AI	68 uh	4.00	250
74F686AP	6.8 uh	1.85	300	74F825AI	82 uh	5.10	200
74F826AP	8.2 uh	1.90	275	74F104AI	100 uh	6.00	150
74F105AP	10 uh	3.00	250				

* Tolerance 1.0 to 2.2 uh, ±20%, 2.7 to 100 uh, ±10%

J. W. MILLER DIVISION, BELL INDUSTRIES / DEPT. EM, 19070 Reyes Ave., Rancho Dominguez, CA 90221 / (213) 537-5200

SEE OUR INDUSTRIAL CATALOG FOR COMPLETE COVERAGE

Custom Windings — May We Quote On Your Requirements?

VLS SERIES VARIABLE INDUCTORS (SHIELDED)

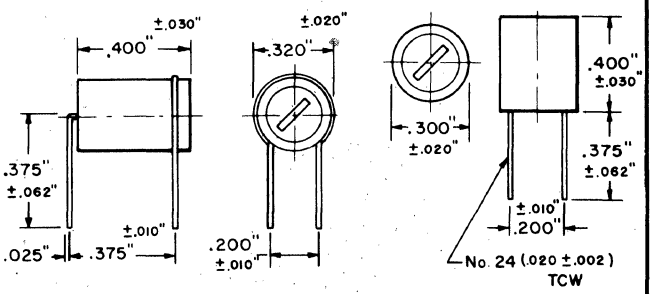
May be mounted either Vertically or Horizontally

Printed Circuit: Mil-C-15305

Tunable Range: .10 uH .12 uH ±5% — All others ±10%

Operating Temperature: −55°C to +125°C

Leads: No. 24 TCW

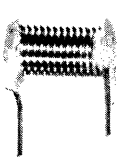


HORIZONTAL STYLE VERTICAL STYLE

Part No.	Nom. L	DCR 25°C, Max. Ohms	Max. I mA	Part No.	Nom. L	DCR 25°C, Max. Ohms	Max. I mA
VLSR10	.10	0.030	2500	VLS121	120.00	2.38	316
VLSR12	.12	0.030	2500	VLS151	150.00	2.52	306
VLSR15	.15	0.030	2500	VLS181	180.00	2.88	288
VLSR18	.18	0.035	2400	VLS221	220.00	3.18	273
VLSR22	.22	0.038	2300	VLS271	270.00	3.50	260
VLSR27	.27	0.040	2200	VLS331	330.00	4.80	222
VLSR33	.33	0.040	2200	VLS391	390.00	5.44	209
VLSR39	.39	0.045	2100	VLS471	470.00	5.90	201
VLSR47	.47	0.045	2100	VLS561	560.00	6.30	194
VLSR56	.56	0.050	2000	VLS681	680.00	7.20	181
VLSR68	.68	0.055	1900	VLS821	820.00	8.00	172
VLSR82	.82	0.060	1800	VLS102	1,000.00	12.00	141
VLS1R0	1.00	0.070	1700	VLS122	1,200.00	13.50	132
VLS1R2	1.20	0.085	1670	VLS152	1,500.00	16.50	119
VLS1R5	1.50	0.100	1540	VLS182	1,800.00	18.00	114
VLS1R8	1.80	0.110	1470	VLS222	2,200.00	20.50	107
VLS2R2	2.20	0.120	1410	VLS272	2,700.00	22.50	102
VLS2R7	2.70	0.125	1380	VLS332	3,300.00	42.00	76
VLS3R3	3.30	0.165	1200	VLS392	3,900.00	47.50	71
VLS3R9	3.90	0.180	1135	VLS472	4,700.00	53.00	67
VLS4R7	4.70	0.245	985	VLS562	5,600.00	62.50	65
VLS5R6	5.60	0.265	950	VLS682	6,800.00	69.50	58
VLS6R8	6.80	0.330	853	VLS822	8,200.00	75.00	56
VLS8R2	8.20	0.460	720	VLS103	10,000.00	100.00	49
VLS100	10.00	0.640	620	VLS123	12,000.00	64.00	60
VLS120	12.00	0.800	545	VLS153	15,000.00	84.00	52
VLS150	15.00	0.865	520	VLS183	18,000.00	93.00	50
VLS180	18.00	0.940	504	VLS223	22,000.00	104.00	45
VLS220	22.00	1.03	460	VLS273	27,000.00	173.00	35
VLS270	27.00	1.18	418	VLS333	33,000.00	187.00	32
VLS330	33.00	1.30	398	VLS393	39,000.00	220.00	30
VLS390	39.00	1.41	385	VLS473	47,000.00	253.00	28
VLS470	47.00	1.61	350	VLS563	56,000.00	285.00	26
VLS560	56.00	2.08	330	VLS683	68,000.00	311.00	24
VLS680	68.00	2.20	320	VLS823	82,000.00	385.00	22
VLS820	82.00	2.42	300	VLS104	100,000.00	420.00	20
VLS101	100.00	2.15	333				

FIXED COILS

The 75F series are of Polypropylene moulded around an accurately positioned winding. Unsurpassed stability and uniformity is obtained.



Frequency range: 50 MHz to 450 MHz
Lead length: 3/16" ±1/32"
Maximum length: .38 inches
Maximum width: .23 inches

Miller Part Number	Inductance	Q Minimum	DC Current	Wire Size
75F238MPC	.023 uH	110	1A	22 AWG
75F328MPC	.032 uH	110	1A	22 AWG
75F518MPC	.051 uH	110	1A	22 AWG
75F117MPC	.110 uH	110	1A	22 AWG
75F157MPC	.150 uH	110	1A	22 AWG
75F227MPC	.270 uH	110	.5A	26 AWG
75F397MPC	.390 uH	110	.5A	26 AWG
75F477MPC	.470 uH	110	.5A	26 AWG
75F597MPC	.590 uH	110	.5A	26 AWG

I.F. COMPONENTS SUB MINIATURE

The transformers in this series represents the state of the art, as it relates to a commercial product. In both the 455 kc. and 10.7 Mc. groups there are a complete set of I.F. transformers as well as Ratio Detector and Discriminator transformers.

Dimensions: 8849, 8850, 8851, 8805, 8806, 8807 — 25/32" x 7/16" x 1/2" high • 8852, 8853 & 8854 — 13/32" sq. x 5/8" high • 8810, 8811, 8812 & 8813 — 9/32" sq. x 15/32" high

Cat. No.	Specs	Description
	10.7 Mc. Transistor Transformers	
8849	500 kc. P P	10.7 Mc. Ratio Detector
8850	300 kc. P P	10.7 Mc. Discriminator
8851-A	6 db 300 kc.	10.7 Mc. Double Tuned IF
8852	100 K-300	10.7 Mc. Single Tuned IF
8853	20 K-500	10.7 Mc. Single Tuned IF
8854	25 K-500	10.7 Mc. Single Tuned IF
	455 Kc. Transistor Transformers	
8805	20 kc. P P	455 kc. Ratio Detector
8806	20 kc. P P	455 kc. Discriminator
8807	6 db 15 kc.	455 kc. Double Tuned IF
8810	50 K-500	455 kc. Single Tuned IF
8811	30 K-500	455 kc. Single Tuned IF
8812	20 K-5 K	455 kc. Single Tuned IF
8813	Oscillator (455 kc. IF). (Tuning Cap. 78 to 110 pf. Max.)	

ADJUSTABLE R.F. COILS 9100 SERIES SHIELDED

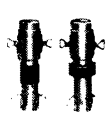
These ultra compact adjustable coils offer a good inductance range with relatively small changes in Q. Tuning is accessible from either top or bottom of the assembly. Magnetic shielding is achieved by the use of cup cores while the copper shield offers effective electro static shielding. Printed circuit terminals on base and shield.

Applications between 10 kHz and 200 MHz
Dimensions: .440" Sq. x .550" High.

Part No.	L Min.	L Max.	Max. DC Ohms	Max. Current
9101	.099	.134	0.01	4.85 A
9102	.129	.192	0.01	4.43 A
9103	.165	.258	0.02	3.97 A
9104	.246	.418	0.02	3.83 A
9105	.366	.627	0.02	3.43 A
9106	.588	.950	0.90	516.00 mA
9107	.830	1.54	1.02	485.00 mA
9108	1.44	2.94	1.38	417.00 mA
9109	2.52	5.70	1.76	368.00 mA
9110	5.35	13.49	2.92	286.00 mA
9111	12.50	29.45	4.72	225.00 mA
9112	26.25	71.25	6.97	185.00 mA
9113	64.57	163.00	9.98	155.00 mA
9114	147.00	430.00	16.32	121.00 mA
9115	422.00	1.10	27.84	92.00 mA
9116	1.05	3.74	41.06	76.00 mA
9117	3.36	11.12	78.92	55.00 mA

ECONOMY ADJUSTABLE R.F. CHOKES

Through the use of a recently developed Nylon molding process we are able to offer an inexpensive line of adjustable chokes. These items feature a wide inductance range which has been achieved through the use of a threaded ferrite core. They can be adjusted from either the top or bottom. This lends a degree of flexibility to your design. Mounting is achieved by means of a metal clip in a 5/16" round hole or a special keyed hole. Instructions supplied with each coil.



Dimensions: 3/8" x 1 3/8" long.

Miller Part Number	Inductance Minimum	Inductance Maximum	R Ohms Max.	Max. Current Ma.
4201	.300 uh	.580 uh	.04	636
4201-A	.550 uh	1.10 uh	.05	636
4202	1.00 uh	2.50 uh	.15	400
4203	2.00 uh	5.50 uh	.19	400
4204	5.00 uh	12.0 uh	1.1	126
4205	10.0 uh	25. uh	1.6	100
4206	20.0 uh	55. uh	2.3	100
4207	50.0 uh	140. uh	4.0	100
4208	120. uh	330. uh	6.6	100
4209	310. uh	860. uh	12.	100

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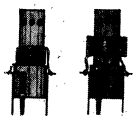
VERTICAL MOUNTED PRINTED CIRCUIT VELVETORK ADJUSTABLE RF COILS



Dimensions (form only) Over Collar 3/8" Dia. x 3/4" long.

The coil form is Polyester impregnated Alpha Cellulose tubing with internally bonded resilient ribs which provide both thread and torque control. Coils may be adjusted from either end of form.

Miller Part No.	Inductance Min.	Inductance Max.	R Ohms Max.	Max. Current Ma.	Dia. over Winding
23A107RPC	.095 uH	.125 uH	.02	4100	.40
23A157RPC	.130 uH	.170 uH	.02	1600	.37
23A227RPC	.185 uH	.265 uH	.02	1600	.37
23A337RPC	.285 uH	.410 uH	.03	1000	.37
23A477RPC	.420 uH	.580 uH	.03	2500	.37
23A687RPC	.540 uH	.850 uH	.03	1600	.37
23A827RPC	.640 uH	1.00 uH	.03	1600	.37
23A106RPC	.760 uH	1.25 uH	.04	1600	.37
23A156RPC	1.20 uH	1.87 uH	.06	1000	.37
23A226RPC	1.65 uH	2.75 uH	.14	400	.37
23A336RPC	2.40 uH	4.10 uH	.17	400	.37
23A476RPC	3.40 uH	5.80 uH	.24	400	.37
23A686RPC	4.60 uH	8.50 uH	.39	250	.37
23A826RPC	5.60 uH	10.00 uH	.64	160	.37
23A105RPC	7.10 uH	12.50 uH	.77	160	.37
23A155RPC	10.00 uH	18.70 uH	1.68	100	.37
23A225RPC	14.80 uH	27.50 uH	1.91	100	.37
23A335RPC	22.00 uH	41.00 uH	2.34	100	.37
23A475RPC	31.00 uH	58.00 uH	2.72	100	.40
23A685RPC	43.50 uH	85.00 uH	3.30	100	.40
23A825RPC	61.00 uH	100.00 uH	3.89	100	.40
23A104RPC	76.00 uH	125.00 uH	4.39	100	.40
23A154RPC	105.00 uH	187.00 uH	5.46	100	.40
23A224RPC	160.00 uH	275.00 uH	6.70	100	.44
23A334RPC	240.00 uH	410.00 uH	8.30	100	.44
23A474RPC	360.00 uH	580.00 uH	10.50	100	.48
23A684RPC	530.00 uH	850.00 uH	12.90	100	.48
23A824RPC	700.00 uH	1.00 mH	14.90	100	.53
23A103RPC	910.00 uH	1.25 mH	17.10	100	.58
23A153RPC	990.00 uH	1.87 mH	28.20	65	.45
23A223RPC	1.60 mH	2.75 mH	34.80	65	.45
23A333RPC	2.40 mH	4.10 mH	42.90	65	.48
23A473RPC	3.40 mH	5.80 mH	51.60	65	.48
23A683RPC	5.15 mH	8.50 mH	63.60	65	.55
23A823RPC	7.40 mH	10.00 mH	75.60	65	.55
23A102RPC	9.80 mH	12.50 mH	87.30	65	.55
23A152RPC	12.00 mH	18.70 mH	111.00	65	.60
23A222RPC	12.10 mH	27.50 mH	197.00	33	.60
23A332RPC	18.20 mH	41.00 mH	244.00	33	.60
23A472RPC	27.50 mH	58.00 mH	302.00	33	.60
23A682RPC	40.00 mH	85.00 mH	378.00	33	.58
23A822RPC	50.00 mH	100.00 mH	423.00	33	.58
23A101RPC	62.00 mH	125.00 mH	468.00	33	.60

SHIELDED SUBMINIATURE ADJUSTABLE RF COILS

Dimensions: 1/2" sq., x 5/8" high.

These compact adjustable coils offer a minimum two-to-one inductance range with relatively small changes in Q. The tuning adjustment is accessible from either the top or bottom of the coil assembly. Magnetic shielding is achieved through the use of cup cores while the metal shield offers effective electrostatic shielding. Printed circuit terminals on base and shield.

Miller Part No.	Inductance Min.	Inductance Max.	R Ohms Max.	Max. Current Ma.
9050	1.5 uH	3.0 uH	.66	80
9051	3.0 uH	7.0 uH	.85	125
9052	7.0 uH	14.0 uH	1.38	80
9053	14.0 uH	28.0 uH	2.10	80
9054	28.0 uH	60.0 uH	3.00	100
9055	60.0 uH	120.0 uH	4.00	100
9056	120.0 uH	280.0 uH	5.75	80
9057	280.0 uH	650.0 uH	12.00	80
9058	650.0 uH	1.3 mH	15.00	100
9059	1.3 mH	3.0 mH	23.00	100
9059-1	1.8 mH	2.2 mH	10.00	141
9060	3.0 mH	10.0 mH	76.00	30
9061	8.0 mH	20.0 mH	110.00	30
9062	15.0 mH	40.0 mH	150.00	30
9063	20.0 mH	60.0 mH	175.00	25

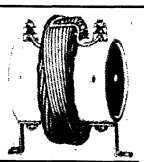
HIGH Q MOLDED ADJUSTABLE COILS

The 48A Series of coils listed below may easily be tapped at 1/8, 1/4, 3/8, 5/8, 3/4, 7/8 turn if desired.

Frequency Range: 30 MHz to 250 MHz
Wire Size: 20 AWG tinned copper
Form Length: .73 inches
Coil OD: .310 inches
Lead Spacing: .408 inches
Core: 10-32 x 3/8" Carbonyl J

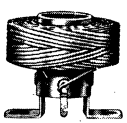
Miller Part No.	Minimum Inductance	Maximum Inductance	D.C. Current
48A518mpc	.046 uH	.055 uH	2A
48A778mpc	.071 uH	.082 uH	2A
48A117mpc	.099 uH	.122 uH	2A
48A147mpc	.118 uH	.157 uH	2A
48A187mpc	.150 uH	.207 uH	2A
48A227mpc	.181 uH	.278 uH	2A
48A257mpc	.209 uH	.283 uH	2A
48A287mpc	.241 uH	.316 uH	2A
48A317mpc	.270 uH	.351 uH	2A

MEDIUM DUTY DUO-LATERAL LINE FILTER CHOKES



Cat. No.	Amps.	Ohms	Induc.	Dimensions
7826	5	.28	570 uH	2 1/2" x 4"
7827	10	.15	370 uH	2 1/2" x 4"
7828	15	.085	200 uH	2 1/2" x 4"
7829	20	.05	135 uH	2 1/2" x 4"

LIGHT DUTY DUO-LATERAL LINE FILTER CHOKES



Single Line Filter Chokes
Dimensions: 1 7/8" x 1 3/4".

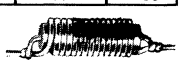
Cat. No.	Amps.	Ohms	uH
7825	2	.7	600
7825-3	3	.25	250
7825-5	5	.1	100
7825-8	8	.05	50

DUAL LINE FILTER CHOKES

Dimensions: 3 1/4" x 2 1/8".

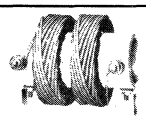
Cat. No.	Amps.	Ohms	uH
D-7825	2	.7	600
D-7825-3	3	.25	250
D-7825-5	5	.1	100
D-7825-8	8	.05	50

HEAVY DUTY HASH CHOKES



Part No.	uH ±20%	Ohms Max.	Amps.	Dimensions
5218	3.35	.010	20	17/32" x 1 5/8"
5219	4.90	.016	15	1/2" x 1 1/4"
5220	8.80	.021	10	1/2" x 1 1/8"
5230	4.00	.012	8	5/16" x 25/32"
5240	40.00	.082	3	3/16" x 1 1/4"
5248	68.00	.054	5	17/32" x 1 1/4"
5250	100.00	.216	2	5/16" x 1 1/4"
5252	125.00	.080	3.5	1/2" x 1 1/4"
5254	250.00	.170	2.5	7/16" x 1 1/4"
5256	500.00	.260	2.0	5/16" x 1 1/8"
5258	1000.00	.550	1.0	1/2" x 1 1/8"
*5300	100.00	.087	2.5	3/4" x 1 1/32"

*Dual Choke:
Electrical measurements per section

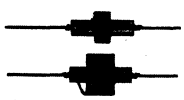


DUAL LINE FILTER CHOKES

Miller Dual Duo-Lateral Line Filter Chokes are wound with two coils on one form, giving the advantage of small physical size in cases where space requirements are stringent and two single coils would occupy too much area. Identical in specifications, except for dimensions, to our single type Duo-Lateral chokes. They are wound on white ceramic forms 2" in diameter by 4 1/2" long.

Cat. No.	Amps.	Ohms	uH	Dimensions
D-7826	5	.28	570	4 1/2" x 4"
D-7827	10	.15	370	4 1/2" x 4"
D-7828	15	.085	200	4 1/2" x 4"
D-7829	20	.05	135	4 1/2" x 4"

SINGLE PI FERRITE CORE RF CHOKES



This series of single pi RF Chokes affords maximum Q with minimum resistance through the use of ferrite core material. The coils are impregnated in a fungus resistant lacquer. Form Dimensions .187" x 5/8".

Part No.	L ±5%	Max. R Ohms	Max. Ma.
73F104AF	100.0 uH	2.0	250
73F124AF	120.0 uH	2.2	250
73F154AF	150.0 uH	2.5	250
73F184AF	180.0 uH	2.9	250
73F224AF	220.0 uH	3.2	250
73F274AF	270.0 uH	3.6	250
73F334AF	330.0 uH	3.8	250
73F394AF	390.0 uH	4.2	225
73F474AF	470.0 uH	4.8	200
73F564AF	560.0 uH	5.3	200
73F684AF	680.0 uH	6.0	200
73F824AF	820.0 uH	6.8	200
73F103AF	1.0 mH	7.5	150
73F123AF	1.2 mH	7.8	150
73F153AF	1.5 mH	8.8	150
73F183AF	1.8 mH	11.0	150
73F223AF	2.2 mH	12.0	150
73F273AF	2.7 mH	13.5	125
73F333AF	3.3 mH	15.1	125
73F393AF	3.9 mH	18.0	125
73F473AF	4.7 mH	21.5	100
73F563AF	5.6 mH	25.0	80
73F683AF	6.8 mH	29.0	80
73F823AF	8.2 mH	30.0	80
73F102AF	10.0 mH	34.0	80

MICRO-MINIATURE MOLDED RF CHOKES

We are pleased to offer the following series of molded RF chokes. They represent what we believe to be the smallest package for the current rating specified. Color Coding is per MIL-C-15305.

Miller Part No.	MS Type	Inductance Micro-henries ±10%	Max. D.C. Resistance	Milli-amp Rating Max.
9230-94	75083-1	.10	.07	1100
9230-96	75083-2	.12	.08	1100
9230-00	75083-3	.15	.10	1100
9230-02	75083-4	.18	.12	1010
9230-04	75083-5	.22	.14	935
9230-06	75083-6	.27	.16	875
9230-08	75083-7	.33	.20	780
9230-10	75083-8	.39	.30	640
9230-12	75083-9	.47	.35	590
9230-14	75083-10	.56	.50	495
9230-16	75083-11	.68	.60	450
9230-18	75083-12	.82	.85	380
9230-20	75083-13	1.00	1.00	350
9230-22	75084-1	1.20	.18	825
9230-24	75084-2	1.50	.22	745
9230-26	75084-3	1.80	.30	640
9230-28	75084-4	2.20	.40	550
9230-30	75084-5	2.70	.50	495
9230-32	75084-6	3.30	.85	380
9230-34	75084-7	3.90	1.00	350
9230-36	75084-8	4.70	1.20	320
9230-38	75084-9	5.60	1.80	260
9230-40	75084-10	6.80	2.00	245
9230-42	75084-11	8.20	2.70	210
9230-44	75084-12	10.00	3.70	180
9230-46	75084-13	12.00	2.70	210
9230-48	75084-14	15.00	2.80	205
9230-50	75084-15	18.00	3.10	195
9230-52	75084-16	22.00	3.30	190
9230-54	75084-17	27.00	3.50	185
9230-56	75085-1	33.00	3.40	187
9230-58	75085-2	39.00	3.60	180
9230-60	75085-3	47.00	4.50	165
9230-62	75085-4	56.00	5.70	145
9230-64	75085-5	68.00	6.70	135
9230-66	75085-6	82.00	7.30	130
9230-68	75085-7	100.00	8.00	125
9230-70	75085-8	120.00	13.00	97
9230-72	75085-9	150.00	15.00	85
9230-74	75085-10	180.00	17.00	79
9230-76	75085-11	220.00	21.00	73
9230-78	75085-12	270.00	25.00	65
9230-80	75085-13	330.00	28.00	62
9230-82	75085-14	390.00	35.00	55
9230-84	75085-15	470.00	42.00	50
9230-86	75085-16	560.00	46.00	48
9230-88	75085-17	680.00	60.00	42
9230-90	75085-18	820.00	65.00	40
9230-92	75085-19	1000.00	72.00	38

Mold Size: .095 ±.010 Diameter; .250 ±.010 Length.
Leads: AWG #24 TCW; 1.500 ±.188 Length.

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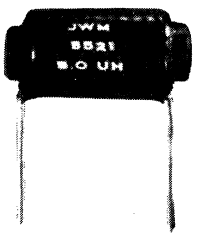
J.W. Miller 5500 & 5600
HIGH CURRENT FILTER CHOKES

Chokes are ideal for all EMI/RFI filtering applications. They are also suitable for energy storage inductors in switching power supplies.

Covered with shrink tubing and varnish impregnated.

Printed Circuit mounting.

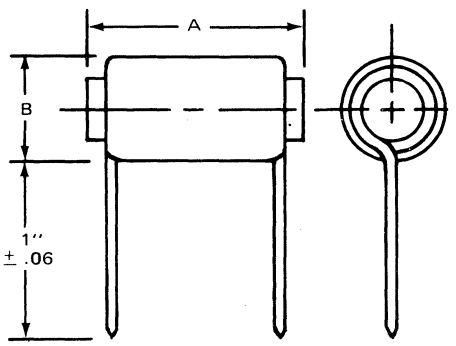
5500 SERIES High saturation flux density ferrite rods.



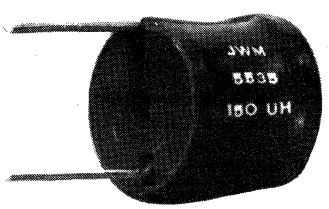
* Inductance measured @ 1 kHz with 0 Amps D.C. current.
Typical inductance change is less than 5% @ maximum rated current.

Leads: 1" long. Tinned within 1/8" of body.

Miller Number	* L uH ± 10%	R,dc Max. Ohms	I,dc Max. Amps	Dim. A Max.	Dim. B Max.
5501	5	.013	10	.88	.63
5502	10	.017	9	1.12	.63
5503	27	.030	7	.88	.81
5504	50	.045	5.6	1.12	.81
5505	100	.061	4.9	1.12	.81
5506	150	.069	4.6	1.38	.81
5507	250	.089	4	1.62	.81
5508	5	.009	14	.88	.64
5509	10	.012	12	1.12	.64
5510	27	.022	9	.88	.88
5511	50	.028	8	1.12	.88
5512	68	.034	7.3	1.12	.88
5513	100	.038	6.8	1.38	.88
5514	150	.046	6.3	1.62	.88
5515	5	.006	19	1.12	.69
5516	10	.008	16	1.38	.69
5517	27	.014	12.5	1.12	.94
5518	50	.020	10.5	1.38	.94
5519	68	.023	10	1.38	.94
5520	100	.027	10	1.62	.94
5521	5	.004	23	1.38	.72
5522	10	.006	20	1.69	.72
5523	27	.010	15	1.38	1
5524	50	.013	15	1.62	1

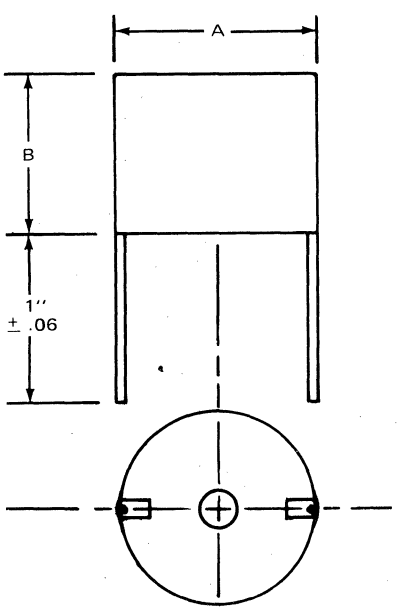


5600 SERIES High saturation flux density ferrite bobbins.



* Inductance measured @ 1 kHz with 0 Amps D.C. current.
Typical inductance change is less than 5% @ twice rated current.

Miller Number	* L uH ± 10%	R,dc Max. Ohms	I,dc Max. Amps	Dim. A Max.	Dim. B Max.
5601	5	.007	15	.83	.91
5602	10	.008	14	.83	.91
5603	25	.023	8	.83	.91
5604	50	.034	6.6	.83	.91
5605	100	.072	4.5	.83	.91
5606	250	.173	2.9	.83	.91
5607	500	.378	2	.83	.91
5608	1,000	.801	1.3	.83	.91
5609	2,500	2.04	.85	.83	.91
5610	5	.005	20	1.22	1.11
5611	10	.006	17	1.22	1.11
5612	25	.009	14	1.22	1.11
5613	50	.017	10	1.22	1.11
5614	100	.034	7	1.22	1.11
5615	250	.083	4.6	1.22	1.11
5616	500	.129	3.7	1.22	1.11
5617	1,000	.279	2.5	1.22	1.11
5618	2,500	.690	1.6	1.22	1.11
5619	50	.012	14	1.50	1.11
5620	100	.025	9.8	1.50	1.11
5621	250	.059	6.4	1.50	1.11
5622	500	.090	5	1.50	1.11
5623	1,000	.195	3.5	1.50	1.11
5624	2,500	.499	2.2	1.50	1.11
5625	5,000	1.08	1.5	1.50	1.11
5626	100	.018	14	1.50	1.50
5627	250	.040	9	1.50	1.50
5628	500	.085	6.5	1.50	1.50
5629	1,000	.183	4.4	1.50	1.50
5630	2,500	.464	2.8	1.50	1.50
5631	5,000	.714	2.2	1.50	1.50
5632	10,000	1.55	1.5	1.50	1.50

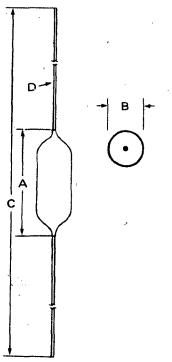


J. W. MILLER DIVISION, BELL INDUSTRIES / Dept. EM, 19070 Reyes Ave., Rancho Dominguez, CA 90221 / (213) 537-5200

EPOXY CONFORMAL COATED INDUCTORS

8210 SERIES

Part Number	L ±5% μH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA	Core Material	Part Number	L ±5% μH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA	Core Material
8210-54	36	60	2.5	15.5	2.5	180	Iron	8210-74	91	50	2.5	10	4.3	136	Iron
8210-56	39	60	2.5	14.5	2.6	176	Iron	8210-76	100	50	2.5	9.5	4.5	133	Iron
8210-58	43	60	2.5	13.7	2.7	172	Iron	8210-78	110	60	.79	8.9	4.9	128	Iron
8210-60	47	55	2.5	13	2.75	170	Iron	8210-80	120	65	.79	8.7	5.2	124	Iron
8210-62	51	55	2.5	12.7	2.85	167	Iron	8210-82	130	65	.79	8.5	5.45	121	Iron
8210-64	56	55	2.5	12	3	164	Iron	8210-84	150	65	.79	8	6.05	114	Iron
8210-66	62	55	2.5	11.5	3.15	160	Iron	8210-86	160	65	.79	7.5	6.4	111	Iron
8210-68	68	55	2.5	11	3.3	156	Iron	8210-88	180	65	.79	7	6.75	108	Iron
8210-70	75	55	2.5	10.5	3.7	147	Iron	8210-90	200	65	.79	6.5	7.1	106	Iron
8210-72	82	50	2.5	10.3	3.9	143	Iron	8210-92	220	65	.79	6.2	7.45	103	Iron
								8210-94	240	65	.79	5.9	7.8	101	Iron

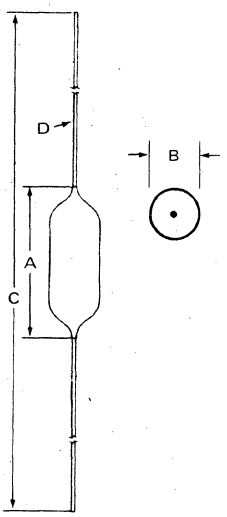


DIMENSIONS

	A	B	C	D
MAX.	.440	.180	—	.027
MIN.	—	—	2.98	.023

8230 SERIES

Part Number	L ±10% μH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA	Core Material	Part Number	L ±10% μH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA	Core Material
8230-94	.1	40	25	690	.07	1100	Phenolic	8230-46	12	45	2.5	40	2.7	210	Iron
8230-96	.12	40	25	650	.08	1100	Phenolic	8230-48	15	45	2.5	35	2.8	205	Iron
8230-00	.15	38	25	600	.1	1100	Phenolic	8230-50	18	50	2.5	32	3.1	195	Iron
8230-02	.18	35	25	550	.12	1010	Phenolic	8230-52	22	50	2.5	25	3.3	190	Iron
8230-04	.22	33	25	510	.14	935	Phenolic	8230-54	27	50	2.5	22	3.5	185	Iron
8230-06	.27	33	25	430	.16	875	Phenolic	8230-56	33	45	2.5	24	3.4	187	Ferrite
8230-08	.33	30	25	410	.2	780	Phenolic	8230-58	39	45	2.5	22	3.6	180	Ferrite
8230-10	.39	30	25	380	.3	640	Phenolic	8230-60	47	45	2.5	20	4.5	165	Ferrite
8230-12	.47	30	25	340	.35	590	Phenolic	8230-62	56	45	2.5	18	5.7	145	Ferrite
8230-14	.56	30	25	300	.5	495	Phenolic	8230-64	68	50	2.5	15	6.7	135	Ferrite
8230-16	.68	28	25	275	.6	450	Phenolic	8230-66	82	50	2.5	14	7.3	130	Ferrite
8230-18	.82	28	25	250	.85	380	Phenolic	8230-68	100	50	2.5	13	8	125	Ferrite
8230-20	1	25	25	230	1	350	Phenolic	8230-70	120	30	.79	12	13	97	Ferrite
8230-22	1.2	25	7.9	150	.18	825	Iron	8230-72	150	30	.79	11	15	85	Ferrite
8230-24	1.5	28	7.9	140	.22	745	Iron	8230-74	180	30	.79	10	17	79	Ferrite
8230-26	1.8	30	7.9	125	.3	640	Iron	8230-76	220	30	.79	9	21	73	Ferrite
8230-28	2.2	30	7.9	115	.4	550	Iron	8230-78	270	30	.79	8	25	65	Ferrite
8230-30	2.7	37	7.9	100	.5	495	Iron	8230-80	330	30	.79	7	28	62	Ferrite
8230-32	3.3	45	7.9	90	.85	380	Iron	8230-82	390	30	.79	6.5	35	55	Ferrite
8230-34	3.9	45	7.9	82	1	350	Iron	8230-84	470	30	.79	6	42	50	Ferrite
8230-36	4.7	45	7.9	75	1.2	320	Iron	8230-86	560	30	.79	5	46	48	Ferrite
8230-38	5.6	50	7.9	68	1.8	260	Iron	8230-88	680	30	.79	4.2	60	42	Ferrite
8230-40	6.8	50	7.9	60	2	245	Iron	8230-90	820	30	.79	3.8	65	40	Ferrite
8230-42	8.2	55	7.9	55	2.7	210	Iron	8230-92	1000	30	.79	3.4	72	38	Ferrite
8230-44	10	55	7.9	50	3.7	180	Iron								

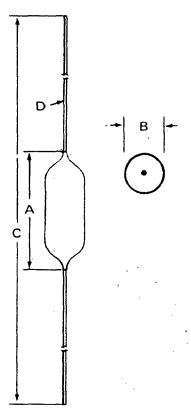


DIMENSIONS

	A	B	C	D
MAX.	300	.120	—	.0215
MIN.	—	—	2.92	.0185

8310 SERIES

Part Number	L ±20% μH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA	Core Material	Part Number	L ±20% μH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA	Core Material
8310-00	.15	50	25	525	.03	2450	Phenolic	8310-04	.33	45	25	360	.09	1400	Phenolic
8310-02	.22	50	25	450	.055	1900	Phenolic	8310-06	.47	45	25	310	.12	1225	Phenolic
Part Number	L ±10% μH							Part Number	L ±10% μH						
8310-07	.56	50	25	280	.135	1220	Phenolic	8310-30	5.6	45	7.9	60	.32	750	Iron
8310-08	.68	50	25	250	.15	1100	Phenolic	8310-32	6.8	50	7.9	55	.5	600	Iron
8310-10	.82	50	25	220	.22	900	Phenolic	8310-34	8.2	50	7.9	50	.6	545	Iron
8310-12	1	50	25	200	.29	830	Phenolic	8310-36	10	55	7.9	45	.9	445	Iron
8310-14	1.2	33	7.9	180	.42	650	Phenolic	8310-38	12	65	2.5	42	1.1	404	Iron
8310-16	1.5	33	7.9	160	.5	600	Phenolic	8310-40	15	65	2.5	40	1.4	370	Iron
8310-18	1.8	33	7.9	150	.65	525	Phenolic	8310-42	18	75	2.5	34	2.25	280	Iron
8310-20	2.2	33	7.9	135	.95	435	Phenolic	8310-44	22	75	2.5	30	2.5	265	Iron
8310-22	2.7	33	7.9	120	1.2	385	Phenolic	8310-46	24	60	2.5	26	2.5	265	Iron
8310-24	3.3	33	7.9	110	2	300	Phenolic	8310-48	27	60	2.5	25	2.6	260	Iron
8310-26	3.9	33	7.9	100	2.3	280	Phenolic	8310-50	30	65	2.5	19	2.8	255	Iron
8310-28	4.7	33	7.9	90	2.6	260	Phenolic	8310-52	33	65	2.5	19	3	250	Iron



DIMENSIONS

	A	B	C	D
MAX.	.440	.180	—	.027
MIN.	—	—	2.98	.023

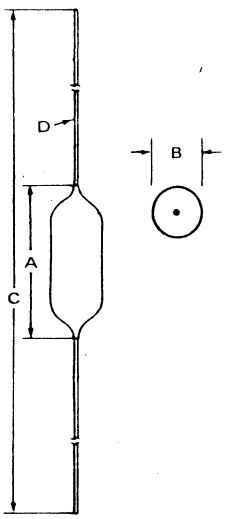
J. W. MILLER DIVISION, BELL INDUSTRIES / Dept. EM, 19070 Reyes Ave., Rancho Dominguez, CA 90221 / (213) 537-5200

EPOXY CONFORMAL COATED INDUCTORS

8250 SERIES

Electromagnetic Shielding

Part Number	L ±10% μH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA	Incr. I,dc Apprx. mA	Core Material	Part Number	L ±10% μH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA	Incr. I,dc Apprx. mA	Core Material
8250-101	.1	50	25	250	.025	1790	1790	Phenolic	8250-823	82	50	2.5	10.5	2.44	180	140	Ferrite
8250-121	.12	51	25	250	.034	1530	1530	Phenolic	8250-104	100	50	2.5	10	3.12	160	120	Ferrite
8250-151	.15	51	25	250	.037	1470	1470	Phenolic	8250-124	120	55	.79	9.7	3.6	150	95	Ferrite
8250-181	.18	50	25	250	.047	1300	1300	Phenolic	8250-154	150	55	.79	8.5	4.1	140	90	Ferrite
8250-221	.22	49	25	250	.067	1100	1100	Phenolic	8250-184	180	55	.79	8	4.4	135	85	Ferrite
8250-271	.27	47	25	250	.11	855	855	Phenolic	8250-224	220	55	.79	7.5	5	125	80	Ferrite
8250-331	.33	46	25	250	.13	780	780	Phenolic	8250-274	270	55	.79	7	5.8	115	70	Ferrite
8250-391	.39	44	25	250	.18	670	670	Phenolic	8250-334	330	55	.79	6.5	6.4	110	65	Ferrite
8250-471	.47	44	25	235	.25	565	565	Phenolic	8250-394	390	60	.79	6.2	7.4	105	60	Ferrite
8250-561	.56	43	25	210	.33	490	490	Phenolic	8250-474	470	60	.79	5.7	9.5	92	58	Ferrite
8250-681	.68	42	25	190	.45	420	420	Phenolic	8250-564	560	60	.79	4.7	10.5	90	55	Ferrite
8250-821	.82	40	25	180	.59	370	370	Phenolic	8250-684	680	60	.79	4.5	11.8	80	50	Ferrite
8250-102	1	44	25	140	.07	1070	1070	Iron	8250-824	820	60	.79	4.2	13	80	45	Ferrite
8250-122	1.2	44	7.9	130	.1	895	895	Iron	8250-105	1000	60	.79	3.8	17.5	70	40	Ferrite
8250-152	1.5	44	7.9	115	.12	815	815	Iron	8250-125	1200	45	.25	1.5	22.1	60	35	Ferrite
8250-182	1.8	44	7.9	105	.14	775	775	Iron	8250-155	1500	45	.25	1.2	26.5	55	33	Ferrite
8250-222	2.2	44	7.9	100	.19	650	650	Iron	8250-185	1800	45	.25	1	29.9	50	30	Ferrite
8250-272	2.7	44	7.9	92	.28	535	535	Iron	8250-225	2200	45	.25	.97	33.8	50	27	Ferrite
8250-332	3.3	44	7.9	85	.35	480	480	Iron	8250-275	2700	45	.25	.92	47.3	40	25	Ferrite
8250-392	3.9	44	7.9	75	.4	450	450	Iron	8250-335	3300	45	.25	.84	53	40	22	Ferrite
8250-472	4.7	44	7.9	70	.55	380	380	Iron	8250-395	3900	45	.25	.8	73.8	35	20	Ferrite
8250-562	5.6	44	7.9	65	.72	335	335	Iron	8250-474	4700	45	.25	.74	81.6	31	19	Ferrite
8250-682	6.8	50	7.9	55	1.02	280	280	Iron	8250-565	5600	44	.25	.73	98.9	28	17	Ferrite
8250-822	8.2	50	7.9	50	1.32	250	250	Iron	8250-685	6800	40	.25	.66	111	27	16	Ferrite
8250-103	10	50	7.9	46	1.62	220	220	Iron	8250-825	8200	40	.25	.54	119	26	15	Ferrite
8250-123	12	55	2.5	44	2	200	200	Iron	8250-106	10,000	40	.25	.47	137	24	14	Ferrite
8250-153	15	45	2.5	49	.8	315	250	Ferrite	8250-126	12,000	30	.079	.33	143	23	13	Ferrite
8250-183	18	45	2.5	45	.89	300	235	Ferrite	8250-156	15,000	30	.079	.29	157	22	12	Ferrite
8250-223	22	45	2.5	41	.96	290	220	Ferrite	8250-186	18,000	30	.079	.28	175	21	10	Ferrite
8250-273	27	45	2.5	38	1.19	260	200	Ferrite	8250-226	22,000	27	.079	.25	274	17	9	Ferrite
8250-333	33	45	2.5	34	1.37	240	190	Ferrite	8250-276	27,000	27	.079	.21	308	16	8	Ferrite
8250-393	39	50	2.5	29	1.93	205	180	Ferrite	8250-336	33,000	27	.079	.19	343	15	7.5	Ferrite
8250-743	47	50	2.5	27	2.11	195	175	Ferrite	8250-396	39,000	27	.079	.17	376	15	6	Ferrite
8250-563	56	50	2.5	25	2.23	190	160	Ferrite	8250-476	47,000	23	.079	.16	473	13	5.5	Ferrite
8250-683	68	50	2.5	21	2.7	170	150	Ferrite	8250-566	56,000	23	.079	.14	512	13	5	Ferrite
									8250-686	68,000	23	.079	.13	580	12	4	Ferrite



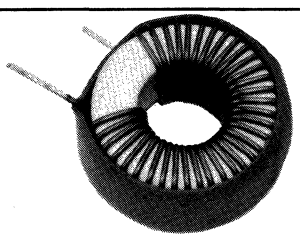
DIMENSIONS

	A	B	C	D
MAX.	.560	.187	—	.027
MIN.	—	—	2.98	.023

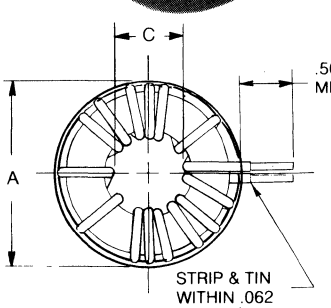
HIGH CURRENT TOROIDS

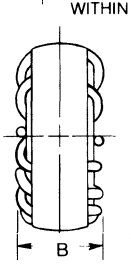
5700 SERIES

Chokes are ideal for all EMI/RFI filtering applications. They are also suitable for energy storage inductors in switching power supplies. Can be covered with shrink tubing and varnish impregnated. Printed Circuit mounting.



Miller No.	Ls at OADC μHy +15%	Rated DC Amps	Min. Ind. μHy at Rated DC	DC Res. Ohms Max.	DC Amps for 0.8 Ls	Out-line Style	Lead Dia. Nom.	Miller No.	Ls at OADC μHy +15%	Rated DC Amps	Min. Ind. μHy at Rated DC	DC Res. Ohms Max.	DC Amps for 0.8 Ls	Out-line Style	Lead Dia. Nom.
5701	10	11.00	5	.003	7.50	1	.064	5714	1250	1.75	750	.85	1.00	3	.015
5702	25	5.50	12	.012	3.25	1	.040	5715	1600	1.50	950	1.27	0.80	3	.012
5703	125	2.75	70	.12	1.50	1	.020	5716	125	7.75	65	.032	5.25	4	.064
5704	275	2.00	150	.24	1.30	1	.016	5717	500	4.00	275	.15	2.75	4	.032
5705	450	1.50	250	.49	0.80	1	.012	5718	1100	2.50	650	.33	1.80	4	.025
5706	25	9.00	15	.012	5.50	2	.064	5719	2250	1.75	1350	.92	1.30	4	.08
5707	75	5.00	40	03	3.00	2	.036	5720	4500	1.25	2700	2.64	0.90	4	.012
5708	400	2.25	225	.33	1.40	2	.018	5721	250	8.00	125	.041	4.75	5	.062
5709	800	1.75	475	.64	1.00	2	.015	5722	900	3.75	500	.175	2.00	5	.032
5710	1000	1.50	575	.98	0.90	2	.012	5723	1800	2.50	1000	.55	1.40	5	.023
5711	50	9.50	25	.012	6.00	3	.064	5724	4000	1.75	2100	1.16	1.10	5	.018
5712	150	4.75	85	.046	2.50	3	.036	5725	8000	1.00	4500	3.34	0.70	5	.012
5713	700	2.25	400	.42	1.25	3	.018								





Options:

1. Half shell potted
2. Full shell potted
3. Horizontal Mounting
4. Special DC and Inductances

OUTLINE STYLE	MAX. A	MAX. B	MIN. C
1	.875	.437	.187
2	1.125	.562	.312
3	1.250	.625	.375
4	1.812	.750	.750
5	2.125	.937	.625

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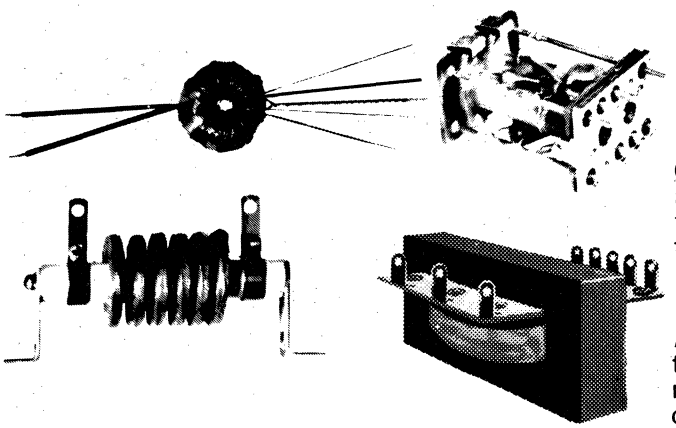

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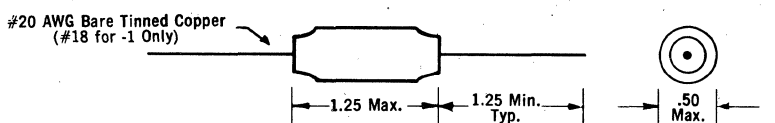
MODIFIED STOCK COILS

Any of the coils shown on these pages can be wound to intermediate inductance values or modified to meet customer requirements, often at no additional cost.

HIGH CURRENT CHOKES

TYPE 6150 10-100μH
Recommended mounting pitch — 1.50″



NOTES:

1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on .75 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating Temperature Range — −55°C to +85°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Jacket — PVC shrink tube.

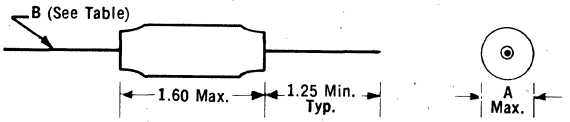
STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance*	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} Amps	Incr I Amps
6150-1	10μH	30	2.5	.018	10	6.40	21
6150-2	20	18	2.5	.036	7.2	4.50	15
6150-3	30	12	2.5	.063	5.0	3.40	13
6150-4	40	12	2.5	.096	4.3	2.75	12
6150-5	50	10	2.5	.110	3.7	2.60	10
6150-6	75	8	2.5	.200	3.2	1.90	9
6150-7	100	26	.79	.400	2.2	1.30	7.8

*(−10, +20%)

HIGH CURRENT CHOKES

TYPE 6490 10μH-1.0mH 10% Tolerance
Recommended mounting pitch — 1.75″



NOTES:

1. Inductance measured on General Radio 1650B Impedance Bridge at 1 kHz.
2. Current rating (Rated IDC) is based on 1.0 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating Temperature Range — −55°C to +85°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Jacket — PVC shrink tube.
   Lead Wires — Bare tinned copper.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} Amps	Incr I Amps	A Dia. In.	B Lead Size AWG
6490-1	10μH	.010	12.0	10.0	20	.65	14
6490-2	20	.017	9.0	7.7	16	.62	16
6490-3	30	.031	6.0	5.7	12	.61	18
6490-4	40	.050	5.0	4.5	11	.60	20
6490-5	50	.068	4.5	3.8	10	.59	20
6490-6	75	.13	3.4	2.8	9.0	.58	20
6490-7	100	.056	1.5	4.2	7.0	.79	18
6490-8	250	.14	0.90	2.7	4.5	.75	20
6490-9	500	.30	0.60	1.8	3.3	.72	20
6490-10	750	.56	0.45	1.3	2.6	.68	20
6490-11	1.0mH	.80	0.35	1.1	2.3	.66	20

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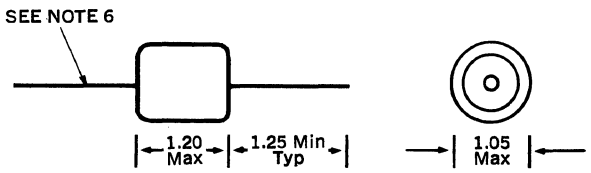
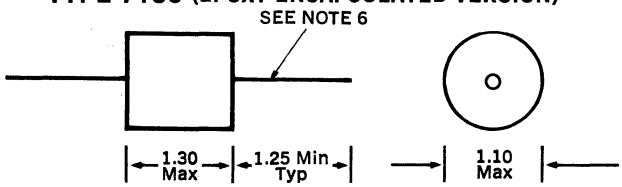
HIGH CURRENT CHOKES

10 μH-100 mH. 10% Tolerance. Recommended Mounting Pitch—1.50″

TYPE 7140



TYPE 7150 (EPOXY ENCAPSULATED VERSION)



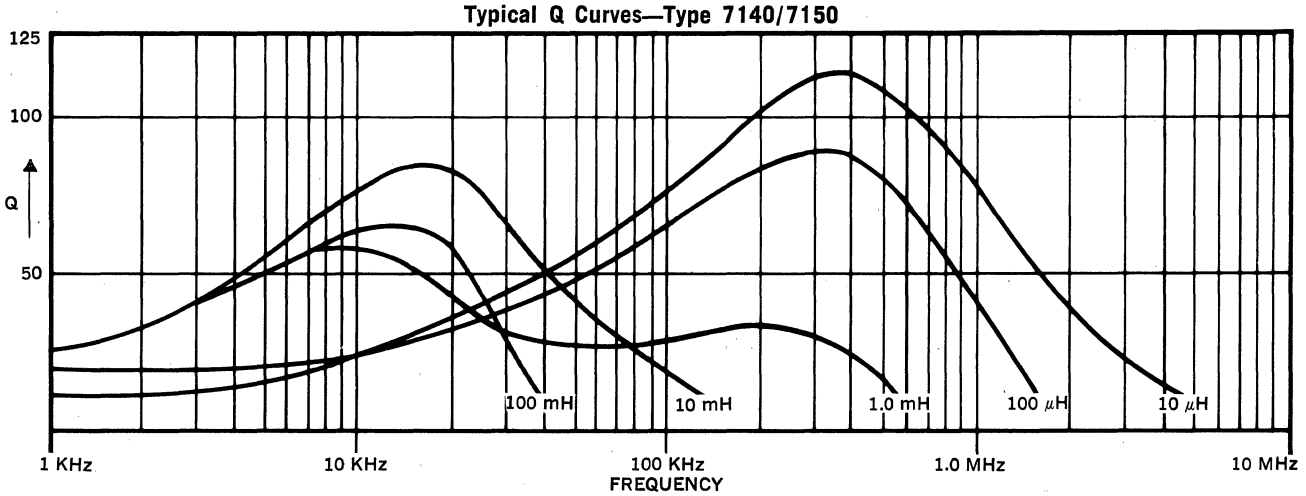
NOTES: (FOR BOTH TYPES)
1. Inductance measured on Cambridge Technology type 520 L/C Meter at 1 KHz.
2. Current rating (Rated IDC) is based on 1.5 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental Current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value because of saturation.
4. Dielectric Withstanding Voltage—1000 VRMS.
5. Operating temperature range −55° to +105°C.
6. Leads are bare tinned copper: -01 thru -10, #14 AWG; -11, #15 AWG; -12 thru -49, #16 AWG.
7. Marking—Printed with Caddell-Burns Part Number.
8. Materials: (See below)
   TYPE 7140
   Coil Form: Ferrite
   Magnet Wire: Per FED SPEC J-W-001177/9
   Jacket: Flame Retardant PVC shrink tube UL Type FR-1 Per MIL-I-23053
   TYPE 7150
   Coil Form: Ferrite
   Magnet Wire: Per FED SPEC J-W-001177/9
   Cover and Coating: Epoxy encapsulated

STANDARD VALUES: (Electrical characteristics are identical for both types. Other values are available on special order.)

DASH NO.	Nominal Inductance	DCR ±20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
-01	10 μH	0.0060	8.8	16	43
-02	12	0.0065	8.0	15	39
-03	15	0.0070	7.4	15	36
-04	18	0.0080	5.4	14	32
-05	22	0.0085	3.9	13	29
-06	27	0.0090	3.3	13	26
-07	33	0.010	3.1	12	24
-08	39	0.011	2.7	12	21
-09	47	0.012	2.6	11	20
-10	56	0.013	2.3	11	18
-11	68	0.017	2.1	9.4	16
-12	82	0.023	1.8	8.1	15
-13	100	0.025	1.6	7.7	14
-14	120	0.028	1.5	7.3	12
-15	150	0.032	1.4	6.8	11
-16	180	0.042	1.2	6.0	10
-17	220	0.048	1.1	5.6	9.2
-18	270	0.055	1.0	5.2	8.0
-19	330	0.072	0.96	4.6	7.4
-20	390	0.079	0.84	4.4	6.8
-21	470	0.11	0.72	3.7	6.2
-22	560	0.12	0.64	3.5	5.7
-23	680	0.14	0.62	3.3	5.1
-24	820	0.18	0.60	2.9	4.7
-25	1.0 mH	0.20	0.52	2.7	4.2

DASH NO.	Nominal Inductance	DCR ±20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
-26	1.2 mH	0.23	0.48	2.6	3.8
-27	1.5	0.31	0.40	2.2	3.4
-28	1.8	0.35	0.37	2.1	3.1
-29	2.2	0.46	0.32	1.8	2.8
-30	2.7	0.54	0.30	1.7	2.6
-31	3.3	0.72	0.27	1.4	2.3
-32	3.9	0.79	0.25	1.4	2.1
-33	4.7	0.90	0.24	1.3	1.9
-34	5.6	1.2	0.20	1.1	1.8
-35	6.8	1.3	0.19	1.1	1.6
-36	8.2	1.7	0.16	0.94	1.5
-37	10	2.0	0.15	0.87	1.3
-38	12	2.7	0.12	0.75	1.2
-39	15	3.1	0.11	0.70	1.1
-40	18	3.5	0.10	0.65	1.0
-41	22	4.7	0.096	0.56	0.90
-42	27	5.3	0.088	0.53	0.81
-43	33	7.1	0.076	0.46	0.74
-44	39	7.9	0.070	0.44	0.68
-45	47	11	0.067	0.37	0.62
-46	56	12	0.062	0.35	0.57
-47	68	14	0.054	0.33	0.51
-48	82	18	0.051	0.29	0.46
-49	100	21	0.042	0.27	0.42

Typical Q Curves—Type 7140/7150



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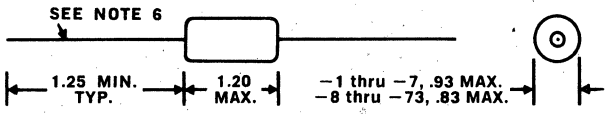
HIGH CURRENT CHOKES

TYPE 6950 10μH - 10H — 10% Tolerance
Recommended mounting pitch — 1.40"



NOTES:

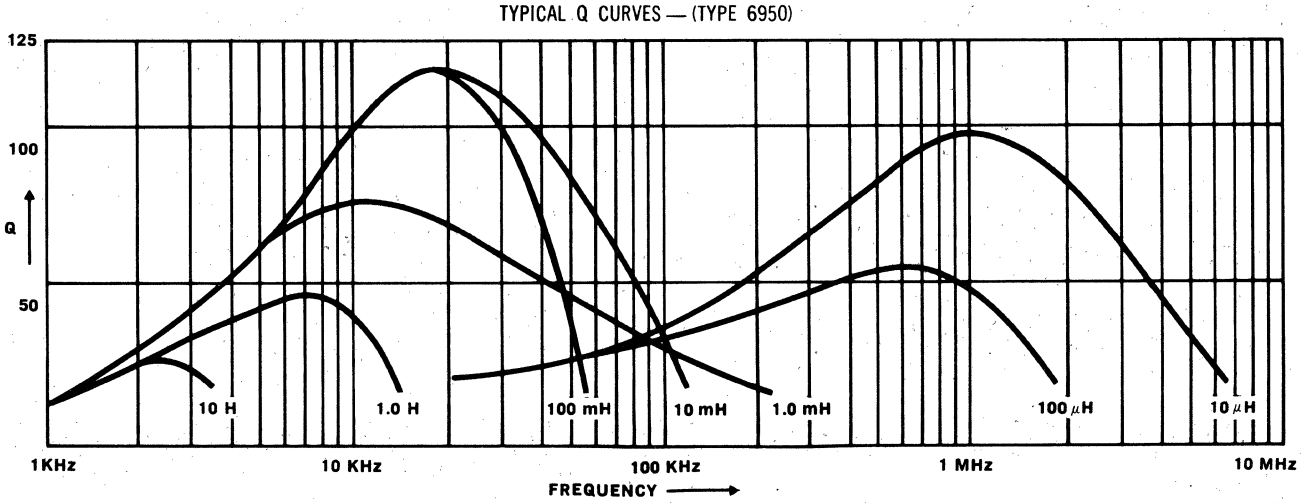
1. Inductance measured on General Radio 1650B Impedance Bridge at 1 KHz.
2. Current rating (Rated IDC) is based on 1.0 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value.
4. Dielectric withstanding voltage — 1000 VRMS.
5. Operating temperature range: −55° to +105°C.
6. Leads are bare tinned copper: −1 thru −7, #14 AWG; −8 and −9, #16 AWG; −10 thru −14, #18 AWG; −15 thru −17, #19 AWG; −18 thru −73, #20 AWG.
7. Materials:
   Coil Form — Ferrite
   Magnet Wire — Per FED. SPEC. J-W-001177/9 (MIL-W-583 Type B)
   Jacket — PVC Shrink Tube — FLAME RETARDANT UL TYPE FR-1 PER MIL-I-23053
8. Marking — Printed with Caddell-Burns Part Number.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma (2)	INCR I ma (3)
6950-01	10 μH	.007	12	12,000	35,000
-02	12	.008	8.0	11,200	32,600
-03	15	.009	6.0	10,500	28,400
-04	18	.010	5.7	10,000	25,900
-05	22	.011	5.3	9500	23,800
-06	27	.012	5.0	9100	21,000
-07	33	.013	4.5	8800	18,700
-08	39	.020	3.4	7100	17,600
-09	47	.022	3.2	6700	16,300
-10	56	.034	2.6	5400	14,700
-11	68	.038	2.4	5100	13,300
-12	82	.042	2.2	4900	12,400
-13	100	.048	1.9	4600	11,100
-14	120	.054	1.7	4300	10,100
-15	150	.073	1.5	3700	9100
-16	180	.082	1.3	3500	8300
-17	220	.091	1.2	3300	7500
-18	270	.12	1.1	2900	6800
-19	330	.13	1.0	2800	6100
-20	390	.18	.92	2400	5600
-21	470	.20	.84	2200	5100
-22	560	.26	.78	2000	4700
-23	680	.30	.69	1800	4300
-24	820	.40	.56	1600	3900
-25	1.0 mH	.45	.54	1500	3500
-26	1.2	.50	.50	1400	3200
-27	1.5	.70	.45	1200	2900
-28	1.8	.80	.43	1100	2600
-29	2.2	1.1	.42	950	2400
-30	2.7	1.2	.40	910	2100
-31	3.3	1.6	.28	790	1900
-32	3.9	1.8	.26	750	1800
-33	4.7	2.4	.23	650	1600
-34	5.6	2.6	.21	620	1500
-35	6.8	3.0	.20	580	1300
-36	8.2	4.0	.19	500	1200
-37	10	4.6	.18	470	1100

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma (2)	INCR I ma (3)
6950-38	12 mH	6.1	.16	400	1000
-39	15	7.1	.15	380	910
-40	18	9.6	.14	320	830
-41	22	11	.12	300	750
-42	27	13	.095	280	680
-43	33	15	.085	260	610
-44	39	21	.077	220	560
-45	47	24	.067	200	510
-46	56	33	.065	180	470
-47	68	36	.062	170	430
-48	82	41	.057	160	390
-49	100	55	.051	140	350
-50	120	60	.048	130	320
-51	150	84	.040	110	290
-52	180	94	.033	100	260
-53	220	110	.032	95	240
-54	270	127	.030	88	210
-55	330	165	.027	78	190
-56	390	220	.023	67	180
-57	470	240	.021	65	160
-58	560	330	.020	55	150
-59	680	360	.017	53	130
-60	820	400	.016	50	120
-61	1.0 H	570	.014	42	110
-62	1.2	650	.013	40	100
-63	1.5	740	.012	37	90
-64	1.8	1000	.011	32	83
-65	2.2	1100	.010	30	75
-66	2.7	1500	.0090	26	68
-67	3.3	1700	.0085	24	61
-68	3.9	2200	.0080	21	56
-69	4.7	2500	.0073	20	51
-70	5.6	3500	.0062	17	47
-71	6.8	4000	.0058	16	43
-72	8.2	4800	.0050	15	39
-73	10	5400	.0042	14	35

TYPICAL Q CURVES — (TYPE 6950)



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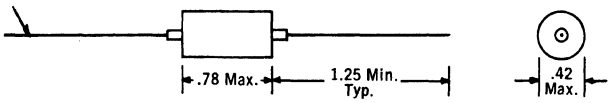
HIGH CURRENT CHOKES

10μH-1.0H. 10% Tolerance. Recommended Mounting Pitch — 1.25"

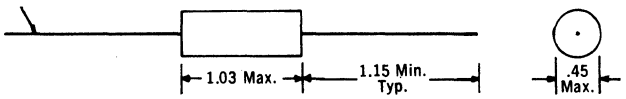
TYPE 6860

#20 AWG Bare Tinned Copper



TYPE 6870 (EPOXY ENCAPSULATED VERSION)

#20 AWG Bare Tinned Copper



NOTES: (FOR BOTH TYPES)

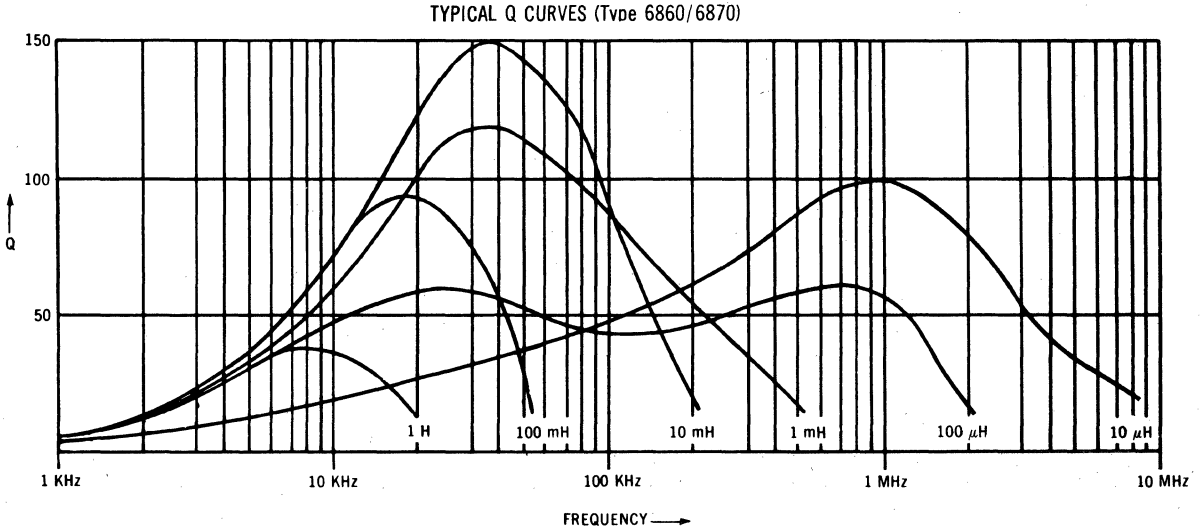
1. Inductance (Ls) measured on General Radio 1650B Impedance Bridge at 1 KHz.
2. Current rating (Rated IDC) is based on 0.5 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating temperature range — 55° to + 105°C.
6. Materials:
   Coil Form: Ferrite.
   Cover: TYPE 6860 - Polyester alpha-cellulose.
   Coating: Polyurethane per MIL-1-46058.
   TYPE 6870- Cover & Coating: Epoxy encapsulated.
   Magnet Wire: Per FED SPEC J-W-001177/9 (MIL-W-583 Type B)

STANDARD VALUES: (Electrical characteristics are identical for both types. Other values are available on special order.)

Dash No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
—01	10 μH	.023	45	4600	3200
—02	12	.025	40	4500	2900
—03	15	.030	32	4100	2600
—04	18	.032	21	3900	2400
—05	22	.035	12	3700	2200
—06	27	.038	8.5	3600	2000
—07	33	.043	5.8	3400	1800
—08	39	.047	3.5	3200	1700
—09	47	.054	3.2	3000	1500
—10	56	.060	2.9	2900	1400
—11	68	.068	2.7	2700	1200
—12	82	.073	2.5	2600	1100
—13	100	.098	2.3	2300	1000
—14	120	.14	2.1	1900	930
—15	150	.18	1.9	1700	830
—16	180	.20	1.5	1600	760
—17	220	.28	1.3	1400	680
—18	270	.31	1.3	1300	620
—19	330	.35	1.2	1200	560
—20	390	.38	1.1	1100	510
—21	470	.44	1.0	1050	460
—22	560	.48	.90	1000	430
—23	680	.63	.80	890	390
—24	820	.87	.72	760	350
—25	1.0 mH	.96	.65	720	320
—26	1.2	1.3	.62	620	290
—27	1.5	1.4	.58	600	260
—28	1.8	1.7	.53	540	240
—29	2.2	2.3	.44	470	220
—30	2.7	2.6	.39	440	190
—31	3.3	3.5	.36	380	180

Dash No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
—32	3.9 mH	3.8	.34	360	160
—33	4.7	4.3	.32	340	150
—34	5.6	5.6	.26	300	140
—35	6.8	6.3	.24	280	120
—36	8.2	8.6	.21	240	110
—37	10	9.7	.20	220	100
—38	12	11	.19	210	92
—39	15	15	.17	180	84
—40	18	20	.14	160	75
—41	22	24	.13	140	68
—42	27	26	.12	130	62
—43	33	35	.10	120	56
—44	39	38	.95	110	51
—45	47	50	.80	100	47
—46	56	55	.72	95	43
—47	68	76	.66	81	39
—48	82	86	.62	76	35
—49	100	99	.57	71	32
—50	120	110	.52	67	29
—51	150	200	.47	50	26
—52	180	220	.43	48	24
—53	220	300	.38	41	22
—54	270	320	.35	40	20
—55	330	420	.32	35	18
—56	390	480	.29	32	16
—57	470	670	.26	27	15
—58	560	730	.24	26	14
—59	680	870	.19	24	12
—60	820	950	.18	23	11
—61	1.0 H	1100	.17	21	10

TYPICAL Q CURVES (Type 6860/6870)



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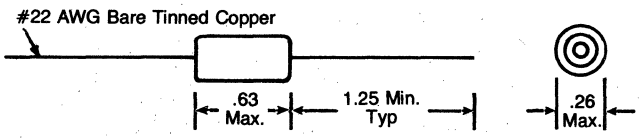
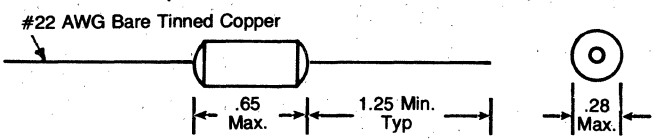
MINIATURE HIGH CURRENT CHOKES

1.0μH - 100mH. 10% Tolerance. Recommended Mounting Pitch — .80"

TYPE 7070



TYPE 7080 (EPOXY ENCAPSULATED VERSION)



NOTES: (FOR BOTH TYPES)

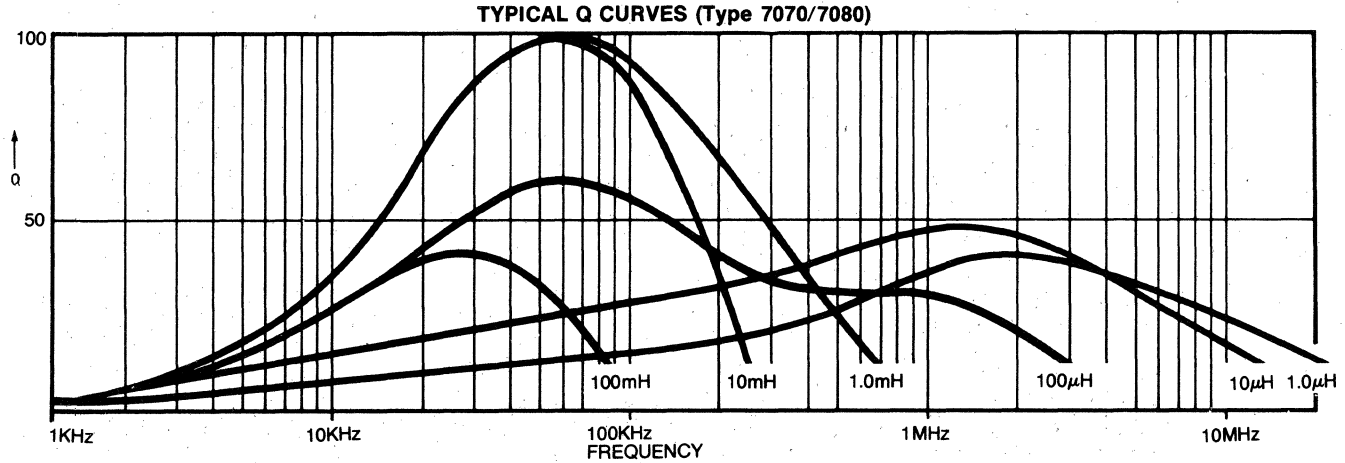
1. INDUCTANCE:
   For 1.0μH thru 8.2μH; effective inductance measured on Boonton 260A Q-meter at 7.9 MHz in accordance with MIL-C-15305.
   For 10μH thru 100mH; inductance (Ls) measured on General Radio 1650B Impedance Bridge at 1 KHz.
2. Current rating (Rated IDC) is based on 0.25 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating temperature range −55° to +105°C.
6. Materials:
   Coil Form: Ferrite
   Cover: TYPE 7070 - PVC shrink tube-flame retardant UL type FR-1 per MIL-I-23053
   TYPE 7080 - Epoxy encapsulated.
   Magnet Wire: Per FED SPEC J-W-001177/9 (MIL-W-583 Type B)

STANDARD VALUES: (Electrical characteristics are identical for both types. Other values are available on special order.)

DASH NO.	NOMINAL INDUCTANCE	MAX.DCR OHMS	MIN.SRF MHz	RATED IDC ma	INCR I ma
-01	1.0μH	.010	155	5,000	6,400
-02	1.2	.011	148	4,800	6,000
-03	1.5	.012	128	4,600	5,000
-04	1.8	.013	120	4,400	4,500
-05	2.2	.014	108	4,200	4,100
-06	2.7	.015	100	4,100	3,600
-07	3.3	.016	96	4,000	3,200
-08	3.9	.017	90	3,800	3,000
-09	4.7	.022	85	3,400	2,700
-10	5.6	.028	76	3,000	2,500
-11	6.8	.031	70	2,800	2,300
-12	8.2	.035	51	2,700	2,000
-13	10	.038	35	2,600	1,900
-14	12	.043	21	2,400	1,700
-15	15	.049	14	2,300	1,500
-16	18	.054	10	2,200	1,400
-17	22	.059	8.0	2,100	1,300
-18	27	.070	6.5	1,900	1,100
-19	33	.077	6.1	1,800	1,000
-20	39	.084	5.7	1,700	940
-21	47	.093	5.1	1,600	870
-22	56	.12	4.3	1,500	790
-23	68	.13	3.6	1,400	710
-24	82	.16	3.2	1,300	650
-25	100	.24	3.0	1,000	590
-26	120	.32	2.7	880	540
-27	150	.43	2.1	760	480
-28	180	.48	1.7	720	440
-29	220	.55	1.6	670	400
-30	270	.62	1.5	640	360

DASH NO.	NOMINAL INDUCTANCE	MAX.DCR OHMS	MIN.SRF MHz	RATED IDC ma	INCR I ma
-31	330μH	.72	1.4	590	320
-32	390	.79	1.3	560	300
-33	470	.88	1.2	530	270
-34	560	1.2	1.1	460	250
-35	680	1.5	1.0	410	230
-36	820	1.7	.96	380	210
-37	1.0mH	1.9	.88	360	190
-38	1.2	2.4	.78	320	170
-39	1.5	2.8	.64	300	150
-40	1.8	3.1	.60	280	140
-41	2.2	4.5	.54	240	120
-42	2.7	5.8	.44	210	110
-43	3.3	8.1	.43	180	100
-44	3.9	8.9	.40	170	95
-45	4.7	10	.38	160	86
-46	5.6	11	.35	150	79
-47	6.8	15	.29	130	72
-48	8.2	17	.26	120	65
-49	10	22	.24	110	59
-50	12	26	.23	100	54
-51	15	34	.19	86	48
-52	18	39	.17	80	44
-53	22	54	.16	68	40
-54	27	62	.15	64	36
-55	33	82	.12	55	32
-56	39	93	.11	52	30
-57	47	120	.096	46	27
-58	56	130	.092	44	25
-59	68	190	.088	36	23
-60	82	210	.080	35	21
-61	100	270	.074	30	19

TYPICAL Q CURVES (Type 7070/7080)



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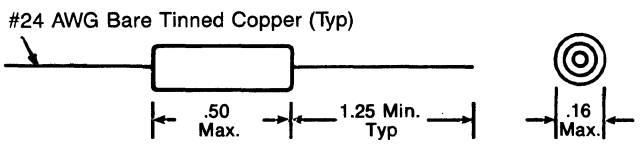
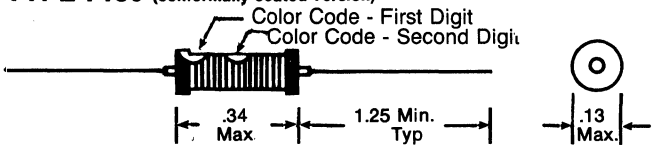
MINIATURE HIGH CURRENT CHOKES

1.0μH - 10mH. 10% Tolerance. Recommended Mounting Pitch — .60"

TYPE 7120



TYPE 7130 (conformally coated version)



NOTES: (FOR BOTH TYPES)

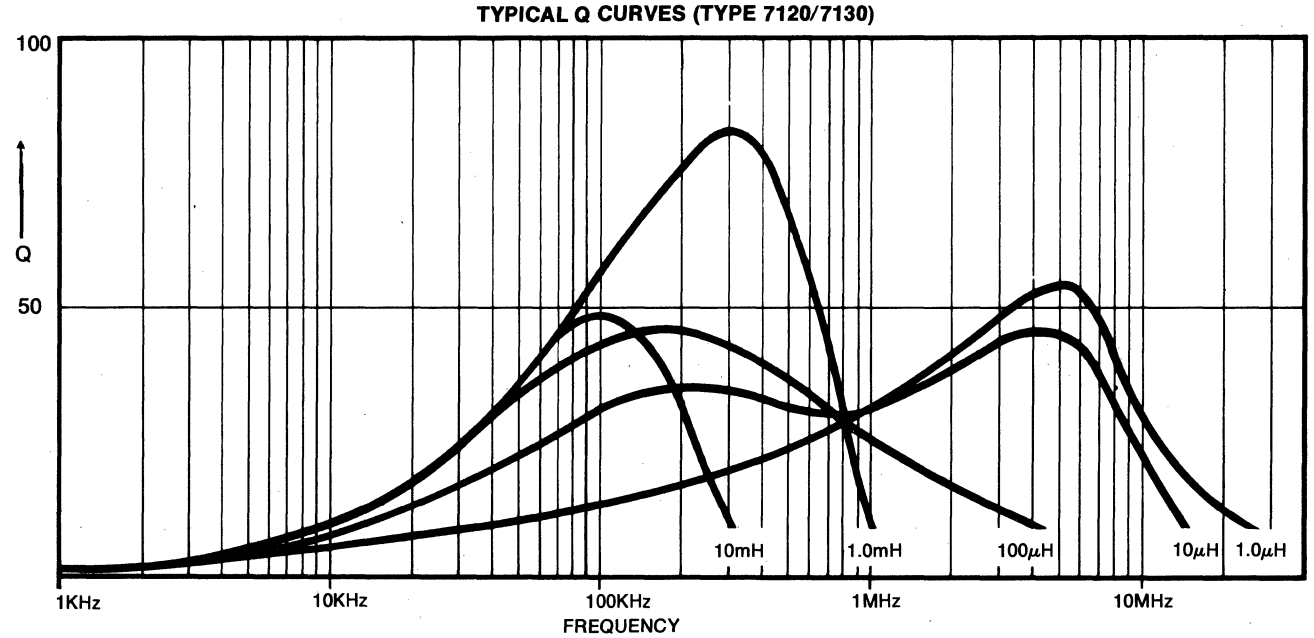
1. Inductance:
   For 1.0μH thru 8.2μH; effective inductance measured on Boonton 260A Q-meter at 7.9 MHz in accordance with MIL-C-15305. For 10μH thru 10mH, inductance (Ls) measured on General Radio 1650 B Impedance Bridge at 1 KHz.
2. Current Rating (Rated 1 DC) is based on 0.2 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR 1) is the minimum current at which the inductance will be decreased by 5% from its initial (zero - DC) value because of saturation.
4. Dielectric Withstanding Voltage:
   Type 7120 - 1000 VRMS
   Type 7130 - 100 VRMS
5. Operating temperature range -55° to +105°C.
6. Materials:
   Coil Form: Ferrite
   Cover: Type 7120 - PVC shrink tube - flame retardant UL type FR-1 per MIL-I-23053
   Type 7130 - conformally coated with Polyurethane per MIL-I-46058
   Magnet Wire: Per FED SPEC J-W-001177/9
   (MIL-W-583 Type B)
7. Marking:
   Type 7120 - Printed with part number
   Type 7130 - Color coded per dash number using standard EIA color code.

STANDARD VALUES (Electrical Characteristics are identical for both types. Other values are available on special order.)

DASH NO.	NOMINAL INDUCTANCE	MAX. DCR OHMS	MIN.SRF MHz	RATED IDC ma	INCR I ma
-01	1.0μH	.018	190	3300	3000
-02	1.2	.019	170	3200	2700
-03	1.5	.020	160	3100	2500
-04	1.8	.023	150	2900	2100
-05	2.2	.031	130	2600	2000
-06	2.7	.033	120	2500	1900
-07	3.3	.054	110	1900	1700
-08	3.9	.060	100	1800	1500
-09	4.7	.068	86	1700	1400
-10	5.6	.074	64	1600	1300
-11	6.8	.080	44	1600	1200
-12	8.2	.087	32	1500	1100
-13	10	.095	25	1500	970
-14	12	.11	17	1400	880
-15	15	.15	13	1200	790
-16	18	.16	10	1100	710
-17	22	.19	8.4	1000	640
-18	27	.22	8.0	950	580
-19	33	.24	7.6	910	530
-20	39	.26	7.1	880	480
-21	47	.35	6.0	760	430
-22	56	.47	5.8	650	400
-23	68	.53	4.3	610	370
-24	82	.60	4.1	580	330
-25	100	.67	3.9	550	300

DASH NO.	NOMINAL INDUCTANCE	MAX. DCR OHMS	MIN.SRF MHz	RATED IDC ma	INCR I ma
-26	120μH	.90	3.6	470	270
-27	150	1.2	3.2	410	250
-28	180	1.4	2.8	380	220
-29	220	1.9	2.3	320	200
-30	270	2.1	2.1	310	180
-31	330	2.4	1.9	290	170
-32	390	3.0	1.7	260	150
-33	470	3.4	1.4	240	140
-34	560	4.7	1.3	210	130
-35	680	6.4	1.2	180	110
-36	820	7.1	1.1	170	100
-37	1.0mH	7.9	1.0	160	95
-38	1.2	9.0	.94	150	87
-39	1.5	12	.76	130	78
-40	1.8	14	.72	120	71
-41	2.2	19	.64	100	64
-42	2.7	25	56	90	58
-43	3.3	29	53	83	52
-44	3.9	34	48	77	48
-45	4.7	37	.45	74	44
-46	5.6	50	.40	63	40
-47	6.8	58	.36	59	36
-48	8.2	68	.29	54	33
-49	10	75	.27	52	30

TYPICAL Q CURVES (TYPE 7120/7130)



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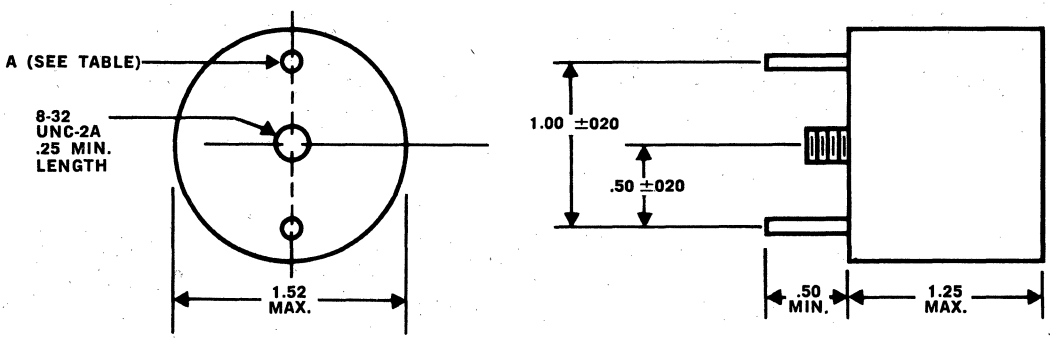
HIGH CURRENT CHOKES

TYPE 7000 10 μH — 10 mH — 10% Tolerance



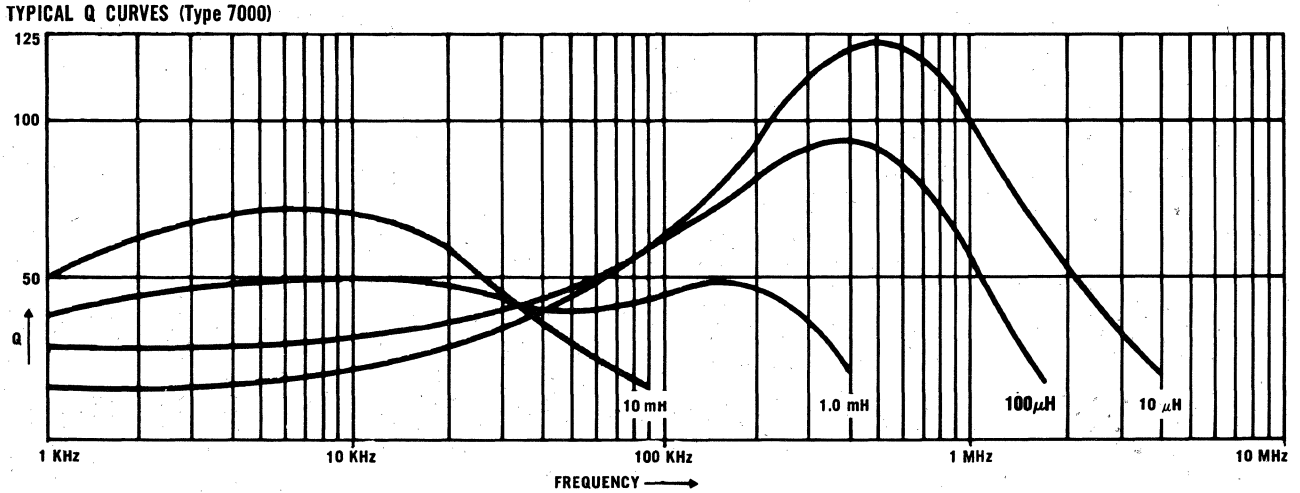
NOTES:

1. Inductance measured on General Radio 1650 B Impedance Bridge at 1 KHz.
2. Current Rating (Rated IDC) is based on 3.0 watts power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental Current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value.
4. Dielectric withstanding voltage (winding to case and mounting stud) — 500 VRMS.
5. Operating temperature range: −55°C to +105°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — per FED. SPEC. J-W-001177/9 (MIL-W-583 Type B).
   Leads — Bare tinned copper.
   Mounting Stud — 18-8 stainless steel.
   Case — epoxy encapsulated.
7. Marking — Printed with Caddell-Burns Part Number.

STANDARD VALUES: (other values available on special order)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC Amps (2)	INCR I Amps (3)	A Lead Size AWG
7000-01	10 μH	.004	9.0	27	65	10
7000-02	12	.004	7.2	27	58	10
7000-03	15	.005	5.2	24	52	10
7000-04	18	.006	4.4	22	44	11
7000-05	22	.007	3.8	21	41	11
7000-06	27	.008	3.5	19	38	12
7000-07	33	.011	2.8	17	33	13
7000-08	39	.012	2.7	16	31	13
7000-09	47	.013	2.5	15	28	13
7000-10	56	.014	2.4	14	26	13
7000-11	68	.017	2.1	13	23	13
7000-12	82	.019	2.0	13	21	13
7000-13	100	.022	1.8	12	19	13
7000-14	120	.027	1.4	11	17	14
7000-15	150	.030	1.3	10	15	14
7000-16	180	.039	1.1	8.8	14	15
7000-17	220	.054	.90	7.5	13	16
7000-18	270	.060	.85	7.1	12	16
7000-19	330	.070	.75	6.5	11	16
7000-20	390 μH	.090	.65	5.8	10	17
7000-21	470	.10	.62	5.5	8.8	17
7000-22	560	.11	.56	5.2	8.0	17
7000-23	680	.14	.51	4.6	7.5	18
7000-24	820	.17	.49	4.2	6.7	18
7000-25	1.0 mH	.22	.43	3.7	6.0	19
7000-26	1.2	.25	.37	3.5	5.4	19
7000-27	1.5	.29	.36	3.2	4.8	19
7000-28	1.8	.32	.33	3.1	4.4	19
7000-29	2.2	.44	.31	2.6	4.0	20
7000-30	2.7	.50	.27	2.4	3.6	20
7000-31	3.3	.69	.23	2.1	3.2	21
7000-32	3.9	.75	.21	2.0	3.0	21
7000-33	4.7	1.0	.20	1.7	2.8	22
7000-34	5.6	1.1	.18	1.6	2.6	22
7000-35	6.8	1.3	.17	1.5	2.3	22
7000-36	8.2	1.6	.14	1.4	2.1	23
7000-37	10	1.8	.13	1.3	1.9	23

TYPICAL Q CURVES (Type 7000)



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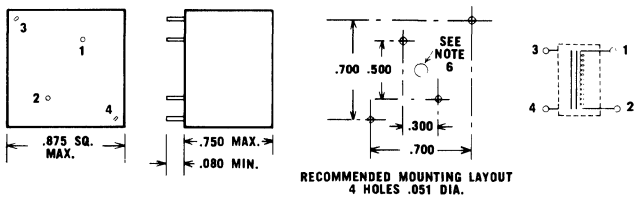
SHIELDED HIGH CURRENT CHOKES

TYPE 6900 10 μH — 82 μH — 10% Tolerance
100 μH — 1.0 μH — 5% Tolerance



SPECIAL FEATURES

SHIELDED — Magnetically shielded with ground lugs to minimize external field.

ENCAPSULATED — with epoxy for maximum ruggedness and moisture protection.

VARIABLE — with optional trimmer. See note 6.

STABLE — typical temperature coefficient of +76 ±28 ppm/°C from −30° to +70°C.

NOTES:

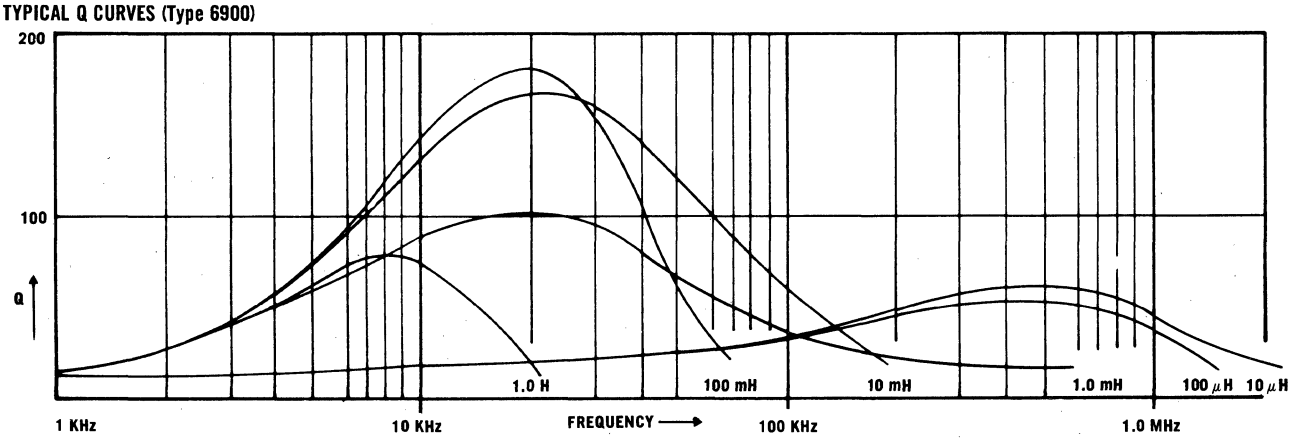
1. Inductance measured on General Radio 1650 B Impedance Bridge at 1 KHz.
2. Current rating (Rated IDC) is based on 1.0 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from the initial (zero-DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating temperature range −55° to +105°C.
6. These units are available with an optional trimmer which, when fully inserted, will increase the inductance by at least 20%. Order by adding suffix "V" to dash numbers, e.g.: 6900 -25V is continuously variable from 1.0 mH ±5% to 1.2 mH +10% −5%. If bottom access to trimmer is desired, provide a 3/16" dia. center hole as shown in the recommended mounting layout.
7. Materials:
   Core — Ferrite.
   Case — Epoxy encapsulated.
   Magnet Wire — per FED SPEC J-W-001177/9 (MIL-W-583 Type B)
   Terminals (1-2) — -01 thru -08 #18 AWG TINNED COPPER
   -09 thru -14 #20 AWG TINNED COPPER
   -15 and -16 #21 AWG TINNED COPPER
   -17 #22 AWG TINNED COPPER
   -18 thru -61 .024 dia. TINNED PH. BRONZE
   Ground Lugs (3-4) — .016 x .028 STEEL, NICKEL PLATE WITH GOLD FLASH.
8. Marking — Rubber stamped with Caddell-Burns part number.

STANDARD VALUES: (other values available on special order)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
6900-01	10 μH	.010	19	10,000	10,500
6900-02	12	.011	13	9,500	9,500
6900-03	15	.012	8.0	9,100	8,000
6900-04	18	.013	6.6	8,700	7,400
6900-05	22	.014	5.3	8,400	6,900
6900-06	27	.016	4.9	7,900	6,000
6900-07	33	.018	4.5	7,400	5,400
6900-08	39	.020	4.0	7,000	5,100
6900-09	47	.031	3.6	5,700	4,600
6900-10	56	.034	3.4	5,400	4,200
6900-11	68	.040	3.2	5,000	3,800
6900-12	82	.042	2.9	4,900	3,500
6900-13	100	.047	2.7	4,600	3,200
6900-14	120	.053	2.4	4,300	2,900
6900-15	150	.071	2.1	3,800	2,600
6900-16	180	.080	1.9	3,500	2,300
6900-17	220	.11	1.7	3,000	2,100
6900-18	270	.15	1.5	2,600	1,900
6900-19	330	.17	1.4	2,400	1,700
6900-20	390	.19	1.2	2,300	1,600
6900-21	470	.24	1.1	2,000	1,500
6900-22	560	.28	.90	1,900	1,300
6900-23	680	.31	.80	1,800	1,200
6900-24	820	.34	.70	1,700	1,100
6900-25	1.0 mH	.46	.61	1,500	1,000
6900-26	1.2	.52	.57	1,400	910
6900-27	1.5	.72	.54	1,200	820
6900-28	1.8	.79	.52	1,100	740
6900-29	2.2	.89	.50	1,000	670
6900-30	2.7	1.2	.44	900	610

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
6900-31	3.3 mH	1.3	.38	880	550
6900-32	3.9	1.9	.35	730	510
6900-33	4.7	2.1	.32	690	460
6900-34	5.6	2.6	.29	620	420
6900-35	6.8	3.1	.26	570	380
6900-36	8.2	3.4	.23	540	350
6900-37	10	4.6	.20	470	310
6900-38	12	5.1	.18	440	290
6900-39	15	5.8	.17	420	260
6900-40	18	7.8	.16	360	240
6900-41	22	9.0	.15	330	210
6900-42	27	12	.13	290	190
6900-43	33	13	.12	280	170
6900-44	39	18	.11	240	160
6900-45	47	20	.10	220	150
6900-46	56	27	.085	190	130
6900-47	68	31	.070	180	120
6900-48	82	34	.065	170	110
6900-49	100	45	.060	150	100
6900-50	120	51	.055	140	91
6900-51	150	58	.050	130	82
6900-52	180	77	.045	110	75
6900-53	220	88	.040	105	67
6900-54	270	120	.036	91	61
6900-55	330	130	.032	88	55
6900-56	390	150	.030	82	51
6900-57	470	200	.028	71	46
6900-58	560	280	.026	60	42
6900-59	680	310	.024	57	38
6900-60	820	350	.020	53	35
6900-61	1.0 H	470	.016	46	31

TYPICAL Q CURVES (Type 6900)



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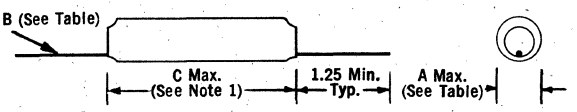
HIGH CURRENT/HIGH VOLTAGE CHOKES

suitable for any high-current application — especially those requiring high-voltage transient suppression.



TYPE 6309 11-360μH 10% Tolerance
20-50KV minimum breakdown voltage

NOTES:
1. Minimum Breakdown Voltage ratings and dimensions are as follows:

	Min. Breakdown	C Max. Length In.	Rec. Mtg. Pitch In.
-1 thru -5	20KV	2.8	3.0
-6 thru -10	35KV	4.2	4.4
-11 thru -15	50KV	5.8	6.0

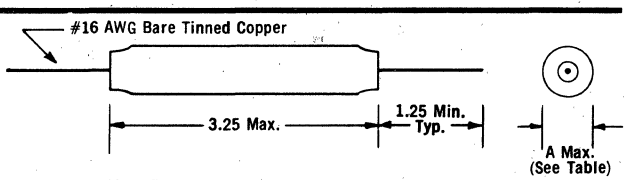
2. Inductance measured on General Radio 1650 Impedance Bridge at 1 KHz.
3. Current rating (Rated IDC) is based on power dissipation of 1.5 watt for -1 thru -5, 2.5 watt for -6 thru -10, and 3.5 watt for -11 thru -15; for approx. 20°C temperature rise. Depending on application, these units may be operated at up to twice the rated current.
4. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
5. Dielectric Withstanding Voltage — 1000 VRMS.
6. Materials:
   Coil Form — Ferrite. Jacket — PVC shrink tube.
   Magnet Wire — Type B per MIL-W-583.
   Lead Wires — Bare tinned copper.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} Amps	Incr I Amps	A Dia. In.	B Lead Size AWG
6309-1	11μH	.005	40	18	11	.62	10
6309-2	18	.007	33	15	9.0	.59	12
6309-3	31	.013	27	11	7.0	.56	14
6309-4	46	.023	22	8.0	6.0	.52	16
6309-5	79	.042	15	6.0	4.5	.49	18
6309-6	32	.008	25	18	4.0	.62	10
6309-7	48	.012	20	15	3.2	.59	12
6309-8	80	.019	15	12	2.7	.56	14
6309-9	120	.036	13	8.3	2.2	.52	16
6309-10	190	.068	11	6.0	1.7	.49	18
6309-11	60	.010	15	19	2.2	.62	10
6309-12	90	.014	13	16	1.8	.59	12
6309-13	146	.025	10	12	1.4	.56	14
6309-14	225	.050	8	8.4	1.2	.52	16
6309-15	360	.100	7	6.0	.95	.49	18

HIGH CURRENT/HIGH VOLTAGE CHOKES

suitable for any high-current application — especially those requiring high-voltage transient suppression.



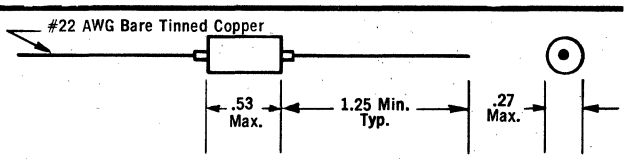
TYPE 6400 80μH-2.0mH 10% Tolerance
Recommended mounting pitch — 3.50"
25kV minimum breakdown voltage

NOTES:
1. Inductance measured on General Radio 1650B Impedance Bridge at 1 KHz.
2. Current rating (Rated IDC) is based on 2.0 watt power dissipation for approx. 20°C temperature rise. Depending on application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating Temperature Range — −55°C to +85°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Jacket — PVC shrink tube.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} Amps	Incr I Amps	A Dia.
6400-1	80μH	.034	12	7.7	7.5	.70
6400-2	130	.065	11	5.5	5.6	.68
6400-3	220	.13	9.0	3.9	4.3	.67
6400-4	350	.25	7.0	2.8	3.6	.66
6400-5	560	.49	5.0	2.0	2.9	.65
6400-6	780	.87	4.5	1.5	2.5	.64
6400-7	1.4mH	1.9	3.2	1.0	1.8	.63
6400-8	2.0	3.6	2.6	.75	1.4	.62

SHIELDED CHOKES



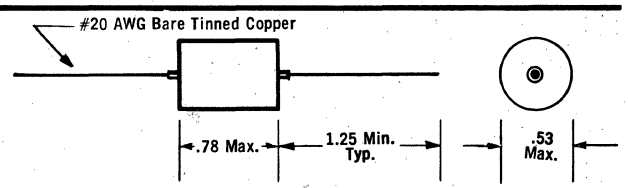
TYPE 1670 250μH-100mH 10% or 25% Tolerance (GMV also available).
Recommended mounting pitch — .80"

NOTES:
1. These units are especially suited for filtering applications where small size, low DC resistance and magnetic shielding are required. They are not recommended for applications requiring extremely high stability.
2. Inductance (LP) is measured at 1.0 KHz on a General Radio 1650-B impedance bridge. These units are available in either 10% or 25% inductance tolerance.
3. The test voltage specified in column 3 is the RMS voltage across the test unit during inductance measurement.
4. Current rating (Rated IDC) is based on 0.3 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
5. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
6. Dielectric Withstanding Voltage — 100 VRMS.
7. Materials:
   Coil Form and Shield — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Test Volts See Note 3	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} ma See Note 4	Incr I ma See Note 5
1670-1	250μH	.007	0.17	1.5	1330	60
1670-2	500	.014	0.39	1.1	880	44
1670-3	1.0mH	.028	0.80	0.90	610	30
1670-4	2.5	.07	1.8	0.40	400	20
1670-5	5.0	.14	3.1	0.30	310	13
1670-6	10	.15	6.3	0.20	220	9.4
1670-7	25	.30	13	0.14	150	6.0
1670-8	50	.40	28	0.10	100	4.3
1670-9	100	.24	54	0.70	75	3.0

SHIELDED CHOKES



TYPE 1662 5.0mH-1.0H 10% or 25% Tolerance (GMV also available).
Recommended mounting pitch — 1.20"

NOTES:
1. These units are especially suited for filtering applications where small size, low DC resistance and magnetic shielding are required. They are not recommended for applications requiring extremely high stability.
2. Inductance (Lp) is measured at 1.0 KHz on a General Radio 1650-B impedance bridge. These units are available in either 10% or 25% inductance tolerance.
3. The test voltage specified in column 3 is the RMS voltage across the test unit during inductance measurement.
4. Current rating (Rated IDC) is based on 0.5 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
5. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
6. Dielectric Withstanding Voltage — 100 VRMS.
7. Materials:
   Coil Form and Shield — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Test Volts See Note 3	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} ma See Note 4	Incr I ma See Note 5
1662-1	5.0mH	.14	.83	.28	770	20
1662-2	10	.16	2.4	.20	450	13
1662-3	25	.32	5.2	.11	310	8.0
1662-4	50	.42	12	.080	200	5.0
1662-5	100	.24	30	.050	130	4.0
1662-6	250	.40	65	.035	88	2.3
1662-7	500	.46	130	.024	62	1.6
1662-8	1.0H	.25	200	.015	50	1.2

SEND YOUR REQUIREMENTS. PROMPT QUOTES.

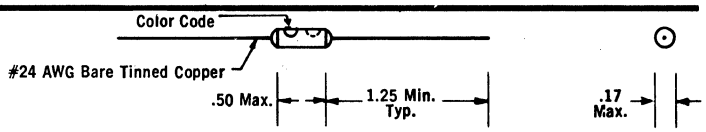
QUALITY COILS SINCE 1946

CADDELL-BURNS

40 East Second Street
Mineola, New York 11501-3597
Area Code 516 746-2310

MINIATURE SHIELDED CHOKES

TYPES 6375/6376 1.0μH-5.0mH 10% Tolerance
Recommended mounting pitch — .70″



NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on 0.25 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating Temperature Range — −55°C to +105°C.
6. Materials:
   Coil Form and Shield — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Construction — Epoxy encapsulated.
   Coating — Polyurethane per MIL-I-46058.

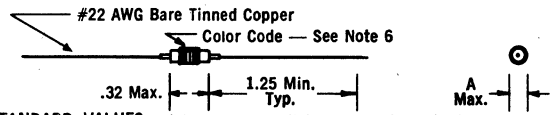
Marking — Color coded per dash number using standard EIA color as follows: 6375 — one color dot; 6376 — two color dots. e.g.: 6375-1 — one brown dot; 6376-1 — two brown dots, etc.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma See Note 2	INCR I ma See Note 3
6375-1	1.0μH	55	7.9	.05	200	2200	2700
6375-2	2.5	45	7.9	.08	115	1700	1600
6375-3	5.0	35	7.9	.12	90	1400	1000
6375-4	10	65	2.5	.42	55	770	750
6375-5	25	55	2.5	.80	35	560	450
6375-6	50	60	2.5	1.5	27	400	300
6375-7	100	70	2.5	3.1	20	280	200
6376-1	100	50	.79	.60	6.0	640	50
6376-2	250	55	.79	.92	2.6	520	32
6376-3	500	50	.79	2.0	1.9	350	22
6376-4	1.0mH	45	.25	4.7	0.8	230	15
6376-5	2.5	45	.25	7.5	0.5	180	10
6377-6	5.0	45	.25	17	0.4	120	7.0

MINIATURE CHOKES

TYPE 660 0.1-2.0μH 10% Tolerance
Recommended mounting pitch — .70″



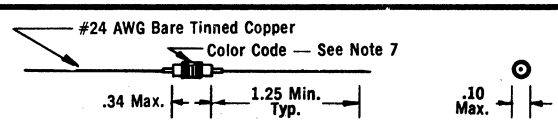
NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on 0.2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Dielectric Withstanding Voltage — 100 VRMS.
4. Operating Temperature Range — −55°C to +105°C.
5. Materials:
   Coil Form — Mineral filled phenolic.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.
6. Marking — Color coded per dash number using standard EIA color code.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated IDC Amps See Note 2	A Dia.
660-1	0.1μH	60	25	.014	420	3.8	.15
660-2	0.2	60	25	.034	380	2.4	.14
660-3	0.3	55	25	.060	340	1.8	.13
660-4	0.4	55	25	.074	310	1.6	.13
660-5	0.5	55	25	.12	280	1.3	.13
660-6	0.75	45	25	.23	240	0.9	.13
660-7	1.0	50	25	.39	200	0.7	.13
660-8	1.5	30	7.9	.76	160	0.5	.12
660-9	2.0	30	7.9	.96	140	0.4	.12

MINIATURE CHOKES

TYPE 620 1.0-100μH 10% Tolerance
Recommended mounting pitch — .60″



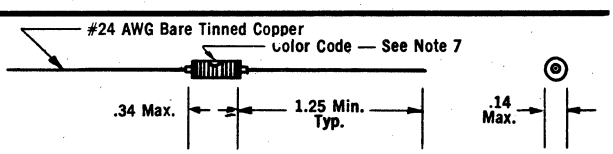
NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on 0.2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 100 VRMS.
5. Operating Temperature Range — −55°C to +105°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.
7. Marking — Color coded per dash number using standard EIA color code.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma See Note 2	INCR I ma See Note 3
620-1	1.0μH	50	7.9	.11	190	1300	4400
620-2	2.5	50	7.9	.18	120	1000	2600
620-3	5.0	45	7.9	.24	90	900	1800
620-4	7.5	40	7.9	.33	70	800	1350
620-5	10	40	2.5	.39	64	700	1100
620-6	15	60	2.5	.74	54	500	950
620-7	20	55	2.5	.96	46	450	780
620-8	25	60	2.5	1.2	40	400	680
620-9	50	85	2.5	3.6	28	270	490
620-10	75	90	2.5	6.3	22	170	410
620-11	100	80	2.5	8.6	20	150	320

MINIATURE CHOKES

TYPE 659 250μH-10.0mH 10% Tolerance
Recommended mounting pitch — .60″



NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on 0.2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 100 VRMS.
5. Operating Temperature Range — −55°C to +105°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.
7. Marking — Color coded per dash number using standard EIA color code.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma See Note 2	INCR I ma See Note 3
659-1	250μH	40	.79	2.0	3.2	315	165
659-2	500	35	.79	3.9	1.5	225	120
659-3	1.0mH	60	.25	9.5	1.1	145	78
659-4	2.5	55	.25	24	0.6	90	50
659-5	5.0	50	.25	50	0.5	63	37
659-6	10	40	.079	75	0.3	51	30

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QUALITY COILS SINCE 1946

CADDELL-BURNS

40 East Second Street
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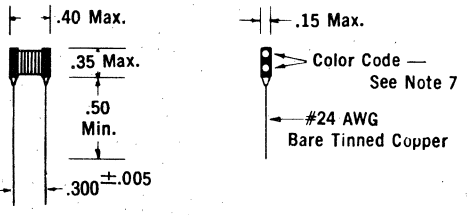
Area Code 516 746-2310

PRINTED CIRCUIT CHOKES TYPE 6550 1.0μH-10mH 10% Tolerance



NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on 0.2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 100 VRMS.
5. Operating Temperature Range — −55°C to +105°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.
7. Marking — color coded per dash number using standard EIA color code.

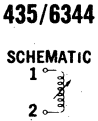
STANDARD VALUES: (Other values available on special order.)

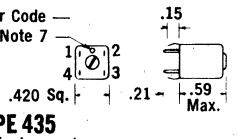
Part No.	Nominal Inductance	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma See Note 2	INCR I ma See Note 3
6550-1	1.0μH	90	7.9	.015	180	3600	7000
6550-2	2.5	85	7.9	.03	110	2500	4100
6550-3	5.0	90	7.9	.06	75	1800	2900
6550-4	7.5	95	7.9	.11	70	1300	2500
6550-5	10	90	7.9	.19	55	1020	2100
6550-6	25	80	2.5	.50	18	630	1300
6550-7	50	70	2.5	1.1	11	420	1000
6550-8	75	45	2.5	1.2	5.5	400	860
6550-9	100	85	.79	1.5	2.8	365	700
6550-10	250	55	.79	2.7	1.6	270	450
6550-11	500	35	.79	3.3	1.3	240	340
6550-12	750	30	.79	4.2	1.2	215	280
6550-13	1.0mH	80	.25	8.6	1.0	150	210
6550-14	2.5	75	.25	16	.53	110	140
6550-15	5.0	45	.25	31	.45	80	100
6550-16	7.5	25	.25	50	.32	63	80
6550-17	10	50	.079	70	.26	53	70

MINIATURE SHIELDED VARIABLE INDUCTORS

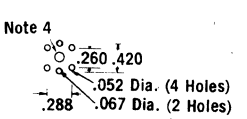
TYPES 435/6344 .25-70μH

SCHEMATIC



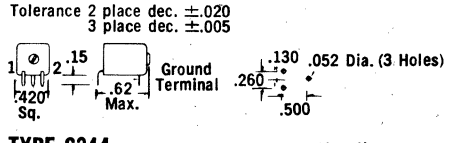


TYPE 435
vertical mount



Recommended Mounting Layout

Tolerance 2 place dec. ±.020
3 place dec. ±.005



TYPE 6344
horizontal mount

Recommended Mounting Layout

NOTES:
1. For vertical mount, order as 435-1 . . . etc. For horizontal mount, order as 6344-1 . . . etc.
2. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
3. Self-resonant frequencies are measured at maximum inductance.
4. Unit can be tuned from top or bottom with ⅛" insulated screwdriver (part no. C-B 2102). For type 435 only, provide .156 dia. hole if bottom access to tuning core is desired.
5. Current rating is based on .15 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
6. Materials:
   Terminals — Tin-plated brass. Core — Ferrite.
   Coil Form and Base — Molded nylon. Shield Can — Cadmium-plated brass.
7. Marking — Marked with Caddell-Burns Part No. on side of can, and color-coded per dash number on bottom between two active terminals.

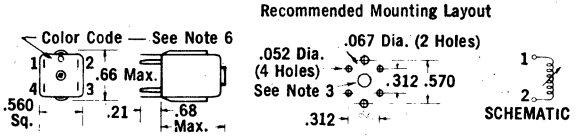
STANDARD VALUES: (Other values available on special order.)

Part No.	Minimum Range L Min.	L Max.	Minimum Q @ L Min.	@ L Max.	Test Freq. MHz	Min. SRF MHz Note 3	Max. DCR Ohms	Current Rating ma
435/6344-1	.25μH	.50μH	75	50	25	200	.03	2200
435/6344-2	.48	1.0	70	45	25	150	.08	1300
435/6344-3	.90	2.1	70	45	25/7.9	110	.17	930
435/6344-4	1.7	3.9	50	55	7.9	80	.60	500
435/6344-5	3.5	8.5	50	45	7.9	55	1.2	350
435/6344-6	7.5	17	60	40	7.9/2.5	40	2.3	250
435/6344-7	16.5	35	50	50	2.5	11	1.9	280
435/6344-8	33	70	45	45	2.5	8	2.9	220

MINIATURE SHIELDED VARIABLE INDUCTORS

TYPE 434 .55-64μH

Tol: 2 Place Dec. ±.020
3 Place Dec. ±.005



Recommended Mounting Layout

NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Self-resonant frequencies are measured at maximum inductance.
3. Provide .187 dia. hole if bottom access to tuning core is desired. Unit can be tuned from top or bottom with standard .060 square tuning tool (Part No. C-B2102).
4. Current rating is based on .2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
5. Materials:
   Terminals — Tin-plated brass.
   Coil Form and Base — Molded nylon.
   Core — Moisture proofed powdered iron.
   Shield Can — Aluminum plain finish.
6. Marking — Marked with Caddell-Burns No. on side of can; and color-coded per dash number on bottom between two active terminals.

STANDARD VALUES: (Other values available on special order.)

Part No.	Minimum Range L Min.	L Max.	Minimum Q @ L Min.	@ L Max.	Test Freq. MHz	Min. SRF MHz Note 2	Max. DCR Ohms	Current Rating ma
434-1	.55μH	.90μH	90	85	25	160	.06	1800
434-2	.90	1.4	90	70	25/7.9	130	.12	1200
434-3	1.4	2.4	60	70	7.9	100	.25	890
434-4	2.2	4.1	60	80	7.9	80	.60	570
434-5	3.9	7.7	55	55	7.9	52	1.0	440
434-6	7.5	11	35	70	7.9/2.5	21	1.2	400
434-7	11	17	55	75	2.5	16	1.4	370
434-8	18	27	55	75	2.5	14	1.8	330
434-9	27	42	55	70	2.5	13	2.4	280
434-10	42	64	55	65	2.5	11	3.1	250

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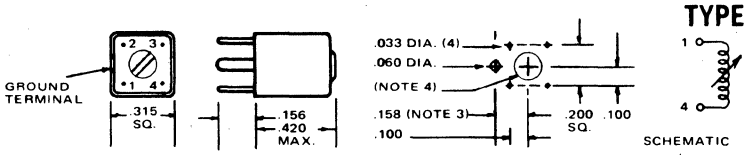
40 East Second Street
Mineola, New York 11501-3597
Area Code 516 746-2310

SUBMINIATURE SHIELDED VARIABLE INDUCTORS

TYPE 6740



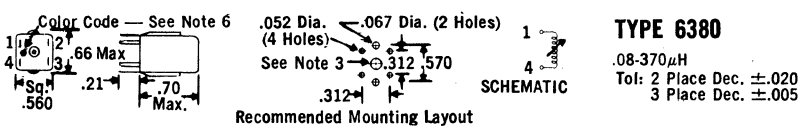
NOTES:

1. Effective inductance and Q measured on Boonton 260A Q-meter in accordance with MIL-C-15305.
2. Self-resonant frequencies are measured at nominal inductance.
3. Ground terminal may be bent as required to fit existing layouts.
4. Provide .156 DIA. hole if bottom access to tuning core is desired. Tuning range on −38 thru −61 may be extended by allowing core to extend 1/16" below mounting surface (when Lmin≈½Lnom).
5. Current rating is based on ¼ watt power dissipation.
6. MATERIALS–
   Terminals: tin plated copper.
   Terminal Base: molded phenolic.
   Coil Form: polyester fiberglass.
   Core: moisture-proofed powdered iron or ferrite.
   Shield Can: tin plated copper.
   Impregnation: varnish per MIL-V-173.

STANDARD VALUES (INTERMEDIATE AND SPECIAL VALUES AVAILABLE ON SPECIAL ORDER)

Dash No.	Nominal Inductance	Minimum Range LMIN	LMAX	Min Q @ LNOM	Test Freq. MHz	Max DCR OHMS	Min SRF MHz Note 2	Max IDC mA Note 5
−01	.10uH	.08uH	.12uH	80	25	.02	250	3500
−03	.15	.12	.18	85	25	.03	250	2800
−05	.22	.18	.27	85	25	.04	250	2500
−07	.33	.27	.39	90	25	.05	250	2200
−09	.47	.39	.56	90	25	.13	230	1350
−11	.68	.56	.82	90	25	.17	200	1200
−13	1.0	.82	1.2	90	25	.31	160	850
−15	1.5	1.0	1.8	60	7.9	.33	125	850
−17	2.2	1.5	2.7	65	7.9	.72	110	550
−19	3.3	2.2	3.9	65	7.9	1.3	95	425
−21	4.7	3.3	5.6	60	7.9	1.5	80	400
−23	6.8	4.7	8.2	60	7.9	1.8	62	350
−25	10	6.8	12.	60	7.9	2.2	45	325
−27	15	10	18	72	2.5	1.5	12	400
−29	22	15	27	67	2.5	1.8	9.5	350
−31	33	22	39	65	2.5	2.1	7.8	325
−33	47	33	56	57	2.5	2.6	6.6	300
−35	68	47	82	47	2.5	3.0	5.3	275
−37	100	68	120	45	2.5	3.5	5.0	250
−39	150	100	180	70	.79	3.6	3.4	250
−41	220	150	270	65	.79	6.0	2.8	200
−43	330	220	390	60	.79	7.9	2.3	150
−45	470	330	560	40	.79	11	1.9	125
−47	680	470	820	35	.79	13	1.7	125
−49	1.0mH	.68mH	1.2mH	32	.79	17	1.5	100
−51	1.5	1.0	1.8	37	.25	32	.86	85
−53	2.2	1.5	2.7	37	.25	41	.72	75
−55	3.3	2.2	3.9	40	.25	51	.69	65
−57	4.7	3.3	5.6	27	.25	80	.47	55
−59	6.8	4.7	8.2	25	.25	90	.39	50
−61	10	6.8	12	25	.25	110	.37	45

MINIATURE SHIELDED VARIABLE INDUCTORS



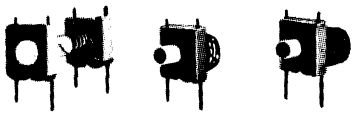
TYPE 6380

.08-370μH
Tol: 2 Place Dec. ±.020
3 Place Dec. ±.005

NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Self-resonant frequencies are measured at maximum inductance.
3. Provide .187 dia. hole if bottom access to tuning core is desired. Unit can be tuned from top or bottom with standard .060 square tuning tool (Part No. C-B2102).
4. Current rating is based on .2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
5. Materials:
   Terminals — Tin-plated brass.
   Coil Form and Base — Molded nylon.
   Core — Moisture-proofed powered iron or ferrite.
   Shield Can — Aluminum plain finish.
6. Marking — Marked with Caddell-Burns Part No. on side of can; and color-coded per dash number on bottom between two active terminals.

STANDARD VALUES: (Other values available on special order.)

Part No.	Minimum Range L Min.	L Max.	Minimum Q @ L Min.	@ L Max.	Test Freq. MHz	Min. SRF MHz Note 2	Max. DCR Ohms	Current Rating ma
6380-1	.08μH	.11μH	65	75	25	300	.012	4000
6380-2	.10	.17	75	85	25	280	.014	3700
6380-3	.13	.23	75	90	25	260	.015	3600
6380-4	.17	.28	80	90	25	230	.016	3500
6380-5	.25	.44	90	95	25	180	.024	2800
6380-6	.29	.53	90	95	25	170	.026	2700
6380-7	.48	.84	90	90	25	140	.058	1800
6380-8	.71	2.5	90	85	25/7.9	80	.10	1400
6380-9	1.8	5.7	70	110	7.9	50	.50	630
6380-10	4.5	14	55	120	7.9/2.5	18	.85	480
6380-11	12	40	60	115	2.5	10	1.6	350
6380-12	30	99	55	80	2.5	5.6	2.4	280
6380-13	73	190	55	115	2.5/.79	4.8	3.8	220
6380-14	148	370	75	120	.79	3.5	5.6	180



LOW-COST PRINTED-CIRCUIT VARIABLE INDUCTORS

TYPE 6460

Variable R.F. Inductors
Four Printed Circuit Terminals, Mounting—.5" x .8" Centers
Size 5/8" x 5/8" x .985 Long
Polyester Cellulose Coil Form

Stock No.	Inductance Range Microhenries Min.	Max.	Q'	Q''	Nom. D.C. Res. Ohms	Wire Size AWG
6460-1	.06	.09	80	105	.008	22
6460-2	.09	.16	100	130	.010	22
6460-3	.15	.29	120	140	.011	22
6460-4	.19	.40	130	145	.012	22
6460-5	.32	.68	80	105	.08	20/44
6460-6	.60	1.35	80	125	.11	20/44
6460-7	1.14	2.5	90	135	.15	20/44
6460-8	2.0	4.0	100	140	.21	20/44
6460-9	3.1	5.6	110	120	.26	20/44
6460-10	4.5	8.1	48	85	.29	20/44
6460-11	7.0	11.4	43	150	.37	20/44
6460-12	9.7	16.4	80	140	.47	20/44
6460-13	15.6	26.2	90	155	.61	20/44
6460-14	19.2	44	80	110	1.80	7/44
6460-15	41	95	80	90	2.56	7/44
6460-16	70	183	65	100	3.24	7/44
6460-17	180	525	90	98	5.76	7/44
6460-18	445	1040	94	105	9.32	7/44

Note: Inductance & Q at various frequencies can be altered by changing type of core used (see parts section for cores available). Dash No. 1 thru 15 uses Powdered Iron Core 302—250—6R. Dash No. 16 thru 18 uses Ferrite Core 303—250—6R.

TYPE 6461

Variable R.F. Coil Series
Size 5/8" x 5/8" x .625 Long
0.5" P.C. Mounting

Stock No.	Inductance Range Microhenries Min.	Max.	Q'	Q''	Nom. D.C. Res. Ohms	Wire Size AWG
6461-1	.09	.12	58	66	.007	22
6461-2	.1	.14	102	128	.009	22
6461-3	.14	.22	128	150	.01	22
6461-4	.18	.33	134	155	.011	22
6461-5	.23	.44	140	154	.013	22
6461-6	.37	.68	87	105	.102	7/41
6461-7	.58	1.1	87	100	.136	7/41
6461-8	1.1	2.2	72	115	.2	7/41
6461-9	2	4.4	80	112	.29	7/41
6461-10	3.3	8	96	140	.77	7/44
6461-11	7	13.6	70	130	1.02	7/44
6461-12	12.4	25.5	85	134	1.42	7/44
6461-13	22.5	49	90	127	1.93	7/44
6461-14	47	100	86	97	2.8	7/44
6461-15	99	174	75	142	4.2	7/44
6461-16	170	332	95	146	6.0	7/44
6461-17	322	570	102	140	8.5	7/44
6461-18	525	910	97	125	10.4	7/44

TYPE 6462

Variable R.F. Coil with Powdered Iron Shield
Size 5/8" x 5/8" x .730 Long
0.5" P.C. Mounting

Stock No.	Inductance Range Microhenries Min.	Max.	Q'	Q''	Nom. D.C. Res. Ohms	Wire Size AWG
6462-1	.08	.10	84	89	.007	22
6462-2	.4	.8	82	100	.11	7/41
6462-3	.6	1.3	85	105	.14	7/41
6462-4	1.1	2.6	71	115	.20	7/41
6462-5	2.1	5.1	85	145	.55	7/44
6462-6	3.4	8.6	96	145	.75	7/44
6462-7	8.0	16.9	70	150	1.14	7/44
6462-8	16.2	39.5	94	142	1.52	7/44
6462-9	34	84	86	110	2.21	7/44
6462-10	57	124	80	145	2.74	7/44
6462-11	67	141	80	148	3.16	7/44

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MS-90537 AND MUCH MORE...

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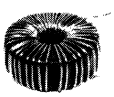
FOR NOISE FILTERING
HIGH CURRENT
RANGE 1 μh TO 15,000 μh

TOROIDS



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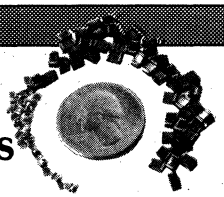

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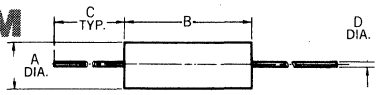


INDUCTANCE RANGE & MIL STANDARD

Model No.	INDUCTANCE RANGE Mil. Range shown in bold face From	To	CLASSIFICATION Grade	Class	Military Standard
IM-2	**.10 μH**	**1.00 μH**	1	B	MS75083
	1.2 μH	**27 μH**	1	A	MS75084
	33 μH	**1000 μH**	1	A	MS75085
IM-4	**.15 μH**	**4.7 μH**	1	B	MS18130
	5.6 μH	**33 μH**	1	A	MS14046
	36 μH	**240 μH**	1	A	MS90538
	270 μH	1800 μH	—	—	—
IM-6	**.10 μH**	**2.7 μH**	1	B	MS75008
	3.3 μH	**27 μH**	1	A	MS75101
	33 μH	220 μH	—	—	—
	270 μH	**1000 μH**	1	A	MS90539
IM-8	**1100 μH**	**3600 μH**	1	A	MS90540
IM-10	**3900 μH**	**10,000 μH**	1	A	MS90541
IMS-5	**.1 μH**	**100,000 μH**	1	A	MS75088

DIMENSIONS

Model No.		A	B	C	D
IM-2	Max.	.105 [2.67]	.260 [6.60]	1.626 [41.30]	.0215 [.546]
	Min.	.085 [2.16]	.240 [6.10]	1.250 [31.75]	.0185 [.470]
IM-4	Max.	.165 [4.19]	.385 [9.78]	1.625 [41.28]	.027 [.686]
	Min.	.145 [3.68]	.365 [9.27]	1.250 [31.75]	.023 [.584]
IM-6	Max.	.200 [5.08]	.450 [11.43]	1.625 [41.28]	.027 [.686]
	Min.	.180 [4.57]	.430 [10.92]	1.250 [31.75]	.023 [.584]
IM-8	Max.	.225 [5.72]	.570 [14.48]	1.625 [41.28]	.030 [.762]
	Min.	.205 [5.21]	.550 [13.97]	1.250 [31.75]	.026 [.660]
IM-10	Max.	.250 [6.35]	.750 [19.05]	1.625 [41.28]	.034 [.864]
	Min.	.230 [5.84]	.730 [18.54]	1.250 [31.75]	.030 [.762]
IMS-5	Max.	.172 [4.37]	.430 [10.92]	1.625 [41.28]	.027 [.686]
	Min.	.152 [3.86]	.390 [9.91]	1.250 [31.75]	.023 [.584]

MODEL NO. IM-2

Ind. & Tol. (μH)	Q Min.	Test Freq. L & Q (Mhz)
.10±10%	40	25.0
.12±10%	40	25.0
.15±10%	38	25.0
.18±10%	35	25.0
.22±10%	33	25.0
.27±10%	33	25.0
.33±10%	30	25.0
.39±10%	30	25.0
.47±10%	30	25.0
.56±10%	30	25.0
.68±10%	28	25.0
.82±10%	28	25.0
1.00±10%	25	25.0
1.20±10%	25	7.9
1.50±10%	28	7.9
1.80±10%	30	7.9
2.20±10%	30	7.9
2.70±10%	37	7.9
3.30±10%	45	7.9
3.90±10%	45	7.9
4.70±10%	45	7.9
5.60±10%	50	7.9
6.80±10%	50	7.9
8.20±10%	55	7.9
10.0 ±10%	55	7.9
12.0 ±10%	45	2.5
15.0 ±10%	40	2.5
18.0 ±10%	50	2.5
22.0 ±10%	50	2.5
27.0 ±10%	50	2.5
33.0 ±10%	45	2.5
39.0 ±10%	45	2.5
47.0 ±10%	45	2.5
56.0 ±10%	45	2.5
68.0 ±10%	50	2.5
82.0 ±10%	50	2.5
100. ±10%	50	2.5
120. ±10%	30	.79
150. ±10%	30	.79
180. ±10%	30	.79
220. ±10%	30	.79
270. ±10%	30	.79
330. ±10%	30	.79
390. ±10%	30	.79
470. ±10%	30	.79
560. ±10%	30	.79
680. ±10%	30	.79
820. ±10%	30	.79
1000. ±10%	30	.79

MODEL NO. IM-4

Ind. & Tol. (μH)	Q Min.	Test Freq. L & Q (Mhz)
.15±20%	50	25.0
.22±20%	50	25.0
.33±20%	45	25.0
.47±20%	45	25.0
.56±10%	50	25.0
.68±10%	50	25.0
.82±10%	50	25.0
1.00±10%	50	25.0
1.20±10%	33	7.9
1.50±10%	33	7.9
1.80±10%	33	7.9
2.20±10%	33	7.9
2.70±10%	33	7.9
3.30±10%	33	7.9
3.90±10%	33	7.9
4.70±10%	33	7.9
5.60±10%	45	7.9
6.80±10%	50	7.9
8.20±10%	50	7.9
10 ±10%	55	7.9
12 ±10%	65	2.5
15 ±10%	65	2.5
18 ±10%	75	2.5
22 ±10%	75	2.5
27 ±10%	60	2.5
33 ±10%	65	2.5
36 ± 5%	60	2.5
39 ± 5%	60	2.5
43 ± 5%	60	2.5
47 ± 5%	55	2.5
51 ± 5%	55	2.5
56 ± 5%	55	2.5
62 ± 5%	55	2.5
68 ± 5%	55	2.5
75 ± 5%	55	2.5
82 ± 5%	50	2.5
91 ± 5%	50	2.5
100 ± 5%	50	2.5
110 ± 5%	60	.79
120 ± 5%	65	.79
130 ± 5%	65	.79
150 ± 5%	65	.79
160 ± 5%	65	.79
180 ± 5%	65	.79
200 ± 5%	65	.79
220 ± 5%	65	.79
240 ± 5%	65	.79
270 ± 5%	65	.79
300 ± 5%	65	.79
330 ± 5%	65	.79
360 ± 5%	65	.79
390 ± 5%	65	.79
430 ± 5%	65	.79
470 ± 5%	65	.79
510 ± 5%	65	.79
560 ± 5%	65	.79
620 ± 5%	65	.79
680 ± 5%	55	.79
750 ± 5%	55	.79
820 ± 5%	55	.79
910 ± 5%	55	.79
1000 ± 5%	55	.79
1100 ± 5%	30	.25
1200 ± 5%	30	.25
1300 ± 5%	30	.25
1400 ± 5%	30	.25
1500 ± 5%	30	.25
1600 ± 5%	30	.25
1800 ± 5%	30	.25

MODEL NO. IM-6

Ind. & Tol. (μH)	Q Min.	Test Freq. L & Q (Mhz)
.10±10%	55	25.0
.12±10%	55	25.0
.15±10%	55	25.0
.18±10%	55	25.0
.22±10%	50	25.0
.27±10%	50	25.0
.33±10%	50	25.0
.39±10%	50	25.0
.47±10%	50	25.0
.56±10%	50	25.0
.68±10%	45	25.0
.82±10%	40	25.0
1.00±10%	40	25.0
1.20±10%	30	7.9
1.50±10%	30	7.9
1.80±10%	30	7.9
2.20±10%	30	7.9
2.70±10%	30	7.9
3.30±10%	30	7.9
3.90±10%	30	7.9
4.70±10%	30	7.9
5.60±10%	30	7.9
6.80±10%	30	7.9
8.20±10%	30	7.9
10.0 ±10%	30	7.9
12.0 ±10%	50	2.5
15.0 ±10%	55	2.5
18.0 ±10%	60	2.5
22.0 ±10%	60	2.5
27.0 ±10%	65	2.5
33.0 ±10%	75	2.5
39.0 ±10%	75	2.5
47.0 ±10%	75	2.5
56.0 ±10%	75	2.5
68.0 ±10%	75	2.5
82.0 ±10%	75	2.5
100 ±10%	65	2.5
120 ±10%	65	.79
150 ±10%	65	.79
180 ±10%	65	.79
220 ±10%	65	.79
270 ± 5%	65	.79
300 ± 5%	65	.79
330 ± 5%	65	.79
360 ± 5%	65	.79
390 ± 5%	65	.79
430 ± 5%	65	.79
470 ± 5%	65	.79
510 ± 5%	65	.79
560 ± 5%	65	.79
620 ± 5%	60	.79
680 ± 5%	60	.79
750 ± 5%	60	.79
820 ± 5%	60	.79
910 ± 5%	60	.79
1000 ± 5%	60	.79

MODEL NO. IM-8

Ind. & Tol. (μH)	Q Min.	Test Freq. L & Q (Mhz)
1100 ± 5%	60	.25
1200 ± 5%	60	.25
1300 ± 5%	60	.25
1500 ± 5%	65	.25
1600 ± 5%	65	.25
1800 ± 5%	65	.25
2000 ± 5%	65	.25
2200 ± 5%	70	.25
2400 ± 5%	70	.25
2700 ± 5%	70	.25
3000 ± 5%	70	.25
3300 ± 5%	70	.25
3600 ± 5%	70	.25

MODEL NO. IM-10

Ind. & Tol. (μH)	Q Min.	Test Freq. L & Q (Mhz)
3900 ± 5%	80	.25
4300 ± 5%	80	.25
4700 ± 5%	80	.25
5000 ± 5%	80	.25
5600 ± 5%	80	.25
6200 ± 5%	80	.25
6800 ± 5%	80	.25
7500 ± 5%	80	.25
8200 ± 5%	80	.25
9100 ± 5%	80	.25
10,000 ± 5%	80	.25

MODEL NO. IMS-5 Shielded Inductor

Ind. ±10% (μH)	Q. Min.	Test Freq. (Mhz)
.10	50	25
.12	51	25
.15	51	25
.18	50	25
.22	49	25
.27	47	25
.33	46	25
.39	44	25
.47	44	25
.56	43	25
.68	42	25
.82	40	25
1.00	44	25
1.20	44	7.9
1.50	44	7.9
1.80	44	7.9
2.20	44	7.9
2.70	44	7.9
3.30	44	7.9
3.90	44	7.9
4.70	44	7.9
5.60	44	7.9
6.80	50	7.9
8.20	50	7.9
10.0	50	7.9
12.0	55	2.5
15.0	45	2.5
18.0	45	2.5
22.0	45	2.5
27.0	45	2.5
33.0	45	2.5
39.0	50	2.5
47.0	50	2.5
56.0	50	2.5
68.0	50	2.5
82.0	50	2.5
100.0	50	2.5
120.0	55	.79
150.0	55	.79
180.0	55	.79
220.0	55	.79
270.0	55	.79
330.0	55	.79
390.0	60	.79
470.0	60	.79
560.0	60	.79
680.0	60	.79
820.0	60	.79
1,000.0	60	.79
1,200.0	45	.25
1,500.0	45	.25
1,800.0	45	.25
2,200.0	45	.25
2,700.0	45	.25
3,300.0	45	.25
3,900.0	45	.25
4,700.0	45	.25
5,600.0	44	.25
6,800.0	40	.25
8,200.0	40	.25
10,000.0	40	.25
12,000.0	30	.079
15,000.0	30	.079
18,000.0	30	.079
22,000.0	27	.079
27,000.0	27	.079
33,000.0	27	.079
39,000.0	27	.079
47,000.0	23	.079
56,000.0	23	.079
68,000.0	23	.079
82,000.0	21	.079
100,000.0	18	.079

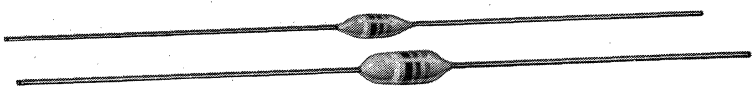
For complete information, write or phone

DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078. Phone 605-665-9301

DALE®

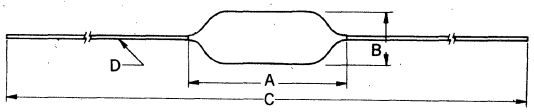
EPOXY CONFORMAL COATED INDUCTORS
RF CHOKES

MODEL IR



FEATURES

- Equivalent in quality to molded chokes—at a lower price.
- Excellent for automatic insertion.



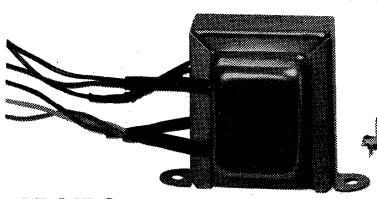
Model No.		A	B	C	D
IR-2	MAX.	.330 [8.38]	.120 [3.05]	—	.0215 [.534]
	MIN.	—	.100 [2.54]	2.9202 [74.17]	.0185 [.458]
IR-4	MAX.	.440 [11.18]	.180 [4.57]	—	.027 [.686]
	MIN.	—	.150 [3.81]	2.985 [75.82]	.023 [.584]

MODEL NO. IR-2

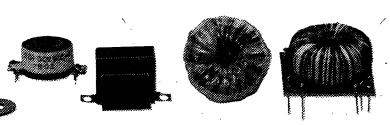
Ind. (μh)	Tol.	Q Min.	Test Freq. L & Q (Mhz)	Ind. (μh)	Tol.	Q. Min.	Test Freq. L & Q (Mhz)
.10	±10%	40	25.0	12.0	±10%	45	2.5
.12	±10%	40	25.0	15.0	±10%	40	2.5
.15	±10%	38	25.0	18.0	±10%	50	2.5
.18	±10%	35	25.0	22.0	±10%	50	2.5
.22	±10%	33	25.0	27.0	±10%	50	2.5
.27	±10%	33	25.0	33.0	±10%	45	2.5
.33	±10%	30	25.0	39.0	±10%	45	2.5
.39	±10%	30	25.0	47.0	±10%	45	2.5
.47	±10%	30	25.0	56.0	±10%	45	2.5
.56	±10%	30	25.0	68.0	±10%	50	2.5
.68	±10%	28	25.0	82.0	±10%	50	2.5
.82	±10%	28	25.0	100.0	±10%	50	2.5
1.00	±10%	25	25.0	120.	±10%	30	.79
1.20	±10%	25	7.9	150.	±10%	30	.79
1.50	±10%	28	7.9	180.	±10%	30	.79
1.80	±10%	30	7.9	220.	±10%	30	.79
2.20	±10%	30	7.9	270.	±10%	30	.79
2.70	±10%	37	7.9	330.	±10%	30	.79
3.30	±10%	45	7.9	390.	±10%	30	.79
3.90	±10%	45	7.9	470.	±10%	30	.79
4.70	±10%	45	7.9	560.	±10%	30	.79
5.60	±10%	50	7.9	680.	±10%	30	.79
6.80	±10%	50	7.9	820.	±10%	30	.79
8.20	±10%	55	7.9	1000.	±10%	30	.79
10.0	±10%	55	7.9				

MODEL NO. IR-4

Ind. (μh)	Tol.	Q. Min.	Test Freq. L & Q (Mhz)	Ind. (μh)	Tol.	Q. Min.	Test Freq. L & Q (Mhz)
.15	±20%	50	25.0	75.0	± 5%	55	2.5
.22	±20%	50	25.0	82.0	± 5%	50	2.5
.33	±20%	45	25.0	91.0	± 5%	50	2.5
.47	±20%	45	25.0	100.0	± 5%	50	2.5
.56	±10%	50	25.0	110.0	± 5%	60	.79
.68	±10%	50	25.0	120.0	± 5%	65	.79
.82	±10%	50	25.0	130.0	± 5%	65	.79
1.00	±10%	50	25.0	150.0	± 5%	65	.79
1.20	±10%	33	7.9	160.0	± 5%	65	.79
1.50	±10%	33	7.9	180.0	± 5%	65	.79
1.80	±10%	33	7.9	200.0	± 5%	65	.79
2.20	±10%	33	7.9	220.0	± 5%	65	.79
2.70	±10%	33	7.9	240.0	± 5%	65	.79
3.30	±10%	33	7.9	270.0	± 5%	65	.79
3.90	±10%	33	7.9	300.	± 5%	65	.79
4.70	±10%	33	7.9	330.	± 5%	65	.79
5.60	±10%	45	7.9	360.	± 5%	65	.79
6.80	±10%	50	7.9	390.	± 5%	65	.79
8.20	±10%	50	7.9	430.	± 5%	65	.79
10.0	±10%	55	7.9	470.	± 5%	65	.79
12.0	±10%	65	2.5	510.	± 5%	65	.79
15.0	±10%	65	2.5	560.	± 5%	65	.79
18.0	±10%	75	2.5	620.	± 5%	65	.79
22.0	±10%	75	2.5	680.	± 5%	55	.79
27.0	±10%	60	2.5	750.	± 5%	55	.79
33.0	±10%	65	2.5	820.	± 5%	55	.79
36.0	± 5%	60	2.5	910.	± 5%	55	.79
39.0	± 5%	60	2.5	1000.	± 5%	55	.79
43.0	± 5%	60	2.5	1100.	± 5%	30	.25
47.0	± 5%	55	2.5	1200.	± 5%	30	.25
51.0	± 5%	55	2.5	1300.	± 5%	30	.25
56.0	± 5%	55	2.5	1500.	± 5%	30	.25
62.0	± 5%	55	2.5	1600.	± 5%	30	.25
68.0	± 5%	55	2.5	1800.	± 5%	30	.25



CUSTOM INDUCTIVE PRODUCTS



TOROIDS

• Potted with case sizes to fit your specific designs • Open wound using Dale-formulated coatings for extra protection • Inverters, RF Inductors and Transformers with or without terminal boards. Unusual shapes and sizes a specialty.

BOBBINS

• Statistical control on high volume production items • Low initial tooling cost.

TOUGH COIL JOBS

Whether you need a hundred pieces or a million, we offer: • Complete facilities to design, engineer and produce prototype quantities • Faster turnaround on custom samples and short run production quantities • Close production coordination including cost-saving statistical control on high volume items.

AIR CORE CHOKES, INDUCTORS

Produced to your specifications for a wide range of high frequency applications including: • Television • Radio (2-way, scanners, AM/FM) • Cable TV Systems • Satellite Communication • Microwave • Test Equipment

SPECIFICATIONS

ELECTRICAL

Frequency: To 500 MHz
Current: 1 amp. max.
Temperature: To 130°C

MECHANICAL

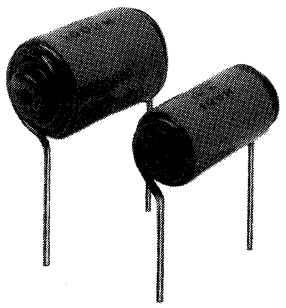
Winding: 1 to 32 turns, clockwise or counter-clockwise with variable pitch.
Wire Gauge: #18 to #32
Leads: Automatically tinned. Various configurations available.
Coil Inside Diameter: .079″ to .354″
Coil Length: Up to 1.26″

For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078. Phone 605-665-9301

DALE®

HIGH CURRENT FILTER CHOKES

MODEL IH



FEATURES

- Printed circuit mounting
- Pre-tinned leads

TYPICAL APPLICATIONS

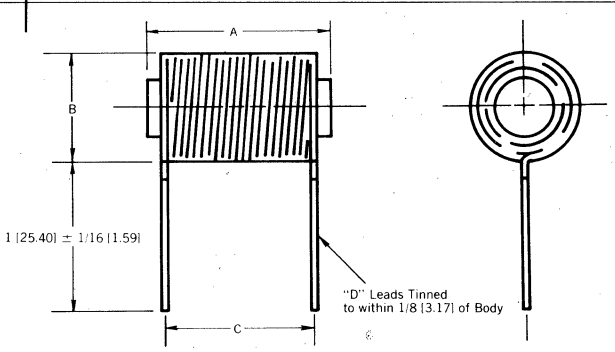
Noise filtering for switching regulators, power amplifiers, power supplies and SCR or Triac control circuits.

ELECTRICAL SPECIFICATIONS / DIMENSIONS

Dimension in Inches [Dimensions in Millimeters]

MODEL	IND. @ 1 KHz *±10%	RATED CURRENT (Max.)	DC RESISTANCE (Max.)	SELF-RESONANT FREQUENCY (Min.)	INCREMENTAL CURRENT**	A (Max.)	B (Max.)	C ±.062 [1.59]	D ±.005 [0.13]
IH-3	5 μh	3 amps	.015 Ω	40 MHz	19 amps	0.875 [22.23]	0.625 [15.88]	0.500 [12.70]	.042 [1.067]
IH-3	10 μh	3 amps	.018 Ω	25 MHz	17 amps	1.125 [28.58]	0.625 [15.88]	0.687 [17.45]	.042 [1.067]
IH-3	27 μh	3 amps	.035 Ω	8 MHz	15 amps	0.875 [22.23]	0.812 [20.62]	0.437 [11.10]	.042 [1.067]
IH-3	50 μh	3 amps	.050 Ω	5 MHz	12 amps	1.125 [28.58]	0.812 [20.62]	0.750 [19.05]	.042 [1.067]
IH-3	100 μh	3 amps	.065 Ω	2.5 MHz	8 amps	1.125 [28.58]	0.812 [20.62]	0.937 [23.80]	.042 [1.067]
IH-3	150 μh	3 amps	.075 Ω	2.0 MHz	5 amps	1.375 [34.93]	0.812 [20.62]	1.062 [26.97]	.042 [1.067]
IH-3	250 μh	3 amps	.090 Ω	1.0 MHz	3 amps	1.625 [41.28]	0.812 [20.62]	1.312 [33.32]	.042 [1.067]
IH-5	5 μh	5 amps	.012 Ω	30 MHz	20 amps	0.875 [22.23]	0.640 [16.26]	0.750 [19.05]	.053 [1.35]
IH-5	10 μh	5 amps	.015 Ω	20 MHz	18 amps	1.125 [28.53]	0.640 [16.26]	1.000 [25.40]	.053 [1.35]
IH-5	27 μh	5 amps	.025 Ω	7 MHz	15 amps	0.875 [22.23]	0.875 [22.23]	0.562 [14.27]	.053 [1.35]
IH-5	50 μh	5 amps	.030 Ω	4 MHz	10 amps	1.125 [28.53]	0.875 [22.23]	0.750 [19.05]	.053 [1.35]
IH-5	68 μh	5 amps	.035 Ω	3.5 MHz	9 amps	1.125 [28.53]	0.875 [22.23]	0.875 [22.23]	.053 [1.35]
IH-5	100 μh	5 amps	.050 Ω	2.5 MHz	7 amps	1.375 [34.93]	0.875 [22.23]	1.000 [25.40]	.053 [1.35]
IH-5	150 μh	5 amps	.060 Ω	2.0 MHz	5 amps	1.625 [41.28]	0.875 [22.23]	1.250 [31.75]	.053 [1.35]
IH-10	5 μh	10 amps	.010 Ω	30 MHz	19 amps	1.125 [28.53]	0.687 [17.45]	0.812 [20.62]	.065 [1.65]
IH-10	10 μh	10 amps	.012 Ω	20 MHz	17 amps	1.375 [34.93]	0.687 [17.45]	1.218 [30.94]	.065 [1.65]
IH-10	27 μh	10 amps	.018 Ω	7 MHz	15 amps	1.125 [28.53]	0.937 [23.80]	0.687 [17.45]	.065 [1.65]
IH-10	50 μh	10 amps	.025 Ω	4 MHz	9 amps	1.375 [34.93]	0.937 [23.80]	0.937 [23.80]	.065 [1.65]
IH-10	68 μh	10 amps	.027 Ω	3.5 MHz	8 amps	1.375 [34.93]	0.937 [23.80]	1.125 [28.53]	.065 [1.65]
IH-10	100 μh	10 amps	.030 Ω	2.5 MHz	6 amps	1.625 [41.28]	0.937 [23.80]	1.312 [33.32]	.065 [1.65]
IH-15	5 μh	15 amps	.008 Ω	30 MHz	20 amps	1.375 [34.93]	0.725 [18.42]	0.937 [23.80]	.082 [2.08]
IH-15	10 μh	15 amps	.010 Ω	20 MHz	17 amps	1.687 [42.85]	0.725 [18.42]	1.500 [38.10]	.082 [2.08]
IH-15	27 μh	15 amps	.015 Ω	7 MHz	14 amps	1.375 [34.93]	1.000 [25.40]	0.937 [23.80]	.082 [2.08]
IH-15	50 μh	15 amps	.020 Ω	4 MHz	9 amps	1.625 [41.28]	1.000 [25.40]	1.125 [28.53]	.082 [2.08]

*Inductance measured with zero D.C. current.
**Incremental current reduces inductance by 10% or less. Average current must not exceed specified rated current.



SCHEMATIC

ORDERING INFORMATION

IH	−5	10 μh ±10%
1.	2.	3.

1. Basic model high current choke
2. Current rating maximum (amperes)
3. Inductance (μh)

For complete information, write or phone
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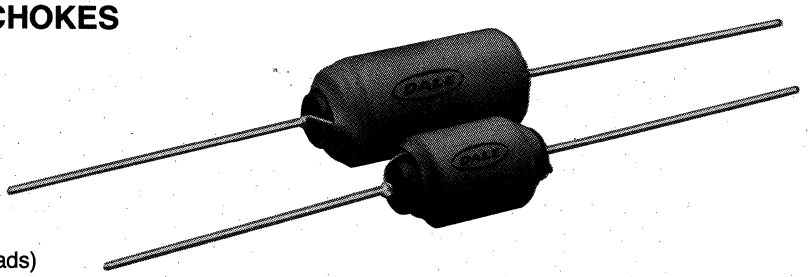
DALE®

HIGH CURRENT FILTER CHOKES

MODEL IHA



FEATURES

- Printed circuit mounting (axial leads)
- Pre-tinned leads
- Low cost construction
- Designed for use with switching power supplies
- Protected by polyolefin sleeve

SPECIFICATIONS

ELECTRICAL

Inductance: Measured at 1 KHz with no D.C. current. Rated current will reduce inductance by 10% or less.

Current Rating: Maximum continuous operating current (DC or RMS) at room temperature ambient.

Dielectric Rating: 2,500 V RMS, 60 Hz, applied for one minute between winding and outer circumference to within .25" of the insulation sleeve edge.

Temperature Rating: Continuous operation at temperature between −55°C and 105°C.

MECHANICAL

Winding: Layered solenoid type with magnetic core

Wire: Solid soft copper

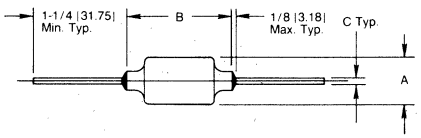
Terminals: Tinned copper leads

Coating: Polyolefin tubing

ELECTRICAL SPECIFICATIONS

MODEL	INDUCTANCE @ 1 KHz ±10%	CURRENT (Max.)	DC RESISTANCE (Max.)	SELF-RESONANT FREQUENCY (Min.)
IHA-101	50 μh	1 amp.	.12Ω	4.0 MHz
IHA-102	100 μh	1 amp.	.18Ω	2.0 MHz
IHA-103	250 μh	1 amp.	.30Ω	1.0 MHz
IHA-104	500 μh	1 amp.	.50Ω	.8 MHz
IHA-105	1000 μh	1 amp.	.60Ω	.5 MHz
IHA-201	27 μh	2 amp.	.085Ω	5.5 MHz
IHA-202	50 μh	2 amp.	.10Ω	4.0 MHz
IHA-203	100 μh	2 amp.	.15Ω	2.0 MHz
IHA-204	250 μh	2 amp.	.25Ω	1.0 MHz
IHA-205	500 μh	2 amp.	.45Ω	.5 MHz
IHA-301	5 μh	3 amp.	.025Ω	25.0 MHz
IHA-302	10 μh	3 amp.	.035Ω	20.0 MHz
IHA-303	27 μh	3 amp.	.05Ω	6.0 MHz
IHA-304	50 μh	3 amp.	.065Ω	4.0 MHz
IHA-305	100 μh	3 amp.	.075Ω	2.0 MHz
IHA-501	5 μh	5 amp.	.015Ω	50.0 MHz
IHA-502	10 μh	5 amp.	.025Ω	40.0 MHz
IHA-503	27 μh	5 amp.	.035Ω	7.0 MHz
IHA-504	50 μh	5 amp.	.05Ω	2.0 MHz
IHA-505	100 μh	5 amp.	.065Ω	1.0 MHz

SCHEMATIC



MECHANICAL SPECIFICATIONS

MODEL	A (Max.)	B (Max.)	C ±.002 [0.05]
IHA-101	.475 [12.06]	.800 [20.32]	.032 [0.81]
IHA-102	.475 [12.06]	.800 [20.32]	.032 [0.81]
IHA-103	.475 [12.06]	1.050 [26.67]	.032 [0.81]
IHA-104	.550 [13.97]	1.050 [26.67]	.032 [0.81]
IHA-105	.550 [13.97]	1.175 [29.84]	.032 [0.81]
IHA-201	.500 [12.70]	.800 [20.32]	.032 [0.81]
IHA-202	.500 [12.70]	.800 [20.32]	.032 [0.81]
IHA-203	.500 [12.70]	.920 [23.37]	.032 [0.81]
IHA-204	.600 [15.24]	.920 [23.37]	.032 [0.81]
IHA-205	.750 [19.05]	1.050 [26.67]	.032 [0.81]
IHA-301	.475 [12.06]	.800 [20.32]	.032 [0.81]
IHA-302	.475 [12.06]	.920 [23.37]	.032 [0.81]
IHA-303	.550 [13.97]	.800 [20.32]	.032 [0.81]
IHA-304	.550 [13.97]	.920 [23.37]	.032 [0.81]
IHA-305	.550 [13.97]	1.175 [29.84]	.032 [0.81]
IHA-501	.475 [12.06]	1.050 [26.67]	.040 [1.02]
IHA-502	.475 [12.06]	1.050 [26.67]	.040 [1.02]
IHA-503	.700 [17.78]	1.050 [26.67]	.040 [1.02]
IHA-504	.700 [17.78]	1.050 [26.67]	.040 [1.02]
IHA-505	.700 [17.78]	1.300 [33.02]	.040 [1.02]

ORDERING INFORMATION

IHA (1.) −101 (2.)

1. Basic model high current choke
2. Dash number for current and inductance value desired.

For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078. Phone 605-665-9301

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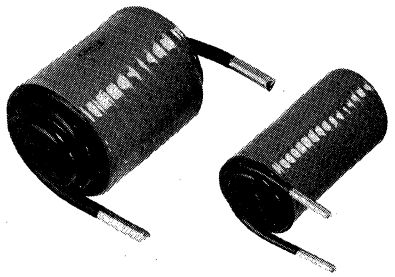
HIGH CURRENT FILTER CHOKES



MODEL IHV

FEATURES

- Printed circuit mounting
- Low cost construction
- Designed for use with switching power supplies
- Pre-tinned leads
- Epoxy coated for durability and reliability

SPECIFICATIONS

ELECTRICAL

Inductance: Measured at 1 KHz with no D.C. current

Dielectric: 2500 Volts RMS between winding and outer circumference to within 0.25 inches of the insulation sleeve edge.

Temperature: Operating: −55°C to +105°C
Storage: −55°C to +130°C

Current Rating: Based on continuous operation at room temperature ambient. Derating is required at elevated ambient temperatures in accordance with the derating curve.

MECHANICAL

Terminals: Extensions of winding wire, solder coated

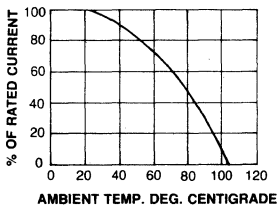
Coating: Epoxy conformal coated

ELECTRICAL SPECIFICATIONS

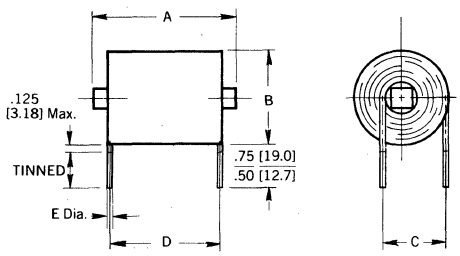
MODEL	INDUCTANCE* ±10%	CURRENT (Max.)	DC RESISTANCE (Max.)	SELF-RESONANT FREQUENCY (Min.)
IHV-15-500	500 μh	15 amps	.050Ω	0.8 MHz
IHV-20-200	200 μh	20 amps	.021Ω	1.2 MHz
IHV-28-60	60 μh	28 amps	.0085Ω	1.9 MHz
IHV-30-150	150 μh	30 amps	.013Ω	2.1 MHz
IHV-40-39	39 μh	40 amps	.0048Ω	2.5 MHz
IHV-45-92	92 μh	45 amps	.0075Ω	2.9 MHz
IHV-50-50	50 μh	50 amps	.0045Ω	3.1 MHz
IHV-60-24	24 μh	60 amps	.0025Ω	5.7 MHz

*Will not decrease more than 10% at rated current.

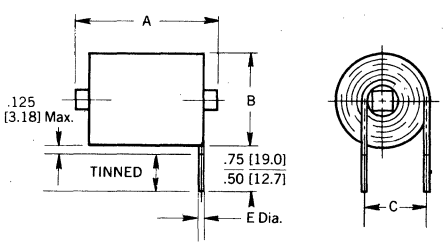
DERATING CHART



STYLE 1



STYLE 2



MECHANICAL SPECIFICATIONS

MODEL	STYLE	A (Max.)	B ±.050 [1.27]	C ±.062 [1.57]	D ±.062 [1.57]	E (Dia.)	TYPICAL WEIGHT (Grams)
IHV-15-500	1	2.45 [62.2]	1.45 [36.8]	.98 [24.9]	1.95 [49.6]	.082 [2.08]	305
IHV-20-200	2	2.45 [62.2]	1.45 [36.8]	.98 [24.9]	—	.102 [2.59]	310
IHV-28-60	2	2.45 [62.2]	1.02 [25.9]	.77 [19.6]	—	.102 [2.59]	160
IHV-30-150	2	2.45 [62.2]	1.65 [41.9]	1.08 [27.4]	—	.129 [3.28]	470
IHV-40-39	2	2.45 [62.2]	1.15 [29.2]	.82 [20.8]	—	.129 [3.28]	210
IHV-45-92	2	2.55 [64.8]	1.92 [48.8]	1.21 [30.7]	—	.162 [4.11]	650
IHV-50-50	1	2.55 [64.8]	1.57 [39.9]	1.05 [26.7]	2.10 [53.3]	.162 [4.11]	420
IHV-60-24	2	2.45 [62.2]	1.27 [32.3]	.89 [22.6]	—	.162 [4.11]	270

ORDERING INFORMATION

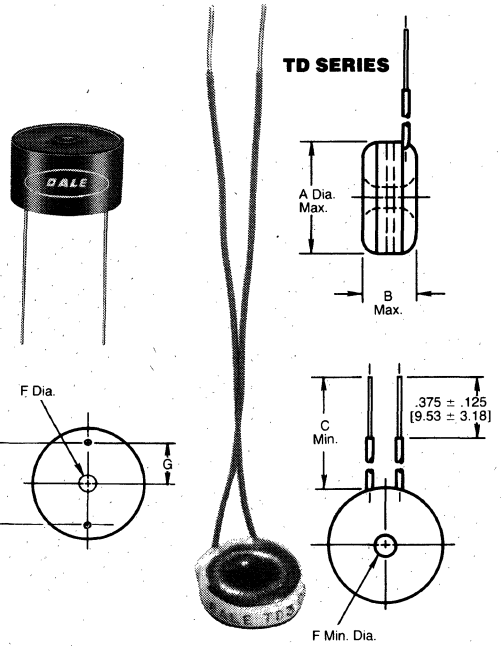
IHV (1.) — −15 (2.) — 500 ±10% (3.)

1. Basic model high current choke
2. Current rating maximum (amperes)
3. Inductance (μh)

For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078. Phone 605-665-9301

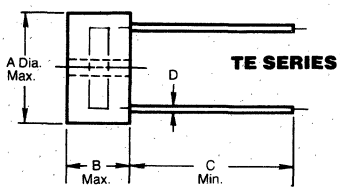
TOROIDAL FILTER INDUCTORS

MODELS TE & TD



FEATURES

- Choice of encapsulated (TE) or dipped (TD) styles
- TE style designed to meet the requirements of MIL-T-27, Type TF5SX20ZZ. TD style combines low cost with excellent performance in commercial applications.
- High Q and wide selection of Q vs frequency ranges in one small package. Large number of standard inductance values.



SPECIFICATIONS

ELECTRICAL

Tolerance:
TE-2, TD-2 = ±1% > 2mH, ±2% = 0.05mH to 2.0mH
TE-3, TD-3 = ±1% > 2mH, ±2% 154μH to 2.0mH, ±5% < 150μH
TE-4, TD-4 = ±1% > 2mH, ±2% < 2mH
TE-5, TD-5 = ±1% > 2mH, ±2% < 2mH

Insulation Resistance: 1000 Megohms minimum

Dielectric Strength: 1000 Volts minimum (TE)
500 Volts minimum (TD)

MECHANICAL

Terminal Strength: 2 lb. pull test (TE)

Vibration: Per MIL-T-27 (TE)

Shock: Per MIL-T-27 (TE)

Weight: TE-2 = 2 grams TD-2 = 1.6 grams typ.
TE-3 = 5.1 grams TD-3 = 4.9 grams typ.
TE-4 = 20 grams TD-4 = 17 grams typ.
TE-5 = 53 grams TD-5 = 52 grams typ.

MATERIAL

Encapsulant: Epoxy (TE)

Coating: Vinyl (TD), non-flammable, abrasion and moisture resistant. Resists most cleaning agents. (Consult factory for chemicals which may be used.)

Standard Terminals: Tinned copper (TE); Stranded, tinned copper, Teflon insulated (TD)

Gauge: TE-2 = 24AWG TD-2 = 30AWG
TE-3 = 22AWG TD-3 = 26AWG
TE-4 = 20AWG TD-4 = 24AWG
TE-5 = 20AWG TD-5 = 24AWG

DIMENSIONS [Numbers in brackets indicate millimeters]

TYPE	A	B	C	D	E	F	G
TE-2	.437 [11.10]	.270 [6.86]	1.00 [25.40]	.020 [0.51]	.300 [7.62]	—	—
TD-2	.437 [11.10]	.250 [6.35]	2.00 [50.80]	—	—	—	—
TE-3	.685 [14.86]	.385 [9.78]	1.00 [25.40]	.025 [0.64]	.500 [12.70]	.093 [2.36]	.250 [6.35]
TD-3	.685 [14.86]	.320 [8.13]	3.0 [76.20]	—	—	.125 [3.18]	—
TE-4	1.062 [26.97]	.500 [12.70]	1.00 [25.40]	.032 [0.81]	.900 [22.86]	.120 [3.05]	.450 [11.43]
TD-4	1.062 [26.97]	.437 [11.10]	4.0 [101.6]	—	—	.220 [5.59]	—
TE-5	1.32 [33.53]	.725 [18.42]	1.00 [25.40]	.032 [0.81]	1.00 [25.40]	.144 [3.66]	.50 [12.70]
TD-5	1.32 [33.53]	.688 [17.48]	6.00 [142.4]	—	—	.220 [5.59]	—

INDUCTANCE RANGES

T.C. AVAIL.	TE-2 TD-2	TE-3 TD-3	TE-4 TD-4	TE-5 TD-5
Q0	50μH to 10mH	50μH to 15mH	150μH to 20mH	1mH to 100mH
Q3	470μH to 120mH	500μH to 1H	1mH to 2H	5mH to 2H
Q4	1mH to 250mH	1mH to 4H	2mH to 7.5H	10mH to 20H

TEMPERATURE COEFFICIENT CODE (APPLIES TO CORE ONLY)

DALE TYPES				T.C. CODE	TEMPERATURE COEFFICIENT	TEMPERATURE RANGE	T.C. AVAILABILITY		
TE-2 TD-2	TE-3 TD-3	TE-4 TD-4	TE-5 TD-5				Q0	Q3	Q4
X	X	X	X	TA	0 ± 1%	−55°C to +125°C		X	X
		X	X	TB	0 ± 0.1%	+13°C to +35°C		X	X
X	X	X	X	TD	0 ± 0.1%	0°C to +55°C		X	X
		X	X	TE	0 ± 0.15%	0°C to +55°C			X
	X	X	X	TL*	+40 to +110 PPM/°C +85 to +185 PPM/°C	−55°C to +25°C +25°C to +85°C			X
X	X	X	X	TM	0 ± 0.25%	−65°C to +125°C		X	X
X	X	X	X	TR	50 PPM/°C (Typical)	−65°C to +125°C	X		
X	X	X	X	TW	0 ± 0.25%	−55°C to +85°C		X	X

*Inverse of typical Temperature Coefficient of polystyrene capacitor.

For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078 • Phone 605-665-9301

DC RESISTANCE AND SELF RESONANT FREQUENCIES
(Typical Values)

TE-2, TD-2

INDUCTANCE (mH)	DC RESISTANCE (Ohms)			SELF-RESONANT FREQUENCIES (MHz)		
	Q0	Q3	Q4	Q0	Q3	Q4
0.050	1.9	—	—	10	—	—
0.100	2.7	—	—	7	—	—
0.330	7.7	—	—	3.1	—	—
0.470	9.3	2.3	—	2.5	2.4	—
1.00	26	4.2	2.3	1.4	1.2	2.0
3.30	79	9.7	5.4	.70	.79	.95
10.0	251	31	18	.34	.40	.43
33.0	—	118	54	—	.18	.21
100	—	408	227	—	.06	.10
250	—	—	450	—	—	.05

TE-3, TD-3

INDUCTANCE	DC RESISTANCE (Ohms)			SELF-RESONANT FREQUENCIES (MHz)		
	Q0	Q3	Q4	Q0	Q3	Q4
50.0 μH	.68	—	—	7.6	—	—
100. μH	1.0	—	—	5.1	—	—
330. μH	3.3	—	—	2.9	—	—
1.00 mH	6.9	1.5	.82	1.4	1.1	1.0
3.30 mH	24	4.1	2.3	.79	.57	.55
10.0 mH	84	14	5.9	.40	.29	.25
15.0 mH	106	17	9.1	.34	.24	.21
33.0 mH	—	40	18	—	.14	.12
100. mH	—	138	58	—	.080	.077
330. mH	—	555	220	—	.040	.038
1.0 H	—	1500	670	—	.021	.019
4.00 H	—	—	2700	—	—	.009

TE-4, TD-4

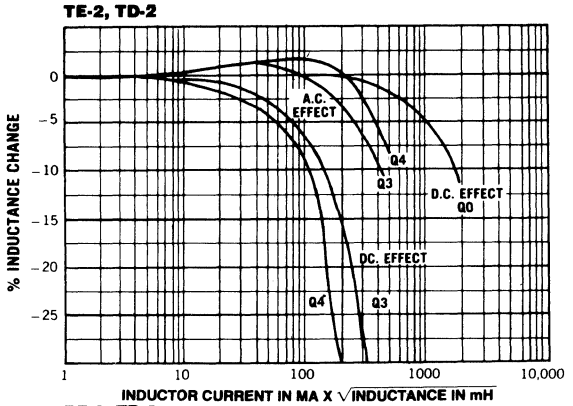
INDUCTANCE	DC RESISTANCE (Ohms)			SELF-RESONANT FREQUENCIES (MHz)		
	Q0	Q3	Q4	Q0	Q3	Q4
150. μH	.54	—	—	2.6	—	—
1.00 mH	2.8	.70	—	1.0	.75	—
2.00 mH	5.5	1.4	.78	.64	.54	.45
10.0 mH	27	4.9	2.5	.24	.21	.18
20.0 mH	54	9.6	5.0	.18	.15	.13
100. mH	—	56	23	—	.059	.051
1.00 H	—	570	260	—	.016	.014
2.00 H	—	1200	520	—	.013	.011
7.5 H	—	—	2000	—	—	.004

TE-5, TD-5

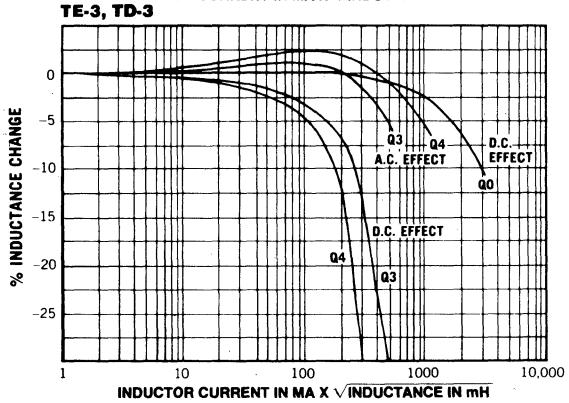
INDUCTANCE	DC RESISTANCE (Ohms)			SELF-RESONANT FREQUENCIES (MHz)		
	Q0	Q3	Q4	Q0	Q3	Q4
1.00 mH	1.8	—	—	.80	—	—
3.30 mH	5.2	—	—	.44	—	—
5.00 mH	6.5	1.8	—	.33	.32	—
10.00 mH	13	2.4	1.7	.21	.20	.15
33.00 mH	49	8.8	3.9	.12	.11	.086
100.00 mH	133	27	11	.061	.057	.044
330.00 mH	—	80	44	—	.032	.024
1.00 H	—	222	121	—	.016	.012
2.00 H	—	475	217	—	.012	.008
10.00 H	—	—	1300	—	—	.003
20.00 H	—	—	2400	—	—	.002

INDUCTANCE VS D.C. BIAS
INDUCTANCE VS A.C. EXCITATION

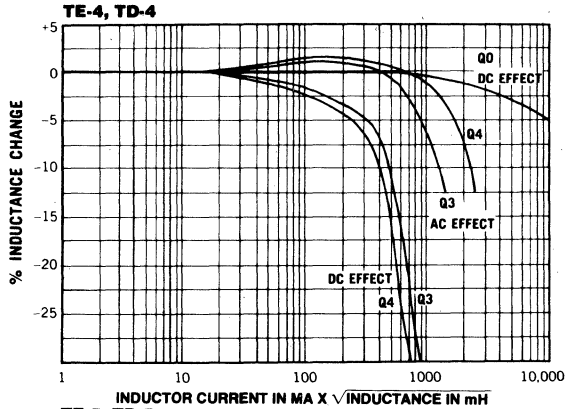
TE-2, TD-2



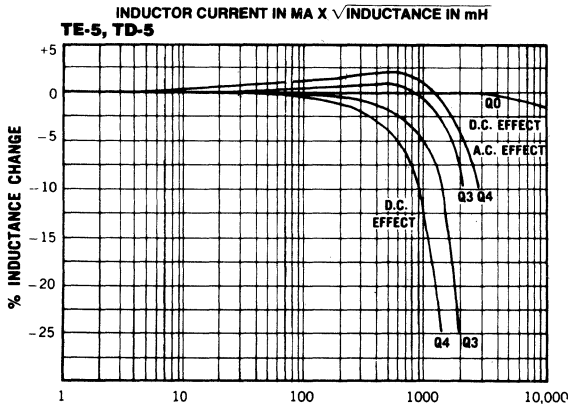
TE-3, TD-3



TE-4, TD-4



TE-5, TD-5



SAMPLE PART NUMBER

TE-X / TD-X	Q0	TR	5mH	1.0
DALE SIZE	Q TYPE	T.C. CODE	INDUCTANCE in μH, mH or H	% TOLERANCE

For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078• Phone 605-665-9301

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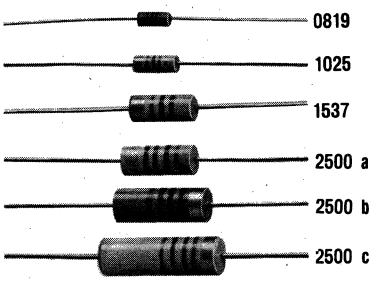
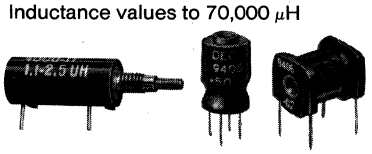
MOLDED RF COILS

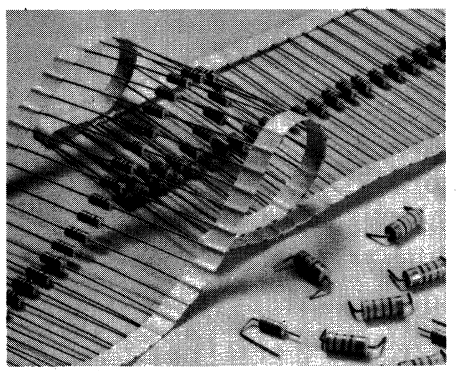


Series	Inductance Range Microhenries	Dia.		Length
0819	.10- 1,000	.078"	x	.200"
1025	.10- 1,000	.095"	x	.250"
1537	.15- 240	.156"	x	.375"
2500	270-10,000	a .190"	x	.440"
		b .215"	x	.560"
		c .240"	x	.740"

VARIABLE RF COILS

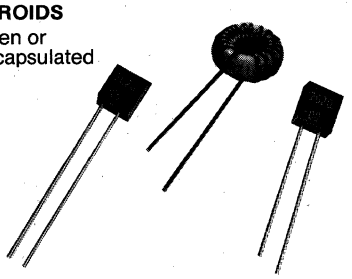
Inductance values to 70,000 μH



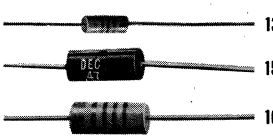


TOROIDS

Open or encapsulated



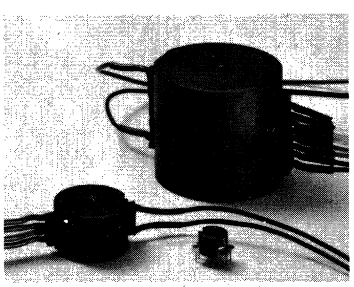
MOLDED SHIELDED RF COILS



Series	Inductance Range Microhenries	Dia.		Length
1325	.10- 560	.125"	x	.250"
1537-700	.10-10,000	.156"	x	.375"
1641	.10-10,000	.162"	x	.410"

MICRO-i® CHIP INDUCTORS

- Low profile
- Ribbon leads or chip
- Gold plated or Solder coated
- Wire bondable versions
- from .010 μH to 1,000 μH



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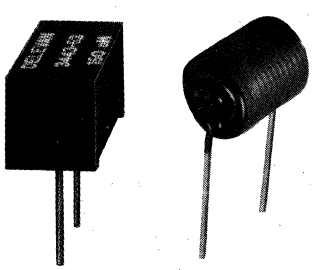
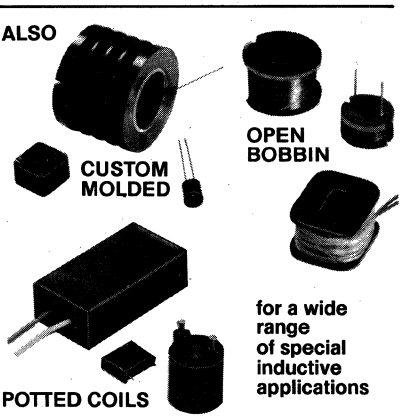


POWER CHOKES

- for high current applications
- standard values— 1.0 μH to 15,000 μH

ALSO



for a wide range of special inductive applications

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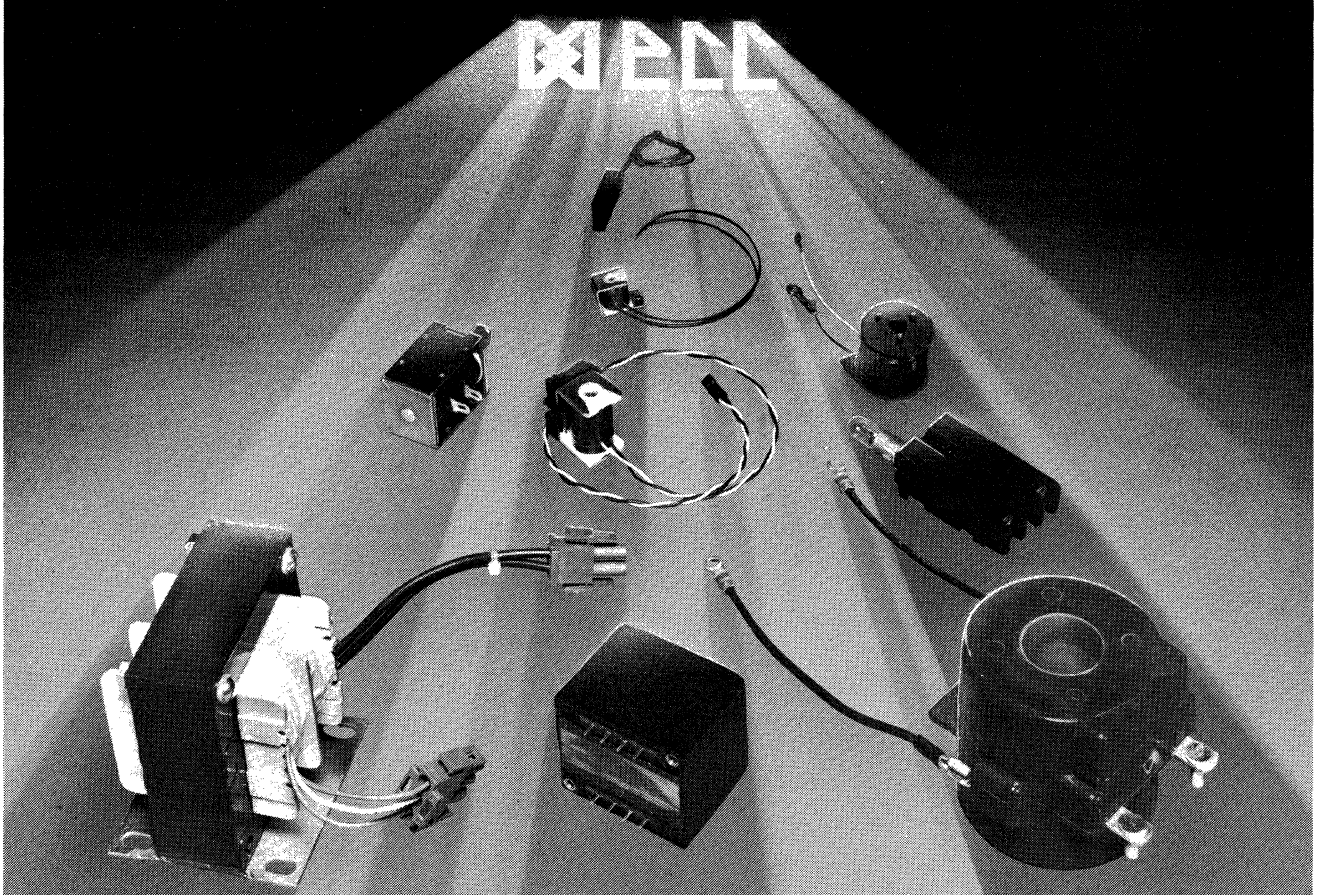

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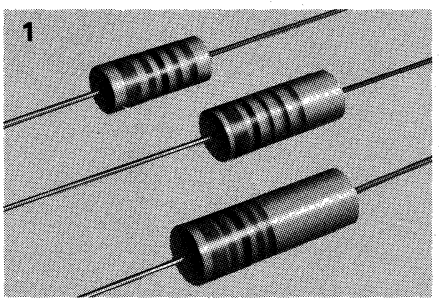
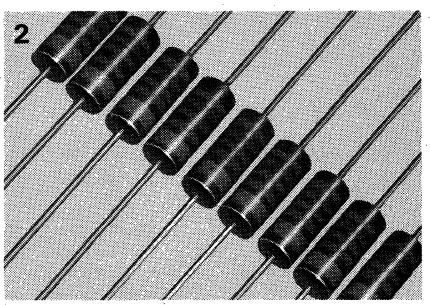
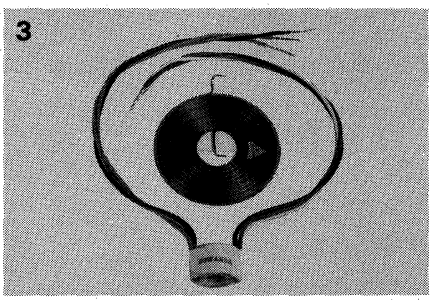
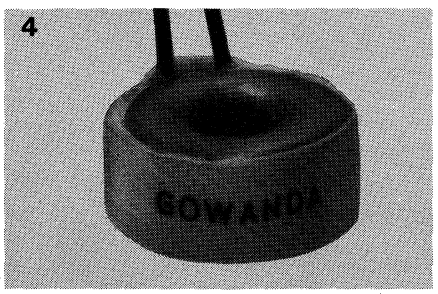
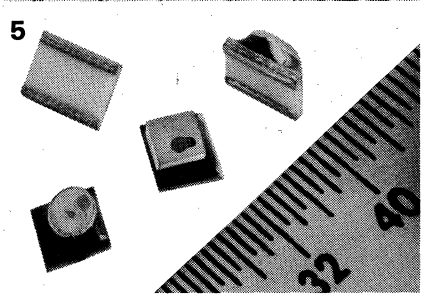
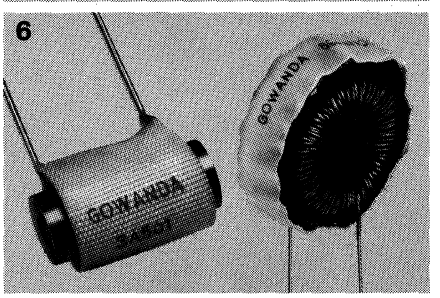


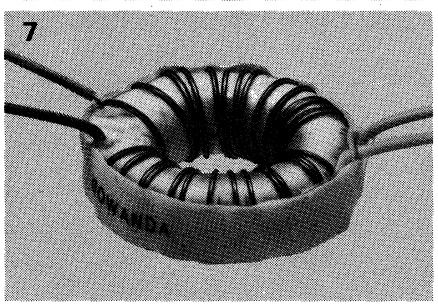


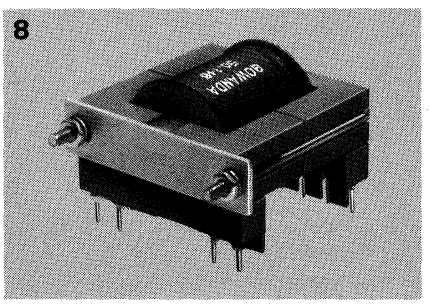


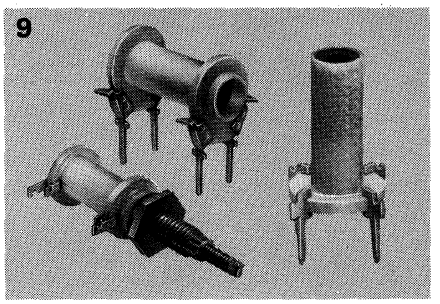












1. RF MOLDED CHOKES
Manufactured to MIL-C-15305 standards. Inductance values .10 μH to 10,000 μH. Standard series for both Q-meter and LCR bridge testing.

2. RF SHIELDED CHOKES
Manufactured to MIL-C-15305 standards. Inductance values .10 μH to 10,000 μH.

3. CUSTOM COIL WINDING
Capabilities for winding your specials--Toroids, Bobbins, self-supporting. Equipped to handle a wide range of wire sizes and coil configurations.

4. TOROIDAL INDUCTORS
Vinyl coated, non-flammable. Abrasion and moisture resistant. High Q and wide selection of Q vs. frequency ranges. Standard inductance TOL ± 2%. Other tolerances available. Custom designs available.

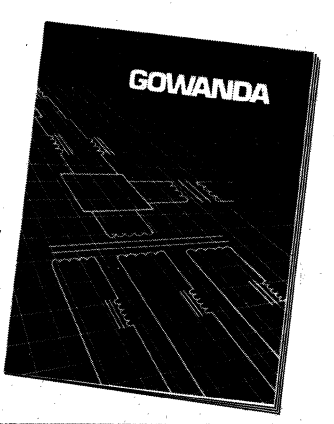
5. SURFACE MOUNT INDUCTORS AND TRANSFORMERS
Standard and custom inductors to meet your electrical, mechanical and packaging requirements. Custom transformers to your requirements.

6. POWER SUPPLY CHOKES
High current filter chokes with printed circuit mounting and pre-tinned leads. Inductance values 1.0 μH to 15.0 mH. Current rating .8 to 35 amps.

7. COMMON MODE INDUCTORS
Custom designed to your requirements. Open, partially or fully encapsulated in both toroidal or bobbin wound forms in the entire range of physical or performance specifications.

8. SWITCHING FREQUENCY TRANSFORMERS
Switching frequency power output transformers and base drive and gate drive transformers custom designed or manufactured to your requirements.

9. TUNABLE COILFORMS
Wide range of printed circuit and chasis mount designs. Winding provided to your specifications.



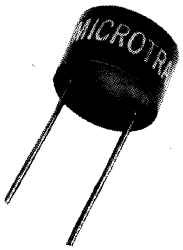
For complete information, specificiations and rating data, write or call for the new GOWANDA CATALOG No. 285.

GOWANDA

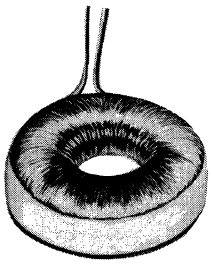
ELECTRONICS CORP. P.O. Box 111
NO. 1 INDUSTRIAL PLACE GOWANDA, NY 14070
PHONE 716-532-2234 • TWX 710-529-1211

TOROIDAL INDUCTORS

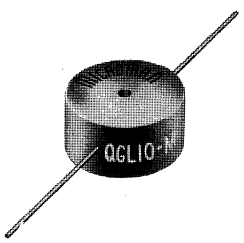
MICROTRAN company, inc.



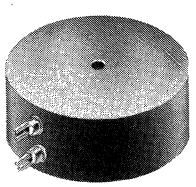
QE-M Molded



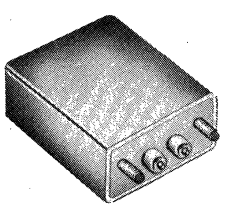
QG-F, QI-F, QK-F, QPL-F, QTL-F
Open Frame



QG-M Molded



QI-M, QK-M, QPL-M, QTL-M Molded



QI-H, QK-H 2 studs, QPL-H, QTL-H
4 studs Hermetic

QE SERIES

Ultra miniaturized with low height design. Exceptionally high "Q" and wide frequency range. Frequency range of QEL Series 1 to 300 kHz; QEM, 3 to 500 kHz. Accuracy, ±2%. Molded in epoxy resin with .020″ x 2″ gold-plated nickel alloy leads. Size, .450″ dia. x .285″.

QEL-M SERIES				QEM-M SERIES			
Part No.	Inductance	Typ. DCR	Typ. Dist. Cap., pF	Part No.	Inductance	Typ. DCR	Typ. Dist. Cap., pF
QEL1-M	1 mH	2.1	25	QEM05-M	0.5 mH	2.1	20
QEL2-M	2	3.6	30	QEM1-M	1	3.8	30
QEL5-M	5	7.3	35	QEM2-M	2	6.2	35
QEL10-M	10	15.8	45	QEM5-M	5	15.9	45
QEL15-M	15	20	45	QEM10-M	10	19	50
QEL25-M	25	32	50	QEM15-M	15	42	55
QEL50-M	50	69	50	QEM25-M	25	88	60
QEL100-M	100	185	70	QEM50-M	50	193	70

QG SERIES

Frequency range of QGL Series, to 20 kHz; QGM Series, 2 to 100 kHz. Accuracy, ±2%. **QG-F:** Open frame, microcrystalline wax dipped with 4″ #28 plastic leads. Size, ⅝″ dia. x 3/32″. **QG-M:** Molded in high temperature epoxy resin with .020″ x 2″ gold plated nickel alloy leads. Leads may be bent downward for plug-in printed circuit use. Size, ⅞″ dia. x ⅜″.

QGL SERIES				QGM SERIES			
QGL5-	5 mH	2.5	30	QGM1-	1 mH	1.4	22
QGL10-	10	5	33	QGM2-	2	2.5	25
QGL15-	15	8	34	QGM5-	5	6	28
QGL30-	30	17	37	QGM10-	10	12	31
QGL50-	50	28	40	QGM15-	15	18	32
QGL100-	100	50	42	QGM25-	25	30	35
QGL250-	250	130	46	QGM50-	50	52	37
QGL500-	500	290	48	QGM100-	100	115	39
QGL1000-	1.0 H	530	51				
QGL1500-	1.5	825	53				

QI SERIES

Frequency range to 20 kHz; accuracy, ±2%. **QIL-M:** Molded in high temperature epoxy with silver plated turret lugs. Size, 1¾″ dia. x ½″. **QIL-H:** Hermetically sealed in metal case with Teflon terminals. Size, 1 1/16″ x ½″ x 17/32″. **QIL-F:** Open frame. Microcrystalline wax dipped with 4″ #28 plastic leads. Size, 1″ dia. x 13/32″.

QIL SERIES							
QIL3-	3 mH	.73	36	QIL150-	150 mH	34	50
QIL5-	5	1.1	38	QIL250-	250	55	53
QIL10-	10	2.1	40	QIL500-	500	95	55
QIL15-	15	3.3	42	QIL1000-	1.0 H	210	57
QIL25-	25	5.3	45	QIL1500-	1.5	335	59
QIL50-	50	11	47	QIL2500-	2.5	550	61
QIL100-	100	22	49				

QK SERIES

Frequency range of QKL Series, to 10 kHz; QKM Series, 5 to 50 kHz. Accuracy, ±2%. **QK-F:** Open frame, microcrystalline wax dipped; 4″ #28 plastic leads. Size, 1¼″ dia. x ⅝″. **QK-H:** Hermetically sealed with Teflon terminals. Size, 1 15/32″ x 25/32″ x 1 47/64″. **QK-M:** Molded in high temperature epoxy resin, silver plated turret lugs. Size, 1⅜″ dia. x ¾″; #8 clearance hole.

QKL SERIES							
QKL5-	5 mH	.62	60	QKL250-	250 mH	28	87
QKL10-	10	1.1	66	QKL500-	500	63	91
QKL15-	15	1.7	68	QKL1000-	1.0 H	110	96
QKL25-	25	2.8	72	QKL1500-	1.5	175	98
QKL50-	50	6	76	QKL2500-	2.5	275	103
QKL100-	100	11	81	QKL5000-	5	645	106
QKL150-	150	17	83	QKL10,000-	10	1175	112
QKM SERIES							
QKM2-	2 mH	.45	52	QKM100-	100 mH	25	79
QKM5-	5	1.1	58	QKM250-	250	65	87
QKM10-	10	2.5	62	QKM500-	500	115	92
QKM25-	25	6.5	70	QKM1000-	1.0 H	250	97
QKM50-	50	11	74				

QP SERIES

Frequency range to 10 kHz; accuracy, ±2%. **QPL-F:** Open frame, microcrystalline wax dipped; 4″ #24 leads. Size, 1 15/16″ x ⅞″. **QPL-H:** Hermetically sealed with Teflon terminals. Size, 1 15/16″ x 1 1/16″ x 2 3/32″. **QPL-M:** Molded in high temperature epoxy resin; silver plated turret lugs. Size, 2″ dia. x 1″.

QPL SERIES							
QPL25-	25 mH	1.5	100	QPL2500-	2.5 H	150	133
QPL50-	50	2.5	105	QPL5000-	5.0	350	138
QPL100-	100	6	110	QPL7500-	7.5	525	140
QPL250-	250	15	115	QPL10,000-	10	600	142
QPL500-	500	25	120	QPL15,000-	15	900	146
QPL1000-	1.0 H	60	125	QPL25,000-	25	1500	150
QPL1500-	1.5	90	130				

QT SERIES

Frequency range to 15 kHz; accuracy, ±2%. **QTL-F:** Open frame, microcrystalline wax dipped; 4″ #24 leads. Size, 2 1/16″ dia. x 1″. **QTL-H:** Hermetically sealed with Teflon terminals. Size, 2 1/16″ x 1 5/16″ x 2 13/16″. **QTL-M:** Molded in epoxy resin. Size, 2⅞″ x 1⅜″.

QTL SERIES							
QTL25-	25 mH	0.85	127	QTL1500-	1.5 H	40	177
QTL50-	50	1.5	136	QTL2500-	2.5	70	184
QTL100-	100	2.8	144	QTL5000-	5	140	192
QTL150-	150	3.9	149	QTL10,000-	10	270	200
QTL250-	250	7	156	QTL15,000-	15	430	205
QTL500-	500	15	164	QTL25,000-	25	850	212
QTL1000-	1.0 H	27	173	QTL50,000-	50	1500	221

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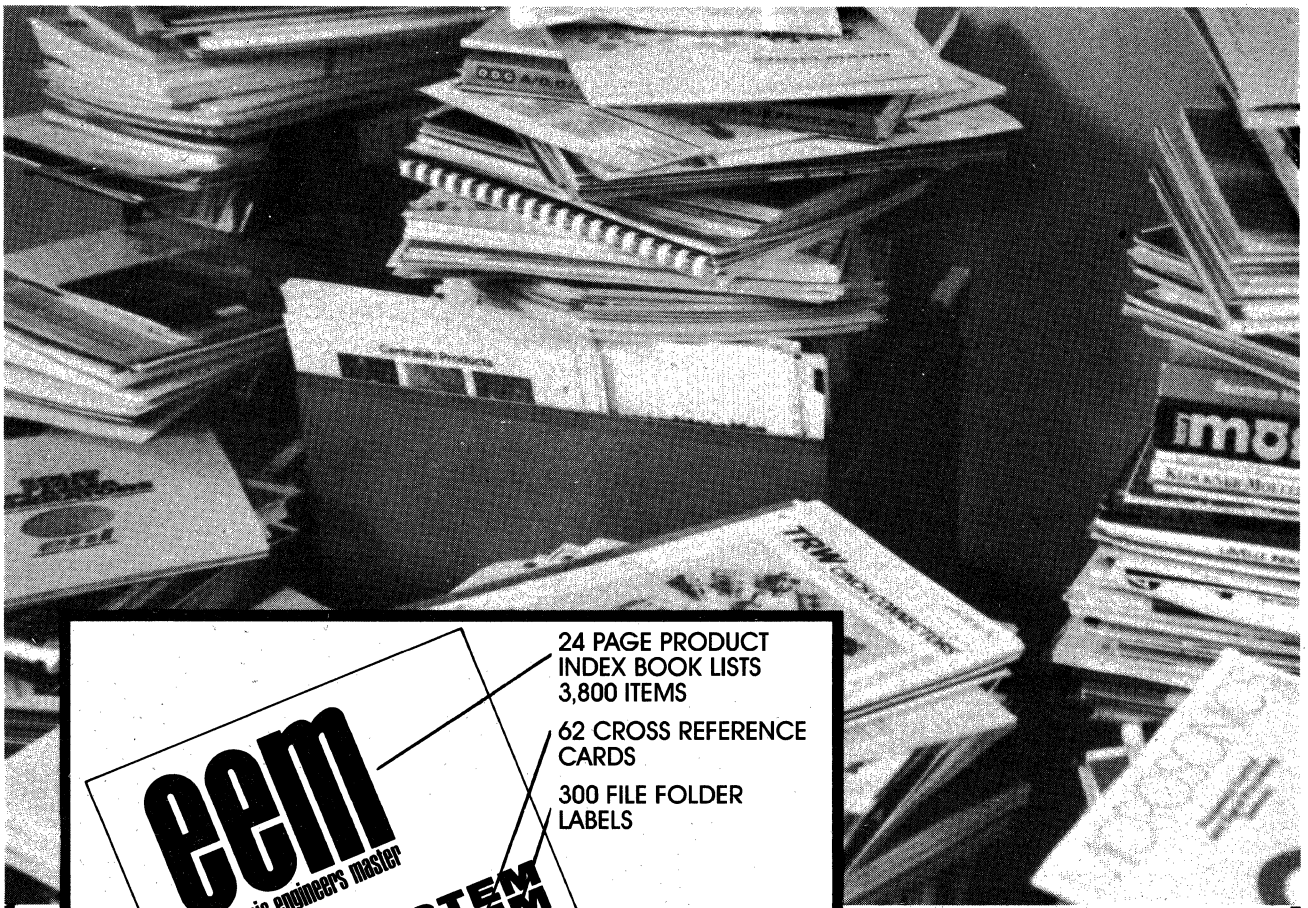

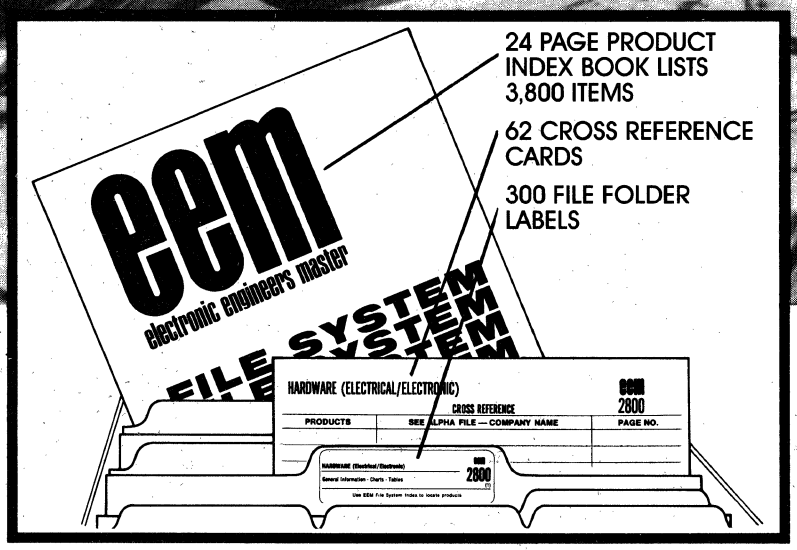

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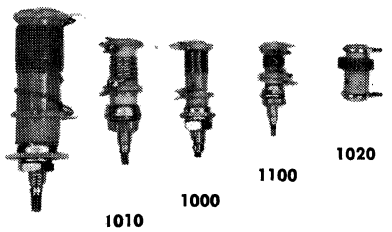
North Hills · HIGH-PERFORMANCE COILS, ADJUSTABLE & FIXED

TO COVER ALL FREQUENCY RANGES FROM AUDIO TO 200 MHZ

COILS ON CERAMIC FORMS PER MIL-I-10



Series No.	Dimensions (Inches) Dia.	Length	Mtg. Hole Dia. (Inches)
1000	.50	.88	.196
1020	.50	.63	.050, .500 Apart
1100	.33	.63	.166
1300	.70	1.80	.252
1010	.43	.88	.196

Miniature 1000 Series

Part No.	Range Microhenries	Average Q
1000-A	1.0- 1.6	70 @ 7.9 MHz
1000-B	1.6- 2.7	80 @ 7.9 MHz
1000-C	2.7- 4.5	85 @ 7.9 MHz
1000-D	4.5- 8.5	85 @ 7.9 MHz
1000-E	8.5-14.5	75 @ 2.5 MHz
1000-F	14.5-22	65 @ 2.5 MHz
1000-G	22-29	65 @ 2.5 MHz
1000-H	29-55	85 @ 2.5 MHz
1000-I	55-110	80 @ 2.5 MHz
1000-J	110-185	85 @ .79 MHz
1000-K	185-305	85 @ .79 MHz
1000-L	305-515	85 @ .79 MHz
1000-M	515-820	85 @ .79 MHz
1000-N	820-1100	75 @ .79 MHz

RF Printed Circuit Coils

1020-A	0.41- 0.53	75 @ 25 MHz
1020-B	0.85- 1.15	65 @ 7.9 MHz
1020-C	1.87- 2.50	65 @ 7.9 MHz
1020-D	4.0 - 5.4	70 @ 7.9 MHz
1020-E	7.5 -12.5	70 @ 2.5 MHz
1020-F	20 -29	80 @ 2.5 MHz
1020-G	33 -61	80 @ 2.5 MHz
1020-H	80 -120	60 @ 0.79 MHz
1020-I	170 -260	70 @ 0.79 MHz

Subminiature 1100 Series

1100-A	0.9- 1.4	60 @ 7.9 MHz
1100-B	1.4- 1.9	70 @ 7.9 MHz
1100-C	1.9- 2.6	65 @ 7.9 MHz
1100-D	2.6- 3.7	65 @ 7.9 MHz
1100-E	3.7- 5.5	65 @ 7.9 MHz
1100-F	5.5- 7.4	60 @ 7.9 MHz
1100-G	7.4-12.5	70 @ 7.9 MHz
1100-H	12.5-18.0	65 @ 2.5 MHz
1100-I	18.0-28.0	70 @ 2.5 MHz
1100-J	28.0-38.0	70 @ 2.5 MHz
1100-K	38.0-55.0	70 @ 2.5 MHz

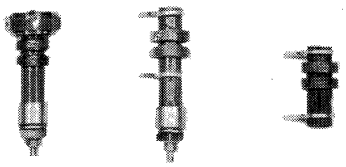
Transmitter 1300 Series

1300-A	For use from 90-200 MHz	
1300-B	For use from 40-90 MHz	
1300-C	For use from 20-40 MHz	
1300-D	0.7- 1.0	170 @ 25 MHz
1300-E	1.1- 1.6	130 @ 7.9 MHz
1300-F	1.7- 2.5	140 @ 7.9 MHz
1300-G	2.7- 4.1	140 @ 7.9 MHz
1300-H	4.4- 6.5	140 @ 7.9 MHz
1300-I	6.8-10.0	140 @ 7.9 MHz
1300-J	11.5-17.0	110 @ 2.5 MHz
1300-K	19.0-29.0	95 @ 2.5 MHz
1300-L	31.0-45.0	100 @ 2.5 MHz
1300-M	49.0-75.0	100 @ 2.5 MHz

HF Coils, Variable Approx. ±15%

1010-A	0.118	115 @ 50 MHz
1010-B	0.225	125 @ 25 MHz
1010-C	0.315	130 @ 25 MHz

WIDE ADJUSTMENT RANGE 120 SERIES



120 Series Mica-filled form .75″ O.D. x 1.3″ H. .196″ dia. mtg. hole

PCS-120 Series Phenolic form

PC-120 Series Phenolic form .5″ O.D.x1.25″ L. .05″ Pins, .70″ Apart

Part No.	Range Microhenries	Average Q
120-A	2-3	70 @ 7.9 MHz
120-B	3-5	80 @ 7.9 MHz
120-C	5-9	85 @ 7.9 MHz
120-D	9-18	65 @ 2.5 MHz
120-E	18-36	70 @ 2.5 MHz
120-F	36-64	65 @ 2.5 MHz
120-G	64-105	85 @ 2.5 MHz
120-H	105-200	80 @ .79 MHz
120-I	200-500	75 @ .79 MHz
120-J	500-1000	85 @ .79 MHz
120-K	1000-2000	50 @ .25 MHz

Subminiature 600 Series

- Variable ±10%
- Shielded
- 0.3″ O.D. x 0.4″ H
- .020″ Leads .20″ Apart

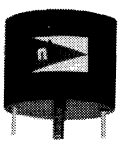
Part No.	Nominal Microhenries	Average Q
600U1X0	1.0	120 @ 7.9 MHz
600U1X5	1.5	120 @ 7.9 MHz
600U2X2	2.2	120 @ 7.9 MHz
600U3X3	3.3	130 @ 7.9 MHz
600U4X7	4.7	125 @ 7.9 MHz
600U6X8	6.8	140 @ 7.9 MHz
600U10X	10	135 @ 7.9 MHz
600U15X	15	130 @ 2.5 MHz
600U22X	22	135 @ 2.5 MHz
600U33X	33	130 @ 2.5 MHz
600U47X	47	130 @ 2.5 MHz
600U68X	68	120 @ 2.5 MHz
600MX10	100	100 @ 2.5 MHz
600MX15	150	125 @ .79 MHz
600MX22	220	130 @ .79 MHz
600MX33	330	125 @ .79 MHz
600MX47	470	120 @ .79 MHz
600MX68	680	100 @ .79 MHz
600M1X0	1000	100 @ .79 MHz

High Q RF Coils, Fixed

- .75″ O.D. x .63″ H
- Hermetically sealed
- Complete shielding
- For printed circuitry
- For standard circuitry

Part No.	Nominal Microhenries	Average Q
1219-A	0.47± 5%	90 @ 20 MHz
1219-B	1.0 ± 5%	100 @ 10 MHz
1219-C	2.2 ± 5%	130 @ 8 MHz
1219-D	4.7 ± 5%	130 @ 5 MHz
1219-E	10 ± 5%	130 @ 3 MHz
1219-F	22 ± 3%	185 @ 1.7 MHz
1219-G	47 ± 3%	185 @ 1 MHz
1219-H	100 ± 3%	200 @ 0.8 MHz
1219-I	220 ± 3%	225 @ 0.7 MHz
1219-J	470 ± 3%	250 @ 0.6 MHz
1219-K	1000 ± 3%	300 @ 0.5 MHz
1219-L	2200 ± 3%	300 @ 0.25 MHz

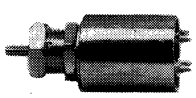
Hi Q 801, 802 Series, Adjustable ±10%



801, 802 Series 1.18″ O.D. x .93″ H

Part No.	Nominal Millihenries	Peak Q
801M1X0	1.0	100 @ 10 kHz
801M1X5	1.5	100 @ 10 kHz
801M2X2	2.2	100 @ 10 kHz
801M3X3	3.3	100 @ 10 kHz
801M4X7	4.7	100 @ 10 kHz
801M6X8	6.8	100 @ 10 kHz
801M10X	10	200 @ 20 kHz
801M15X	15	200 @ 20 kHz
801M22X	22	200 @ 20 kHz
801M33X	33	200 @ 20 kHz
801M47X	47	200 @ 20 kHz
801M68X	68	200 @ 20 kHz
801HX10	100	300 @ 30 kHz
801HX15	150	300 @ 30 kHz
801HX22	220	300 @ 30 kHz
801HX33	330	250 @ 20 kHz
801HX47	470	250 @ 20 kHz
801HX68	680	250 @ 20 kHz
801H1X0	1000	150 @ 15 kHz
802M1X0	1.0	400 @ 100 kHz
802M1X5	1.5	400 @ 100 kHz
802M2X2	2.2	400 @ 100 kHz
802M3X3	3.3	400 @ 100 kHz
802M4X7	4.7	400 @ 100 kHz
802M6X8	6.8	400 @ 100 kHz
802M10X	10	400 @ 70 kHz
802M15X	15	400 @ 70 kHz
802M22X	22	400 @ 70 kHz
802M33X	33	400 @ 70 kHz
802M47X	47	400 @ 40 kHz

SHIELDED COILS



- Shielded
- Encapsulated

- .44″ Diameter **900 Series**

Part No.	Range Microhenries	Average Q
900-A	0.5- 0.8	80 @ 25 MHz
900-B	0.8- 1.3	70 @ 18 MHz
900-C	1.3- 2.0	60 @ 15 MHz
900-D	2.0- 4.0	70 @ 8 MHz
900-E	4.0- 7.0	70 @ 5 MHz
900-F	7.0-12.0	70 @ 4 MHz
900-G	12.0-20.0	70 @ 3 MHz
900-H	20.0-35.0	70 @ 2.5 MHz
900-I	35.0-60.0	70 @ 2.0 MHz
900-J	60.0-100.0	70 @ 1.0 MHz

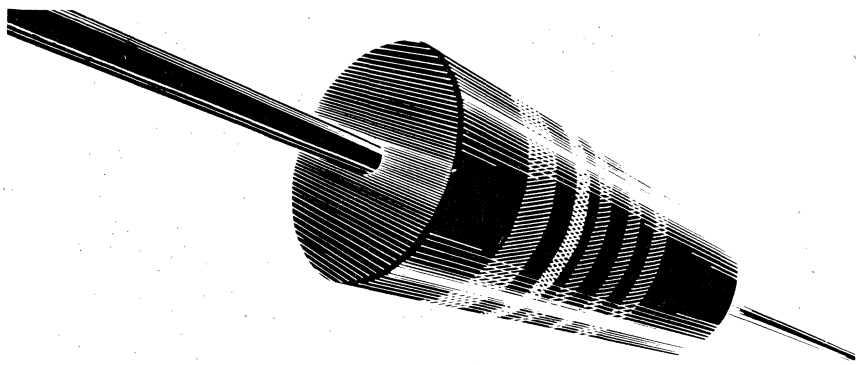
- .63″ Diameter **1500 Series**

Part No.	Range Millihenries	Average Q
1500-A	.100- .175	80 @ 790 kHz
1500-B	.175- .300	80 @ 790 kHz
1500-C	.300- .500	80 @ 790 kHz
1500-D	.500- .800	75 @ 790 kHz
1500-E	.800-1.15	55 @ 500 kHz
1500-F	1.15-1.50	55 @ 250 kHz
1500-G	1.50-2.30	55 @ 250 kHz
1500-H	2.30-3.50	50 @ 250 kHz
1500-I	3.50-7.50	40 @ 250 kHz

For North Hills Wideband Transformers See Section 5600.

North Hills Electronics, INC.
1 ALEXANDER PLACE, GLEN COVE, NY 11542-3796 / TELEX: 46-6886 / TEL. (516) 671-5700

Nytronics Inductors



HI-REL . . .
Nytronics Inductors are fully qualified to the established reliability spec MIL-C-39010 in styles /1 through /10. But, Nytronics Inductors also meet the requirements of a **higher authority!** They are widely used in heart pacers to provide RF protection. . . . It's a life or death matter. . . . Literally.

AVAILABILITY . . .
Off-the-shelf from a distributor near you.

***UPDATE**
UNITS HOURS: 352,016,640
Date: 3:1:84

NCG part number. The military part number shall consist of the letter "M", the basic document number, and an assigned dash number as shown in the following:

M	39010/01	A	1R0	K	R
Military designator	Document sheet number	Class	Inductance	Inductance tolerance	Failure rate level

Class. The classes of coils denoting the maximum operating temperatures are identified by a single letter in accordance with MIL-C-39010 slash sheets.

Maximum operating temperature

Class	Temperature
A ------	105°C
B ------	125°C

New High Reliability Qualification	
MIL-C-39010-1	MIL-C-39010-6
MIL-C-39010-2	MIL-C-39010-7
MIL-C-39010-3	MIL-C-39010-8
MIL-C-39010-4	MIL-C-39010-9
MIL-C-39010-5	MIL-C-39010-10

BROAD LINE . . .

There's a Nytronics Inductor to meet every need from 0.10uH to 180kuH.

With sizes ranging from the world's smallest shielded inductor to the most complex variable inductor . . . shielded, unshielded and variable, in hundreds of off-the-shelf values . . . it makes good sense to check first with Nytronics or your local distributor.

FIXED SHIELDED INDUCTORS
Super Wee Ductor
MS75087, MS75088, MS75089
MS90537
Super Wee Wee Ductor MS21399-21401
Wee Ductor
Wee Wee Ductor
Pee Wee Ductor
Pee Cee Ductor

FIXED NON-SHIELDED INDUCTORS
Deci Ductor
Mili Ductor
MS75083, MS75084, MS75085
RFC-SS MS18130, 14046, 90538
RFC-S MS21389, 21390
MS75008, MS75101, M90539
RFC-M MS21388
RFC-L MS21380
Pee Dee Ductor

VARIABLE INDUCTORS
Wee V-L (Shielded) MS21381, MS21402
H Wee V-L (Shielded) MS21381, MS21402
VIV (Non-Shielded)
VIH (Non-Shielded)

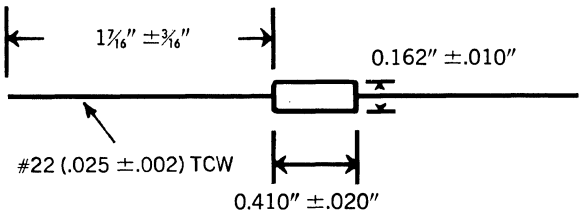
Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

M39010/1, /2, /3 INDUCTORS

ESTABLISHED RELIABILITY

MIL-C-39010
(LATEST REVISION)



Magnetically Shielded
MIL-C-39010-1 (Phenolic Core - Iron Sleeve)
MIL-C-39010-2 (Iron Core - Iron Sleeve)
MIL-C-39010-3 (Ferrite Core - Ferrite Sleeve)

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over the entire inductance range.

Dielectric Strength: 1500 volts RMS at sea level.

Self-Resonant Frequency: Measured per MIL-C-39010.

Q: Measured on a Q-Meter.

Maximum Current: Based on temperature rise not to exceed 15°C at 90°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.0076 cubic inches. **Weight:** 1.0 grams maximum.

Shielding: At 1000 cycles two units assembled side by side exhibit less than 3% coupling.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +105°C.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions.

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-39010. High frequency 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

Marking:
EXAMPLE: M39010 /01 A1ROKR } - Military part number.
83125 - Manufacturer's source code.
J 8411A - "JAN" marking, date code, and lot symbol.

M39010	Dash Number	L µH	Q min	MHz	Min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.† I mA
/1	AR10K*	0.10	50	25	250	0.025	1790	
	AR12K*	0.12	51	25	250	0.034	1530	
	AR15K*	0.15	51	25	250	0.037	1470	
	AR18K*	0.18	50	25	250	0.047	1300	
	AR22K*	0.22	49	25	250	0.067	1100	
	AR27K*	0.27	47	25	250	0.11	855	
	AR33K*	0.33	46	25	250	0.13	780	
	AR39K*	0.39	44	25	250	0.18	670	
	AR47K*	0.47	44	25	235	0.25	565	
	AR56K*	0.56	43	25	210	0.33	490	
	AR68K*	0.68	42	25	190	0.45	420	
	AR82K*	0.82	40	25	180	0.59	370	
/2	A1R0K*	1.0	44	25	140	0.070	1070	
	A1R2K*	1.2	44	7.9	130	0.093	895	
	A1R5K*	1.5	44	7.9	115	0.12	815	
	A1R8K*	1.8	44	7.9	105	0.14	775	
	A2R2K*	2.2	44	7.9	100	0.19	650	
	A2R7K*	2.7	44	7.9	92	0.28	535	
	A3R3K*	3.3	44	7.9	85	0.35	480	
	A3R9K*	3.9	44	7.9	75	0.40	450	
	A4R7K*	4.7	44	7.9	70	0.55	380	
	A5R6K*	5.6	44	7.9	65	0.72	335	
	A6R8K*	6.8	50	7.9	55	1.02	280	
	A8R2K*	8.2	50	7.9	50	1.32	250	
	A100K*	10	50	7.9	46	1.62	220	
	A120K*	12	55	2.5	44	2.00	200	
/3	A150K*	15	45	2.5	49	0.80	315	250
	A180K*	18	45	2.5	45	0.89	300	235
	A220K*	22	45	2.5	41	0.96	290	220
	A270K*	27	45	2.5	38	1.19	260	200
	A330K*	33	45	2.5	34	1.37	240	190
	A390K*	39	50	2.5	29	1.93	205	180
	A470K*	47	50	2.5	27	2.11	195	175
	A560K*	56	50	2.5	25	2.23	190	160
	A680K*	68	50	2.5	21	2.70	170	150
	A820K*	82	50	2.5	10.5	2.44	180	140

M39010	Dash Number	L µH	Q min	MHz	Min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.† I mA
/3	A101K*	100	50	2.5	10.0	3.12	160	120
	A121K*	120	55	0.79	9.7	3.60	150	95
	A151K*	150	55	0.79	8.5	4.10	140	90
	A181K*	180	55	0.79	8.0	4.40	135	85
	A221K*	220	55	0.79	7.5	5.00	125	80
	A271K*	270	55	0.79	7.0	5.80	115	70
	A331K*	330	55	0.79	6.5	6.40	110	65
	A391K*	390	60	0.79	6.2	7.40	105	60
	A471K*	470	60	0.79	5.7	9.50	92	58
	A561K*	560	60	0.79	4.7	10.5	90	55
	A681K*	680	60	0.79	4.5	11.8	80	50
	A821K*	820	60	0.79	4.2	13.0	80	45
	A102K*	1000	60	0.79	3.8	17.5	70	40
	A122K*	1200	45	0.25	1.5	22.1	60	35
	A152K*	1500	45	0.25	1.2	26.5	55	33
	A182K*	1800	45	0.25	1.0	29.9	50	30
	A222K*	2200	45	0.25	0.97	33.8	50	27
	A272K*	2700	45	0.25	0.92	47.3	40	25
	A332K*	3300	45	0.25	0.84	53.0	40	22
	A392K*	3900	45	0.25	0.80	73.8	35	20
	A472K*	4700	45	0.25	0.74	81.6	31	19
	A562K*	5600	44	0.25	0.73	98.9	28	17
	A682K*	6800	40	0.25	0.66	111.0	27	16
	A822K*	8200	40	0.25	0.54	119.0	26	15
	A103K*	10,000	40	0.25	0.47	137.0	24	14
	A123K*	12,000	30	0.079	0.33	143.0	23	13
	A153K*	15,000	30	0.079	0.29	157.0	22	12
	A183K*	18,000	30	0.079	0.28	175.0	21	10
	A223K*	22,000	27	0.079	0.25	274.0	17	9
	A273K*	27,000	27	0.079	0.21	308.0	16	8
	A333K*	33,000	27	0.079	0.19	343.0	15	7.5
	A393K*	39,000	27	0.079	0.17	376.0	15	6.0
	A473K*	47,000	23	0.079	0.16	473.0	13	5.5
	A563K*	56,000	23	0.079	0.14	512.0	13	5.0
	A683K*	68,000	23	0.079	0.13	580.0	12	4.0
	A823K*	82,000	21	0.079	0.12	618.0	11	3.5
	A104K*	100,000	18	0.079	0.11	678.0	11	3.0

† INCREMENTAL CURRENT: The D.C. current required to cause a 5% reduction in the nominal inductance value.

* Complete dash number will include an additional letter symbol to indicate failure rate level.

MIL-C-39010/1 - /2 - /3 FAILURE RATE "R" .01%/1000 HRS.

Nytronics Components Group, Inc.
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M39010/4, /5, /6, /7 INDUCTORS

ESTABLISHED RELIABILITY

MIL-C-39010 (LATEST REVISION)

MIL-C-39010-4 (Phenolic Core)
MIL-C-39010-5 (Iron Core)
MIL-C-39010-6 (Phenolic Core)
MIL-C-39010-7 (Iron Core)

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 0.15 to 0.47 uhy ±20%; 0.56 and up ±10%.

Dielectric Strength: 1500 Volts RMS at sea level.

Self-Resonant Frequency: Measured per MIL-C-39010.

Rating: Maximum current based on: 35°C rise in 90° ambient for phenolic, 15°C rise in 90° ambient for iron.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

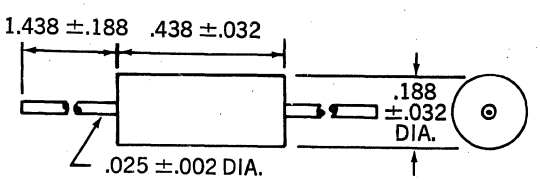
Operating Temperature: −55°C to +125°C phenolic core, −55°C to +105°C iron.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-39010.

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-39010 (latest revision), 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

Marking:

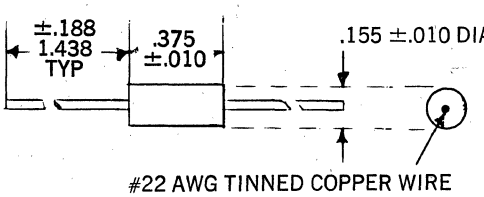
EXAMPLE: M39010 /04 A1ROKR } - Military part number.
83125 - Manufacturer's source code.
J 8411 A - "JAN" marking, date code, and lot symbol.



ALL DIMENSIONS IN INCHES

Weight: 0.950 gram maximum.

M39010	Dash Number	Inductance µH	Q min	Test frequency MHz	Self-resonant frequency Min. MHz	DC resistance Max. (25°C) ohms	Rated dc current mA
/4	BR15L*	0.15 ±20%	55	25.0	510	0.030	2,900
	BR22L*	0.22 ±20%	50	25.0	415	0.035	2,700
	BR33L*	0.33 ±20%	50	25.0	350	0.065	2,000
	BR47L*	0.47 ±20%	50	25.0	300	0.085	1,700
	BR56K*	0.56 ±10%	50	25.0	270	0.125	1,450
	BR68K*	0.68 ±10%	45	25.0	250	0.150	1,300
	BR82K*	0.82 ±10%	40	25.0	210	0.205	1,100
	B1R0K*	1.00 ±10%	40	25.0	200	0.290	930
	B1R2K*	1.20 ±10%	30	7.9	180	0.400	785
	B1R5K*	1.50 ±10%	30	7.9	170	0.485	720
	B1R8K*	1.80 ±10%	30	7.9	150	0.740	580
	B2R2K*	2.20 ±10%	30	7.9	140	0.970	505
	B2R7K*	2.70 ±10%	30	7.9	120	1.20	460
/5	A3R3K*	3.30	30	7.9	70	0.140	945
	A3R9K*	3.90	30	7.9	65	0.155	370
	A4R7K*	4.70	30	7.9	60	0.210	745
	A5R6K*	5.60	30	7.9	50	0.280	645
	A6R8K*	6.80	30	7.9	50	0.375	560
	A8R2K*	8.20	30	7.9	48	0.440	520
	A100K*	10.0	30	7.9	42	0.605	440
	A120K*	12.0	50	2.5	36	1.05	335
	A150K*	15.0	55	2.5	30	1.20	310
	A180K*	18.0	60	2.5	30	1.95	245
	A220K*	22.0	60	2.5	24	2.20	230
	A270K*	27.0	65	2.5	22	2.75	205



#22 AWG TINNED COPPER WIRE

Weight: 0.90 gram maximum.

M39010	Dash Number	Inductance µH	Q min	Test frequency MHz	Self-resonant frequency Min. MHz	DC resistance Max. (25°C) ohms	Rated dc current mA
/6	BR15L*	0.15 ±20%	50	25.0	525	0.030	2,450
	BR22L*	0.22 ±20%	50	25.0	450	0.055	1,810
	BR33L*	0.33 ±20%	45	25.0	360	0.090	1,400
	BR47L*	0.47 ±20%	45	25.0	310	0.12	1,225
	BR56K*	0.56 ±10%	50	25.0	280	0.135	1,150
	BR68K*	0.68 ±10%	50	25.0	250	0.150	1,100
	BR82K*	0.82 ±10%	50	25.0	220	0.220	900
	B1R0K*	1.00 ±10%	50	25.0	200	0.290	785
	B1R2K*	1.20 ±10%	33	7.9	180	0.420	650
	B1R5K*	1.50 ±10%	33	7.9	160	0.500	600
	B1R8K*	1.80 ±10%	33	7.9	150	0.650	525
	B2R2K*	2.20 ±10%	33	7.9	135	0.950	435
	B2R7K*	2.70 ±10%	33	7.9	120	1.20	385
	B3R3K*	3.30 ±10%	33	7.9	110	2.00	300
	B3R9K*	3.90 ±10%	33	7.9	100	2.30	280
	B4R7K*	4.70 ±10%	33	7.9	90	2.60	260
/7	A5R6K*	5.6	45	7.9	60	0.32	495
	A6R8K*	6.8	50	7.9	55	0.50	395
	A8R2K*	8.2	50	7.9	50	0.60	360
	A100K*	10	55	7.9	45	0.90	290
	A120K*	12	65	2.5	42	1.10	265
	A150K*	15	65	2.5	40	1.40	240
	A180K*	18	75	2.5	34	2.25	185
	A220K*	22	75	2.5	30	2.50	175
	A270K*	27	60	2.5	25	2.60	170
	A330K*	33	65	2.5	19	3.00	165

* Complete dash number will include an additional letter symbol to indicate failure rate level.

MIL-C-39010/4 - /5 - /6 - /7 FAILURE RATE "R" .01%/1000 HRS.

Nytronics Components Group, Inc.
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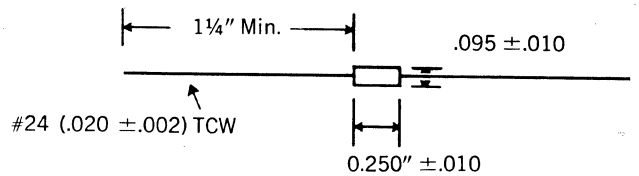
M39010/8, /9, /10 INDUCTORS

ESTABLISHED RELIABILITY

MIL-C-39010 (LATEST REVISION)



MIL-C-39010-8 (Phenolic Core)
MIL-C-39010-9 (Iron Core)
MIL-C-39010-10 (Ferrite Core)

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over entire range.

Dielectric Strength: 1000 volts RMS at sea level.

Self-Resonant Frequency: Measured per MIL-C-39010.

Rating: Maximum current based on: 35°C rise in 90° ambient for phenolic, 15°C rise in 90° ambient for iron, and for ferrite core inductors.

DENSITY CHARACTERISTICS

Volume: 0.002 cubic inches; **Weight:** 0.30 grams.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +125°C phenolic core, −55°C to +105°C iron and ferrite core.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate direction.

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-39010 (latest revision), 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

Marking:

EXAMPLE: M39010 /08 A1ROKR } - Military part number.
83125 - Manufacturer's source code.
J 8411 A - "JAN" marking, date code, and lot symbol.

M39010	Dash Number	Inductance (±10%) μH	Q min	Test frequency MHz	Self-resonant frequency Min MHz	DC resistance Max. (25°C) ohms	Rated dc current mA
/8	BR10K*	.10	40	25.0	680	.08	1350
	BR12K*	.12	40	25.0	640	.09	1270
	BR15K*	.15	38	25.0	600	.10	1200
	BR18K*	.18	35	25.0	550	.12	1105
	BR22K*	.22	33	25.0	510	.14	1025
	BR27K*	.27	33	25.0	430	.16	960
	BR33K*	.33	30	25.0	410	.22	815
	BR39K*	.39	30	25.0	365	.30	700
	BR47K*	.47	30	25.0	330	.35	650
	BR56K*	.56	30	25.0	300	.50	545
	BR68K*	.68	28	25.0	275	.60	495
	BR82K*	.82	28	25.0	250	.85	415
	B1R0K*	1.00	25	25.0	230	1.00	385
/9	A1R2K*	1.2	25	7.9	150	.18	590
	A1R5K*	1.5	28	7.9	140	.22	535
	A1R8K*	1.8	30	7.9	125	.30	455
	A2R2K*	2.2	30	7.9	115	.40	395
	A2R7K*	2.7	37	7.9	100	.55	335
	A3R3K*	3.3	45	7.9	90	.85	270
	A3R9K*	3.9	45	7.9	80	1.00	250
	A4R7K*	4.7	45	7.9	75	1.20	230
	A5R6K*	5.6	50	7.9	65	1.80	185
	A6R8K*	6.8	50	7.9	60	2.00	175
	A8R2K*	8.2	55	7.9	55	2.70	155
	A100K*	10	55	7.9	50	3.70	130
	A120K*	12	45	2.5	40	2.70	155
	A150K*	15	40	2.5	35	2.80	150
	A180K*	18	50	2.5	30	3.10	145
	A220K*	22	50	2.5	25	3.30	140
	A270K*	27	50	2.5	20	3.50	135

M39010	Dash Number	Inductance (±10%) μH	Q min	Test frequency MHz	Self-resonant frequency Min MHz	DC resistance Max. (25°C) ohms	Rated dc current mA
/10	A330K*	33	45	2.5	24	3.4	130
	A390K*	39	45	2.5	22	3.6	125
	A470K*	47	45	2.5	20	4.5	110
	A560K*	56	45	2.5	18	5.7	100
	A680K*	68	50	2.5	15	6.7	92
	A820K*	82	50	2.5	14	7.3	88
	A101K*	100	50	2.5	13	8	84
	A121K*	120	30	.79	12	13	66
	A151K*	150	30	.79	11	15	61
	A181K*	180	30	.79	10	17	57
	A221K*	220	30	.79	9	21	52
	A271K*	270	30	.79	8	25	47
	A331K*	330	30	.79	7	28	45
	A391K*	390	30	.79	6.5	35	40
	A471K*	470	30	.79	6	42	36
	A561K*	560	30	.79	5	46	35
	A681K*	680	30	.79	4	60	30
	A821K*	820	30	.79	3.8	65	29
	A102K*	1000	30	.79	3.4	72	28

* Complete dash number will include an additional letter symbol to indicate failure rate level.

MIL-C-39010/8 - /9 - /10 FAILURE RATE "R" .01%/1000 HRS.

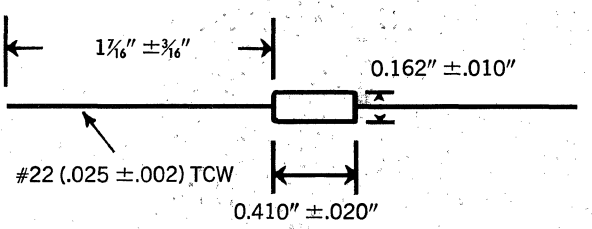
Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE SWD
MS75087, 75088 & 75089
INDUCTORS

MS-INDUCTOR SERIES 75087, 75088, 75089 MOLDED SHIELDED INDUCTOR

GRADE 1 CLASS A

Ultra-Reliable Molded Shielded Miniature Inductor.
Inductance Range: 0.1uH to 100,000uH.



The **MS-INDUCTOR SERIES** are R.F. Inductors specifically designed to meet the demanding requirements of MIL-C-15305 (latest revision). The MS-INDUCTOR Series epoxy molded envelope and shielding offers the design engineer reliability, electrical performance, and minimum coupling in high density packaging.

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over the entire inductance range.
Dielectric Strength: 1000 volts RMS at sea level.
Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).
Q: Measured on a Q-Meter.
Maximum Current: Based on temperature rise not to exceed 15°C at 90°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.0076 cubic inches **Weight:** 0.75 grams maximum
Shielding: At 1000 cycles two units assembled side by side exhibit less than 3% coupling.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +105°C.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision), Grade 1, Class B. High frequency 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

Marking: Color coded per MIL-C-15305 (latest revision).

Material	MS No.	NCG P/N	L uH	Q min	MHz	Min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.† I mA
PHENOLIC	MS75087-1	SWD	0.10	50	25	250	0.025	1790	>2900
	MS75087-2	SWD	0.12	51	25	250	0.034	1530	>2800
	MS75087-3	SWD	0.15	51	25	250	0.037	1470	>2750
	MS75087-4	SWD	0.18	50	25	250	0.047	1300	>2200
	MS75087-5	SWD	0.22	49	25	250	0.067	1100	>1700
	MS75087-6	SWD	0.27	47	25	250	0.11	855	>1500
	MS75087-7	SWD	0.33	46	25	250	0.13	780	>1300
	MS75087-8	SWD	0.39	44	25	250	0.18	670	>1100
	MS75087-9	SWD	0.47	44	25	235	0.25	565	>1000
	MS75087-10	SWD	0.56	43	25	210	0.33	490	> 900
	MS75087-11	SWD	0.68	42	25	190	0.45	420	> 750
	MS75087-12	SWD	0.82	40	25	180	0.59	370	> 600
IRON	MS75088-1	SWD	1.0	44	25	140	0.070	1070	>1900
	MS75088-2	SWD	1.2	44	7.9	130	0.093	895	>1600
	MS75088-3	SWD	1.5	44	7.9	115	0.12	815	>1300
	MS75088-4	SWD	1.8	44	7.9	105	0.14	775	>1200
	MS75088-5	SWD	2.2	44	7.9	100	0.19	650	>1100
	MS75088-6	SWD	2.7	44	7.9	92	0.28	535	> 950
	MS75088-7	SWD	3.3	44	7.9	85	0.35	480	> 800
	MS75088-8	SWD	3.9	44	7.9	75	0.40	450	> 750
	MS75088-9	SWD	4.7	44	7.9	70	0.55	380	> 650
	MS75088-10	SWD	5.6	44	7.9	65	0.72	335	> 550
	MS75088-11	SWD	6.8	50	7.9	55	1.02	280	> 500
	MS75088-12	SWD	8.2	50	7.9	50	1.32	250	> 475
	MS75088-13	SWD	10	50	7.9	46	1.62	220	> 450
	MS75088-14	SWD	12	55	2.5	44	2.00	200	> 400
FERRITE	MS75089-1	SWD	15	45	2.5	49	0.80	315	250
	MS75089-2	SWD	18	45	2.5	45	0.89	300	235
	MS75089-3	SWD	22	45	2.5	41	0.96	290	220
	MS75089-4	SWD	27	45	2.5	38	1.19	260	200
	MS75089-5	SWD	33	50	2.5	34	1.37	240	190
	MS75089-6	SWD	39	50	2.5	29	1.93	205	180
	MS75089-7	SWD	47	50	2.5	27	2.11	195	175
	MS75089-8	SWD	56	50	2.5	25	2.23	190	160
	MS75089-9	SWD	68	50	2.5	21	2.70	170	150
	MS75089-10	SWD	82	50	2.5	10.5	2.44	180	140
FERRITE	MS75089-11	SWD	100	50	2.5	10.0	3.12	160	120
	MS75089-12	SWD	120	55	0.79	9.7	3.60	150	95
	MS75089-13	SWD	150	55	0.79	8.5	4.10	140	90
	MS75089-14	SWD	180	55	0.79	8.0	4.40	135	85
	MS75089-15	SWD	220	55	0.79	7.5	5.00	125	80
	MS75089-16	SWD	270	55	0.79	7.0	5.80	115	70
	MS75089-17	SWD	330	55	0.79	6.5	6.40	110	65
	MS75089-18	SWD	390	60	0.79	6.2	7.40	105	60
	MS75089-19	SWD	470	60	0.79	5.7	9.50	92	58
	MS75089-20	SWD	560	60	0.79	4.7	10.5	90	55
	MS75089-21	SWD	680	60	0.79	4.5	11.8	80	50
	MS75089-22	SWD	820	60	0.79	4.2	13.0	80	45
	MS75089-23	SWD	1000	60	0.79	3.8	17.5	70	40
	MS75089-24	SWD	1200	45	0.25	1.5	22.1	60	35
	MS75089-25	SWD	1500	45	0.25	1.2	26.5	55	33
	MS75089-26	SWD	1800	45	0.25	1.0	29.9	50	30
	MS75089-27	SWD	2200	45	0.25	0.97	33.8	50	27
	MS75089-28	SWD	2700	45	0.25	0.92	47.3	40	25
	MS75089-29	SWD	3300	45	0.25	0.84	53.0	40	22
	MS75089-30	SWD	3900	45	0.25	0.80	73.8	35	20
	MS75089-31	SWD	4700	45	0.25	0.74	81.6	31	19
	MS75089-32	SWD	5600	44	0.25	0.73	98.9	28	17
	MS75089-33	SWD	6800	40	0.25	0.66	111.0	27	16
	MS75089-34	SWD	8200	40	0.25	0.54	119.0	26	15
	MS75089-35	SWD	10,000	40	0.25	0.47	137.0	24	14
	MS75089-36	SWD	12,000	30	0.079	0.33	143.0	23	13
	MS75089-37	SWD	15,000	30	0.079	0.29	157.0	22	12
	MS75089-38	SWD	18,000	30	0.079	0.28	175.0	21	10
	MS75089-39	SWD	22,000	27	0.079	0.25	274.0	17	9
	MS75089-40	SWD	27,000	27	0.079	0.21	308.0	16	8
	MS75089-41	SWD	33,000	27	0.079	0.19	343.0	15	7.5
	MS75089-42	SWD	39,000	27	0.079	0.17	376.0	15	6.0
	MS75089-43	SWD	47,000	23	0.079	0.16	473.0	13	5.5
	MS75089-44	SWD	56,000	23	0.079	0.14	512.0	13	5.0
	MS75089-45	SWD	68,000	23	0.079	0.13	580.0	12	4.0
	MS75089-46	SWD	82,000	21	0.079	0.12	618.0	11	3.5
	MS75089-47	SWD	100,000	18	0.079	0.11	678.0	11	3.0

† INCREMENTAL CURRENT: The D.C. current required to cause a 5% reduction in the nominal inductance value.
MS No. Electricals as shown.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

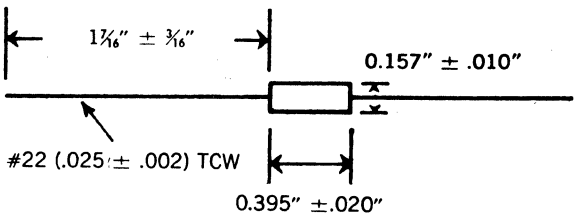
TYPE SWD
MS90537
INDUCTORS

MS-INDUCTOR SERIES
90537
MOLDED SHIELDED INDUCTOR

(Manufactured per MS-90537)

Ultra-Reliable Molded Shielded Miniature Inductor.
Inductance Range: 0.1uH to 100,000uH.

The **MS-INDUCTOR SERIES** are R.F. Inductors specifically designed to meet the demanding requirements of MIL-C-15305 (latest revision). The MS-INDUCTOR Series epoxy molded envelope and shielding offers the design engineer reliability, electrical performance, and minimum coupling in high density packaging.



GRADE 1 CLASS B

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over the entire inductance range.
Dielectric Strength: 700 volts RMS at sea level.
Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).
Q: Measured on Q-Meter.
Maximum Current: Based on temperature rise not to exceed 35°C at 90°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.0076 cubic inches **Weight:** 0.75 grams maximum
Shielding: At 1000 cycles two units assembled side by side exhibit less than 3% coupling.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: —55°C to +125°C.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305D, Grade 1, Class B. High frequency 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

Marking: Color coded per MIL-C-15305 (latest revision).

Material	MS Catalog No.	NCG P/N	L µH	Q Min.	MHz	Min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.** I mA
PHENOLIC	90537-1	SWD	0.10	50	25	250	0.025	2900	>2900
	90537-2	SWD	0.12	51	25	250	0.034	2800	>2800
	90537-3	SWD	0.15	51	25	250	0.037	2750	>2750
	90537-4	SWD	0.18	50	25	250	0.047	2200	>2200
	90537-5	SWD	0.22	49	25	250	0.067	1700	>1700
	90537-6	SWD	0.27	47	25	250	0.11	1500	>1500
	90537-7	SWD	0.33	46	25	250	0.13	1300	>1300
	90537-8	SWD	0.39	44	25	250	0.18	1100	>1100
	90537-9	SWD	0.47	44	25	235	0.25	1000	>1000
	90537-10	SWD	0.56	43	25	210	0.33	900	>900
	90537-11	SWD	0.68	42	25	190	0.45	750	>750
	90537-12	SWD	0.82	40	25	180	0.59	600	>600
IRON	90537-13	SWD	1.0	47	25	140	0.070	1900	>1900
	90537-14	SWD	1.2	46	7.9	130	0.093	1600	>1600
	90537-15	SWD	1.5	45	7.9	115	0.12	1300	>1300
	90537-16	SWD	1.8	43	7.9	105	0.14	1200	>1200
	90537-17	SWD	2.2	45	7.9	100	0.19	1100	>1100
	90537-18	SWD	2.7	46	7.9	92	0.28	950	>950
	90537-19	SWD	3.3	44	7.9	85	0.35	800	>800
	90537-20	SWD	3.9	44	7.9	75	0.40	750	>750
	90537-21	SWD	4.7	44	7.9	70	0.55	650	>650
	90537-22	SWD	5.6	47	7.9	65	0.72	550	>550
	90537-23	SWD	6.8	50	7.9	55	1.02	500	>500
	90537-24	SWD	8.2	50	7.9	50	1.32	475	>475
	90537-25	SWD	10	49	7.9	46	1.62	450	>450
	90537-26	SWD	12	55	2.5	44	2.00	400	>400
FERRITE	90537-27	SWD	15	44	2.5	49	0.80	620	250
	90537-28	SWD	18	45	2.5	45	0.89	610	235
	90537-29	SWD	22	46	2.5	41	0.96	600	220
	90537-30	SWD	27	49	2.5	38	1.19	500	200
	90537-31	SWD	33	45	2.5	34	1.37	490	190
	90537-32	SWD	39	53	2.5	29	1.93	410	180
	90537-33	SWD	47	52	2.5	27	2.11	400	175
	90537-34	SWD	56	49	2.5	25	2.23	380	160
	90537-35	SWD	68	51	2.5	21	2.70	370	150
	90537-36	SWD	82	45	2.5	10.5	2.44	360	140

Material	MS Catalog No.	NCG P/N	L µH	Q Min.	MHz	Min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.** I mA
FERRITE	90537-37	SWD	100	52	2.5	10.0	3.12	325	120
	90537-38	SWD	120	57	.79	9.7	3.60	290	95
	90537-39	SWD	150	56	.79	8.5	4.10	275	90
	90537-40	SWD	180	60	.70	8.0	4.40	260	85
	90537-41	SWD	220	58	.79	7.5	5.00	250	80
	90537-42	SWD	270	60	.79	7.0	5.80	240	70
	90537-43	SWD	330	54	.79	6.5	6.40	225	65
	90537-44	SWD	390	67	.79	6.2	7.40	200	60
	90537-45	SWD	470	60	.79	5.7	9.50	180	58
	90537-46	SWD	560	60	.79	4.7	10.5	174	55
	90537-47	SWD	680	60	.79	4.5	11.8	168	50
	90537-48	SWD	820	57	.79	4.2	13.0	152	45
	90537-49	SWD	1000	65	.79	3.8	17.5	135	40
	90537-50	SWD	1200	45	.25	1.5	22.1	115	35
	90537-51	SWD	1500	49	.25	1.2	26.5	110	33
	90537-52	SWD	1800	47	.25	1.0	29.9	105	30
	90537-53	SWD	2200	50	.25	0.97	33.8	99	27
	90537-54	SWD	2700	47	.25	0.92	47.3	83	25
	90537-55	SWD	3300	43	.25	0.84	53.0	80	22
	90537-56	SWD	3900	43	.25	0.80	73.8	67	20
	90537-57	SWD	4700	44	.25	0.74	81.6	63	19
	90537-58	SWD	5600	45	.25	0.73	98.9	56	17
	90537-59	SWD	6800	43	.25	0.66	111.0	54	16
	90537-60	SWD	8200	42	.25	0.54	119.0	52	15
	90537-61	SWD	10,000	39	.25	0.47	137.0	49	14
	90537-62	SWD	12,000	31	.079	0.33	143.0	46	13
	90537-63	SWD	15,000	31	.079	0.29	157.0	45	12
	90537-64	SWD	18,000	31	.079	0.28	175.0	41	10
	90537-65	SWD	22,000	27	.079	0.25	274.0	33	9
	90537-66	SWD	27,000	27	.079	0.21	308.0	31	8
	90537-67	SWD	33,000	27	.079	0.19	343.0	30	7.5
	90537-68	SWD	39,000	27	.079	0.17	376.0	27	6.0
	90537-69	SWD	47,000	23	.079	0.16	473.0	26	5.5
	90537-70	SWD	56,000	23	.079	0.14	512.0	25	5.0
	90537-71	SWD	68,000	23	.079	0.13	580.0	24	4.0
	90537-72	SWD	82,000	21	.079	0.12	618.0	23	3.5
	90537-73	SWD	100,000	18	.079	0.11	678.0	22	3.0

**INCREMENTAL CURRENT — The D.C. current required to cause a 5% reduction in the nominal inductance value.
NCG and MS Part No. electricals as shown.

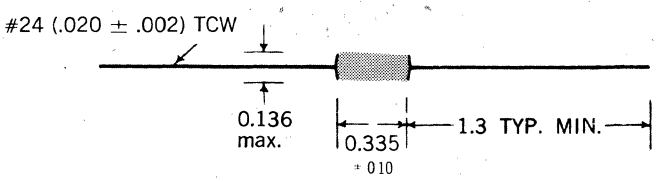
Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE SWWD
MS21399, 21400 & 21401
INDUCTORS

SUPER WEE-WEE-DUCTOR

An Ultra-Reliable molded shielded inductor. Subminiature size for high density circuits. Great Inductance-to-size ratio. .10 uH to 10,000 uH. 0.136" diameter x 0.335" length. 61 stock values.

The **SUPER WEE-WEE-DUCTOR,** a shielded miniaturized inductor, provides a greater inductance-to-size ratio in a molded epoxy envelope. Use of unique "T" lead construction on all values from 15 uH to 10,000 uH assures exceptional reliability in ranges where fine wire sizes are used. This MS inductor series is designed to meet the stringent requirements of MIL-C-15305 (latest revision). This provides the design engineer with utmost reliability, electrical performance, and minimum coupling in high density packaging.



GRADE 1 CLASS A

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% (Q-Meter).
Dielectric Strength: 700 volts RMS at sea level.
Self-Resonant Frequency: Measured with full length leads on Q-Meter.
Q: Measured on Q-Meter.
Rating: maximum based on ⅓ watt dissipation.

DENSITY CHARACTERISTICS

Volume: 0.0041 cubic inches.
Weight: 0.50 grams maximum.
Shielding: Less than 3% coupling with two units mounted side by side at 1000 cycles.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +105°C.
Terminal Strength: Meets five pounds pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).
Moisture, Vibration and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision). High Frequency: 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes.
Shock: 100G, 6 MS.
Marking: Color coded per MIL-C-15305 (latest revision).

SUPER WEE-WEE-DUCTOR STANDARD VALUES

Material	MS No.	NCG Part No.	L µH	Q min.		min. SRF MHz	approx. Cd Pf	Max. DCR Ω	Max. I mA	Incr.* I mA
PHENOLIC	MS21399-1	SW-W- 0.10	0.10	42	25	480	.70	.087	1650	>1650
	MS21399-2	SW-W- 0.12	0.12	42	25	460	.63	.090	1630	>1630
	MS21399-3	SW-W- 0.15	0.15	42	25	400	.66	.098	1550	>1550
	MS21399-4	SW-W- 0.18	0.18	42	25	360	.62	.117	1420	>1420
	MS21399-5	SW-W- 0.22	0.22	42	25	340	.63	.141	1330	>1330
	MS21399-6	SW-W- 0.27	0.27	42	25	320	.59	.157	1230	>1230
	MS21399-7	SW-W- 0.33	0.33	42	25	295	.55	.178	1140	>1140
	MS21399-8	SW-W- 0.39	0.39	42	25	275	.55	.208	1060	>1060
	MS21399-9	SW-W- 0.47	0.47	41	25	250	.56	.257	960	> 960
	MS21399-10	SW-W- 0.56	0.56	39	25	238	.52	.283	915	> 915
	MS21399-11	SW-W- 0.68	0.68	36	25	224	.50	.337	840	> 840
	MS21399-12	SW-W- 0.82	0.82	35	25	205	.50	.470	720	> 720
IRON	MS21400-1	SW-W- 1.0	1.0	38	25	135	.87	.170	1180	>1180
	MS21400-2	SW-W- 1.2	1.2	38	7.9	124	.87	.190	1150	>1150
	MS21400-3	SW-W- 1.5	1.5	38	7.9	114	.87	.212	1050	>1050
	MS21400-4	SW-W- 1.8	1.8	38	7.9	105	.89	.242	990	> 990
	MS21400-5	SW-W- 2.2	2.2	38	7.9	95	.88	.263	950	> 950
	MS21400-6	SW-W- 2.7	2.7	38	7.9	85	.83	.320	880	> 880
	MS21400-7	SW-W- 3.3	3.3	38	7.9	78	.81	.345	820	> 820
	MS21400-8	SW-W- 3.9	3.9	42	7.9	74	.76	.411	755	> 755
	MS21400-9	SW-W- 4.7	4.7	42	7.9	68	.75	.562	650	> 650
	MS21400-10	SW-W- 5.6	5.6	42	7.9	62	.77	.742	565	> 565
	MS21400-11	SW-W- 6.8	6.8	45	7.9	55	.80	1.00	485	> 485
	MS21400-12	SW-W- 8.2	8.2	47	7.9	51	.78	1.20	440	> 440
	MS21400-13	SW-W- 10	10	51	7.9	45	.78	1.84	355	> 335
	MS21400-14	SW-W- 12	12	51	2.5	41	.85	2.60	300	> 300
FERRITE "T" LEAD	MS21401-1	SW-W- 15	15	45	2.5	48	.55	.635	610	200
	MS21401-2	SW-W- 18	18	45	2.5	44	.55	.728	570	175
	MS21401-3	SW-W- 22	22	45	2.5	37	.60	.825	530	160
	MS21401-4	SW-W- 27	27	45	2.5	32	.65	.950	500	155
	MS21401-5	SW-W- 33	33	46	2.5	30	.65	1.26	430	150
	MS21401-6	SW-W- 39	39	46	2.5	27	.66	1.42	405	145
	MS21401-7	SW-W- 47	47	46	2.5	23	.66	1.72	370	140
	MS21401-8	SW-W- 56	56	48	2.5	21	.75	2.03	340	130
	MS21401-9	SW-W- 68	68	48	2.5	18.5	.75	2.29	320	120
	MS21401-10	SW-W- 82	82	46	2.5	17.0	.75	2.55	305	115
	MS21401-11	SW-W- 100	100	46	2.5	15.5	.78	2.92	280	100
	MS21401-12	SW-W- 120	120	53	0.79	14.5	.72	3.30	235	80
	MS21401-13	SW-W- 150	150	53	0.79	13.0	.70	4.30	215	68
	MS21401-14	SW-W- 180	180	53	0.79	11.5	.70	5.40	200	64
	MS21401-15	SW-W- 220	220	55	0.79	10.0	.84	6.65	150	60
	MS21401-16	SW-W- 270	270	57	0.79	9.50	.74	7.60	140	58
	MS21401-17	SW-W- 330	330	57	0.79	8.50	.75	8.50	130	56
	MS21401-18	SW-W- 390	390	57	0.79	8.00	.74	10.0	120	54
	MS21401-19	SW-W- 470	470	57	0.79	7.20	.70	13.5	100	52
	MS21401-20	SW-W- 560	560	61	0.79	6.40	.70	14.5	95	50
	MS21401-21	SW-W- 680	680	61	0.79	5.80	.78	16.0	90	48
	MS21401-22	SW-W- 820	820	58	0.79	5.30	.78	19.0	85	47
	MS21401-23	SW-W- 1000	1000	58	0.79	4.80	.78	21.5	80	45
	MS21401-24	SW-W- 1200	1200	55	0.25	2.90	1.9	23	100	40
	MS21401-25	SW-W- 1500	1500	55	0.25	2.80	1.6	30	90	35
	MS21401-26	SW-W- 1800	1800	55	0.25	2.60	1.5	33	86	32
	MS21401-27	SW-W- 2200	2200	55	0.25	2.55	1.3	40	78	30
	MS21401-28	SW-W- 2700	2700	55	0.25	2.40	1.2	43	74	28
	MS21401-29	SW-W- 3300	3300	55	0.25	2.00	1.1	58	65	26
	MS21401-30	SW-W- 3900	3900	55	0.25	1.95	1.1	76	56	23
	MS21401-31	SW-W- 4700	4700	55	0.25	1.85	1.1	85	53	20
	MS21401-32	SW-W- 5600	5600	55	0.25	1.75	1.0	100	48	18
	MS21401-33	SW-W- 6800	6800	50	0.25	1.58	1.0	127	43	15
	MS21401-34	SW-W- 8200	8200	50	0.25	1.55	1.0	150	40	12
	MS21401-35	SW-W- 10,000	10,000	50	0.25	1.45	1.0	190	37	10

*INCREMENTAL CURRENT — The D.C. current to cause a 5% reduction in the nominal inductance value.

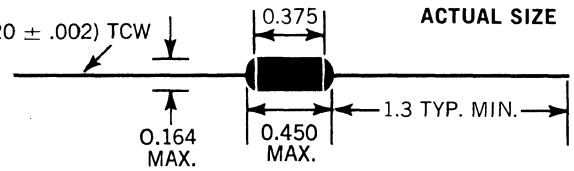
Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE WD INDUCTORS

WEE-DUCTOR

**Miniature Shielded Inductor with high inductance-to-size ratio.
0.10uH to 180,000uH in 76 values
Designed to meet MIL-C-15305B.**

The **WEE-DUCTOR** was the first miniature shielded inductor that Nytronics standardized for stock delivery. This encapsulated non-flammable shielded unit in a 0.164" diameter by 0.450" long envelope offers the design engineer extremely high inductance for density packaging. The WEE-DUCTOR is designed to meet the environmental requirements of MIL-C-15305 Rev. B. **GRADE 2 CLASS B**



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 0.1 to 22uH ±10% (Q-Meter); 27uH to 1,000 ±5% (1KC Bridge); 1,200uH to 56,000uH ±10% (1KC Bridge) 68,000uH to 180,000uH ±20% (1KC Bridge) measured at point on leads ¼ inch from body.

Dielectric Strength: 700 volts RMS at sea level.

Self-Resonant Frequency: Minimum SRF to be not less than 80% of published data, and measured with full length leads on Q-Meter.

Q: Measured on Q-Meter.

Maximum Current: Based on temperature rise not to exceed 40°C at 85°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.0087 cubic inches **Weight:** 0.75 grams maximum
Shielding: Less than 3% coupling with two units measured side by side at 1000 cycles.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: —55°C to +125°C.
Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305B.
Marking: Printed with pertinent data.

Note: L & Q are not always tested at the same frequency.

MATERIAL	NCG PART NO.	L	Q min		Approx. SRF	approx. Cd	Max. DCR	Max. I	Incr* I
		uH		MHz	MHz	uuF	Ω	mA	mA
PHENOLIC	WEE- 0.10	0.10	63	25	>500	0.67	0.020	4000	4000
	WEE- 0.12	0.12	61	25	>500	0.67	0.029	3350	3350
	WEE- 0.15	0.15	59	25	>500	0.67	0.032	3000	3000
	WEE- 0.18	0.18	57	25	458	0.67	0.040	2850	2850
	WEE- 0.22	0.22	56	25	414	0.67	0.045	2700	2700
	WEE- 0.27	0.27	50	25	373	0.67	0.08	2000	2000
	WEE- 0.33	0.33	48	25	337	0.67	0.09	1900	1900
	WEE- 0.39	0.39	48	25	310	0.67	0.16	1420	1420
	WEE- 0.47	0.47	48	25	283	0.67	0.17	1400	1400
	WEE- 0.56	0.56	45	25	258	0.67	0.36	960	960
	WEE- 0.68	0.68	45	25	235	0.67	0.37	940	940
	WEE- 0.82	0.82	41	25	214	0.67	0.46	870	870
IRON	WEE- 1.0	1.0	42	7.9	164	0.92	0.062	2300	2300
	WEE- 1.2	1.2	43	7.9	150	0.92	0.067	2200	2200
	WEE- 1.5	1.5	41	7.9	135	0.92	0.16	1420	1420
	WEE- 1.8	1.8	42	7.9	124	0.92	0.17	1370	1370
	WEE- 2.2	2.2	42	7.9	112	0.92	0.19	1300	1300
	WEE- 2.7	2.7	41	7.9	107	0.92	0.20	1270	1270
	WEE- 3.3	3.3	40	7.9	91.5	0.92	0.31	1030	1030
	WEE- 3.9	3.9	40	7.9	84.5	0.92	0.33	1000	1000
	WEE- 4.7	4.7	40	7.9	76.5	0.92	0.58	750	750
	WEE- 5.6	5.6	40	7.9	69.5	0.92	0.64	710	710
	WEE- 6.8	6.8	40	7.9	63.5	0.92	0.68	680	680
	WEE- 8.2	8.2	45	7.9	57.5	0.92	1.3	500	500
	WEE- 10	10	46	2.5	52.5	0.92	1.4	480	480
	WEE- 12	12	47	2.5	47.5	0.92	1.5	460	460
	WEE- 15	15	47	2.5	42.5	0.92	1.7	440	440
FERRITE	WEE- 18	18	45	2.5	53.5	0.49	0.88	610	235
	WEE- 22	22	47	2.5	47.0	0.50	0.95	590	220
	WEE- 27	27	42	2.5	44.0	0.48	1.15	530	200
	WEE- 33	33	43	2.5	40.0	0.48	1.2	520	193
	WEE- 39	39	45	2.5	36.5	0.48	1.6	450	183
	WEE- 47	47	46	2.5	33.0	0.49	1.8	420	177
	WEE- 56	56	40	2.5	30.0	0.49	2.2	390	170
	WEE- 68	68	40	2.5	27.0	0.50	2.3	375	165
	WEE- 82	82	42	2.5	17.5	1.0	2.4	360	160
	WEE- 100	100	63	.79	15.0	1.0	2.6	345	157
	WEE- 120	120	62	.79	14.0	1.0	2.9	330	145

MATERIAL	NCG PART NO.	L	Q min		Approx SRF	approx. Cd	Max. DCR	Max. I	Incr* I
		uH		MHz	MHz	uuF	Ω	mA	mA
FERRITE	WEE- 150	150	63	.79	12.5	1.0	3.3	315	126
	WEE- 180	180	60	.79	11.5	1.0	3.6	300	110
	WEE- 220	220	57	.79	11.0	0.94	4.1	280	105
	WEE- 270	270	52	.79	10.0	0.92	4.8	260	91
	WEE- 330	330	50	.79	9.0	0.92	5.6	240	87
	WEE- 390	390	43	.79	8.5	0.87	6.2	230	72
	WEE- 470	470	66	.79	8.0	0.83	10.0	180	67
	WEE- 560	560	64	.79	7.5	0.82	11.5	170	65
	WEE- 680	680	71	.79	6.5	0.87	12.0	160	60
	WEE- 820	820	67	.79	6.0	0.87	13.8	150	55
	WEE- 1000	1000	62	.79	5.6	0.87	16.0	140	52
	WEE- 1200	1200	52	.250	1.490	9.0	18.2	135	50
	WEE- 1500	1500	51	.250	1.460	8.0	23.7	118	48
	WEE- 1800	1800	51	.250	1.420	6.5	30.2	105	42
	WEE- 2200	2200	50	.250	1.300	6.8	33.7	99	37
	WEE- 2700	2700	51	.250	1.180	6.8	43.1	87	33
	WEE- 3300	3300	52	250	1.050	7.0	48.7	82	30
	WEE- 3900	3900	48	.250	.960	7.0	62.7	72	29
	WEE- 4700	4700	48	.250	.840	7.4	70.5	68	28
	WEE- 5600	5600	48	.250	.810	6.8	104	56	24
	WEE- 6800	6800	45	.250	.740	6.8	118	53	20
	WEE- 8200	8200	38	.250	.580	9.2	146	47	18
	WEE- 10,000	10,000	36	.079	.470	11.5	76.6	66	15
	WEE- 12,000	12,000	36	.079	.370	15.0	109	55	14
	WEE- 15,000	15,000	38	.079	.330	15.0	119	52	13
	WEE- 18,000	18,000	38	.079	.305	15.0	138	49	13
	WEE- 22,000	22,000	32	.079	.295	13.0	219	39	12
	WEE- 27,000	27,000	32	.079	.270	13.0	259	35	12
	WEE- 33,000	33,000	32	.079	.250	12.5	296	33	11
	WEE- 39,000	39,000	30	.079	.215	14.0	395	29	10
	WEE- 47,000	47,000	25	.079	.210	12.5	452	27	9
	WEE- 56,000	56,000	25	.079	.195	12.0	499	26	8
	WEE- 68,000	68,000	20	.079	.130	18.4	395	29	1.1
	WEE- 82,000	82,000	20	.079	.125	16.5	452	27	1.1
	WEE-100,000	100,000	20	.079	.115	16.2	499	26	1.1
	WEE-120,000	120,000	20	.070	.105	16.8	540	23	1.1
	WEE-150,000	150,000	20	.060	.098	13.4	750	20	1.0
	WEE-180,000	180,000	20	.050	.094	13.4	880	18	0.8

*INCREMENTAL CURRENT — The D.C. current to cause a 5% reduction in the nominal inductance value.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE WWD INDUCTORS

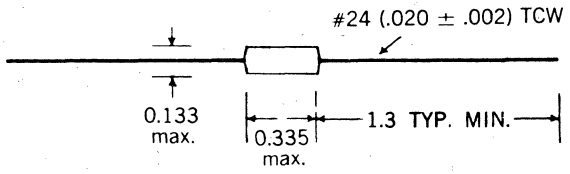
WEE-WEE-DUCTOR SERIES

The smallest shielded inductor for high density circuits 0.10 to 1,000 uh 0.133" diameter x 0.335" length. We have 49 stock values.

GRADE 2 CLASS B

The **WEE-WEE-DUCTOR** offers the Design Engineer a subminiature shielded inductor to solve special problems in density circuit application. This shielded inductor has great inductance-to-size ratio and is designed to meet the stringent requirements of MIL-C-15305 Rev. B.

0.10 to 1,000uH
0.133" diameter x 0.335" length
49 stock values



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% (Q-Meter).

Dielectric Strength: 700 volts RMS at sea level.

Self-Resonant Frequency: Minimum SRF to be not less than 80% of published data, and measured with full length leads on Q-Meter.

Rating: I maximum based on ⅓ watt dissipation.

DENSITY CHARACTERISTICS

Volume: 0.0041 cubic inches.

Weight: 0.50 grams maximum.

Shielding: Less than 3% coupling with two units mounted side by side at 1000 cycles.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +125°C.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).

Marking: Color coded per MIL-C-15305 (latest revision).

WEE-WEE-DUCTOR STANDARD VALUES

NCG PART NO.	L	Q min.		approx. SRF	Max. DCR	Max. I	Incr.* I	
	uH		MHz	MHz	Ω	mA	mA	
WEE-WEE- 0.10	0.10	42	25	500	.112	1720	>1720	PHENOLIC
WEE-WEE- 0.12	0.12	42	25	500	.126	1630	>1630	
WEE-WEE- 0.15	0.15	42	25	500	.138	1550	>1550	
WEE-WEE- 0.18	0.18	42	25	458	.165	1420	>1420	
WEE-WEE- 0.22	0.22	42	25	414	.198	1330	>1330	
WEE-WEE- 0.27	0.27	42	25	373	.220	1230	>1230	
WEE-WEE- 0.33	0.33	42	25	360	.258	1140	>1140	
WEE-WEE- 0.39	0.39	42	25	339	.292	1060	>1060	
WEE-WEE- 0.47	0.47	41	25	309	.360	960	> 960	
WEE-WEE- 0.56	0.56	39	25	295	.397	915	> 915	
WEE-WEE- 0.68	0.68	36	25	270	.472	840	> 840	
WEE-WEE- 0.82	0.82	35	25	250	.638	720	> 720	
WEE-WEE- 1.0	1.0	42	25	170	.208	1260	>1260	IRON
WEE-WEE- 1.2	1.2	38	7.9	150	.225	1210	>1210	
WEE-WEE- 1.5	1.5	38	7.9	139	.265	1120	>1120	
WEE-WEE- 1.8	1.8	38	7.9	129	.285	1080	>1080	
WEE-WEE- 2.2	2.2	36	7.9	118	.330	1000	>1000	
WEE-WEE- 2.7	2.7	38	7.9	106	.381	935	> 935	
WEE-WEE- 3.3	3.3	38	7.9	98	.432	875	> 875	
WEE-WEE- 3.9	3.9	40	7.9	91	.576	755	> 755	
WEE-WEE- 4.7	4.7	42	7.9	83	.787	650	> 650	
WEE-WEE- 5.6	5.6	42	7.9	77	1.04	565	> 565	
WEE-WEE- 6.8	6.8	45	7.9	67	1.40	485	> 485	
WEE-WEE- 8.2	8.2	47	7.9	62	1.68	440	> 440	
WEE-WEE- 10	10	51	7.9	55	2.58	355	> 355	
WEE-WEE- 12	12	51	2.5	49	3.65	300	> 300	
WEE-WEE- 15	15	45	2.5	55	.862	620	200	FERRITE
WEE-WEE- 18	18	43	2.5	50	1.02	570	175	
WEE-WEE- 22	22	42	2.5	45	1.12	545	160	
WEE-WEE- 27	27	37	2.5	41	1.28	510	155	
WEE-WEE 33	33	46	2.5	37	1.70	440	150	
WEE-WEE- 39	39	38	2.5	33	1.99	405	145	
WEE-WEE- 47	47	42	2.5	29	2.41	370	140	
WEE-WEE- 56	56	41	2.5	27	2.85	340	130	
WEE-WEE- 68	68	46	2.5	23	3.21	320	120	
WEE-WEE- 82	82	46	2.5	21	3.57	305	115	
WEE-WEE- 100	100	43	2.5	19	4.10	280	100	
WEE-WEE- 120	120	50	0.79	16	5.97	235	80	
WEE-WEE- 150	150	49	0.79	15	7.05	215	68	
WEE-WEE- 180	180	56	0.79	14	8.12	200	64	
WEE-WEE- 220	220	53	0.79	12	14.8	150	60	
WEE-WEE- 270	270	57	0.79	11.5	16.8	140	58	
WEE-WEE- 330	330	57	0.79	10.5	18.6	130	56	
WEE-WEE- 390	390	57	0.79	10.0	21.1	120	54	
WEE-WEE- 470	470	50	0.79	8.5	32.2	100	52	
WEE-WEE- 560	560	50	0.79	7.5	36.4	95	50	
WEE-WEE- 680	680	56	0.79	7.0	41.1	90	48	
WEE-WEE- 820	820	49	0.79	6.5	45.0	85	47	
WEE-WEE-1000	1000	49	0.79	6.0	52.0	80	45	

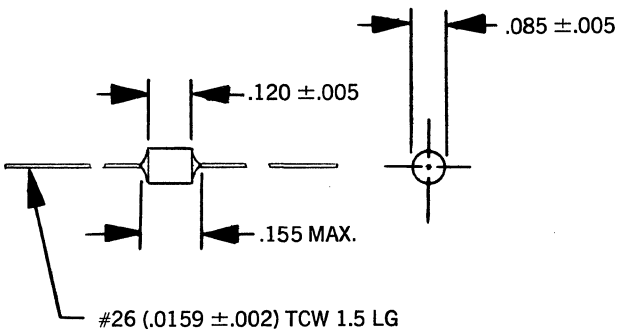
*INCREMENTAL CURRENT — The D.C. current to cause a 5% reduction in the nominal inductance value.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE PW INDUCTORS

PEE-WEE SERIES

The amazing **PEE-WEE DUCTOR** represents a 66% size reduction from the smallest magnetically shielded axial leaded inductor series heretofore available anywhere. Furthermore, this size reduction was obtained with negligible loss of electrical performance by employing several unique concepts in RF coil design.



ALL DIMENSIONS IN INCHES

ELECTRICAL CHARACTERISTICS:

Inductance Tolerance: ± 10% (Std).

L,Q,F, values: Measurements per MIL-C-15305. (latest revision).

Incremental Current: Incremental current in table is for 5% reduction in inductance value.

Dielectric Strength: 300 Volts RMS @ Sea Level.

*SRF minimum not less than 80% of specified values.

DENSITY CHARACTERISTICS:

Volume: .0007 Cubic Inches

Weight: 0.12 Grams

Shielding: 5% maximum coupling for two units side by side.

Marking: EIA color coded

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS:

Terminal pull: 3 lbs minimum.

Environmental: Grade 2 Class A

PEE-WEE DUCTOR STANDARD VALUES

NCG PART NO.	L μH	Q min. @	MHz	**SRF MHz	Max. DCR Ω	Max. I mA	Incr. I mA
PW- 0.10	.10	40	25	500	.060	1500	*
PW- 0.12	.12	40	25	480	.070	1400	*
PW- 0.15	.15	40	25	450	.080	1300	*
PW- 0.18	.18	40	25	430	.090	1200	*
PW- 0.22	.22	40	25	390	.11	1100	*
PW- 0.27	.27	40	25	340	.12	1000	*
PW- 0.33	.33	40	25	310	.14	950	*
PW- 0.39	.39	40	25	280	.16	900	*
PW- 0.47	.47	40	25	250	.20	800	*
PW- 0.56	.56	40	25	220	.25	750	*
PW- 0.68	.68	35	25	200	.27	700	*
PW- 0.82	.82	35	25	180	.36	600	*
PW- 1.0	1.0	35	25	165	.40	525	*
PW- 1.2	1.2	35	7.9	150	.70	425	*
PW- 1.5	1.5	35	7.9	130	.80	400	*
PW- 1.8	1.8	35	7.9	120	.90	350	*
PW- 2.2	2.2	35	7.9	110	1.3	320	*
PW- 2.7	2.7	35	7.9	100	1.8	275	*
PW- 3.3	3.3	35	7.9	70	1.7	290	*
PW- 3.9	3.9	35	7.9	65	1.8	275	*
PW- 4.7	4.7	35	7.9	58	2.6	225	*
PW- 5.6	5.6	35	7.9	54	2.9	210	*
PW- 6.8	6.8	35	7.9	50	3.3	200	*
PW- 8.2	8.2	35	7.9	48	4.5	170	*
PW- 10	10	35	7.9	45	4.8	165	*
PW- 12	12	35	2.5	40	2.0	250	230
PW- 15	15	35	2.5	36	2.5	230	180
PW- 18	18	35	2.5	31	3.5	195	150
PW- 22	22	35	2.5	28	4.5	170	135
PW- 27	27	35	2.5	25	5.0	160	115
PW- 33	33	35	2.5	23	5.5	150	105
PW- 39	39	35	2.5	22	7.0	140	100
PW- 47	47	35	2.5	21	7.5	135	95
PW- 56	56	35	2.5	19	8.0	130	90
PW- 68	68	35	2.5	18	9.0	120	83
PW- 82	82	35	2.5	16	14	95	65
PW- 100	100	35	2.5	14	16	90	70
PW- 120	120	35	.79	9.5	10	115	40
PW- 150	150	35	.79	8.8	12	105	35
PW- 180	180	35	.79	8.1	15	90	32
PW- 220	220	35	.79	7.8	20	80	30
PW- 270	270	35	.79	7.3	23	75	27
PW- 330	330	35	.79	6.8	26	70	25
PW- 390	390	35	.79	6.0	35	65	23
PW- 470	470	35	.79	5.6	37	60	21
PW- 560	560	35	.79	5.0	40	58	20
PW- 680	680	35	.79	4.3	48	54	18
PW- 820	820	35	.79	3.8	54	47	17
PW-1000	1000	35	.79	3.5	65	43	15

* GREATER THAN MAX I

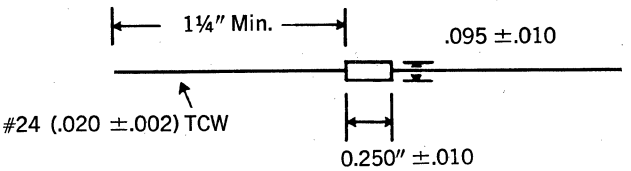
Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE DD INDUCTORS

DECI-DUCTOR

New Subminiature Inductor 0.10uH to 1000uH Range
0.100″ diameter by 0.250″ length 49 STANDARD VALUES

The **DECI-DUCTOR** offers the design engineer epoxy-molded reliability and uniformity in a subminiature R.F. Inductor. This Nytronics R.F. Inductor line is designed to meet all the environmental specifications of MIL-C-15305 (latest revision).



GRADE 1 CLASS B

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over entire range.
Dielectric Strength: 700 volts RMS at sea level.
Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).
Rating: Maximum Current based on 35°C rise in 90°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.002 cubic inches **Weight:** 0.35 grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: —55°C to +125°C

Terminal Strength: Meets three pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision), 10 cps to 2000 cps @ 15 G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 50G, 11 MS.

Marking: Color coded per MIL-C-15305 (latest revision).

	NCG Part No.	L uH	Q Min.	MHz	Min. SRF MHz	Max. DCR Ohms	Max I. mA
PHENOLIC	DD-0.10	0.10	40	25	690	0.07	2000
	DD-0.12	0.12	40	25	650	0.08	1900
	DD-0.15	0.15	38	25	600	0.09	1750
	DD-0.18	0.18	38	25	550	0.10	1600
	DD-0.22	0.22	35	25	510	0.11	1550
	DD-0.27	0.27	35	25	470	0.15	1350
	DD-0.33	0.33	32	25	410	0.21	1150
	DD-0.39	0.39	32	25	370	0.29	970
	DD-0.47	0.47	32	25	340	0.35	820
	DD-0.56	0.56	32	25	310	0.48	700
	DD-0.68	0.68	33	25	280	0.65	600
	DD-0.82	0.82	30	25	255	0.82	500
	DD-1.00	1.00	30	25	240	1.10	475
IRON	DD-1.20	1.20	30	7.9	155	0.16	1200
	DD-1.50	1.50	32	7.9	140	0.20	1100
	DD-1.80	1.80	35	7.9	130	0.32	900
	DD-2.20	2.20	35	7.9	120	0.37	760
	DD-2.70	2.70	37	7.9	105	0.49	700
	DD-3.30	3.30	45	7.9	95	0.67	575
	DD-3.90	3.90	45	7.9	87	0.95	500
	DD-4.70	4.70	45	7.9	80	1.10	475
	DD-5.60	5.60	52	7.9	75	1.60	380
	DD-6.80	6.80	52	7.9	65	1.80	350
	DD-8.20	8.20	60	7.9	62	2.40	300
	DD-10.0	10.0	60	7.9	52	3.40	265
	DD-12.0	12.0	45	2.5	42	2.40	300
	DD-15.0	15.0	47	2.5	36	2.70	275
	DD-18.0	18.0	50	2.5	32	3.00	260
	DD-22.0	22.0	50	2.5	28	3.30	250
	DD-27.0	27.0	50	2.5	25	3.80	240
FERRITE	DD-33.0	33.0	50	2.5	30	3.80	260
	DD-39.0	39.0	50	2.5	26	4.10	240
	DD-47.0	47.0	50	2.5	24	4.40	210
	DD-56.0	56.0	50	2.5	22	5.70	205
	DD-68.0	68.0	52	2.5	19	6.50	180
	DD-82.0	82.0	52	2.5	17	7.30	175
	DD-100	100	50	2.5	15	8.20	165
	DD-120	120	28	0.79	14	14	110
	DD-150	150	28	0.79	13	16	105
	DD-180	180	28	0.79	12	18	100
	DD-220	220	26	0.79	11	25	90
	DD-270	270	26	0.79	10	33	75
	DD-330	330	26	0.79	9.0	37	70
	DD-390	390	25	0.79	8.0	51	60
	DD-470	470	27	0.79	7.0	56	58
	DD-560	560	27	0.79	6.5	61	55
	DD-680	680	28	0.79	6.0	70	50
	DD-820	820	28	0.79	5.5	91	45
	DD-1000	1000	28	0.79	5.2	102	40

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
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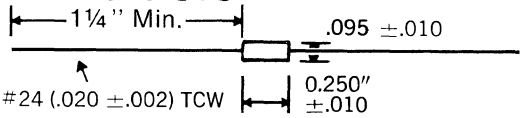
TYPE MD INDUCTORS

Mili-Ductor



—MS INDUCTOR SERIES 75083, 75084, 75085 MOLDED INDUCTOR/0.100 uh to 1000 uh

Markings: Color coded per MIL-C-15305 (Latest Rev.)

The MS Inductor Series are RF Inductors specifically designed to meet the demanding requirements of MIL-C-15305 (latest revision). This MS Series is Epoxy Molded enveloped features reliability and uniformity in a Subminiature Inductor.

ELECTRICAL CHARACTERISTICS
Inductance Tolerance: ±10% over entire range.
Dielectric Strength: 1000 volts RMS at sea level.
Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).
Rating: Maximum current based on; 35°C rise in 90° ambient for phenolic, 15°C rise in 90° ambient for iron, 35°C rise in 70° ambient for ferrite core inductors.

DENSITY CHARACTERISTICS
Volume: 0.002 cubic inches; **Weight:** 0.30 grams.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS
Operating Temperature: —55°C to +125°C phenolic core, —55°C to +105°C iron and ferrite core.
Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).
Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision), 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

MS No.	NCG Part No.	±10% Inductance uh	Q Min.	Test Frequency (L & Q) MHz	Self-resonant Frequency, Min. MHz	DC Resistance Max. Ohms	Rated DC Current MA	Material
MS75083-01	MD	.10	40	25.0	680	.08	1350	PHENOLIC
MS75083-02	MD	.12	40	25.0	640	.09	1270	
MS75083-03	MD	.15	38	25.0	600	.10	1200	
MS75083-04	MD	.18	35	25.0	550	.12	1105	
MS75083-05	MD	.22	33	25.0	510	.14	1025	
MS75083-06	MD	.27	33	25.0	430	.16	960	
MS75083-07	MD	.33	30	25.0	410	.22	815	
MS75083-08	MD	.39	30	25.0	365	.30	700	
MS75083-09	MD	.47	30	25.0	330	.35	650	
MS75083-10	MD	.56	30	25.0	300	.50	545	
MS75083-11	MD	.68	28	25.0	275	.60	495	
MS75083-12	MD	.82	28	25.0	250	.85	415	
MS75083-13	MD	1.00	25	25.0	230	1.00	385	
MS75084-01	MD	1.2	25	7.9	150	.18	590	IRON
MS75084-02	MD	1.5	28	7.9	140	.22	535	
MS75084-03	MD	1.8	30	7.9	125	.30	455	
MS75084-04	MD	2.2	30	7.9	115	.40	395	
MS75084-05	MD	2.7	37	7.9	100	.55	355	
MS75084-06	MD	3.3	45	7.9	90	.85	270	
MS75084-07	MD	3.9	45	7.9	80	1.00	250	
MS75084-08	MD	4.7	45	7.9	75	1.20	230	
MS75084-09	MD	5.6	50	7.9	65	1.80	185	
MS75084-10	MD	6.8	50	7.9	60	2.00	175	
MS75084-11	MD	8.2	55	7.9	55	2.70	155	
MS75084-12	MD	10	55	7.9	50	3.70	130	
MS75084-13	MD	12	45	2.5	40	2.70	155	
MS75084-14	MD	15	40	2.5	35	2.80	150	
MS75084-15	MD	18	50	2.5	30	3.10	145	
MS75084-16	MD	22	50	2.5	25	3.30	140	
MS75084-17	MD	27	50	2.5	20	3.50	135	
MS75085-01	MD	33	45	2.5	24	3.4	130	FERRITE
MS75085-02	MD	39	45	2.5	22	3.6	125	
MS75085-03	MD	47	45	2.5	20	4.5	110	
MS75085-04	MD	56	45	2.5	18	5.7	100	
MS75085-05	MD	68	50	2.5	15	6.7	92	
MS75085-06	MD	82	50	2.5	14	7.3	88	
MS75085-07	MD	100	50	2.5	13	8	84	
MS75085-08	MD	120	30	.79	12	13	66	
MS75085-09	MD	150	30	.79	11	15	61	
MS75085-10	MD	180	30	.79	10	17	57	
MS75085-11	MD	220	30	.79	9	21	52	
MS75085-12	MD	270	30	.79	8	25	47	
MS75085-13	MD	330	30	.79	7	28	45	
MS75085-14	MD	390	30	.79	6.5	35	40	
MS75085-15	MD	470	30	.79	6	42	36	
MS75085-16	MD	560	30	.79	5	46	35	
MS75085-17	MD	680	30	.79	4	60	30	
MS75085-18	MD	820	30	.79	3.8	65	29	
MS75085-19	MD	1000	30	.79	3.4	72	28	

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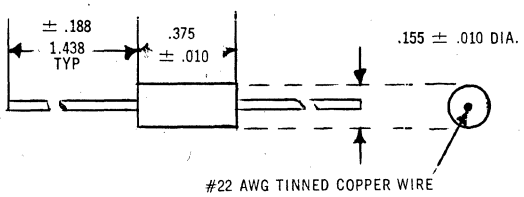
**TYPE RFC-SS
MS18130, 14046 & 90538
INDUCTORS**

RFC-SS SERIES

Molded inductors specifically designed to meet MIL-C-15305 (latest revision). Inductance from 0.15 to 240uH.

GRADE 1 CLASS A (0.15-4.7)
CLASS B (5.6-240)



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 0.15 to 33 uH ±10%
36 to 240 uH ±5%
Measured on Q meter per MIL-C-15305 (latest revision).

Dielectric Strength: 1000 volts RMS @ sea level

Rated Current: Based on max. temp. rise of 35°C (ambient 90°C) for RFC-SS-0.15 to 4.7
15°C (ambient 90°C) for RFC-SS-5.6 to -240

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: Max. 125°C for RFC-SS-0.15 to -4.7
Max. 105°C for RFC-SS-5.6 to -240

Terminal Strength: Meets five pound pull test per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision), high frequency 10 cps

Marking: Color banded.

MS NO.	NCG* PART NO.	L uH	Q Min.	@ MHz	Min. SRF MHz	Max. DCR Ω	Rated DC Cur. mA	Material
MS18130-1	RFC-SS- .15	0.15	50	25	525	0.03	2450	PHENOLIC
MS18130-2	RFC-SS- .22	0.22	50	25	450	0.05	1900	
MS18130-3	RFC-SS- .33	0.33	45	25	360	0.09	1400	
MS18130-4	RFC-SS- .47	0.47	45	25	310	0.12	1225	
MS18130-5	RFC-SS- .56	0.56	50	25	280	0.13	1220	
MS18130-6	RFC-SS- .68	0.68	50	25	250	0.15	1100	
MS18130-7	RFC-SS- .82	0.82	50	25	220	0.22	900	
MS18130-8	RFC-SS- 1.00	1.00	50	25	200	0.29	830	
MS18130-9	RFC-SS- 1.20	1.20	33	7.9	180	0.42	650	
MS18130-10	RFC-SS- 1.50	1.5	33	7.9	160	0.50	600	
MS18130-11	RFC-SS- 1.80	1.8	33	7.9	150	0.65	525	
MS18130-12	RFC-SS- 2.2	2.2	33	7.9	135	0.95	435	
MS18130-13	RFC-SS- 2.7	2.7	33	7.9	120	1.20	385	
MS18130-14	RFC-SS- 3.3	3.3	33	7.9	110	2.00	300	
MS18130-15	RFC-SS- 3.9	3.9	33	7.9	100	2.30	280	
MS18130-16	RFC-SS- 4.7	4.7	33	7.9	90	2.60	260	
MS14046-1	RFC-SS- 5.6	5.6	45	7.9	60	0.32	750	IRON
MS14046-2	RFC-SS- 6.8	6.8	50	7.9	55	0.50	600	
MS14046-3	RFC-SS- 8.2	8.2	50	7.9	50	0.60	545	
MS14046-4	RFC-SS- 10	10.0	55	7.9	45	0.90	445	
MS14046-5	RFC-SS- 12	12	65	2.5	42	1.10	404	
MS14046-6	RFC-SS- 15	15	65	2.5	40	1.40	370	
MS14046-7	RFC-SS- 18	18	75	2.5	34	2.25	280	
MS14046-8	RFC-SS- 22	22	75	2.5	30	2.50	265	
MS14046-9	RFC-SS- 27	27	60	2.5	25	2.60	260	
MS14046-10	RFC-SS- 33	33	65	2.5	19	3.00	250	
MS90538-1	RFC-SS- 36	36	60	2.5	15.5	2.50	180	
MS90538-2	RFC-SS- 39	39	60	2.5	14.5	2.60	176	
MS90538-3	RFC-SS- 43	43	60	2.5	13.7	2.70	172	
MS90538-4	RFC-SS- 47	47	55	2.5	13.0	2.75	170	
MS90538-5	RFC-SS- 51	51	55	2.5	12.7	2.85	167	
MS90538-6	RFC-SS- 56	56	55	2.5	12.0	3.00	164	
MS90538-7	RFC-SS- 62	62	55	2.5	11.5	3.15	160	
MS90538-8	RFC-SS- 68	68	55	2.5	11.0	3.30	156	
MS90538-9	RFC-SS- 75	75	55	2.5	10.5	3.70	147	
MS90538-10	RFC-SS- 82	82	50	2.5	10.3	3.9	143	
MS90538-11	RFC-SS- 91	91	50	2.5	10.0	4.3	136	
MS90538-12	RFC-SS-100	100	50	2.5	9.5	4.5	133	
MS90538-13	RFC-SS-110	110	60	0.79	8.9	4.9	128	
MS90538-14	RFC-SS-120	120	65	0.79	8.7	5.2	124	
MS90538-15	RFC-SS-130	130	65	0.79	8.5	5.45	121	
MS90538-16	RFC-SS-150	150	65	0.79	8.0	6.05	114	
MS90538-17	RFS-SS-160	160	65	0.79	7.5	6.40	111	
MS90538-18	RFC-SS-180	180	65	0.79	7.0	6.75	108	
MS90538-19	RFC-SS-200	200	65	0.79	6.5	7.10	106	
MS90538-20	RFC-SS-220	220	65	0.79	6.2	7.45	103	
MS90538-21	RFC-SS-240	240	65	0.79	5.9	7.8	101	

* NCG Part No. electricals and tolerances as shown,
MS No. electricals and tolerances per actual MS sheet.

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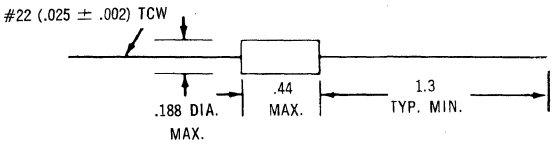
TYPE RFC-S MS21389 & 21390 INDUCTORS

Proven reliability molded inductors specifically designed to meet MIL-C-15305 (latest revision). Inductance 0.1 to 1000uH.

GRADE 1 CLASS B

ACTUAL SIZE



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 0.1 to 22uH ±10% on Q-Meter
27uH to 100 ±5%
1,000 cps bridge
120uH to 1000uH ±5% on Q-Meter

Dielectric Strength: 700 volts RMS at sea level.

****Self-Resonant Frequency:** Minimum SRF to be not less than 80% of published data and measured with full length leads on Grid-Dip Meter.

Q: Measured on Q-Meter.

Rating: ⅓ watt dissipation for series S

Note: L & Q are not always tested at the same frequency.

DENSITY CHARACTERISTICS

Volume: 0.012 cu. in.

Weight: 0.90 grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +125°C.

Terminal Strength: Meets five pound pull test per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 Grade 1, Class B. High frequency 10 cps to 2000 cps @ 30G ±10% maximum for 12 logarithmic swings, each of 20 minute duration repeated for each of three mutually perpendicular planes.

RFC-S SERIES

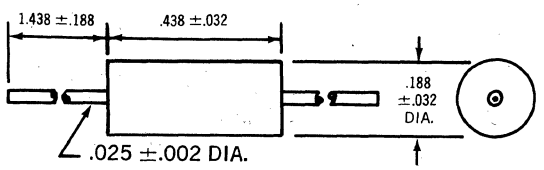
MS NO.	NCG PART NO.*	L	Q min		approx. SRF **	Max. DCR	max. I	MATERIAL
		uH		MHz	MHz	Ω	mA	
MS21389-1	RFC-S- 0.10	0.10	85	50	500	.02	4000	PHENOLIC
MS21389-2	RFC-S- 0.12	0.12	85	50	500	0.25	3500	
MS21389-3	RFC-S- 0.15	0.15	85	50	500	.03	3000	
MS21389-4	RFC-S- 0.18	0.18	75	50	500	.03	3000	
MS21389-5	RFC-S- 0.22	0.22	75	50	500	.03	3000	
MS21389-6	RFC-S- 0.27	0.27	70	45	470	.04	2700	
MS21389-7	RFC-S- 0.33	0.33	70	40	440	.05	2500	
MS21389-8	RFC-S- 0.39	0.39	65	40	400	.08	2000	
MS21389-9	RFC-S- 0.47	0.47	60	25	360	.08	2000	
MS21389-10	RFC-S- 0.56	0.56	55	25	330	.10	1700	
MS21389-11	RFC-S- 0.68	0.68	55	25	300	.12	1500	
MS21389-12	RFC-S- 0.82	0.82	50	25	275	.18	1300	
MS21389-13	RFC-S- 1.0	1.0	50	20	250	.24	1100	
MS21389-14	RFC-S- 1.2	1.2	45	20	220	.35	1000	
MS21389-15	RFC-S- 1.5	1.5	45	15	200	.43	850	
MS21389-16	RFC-S- 1.8	1.8	45	15	180	.65	720	
MS21389-17	RFC-S- 2.2	2.2	45	15	165	.80	610	
MS21390-1	RFC-S- 2.7	2.7	55	10	110	.12	1600	IRON
MS21390-2	RFC-S- 3.3	3.3	55	10	100	.15	1400	
MS21390-3	RFC-S- 3.9	3.9	60	10	95	.23	1200	
MS21390-4	RFC-S- 4.7	4.7	70	7.9	90	.30	1000	
MS21390-5	RFC-S- 5.6	5.6	65	7.9	80	.45	900	
MS21390-6	RFC-S- 6.8	6.8	65	7.9	70	.55	800	
MS21390-7	RFC-S- 8.2	8.2	60	7.9	65	.65	720	
MS21390-8	RFC-S- 10	10	60	5	60	.73	650	
MS21390-9	RFC-S- 12	12	65	5	53	1.1	590	
MS21390-10	RFC-S- 15	15	80	2.5	47	1.4	500	
MS21390-11	RFC-S- 18	18	75	2.5	43	1.6	460	
MS21390-12	RFC-S- 22	22	75	2.5	40	1.8	430	
MS21390-13	RFC-S- 27	27	75	2.5	36	2.7	360	
MS21390-14	RFC-S- 33	33	85	2.5	32	3.5	300	
MS21390-15	RFC-S- 39	39	80	2.5	26	3.8	290	
MS21390-16	RFC-S- 47	47	80	2.5	22	4.0	275	
MS21390-17	RFC-S- 56	56	75	2.5	19	4.4	265	
MS21390-18	RFC-S- 68	68	75	2.5	16	4.7	250	
MS21390-19	RFC-S- 82	82	75	2.5	13	5.3	235	
MS21390-20	RFC-S- 100	100	75	1.5	10	6.0	220	
MS21390-21	RFC-S- 120	120	65	0.79	7.2	5.0	170	
MS21390-22	RFC-S- 150	150	65	0.79	6.7	5.8	164	
MS21390-23	RFC-S- 180	180	65	0.79	6.3	6.6	158	
MS21390-24	RFC-S- 220	220	65	0.79	5.9	7.4	155	
MS21390-25	RFC-S- 270	270	65	0.79	5.6	8.0	150	
MS21390-26	RFC-S- 300	300	65	0.79	5.3	8.6	145	
MS21390-27	RFC-S- 330	330	65	0.79	5.0	8.9	142	
MS21390-28	RFC-S- 360	360	65	0.79	4.7	9.6	137	
MS21390-29	RFC-S- 390	390	65	0.79	4.5	9.9	135	
MS21390-30	RFC-S- 430	430	65	0.79	4.3	10.4	131	
MS21390-31	RFC-S- 470	470	65	0.79	4.0	10.9	128	
MS21390-32	RFC-S- 510	510	65	0.79	3.8	11.6	124	
MS21390-33	RFC-S- 560	560	65	0.79	3.6	11.8	123	
MS21390-34	RFC-S- 620	620	60	0.79	3.5	12.5	120	
MS21390-35	RFC-S- 680	680	60	0.79	3.4	13.5	115	
MS21390-36	RFC-S- 750	750	60	0.79	3.3	14.0	113	
MS21390-37	RFC-S- 820	820	60	0.79	3.1	15.0	110	
MS21390-38	RFC-S- 910	910	60	0.79	3.0	15.5	107	
MS21390-39	RFC-S-1000	1000	60	0.79	2.8	16.5	104	

* NCG Part No. electricals and tolerances as shown, MS No. electricals and tolerances per actual MS sheet.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

**TYPE RFC-S
MS75008, 75101 & 90539
INDUCTORS**

MS-INDUCTOR SERIES 75008-75101-90539 MOLDED INDUCTOR



ALL DIMENSIONS IN INCHES

Proven reliability molded inductors designed to meet MIL-C-15305 (latest revision).
Inductance 0.15 to 1000 uh.

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 0.15 to 0.47 uh ±20%; 0.56-27 uh ±10%; 270-1000 uH ±5%.
Dielectric Strength: 1000 Volts RMS at sea level
Max. Temp. Rise: 35°C

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: —55°C to +125°C.
Terminal Strength: Meets five pound pull test per MIL-C-15305 (latest revision).
Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision). High frequency 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings, each of 20 minute duration repeated for each of three mutually perpendicular planes.
Volume: S Type — 0.012 cu. in.
Weight: S Type — 0.90 grams
Marking: Color banded per MIL-C-15305 (latest revision).

	MS No.	NCG Part No.*	Inductance ±5% uh	Q Min.	Test Frequency MHz	Self-Resonant Frequency, Min. MHz	DC Resistance Maximum Ohms	Rated DC Current mA	Material
GRADE 1, CLASS B	MS75008-21	RFC-S	0.15 ±20%	55	25.0	510	0.030	3,000	PHENOLIC
	MS75008-22	RFC-S	0.22 ±20%	50	25.0	415	0.035	2,800	
	MS75008-23	RFC-S	0.33 ±20%	50	25.0	350	0.065	2,000	
	MS75008-24	RFC-S	0.47 ±20%	50	25.0	300	0.085	1,700	
	MS75008-25	RFC-S	0.56 ±10%	50	25.0	270	0.125	1,450	
	MS75008-26	RFC-S	0.68 ±10%	45	25.0	250	0.150	1,300	
	MS75008-27	RFC-S	0.82 ±10%	40	25.0	210	0.205	1,100	
	MS75008-28	RFC-S	1.00 ±10%	40	25.0	200	0.290	930	
	MS75008-29	RFC-S	1.20 ±10%	30	7.9	180	0.400	785	
	MS75008-30	RFC-S	1.50 ±10%	30	7.9	170	0.485	700	
	MS75008-31	RFC-S	1.80 ±10%	30	7.9	150	0.740	580	
	MS75008-32	RFC-S	2.20 ±10%	30	7.9	140	0.970	505	
	MS75008-33	RFC-S	2.70 ±10%	30	7.9	120	1.20	460	
	MS75101-1	RFC-S	3.30 ±10%	30	7.9	70	0.140	1,350	IRON
	MS75101-2	RFC-S	3.90 ±10%	30	7.9	65	0.155	1,250	
	MS75101-3	RFC-S	4.70 ±10%	30	7.9	60	0.210	1,100	
	MS75101-4	RFC-S	5.60 ±10%	30	7.9	50	0.280	935	
	MS75101-5	RFC-S	6.80 ±10%	30	7.9	50	0.375	810	
	MS75101-6	RFC-S	8.20 ±10%	30	7.9	48	0.440	750	
	MS75101-7	RFC-S	10.00 ±10%	30	7.9	42	0.605	640	
	MS75101-8	RFC-S	12.00 ±10%	50	2.5	36	1.05	490	
	MS75101-9	RFC-S	15.00 ±10%	55	2.5	30	1.20	460	
	MS75101-10	RFC-S	18.00 ±10%	60	2.5	30	1.95	360	
	MS75101-11	RFC-S	22.00 ±10%	60	2.5	24	2.20	335	
	MS75101-12	RFC-S	27.00 ±10%	65	2.5	22	2.75	300	
GRADE 1, CLASS A	MS90539-01	RFC-S	270 ±5%	65	.79	5.6	8.2	110	IRON
	MS90539-02	RFC-S	300 ±5%	65	.79	5.3	8.7	107	
	MS90539-03	RFC-S	330 ±5%	65	.79	5.0	9.1	105	
	MS90539-04	RFC-S	360 ±5%	65	.79	4.7	9.6	102	
	MS90539-05	RFC-S	390 ±5%	65	.79	4.5	10.0	100	
	MS90539-06	RFC-S	430 ±5%	65	.79	4.3	10.6	97	
	MS90539-07	RFC-S	470 ±5%	65	.79	4.0	11.1	95	
	MS90539-08	RFC-S	510 ±5%	65	.79	3.8	11.6	93	
	MS90539-09	RFC-S	560 ±5%	65	.79	3.6	12.3	91	
	MS90539-10	RFC-S	620 ±5%	60	.79	3.5	13.0	88	
	MS90539-11	RFC-S	680 ±5%	60	.79	3.4	13.7	85	
	MS90539-12	RFC-S	750 ±5%	60	.79	3.3	14.4	83	
	MS90539-13	RFC-S	820 ±5%	60	.79	3.1	15.1	81	
	MS90539-14	RFC-S	910 ±5%	60	.79	2.9	15.8	79	
	MS90539-15	RFC-S	1000 ±5%	60	.79	2.8	16.5	78	

MS No. electricals as shown.
NCG Part No. is reference only, see page 18 for RFC--S electricals.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

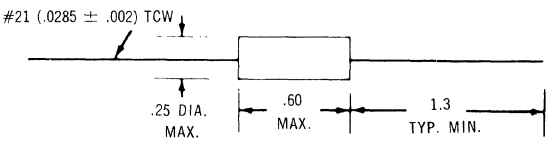
**TYPE RFC-M
MS21388
INDUCTORS**

RFC-M SERIES

Proven reliability molded inductors specifically designed to meet MIL-C-15305 (latest revision). Inductance 1.0 to 2200uH.

GRADE 1 CLASS B

ACTUAL SIZE



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 1.0 to 22uH ± 10% on Q-Meter
27uH to 2200 ± 5%
1,000 cps bridge

Dielectric Strength: 700 volts RMS at sea level.

****Self-Resonant Frequency:** Minimum SRF to be not less than 80% of published data and measured with full length leads on Grid-Dip Meter.

Q: Measured on Q-Meter.

Rating: 1/3 watt dissipation for series M

Note: L & Q are not always tested at the same frequency.

DENSITY CHARACTERISTICS

Volume: 0.029 cu. in.

Weight: 2.00 grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +125°C.

Terminal Strength: Meets five pound pull test per MIL-C-15305.

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision). High frequency 10 cps to 2000 cps @ 30G ±10% maximum for 12 logarithmic swings, each of 20 minute duration repeated for each of three mutually perpendicular planes.

MS NO.	NCG PART NO.*	L	Q Min.		approx. SRF **	Max. DCR	Max. I	MATERIAL
		uH		MHz	MHz	Ω	mA	
MS21388-1	RFC-M- 1.0	1.0	100	15	170	.04	2700	IRON
MS21388-2	RFC-M- 1.2	1.2	100	15	155	.04	2700	
MS21388-3	RFC-M- 1.5	1.5	100	10	140	.04	2700	
MS21388-4	RFC-M- 1.8	1.8	95	10	125	.05	2500	
MS21388-5	RFC-M- 2.2	2.2	95	10	110	.05	2500	
MS21388-6	RFC-M- 2.7	2.7	68	7.9	95	.05	2500	
MS21388-7	RFC-M- 3.3	3.3	60	7.9	90	.05	2500	
MS21388-8	RFC-M- 3.9	3.9	60	7.9	87	.07	2100	
MS21388-9	RFC-M- 4.7	4.7	60	7.9	75	.09	1800	
MS21388-10	RFC-M- 5.6	5.6	65	7.9	70	.14	1550	
MS21388-11	RFC-M- 6.8	6.8	70	7.9	65	.17	1300	
MS21388-12	RFC-M- 8.2	8.2	65	7.9	57	.25	1150	
MS21388-13	RFC-M- 10	10	65	5	50	.32	1000	
MS21388-14	RFC-M- 12	12	65	5	45	.47	870	
MS21388-15	RFC-M- 15	15	75	4	40	.62	730	
MS21388-16	RFC-M- 18	18	65	4	37	.72	660	
MS21388-17	RFC-M- 22	22	65	2.5	35	.8	600	
MS21388-18	RFC-M- 27	27	65	2.5	31	1.2	520	
MS21388-19	RFC-M- 33	33	80	2.5	27	1.5	450	
MS21388-20	RFC-M- 39	39	80	2.5	25	2.3	380	
MS21388-21	RFC-M- 47	47	100	2.5	24	3.0	300	
MS21388-22	RFC-M- 56	56	100	2.5	22	4.2	270	
MS21388-23	RFC-M- 68	68	100	2.5	20	5.2	250	
MS21388-24	RFC-M- 82	82	100	2.5	18	6.2	220	
MS21388-25	RFC-M- 100	100	100	1.5	17	7	200	
MS21388-26	RFC-M- 120	120	95	1.5	14	7.5	200	
MS21388-27	RFC-M- 150	150	90	1.0	11	8	190	
MS21388-28	RFC-M- 180	180	85	1.0	9	9	185	
MS21388-29	RFC-M- 220	220	85	1.0	7	10	180	
MS21388-30	RFC-M- 270	270	80	1.0	5.5	11	172	
MS21388-31	RFC-M- 330	330	80	.8	4.5	12	165	
MS21388-32	RFC-M- 390	390	75	.8	4.0	13	157	
MS21388-33	RFC-M- 470	470	75	.8	3.5	14	150	
MS21388-34	RFC-M- 560	560	65	.8	3.1	16	145	
MS21388-35	RFC-M- 680	680	65	.8	2.7	17	140	
MS21388-36	RFC-M- 820	820	65	.8	2.5	19	132	
MS21388-37	RFC-M-1000	1000	70	.5	2.3	21	125	
MS21388-38	RFC-M-1200	1200	60	.25	2.7	22	120	
MS21388-39	RFC-M-2200	2200	70	.25	2.0	30	100	

* NCG Part No. electricals and tolerances as shown.
MS No. electricals and tolerances per actual MS sheet.

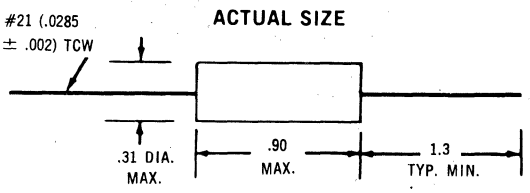
Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

**TYPE RFC-L
MS21380
INDUCTORS**

RFC-L SERIES

Proven reliability molded inductors specifically designed to meet MIL-C-15305 (latest revision). Inductance 1.0 to 10,000uH.

GRADE 1 CLASS B



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 0.1 to 22uH ±10% on Q-Meter
27uH to 10,000 ±5%
1,000 cps bridge

Dielectric Strength: 700 volts RMS at sea level.

****Self-Resonant Frequency:** Minimum SRF to be not less than 80% of published data and measured with full length leads on Grid-Dip Meter.

Q: Measured on Q-Meter.

Rating: ½ watt dissipation for L series.

Note: L & Q are not always tested at the same frequency.

DENSITY CHARACTERISTICS

Volume: 0.068 cu. in.

Weight: 4.10 grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +125°C.

Terminal Strength: Meets five pound pull test per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision). High frequency 10 cps to 2000 cps @ 30G ±10% maximum for 12 logarithmic swings, each of 20 minute duration repeated for each of three mutually perpendicular planes.

MS NO.	NCG PART NO.*	L	Q min		approx. SRF**	Max. DCR	max. I	MAT.
		µH		MHz	MHz	Ω	mA	
MS21380-1	RFC-L- 1.0	1.0	130	15	170	.03	4000	IRON
MS21380-2	RFC-L- 1.2	1.2	130	15	155	.03	4000	
MS21380-3	RFC-L- 1.5	1.5	130	10	140	.03	4000	
MS21380-4	RFC-L- 1.8	1.8	130	10	125	.03	4000	
MS21380-5	RFC-L- 2.2	2.2	130	10	115	.04	3500	
MS21380-6	RFC-L- 2.7	2.7	100	10	102	.04	3500	
MS21380-7	RFC-L- 3.3	3.3	100	7.9	90	.04	3500	
MS21380-8	RFC-L- 3.9	3.9	80	7.9	85	.05	3100	
MS21380-9	RFC-L- 4.7	4.7	75	7.9	80	.05	3100	
MS21380-10	RFC-L- 5.6	5.6	65	7.9	72	.06	3000	
MS21380-11	RFC-L- 6.8	6.8	65	7.9	65	.06	3000	
MS21380-12	RFC-L- 8.2	8.2	65	7.9	57	.11	2400	
MS21380-13	RFC-L- 10	10	75	5	50	.15	1800	
MS21380-14	RFC-L- 12	12	75	5	45	.23	1600	
MS21380-15	RFC-L- 15	15	75	5	40	.3	1300	
MS21380-16	RFC-L- 18	18	75	5	36	.4	1150	
MS21380-17	RFC-L- 22	22	75	2.5	32	.5	1000	
MS21380-18	RFC-L- 27	27	70	2.5	30	.6	900	
MS21380-19	RFC-L- 33	33	70	2.5	28	.7	850	
MS21380-20	RFC-L- 39	39	70	2.5	26	1.1	720	
MS21380-21	RFC-L- 47	47	75	2.5	25	1.3	620	
MS21380-22	RFC-L- 56	56	80	2.5	22	1.8	540	
MS21380-23	RFC-L- 68	68	100	2.5	20	2.4	450	
MS21380-24	RFC-L- 82	82	100	2.5	18	2.8	425	
MS21380-25	RFC-L- 100	100	100	1.5	17	3.2	400	
MS21380-26	RFC-L- 120	120	100	1.5	15	4.8	360	
MS21380-27	RFC-L- 150	150	100	1.0	14	6.4	280	
MS21380-28	RFC-L- 180	180	95	1.0	12	9.5	240	
MS21380-29	RFC-L- 220	220	95	1.0	11	12	200	
MS21380-30	RFC-L- 270	270	70	1.0	9	13	195	
MS21380-31	RFC-L- 330	330	65	.79	7.5	14	190	
MS21380-32	RFC-L- 390	390	65	.79	6.5	15.5	180	
MS21380-33	RFC-L- 470	470	60	.79	5.5	17	170	
MS21380-34	RFC-L- 560	560	75	.5	4	18.5	165	
MS21380-35	RFC-L- 680	680	75	.5	3.2	20	155	
MS21380-36	RFC-L- 820	820	75	.5	2.8	22	150	
MS21380-37	RFC-L- 1000	1000	75	.5	2.4	24	145	
MS21380-38	RFC-L- 1200	1200	75	.5	2.1	27	137	
MS21380-39	RFC-L- 1500	1500	75	.4	1.9	29	130	
MS21380-40	RFC-L- 1800	1800	65	.4	1.7	32	125	
MS21380-41	RFC-L- 2200	2200	65	.25	1.5	35	120	
MS21380-42	RFC-L- 2700	2700	65	.25	1.3	40	112	
MS21380-43	RFC-L- 3300	3300	65	.25	1.2	45	105	
MS21380-44	RFC-L- 3900	3900	65	.25	1.05	49	100	
MS21380-45	RFC-L- 4700	4700	65	.25	.95	53	95	
MS21380-46	RFC-L- 5600	5600	65	.25	.85	60	90	
MS21380-47	RFC-L- 6800	6800	65	.25	.75	67	85	
MS21380-48	RFC-L- 8200	8200	65	.25	.65	75	82	
MS21380-49	RFC-L-10000	10000	65	.15	.58	80	80	

MS91189-14 THRU -28, VALUES 1.2 THRU 18uH (ON PHENOLIC CORES) ARE AVAILABLE.

MS75103-1 THRU -10, VALUES 22 THRU 120uH ARE ALSO AVAILABLE.

* NCG Part No. electricals and tolerances as shown.
MS No. electricals and tolerances per actual MS sheet.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

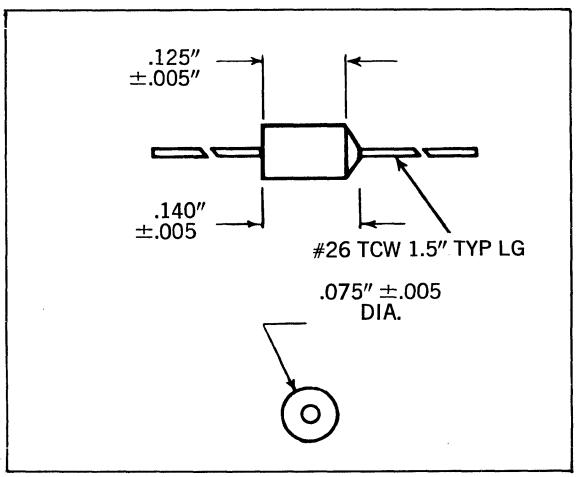
TYPE PD INDUCTORS

Pee Dee Ductor Series

The Pee Dee Ductor is a new, micro-miniature, axial-leaded RF inductor for hybrid circuit applications. It is significantly smaller than any unshielded inductor available anywhere. Designed to meet the requirements of MIL-C-15305 B, this reliable, high performance inductor has a standard inductance tolerance of ±10%.

GRADE 2 CLASS A

Marking: EIA color coded



ELECTRICAL CHARACTERISTICS:

Inductance Tolerance: ±10% (Std).

L,Q,F, values: Measurements per MIL-C-15305. (latest revision).

Dielectric Strength: 300 Volts RMS @ Sea Level.

* SRF minimum not less than 80% of specified values.

DENSITY CHARACTERISTICS:

Volume: .0007 Cubic Inches

Weight: 0.12 Grams

Marking: EIA color coded

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS:

Terminal pull: 3 lbs. minimum.

Environmental: Grade 2 Class A

ALL DIMENSIONS IN INCHES

ELECTRICAL DATA

NCG Part No.	L uH	Q (Min.)	Test Freq. MHz	*SRF MHz	DCR Max. Ohms	Rated Current mA
PD-0.10	0.10	40	25	500	0.2	600
PD-0.12	0.12	40	25	450	0.2	600
PD-0.15	0.15	40	25	400	0.25	575
PD-0.18	0.18	40	25	380	0.25	575
PD-0.22	0.22	40	25	360	0.30	565
PD-0.27	0.27	40	25	300	0.30	565
PD-0.33	0.33	40	25	280	0.35	560
PD-0.39	0.39	40	25	260	0.37	550
PD-0.47	0.47	40	25	250	0.39	535
PD-0.56	0.56	40	25	240	0.40	525
PD-0.68	0.68	35	25	220	0.45	500
PD-0.82	0.82	35	25	180	0.50	480
PD-1.0	1.0	35	25	170	0.60	450
PD-1.2	1.2	35	7.9	150	0.70	425
PD-1.5	1.5	35	7.9	130	0.80	400
PD-1.8	1.8	35	7.9	120	0.90	350
PD-2.2	2.2	35	7.9	110	1.3	320
PD-2.7	2.7	35	7.9	105	1.8	275
PD-3.3	3.3	35	7.9	100	1.1	340
PD-3.9	3.9	35	7.9	90	1.4	310
PD-4.7	4.7	35	7.9	85	1.6	290
PD-5.6	5.6	35	7.9	70	1.8	275
PD-6.8	6.8	35	7.9	65	2.0	250
PD-8.2	8.2	35	7.9	62	2.2	245
PD-10	10	35	7.9	60	3.0	210
PD-12	12	35	2.5	35	2.0	250
PD-15	15	35	2.5	30	2.2	245
PD-18	18	35	2.5	25	2.5	230
PD-22	22	35	2.5	23	2.7	220
PD-27	27	35	2.5	21	3.8	195
PD-33	33	35	2.5	20	4.5	170
PD-39	39	35	2.5	16	6.0	150
PD-47	47	35	2.5	14	6.5	145
PD-56	56	35	2.5	12	7.8	135
PD-68	68	35	2.5	10	8.6	130
PD-82	82	35	2.5	9.0	9.8	120
PD-100	100	35	2.5	8.0	11.5	110
PD-120	120	28	.79	7.0	15.0	90
PD-150	150	28	.79	6.0	16.5	88
PD-180	180	25	.79	5.5	22	75
PD-220	220	24	.79	5.2	31	62
PD-270	270	24	.79	5.0	38	56
PD-330	330	24	.79	4.8	42	53
PD-390	390	24	.79	3.6	58	47
PD-470	470	24	.79	3.4	60	45
PD-560	560	24	.79	3.2	65	43
PD-680	680	22	.79	3.0	90	36
PD-820	820	23	.79	2.5	95	34
PD-1000	1000	21	.79	2.0	130	30

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

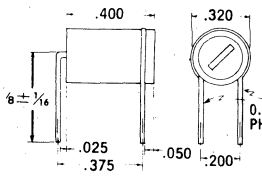
TYPE WEE-VL MS21381 & 21402 VARIABLE INDUCTORS

WEE V-L

NOW MIL APPROVED MIL-C-15305 (latest revision) — MS21381 & MS21402

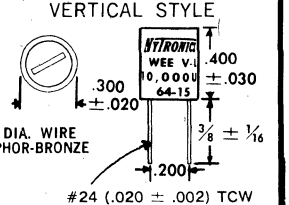
Subminiature Shielded Adjustable Inductor
High Q Values
Vertical or Horizontal* Mounting
Unitized Epoxy-Molded Construction
0.400" by 0.300"
0.10 to 100,000uH

HORIZONTAL STYLE



HORIZONTAL MOUNTING CLIP
Nytronics Part No. ACS 57
(one required per unit)

VERTICAL STYLE



ACTUAL SIZE

The **WEE V-L** is designed to accommodate close inductance adjustments in high-density circuits that demand exceptional stability and high "Q" in the smallest size available.
The **WEE V-L** is qualified MIL-C-15305 (latest revision). Printed board mounting is facilitated by 0.200 grid spacing and unit has shield construction to allow maximum density packaging. Standardized in 73 stock values.

ELECTRICAL CHARACTERISTICS

Adjustable Inductance Range: ±10%† over entire range as measured per MIL-C-15305 (latest revision).
Q and SRF Values: Minimum not less than 80% of specified value at L nominal.
Dielectric Strength: 840 Volts R.M.S. at sea level.
Working Voltage: 300 Volts D.C.
Maximum Current: Based on temperature rise not to exceed 15°C at 90°C ambient.
Incremental Current: Defined as the DC current required to cause a five percent reduction in the nominal inductance value.

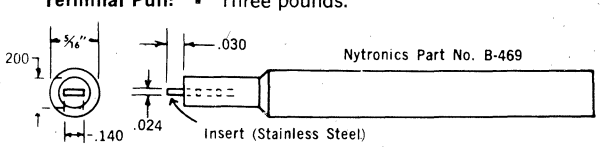
DENSITY CHARACTERISTICS

Weight: 1.5 grams maximum
Volume: .0346 cubic inches
Shielding: 3% coupling maximum when two units are tested side by side.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Use Nytronics Tuning Tool No. B-469 or equal.

Torque: 0.75 to 6.0 inch-oz.
Operating Temperature: −55°C to +105°C.
Moisture, Vibration, and Shock Resistance: Meet requirements of MIL-C-15305 (latest revision).
Marking: Manufacturer data printed.
Terminal Pull: Three pounds.



MS GRADE 1 CLASS A
WVL GRADE 3 CLASS A

MS No.	NCG Part No.**		L nom. uH	f MHz	Q nom.	SRF Nom. MHz	Max. DCR ohms	Max. I m.a.	Incr. I m.a.
*MS21381-1	WEE V-L†	0.10	.10	25	70	>250	0.030	1510	NA
*MS21381-2	WEE V-L†	0.12	.12	25	70	>250	0.030	1450	NA
*MS21381-3	WEE V-L	0.15	.15	25	70	>250	0.030	1400	NA
*MS21381-4	WEE V-L	0.18	.18	25	70	>250	0.035	1370	NA
*MS21381-5	WEE V-L	0.22	.22	25	70	>250	0.038	1340	NA
*MS21381-6	WEE V-L	0.27	.27	25	80	>250	0.040	1300	NA
*MS21381-7	WEE V-L	0.33	.33	25	80	>250	0.040	1260	NA
*MS21381-8	WEE V-L	0.39	.39	25	80	250	0.045	1240	NA
*MS21381-9	WEE V-L	0.47	.47	25	80	230	0.045	1200	NA
*MS21381-10	WEE V-L	0.56	.56	25	80	220	0.050	1160	NA
*MS21381-11	WEE V-L	0.68	.68	25	80	190	0.055	1100	NA
*MS21381-12	WEE V-L	0.82	.82	25	85	180	0.060	1040	NA
*MS21381-13	WEE V-L	1.00	1.00	25	85	160	0.070	986	NA
MS21381-14	WEE V-L	1.2	1.2	7.9	90	170	0.085	968	NA
MS21381-15	WEE V-L	1.5	1.5	7.9	100	155	0.100	893	NA
MS21381-16	WEE V-L	1.8	1.8	7.9	115	135	0.110	853	NA
MS21381-17	WEE V-L	2.2	2.2	7.9	110	120	0.120	817	NA
MS21381-18	WEE V-L	2.7	2.7	7.9	110	104	0.125	800	NA
MS21381-19	WEE V-L	3.3	3.3	7.9	90	93.0	0.165	696	NA
MS21381-20	WEE V-L	3.9	3.9	7.9	90	87.0	0.180	659	NA
MS21381-21	WEE V-L	4.7	4.7	7.9	95	79.0	0.245	571	NA
MS21381-22	WEE V-L	5.6	5.6	7.9	95	72.0	0.265	550	NA
MS21381-23	WEE V-L	6.8	6.8	7.9	85	63.0	0.330	493	NA
MS21381-24	WEE V-L	8.2	8.2	7.9	95	60.0	0.460	417	NA
MS21381-25	WEE V-L	10	10	7.9	90	54.0	0.640	359	NA
MS21381-26	WEE V-L	12	12	2.5	120	37.0	0.800	316	NA
MS21381-27	WEE V-L	15	15	2.5	120	28.8	0.865	301	NA
MS21381-28	WEE V-L	18	18	2.5	115	23.8	0.940	292	NA
MS21381-29	WEE V-L	22	22	2.5	125	21.3	1.03	267	NA
MS21381-30	WEE V-L	27	27	2.5	115	20.6	1.18	243	NA
MS21381-31	WEE V-L	33	33	2.5	120	18.6	1.30	231	NA
MS21381-32	WEE V-L	39	39	2.5	120	17.7	1.41	223	NA
MS21381-33	WEE V-L	47	47	2.5	110	14.9	1.61	203	NA
MS21381-34	WEE V-L	56	56	2.5	115	13.9	2.08	191	NA
MS21381-35	WEE V-L	68	68	2.5	105	12.9	2.20	185	NA
MS21381-36	WEE V-L	82	82	2.5	105	11.7	2.42	174	NA
MS21402-1	WEE V-L	100	100	2.5	95	10.5	2.15	333	333
MS21402-2	WEE V-L	120	120	0.790	95	5.60	2.38	316	190
MS21402-3	WEE V-L	150	150	0.790	90	5.20	2.52	306	175
MS21402-4	WEE V-L	180	180	0.790	95	4.90	2.88	288	150
MS21402-5	WEE V-L	220	220	0.790	95	4.60	3.18	273	125
MS21402-6	WEE V-L	270	270	0.790	100	4.20	3.50	260	120
MS21402-7	WEE V-L	330	330	0.790	100	3.55	4.80	222	110
MS21402-8	WEE V-L	390	390	0.790	100	3.45	5.44	209	105
MS21402-9	WEE V-L	470	470	0.790	100	3.20	5.90	201	100
MS21402 10	WEE V-L	560	560	0.790	95	2.90	6.30	194	90
MS21402-11	WEE V-L	680	680	0.790	100	2.70	7.20	181	80
MS21402-12	WEE V-L	820	820	0.790	90	2.50	8.00	172	70
MS21402-13	WEE V-L	1,000	1,000	0.790	100	2.35	12.0	141	65
MS21402-14	WEE V-L	1,200	1,200	0.250	95	2.20	13.5	132	60
MS21402-15	WEE V-L	1,500	1,500	0.250	90	1.90	16.5	119	55
MS21402-16	WEE V-L	1,800	1,800	0.250	100	1.80	18.0	114	47
MS21402-17	WEE V-L	2,200	2,200	0.250	100	1.70	20.5	107	43
MS21402-18	WEE V-L	2,700	2,700	0.250	95	1.50	22.5	102	39
MS21402-19	WEE V-L	3,300	3,300	0.250	90	1.40	42.0	76	36
MS21402-20	WEE V-L	3,900	3,900	0.250	85	1.27	47.5	71	35
MS21402-21	WEE V-L	4,700	4,700	0.250	85	1.24	53.0	67	34
MS21402-22	WEE V-L	5,600	5,600	0.250	85	0.93	62.5	65	31
MS21402-23	WEE V-L	6,800	6,800	0.250	75	0.79	69.5	58	27
MS21402-24	WEE V-L	8,200	8,200	0.250	80	0.75	75.0	56	26
MS21402-25	WEE V-L	10,000	10,000	0.250	70	0.70	100.0	49	24
MS21402-26	WEE V-L	12,000	12,000	0.079	70	0.50	64	60	40
MS21402-27	WEE V-L	15,000	15,000	0.079	70	0.38	84	52	34
MS21402-28	WEE V-L	18,000	18,000	0.079	70	0.36	93	50	30
MS21402-29	WEE V-L	22,000	22,000	0.079	70	0.32	104	45	28
MS21402-30	WEE V-L	27,000	27,000	0.079	70	0.30	173	35	26
MS21402-31	WEE V-L	33,000	33,000	0.079	70	0.27	187	32	24
MS21402-32	WEE V-L	39,000	39,000	0.079	70	0.26	220	30	22
MS21402-33	WEE V-L	47,000	47,000	0.079	70	0.25	253	28	20
MS21402-34	WEE V-L	56,000	56,000	0.079	70	0.24	285	26	19
MS21402-35	WEE V-L	68,000	68,000	0.079	60	0.20	311	24	18
MS21402-36	WEE V-L	82,000	82,000	0.079	60	0.19	385	22	16
MS21402-37	WEE V-L	100,000	100,000	0.079	60	0.17	420	20	15

*Turntable range on MS2138-1 thru -13 and -74 thru -85 is ±5%.

*For horizontal mounting use Nytronics mounting clip No. ACS-57 or order with prefix H (i.e. H WEE V-L 0.10).

†Tunable range ±5.0% on 0.10uH thru 1.0uH.

**NCG Part No. cannot be used as the MS number.

NOTE: Min. Q on MIL version not less than 80% of Q min. of commercial version.
NOTE: MS 21381 -74 thru -85 are available.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

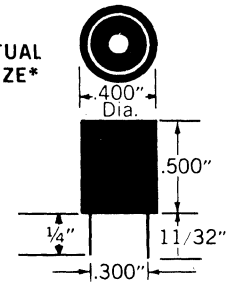
TYPE VIV - VIH VARIABLE INDUCTORS

VIV-VIH

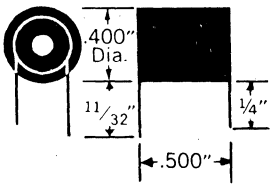
Miniature with inductance range of 0.10 to 4700uH in 29 values.
Encapsulated in epoxy resin for reliability.
Designed to meet MIL-C-15305B

ALL DIMENSIONS ARE ±1/32 INCH

ACTUAL SIZE*



ACTUAL SIZE



Terminal Leads #22 (.025 ± .002) VCW

VERTICAL STYLE HORIZONTAL STYLE

The **VARIABLE INDUCTOR** offers high reliability and exceptional stability over extreme temperature variations. This small lightweight unit is furnished in vertical and horizontal styles to facilitate mounting on printed circuit boards. The unit is designed to meet the requirements of MIL-C-15305B.

GRADE 2 CLASS B

ELECTRICAL CHARACTERISTICS

Inductance Range: 0.33 to 4700uH Tunable Range ±20%
0.15 to 0.22uH Tunable Range ±15%
0.1 Tunable Range ±10%
All measurements at 25°C on Q-Meter using miniature alligator clips mounted 1/32" from body.
Q values min. not less than 80% of specified value.

**** Self-Resonant Frequency:** Minimum SRF to be not less than 80% of published data as measured with Grid-Dip Meter.

DENSITY CHARACTERISTICS

Volume: 0.063 cubic inches
Weight: 2.6 grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Torque: 0.75 to 5.0 inch-ounces
Use Nytronics Tuning Tool No. B-305 or equal.

Operating Temperature: −55°C to +125°C

Terminal Strength: Meets five pound pull tests.

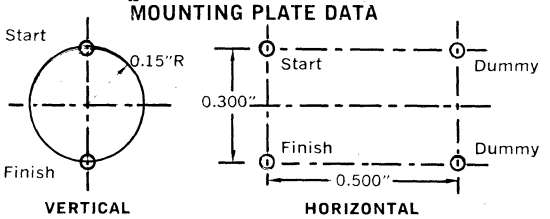
Core Material: Iron

Marking: Manufactured data printed.

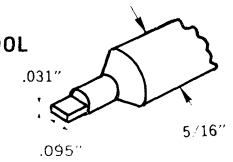
NCG PART NOS.		L nom.	** Q at L Nom.		Approx. SRF, L nom.	Max. DCR	Max. I
VIV	VIH	μH		MHz	MHz	Ω	mA
VIV-0.10	VIH-0.10	0.10	85	25.	>500.	0.02	3500
VIV-0.15	VIH-0.15	0.15	100	25.	>500.	0.035	2600
VIV-0.22	VIH-0.22	0.22	100	25.	>500.	0.04	2500
VIV-0.33	VIH-0.33	0.33	100	25.	334.	0.04	2500
VIV-0.47	VIH-0.47	0.47	100	25.	285.	0.05	2200
VIV-0.68	VIH-0.68	0.68	100	25.	237.	0.07	1850
VIV-1.00	VIH-1.00	1.00	90	25.	205.	0.13	1350
VIV-1.50	VIH-1.50	1.50	70	7.9	168.	0.24	1000
VIV-2.20	VIH-2.20	2.20	73	7.9	135.	0.30	890
VIV-3.30	VIH-3.30	3.30	80	7.9	112.	0.45	730
VIV-4.70	VIH-4.70	4.70	75	7.9	100.0	0.80	550
VIV-6.80	VIH-6.80	6.80	80	7.9	80.0	1.1	460
VIV-10.0	VIH-10.0	10.0	82	7.9	67.0	1.9	355
VIV-15.0	VIH-15.0	15.0	65	2.5	54.2	3.2	270
VIV-22.0	VIH-22.0	22.0	55	2.5	17.5	3.4	265
VIV-33.0	VIH-33.0	33.0	54	2.5	15.0	3.6	255
VIV-47.0	VIH-47.0	47.0	51	2.5	13.2	4.5	230
VIV-68.0	VIH-68.0	68.0	55	2.5	12.0	5.5	210
VIV-100	VIH-100	100.0	50	2.5	10.5	6.7	190
VIV-150	VIH-150	150.	50	.79	3.0	11.0	150
VIV-220	VIH-220	220.	50	.79	2.70	13.0	135
VIV-330	VIH-330	330.	48	.79	2.24	16.0	120
VIV-470	VIH-470	470.	45	.79	1.90	18.0	115
VIV-680	VIH-680	680.	42	.79	1.70	21.0	105
VIV-1000	VIH-1000	1000.	40	.79	1.40	38.0	80
VIV-1500	VIH-1500	1500.	40	.25	1.14	54.0	65
VIV-2200	VIH-2200	2200.	44	.25	0.96	66.0	60
VIV-3300	VIH-3300	3300.	46	.25	0.86	85.0	54
VIV-4700	VIH-4700	4700.	48	.25	0.76	99.0	49

* All dimensions ±1/32 inch.

MOUNTING PLATE DATA



TYPICAL ALIGNING TOOL
B-305



EEM PRODUCT SELECTION GUIDES

Use the EEM Product Selection Guides. There are 34 Guides in this edition of EEM. See page 2 (A•2, B•2, C•2, D•2) of each volume to locate the Product Selection Guides that pertain to your needs.

INDUCTORS FOR SWITCH-MODE POWER REGULATOR, CONTROL AND NOISE FILTERING CIRCUITS

The **SKC SERIES INDUCTORS** are designed on gapped toroidal tape wound cores for DC switching power supply, regulator and energy storage circuits — DC current ratings **5 to 50 AMPS DC.**

The **SKL SERIES INDUCTORS** are designed on functional gapped toroidal tape wound cores for power circuits requiring high inductance at low DC currents and nominal inductance at rated DC amps.

The **SKP SERIES INDUCTORS** are designed on powered iron toroidal cores for RFI and EMI filtering and other noise absorbing applications. Also, **SKP SERIES INDUCTORS** are most useful in DC circuit applications, available in a wide range of "L" values and DC current ratings to **40 AMPS DC.**

SKC SERIES POWER INDUCTORS FOR DC SWITCH-MODE CIRCUITS

PART NUMBER	AMPS (DC)	"L" (μH)	DCR (OHMS)	DIMENSIONS (inch/mm) OD (max.)	HT (max.)
SKC-101	5 to 10	30	0.009	1.26/32	.71/18
SKC-102	5 to 10	50	0.011	1.26/32	.71/18
SKC-103	5 to 10	100	0.017	1.26/32	.71/18
SKC-104	5 to 10	150	0.023	1.26/32	.71/18
SKC-105	5 to 10	200	0.024	1.46/37	.79/20
SKC-106	5 to 7.5	400	0.048	1.46/37	.79/20
SKC-107	5 to 7.5	600	0.056	1.73/44	1.02/26
SKC-108	5 to 7.5	800	0.044	2.13/54	.98/25
SKC-109	5 to 6	1200	0.081	2.17/55	1.02/26
SKC-110	5 to 6	1800	0.099	2.17/55	1.02/26
SKC-201	10 to 15	30	0.005	1.26/32	.71/18
SKC-202	10 to 15	50	0.007	1.46/37	.79/20
SKC-203	10 to 15	100	0.012	1.46/37	.79/20
SKC-204	10 to 15	150	0.014	1.73/44	1.02/26
SKC-205	10 to 15	200	0.011	2.13/54	.98/25
SKC-206	10 to 12	400	0.024	2.17/55	1.02/26
SKC-207	10 to 12	600	0.032	2.20/56	1.06/27
SKC-208	10 to 12	800	0.032	2.20/56	1.30/33
SKC-301	15 to 25	30	0.004	1.46/37	.79/20
SKC-302	15 to 25	50	0.006	1.54/39	.83/21
SKC-303	15 to 25	100	0.006	2.13/54	.98/25
SKC-304	15 to 20	150	0.009	2.17/55	1.02/26
SKC-305	15 to 20	200	0.011	2.17/55	1.02/26
SKC-306	15 to 20	400	0.016	2.20/56	1.30/33
SKC-401	20 to 30	30	0.004	1.61/41	.91/23
SKC-402	20 to 30	50	0.005	1.81/46	.98/25
SKC-403	20 to 28	100	0.006	2.17/55	1.02/26
SKC-404	20 to 25	150	0.008	2.20/56	1.06/27
SKC-405	20 to 25	200	0.008	2.20/56	1.30/33
SKC-501	25 to 35	30	0.003	1.77/45	.95/24
SKC-502	25 to 35	50	0.003	2.17/55	1.02/26
SKC-503	25 to 35	100	0.004	2.17/55	1.30/33
SKC-504	25 to 30	150	0.006	2.24/57	1.34/34
SKC-601	30 to 40	30	0.002	2.13/54	.98/25
SKC-602	30 to 40	50	0.003	2.17/55	1.02/26
SKC-603	30 to 35	100	0.004	2.20/56	1.30/33
SKC-801	40 to 50	30	0.002	2.17/55	1.30/33
SKC-802	40 to 50	50	0.002	2.24/57	1.34/34

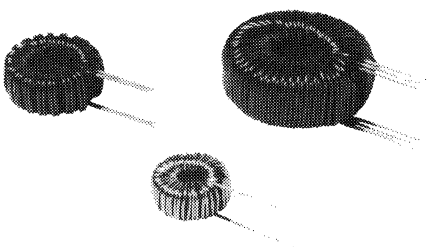
SKL SERIES POWER INDUCTORS WITH HIGH "L" AT LOW DC

PART NUMBER	AMPS (DC)	"L" (μH) with DC	"L" (μH) 0 DC	DCR (OHMS)	DIMENSIONS (inch/mm) OD (max.)	HT (max.)
SKL-103	5	100	450	0.017	1.26/32	.71/18
SKL-105	5	200	1000	0.025	1.26/32	.71/18
SKL-203	10	100	500	0.011	1.69/43	.91/23
SKL-205	10	200	1000	0.015	2.13/54	1.15/29
SKL-303	15	100	500	0.008	2.17/55	1.02/26
SKL-305	15	200	1000	0.011	2.20/56	1.06/27
SKL-403	20	100	500	0.008	2.17/55	1.02/26
SKL-404	20	150	750	0.009	2.20/56	1.06/27
SKL-502	25	50	250	0.006	2.17/55	1.02/26
SKL-503	25	100	600	0.007	2.24/57	1.34/34

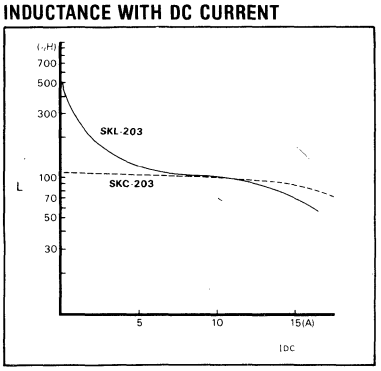
SKP SERIES NOISE ABSORBING INDUCTORS

PART NUMBER	AMPS (AC)	AMPS (DC)	"L" (μH)	DCR (OHMS)	DIMENSIONS (inch/mm) OD (max.)	HT (max.)
SKP1-30	2	1	30	0.039	.62/16	.31/8
SKP1-40	2	1	55	0.050	.62/16	.31/8
SKP1-50	2	1	80	0.061	.62/16	.33/8.5
SKP2-30	2	1	50	0.051	.62/16	.43/11
SKP2-40	2	1	90	0.066	.62/16	.43/11
SKP2-50	2	1	130	0.082	.62/16	.45/11.5
SKP3-30	3	2	40	0.028	.83/21	.43/11
SKP3-40	3	2	80	0.037	.83/21	.43/11
SKP3-50	3	3	120	0.045	.85/21.5	.45/11.5
SKP4-40	5	3	65	0.023	.98/25	.47/12
SKP4-50	5	3	100	0.028	1.02/26	.47/12
SKP5-40	5	3	100	0.033	1.08/27.5	.55/14
SKP5-50	5	3	150	0.041	1.10/28	.59/15

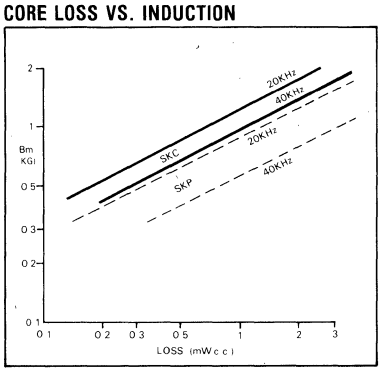
NOTE: SKP SERIES "L" with DC is approximately 50% of value shown.



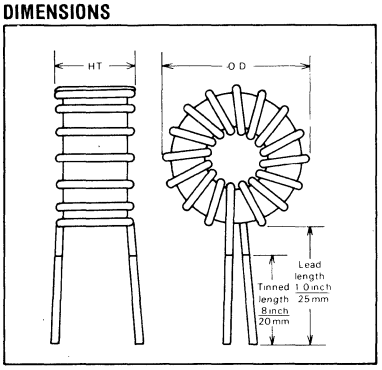
INDUCTANCE WITH DC CURRENT



CORE LOSS VS. INDUCTION



DIMENSIONS



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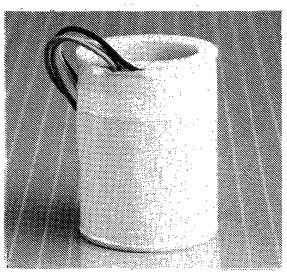
455-A CARSON PLAZA DRIVE, CARSON, CA 90746 • (213) 532-1790 • TELEX: 664759 (PAN-MAG CRSN)

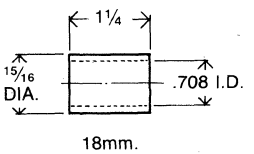
The New PENN-TRAN

Engineers know us for quality and innovation in the design and manufacture of deflection components for CRT Displays and television cameras.

The new Penn-Tran is new versatility and dimension in precision stator yokes for the exacting needs of today's high tech displays. The new Penn-Tran is also the same reliability and custom design capabilities engineers have received from us for 39 years.

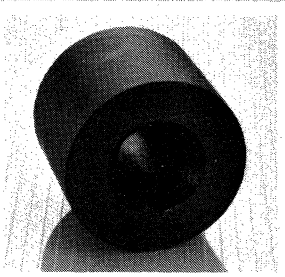
See the rest of the Penn-Tran team: High Voltage Power Supplies in EEM Section 4000, and Horizontal Drive Boards in EEM Section 5600.

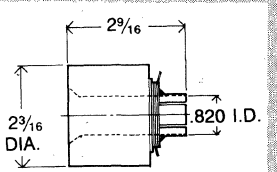




EX6246 — 18mm/25°

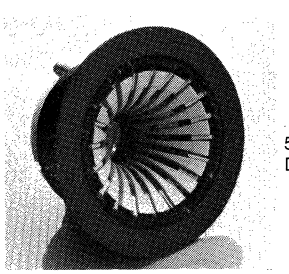
HOR	.125 mh	1.62 ohms	.70A
VERT	.152 mh	1.73 ohms	.70A

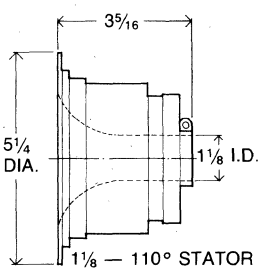




EX6250 — 20mm/55°

HOR	.100 mh	.25 ohms	2.5A
VERT	5.0 mh	12.5 ohms	.375A



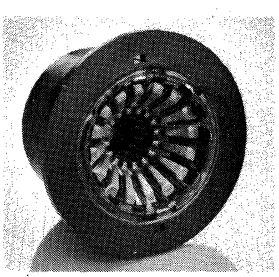


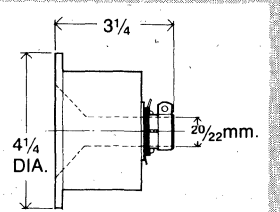
EX6255 — 29mm/110°

HOR	.043 mh	.17 ohms	9.6A
VERT	4.25 mh	5.0 ohms	1.025A

EX6256 — 29mm/110°

HOR	.100 mh	.4 ohms	6.35A
VERT	5.0 mh	6.0 ohms	.96A



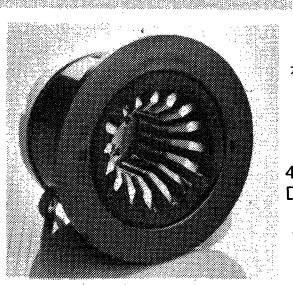


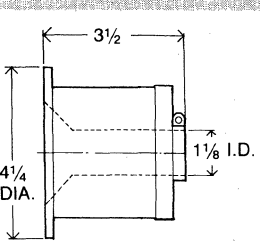
EX6248 — 20mm/90°

HOR	.100 mh	.26 ohms	3.95A
VERT	5.0 mh	8.25 ohms	.635A

EX6249 — 20mm/70°

HOR	.100 mh	.3 ohms	3.19A
VERT	5.0 mh	15.0 ohms	1.527A



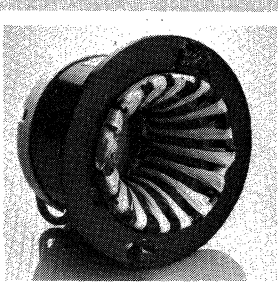


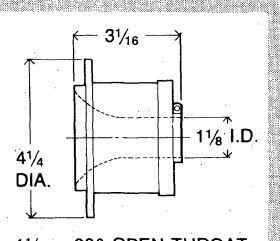
EX6251 — 29mm/70°

HOR	.100 mh	.31 ohms	3.11A
VERT	5.0 mh	12.0 ohms	.466A

EX6252 — 29mm/90°

HOR	.100 mh	.33 ohms	4.44A
VERT	5.0 mh	10.0 ohms	.666A





EX6253 — 29mm/70° Open throat

HOR	.100 mh	.195 ohms	3.4A
VERT	5.0 mh	8.75 ohms	.62A

EX6254 — 29mm/90° Open throat

HOR	.100mh	.27 ohms	4.12A
VERT	5.0 mh	7.6 ohms	.695A

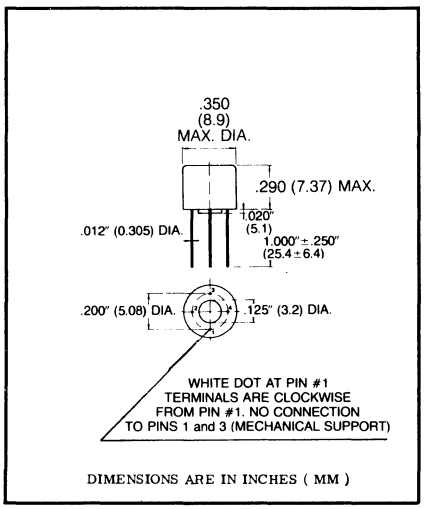
For all units the current (AMP) shown is to deflect 1 radius at 10KV.

PENN-TRAN

Penn-Tran Corporation, Route 144 North, P.O. Box 1321, Wingate, PA 16880
814-355-1521 Telex 706473

PICO's ultra-miniature HIGH "Q" INDUCTORS

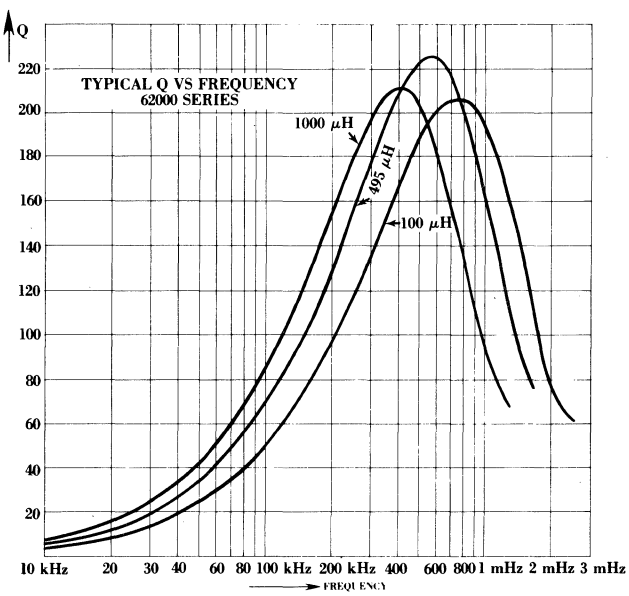
- ± 2% inductance stability vs temperature
- Smallest possible size
- Extreme resistance to thermal shock
- Meets Mil-T-27D (TF5R20ZZ)
- All units are magnetically shielded
- Non-standard inductance values available at 10% higher cost than nearest standard inductor.



Delivery— stock to one week

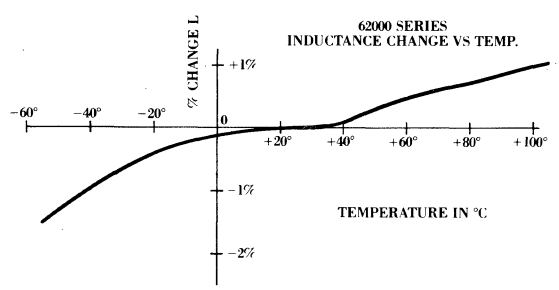
"62000" SERIES

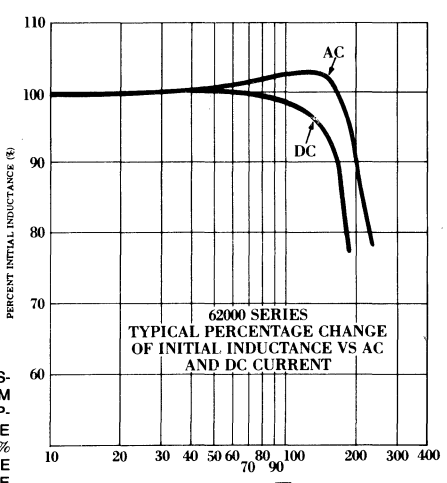
PART NUMBER	INDUCTANCE (MICRO-HENRYS)	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (MHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	PRICE (1-9)
62112	2500	18	1.15	80	180 at (400 kHz)	16.24
62132	1500	10	1.5	100	180 at (400 kHz)	16.24
62152	992	7	1.8	125	200 at (400 kHz)	16.24
62172	900	6.5	1.9	130	200 at (400 kHz)	16.24
62192	800	6.0	2.1	140	200 at (400 kHz)	16.24
62212	742	5.7	2.3	150	200 at (500 kHz)	16.24
62232	702	5.5	2.5	155	200 at (500 kHz)	16.24
62252	600	5.0	2.7	160	200 at (500 kHz)	16.24
62272	495	4.5	3	170	200 at (500 kHz)	16.24
62292	400	3.7	3.3	185	180 at (500 kHz)	16.24
62312	298	2.8	3.8	215	170 at (500 kHz)	16.24
62332	248	2.3	4.2	235	170 at (500 kHz)	16.24
62352	196	1.8	4.75	265	160 at (500 kHz)	16.24
62372	150	1.4	5.5	300	160 at (500 kHz)	16.24
62392	100	1.2	6.8	330	150 at (500 kHz)	16.24



SPECIFICATIONS:

- INDUCTANCE TOLERANCE ±3% AT 0.1V-100KHZ
- INDUCTANCE STABILITY VS TEMPERATURE ±2% -55°C TO 105°C
- MEETS MIL-T-27D TF5R20ZZ
- WEIGHT 1 GRAM
- THERMAL SHOCK 100 CYCLES, METHOD 107D MIL-STD 202E TEST CONDITION A3
- UNIT HAS MAGNETIC SHIELD





ALL INDUCTORS ARE MEASURED AT 0 DC. THE MAXIMUM DC LISTINGS ARE FOR APPROXIMATELY 30°C HEAT RISE AND APPROXIMATELY 2% DROP IN INDUCTANCE. THE CHANGE OF INDUCTANCE WITH AC OR DC CURRENTS IS ILLUSTRATED BY THE CURVES. THE EXCITATION IS PLOTTED IN mA $\times\sqrt{mHy}$. FOR EXAMPLE THE 0.495 mH INDUCTOR (62272) WITH 170 mA DC FLOWING WILL HAVE AN EXCITATION OF mA $\times\sqrt{mHy}$ = 120, AND THE INDUCTANCE WILL DROP FROM 495 uH to 485 uH. IF THE 170 mA WAS AC, THE INDUCTANCE WOULD BE 510 uH.

For immediate engineering assistance or to place an order—

Call Toll Free 800-431-1064

PICO Electronics, Inc.

453 North MacQuesten Pkwy., Mt. Vernon, N.Y. 10552

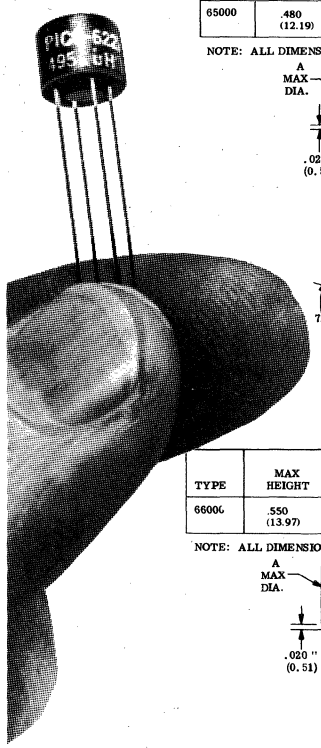
914-699-5514 • TWX 7105620113

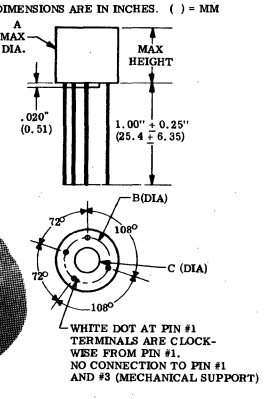
PICO's miniature HIGH "Q" INDUCTORS

- ± 1% inductance stability vs temperature
- Smallest possible size
- Extreme resistance to thermal shock
- Meets Mil-T-27D (TF5R20ZZ)
- All units are magnetically shielded

TYPE	MAX HEIGHT	A MAX DIA.	B BOLT CIRCLE	C STAND-OFF
63000	.310 (7.87)	.420 (10.69)	.260 (6.6)	.160 (4.06)
64000	.350 (8.89)	.530 (13.5)	.350 (8.89)	.250 (6.35)
65000	.480 (12.19)	.670 (17.0)	.440 (11.17)	.340 (8.64)

NOTE: ALL DIMENSIONS ARE IN INCHES. ( ) = MM

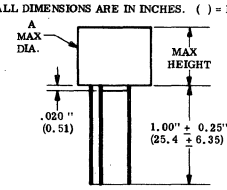


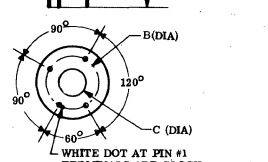


WHITE DOT AT PIN #1 TERMINALS ARE CLOCK-WISE FROM PIN #1. NO CONNECTION TO PIN #1 AND #3 (MECHANICAL SUPPORT)

TYPE	MAX HEIGHT	A MAX DIA	B BOLT CIRCLE	C STAND-OFF
66000	.550 (13.97)	.840 (21.34)	.560 (14.22)	.460 (11.68)

NOTE: ALL DIMENSIONS ARE IN INCHES. ( ) = MM





WHITE DOT AT PIN #1 TERMINALS ARE CLOCK-WISE FROM PIN #1. NO CONNECTION TO PIN #2 AND #4 (MECHANICAL SUPPORT)

ALL INDUCTORS ARE MEASURED AT 0 DC. THE MAXIMUM DC LISTINGS ARE FOR APPROXIMATELY 5% DROP IN INDUCTANCE AND NEGLIGIBLE HEAT RISE. THE CHANGE OF INDUCTANCE WITH AC OR DC CURRENTS IS ILLUSTRATED BY THE CURVES SHOWN FOR EACH INDUCTOR TYPE. THE EXCITATION IS PLOTTED IN mA X $\sqrt{mH}$. FOR EXAMPLE THE 10 mH INDUCTOR (64314) WITH 79 mA DC FLOWING WILL HAVE AN EXCITATION OF mA X $\sqrt{mH}$ = 79 X $\sqrt{10}$ = 250 AND THE INDUCTANCE WILL DROP FROM 10 mH TO 9mH. IF THE 79 mA WAS AC THE INDUCTANCE WOULD BE 9.65 mH.

For immediate engineering assistance or to order—
Call Toll Free 800-431-1064
PICO Electronics, Inc.
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552
914-699-5514 • TWX 7105620113

"63000" SERIES

PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (KHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1-9)
63120	1 Hy	1840	47	5.7	30 at (10 kHz)	18.27
63140	750 mH	1380	54	6.6	30 at (10 kHz)	17.63
63160	500 mH	920	66	8	30 at (10 kHz)	16.60
63180	200 mH	368	105	12.5	60 at (20 kHz)	16.60
63200	100 mH	185	148	18	60 at (20 kHz)	16.60
63220	75 mH	140	172	20.8	100 at (40 kHz)	16.60
63240	50 mH	90	210	25.5	100 at (40 kHz)	16.60
63260	30 mH	55	270	33	100 at (40 kHz)	16.60
63280	20 mH	37	332	40	100 at (40 kHz)	16.60
63300	15 mH	28	383	46	100 at (40 kHz)	16.60
63320	10 mH	18.5	470	57	100 at (40 kHz)	16.60
63340	5 mH	10	665	80	100 at (40 kHz)	16.60
63360	1 mH	2	1480	180	100 at (40 kHz)	18.27

"64000" SERIES

PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT F REQUENCY (KHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1-9)
64114	5 Hy	3000	17	2.8	15 at (2 kHz)	19.88
64134	3 Hy	1800	22	3.6	30 at (4 kHz)	19.17
64154	2 Hy	1200	27	4.4	30 at (4 kHz)	18.27
64174	1 Hy	600	38	6.3	30 at (4 kHz)	16.60
64194	750 mH	450	44	7.3	30 at (4 kHz)	16.60
64214	500 mH	300	54	9	30 at (4 kHz)	16.60
64234	250 mH	150	76	13	65 at (10 kHz)	16.60
64254	100 mH	60	120	20	65 at (10 kHz)	16.60
64274	75 mH	45	139	23	120 at (20 kHz)	16.60
64294	50 mH	30	170	28	120 at (20 kHz)	16.60
64314	10 mH	6	380	63	200 at (40 kHz)	16.60
64334	5 mH	3	537	89	200 at (40 kHz)	16.60
64354	1 mH	6	1200	200	200 at (40 kHz)	18.27

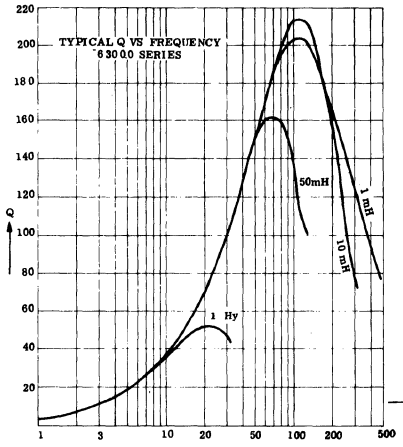
"65000" SERIES

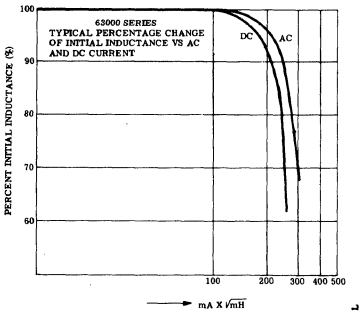
PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (kHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1-9)
65413	10 Hy	3800	11.7	2.8	28 at (2 kHz)	19.88
65433	5 Hy	1900	16.5	3.9	28 at (2 kHz)	19.17
65453	3 Hy	1140	21	5.1	28 at (2 kHz)	18.27
65473	2 Hy	760	26	6.3	56 at (4 kHz)	18.27
65493	1 Hy	380	37	8.8	56 at (4 kHz)	16.60
65513	500 mH	190	52	12.5	56 at (4 kHz)	16.60
65533	250 mH	95	74	17.7	140 at (10 kHz)	16.60
65553	100 mH	38	117	28	140 at (10 kHz)	16.60
65573	50 mH	19	165	39.6	240 at (20 kHz)	16.60
65593	10 mH	3.8	370	88.5	240 at (20 kHz)	16.60

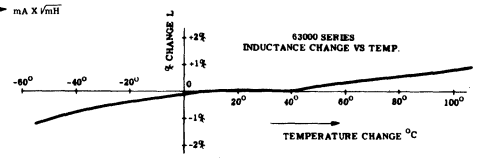
"66000" SERIES

PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (kHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1-9)
66218	10 Hy	2200	11	4.2	50 at (2 kHz)	19.88
66238	5 Hy	1100	15.7	6	50 at (2 kHz)	19.17
66258	3 Hy	660	20	7.7	100 at (4 kHz)	19.17
66278	2 Hy	440	25	9.4	100 at (4 kHz)	16.60
66298	1 Hy	220	35	13	100 at (4 kHz)	16.60
66318	500 mH	110	49	18.8	100 at (4 kHz)	16.60
66338	250 mH	55	70	26.6	200 at (10 kHz)	16.60
66358	100 mH	22	110	42	200 at (10 kHz)	16.60
66378	50 mH	11	156	59	200 at (10 kHz)	16.60
66398	10 mH	2.2	350	133	200 at (10 kHz)	16.60

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

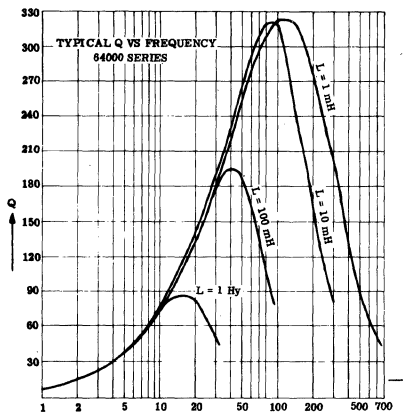


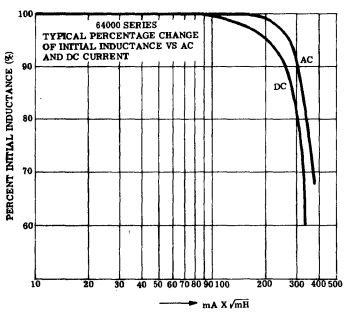


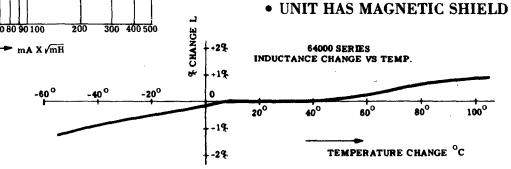


SPECIFICATIONS: **"63000" SERIES**

- INDUCTANCE TOLERANCE
  ± 2% AT .1V - 4 kHz.
- INDUCTANCE STABILITY VS TEMP.
  ± 1% - 30°C TO + 105°C
  ± 1%
  - 2% - 55°C TO + 105°C
- MEETS MIL -T-27D (MIL TYPE TF5R20ZZ)
- WEIGHT 2.2 GRAMS
- THERMAL SHOCK:
  100 CYCLES, METHOD 107D, MIL-STD 202E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD

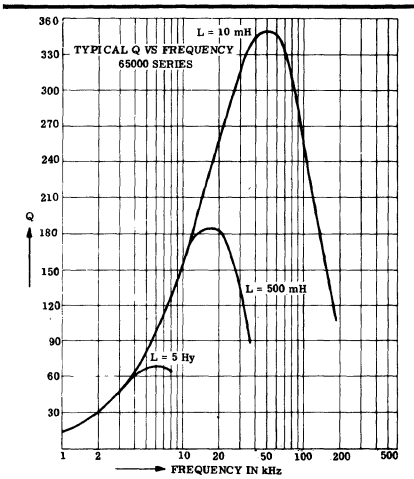


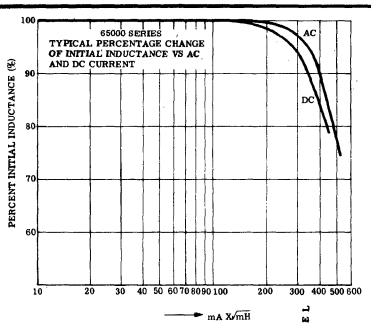


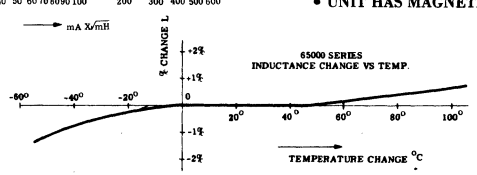


SPECIFICATIONS: **"64000" SERIES**

- INDUCTANCE TOLERANCE
  ± 2% AT .1V - 2 kHz
- INDUCTANCE STABILITY VS TEMP.
  ± 1% - 30°C TO + 105°C
  ± 1%
  - 2% - 55°C TO + 105°C
- MEETS MIL -T-27D (MIL TYPE TF5R20ZZ)
- WEIGHT 3 GRAMS
- THERMAL SHOCK:
  100 CYCLES, METHOD 107D, MIL-STD 202E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD

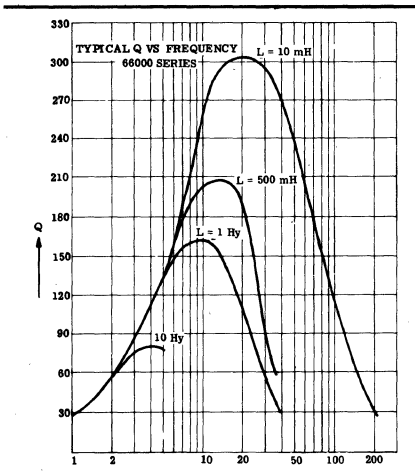


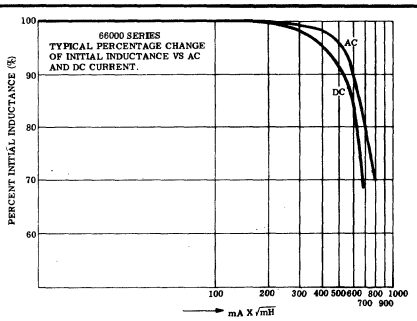


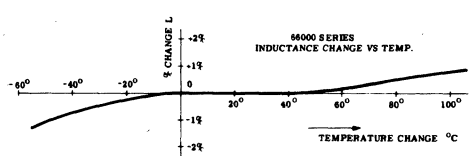


SPECIFICATIONS: **"65000" SERIES**

- INDUCTANCE TOLERANCE
  ± 2% AT .1V - 1 kHz
- INDUCTANCE STABILITY VS TEMP.
  ± 1% - 30°C TO + 105°C
  ± 1%
  - 2% - 55°C TO + 105°C
- MEETS MIL -T-27D (MIL TYPE TF5R20ZZ)
- WEIGHT 6 GRAMS
- THERMAL SHOCK:
  100 CYCLES, METHOD 107D, MIL-STD 202E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD







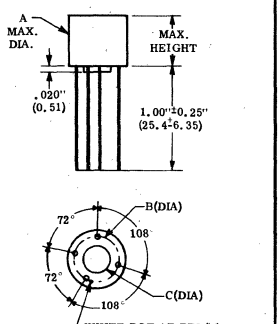
SPECIFICATIONS: **"66000" SERIES**

- INDUCTANCE TOLERANCE
  ± 2% AT .1V - 1 kHz
- INDUCTANCE STABILITY VS TEMP.
  ± 1% - 30°C TO + 105°C
  ± 1%
  - 2% - 55°C TO + 105°C
- MEETS MIL -T-27D (MIL TYPE TF5R20ZZ)
- WEIGHT 13 GRAMS
- THERMAL SHOCK:
  100 CYCLES, METHOD 107D, MIL-STD 202E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD

PICO's Miniaturized Power Inductors

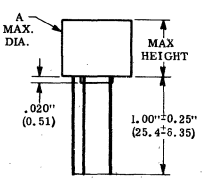
Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off
1	.280 (7.11)	.410 (10.41)	.260 (6.6)	.160 (4.06)
2	.340 (8.63)	.500 (12.7)	.350 (8.89)	.250 (6.35)
3	.415 (10.54)	.630 (16.0)	.440 (11.17)	.340 (8.64)

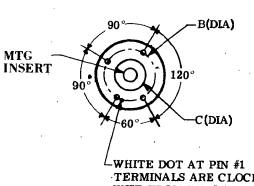
ALL DIMENSIONS ARE IN INCHES, ( ) = MM



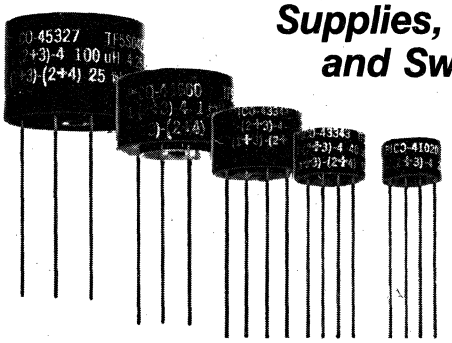
Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off	Mtg. Insert
4	500 (12.7)	800 (20.32)	560 (14.22)	460 (11.68)	—
5	650 (16.51)	950 (24.13)	670 (17.0)	570 (14.48)	6-32 UNC, 8 Threads Deep

ALL DIMENSIONS ARE IN INCHES, ( ) = MM





These Inductors are ideal for Noise, Spike and Power Filtering Applications in Power Supplies, DC-DC Converters and Switching Regulators



- Minimum possible size
- Meets MIL-T-27D (TF5S04ZZ)
- Special high frequency core material to insure low losses
- All units have split windings
- Large selection of sizes available
- All units are magnetically shielded

All inductors have split windings—ratings shown in table are for series connection. Parallel connection will have ¼ inductance at twice the DC current and ¼ the DC resistance, ie. parallel connection of PICO-41020 will have 5 millihenry at .12 Amps DC with DC resistance of 13.5 Ohms

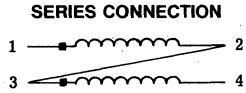
INDUCTANCE	I_{DC} (AMPS)	R_{DC} (OHMS)	SIZE	MODEL NUMBER	*** PRICE 1-9
20 MILLI-HENRY	.06	54	1	41020	12.86
	.10	29	2	42105	12.86
	.14	20	3	43103	12.86
	.22	12.4	4	44500	15.39
	.29	10.2	5	45107	15.39
15 MILLI-HENRY	.07	40.5	1	41040	12.86
	.12	22	2	42125	12.86
	.16	15	3	43123	12.86
	.25	9.3	4	44520	15.39
	.33	7.7	5	45127	15.39
10 MILLI-HENRY	.08	27	1	41060	12.86
	.14	14.6	2	42145	12.86
	.20	10	3	43143	12.86
	.31	6.2	4	44560	15.39
	.40	5.1	5	45147	15.39
7.5 MILLI-HENRY	.10	20.3	1	41080	12.86
	.17	11	2	42165	12.86
	.24	7.5	3	43163	12.86
	.38	4.7	4	44580	15.39
	.49	3.8	5	45167	15.39
5 MILLI-HENRY	.12	13.5	1	41100	12.86
	.21	7.3	2	42185	12.86
	.30	5	3	43183	12.86
	.47	3.1	4	44600	15.39
	.6	2.6	5	45187	15.39
3 MILLI-HENRY	.16	8.1	1	41120	12.86
	.27	4.4	2	42205	12.86
	.38	3	3	43203	12.86
	.6	1.9	4	44620	15.39
	.78	1.5	5	45207	15.39
2 MILLI-HENRY	.19	5.4	1	41140	12.86
	.33	2.9	2	42225	12.86
	.47	2	3	43223	12.86
	.74	1.3	4	44640	15.39
	.95	1	5	45227	15.39
1 MILLI-HENRY	.27	2.7	1	41160	12.86
	.47	1.5	2	42245	12.86
	.66	1	3	43243	12.86
	1	.62	4	44660	15.39
	1.3	.5	5	45247	15.39
750 MICRO-HENRY	.31	2	1	41180	12.86
	.54	1	2	42265	12.86
	.76	.75	3	43263	12.86
	1.2	.47	4	44680	15.39
	1.6	.38	5	45267	15.39
500 MICRO-HENRY	.38	1.3	1	41200	12.86
	.66	.66	2	42285	12.86
	.93	.5	3	43283	12.86
	1.47	.31	4	44700	15.39
	1.9	.25	5	45287	15.39
250 MICRO-HENRY	.53	.66	1	41220	12.86
	.93	.33	2	42305	12.86
	1.3	.25	3	43303	12.86
	2.08	.16	4	44720	15.39
	2.7	.13	5	45307	15.39
100 MICRO-HENRY	0.78	.300	1	41240	12.86
	1.35	.170	2	42325	12.86
	1.95	.110	3	43323	12.86
	3.08	.070	4	44740	15.39
	3.88	.060	5	45327	15.39
40 MICRO-HENRY	1.18	.141	1	41260	12.86
	2.03	.070	2	42345	12.86
	2.68	.060	3	43343	12.86

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

SPECIFICATIONS:

- All units meet MIL-T-27D and are type TF5S04ZZ
- Inductance measured at 0.1 VRMS-10 kHz
- Temperature rise at rated D.C. current is less than 30°C
- Maximum ambient is 100°C
- Unit has magnetic shield

TERMINAL ARRANGEMENT SERIES CONNECTION



PARALLEL CONNECTION

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

For immediate engineering assistance or to place an order—

Call Toll Free 800-431-1064

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552
914-699-5514 • TWX 7105620113

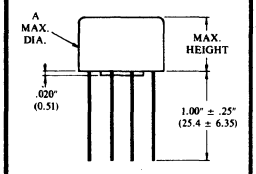
Delivery—stock to one week

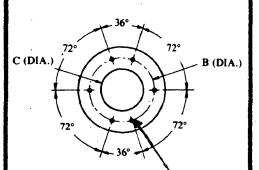
PICO's EMI Common Mode Suppression Inductors

- **Minimum possible size**
- **130°C operation (Ambient + Temp. Rise)**
- **Windings Balance ± 1%**
- **Dielectric Strength .... 1500 Volts RMS**
- **All units are magnetically shielded**

These Inductors are well suited for use in Switching Regulators, DC to DC Power Supplies and all types of Electrical Equipment where the elimination of line transmitted Electromagnetic Interference is important. Electrical equipment will generate noise due to switching operations of transistors, SCR's, relays, triacs, etc. By using these Inductors, noise being fed back to the power line is minimized to an acceptable level and this noise will not interfere with other equipment operating on the same power line.

Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off
1	.280 (7.11)	.410 (10.41)	.260 (6.6)	.160 (4.06)
2	.340 (8.63)	.500 (12.7)	.350 (8.89)	.250 (6.35)
3	.415 (10.54)	.630 (16.0)	.440 (11.17)	.340 (8.64)

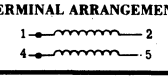




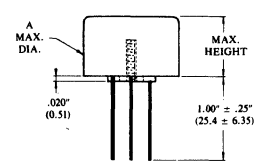
WHITE DOT AT PIN #1 TERMINALS ARE CLOCK-WISE FROM PIN #1.
PINS 3 and 6 HAVE NO CONNECTION (MECHANICAL SUPPORT ONLY).

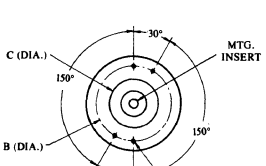
Dimensions are in inches (MM)

TERMINAL ARRANGEMENT



Size	Max. Height	A Max. Dia	B Bolt Circle	C Stand-Off	Mtg Insert
4	.500 (12.7)	.800 (20.32)	.560 (14.22)	.460 (11.68)	2-56 UNC 6 Threads Deep
5	.650 (16.51)	.950 (24.13)	.670 (17.0)	.570 (14.48)	6-32 UNC 8 Threads Deep
6	.745 (18.92)	1.125 (28.57)	.800 (20.32)	.700 (17.78)	6-32 UNC 8 Threads Deep

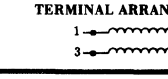




WHITE DOT AT PIN #1 TERMINALS ARE CLOCK-WISE FROM PIN #1.

Dimensions are in inches (MM)

TERMINAL ARRANGEMENT

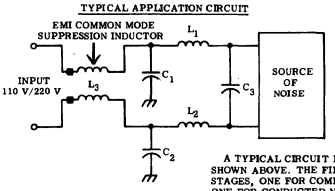


INDUCTANCE	IRMS (AMPS) TEMP. RISE 60°C	TEMP. RISE 40°C	TEMP. RISE 25°C	RDC. (OHMS) EACH WDG.	APPROX. LEAKAGE INDUCTANCE (MICRO-HENRY)	SIZE	MODEL NUMBER	PRICE 1-9
75 MICRO-HENRY	1.95	1.57	1.29	.051	3.5	1	46283	14.38
	2.57	2.20	1.90	.033	3.5	2	47291	14.38
	4.43	3.79	3.23	.015	4	3	48381	14.38
185 MICRO-HENRY	1.25	1.00	.959	.125	5	1	46263	14.38
	1.61	1.39	1.19	.083	5	2	47271	14.38
	2.80	2.39	2.04	.038	4.5	3	48361	14.38
	4.58	3.83	3.06	.019	4.5	4	49461	17.26
375 MICRO-HENRY	.862	.691	.572	.263	9	1	46243	14.38
	1.14	.986	.851	.163	8	2	47251	14.38
	1.98	1.70	1.44	.075	8	3	48341	14.38
	3.23	2.70	2.16	.037	7.5	4	49441	17.26
	4.70	4.18	3.04	.021	6.5	5	50241	17.26
550 MICRO-HENRY	.711	.568	.472	.31	10.3	1	46223	14.38
	.924	.792	.686	.20	8.9	2	47231	14.38
	1.62	1.38	1.18	.09	8.4	3	48321	14.38
	2.64	2.20	1.77	.045	7.7	4	49421	17.26
	3.80	3.39	2.46	.026	7.5	5	50221	17.26
750 MICRO-HENRY	.619	.495	.410	.41	13.8	1	46203	14.38
	.814	.694	.601	.26	11.9	2	47211	14.38
	1.40	1.20	1.02	.12	11.3	3	48301	14.38
	2.29	1.91	1.53	.06	10.3	4	49401	17.26
	3.33	2.96	2.15	.034	10.0	5	50201	17.26
	5.10	4.23	3.77	.022	9.4	6	51303	18.94
1.5 MILLI-HENRY	.437	.349	.290	.82	27.5	1	46183	14.38
	.575	.491	.425	.52	23.8	2	47191	14.38
	.986	.847	.722	.24	22.5	3	48281	14.38
	1.61	1.36	1.08	.12	20.6	4	49381	17.26
	2.31	2.06	1.50	.07	20	5	50181	17.26
	3.78	3.14	2.80	.04	18.8	6	51283	18.94
3 MILLI-HENRY	.308	.246	.204	1.65	55	1	46163	14.38
	.405	.345	.299	1.05	47.5	2	47171	14.38
	.708	.605	.516	.47	45.0	3	48261	14.38
	1.14	.959	.766	.24	41.3	4	49361	17.26
	1.64	1.45	1.06	.14	40.0	5	50161	17.26
	2.53	2.09	1.86	.09	37.5	6	51263	18.94
6.75 MILLI-HENRY	.205	.165	.136	3.71	123.8	1	46143	14.38
	.270	.231	.200	2.36	106.9	2	47151	14.38
	.468	.401	.342	1.07	101.3	3	48241	14.38
	.769	.643	.516	.53	92.8	4	49341	17.26
	1.10	.977	.711	.31	90.0	5	50141	17.26
	1.69	1.41	1.25	.20	84.4	6	51243	18.94
12 MILLI-HENRY	.154	.123	.101	6.6	220	1	46123	14.38
	.202	.172	.150	4.2	190	2	47131	14.38
	.352	.299	.255	1.9	180	3	48221	14.38
	.572	.480	.378	.95	165	4	49321	17.26
	.827	.730	.528	.55	160	5	50121	17.26
	1.28	1.06	.942	.35	150	6	51223	18.94

SPECIFICATIONS

- **All units meet MIL-T-27D and are type TF5S04ZZ**
- **Inductance measured at 0.1VRMS-10kHz**
- **Unit has magnetic shield**
- **Dielectric Strength .... 1500 Volts RMS**
- **Windings Balanced ± 1%**
- **Maximum ambient plus temp. rise limited to 130°C (ie maximum ambient of part no. 46283 would be 105°C if I_{RMS} is 1.29 AMPS)**

TYPICAL APPLICATION CIRCUIT



A TYPICAL CIRCUIT FOR THE ELIMINATION OF NOISE IS SHOWN ABOVE. THE FILTER CONTAINS TWO STAGES, ONE FOR COMMON MODE NOISE (L_3, C_1, C_2) AND ONE FOR CONDUCTED NOISE (L_1, L_2, AND C_3).

*For immediate engineering assistance or to place an order—***Call Toll Free 800-431-1064**

Delivery—stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • TWX 7105620113

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A

AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire gauge

B

BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C

CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D

D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E

EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F

FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G

GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H

HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I

IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J

JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K

kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L

LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M

MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microforad
MHz megahertz
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOSIGT metal-oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N

NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM nuclear instrumentation module
NOR not OR
NTC negative temperature coefficient

O

OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P

PC printed circuit
PCB printed circuit board
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLL phased lock loop
PPI plan position indicator
PROM programmable read only memory
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q

QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R

RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S

SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T

TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U

UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V

VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W

WPS word processing software

Y

YIG yttrium iron garnet

Z

ZIF zero insertion force

PICONICS

INDUCTIVE COMPONENTS
FOR MICROELECTRONIC CIRCUITS

LEADED/CHIP
TUNABLE/FIXED

PICONICS components feature excellent stability, high Q and controlled characteristics.
PICONICS offers custom design capability.
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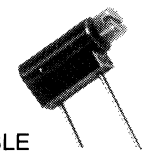
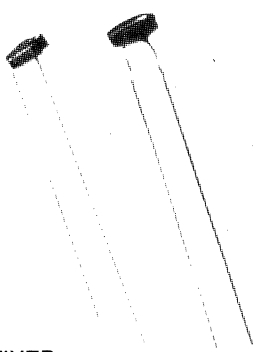
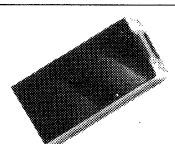
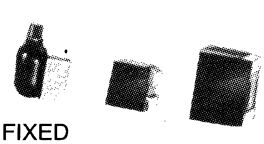
LEADED INDUCTOR SELECTION TABLE — MIL-C-15305

	Series	Length	Width	Height	Inductance	Case	Adjustment	QPL
 TUNABLE	B	.325-.475	.110	.150	.020uH to 1MH	Molded	Screw (side)	Yes
	G	.150-.300	.090	.105	.018uH to 1MH	Conformal Coating	Slide	In Process
	ST	.200	.100	.275	.020uH to 1MH	Molded	Screw (top)	Yes
	TT	.285	.110	.325-.450	.020uH to 1MH	Molded	Screw (top)	Yes
 FIXED	C	.200	.090	.105	.010uH to 1MH	Notes: Conformal Coating		In Process
	D	.200	.085 or .095	.085 or .095	.010uH to 1MH	Molded Case		In Process
	JA	.110 or .180	.060 or .075	.060 or .075	.045uH to 1MH	Epoxy Coated, Open Frame Case Self-Leaded		In Process
	JC	.180	.085	.085	.045uH to 1MH	Bonded, Open Frame Case Self Leaded		In Process
	M	.004-.170	.027	.027	.18nh to 1uh	Bonded, Air Core High Frequency Choke Self-Leaded		In Process
	S	.200	.100	.100	5nh to 330nh	Epoxy Conformal Coating Self-Leaded, Tinned Air Core High Frequency Choke		In Process

CHIP INDUCTOR SELECTION TABLE — MIL-C-83446

	Series	Length	Width	Height	Inductance	Case	Adjustment	QPL
 TUNABLE	PGV	.160	.125	.330	.012uH to 1MH	Molded	Screw (top)	Yes
	PSV	.320	.165	.130	.012uH to 1MH	Molded	Screw (side)	Yes
	PV	.150-.300	.140	.065 or .095	.012uH to 1MH	Conformal Coating	Slide	Yes
	PVW	.150-.300	.140	.065 or .095	.010uH to 1MH	Conformal Coating	Slide	Yes
	P	.180	.140	.065 or .095	.010uH to 1MH	Notes: Conformal Coating		Yes
	PA	.100	.100	.100 or .120	.010uH to 1MH	Epoxy Molded— Minimum Area Profile		In Process
	PG	.160	.125	.130	.010uH to 1MH	Molded Diallyl-Phthalate (DAP) Solder Fillet, Interlock Substrate Easily handled by automatic Equipment		In Process
 FIXED	PK	.160	.125	.130	.010uH to 1MH	Molded Epoxy Case, Solder Fillet Interlock Substrate Easily handled by automatic Equipment		In Process
	PW	.180	.140	.065 or .095	.010uH to 1MH	Conformal Coating Bonding Pad Completes Connection		Yes

See Section 2700 pg. A•1618 for FILTERS
See Section 3130 pg. A•1696 for HYBRID requirements

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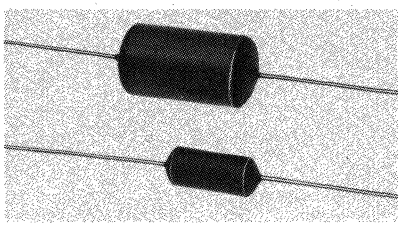
RENCO ELECTRONICS, INC.

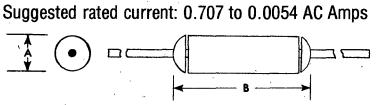
Shielded Inductors RL1123/RL1124



Low cost, miniature shielded coils, extremely useful in compact audio filters, tone control circuits, amplifiers, and wherever high inductance coils are needed. Excellent, low cost alternatives to fixed pot cores.

Series RL1123: (96 values)
Inductance: 1.0 μH to 47.0 H
Max DCR: 0.0066 to 5170.0 Ohms
Suggested rated current: 1.5 to 0.0054 AC Amps

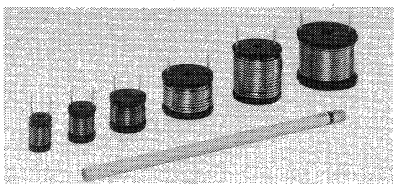
Series RL1124: (80 values)
Inductance: 1.0 μH to 4.7 H
Max DCR: 0.011 to 1700.0 Ohms
Suggested rated current: 0.707 to 0.0054 AC Amps



DIM. (IN)		RL1123	RL1124
	A	.500 max.	.260 max.
	B	.950 max.	.700 max.

WEIGHT: RL1123...15 gm max, approx.
RL1124... 5 gm max, approx.
LEADS: No. 20 tinned copper 1-1/4' long min.

Power Line Chokes RL1256/1283/1284



Available in 406 standard values. High saturation flux density material makes these coils ideal wherever high current choke values in a small physical size are needed.

Series RL1256-1: (34 values)
Inductance: 1.0 to 560.0 μH
Max DCR: 0.003 to 0.696 Ohms
Saturation current: 87.0 to 2.9 DC Amps
Suggested Rated current: 9.0 to 0.8 AC Amps
Dimension "E": 0.406 to 0.550

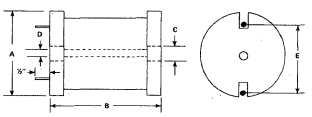
Series RL1256-2: (41 values)
Inductance: 1.0 to 2200.0 μH
Max DCR: 0.003 to 1.54 Ohms
Saturation current: 108.0 to 2.90 DC Amps
Suggested rated current: 11.4 to 0.8 AC Amps
Dimension "E": 0.590 to 0.671

Series RL1256-3: (45 values)
Inductance: 1.0 to 4700.0 μH
Max DCR: 0.003 to 1.86 Ohms
Saturation current: 116.0 to 1.7 DC Amps
Suggested rated current: 21.0 to 1.0 AC Amps
Dimension "E": 0.750 to 0.800

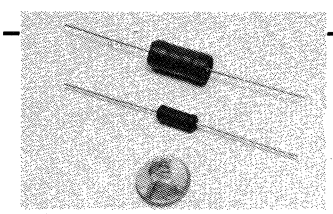
Series RL1256-4: (48 values)
Inductance: 1.8 to 15000.0 μH
Max DCR: 0.002 to 3.39 Ohms
Saturation current: 150.0 to 1.5 DC Amps
Suggested rated current: 27.0 to 1.3 AC Amps
Dimension "E": 1.11 to 1.187

Series RL1256-5: (48 values)
Inductance: 1.8 to 15000.0 μH
Max DCR: 0.002 to 2.17 Ohms
Saturation current: 155.0 to 1.5 DC Amps
Suggested rated current: 35.0 to 2.0 AC Amps
Dimension "E": 1.11 to 1.28

Series RL1256-6: (49 values)
Inductance: 4.7 to 47000.0 μH
Max DCR: 0.002 to 6.19 Ohms
Saturation current: 149.9 to 1.2 DC Amps
Suggested rated current: 35.0 to 1.4 AC Amps
Dimension "E": 1.31 to 1.53



DIM. (IN)	A	B	C	D
RL1256-1	0.660	0.84	0.195	Clearance Hole For 4/40 Screw
RL1256-2	0.825	0.84	0.195	
RL1256-3	1.1	0.84	0.195	
RL1256-4	1.6	1.03	0.290	Clearance Hole For 8/32 Screw
RL1256-5	1.6	1.45	0.290	
RL1256-6	2.0	1.50	0.320	

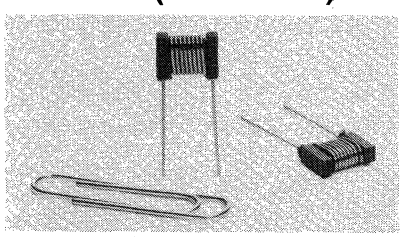


Series RL1283: (54 values)
Inductance: 3.9 to 100000.0 μH
Max DCR: 0.007 to 89.7 Ohms
Saturation current: 15.5 to 0.081 DC Amps
Suggested rated current: 4.0 to 0.065 AC Amps

Series RL1284: (45 values)
Inductance: 3.9 to 18000.0 μH
Max DCR: 0.008 to 48.3 Ohms
Saturation current: 7.3 to 0.091 DC Amps
Suggested rated current: 1.28 to 0.039 AC Amps

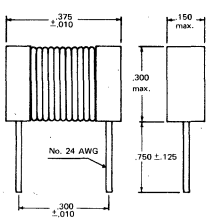
DIM. RL-1283 (A) 0.453 max. **(B)** 0.900 max.
(IN) RL-1284 (A) 0.260 max. **(B)** 0.650 max.

Flat Coils RL1160 (45 values)

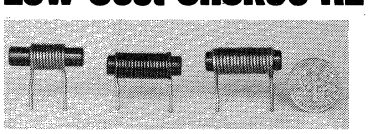


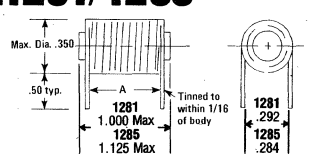
Unique flat coil configuration ideally suited to high density PCBs. Twice the inductance and Q values than axial lead inductors occupying the same space. Wide range of inductance and Q values for use at radio as well as audio frequencies.

Inductance:
1.0 to 4700.0 μH
Frequency:
7.9 MHz to 250.0 KHz
Min Q: 37.0 to 63.0
Max DCR:
0.010 to 29.9 Ohms
Saturation current:
7.0 to 0.11 DC Amps
Suggested rated current: 2.25 to 0.027 AC Amps



Low Cost Chokes RL1281/1285





Heavy duty, general purpose inductors use ferrite cores and offer a wide range of inductance values. Their compact size and pretinned leads make them easy to use in printed circuit boards.

Series RL1281: (23 values)
Max current: 4 Amps
Inductance (±15%)*: 0.22 to 12.50 μH
Max DCR: 0.003 to 0.025 Ohms
Dimension "A": 0.187 to 0.875

Series RL1285: (19 values)
Max current: 6 Amps
Inductance (±15%)*: 0.22 to 10.20 μH
Max DCR: 0.002 to 0.015 Ohms
Dimension "A": 0.125 to 0.883

*Measured at 1 KHz

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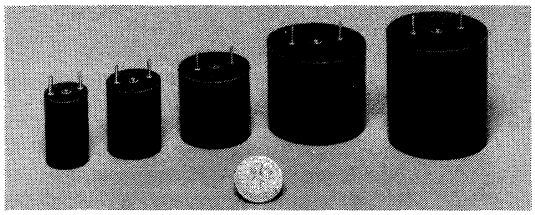
Mil Spec Inductors RL1324/1325/1326

RENCO ELECTRONICS, INC.



Encapsulated power line chokes, designed to meet MIL-T-27D. The use of high saturation flux density material makes these coils ideal for a wide variety of circuit applications that require compact power inductors. A threaded bushing is an integral part of the RL1324 Series, permitting secure fastening to a printed circuit board or chassis. The terminal pins are plated to ensure ease of soldering.

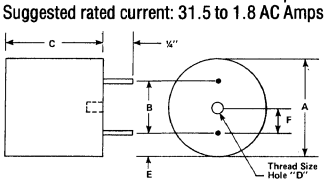
Series RL1324-1: (34 values)
Inductance: 1.0 to 560.0 μH
Max DCR: 0.003 to 0.696 Ohms
Saturation current: 87.0 to 2.9 DC Amps
Suggested rated current: 8.1 to 0.7 AC Amps

Series RL1324-2: (41 values)
Inductance: 1.0 to 2200.0 μH
Max DCR: 0.003 to 1.54 Ohms
Saturation current: 108.0 to 2.0 DC Amps
Suggested rated current: 10.2 to 0.7 AC Amps

Series RL1324-3: (45 values)
Inductance: 1.0 to 4700.0 μH
Max DCR: 0.003 to 1.86 Ohms
Saturation current: 116.0 to 1.7 DC Amps
Suggested rated current: 18.9 to 0.9 AC Amps

Series RL1324-4: (48 values)
Inductance: 1.8 to 15000.0 μH
Max DCR: 0.002 to 3.39 Ohms
Saturation current: 150.0 to 1.5 DC Amps
Suggested rated current: 24.3 to 1.1 AC Amps

Series RL1324-5: (48 values)
Inductance: 1.8 to 15000.0 μH
Max DCR: 0.002 to 2.17 Ohms
Saturation current: 155.0 to 1.5 DC Amps
Suggested rated current: 31.5 to 1.8 AC Amps

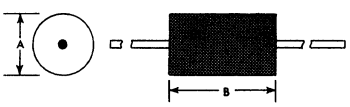


DIM. (IN)	A	B	C	D	E	F
RL1324-1	0.641	0.450	1.031	4-40	0.096	0.225
RL1324-2	0.812	0.500	1.031	4-40	0.156	0.250
RL1324-3	1.075	0.537	1.031	4-40	0.269	0.268
RL1324-4	1.500	0.750	1.312	6-32	0.375	0.375
RL1324-5	1.500	0.750	1.782	6-32	0.375	0.375

Tolerance: ±.010"

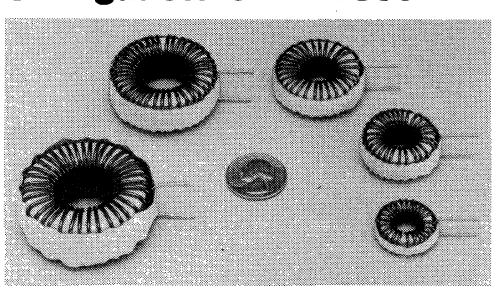
Series RL1325: (54 values)
Inductance: 3.9 to 100000.0 μH
Max DCR: 0.008 to 98.7 Ohms
Saturation current: 14.7 to 0.077 DC Amps
Suggested rated current: 3.6 to 0.077 AC Amps

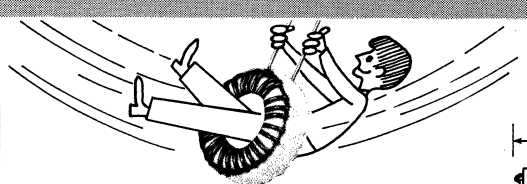
Series RL1326: (45 values)
Inductance: 3.9 to 18000.0 μH
Max DCR: 0.009 to 53.1 Ohms
Saturation current: 6.9 to 0.087 DC Amps
Suggested rated current: 1.15 to 0.035 AC Amps



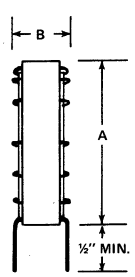
DIM. (IN)	RL 1325	RL 1326
A	0.500 ± 0.015	0.250 ± 0.015
B	1.000 ± 0.030	0.625 ± 0.030

Swingductors™ RL1386





Designed for applications requiring a known inductance change with changing current loads (as in power supplies). Although similar in appearance to conventional toroids, the special core material allows a "controlled saturation," so that a specific inductance value is repeatable at a specific current. The core material is effective up to 1 MHz. As a result of toroidal design, the Swingductor™ produces a closed magnetic field, resulting in low EMI. All are supplied with pretinned leads for easy PC board installation.



Series RL1386-1: (35 values)
Inductance at 0 Amps: 1.1 to 1500.0 μH
Current causing inductance drop of —
10%: 13.0 to 0.30 Amps;
20%: 9.4 to 0.44 Amps;
30%: 26.8 to 0.61 Amps;
40%: 35.1 to 0.81 Amps;
50%: 46.1 to 1.1 Amps
Max DCR: 0.003 to 0.469 Ohms
Suggested rated current: 5.0 to 1.2 AC Amps

Series RL1386-2: (36 values)
Inductance at 0 Amps: 1.2 to 2700.0 μH
Current causing inductance drop of —
10%: 21.7 to 0.93 Amps;
20%: 32.7 to 0.58 Amps;
30%: 45.0 to 0.78 Amps;
40%: 59.1 to 1.11 Amps;
50%: 77.7 to 1.4 Amps
Max DCR: 0.003 to 0.520 Ohms
Suggested rated current: 5.0 to 2.0 Amps

Series RL1386-3: (36 values)
Inductance at 0 Amps: 1.50 to 3900.0 μH
Current causing inductance drop of —
10%: 23.7 to 0.38 Amps;
20%: 39.2 to 0.63 Amps;
30%: 54.9 to 0.78 Amps;
40%: 73.2 to 1.2 Amps;
50%: 96.3 to 1.5 Amps
Max DCR: 0.003 to 0.541
Suggested rated current: 9.0 to 2.0 Amps

Series RL1386-4: (40 values)
Inductance at 0 Amps: 1.2 to 5600.0 μH
Current causing inductance drop of —
10%: 33.3 to 0.42 Amps;
20%: 50.4 to 0.63 Amps;
30%: 69.3 to 0.87 Amps;
40%: 90.9 to 1.1 Amps;
50%: 119.7 to 1.4 Amps
Max DCR: 0.002 to 0.348 Ohms
Suggested rated current: 14.0 to 4.5 Amps

DIM. (IN)	"A" (MAX. DIA.)	"B" (MAX. WIDTH)
RL1386-1	1.10	0.500
RL1386-2	1.45	0.874
RL1386-3	1.80	0.900
RL1386-4	2.00	1.100
RL1386-5	2.60	1.500

Series RL1386-5: (38 values)
Inductance at 0 Amps: 1.0 to 5600.0 μH
Current causing inductance drop of —
10%: 55.8 to 0.59 Amps;
20%: 83.7 to 0.9 Amps;
30%: 115.2 to 1.2 Amps;
40%: 151.2 to 2.1 Amps
Max DCR: 0.001 to .264 Ohms
Suggested rated current: 22.0 to 5.0 Amps

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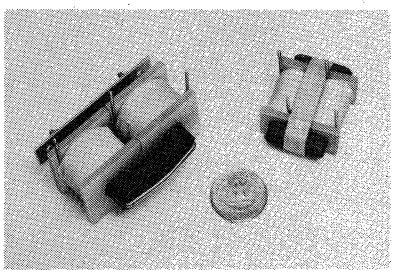
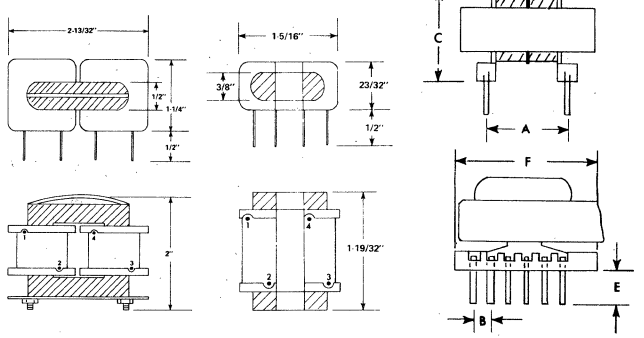
Common Mode Chokes RL1328/1329/1361



Placed at the inputs of electrical equipment, these chokes help meet U.S. and international requirements for safety and EMI. These low priced Common Mode Chokes are available in a wide range of standard inductances, with current ratings to 35 Amps.



Series RL1328: (120 values)
Inductance: 47.0 to 39000.0 μH
Max DCR: 0.002 to 0.555 Ohms
Max leakage inductance: 4.0 to 3080.0 μH
Max interwinding capacitance: 2.0 to 9.4 pF
Hipot winding to winding and winding to core: 5000 VAC
Suggested rated current: 3 to 35 AC Amps

Series RL1329: (86 values)
Inductance: 6.8 to 22000.0 μH
Max DCR: 0.0028 to 0.555 Ohms
Max leakage inductance: 1.5 to 1430.0 μH
Max interwinding capacitance: 1.0 to 10.7 pF
Hipot winding to winding and winding to core: 5000 VAC
Suggested rated current: 2 to 22 AC Amps

Series RL1361-1: (81 values)
Inductance: 47.0 to 150000.0 μH
Max DCR: 0.013 to 16.0 Ohms
Max leakage inductance: 3.5 to 3800.0 μH
Max interwinding capacitance: 6 to 36.0 pF
Hipot winding to winding and winding to core: 2500 VAC
Suggested rated current: 3.5 to 0.10 AC Amps

RENCO ELECTRONICS, INC.

...Want a **FREE** sample of any of the products shown on these pages?
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Custom Coils, Toroids and Pot Core Assemblies

Making custom coils is not just an accommodation for an occasional customer. Custom coils have always been a major part of Renco's business. We have over 29 years experience in making custom designed inductors and transformers.

As for pot core assemblies, we've manufactured millions since 1955, and are thoroughly experienced with all standard cores and hardware, including Ferroxcube, Siemens, TDK, Magnetics Inc., Indiana General, etc. We stock all the popular bobbins, including printed circuit types.

Let us assist you in your upcoming designs. Our fully independent sample and prototype department can usually ship a prototype within 10 days.

Send us your specifications and designs for your pot cores, coils, inductors, or transformers, and we'll respond promptly with very competitive prices. We have a reputation for keeping our delivery promises.

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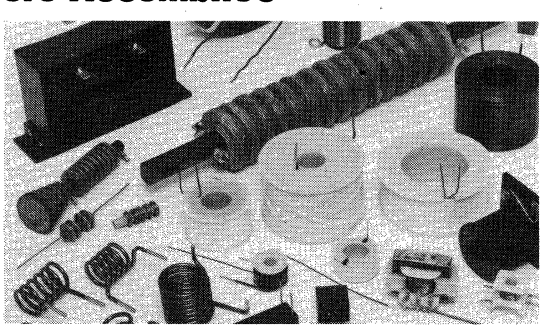

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SINCE 1955

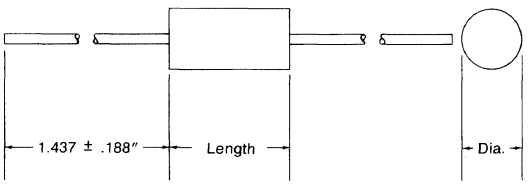
SFE TECHNOLOGIES

West-Cap Arizona

2201 East Elvira Road, Tucson, Arizona 85706-7026 • 602/294-2646 • TWX 910-952-1153

MOLDED MS INDUCTORS SHIELDED/UNSHIELDED

Tinned Copper Leads



MS Number	Series	Dimensions Inductance µH	Length	Dia. ±.010	Lead Gauge AWG
MS-90537	*SSD	.10 – 100K	.395 ± .020	.157	22
MS-75087	*SSM	.10 – .82	.410 ± .020	.162	22
MS-75088	*SSM	1.0 – 12.0	.410 ± .020	.162	22
MS-75089	*SSM	15.0 – 100K	.410 ± .020	.162	22
MS-75083	1A1000M	.10 – 1.0	.250 ± .010	.095	24
MS-75084	1A1001M	1.20 – 27.0	.250 ± .010	.095	24
MS-75085	1A1002M	33.0 – 1000.0	.250 ± .010	.095	24
MS-18130	20000M	.15 – 4.7	.375 ± .010	.156	22
MS-14046	20000M	5.6 – 33.0	.375 ± .010	.156	22
MS-90538	20000M	36.0 – 240.0	.375 ± .010	.156	22
MS-90539	40000M	270 – 1000	.440 ± .010	.190	22
MS-90541	50000M	3900 – 10K	.740 ± .010	.240	20
MS-75008	70000M	.15 – 2.7	.437 ± .030	.187 ± .030	22
MS-75101	70000M	3.3 – 27.0	.437 ± .030	.187 ± .030	22
MS-91189	80000M	1.2 – 120.0	.937 ± .062	.280 ± .030	21
MS-95052	90000M	.47 – 4.7	.560 ± .010	.215	22
MS-14052	90000M	5.6 – 39.0	.560 ± .010	.215	22
MS-90540	90000M	1100 – 3600	.560 ± .010	.215	21
MS-75052	A	47 – 150	.560 ± .010	.250	22
MS-75053	B	180 – 390	.560 ± .010	.310	21
MS-75054	C	470 – 1000	.625 ± .010	.375	21
MS-14050	D	1500 – 10K	.687 ± .010	.468	21
MS-21389	SWS	0.10 – 2.2	.430 ± .010	.178	22
MS-21390	SWS	2.7 – 100.0	.430 ± .010	.178	22
MS-21388	SWM	1.0 – 1000.0	.590 ± .010	.240	21
MS-21380	SWL	1.0 – 10K	.890 ± .010	.300	21

*Indicates shielded part.

ELECTRICAL CHARACTERISTICS

Series	Core Material VS Inductance (µH) Phenolic	Iron	Ferrite	Inductance Tol. (%)
SSD †	.10 – .82	1.0 – 12	15 – 100,000	±10
SSM †	.10 – .82	1.0 – 12	15 – 100,000	±10
1A 1000M‡	.10 – 1.0	1.2 – 27	33 – 1000	±10
20,000M ‡	.10 – 4.7	5.6 – 240	—	±20: .10µH – .47µH ±10: .56µH – 33µH ±5: 36µH – 1000µH
40,000M †	—	270 – 1000	—	±5
50,000M †	—	4300 – 10,000	—	±5
70,000M ‡	0.15 – 2.7	3.3 – 27	—	±20: .15µH – .47µH ±10: .56µH – 27µH
80,000M †	1.2 – 18	22 – 120	—	±10
90,000M †	.47 – 4.7	5.6 – 3600	—	±10: .47µH – .39µH ±5: 1100µH – 3600µH
A, B, C, D†	47 – 56	68 – 10,000	—	±10
SWS †	0.10 – 2.2	2.7 – 100	—	±20: .10µH – 1.2µH ±10: 1.5µH – 22µH ±5: 27µH – 100µH
SWM †	—	1.0 – 1000	—	±10: 1.2µH – 10µH ±5: 12µH – 1000µH
SWL †	—	1.0 – 10,000	—	±10: 1.0µH – 22µH ±5: 27µH – 10,000µH

†Dielectric strength 700 RMS @ sea level.
‡Dielectric strength 1000 RMS @ sea level.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: – 55°C to + 125°C. • **Terminal Strength:** Meets 5lb pull test per MIL-C-15305, latest revision. • **Moisture, Vibration, and Shock Resistance:** Meets requirements of MIL-C-15305, latest revision. • **Marking:** Color banded per MIL-C-15305.

ESTABLISHED RELIABILITY MIL-C-39010

West-Cap Arizona announces the availability of a molded inductor product line conforming to the latest revision of MIL-C-39010. These devices are available in shielded and unshielded configurations in many off-the-shelf values. Packaging is available in tape-and-reel, bandolier or bulk form. These inductors are available now in styles 1 through 10 from West-Cap Arizona . . . your #1 source for hi-rel inductors.

Standard Military Series	West-Cap Series	Established Reliability Series
MS 75087	SSM	MIL-C-39010-1
MS 75088	SSM	MIL-C-39010-2
MS 75089	SSM	MIL-C-39010-3
MS 75008	70,000	MIL-C-39010-4
MS 75101	70,000	MIL-C-39010-5
MS 18130	20,000	MIL-C-39010-6
MS 14046	20,000	MIL-C-39010-7
MS 75083	1A1000	MIL-C-39010-8
MS 75084	1A1000	MIL-C-39010-9
MS 75085	1A1000	MIL-C-39010-10

ORDERING TERMINOLOGY

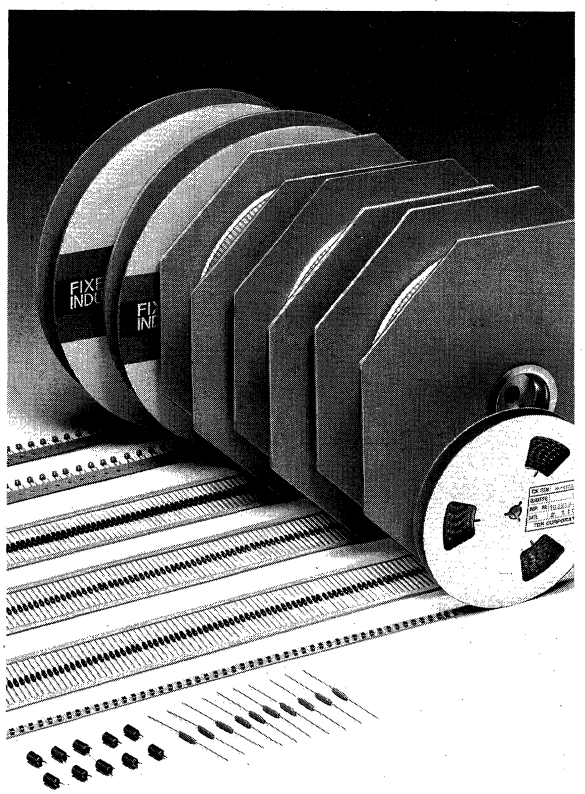
M 39010/01 A R10 J [M, P, R or S]

- M 39010 — Mil designator document sht #
- /01 — Slash sheet
- A — Class
- R10 — Inductance
- J — Inductance tolerance
- [M, P, R or S] — Failure rate level

FIXED INDUCTORS

TDK CORPORATION OF AMERICA 4711 West Golf Road, Suite 300, Skokie, Illinois 60076, U.S.A. Phone: (312) 679-8200 CHICAGO SALES OFFICE (312) 679-8200 LOS ANGELES SALES OFFICE (213) 539-6631 SAN FRANCISCO SALES OFFICE (408) 943-9325 NEW YORK SALES OFFICE (516) 625-0100 INDIANAPOLIS SALES OFFICE (317) 872-0370 DETROIT BRANCH (313) 353-9393 ALABAMA BRANCH (205) 539-4551 **TDK CORPORATION** Tokyo, Japan

Fixed inductors are used in a wide range of applications including VCRs, color TVs, stereo car radios and radio transceivers, and industrial electronics. They are also used in power-driven tools as EMI filters.



Features

1) EL type
The radial lead type inductor is commonly found in consumer products, where most EL inductors are used. TDK's original design and automated production lines mean the reliability of these inductors is very high. The EL0405 uses a very compact design and is supplied on reels.

2) SP type
The axial lead type inductor is also used frequently in consumer products. The structure of the AP0408, 0410 and 0412 provide the smallest distribution capacity. Different types are available to meet the needs of automatic insertion equipment.

3) TP type
This type features high reliability and unusually stable characteristics because it is made using the transfer molding technique. The extremely small size of the TP0206 type makes it suitable for high density assembly PCBs in measuring instruments and control devices.

4) FS type
This small ferrite shield inductor has a high performance ferrite cap shape with a molded inductor. The FS0810 and FS1012 are ideal for magnetic shielding applications.

5) TPF0410 type
This highly reliable inductor complies with Defense Agency standards (MIL standards) for industrial applications requiring a magnetic shield.

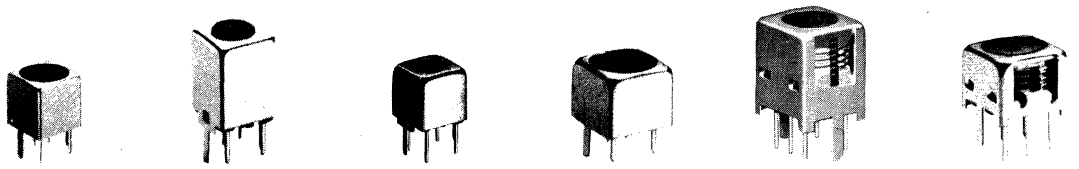
6) NL, NLF type
Has metal tab type electrodes connected to coils encapsulated in heat-proof resins to ensure excellent reliability.

		Type	Taping	Lead space (mm)	No. of L-values available	Inductance range (μH)	Q range min.	Dimensions*1 (mm)
Non-shielded type	Radial lead	EL0405	EL0405RA-	2.5	45	0.22 to 1,000	25 to 50	4×5
		EL0606	EL0606RA-	5.0	49	0.22 to 2,200	30 to 50	6×6
		EL0607	EL0607RA-	5.0	37	10 to 10,000	15 to 45	6×7
		EL0909	FL0909R-	5.0	34	100 to 56,000	35 to 65	9×9
	Radial lead (0.08 to 6A)	TSL0707	–	7.0	6	1 to 6.8	30	7.5×7.5
		TSL0707	–	5.0	13	10 to 10,000	35 to 140	7.5×7.5
		TSL0807	–	8.0	5	3.3 to 15	25 to 60	8.5×7.5
		TSL0807	–	5.0	12	22 to 1,500	20 to 90	8.5×7.5
		TSL1110	–	11.0	12	1 to 68	20 to 30	11.5×10.5
		TSL1110	–	5.0	14	100 to 15,000	30 to 200	11.5×10.5
	Axial lead	SP0305	SPT0305-	–	45	0.22 to 1,000	40 to 60	2.8×7
		SP0406	SPT0406-	–	45	0.22 to 1,000	25 to 85	4×9.5
		SP0408	SPT0408-	–	25	0.15 to 27	50 to 70	4.5×8*2
		SP0410	–	–	4	33 to 56	60 to 65	4.5×10*2
		SP0412	–	–	2	68 to 82	60 to 70	4.5×12*2
		SP0412	–	–	8	1 to 15 (1.0 to 4.5A)	20	4×12*2
		SP0615	–	–	10	1 to 33 (up to 6A)	20	6×15*2
		SP0720	–	–	12	1 to 68 (up to 7A)	20	7×20*2
		SP0830	–	–	15	1 to 220 (up to 10A)	20	8×30*2
	Axial lead	TP0206	TPT0206-	–	37	0.1 to 100	25 to 55	2×6
		TP0410	TPT0410-	–	62	0.15 to 1,000	33 to 90	4×10
		TP0511	–	–	15	270 to 1,000	100	5×11
		TP0514	–	–	13	1,100 to 3,600	90	5×14
		TP0619	–	–	11	3,900 to 10,000	110	6×19
	Leadless	NL322522	NL322522T	–	36	0.12 to 100	20 to 30	3.2×2.5×2.2
		NL453232	NL453232T	–	37	1.0 to 1,000	30 to 50	4.5×3.2×3.2
Magnetic shielded type	Radial lead	ELF0505SKI	ELF0505RA-	2.5	46	0.22 to 1,200	30 to 50	5.5×5.5
		ELF0607SKI	ELF0607RA-	5.0	50	0.22 to 2,700	30 to 60	6.6×7
		ELF0708SKI	ELF0708R-	5.0	39	10 to 15,000	25 to 40	7.7×8
		ELF1010SKI	ELF1010R-	5.0	37	100 to 100,000	30 to 60	10.5×10.5
		FS0712	–	5.0	61	1.0 to 100mH	10 to 40	7×12
		FS0810	–	2.5	24	12 to 1,000	55 to 95	8×10
		FS1012	–	2.5	24	1.2 to 100mH	60 to 110	10×12
	Axial lead	TPF0410	TPFT0410	–	57	0.1 to 4,700	40 to 67	4×10
	Leadless	NLF453232	–	–	37	1.0 to 1,000	30 to 50	4.5×3.2×3.2

*1 *Please refer TDK catalogue.*
*2 *Indicated core length.*

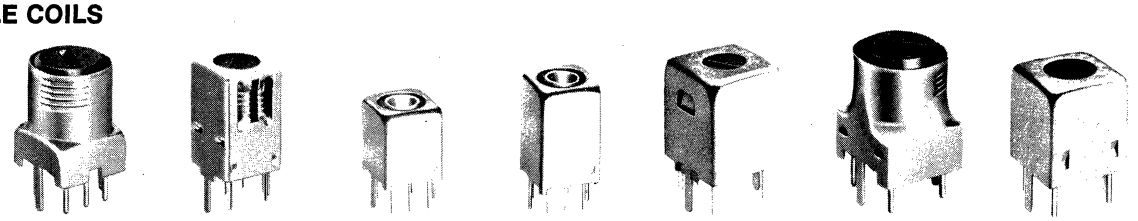
TOKO AMERICA COILS

SUBMINIATURE COILS



Type	5 S	5 A	5 K	7 ES	7 PLA	7 TS
Freq. Range	100 KHz - 10 MHz	50 MHz - 200 MHz	30 MHz - 200 MHz	100 KHz - 10 MHz	10 KHz - 200 KHz	10 KHz - 200 KHz
L Values	1 μH ~ 680 μH	.03 μH ~ .3 μH	.08 μH ~ 1 μH	1 μH ~ 500 μH	1 mH ~ 15 mH	200 μH ~ 7 mH
Q Value	70	50 ~ 70	70	60 ~ 100	50	50
Int. Cap. Values	18 pF ~ 47 pF, 180 pF, 1500 pF	None	None	18 pF ~ 47 pF, 180 pF, 1500 pF	10 pF ~ 6800 pF	None

ADJUSTABLE COILS

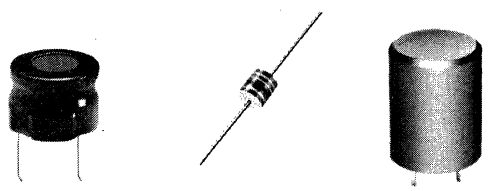


Type	7 P	7 KP	7 KL	7 KM	10 EZ	10 PA	10 K
Freq. Range	100 KHz - 10 MHz	2 MHz - 150 MHz	50 MHz - 200 MHz	25 MHz - 200 MHz	100 KHz - 10 MHz	10 KHz - 200 KHz	1 MHz - 150 MHz
L Values	1 μH ~ 1.1 mH	1 μH ~ 18 μH	.1 μH ~ 50 μH	.1 μH ~ 80 μH	2 μH ~ 2 mH	1 mH ~ 55 mH	.08 μH ~ 50 μH
Q Values	70 ~ 110	70 @ 10.7 MHZ, 100 @ 60 MHZ, 100 @ 100 MHZ	80	80	70 ~ 140	50	80 ~ 100
Int. Cap. Values	5 pF ~ 100 pF, 180 pF, 430 pF	5 pF ~ 100 pF	5 pF ~ 100 pF	5 pF ~ 100 pF	5 pF ~ 100 pF, 100 pF, 430 pF	None	5 pF ~ 100 pF

CHIP COILS

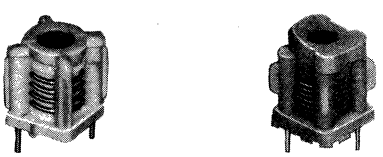
Type	43 CS	43 FS	CIR-01	5 CD
Freq. Range	200 KHz - 150 MHz	200 KHz - 150 MHz	200 KHz - 150 MHz	200 KHz - 15 MHz
L Values	1 μH ~ 470 μH	1 μH ~ 470 μH	1 μH ~ 470 μH	1 μH ~ 500 μH
Q Value	50	50	50	70
Int. Cap. Values	None	None	None	5 pF ~ 330 pF
Mounting	dip soldering	reflow soldering	reflow soldering	reflow soldering

FIXED COILS



Type	8 RBS (RADIAL)	FL4 (AXIAL)	10 RB
Freq. Range	10 KHz - 200 KHz	200 KHz - 150 MHz	10 KHz - 200 KHz
L Values	56 μH ~ 15 mH	1 - 1000 μH	1 mH ~ 120 mH
Q Values	60	50	70 ~ 100
Int. Cap. Values	None	None	None

MOLDED COILS



Type	MC 120	MC 122
Freq. Range	30 MHz - 150 MHz	30 MHz - 150 MHz
L Values	.03 μH ~ .35 μH	.03 μH ~ .44 μH
Q Values	120	110
Winding	Single	

~ Denotes: Numerous variations available between values listed

Toko manufactures a large variety of high grade miniature and subminiature coils. These coils are designed for use in electronics equipment such as video tape recorders and cameras, TV receivers and in AM and FM radios. We have coils available over a wide range of inductances and structures in addition to those shown above. Toko can help you meet all your coil needs. If you don't find the right coil shown here please contact us, we are interested in custom designs.

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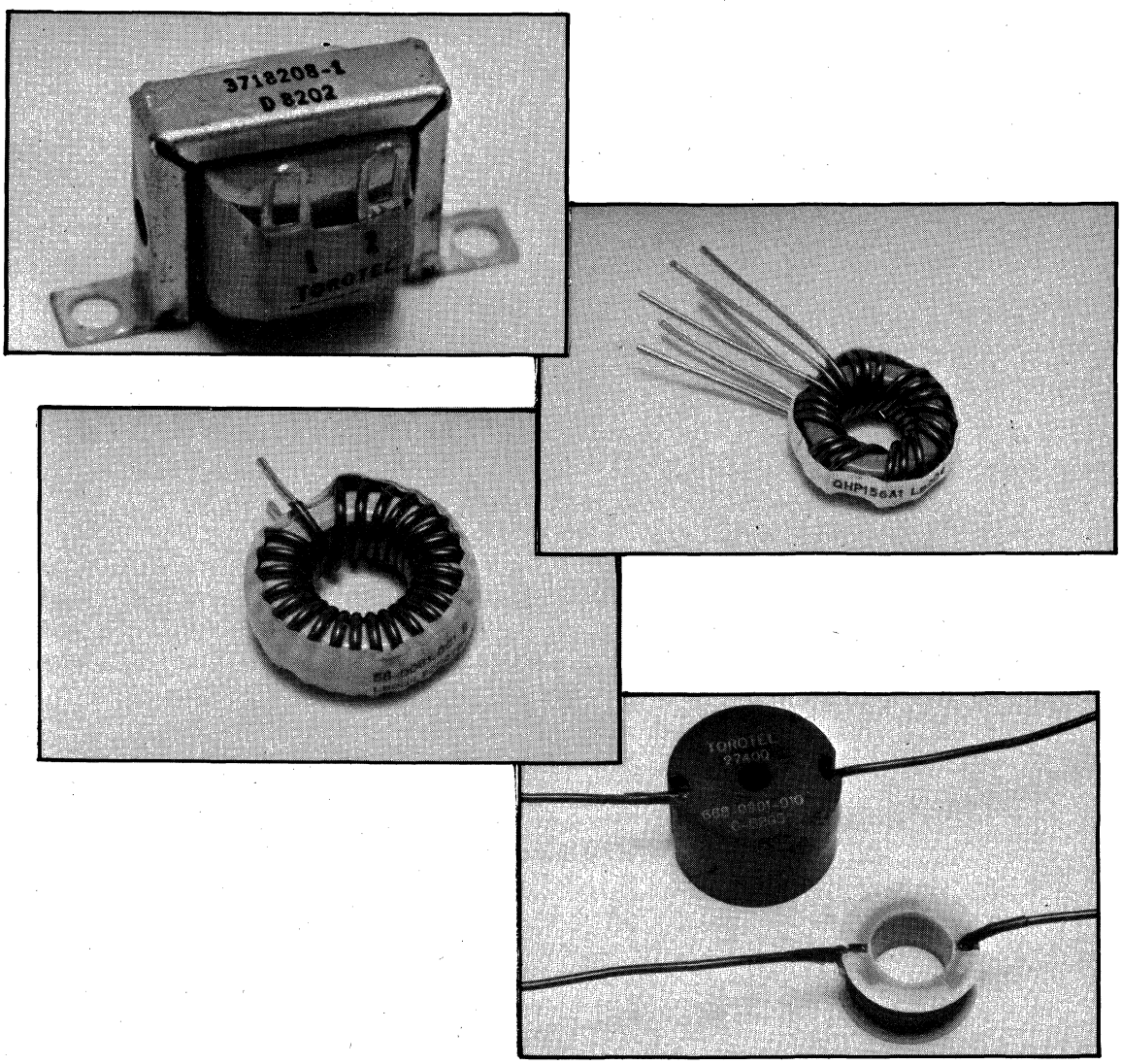

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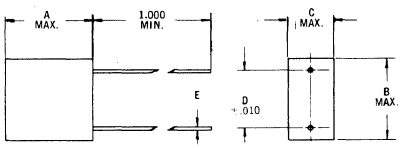
INDUCTORS

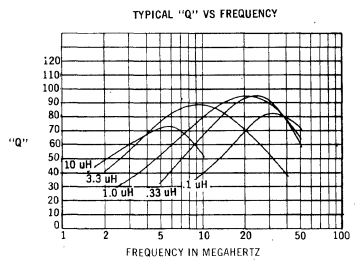
MINI-L
ENCAPSULATED RF INDUCTORS



Type	A	B	C	D	E	Wt.
TA-TF	.225	.210	.110	.100	.020	.01 oz.
TB	.300	.280	.160	.200	.025	.02 oz.
TD	.390	.390	.197	.200	.025	.04 oz.

Designed to meet the requirements of MIL-C-15305, Grade 1, Class B (−55°C to +125°C). The rated temperature rise is 35°C above an ambient of 90°C. Overload current should not exceed 1.4 times the rated current. Dielectric withstanding voltage is 700 volts rms. The powdered iron cores used in these items possess excellent temperature stability and result in an inductor with low external magnetic field. This allows mounting in close proximity to each other and to other circuit components without ill effects.

TA



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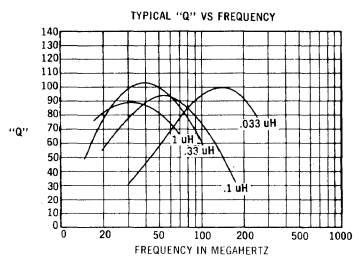

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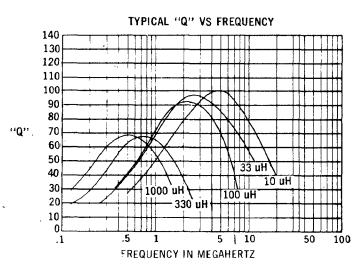
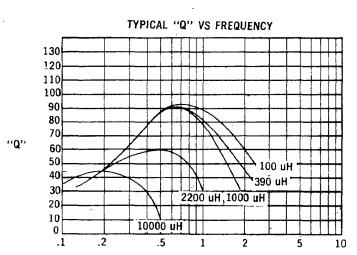


TD



TA SERIES

Frequency Range: 1 to 50 MHz.

Inductance Tolerances: Less than 1.0 uH, ±10%. Greater than or equal to 1.0 uH, ±5%. Closer tolerances available by special request.

Inductance TC: +50 PPM/°C maximum.

Maximum Power Dissipation: 0.2 watt.

Leads: 1 inch minimum AWG 24 tinned copper wire. Weldable gold plated Dumet leads are available.

Method of Measurement: Apparent inductance measured on HP4342A "Q" meter with leads connected ¼ inch from inductor body directly to "Q" meter terminals. Residual "Q" meter inductance of 0.01 uH should be subtracted from reading.

MIL-C-15305, Grade 1, Class B.

Part No.	Apparent Inductance (uH)	Minimum "Q"	Test Frequency (MHz)	Minimum SRF (MHz)	Maximum DCR (ohms)	DC Current (mA)
TA-1	0.10	60	25	450	0.04	2230
TA-2	0.12	60	25	410	0.05	2000
TA-3	0.15	65	25	350	0.06	1825
TA-4	0.18	65	25	325	0.07	1675
TA-5	0.22	65	25	300	0.08	1550
TA-6	0.27	65	25	280	0.09	1475
TA-7	0.33	65	25	260	0.10	1400
TA-8	0.39	70	25	240	0.11	1325
TA-9	0.47	70	25	220	0.15	1125
TA-10	0.56	70	25	200	0.20	1000
TA-11	0.68	70	25	180	0.25	900
TA-12	0.82	70	25	165	0.30	810
TA-13	1.0	70	25	150	0.35	750
TA-14	1.2	65	7.9	130	0.25	875
TA-15	1.5	65	7.9	120	0.30	800
TA-16	1.8	65	7.9	110	0.50	600
TA-17	2.2	65	7.9	100	0.75	500
TA-18	2.7	65	7.9	90	0.90	450
TA-19	3.3	65	7.9	70	1.0	425
TA-20	3.9	65	7.9	60	1.2	400
TA-21	4.7	60	7.9	50	1.5	350
TA-22	5.6	60	7.9	45	1.7	325
TA-23	6.8	60	7.9	40	2.0	300
TA-24	8.2	60	7.9	37	2.4	290
TA-25	10.0	60	7.9	35	2.6	280

TB SERIES

Recommended Frequency Range: 50 KHz to 35 MHz.

Inductance Tolerance: ±5%. Closer tolerances available by special request.

Inductance TC: From +60 PPM/°C maximum to +300 PPM/°C maximum, depending upon inductance value.

Maximum Power Dissipation: .33 watt.

Leads: 1 inch minimum AWG 22 tinned copper wire. Weldable gold plated Dumet leads are available.

Method of Measurement: Apparent inductance measured on HP4342A "Q" meter with leads connected ¼ inch from inductor body directly to "Q" meter terminals. Residual "Q" meter inductance of 0.01 uH should be subtracted from reading.

Part No.	Apparent Inductance (uH)	Minimum "Q"	Test Frequency (MHz)	Minimum SRF (MHz)	Maximum DCR (ohms)	DC Current (mA)
TB-1	10	75	2.5	35	1.1	550
TB-2	12	75	2.5	31	1.3	500
TB-3	15	75	2.5	27	1.5	460
TB-4	18	80	2.5	25	1.9	410
TB-5	22	80	2.5	22	2.2	380
TB-6	27	80	2.5	20	2.6	350
TB-7	33	80	2.5	18	3.3	320
TB-8	39	80	2.5	16	3.8	290
TB-9	47	80	2.5	14	4.6	260
TB-10	56	80	2.5	12	5.6	240
TB-11	68	80	2.5	11	6.7	220
TB-12	82	80	2.5	10	8.1	200
TB-13	100	80	2.5	9.1	9.6	180
TB-14	120	50	0.79	8.2	10.0	175
TB-15	150	50	0.79	7.5	11.0	160
TB-16	180	50	0.79	6.5	12.0	155
TB-17	220	50	0.79	5.6	13.0	150
TB-18	270	55	0.79	5.0	17.0	125
TB-19	330	55	0.79	4.5	19.0	130
TB-20	390	55	0.79	4.0	21.0	120
TB-21	470	55	0.79	3.5	22.0	115
TB-22	560	55	0.79	3.0	24.0	110
TB-23	680	55	0.79	2.8	19.0	130
TB-24	820	50	0.79	2.5	23.0	120
TB-25	1000	50	0.79	2.2	26.0	110

TF SERIES

Frequency Range: 15 to 300 MHz.

Inductance Tolerances: Less than 0.1 uH, ±20%. Greater than or equal to 0.1 uH, ±10%. Closer tolerances available by special request.

Inductance TC: +200 PPM/°C maximum.

Maximum Power Dissipation: 0.2 watt.

Leads: 1 inch minimum AWG 24 tinned copper wire. Weldable gold plated Dumet leads are available.

Method of Measurement: Apparent inductance measured on Boonton 190-A "Q" meter with leads connected ¼ inch from inductor body directly to "Q" meter terminals. Residual "Q" meter inductance of 0.0026 uH should be subtracted from value calculated from C and F readings.

MIL-C-15305, Grade 1, Class B.

Part No.	Apparent Inductance (uH)	Minimum "Q"	Test Frequency (MHz)	Minimum SRF (MHz)	Maximum DCR (ohms)	DC Current (mA)
TF-1	0.01	60	150	1000	0.02	3100
TF-2	0.012	60	150	1000	0.02	3100
TF-3	0.015	60	150	1000	0.02	3100
TF-4	0.018	60	150	1000	0.02	3100
TF-5	0.022	60	100	900	0.02	3100
TF-6	0.027	60	100	800	0.02	3100
TF-7	0.033	60	100	750	0.02	3100
TF-8	0.039	60	100	700	0.02	3100
TF-9	0.047	60	100	650	0.02	3100
TF-10	0.056	60	100	600	0.02	3100
TF-11	0.068	60	100	550	0.03	2500
TF-12	0.082	60	100	500	0.03	2500
TF-13	0.10	70	50	450	0.04	2200
TF-14	0.12	70	50	400	0.05	2000
TF-15	0.15	70	50	350	0.06	1800
TF-16	0.18	70	50	320	0.07	1650
TF-17	0.22	70	50	300	0.08	1500
TF-18	0.27	70	50	280	0.10	1400
TF-19	0.33	70	50	260	0.12	1300
TF-20	0.39	60	50	240	0.15	1150
TF-21	0.47	60	50	220	0.20	1000
TF-22	0.56	60	50	200	0.25	900
TF-23	0.68	60	50	180	0.30	800
TF-24	0.82	60	50	160	0.35	750
TF-25	1.0	60	50	150	0.40	700

TD SERIES

Recommended Frequency Range: 50 KHz to 10 MHz.

Inductance Tolerance: ±5%. Closer tolerances available by special request.

Inductance TC: From +60 PPM/°C maximum to +300 PPM/°C maximum, depending upon inductance value.

Maximum Power Dissipation: .50 watt.

Leads: 1 inch minimum AWG 22 tinned copper wire. Weldable gold plated Dumet leads are available.

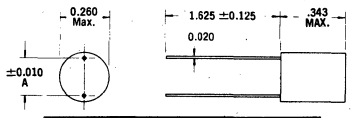
Method of Measurement: Apparent inductance measured on HP4342A "Q" meter with leads connected ¼ inch from inductor body directly to "Q" meter terminals.

Part No.	Apparent Inductance (uH)	Minimum "Q"	Test Frequency (KHz)	Minimum SRF (MHz)	Maximum DCR (ohms)	DC Current (mA)
TD-1	100	75	790	8.4	6	280
TD-2	120	75	790	7.5	7	260
TD-3	150	75	790	6.8	8	240
TD-4	180	75	790	6.1	10	220
TD-5	220	80	790	5.4	12	200
TD-6	270	80	790	4.7	14	180
TD-7	330	80	790	4.2	17	165
TD-8	390	80	790	3.8	20	150
TD-9	470	75	790	3.4	24	140
TD-10	560	75	790	3.1	28	130
TD-11	680	75	790	2.8	33	120
TD-12	820	75	790	2.5	40	110
TD-13	1000	75	790	2.2	46	100
TD-14	1200	45	250	1.9	30	120
TD-15	1500	45	250	1.6	35	110
TD-16	1800	50	250	1.4	40	105
TD-17	2200	50	250	1.3	50	95
TD-18	2700	50	250	1.2	60	85
TD-19	3300	50	250	1.1	70	80
TD-20	3900	50	250	1.0	80	75
TD-21	4700	50	250	0.9	90	70
TD-22	5600	45	250	0.8	100	65
TD-23	6800	40	250	0.7	140	60
TD-24	8200	40	250	0.6	160	55
TD-25	10,000	40	250	0.6	175	50

TOROTEL PRODUCTS INC. 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

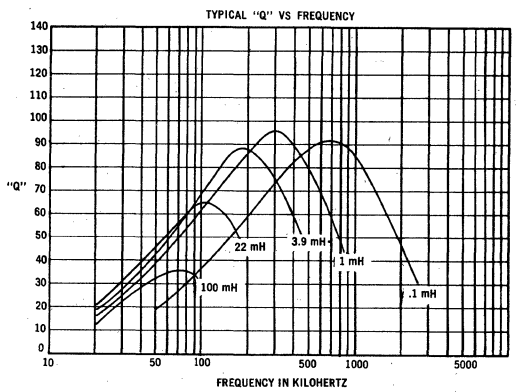
INDUCTORS

MINI-L ENCAPSULATED INDUCTORS
TE/TJ SERIES



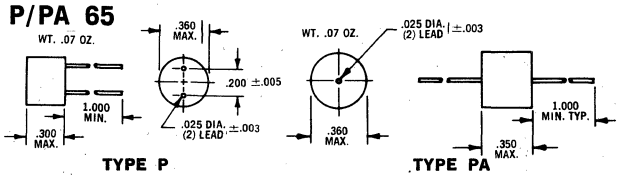
Series	A	WT.
TE	.200	.03 oz.
TJ	.100	.03 oz.

Recommended Frequency Range: 25 KHz to 2.5 MHz.
Inductance Tolerances: ±10% @ 1 KHz.
Maximum Power Dissipation: .33 watt.
Leads: 1.625 ±.125 AWG #24 tinned copper leads. Add suffix "D" to Part Number for Weldable Gold Plated Dumet leads.
Method of Measurement: Inductance at 1 KHz measured on General Radio inductance bridge Type 1632A with leads connected directly to bridge. "Q" at test frequency, measured on HP4342A "Q" meter with leads connected directly to meter terminals.
MIL-C-15305, Grade 1, Class B.

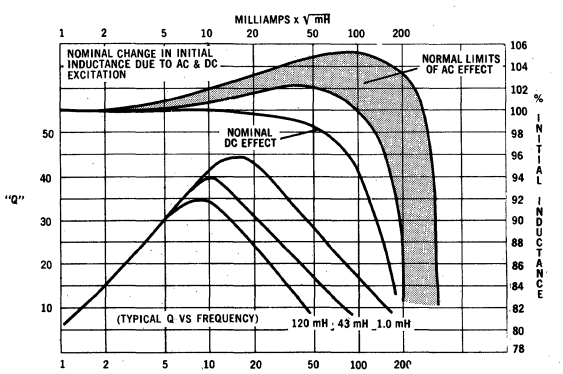


Part Number		Inductance Ref. @ 1 KHz (mH)	Minimum "Q"	"Q" Test Frequency (KHz)	Minimum SRF (MHz)	Maximum DCR (ohms)	DC Current (mA)
TJ-1	TE-1	0.10	80	790	4.5	1.8	450
TJ-2	TE-2	0.12	80	790	3.9	2.1	425
TJ-3	TE-3	0.15	75	790	3.6	2.3	400
TJ-4	TE-4	0.18	75	790	3.3	2.7	380
TJ-5	TE-5	0.22	75	790	3.0	2.9	360
TJ-6	TE-6	0.27	75	790	2.7	3.2	320
TJ-7	TE-7	0.33	70	790	2.5	3.6	300
TJ-8	TE-8	0.39	70	790	2.3	4.0	275
TJ-9	TE-9	0.47	65	790	2.1	4.4	265
TJ-10	TE-10	0.56	60	790	2.0	4.7	250
TJ-11	TE-11	0.68	55	790	1.8	5.4	240
TJ-12	TE-12	0.82	50	790	1.6	5.8	225
TJ-13	TE-13	1.00	80	250	1.5	8.7	190
TJ-14	TE-14	1.20	75	250	1.4	9.5	180
TJ-15	TE-15	1.50	75	250	1.2	11.6	160
TJ-16	TE-16	1.80	75	250	1.1	15.8	140
TJ-17	TE-17	2.20	75	250	0.95	17.3	130
TJ-18	TE-18	2.70	70	250	0.87	18.9	125
TJ-19	TE-19	3.30	70	250	0.80	25.2	110
TJ-20	TE-20	3.90	70	250	0.75	27.2	105
TJ-21	TE-21	4.70	65	250	0.70	31.5	100
TJ-22	TE-22	5.60	65	250	0.60	42.0	85
TJ-23	TE-23	6.80	60	250	0.55	52.5	75
TJ-24	TE-24	8.20	55	250	0.50	63.0	65
TJ-25	TE-25	10.0	45	250	0.45	89.2	55
TJ-26	TE-26	12.0	40	79	0.40	105.0	50
TJ-27	TE-27	15.0	40	79	0.35	121.0	45
TJ-28	TE-28	18.0	40	79	0.33	136.0	40
TJ-29	TE-29	22.0	40	79	0.30	147.0	35
TJ-30	TE-30	27.0	40	79	0.26	241.0	30
TJ-31	TE-31	33.0	35	79	0.24	325.0	28
TJ-32	TE-32	39.0	35	79	0.22	367.0	25
TJ-33	TE-33	47.0	35	79	0.20	420.0	23
TJ-34	TE-34	56.0	30	79	0.18	483.0	20
TJ-35	TE-35	68.0	25	79	0.16	630.0	18
TJ-36	TE-36	82.0	20	79	0.14	893.0	16
TJ-37	TE-37	100.0	20	79	0.12	1100	15
TJ-38	TE-38	120.0	10	50	0.10	1200	14
TJ-39	TE-39	150.0	10	50	0.095	1360	13
TJ-40	TE-40	180.0	10	40	0.080	1520	11
TJ-41	TE-41	220.0	10	40	0.070	1890	10

P/PA 65



MIL-T-27 Grade 5, Class S.
Frequency Range: 1 to 50 KHz
WHEN ORDERING, ADD CASE PREFIX (TYPE) TO PART NUMBER.
EXAMPLE: **PA65 — XX**
CASE TYPE — PART NUMBER



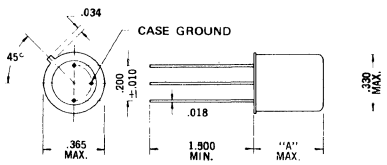
CORE NO. 65

Inductance ±2% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
1.00	65-1	.934	12
1.25	65-2	1.310	12
1.50	65-3	1.430	12
1.75	65-4	1.550	14
2.00	65-5	2.020	14
2.40	65-6	2.200	14
2.50	65-7	2.250	14
3.00	65-8	3.010	16
3.60	65-9	3.300	16
4.30	65-10	3.600	16
5.00	65-11	4.260	18
6.00	65-12	4.680	18
7.20	65-13	5.120	18
7.50	65-14	7.000	20
8.00	65-15	7.700	22
8.60	65-16	8.000	22
10.00	65-17	10.300	24
12.00	65-18	11.300	24
12.50	65-19	11.600	24
15.00	65-20	16.500	26
17.50	65-21	17.800	26
20.00	65-22	19.000	28
24.00	65-23	28.500	28
25.00	65-24	29.100	30
30.00	65-25	31.900	30
36.00	65-26	34.900	32
43.00	65-27	42.100	32
50.00	65-28	48.000	34
60.00	65-29	52.600	34
72.00	65-30	61.500	36
75.00	65-31	78.700	36
86.00	65-32	84.200	36
100.00	65-33	90.800	38
120.00	65-34	115.000	40

TOROTEL PRODUCTS INC. 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

INDUCTORS

MINI-L HERMETICALLY SEALED RF INDUCTORS
TG, TH SERIES



Series	A max.	Weight
TG	.390	.06 oz.
TH	.350	.07 oz.

The TG and TH series offer high "Q" inductors in a TO-5 transistor can configuration. High density packaging can be accomplished with little regard to coupling between adjacent circuitry since construction of these units results in a low external magnetic and electrostatic field.

TG SERIES

Recommended Frequency Range: 10 KHz to 500 KHz.

Inductance Tolerance: ±5%.

Inductance Stability: Less than ±2% from −20°C to +130°C.

Method of Test: Inductance is measured on a General Radio inductance bridge, Type 1632A with leads connected directly to bridge. "Q" is measured on HP4342A "Q" meter with leads connected directly to the "Q" meter terminals.

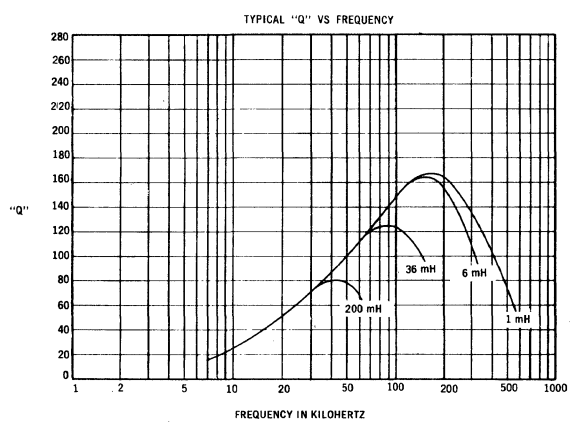
MIL-T-27, Grade 4, Class S.

Temperature Range: −55°C to +130°C.

Insulation Resistance: 10,000 Megohms minimum at 100 volts DC.

Dielectric Withstanding Voltage: 100 volts rms.

Part Number	Inductance (mH)	Inductance Test Frequency (KHz)	"Q" Minimum	"Q" Test Frequency (KHz)	Maximum DCR* (ohms)	Minimum SRF (KHz)	DC Current (mA)
TG-1	1.0	10	120	200	3.3	1500	123
TG-2	1.2	10	120	200	3.6	1300	118
TG-3	1.5	10	120	200	4.8	1160	102
TG-4	1.75	10	120	200	5.2	1080	98
TG-5	2.0	10	120	200	5.7	1000	94
TG-6	2.4	10	120	200	7.9	920	80
TG-7	3.0	10	120	150	8.9	820	75
TG-8	3.6	10	120	150	9.8	730	71
TG-9	4.3	10	120	150	13.7	660	60
TG-10	5.0	10	120	150	14.7	600	58
TG-11	6.0	10	120	150	20.0	540	50
TG-12	7.2	10	120	100	21.8	480	48
TG-13	8.6	10	100	100	24.0	430	45
TG-14	10.0	10	100	100	32.4	400	39
TG-15	12.0	10	100	100	34.8	360	38
TG-16	15.0	10	100	100	39.1	320	36
TG-17	17.5	10	85	70	55.0	300	30
TG-18	20.0	10	85	70	60.0	280	29
TG-19	24.0	10	85	70	64.7	250	28
TG-20	30.0	10	85	70	86.3	220	24
TG-21	36.0	10	85	70	95.8	195	23
TG-22	43.0	10	85	70	132	185	19
TG-23	50.0	10	85	70	143	165	18
TG-24	60.0	10	75	50	155	145	18
TG-25	72.0	10	75	50	172	130	17
TG-26	86.0	10	75	50	233	125	15
TG-27	100	10	75	50	252	115	14
TG-28	120	5	75	50	290	105	13
TG-29	150	5	50	40	323	95	13
TG-30	175	5	50	40	350	85	12
TG-31	200	5	50	40	477	80	10
TG-32	240	5	50	40	693	71	10
TG-33	300	5	50	40	735	63	8
TG-34	360	5	30	30	1005	57	7
TG-35	430	5	30	30	1100	51	6.5
TG-36	500	5	30	20	1200	48	6.5



TH SERIES

Recommended Frequency Range: 100 KHz to 10 MHz.

Inductance Tolerances: 10 uH through 33 uH, ±10%, 39 uH through 130 uH, ±5%, greater than and including 150 uH, ±3%.

Inductance Stability: Less than or equal to ±2% from −20°C to +85°C.

Method of Test: Inductance and "Q" are measured on HP4342A "Q" meter with leads connected directly to the "Q" meter terminals.

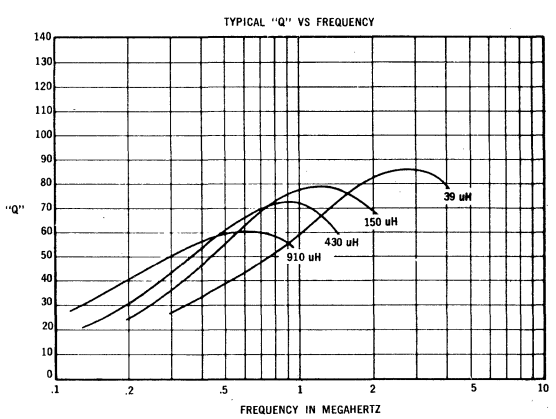
MIL-C-15305, Grade 1, Class C.

Temperature Range: −55°C to +130°C.

Insulation Resistance: 10,000 Megohms minimum at 100 volts DC.

Dielectric Withstanding Voltage: 100 volts rms.

Part Number	Inductance (uH)	Inductance Test Frequency (KHz)	"Q" Minimum	"Q" Test Frequency (KHz)	Maximum DCR* (ohms)	Minimum SRF (MHz)	DC Current (mA)
TH-7	10	1000	75	2500	2.4	35.0	102
TH-8	12	1000	75	2500	2.5	30.0	100
TH-9	15	1000	75	2500	2.6	25.0	98
TH-10	18	1000	75	2500	2.7	23.0	96
TH-11	22	1000	75	2500	2.8	20.0	94
TH-12	27	1000	75	2500	2.9	17.0	93
TH-13	33	1000	75	2500	3.0	14.0	91
TH-14	39	500	70	2500	3.1	11.0	90
TH-15	47	500	70	2500	3.2	10.0	88
TH-16	56	500	70	2500	3.3	9.5	87
TH-17	68	500	70	2500	3.4	9.0	85
TH-18	82	500	70	2500	4.5	8.0	74
TH-19	100	500	70	1500	5.1	7.5	70
TH-20	110	500	70	1500	6.0	7.0	64
TH-21	120	500	70	1500	6.2	6.5	63
TH-22	130	500	70	1500	6.4	6.0	62
TH-23	150	500	70	1500	6.6	5.5	61
TH-24	160	500	60	790	8.6	5.3	54
TH-25	180	500	60	790	9.0	5.0	52
TH-26	200	500	60	790	9.5	4.5	51
TH-27	220	250	60	790	10.0	4.0	50
TH-28	240	250	60	790	10.6	3.8	48
TH-29	270	250	60	790	11.2	3.6	48
TH-30	300	250	60	790	14.2	3.4	42
TH-31	330	250	60	790	14.6	3.2	41
TH-32	360	250	60	790	15.0	3.0	41
TH-33	390	250	60	790	15.6	2.9	40
TH-34	430	250	60	790	16.4	2.8	39
TH-35	470	250	60	790	20.4	2.7	35
TH-36	510	250	60	790	21.8	2.6	34
TH-37	560	250	60	790	23.6	2.5	32
TH-38	620	250	60	790	24.6	2.3	32
TH-39	680	250	50	790	25.8	2.1	31
TH-40	750	250	50	790	26.8	1.9	31
TH-41	820	250	50	790	38.4	1.7	25
TH-42	910	250	50	790	40.8	1.5	24
TH-43	1000	250	50	790	42.6	1.4	24

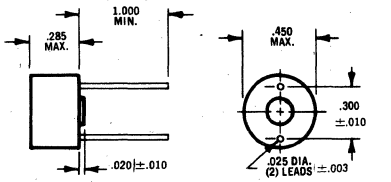


TOROTEL PRODUCTS INC. 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

INDUCTORS

MINIATURE TOROIDS

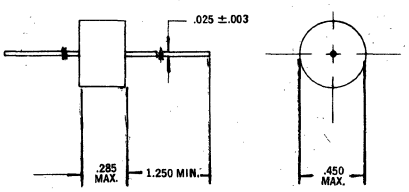
TYPE P/PF
Epoxy Encapsulated
MIL-T-27 Grade 5, Glass S
AVAILABLE FOR CORES
03, 13, 29, 82, 72 & 52



WT. .08 oz.

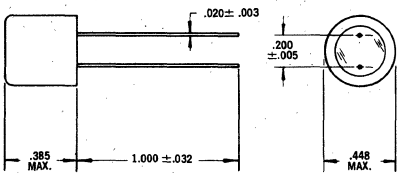
P	PF
NO FOOT	WITH FOOT

TYPICAL TYPE PA
Axial Lead Epoxy Encapsulated
AVAILABLE FOR CORES
03, 13, 29, 82, 72 & 52



WT. .08 oz.

TYPE M
Metal Cased
MIL-T-27 Grade 4, Class R
AVAILABLE FOR CORES
03, 13, 29, 82, 72 & 52



WT. .15 oz.

CORE NO. 03
Recommended Frequency: Up to 100 KHz.
Maximum Inductance: 250 mH.
Special Core Stabilization Available: D, W, M, L.

CORE NO. 18
Recommended Frequency: 10 KHz to 200 KHz.
Maximum Inductance: 100 mH.
Special Core Stabilization Available: D, W, M, L.

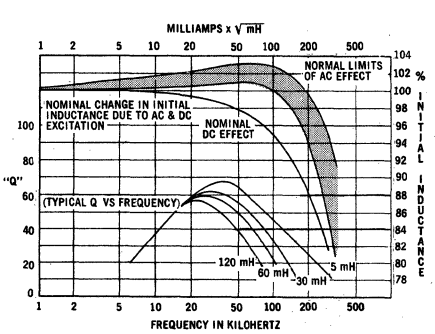
CORE NO. 29
Recommended Frequency: 50 KHz to 5 MHz.
Maximum Inductance: 15 mH.
Only Core Stabilization Available: ±90 PPM/°C

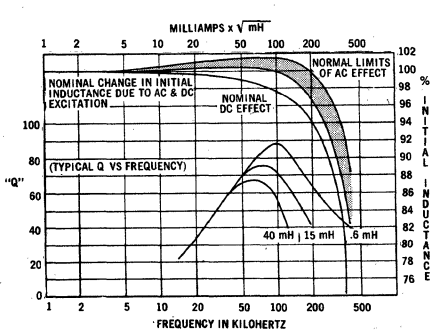
When ordering add the prefix P, PA, PF, or M to the Part Number for the case type desired.

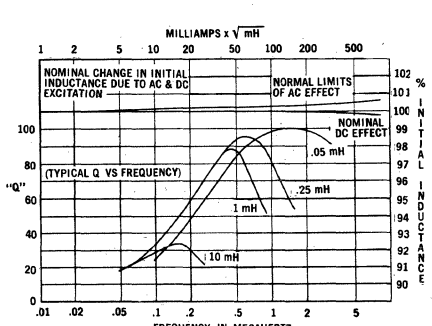
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
1.00	03-1	1.5	14
1.25	03-2	1.7	14
1.50	03-3	2.4	18
1.75	03-4	2.6	20
2.00	03-5	2.7	20
2.40	03-6	3.7	22
2.50	03-7	3.8	22
3.00	03-8	4.0	24
3.60	03-9	5.7	24
4.30	03-10	6.2	24
5.00	03-11	6.7	26
6.00	03-12	9.3	26
7.20	03-13	10.0	26
7.50	03-14	10.5	28
8.00	03-15	11.0	28
8.60	03-16	14.0	28
10.00	03-17	15.0	30
12.00	03-18	15.5	32
12.50	03-19	16.0	34
15.00	03-20	23.0	36
17.50	03-21	25.0	38
20.00	03-22	26.0	40
24.00	03-23	35.0	42
30.00	03-24	39.0	44
36.00	03-25	58.0	46
43.00	03-26	64.0	48
50.00	03-27	69.0	50
60.00	03-28	78.0	52
72.00	03-29	106.0	54
75.00	03-30	108.0	56
86.00	03-31	140.0	58
100.00	03-32	150.0	60
120.00	03-33	155.0	62
150.00	03-34	228.0	64
175.00	03-35	246.0	66
178.00	03-36	248.0	66
200.00	03-37	333.0	68
250.00	03-38	373.0	70

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
.50	13-1	1.5	14
.60	13-2	1.6	14
.72	13-3	2.4	14
.86	13-4	2.6	14
1.00	13-5	2.8	16
1.25	13-6	3.9	16
1.50	13-7	4.1	18
1.75	13-8	5.7	18
2.00	13-9	6.1	20
2.40	13-10	6.7	22
2.50	13-11	6.8	24
3.00	13-12	9.5	24
3.60	13-13	10.5	26
4.30	13-14	14.7	28
5.00	13-15	15.5	30
6.00	13-16	16.0	30
7.20	13-17	24.0	32
8.60	13-18	26.0	34
10.00	13-19	27.0	36
12.00	13-20	39.0	38
15.00	13-21	41.0	40
17.50	13-22	59.0	40
20.00	13-23	63.0	42
24.00	13-24	67.0	42
25.00	13-25	68.0	44
30.00	13-26	100.0	44
36.00	13-27	103.0	46
40.00	13-28	108.0	46
43.00	13-29	142.0	48
50.00	13-30	154.0	48
60.00	13-31	168.0	50
72.00	13-32	228.0	50
86.00	13-33	250.0	52
100.00	13-34	340.0	52

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
.050	29-1	1.2	10
.060	29-2	1.6	10
.072	29-3	1.8	10
.075	29-4	1.8	12
.086	29-5	1.9	12
.100	29-6	2.1	12
.120	29-7	2.3	12
.125	29-8	3.0	12
.150	29-9	3.3	12
.175	29-10	3.5	14
.200	29-11	4.5	14
.240	29-12	4.9	14
.250	29-13	5.0	14
.300	29-14	7.0	14
.360	29-15	7.7	14
.400	29-16	8.1	16
.430	29-17	10.5	16
.500	29-18	12.3	16
.600	29-19	13.5	16
.720	29-20	16.2	16
.750	29-21	16.5	18
.860	29-22	17.7	18
1.000	29-23	19.1	18
1.200	29-24	25.9	20
1.250	29-25	26.4	20
1.500	29-26	29.0	22
1.750	29-27	37.6	22
2.000	29-28	40.3	24
2.400	29-29	44.0	24
2.500	29-30	45.0	26
3.000	29-31	64.0	28
3.600	29-32	69.0	28
4.000	29-33	73.0	30
4.300	29-34	76.0	32
5.000	29-35	102.0	34
6.000	29-36	112.0	34
7.200	29-37	122.0	36
7.500	29-38	125.0	38
8.600	29-39	162.0	40
10.000	29-40	175.0	42







CALL TOROTEL PRODUCTS FOR YOUR COMPETITIVELY PRICED CUSTOM MAGNETICS REQUIREMENTS

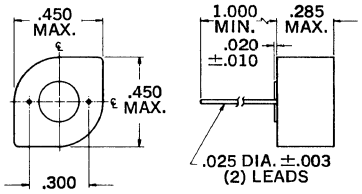
INDUCTORS

TOROTEL PRODUCTS INC./13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

MINIATURE TOROIDS

TYPE PE/PEF
Epoxy Encapsulated
MIL-T-27 Grade 5, Class S
AVAILABLE FOR CORES
03, 13, 29, 82, 72, 52

PE	PEF
NO FOOT	WITH FOOT



WHEN ORDERING, ADD CASE PREFIX (TYPE) TO PART NUMBER.

EXAMPLE P 03-1

CASE TYPE — PART NUMBER

CORE NO. 82

Recommended Frequency: Up to 50 KHz.
Maximum Inductance: 250 mH.
Special Core Stabilization: D, W, M, L.

When ordering add the prefix P, PA, PF, or M, to the part number for the case type desired.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
1.00	82-1	1.23	12
1.25	82-2	1.38	14
1.50	82-3	1.85	14
1.75	82-4	2.00	16
2.00	82-5	2.34	16
2.40	82-6	2.56	18
2.50	82-7	2.62	18
3.00	82-8	3.87	18
3.60	82-9	4.25	20
4.30	82-10	4.63	22
5.00	82-11	6.29	22
6.00	82-12	6.91	24
7.20	82-13	7.55	24
7.50	82-14	9.27	26
8.00	82-15	9.57	26
8.60	82-16	9.93	28
10.00	82-17	10.70	28
12.00	82-18	14.20	30
15.00	82-19	15.90	30
17.50	82-20	22.10	32
20.00	82-21	23.60	34
24.00	82-22	25.90	36
30.00	82-23	36.50	36
36.00	82-24	40.00	38
43.00	82-25	43.70	38
50.00	82-26	56.70	40
60.00	82-27	62.10	40
72.00	82-28	68.10	42
86.00	82-29	96.80	44
100.00	82-30	104.00	44
120.00	82-31	149.00	46
150.00	82-32	206.00	48
175.00	82-33	223.00	48
200.00	82-34	305.00	50
250.00	82-35	341.00	50

CORE NO. 72

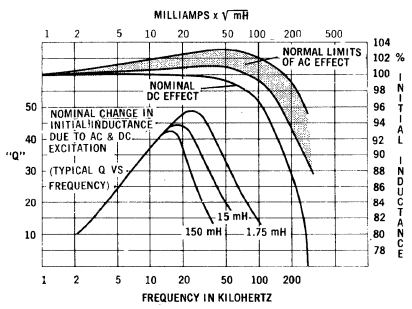
Recommended Frequency: Up to 30 KHz.
Maximum Inductance: 360 mH.
Special Core Stabilization: D, W, M, L.

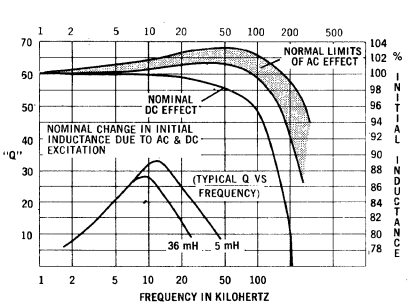
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
1.25	72-1	1.23	12
1.50	72-2	1.34	14
1.75	72-3	1.78	14
2.00	72-4	1.90	16
2.40	72-5	2.28	16
2.50	72-6	2.34	18
3.00	72-7	2.55	18
3.60	72-8	3.78	18
4.30	72-9	4.14	20
5.00	72-10	4.45	22
6.00	72-11	6.15	22
7.20	72-12	6.75	24
7.50	72-13	6.88	24
8.00	72-14	7.09	26
8.60	72-15	8.86	26
10.00	72-16	9.54	28
12.00	72-17	10.50	28
15.00	72-18	14.20	30
17.50	72-19	15.30	30
20.00	72-20	16.40	32
24.00	72-21	23.10	34
30.00	72-22	25.80	36
36.00	72-23	35.70	36
43.00	72-24	39.00	38
50.00	72-25	42.00	38
60.00	72-26	55.40	40
72.00	72-27	60.70	40
86.00	72-28	66.40	42
100.00	72-29	71.60	44
120.00	72-30	102.00	44
150.00	72-31	148.00	46
175.00	72-32	160.00	48
200.00	72-33	213.00	48
250.00	72-34	304.00	50
300.00	72-35	333.00	52
360.00	72-36	365.00	54

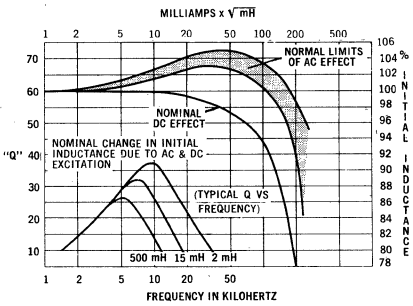
CORE NO. 52

Recommended Frequency: Up to 15 KHz.
Maximum Inductance: 500 mH.
Special Core Stabilization: L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
2.0	52-1	1.27	12
2.4	52-2	1.39	14
2.5	52-3	1.74	14
3.0	52-4	1.91	16
3.6	52-5	2.28	16
4.3	52-6	2.49	18
5.0	52-7	2.70	18
6.0	52-8	4.00	18
7.2	52-9	4.38	20
7.5	52-10	4.47	22
8.0	52-11	4.61	22
8.6	52-12	6.02	24
10.0	52-13	6.50	24
12.0	52-14	7.11	26
15.0	52-15	9.57	26
17.5	52-16	10.30	28
20.0	52-17	11.10	28
24.0	52-18	14.70	30
30.0	52-19	16.40	30
36.0	52-20	23.20	32
43.0	52-21	25.30	34
50.0	52-22	27.30	36
60.0	52-23	37.70	36
72.0	52-24	41.30	38
86.0	52-25	54.30	38
100.0	52-26	58.60	40
120.0	52-27	64.20	40
150.0	52-28	71.70	42
175.0	52-29	101.00	44
200.0	52-30	140.00	44
250.0	52-31	156.00	46
300.0	52-32	213.00	48
360.0	52-33	233.00	48
400.0	52-34	315.00	50
430.0	52-35	326.00	52
500.0	52-36	352.00	54







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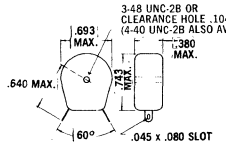
TOROTEL PRODUCTS INC. 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

INDUCTORS

MINIATURE INDUCTORS

Mechanical Tolerance: ±.015 unless otherwise indicated.

TYPE P — Compression Molded AVAILABLE FOR CORES 50, 51, 53, 55, 56 & 57



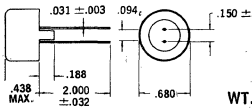
WT. .35 oz.

CORE NO. 50

Recommended Frequency: Up to 50 KHz.
Maximum Inductance: 4.5 H.
Special Core Stabilization Available: D, L, M, W.

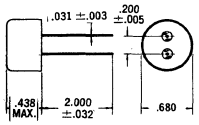
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
1.0	50-1	.6	30
2.5	50-2	1.4	31
5.0	50-3	2.8	31
6.0	50-40	3.3	32
7.2	50-41	3.9	32
7.5	50-4	4.1	32
8.6	50-42	4.7	33
10.0	50-5	5.4	33
12.0	50-43	6.5	33
12.5	50-6	6.6	33
15.0	50-7	7.5	34
17.5	50-44	9.4	34
20.0	50-8	10.7	34
24.0	50-45	12.9	34
25.0	50-9	13.5	34
30.0	50-10	16.1	35
36.0	50-46	19.4	35
40.0	50-11	21.5	35
43.0	50-47	23.1	36
50.0	50-12	27.3	36
60.0	50-48	32.6	36
72.0	50-49	38.9	37
75.0	50-13	41.0	37
86.0	50-50	47.0	38
100.0	50-14	54.0	38
120.0	50-51	66.0	38
125.0	50-15	68.0	39
150.0	50-16	81.0	39
175.0	50-53	95.0	40
200.0	50-17	108.0	40
240.0	50-54	130.0	41
250.0	50-52	135.0	41
300.0	50-18	161.0	42
360.0	50-55	194.0	42
400.0	50-19	215.0	43
430.0	50-56	231.0	43
500.0	50-20	268.0	44
600.0	50-57	321.0	44
720.0	50-58	387.0	45
750.0	50-21	403.0	45
860.0	50-59	461.0	46
1.00 H	50-22	536.0	46
1.20 H	50-60	643.0	47
1.25 H	50-61	672.0	47
1.50 H	50-62	804.0	48
1.75 H	50-63	938.0	48
2.00 H	50-64	1103.0	49
2.40 H	50-67	1286.0	50
2.50 H	50-66	1339.0	50
3.00 H	50-65	1607.0	51

TYPE M — Metal Cased - AVAILABLE FOR CORES 50, 51, 53, 55, 56 & 57



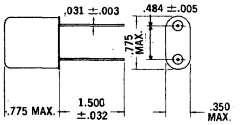
WT. .45 oz.

TYPE MG — Metal Cased - Grid Spacing AVAILABLE FOR CORES 50, 51, 53, 55, 56 & 57



WT. .45 oz.

TYPE MC — Metal Cased - AVAILABLE FOR CORES 50, 51, 53, 55, 56 & 57



WT. .45 oz.

CORE NO. 51

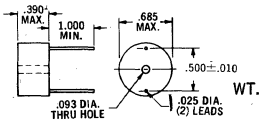
Recommended Frequency: 10 KHz to 200 KHz.
Maximum Inductance: 1 H.
Special Core Stabilization Available: D, M, W, L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
1.00	51-1	1.2	25
1.20	51-2	1.3	25
1.50	51-3	1.7	26
1.75	51-4	1.9	26
2.00	51-5	2.5	26
2.40	51-6	2.7	26
3.00	51-7	3.3	27
3.60	51-8	4.4	27
4.30	51-9	4.7	27
5.00	51-10	5.5	28
6.00	51-11	6.6	28
7.20	51-12	7.8	28
8.60	51-13	9.4	28
10.00	51-14	10.9	28
12.00	51-15	13.1	28
15.00	51-16	16.3	29
17.50	51-17	18.9	29
20.00	51-18	21.7	29
24.00	51-19	26.0	29
30.00	51-20	33.0	29
36.00	51-21	39.0	29
43.00	51-22	47.0	29
50.00	51-23	55.0	30
60.00	51-24	66.0	30
72.00	51-25	78.0	30
86.00	51-26	94.0	30
100.00	51-27	109.0	31
120.00	51-28	130.0	31
150.00	51-29	162.0	31
175.00	51-30	189.0	31
200.00	51-31	217.0	32
240.00	51-32	260.0	32
300.00	51-33	325.0	33
360.00	51-34	389.0	33
430.00	51-35	466.0	34
500.00	51-36	546.0	35

WHEN ORDERING, ADD CASE PREFIX (TYPE) TO PART NUMBER.†
EXAMPLE: U 55-1
CASE TYPE — PART NUMBER

† Add "C" to part number of molded inductor if clearance hole is desired.

TYPE PT — Printed Circuit AVAILABLE FOR CORES 50, 51, 53, 56 & 57

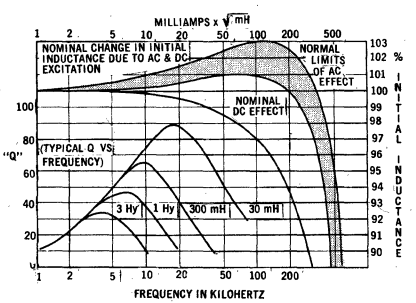


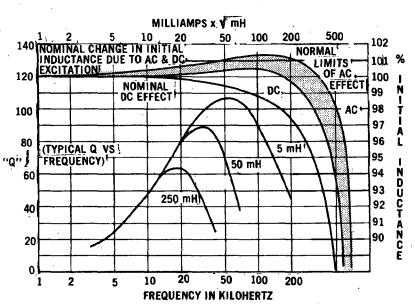
WT. .35 oz.

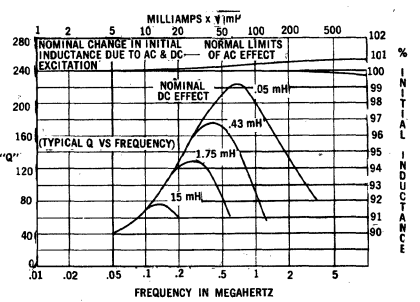
CORE NO. 53 - AVAILABLE

Recommended Frequency: 50 KHz to 2 MHz.
Maximum Inductance: 20 mH.
Only Core Stabilization Available: ±90 PPM/°C

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
0.050	53-1	.42	6
0.060	53-2	.50	6
0.072	53-3	.60	6
0.075	53-4	.61	6
0.086	53-5	.72	6
0.100	53-6	.78	6
0.120	53-7	.89	6
0.125	53-8	.94	6
0.150	53-9	1.17	7
0.175	53-10	1.26	7
0.200	53-11	1.72	7
0.240	53-12	2.02	7
0.250	53-13	2.08	8
0.300	53-14	2.28	8
0.360	53-15	2.44	8
0.400	53-16	3.20	8
0.430	53-17	3.30	8
0.500	53-18	4.80	8
0.600	53-19	5.60	8
0.720	53-20	5.90	8
0.750	53-21	7.40	8
0.860	53-22	7.50	8
1.000	53-23	10.10	8
1.200	53-24	11.30	8
1.250	53-25	11.40	8
1.500	53-26	12.50	8
1.750	53-27	13.50	9
2.000	53-28	18.20	9
2.400	53-29	19.90	9
2.500	53-30	20.80	9
3.000	53-31	23.10	9
3.600	53-32	23.20	9
4.000	53-33	25.90	9
4.300	53-34	27.10	9
5.000	53-35	36.00	9
6.000	53-36	39.00	9
7.200	53-37	51.00	9
7.500	53-38	52.00	9
8.600	53-39	57.00	9
10.000	53-40	64.00	9
12.000	53-41	86.00	9
12.500	53-42	94.00	9
15.000	53-43	104.00	9





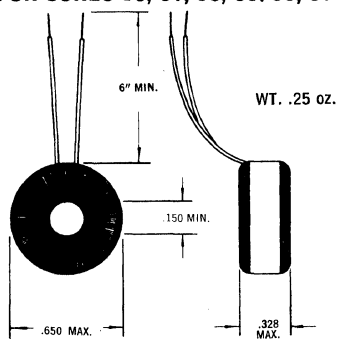


INDUCTORS

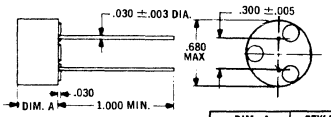
TOROTEL PRODUCTS INC./13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

MINIATURE INDUCTORS

TYPE U — Uncased - AVAILABLE FOR CORES 50, 51, 53, 55. 56, 57



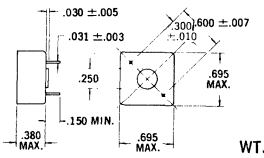
TYPE PS/PST/PW/PWT — Epoxy Encapsulated - AVAILABLE FOR CORES 50, 51, 53, 55, 56, 57



DIM. A		STYLE
.435	.390	
PS	PST	FEET
PW	PWT	NO FEET

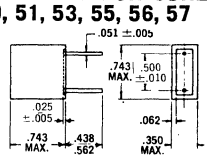
WT. .35 oz.

TYPE S — Epoxy Encapsulated AVAILABLE FOR CORES 50, 51, 53, 55, 56, 57



WT. .35 oz.

TYPE PC — Epoxy Encapsulated AVAILABLE FOR CORES 50, 51, 53, 55, 56, 57

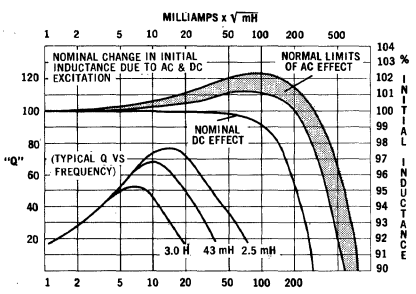


WT. .35 oz.

CORE NO. 55

Recommended Frequency: Up to 50 KHz.
Maximum Inductance: 5 H.
Special Core Stabilization: D, W, M, L.

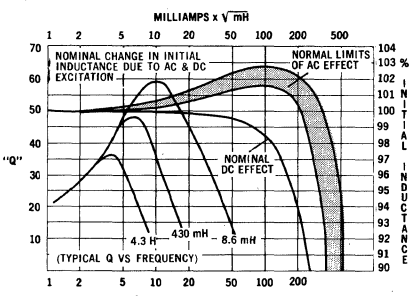
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
1.20	55-1	0.50	30
1.50	55-2	0.71	30
1.75	55-3	0.77	32
2.00	55-4	0.82	32
2.40	55-5	1.13	32
3.00	55-6	1.26	34
3.60	55-7	1.38	34
4.30	55-8	1.51	34
5.00	55-9	1.63	34
6.00	55-10	2.32	34
7.20	55-11	3.20	36
8.60	55-12	3.51	36
10.00	55-13	4.68	36
12.00	55-14	5.11	36
15.00	55-15	5.72	36
17.50	55-16	7.60	38
20.00	55-17	8.12	38
24.00	55-18	8.89	38
30.00	55-19	12.30	38
36.00	55-20	13.40	40
43.00	55-21	18.20	40
50.00	55-22	19.60	40
60.00	55-23	27.00	42
72.00	55-24	29.60	42
86.00	55-25	40.70	42
100.00	55-26	43.90	42
120.00	55-27	48.10	44
150.00	55-28	71.50	44
175.00	55-29	77.30	44
200.00	55-30	82.60	46
240.00	55-31	117.00	46
300.00	55-32	131.00	46
360.00	55-33	143.00	48
430.00	55-34	196.00	48
500.00	55-35	211.00	48
600.00	55-36	292.00	50
720.00	55-37	320.00	50
860.00	55-38	350.00	52
1.00 H	55-39	475.00	52
1.20 H	55-40	520.00	54
1.50 H	55-41	735.00	54
1.75 H	55-42	794.00	54
2.00 H	55-43	1080.00	56
2.40 H	55-44	1180.00	56
3.00 H	55-45	1320.00	56



CORE NO. 56

Recommended Frequency: Up to 40 KHz.
Maximum Inductance: 7 H.
Special Core Stabilization: D, W, M, L.

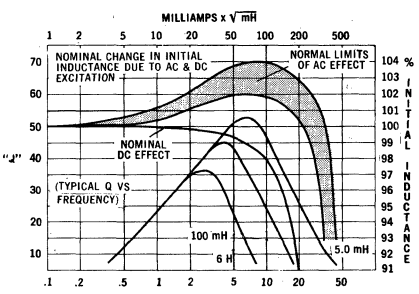
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
1.50	56-1	0.50	36
1.75	56-2	0.54	36
2.00	56-3	0.58	36
2.40	56-4	0.80	36
3.00	56-5	0.90	38
3.60	56-6	1.23	38
4.30	56-7	1.35	38
5.00	56-8	1.46	38
6.00	56-9	1.60	38
7.20	56-10	2.27	40
8.60	56-11	3.13	40
10.00	56-12	3.38	40
12.00	56-13	3.70	42
15.00	56-14	5.11	42
17.50	56-15	5.53	42
20.00	56-16	5.90	44
24.00	56-17	7.95	44
30.00	56-18	8.89	44
36.00	56-19	12.00	46
43.00	56-20	13.10	46
50.00	56-21	14.10	46
60.00	56-22	19.20	46
72.00	56-23	26.40	48
86.00	56-24	28.90	48
100.00	56-25	31.20	48
120.00	56-26	43.00	50
150.00	56-27	48.10	50
175.00	56-28	51.90	52
200.00	56-29	73.90	52
240.00	56-30	80.90	54
300.00	56-31	117.00	54
360.00	56-32	128.00	54
430.00	56-33	140.00	56
500.00	56-34	189.00	56
600.00	56-35	207.00	58
720.00	56-36	286.00	58
860.00	56-37	313.00	60
1.00 H	56-38	337.00	60
1.20 H	56-39	369.00	62
1.50 H	56-40	520.00	62
1.75 H	56-41	710.00	64
2.00 H	56-42	759.00	64
2.40 H	56-43	832.00	66
3.00 H	56-44	1180.00	66
3.60 H	56-45	1290.00	66



CORE NO. 57

Recommended Frequency: Up to 20 KHz.
Maximum Inductance: 10 H.
Special Core Stabilization: L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
2.0	57-1	0.48	40
2.4	57-2	0.52	40
3.0	57-3	0.74	42
3.6	57-4	0.81	42
4.3	57-5	1.11	42
5.0	57-6	1.19	44
6.0	57-7	1.31	44
7.2	57-8	1.43	44
8.6	57-9	1.56	46
10.0	57-10	2.19	46
12.0	57-11	2.40	46
15.0	57-12	3.40	46
17.5	57-13	3.66	48
20.0	57-14	4.84	48
24.0	57-15	5.30	50
30.0	57-16	7.29	50
36.0	57-17	7.99	52
43.0	57-18	8.73	52
50.0	57-19	11.60	54
60.0	57-20	12.70	54
72.0	57-21	13.90	56
86.0	57-22	18.80	56
100.0	57-23	20.30	56
120.0	57-24	28.00	58
150.0	57-25	31.30	58
175.0	57-26	42.60	60
200.0	57-27	45.50	62
240.0	57-28	49.80	62
300.0	57-29	74.10	64
360.0	57-30	81.20	64
430.0	57-31	115.00	64
500.0	57-32	124.00	66
600.0	57-33	136.00	66
720.0	57-34	186.00	66
860.0	57-35	203.00	68
1.00 H	57-36	219.00	68
1.20 H	57-37	303.00	70
1.50 H	57-38	338.00	72
1.75 H	57-39	366.00	72
2.00 H	57-40	492.00	74
2.40 H	57-41	682.00	74
3.00 H	57-42	762.00	74
3.60 H	57-43	835.00	76
4.30 H	57-44	1160.00	76
5.00 H	57-45	1250.00	76



CALL TOROTEL PRODUCTS FOR YOUR COMPETITIVELY PRICED CUSTOM MAGNETICS REQUIREMENTS

TOROTEL PRODUCTS INC. 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

INDUCTORS

TOROIDAL INDUCTORS

Studs are available on the "M" Series on special request.

Mechanical Tolerance: ±.015 unless otherwise indicated.

WHEN ORDERING, ADD CASE PREFIX (TYPE) TO PART NUMBER.
EXAMPLE: PS 90-1
CASE TYPE — PART NUMBER

CORE NO. 90

Recommended Frequency: Up to 50 KHz.
Maximum Inductance: 9 H.
Special Core Stabilization: D, L, M, W.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
3.0	90-1	1.10	34
3.6	90-2	1.20	35
4.0	90-3	1.61	35
4.3	90-4	1.67	36
5.0	90-5	1.80	36
6.0	90-6	1.97	36
7.2	90-7	2.70	37
7.5	90-8	2.75	37
8.6	90-9	2.95	37
10.0	90-10	3.82	38
12.0	90-11	4.19	38
12.5	90-12	4.28	38
15.0	90-13	4.68	38
17.5	90-14	6.15	39
20.0	90-15	6.57	39
24.0	90-16	9.18	39
25.0	90-17	9.36	39
30.0	90-18	10.30	40
36.0	90-19	11.30	40
40.0	90-20	15.10	40
43.0	90-21	15.70	41
50.0	90-22	16.90	41
60.0	90-23	18.50	42
72.0	90-24	25.40	42
75.0	90-25	25.90	43
86.0	90-26	27.70	43
100.0	90-27	29.90	44
120.0	90-28	42.30	45
125.0	90-29	43.10	45
150.0	90-30	47.20	46
175.0	90-31	63.00	46
200.0	90-32	67.50	47
240.0	90-33	74.00	47
250.0	90-34	75.50	48
300.0	90-35	104.00	48
360.0	90-36	114.00	49
400.0	90-37	120.00	49
430.0	90-38	165.00	50
500.0	90-39	178.00	50
600.0	90-40	195.00	50
720.0	90-41	264.00	51
750.0	90-42	270.00	51
860.0	90-43	288.00	52
1.00 H	90-44	312.00	52
1.20 H	90-45	480.00	53
1.25 H	90-46	490.00	53
1.50 H	90-47	610.00	54
1.75 H	90-48	659.00	54
2.00 H	90-49	705.00	55
2.40 H	90-50	772.00	55
2.50 H	90-51	788.00	56
3.00 H	90-52	1090.00	56
3.60 H	90-53	1190.00	57
4.00 H	90-54	1522.00	57
5.00 H	90-55	1705.00	58
6.00 H	90-56	2420.00	58

CORE NO. 89

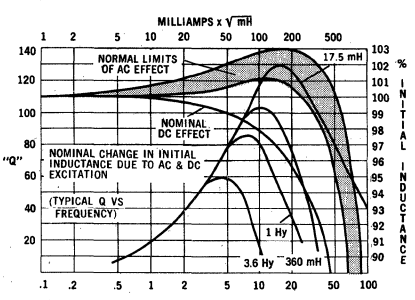
Recommended Frequency: Up to 200 KHz.
Maximum Inductance: 1.5 H.
Special Core Stabilization: D, L, M, W

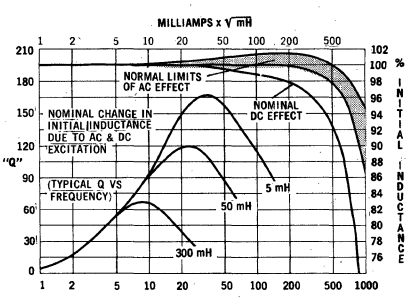
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
1.50	89-1	1.12	27
1.75	89-2	1.20	27
2.00	89-3	1.63	28
2.40	89-4	1.89	28
3.00	89-5	2.00	29
3.60	89-6	2.74	29
4.30	89-7	2.98	30
5.00	89-8	3.87	31
6.00	89-9	4.24	31
7.20	89-10	4.65	32
8.60	89-11	6.18	32
10.00	89-12	6.67	33
12.00	89-13	9.30	33
15.00	89-14	10.40	34
17.50	89-15	11.20	34
20.00	89-16	15.20	35
24.00	89-17	16.70	35
30.00	89-18	18.70	36
36.00	89-19	25.80	36
43.00	89-20	28.20	37
50.00	89-21	30.40	37
60.00	89-22	42.80	38
72.00	89-23	46.80	38
86.00	89-24	62.50	39
100.00	89-25	68.50	39
120.00	89-26	74.90	40
150.00	89-27	105.00	41
175.00	89-28	114.00	42
200.00	89-29	122.00	43
240.00	89-30	177.00	44
300.00	89-31	197.00	45
360.00	89-32	268.00	46
430.00	89-33	292.00	47
500.00	89-34	315.00	48
600.00	89-35	422.00	49

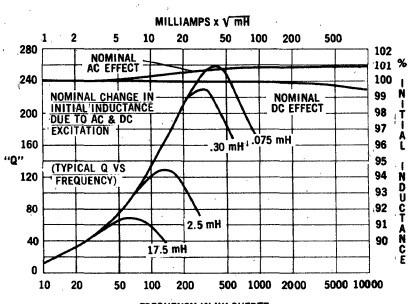
CORE NO. 68

Recommended Frequency: 50 KHz to 2 MHz.
Maximum Inductance: 30 mH.
Only Core Stabilization Available: ±90 PPM/°C.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
0.075	68-1	0.40	9
0.086	68-2	0.54	9
0.100	68-3	0.59	9
0.120	68-4	0.64	9
0.125	68-5	0.65	10
0.150	68-6	0.83	10
0.175	68-7	0.90	10
0.200	68-8	0.96	10
0.240	68-9	1.31	10
0.250	68-10	1.34	10
0.300	68-11	1.47	10
0.360	68-12	1.95	10
0.400	68-13	2.06	10
0.430	68-14	2.14	10
0.500	68-15	2.30	10
0.600	68-16	3.25	11
0.720	68-17	3.56	11
0.750	68-18	3.64	11
0.860	68-19	3.90	11
1.000	68-20	5.02	11
1.200	68-21	5.50	11
1.250	68-22	5.62	11
1.500	68-23	6.15	11
1.750	68-24	8.53	11
2.000	68-25	9.10	11
2.400	68-26	9.98	12
2.500	68-27	10.20	12
3.000	68-28	14.10	12
3.600	68-29	15.50	12
4.000	68-30	16.30	12
4.300	68-31	16.90	12
5.000	68-32	23.40	12
6.000	68-33	25.60	13
7.200	68-34	33.40	13
7.500	68-35	34.00	13
8.600	68-36	36.40	13
10.000	68-37	39.30	13
12.000	68-38	55.50	14
12.500	68-39	56.70	14
15.000	68-40	75.80	15
17.500	68-41	81.80	15







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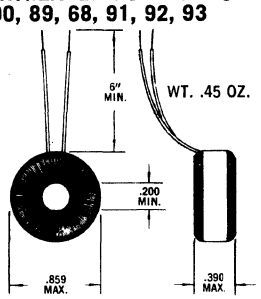
TOROIDAL INDUCTORS

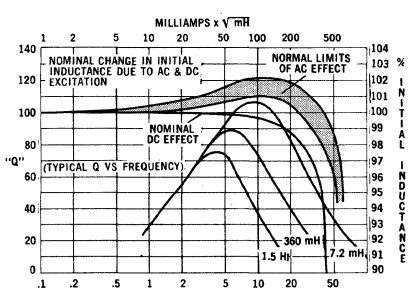
TYPE U — Uncased AVAILABLE FOR CORES 90, 89, 68, 91, 92, 93



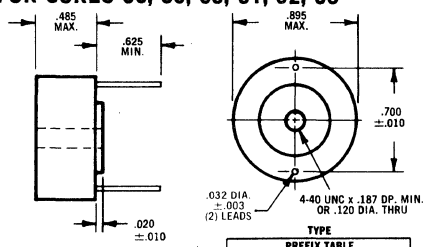
CORE NO. 91

Recommended Frequency: Up to 30 KHz.
Maximum Inductance: 11 H.
Special Core Stabilization: D, W, M, L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
3.0	91-1	0.96	36
3.6	91-2	1.05	36
4.3	91-3	1.14	36
5.0	91-4	1.23	36
6.0	91-5	1.73	38
7.2	91-6	1.90	38
8.6	91-7	2.60	38
10.0	91-8	2.80	38
12.0	91-9	3.07	38
15.0	91-10	4.02	40
17.5	91-11	4.34	40
20.0	91-12	4.64	40
24.0	91-13	6.50	42
30.0	91-14	7.26	42
36.0	91-15	10.00	42
43.0	91-16	10.90	44
50.0	91-17	11.80	44
60.0	91-18	16.30	46
72.0	91-19	17.90	46
86.0	91-20	19.50	46
100.0	91-21	26.60	46
120.0	91-22	29.10	48
150.0	91-23	41.30	48
175.0	91-24	44.60	48
200.0	91-25	47.70	50
240.0	91-26	52.20	50
300.0	91-27	73.10	52
360.0	91-28	80.10	52
430.0	91-29	110.00	54
500.0	91-30	119.00	54
600.0	91-31	170.00	54
720.0	91-32	186.00	56
860.0	91-33	204.00	56
1.00 H	91-34	278.00	58
1.20 H	91-35	305.00	58
1.50 H	91-36	423.00	58
1.75 H	91-37	457.00	60
2.00 H	91-38	489.00	60
2.40 H	91-39	680.00	62
3.00 H	91-40	760.00	62
3.60 H	91-41	833.00	62
4.30 H	91-42	1130.00	64
5.00 H	91-43	1570.00	64
6.00 H	91-44	1720.00	66



TYPE PS/PF/PFC/PSC — Epoxy Encapsulated - AVAILABLE FOR CORES 90, 89, 68, 91, 92, 93

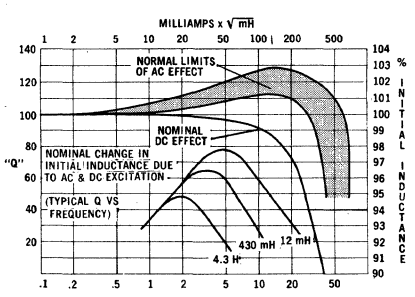


TYPE PREFIX TABLE		
4-40 UNC	THRU HOLE	STYLE
PS	PSC	NO FOOT
PF	PFC	WITH FOOT

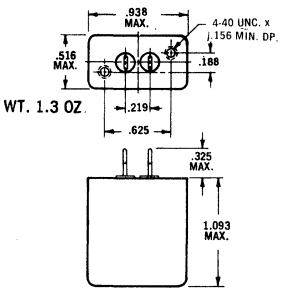
CORE NO. 92

Recommended Frequency: Up to 20 KHz.
Maximum Inductance: 14 H.
Special Core Stabilization: D, W, M, L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
3.6	92-1	0.93	40
4.3	92-2	1.02	42
5.0	92-3	1.10	42
6.0	92-4	1.20	44
7.2	92-5	1.70	44
8.6	92-6	1.85	44
10.0	92-7	2.51	46
12.0	92-8	2.74	46
15.0	92-9	3.07	46
17.5	92-10	3.88	48
20.0	92-11	4.15	48
24.0	92-12	4.55	50
30.0	92-13	6.50	50
36.0	92-14	7.12	52
43.0	92-15	9.76	52
50.0	92-16	10.50	54
60.0	92-17	11.50	54
72.0	92-18	16.00	54
86.0	92-19	17.50	56
100.0	92-20	18.80	56
120.0	92-21	26.10	56
150.0	92-22	29.10	58
175.0	92-23	39.90	58
200.0	92-24	42.70	60
240.0	92-25	46.70	60
300.0	92-26	52.20	62
360.0	92-27	71.60	62
430.0	92-28	78.30	64
500.0	92-29	106.00	64
600.0	92-30	116.00	64
720.0	92-31	167.00	66
860.0	92-32	182.00	66
1.00 H	92-33	196.00	68
1.20 H	92-34	273.00	68
1.50 H	92-35	305.00	70
1.75 H	92-36	409.00	72
2.00 H	92-37	437.00	72
2.40 H	92-38	479.00	74
3.00 H	92-39	680.00	74
3.60 H	92-40	745.00	74
4.30 H	92-41	814.00	76
5.00 H	92-42	1090.00	76
6.00 H	92-43	1540.00	78
7.20 H	92-44	1690.00	80



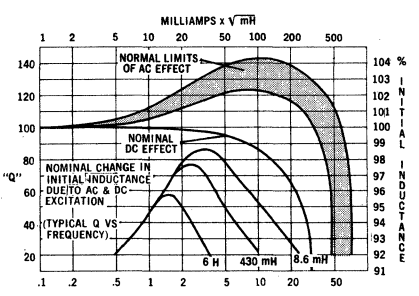
TYPE M — Metal Cased - AVAILABLE FOR CORES 90, 89, 68, 91, 92, 93



CORE NO. 93

Recommended Frequency: Up to 10 KHz.
Maximum Inductance: 20 H.
Special Core Stabilization: L.

Inductance ±1% (mH)	Part Number	Typical DCR* (ohms)	Typical Distributed Capacity (pf)
5.0	93-1	0.90	46
6.0	93-2	0.98	46
7.2	93-3	1.08	46
8.6	93-4	1.18	48
10.0	93-5	1.63	48
12.0	93-6	1.78	50
15.0	93-7	2.50	52
17.5	93-8	2.70	52
20.0	93-9	2.89	54
24.0	93-10	3.70	54
30.0	93-11	4.14	54
36.0	93-12	4.54	56
43.0	93-13	6.35	56
50.0	93-14	6.84	58
60.0	93-15	9.41	58
72.0	93-16	10.30	60
86.0	93-17	11.30	62
100.0	93-18	15.40	62
120.0	93-19	16.80	62
150.0	93-20	18.80	64
175.0	93-21	25.70	64
200.0	93-22	27.40	66
240.0	93-23	30.00	66
300.0	93-24	42.60	68
360.0	93-25	46.70	68
430.0	93-26	51.00	68
500.0	93-27	68.80	70
600.0	93-28	75.40	70
720.0	93-29	104.00	72
860.0	93-30	114.00	72
1.00 H	93-31	160.00	74
1.20 H	93-32	175.00	74
1.50 H	93-33	196.00	76
1.75 H	93-34	269.00	76
2.00 H	93-35	287.00	76
2.40 H	93-36	315.00	78
3.00 H	93-37	436.00	80
3.60 H	93-38	478.00	82
4.30 H	93-39	664.00	82
5.00 H	93-40	716.00	84
6.00 H	93-41	784.00	86
7.20 H	93-42	1070.00	86
8.60 H	93-43	1170.00	88
10.00 H	93-44	1620.00	90



CALL TOROTEL PRODUCTS FOR YOUR COMPETITIVELY PRICED CUSTOM MAGNETICS REQUIREMENTS

TOROTEL PRODUCTS INC.
13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

INDUCTORS

TOROIDAL INDUCTORS

Studs are available on the "M" Series on special request.

Mechanical Tolerance: ±.015 unless otherwise indicated.

WHEN ORDERING, ADD CASE PREFIX (TYPE) TO PART NUMBER.†

EXAMPLE: U 24-1

CASE TYPE — PART NUMBER

† Add "C" to Part Number of molded inductor if clearance hole is desired.

CORE NO. 06

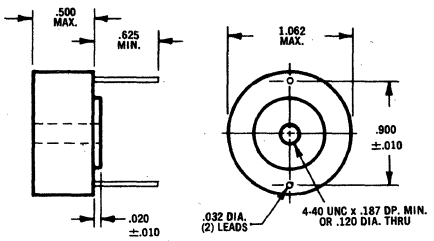
Recommended Frequency: Up to 3) KHz

Maximum Inductance: 7.2 H.

Special Core Stabilization Available: B, D, L, M, W.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
5.0	06-1	1.05	40
6.0	06-40	1.26	42
7.2	06-41	1.51	43
7.5	06-2	1.58	43
8.6	06-42	1.80	43
10.0	06-3	2.10	44
12.0	06-43	2.52	44
12.5	06-4	2.63	44
15.0	06-5	3.15	44
17.5	06-44	3.67	45
20.0	06-6	4.20	45
24.0	06-45	5.04	45
25.0	06-7	5.25	46
30.0	06-8	6.30	46
36.0	06-46	7.56	47
40.0	06-9	8.40	48
43.0	06-47	9.03	48
50.0	06-10	10.50	48
60.0	06-48	12.60	49
72.0	06-49	15.10	49
75.0	06-11	15.80	49
86.0	06-50	18.00	49
100.0	06-12	21.00	50
120.0	06-51	25.20	50
125.0	06-13	26.30	51
150.0	06-14	31.50	51
175.0	06-53	36.80	51
200.0	06-15	42.00	52
240.0	06-54	50.40	52
250.0	06-52	52.50	52
300.0	06-16	63.00	53
360.0	06-55	75.60	53
400.0	06-17	84.00	54
430.0	06-56	90.30	54
500.0	06-18	105.00	55
600.0	06-57	126.00	55
720.0	06-58	151.00	55
750.0	06-19	158.00	56
860.0	06-59	180.00	56
1.00 H	06-20	210.00	57
1.20 H	06-60	252.00	57
1.25 H	06-21	263.00	57
1.50 H	06-22	315.00	58
1.75 H	06-61	368.00	58
2.00 H	06-23	420.00	58
2.40 H	06-62	504.00	59
2.50 H	06-69	525.00	59
3.00 H	06-24	630.00	59
3.60 H	06-70	756.00	60
4.30 H	06-71	840.00	60
5.00 H	06-72	903.00	61
6.00 H	06-73	1260.00	62
7.20 H	06-74	1512.00	62

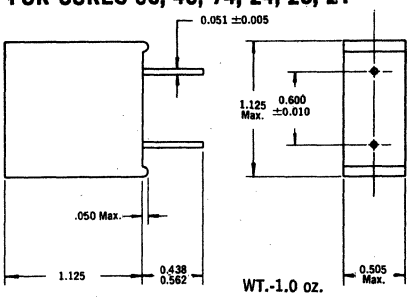
TYPE PS/PF/PFC/PSC — P.C. Mount AVAILABLE FOR CORES 06, 48, 74, 24, 23, 21



WT.-1.0 oz.

TYPE PREFIX TABLE		
4-40 UNC	THRU HOLE	STYLE
PS	PSC	NO FOOT
PF	PFC	WITH FOOT

TYPE PC — P.C. Mount - AVAILABLE FOR CORES 06, 48, 74, 24, 23, 21



WT.-1.0 oz.

CORE NO. 48

Recommended Frequency: Up to 100 KHz.

Maximum Inductance: 1 H.

Special Core Stabilization Available: B, D, M, W, L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
2.0	48-1	0.84	30
2.4	48-2	1.01	31
3.0	48-3	1.26	31
3.6	48-4	1.51	32
4.3	48-5	1.80	32
5.0	48-6	2.10	33
6.0	48-7	2.50	33
7.2	48-8	3.02	34
8.6	48-9	3.61	34
10.0	48-10	4.20	35
12.0	48-11	5.05	35
15.0	48-12	6.30	36
17.5	48-13	7.35	36
20.0	48-14	8.40	37
24.0	48-15	10.10	37
30.0	48-16	12.60	38
36.0	48-17	15.10	39
43.0	48-18	18.00	39
50.0	48-19	21.00	40
60.0	48-20	25.20	41
72.0	48-21	30.20	42
86.0	48-22	36.10	43
100.0	48-23	42.00	44
120.0	48-24	50.40	45
150.0	48-25	63.00	46
175.0	48-26	73.50	47
200.0	48-27	84.00	48
240.0	48-28	101.00	49
300.0	48-29	126.00	50
360.0	48-30	151.00	51
430.0	48-31	180.00	52
500.0	48-32	210.00	53
600.0	48-33	252.00	54

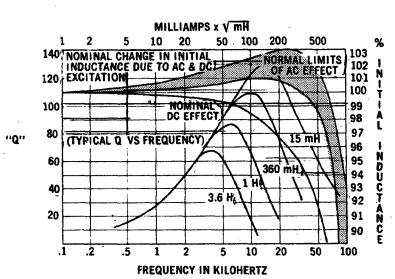
CORE NO. 74

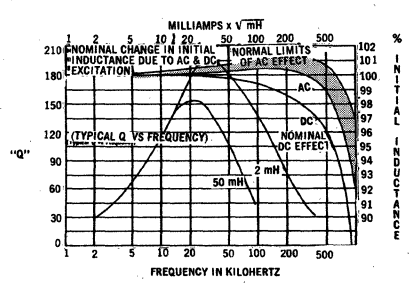
Recommended Frequency: 25 KHz to 1 MHz.

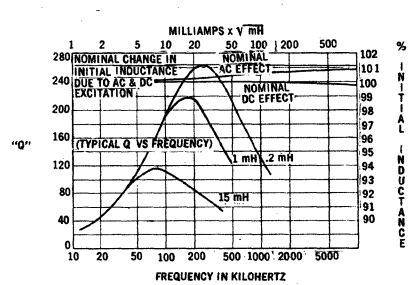
Maximum Inductance: 30 mH.

Only Core Stabilization Available: H.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
0.100	74-1	0.31	18
0.120	74-2	0.36	18
0.125	74-3	0.39	19
0.150	74-4	0.46	19
0.175	74-5	0.55	20
0.200	74-6	0.62	20
0.240	74-7	0.74	20
0.250	74-8	0.77	21
0.300	74-9	0.92	21
0.360	74-10	1.11	21
0.400	74-11	1.23	21
0.430	74-12	1.33	22
0.500	74-13	1.54	22
0.600	74-14	1.85	22
0.720	74-15	2.21	23
0.750	74-16	2.31	23
0.860	74-17	2.65	23
1.000	74-18	3.08	23
1.200	74-19	3.60	24
1.250	74-20	3.80	24
1.500	74-21	4.60	24
1.750	74-22	5.50	25
2.000	74-23	6.20	25
2.400	74-24	7.40	25
2.500	74-25	7.70	26
3.000	74-26	9.20	26
3.600	74-27	11.10	27
4.000	74-28	12.30	27
4.300	74-29	13.30	28
5.000	74-30	15.40	28
6.000	74-31	18.50	29
7.200	74-32	22.10	29
7.500	74-33	23.10	30
8.600	74-34	26.50	30
10.000	74-35	30.80	31
12.000	74-36	36.90	32
12.250	74-37	38.50	33
15.000	74-38	46.20	33
17.500	74-39	53.90	34
20.000	74-40	61.60	35





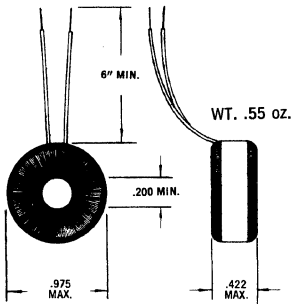


INDUCTORS

TOROTEL PRODUCTS INC./13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

TOROIDAL INDUCTORS

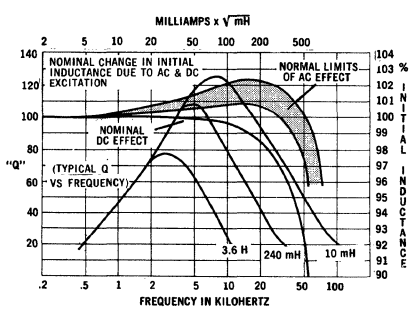
TYPE U — Uncased - AVAILABLE FOR CORES 06, 48, 74, 24, 23, 21



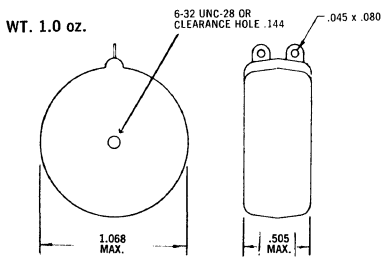
CORE NO. 24

Recommended Frequency: Up to 20 KHz
Maximum Inductance: 12 H.
Special Core Stabilization: D, W, M, L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
6.0	24-1	0.88	40
7.2	24-2	0.97	40
8.6	24-3	1.33	42
10.0	24-4	1.44	42
12.0	24-5	1.80	42
15.0	24-6	2.01	44
17.5	24-7	2.74	44
20.0	24-8	2.93	44
24.0	24-9	3.21	44
30.0	24-10	5.20	46
36.0	24-11	5.70	46
43.0	24-12	6.23	46
50.0	24-13	8.31	46
60.0	24-14	9.10	48
72.0	24-15	9.97	48
86.0	24-16	13.50	48
100.0	24-17	14.50	50
120.0	24-18	20.00	50
150.0	24-19	22.40	50
175.0	24-20	30.80	52
200.0	24-21	32.90	52
240.0	24-22	36.10	52
300.0	24-23	52.50	54
360.0	24-24	57.50	54
430.0	24-25	62.90	56
500.0	24-26	87.00	56
600.0	24-27	95.30	56
720.0	24-28	104.00	58
860.0	24-29	142.00	58
1.00 H	24-30	153.00	58
1.20 H	24-31	212.00	60
1.50 H	24-32	237.00	62
1.75 H	24-33	256.00	62
2.00 H	24-34	345.00	64
2.40 H	24-35	376.00	64
3.00 H	24-36	522.00	64
3.60 H	24-37	572.00	66
4.30 H	24-38	768.00	66
5.00 H	24-39	861.00	68
6.00 H	24-40	1150.00	68
7.20 H	24-41	1260.00	68
8.60 H	24-42	1740.00	70



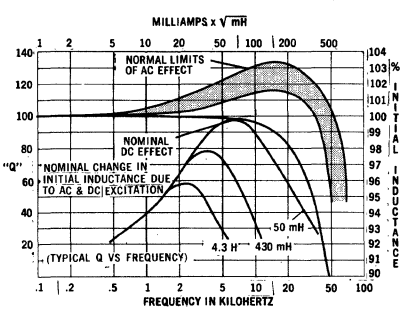
TYPE P — Compression Molded AVAILABLE FOR CORES 06, 48, 74, 24, 23, 21



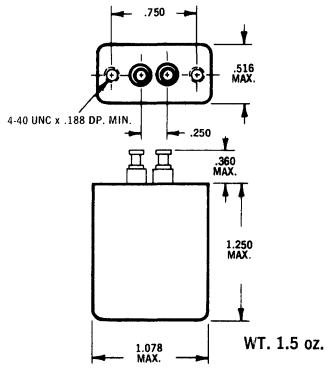
CORE NO. 23

Recommended Frequency Up to 15 KHz.
Maximum Inductance: 15 H.
Special Core Stabilization: D, W, M, L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
7.2	23-1	0.86	44
8.6	23-2	0.94	44
10.0	22-3	1.29	44
12.0	23-4	1.41	46
15.0	23-5	1.80	46
17.5	23-6	1.95	46
20.0	23-7	2.08	46
24.0	23-8	2.87	48
30.0	23-9	3.21	48
36.0	23-10	5.09	48
43.0	23-11	5.56	48
50.0	23-12	6.00	48
60.0	23-13	8.13	50
72.0	23-14	8.91	50
86.0	23-15	9.73	50
100.0	23-16	13.00	52
120.0	23-17	14.20	52
150.0	23-18	20.00	54
175.0	23-19	21.60	54
200.0	23-20	23.10	54
240.0	23-21	32.20	56
300.0	23-22	36.00	56
360.0	23-23	51.40	58
430.0	23-24	56.20	58
500.0	23-25	60.60	60
600.0	23-26	85.20	60
720.0	23-27	93.30	62
860.0	23-28	102.00	64
1.00 H	23-29	137.00	64
1.20 H	23-30	150.00	66
1.50 H	23-31	211.00	66
1.75 H	23-32	228.00	68
2.00 H	23-33	244.00	68
2.40 H	23-34	336.00	68
3.00 H	23-35	376.00	70
3.60 H	23-36	511.00	72
4.30 H	23-37	559.00	74
5.00 H	23-38	602.00	74
6.00 H	23-39	842.00	76
7.20 H	23-40	1130.00	78
8.60 H	23-41	1230.00	80
10.00 H	23-42	1680.00	82



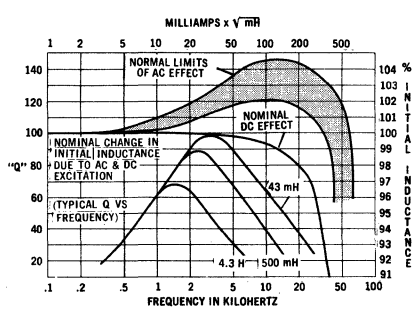
TYPE M — Metal Cased - AVAILABLE FOR CORES 06, 48, 74, 24, 23, 21



CORE NO. 21

Recommended Frequency: Up to 5 KHz.
Maximum Inductance: 20 H.
Special Core Stabilization: L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
10.0	21-1	0.83	50
12.0	21-2	0.91	52
15.0	21-3	1.29	52
17.5	21-4	1.39	54
20.0	21-5	1.70	54
24.0	21-6	1.86	54
30.0	21-7	2.08	56
36.0	21-8	2.87	56
43.0	21-9	3.14	58
50.0	21-10	4.91	58
60.0	21-11	5.38	60
72.0	21-12	5.89	60
86.0	21-13	7.96	62
100.0	21-14	8.58	62
120.0	21-15	9.40	64
150.0	21-16	13.00	64
175.0	21-17	14.00	64
200.0	21-18	15.00	66
240.0	21-19	20.70	66
300.0	21-20	23.20	66
360.0	21-21	32.30	68
430.0	21-22	35.20	68
500.0	21-23	38.00	70
600.0	21-24	54.30	70
720.0	21-25	59.40	72
860.0	21-26	83.40	74
1.00 H	21-27	90.00	74
1.20 H	21-28	98.50	76
1.50 H	21-29	137.00	76
1.75 H	21-30	148.00	76
2.00 H	21-31	199.00	78
2.40 H	21-32	219.00	78
3.00 H	21-33	244.00	80
3.60 H	21-34	337.00	80
4.30 H	21-35	368.00	82
5.00 H	21-36	492.00	84
6.00 H	21-37	540.00	84
7.20 H	21-38	591.00	86
8.60 H	21-39	825.00	86
10.00 H	21-40	1090.00	88
12.00 H	21-41	1190.00	88
15.00 H	21-42	1680.00	90



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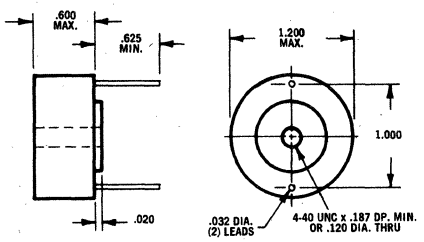
INDUCTORS

TOROIDAL INDUCTORS

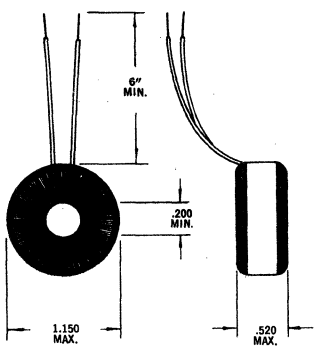
TYPE PS/PF/PFC/PSC — Epoxy Encapsulated - AVAILABLE FOR CORES 59, 10, 08, 07, 05



WT. 1.5 oz

TYPE PREFIX TABLE		
4-40 UNC	THRU HOLE	STYLE
PS	PSC	NO FOOT
PF	PFC	WITH FOOT

TYPE U — Uncased - AVAILABLE FOR CORES 59, 10, 08, 07, 05



WT. .82 oz.

Mech. Tol. = ±.010 unless indicated.

WHEN ORDERING, ADD CASE PREFIX (TYPE) TO PART NUMBER.

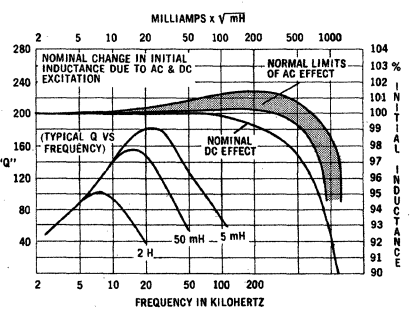
EXAMPLE: U 59-1

CASE TYPE — PART NUMBER

CORE NO. 59

Recommended Frequency: Up to 50 KHz.
Maximum Inductance: 5 H.
Special Core Stabilization: D, W, M, L.

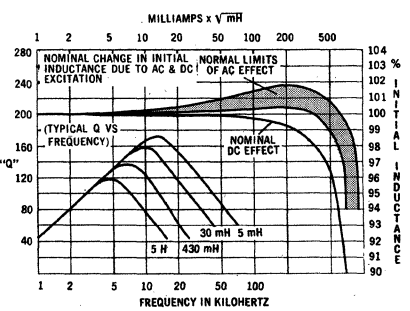
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
3.0	59-1	0.85	50
3.6	59-2	1.17	54
4.3	59-3	1.27	56
5.0	59-4	1.67	60
6.0	59-5	1.83	64
7.2	59-6	2.00	66
8.6	59-7	2.75	68
10.0	59-8	2.97	70
12.0	59-9	3.25	74
15.0	59-10	4.45	76
17.5	59-11	4.80	78
20.0	59-12	6.64	80
24.0	59-13	7.27	82
30.0	59-14	8.13	84
36.0	59-15	11.30	84
43.0	59-16	12.30	86
50.0	59-17	13.30	88
60.0	59-18	18.50	90
72.0	59-19	20.30	92
86.0	59-20	22.20	94
100.0	59-21	30.70	96
120.0	59-22	33.60	98
150.0	59-23	48.30	100
175.0	59-24	52.10	102
200.0	59-25	55.70	104
240.0	59-26	76.90	104
300.0	59-27	86.00	106
360.0	59-28	119.00	106
430.0	59-29	130.00	108
500.0	59-30	140.00	110
600.0	59-31	188.00	112
720.0	59-32	205.00	114
860.0	59-33	225.00	116
1.00 H	59-34	306.00	118
1.20 H	59-35	335.00	120
1.50 H	59-36	472.00	124
1.75 H	59-37	510.00	126
2.00 H	59-38	709.00	130
2.40 H	59-39	777.00	136
3.00 H	59-40	868.00	140
3.60 H	59-41	1200.00	150



CORE NO. 10

Recommended Frequency: Up to 25 KHz.
Maximum Inductance: 12 H.
Special Core Stabilization: D, W, M, L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
5.0	10-1	0.76	50
6.0	10-2	0.83	54
7.2	10-3	1.14	56
8.6	10-4	1.25	60
10.0	10-5	1.34	64
12.0	10-6	1.79	66
15.0	10-7	2.00	68
17.5	10-8	2.71	70
20.0	10-9	2.90	74
24.0	10-10	3.17	76
30.0	10-11	4.34	78
36.0	10-12	4.75	80
43.0	10-13	6.72	82
50.0	10-14	7.25	84
60.0	10-15	7.94	84
72.0	10-16	11.00	86
86.0	10-17	12.00	88
100.0	10-18	13.00	90
120.0	10-19	18.10	92
150.0	10-20	20.20	94
175.0	10-21	21.80	96
200.0	10-22	30.00	98
240.0	10-23	32.90	100
300.0	10-24	47.20	102
360.0	10-25	51.70	104
430.0	10-26	56.50	104
500.0	10-27	76.70	106
600.0	10-28	84.10	106
720.0	10-29	116.00	108
860.0	10-30	127.00	110
1.00 H	10-31	137.00	112
1.20 H	10-32	183.00	114
1.50 H	10-33	205.00	116
1.75 H	10-34	221.00	118
2.00 H	10-35	299.00	120
2.40 H	10-36	328.00	124
3.00 H	10-37	366.00	126
3.60 H	10-38	506.00	130
4.30 H	10-39	719.00	136
5.00 H	10-40	775.00	140
6.00 H	10-41	849.00	150
7.20 H	10-42	1170.00	156
8.60 H	10-43	1610.00	160



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INDUCTORS

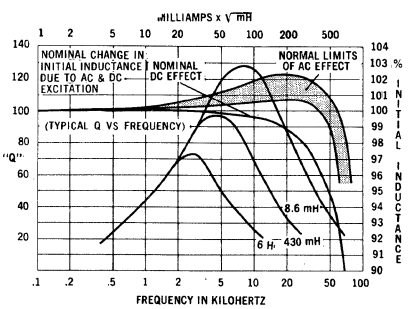
TOROTEL PRODUCTS INC./13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

TOROIDAL INDUCTORS

CORE NO. 08

Recommended Frequency: Up to 20 KHz.
Maximum Inductance: 16 H.
Special Core Stabilization: D, W, M, L.

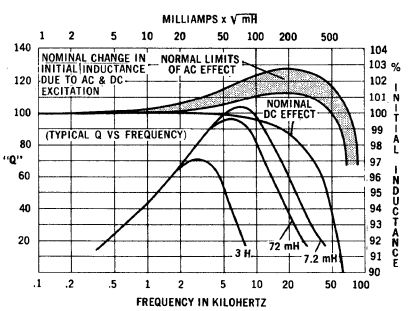
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
7.2	08-1	0.80	60
8.6	08-2	0.88	64
10.0	08-3	1.19	66
12.0	08-4	1.30	68
15.0	08-5	1.77	70
17.5	08-6	1.91	74
20.0	08-7	2.04	76
24.0	08-8	2.81	80
30.0	08-9	3.14	84
36.0	08-10	4.21	86
43.0	08-11	4.60	88
50.0	08-12	4.96	90
60.0	08-13	7.03	94
72.0	08-14	7.70	96
86.0	08-15	8.42	96
100.0	08-16	11.50	98
120.0	08-17	12.60	100
150.0	08-18	14.00	104
175.0	08-19	19.30	106
200.0	08-20	20.70	106
240.0	08-21	29.10	108
300.0	08-22	32.50	110
360.0	08-23	45.70	112
430.0	08-24	50.00	114
500.0	08-25	53.90	116
600.0	08-26	74.40	118
720.0	08-27	81.50	120
860.0	08-28	89.00	124
1.00 H	08-29	121.00	126
1.20 H	08-30	133.00	128
1.50 H	08-31	148.00	130
1.75 H	08-32	196.00	134
2.00 H	08-33	209.00	136
2.40 H	08-34	229.00	140
3.00 H	08-35	324.00	144
3.60 H	08-36	355.00	146
4.30 H	08-37	489.00	150
5.00 H	08-38	527.00	154
6.00 H	08-39	751.00	160
7.20 H	08-40	823.00	166
8.60 H	08-41	938.00	168
10.00 H	08-42	1220.00	170



CORE NO. 07

Recommended Frequency: Up to 15 KHz.
Maximum Inductance: 18 H.
Special Core Stabilization: D, W, M, L.

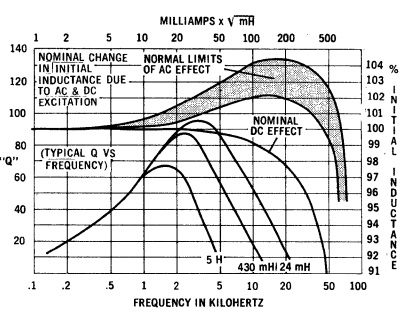
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
10.0	07-1	0.85	60
12.0	07-2	1.17	64
15.0	07-3	1.30	66
17.5	07-4	1.71	68
20.0	07-5	1.83	70
24.0	07-6	2.00	74
30.0	07-7	2.81	76
36.0	07-8	3.08	80
43.0	07-9	3.36	84
50.0	07-10	4.43	86
60.0	07-11	4.85	88
72.0	07-12	6.88	90
86.0	07-13	7.52	94
100.0	07-14	8.11	96
120.0	07-15	11.20	96
150.0	07-16	12.60	98
175.0	07-17	13.60	100
200.0	07-18	18.50	104
240.0	07-19	20.20	106
300.0	07-20	29.00	106
360.0	07-21	31.80	108
430.0	07-22	44.70	110
500.0	07-23	48.10	112
600.0	07-24	52.70	114
720.0	07-25	57.80	116
860.0	07-26	79.60	118
1.00 H	07-27	85.80	120
1.20 H	07-28	119.00	124
1.50 H	07-29	132.00	126
1.75 H	07-30	143.00	128
2.00 H	07-31	187.00	130
2.40 H	07-32	205.00	134
3.00 H	07-33	229.00	136
3.60 H	07-34	317.00	140
4.30 H	07-35	347.00	144
5.00 H	07-36	471.00	146
6.00 H	07-37	516.00	150
7.20 H	07-38	735.00	154
8.60 H	07-39	803.00	160
10.00 H	07-40	866.00	166
12.00 H	07-41	1200.00	170



CORE NO. 05

Recommended Frequency: Up to 5 KHz.
Maximum Inductance: 25 H.
Special Core Stabilization: L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
15.0	05-1	0.85	70
17.5	05-2	1.15	74
20.0	05-3	1.23	76
24.0	05-4	1.34	80
30.0	05-5	1.83	84
36.0	05-6	2.00	86
43.0	05-7	2.74	88
50.0	05-8	2.96	90
60.0	05-9	3.24	92
72.0	05-10	4.34	94
86.0	05-11	4.74	96
100.0	05-12	6.62	100
120.0	05-13	7.25	104
150.0	05-14	8.11	106
175.0	05-15	11.10	108
200.0	05-16	11.80	110
240.0	05-17	13.00	112
300.0	05-18	18.50	114
360.0	05-19	20.20	116
430.0	05-20	22.10	118
500.0	05-21	30.60	120
600.0	05-22	33.50	124
720.0	05-23	47.20	126
860.0	05-24	51.60	130
1.00 H	05-25	55.60	134
1.20 H	05-26	76.70	136
1.50 H	05-27	85.80	138
1.75 H	05-28	117.00	140
2.00 H	05-29	125.00	144
2.40 H	05-30	137.00	146
3.00 H	05-31	187.00	150
3.60 H	05-32	205.00	154
4.30 H	05-33	224.00	156
5.00 H	05-34	305.00	160
6.00 H	05-35	334.00	164
7.20 H	05-36	366.00	166
8.60 H	05-37	504.00	168
10.00 H	05-38	707.00	170
12.00 H	05-39	775.00	174
15.00 H	05-40	866.00	180
17.50 H	05-41	1180.00	186
20.00 H	05-42	1590.00	190



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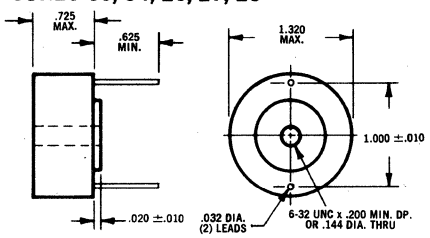
INDUCTORS

TOROIDAL INDUCTORS

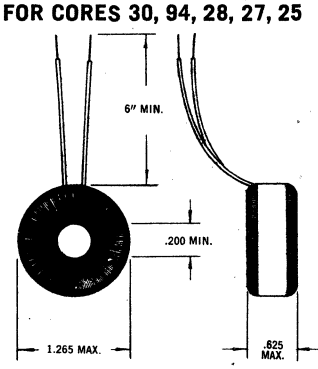
TYPE PS/PF/PSC/PFC — Epoxy Encapsulated - AVAILABLE FOR CORES 30, 94, 28, 27, 25



WT. 2.5 oz.

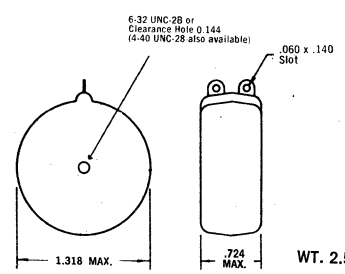
TYPE PREFIX TABLE		
6-32 UNC THRU HOLE		STYLE
PS	PSC	NO FOOT
PF	PFC	WITH FOOT

TYPE U — Uncased - AVAILABLE FOR CORES 30, 94, 28, 27, 25



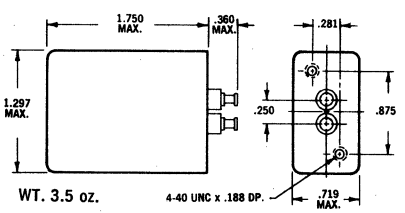
WT. 1.6 oz.

TYPE P — Compression Molded AVAILABLE FOR CORES 30, 94, 28, 27, 25



WT. 2.5 oz.

TYPE M — Metal Cased



WT. 3.5 oz.

Mechanical Tolerance: ±.015 unless otherwise Indicated.

Studs are available on the "M" Series on special request.

CORE NO. 30

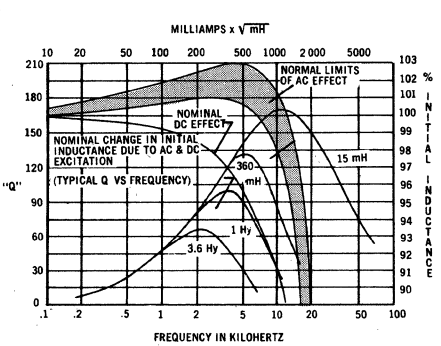
Recommended Frequency: Up to 20 KHz.
Maximum Inductance: 17.5 H.
Special Core Stabilization Available: B, D, L, M, W.

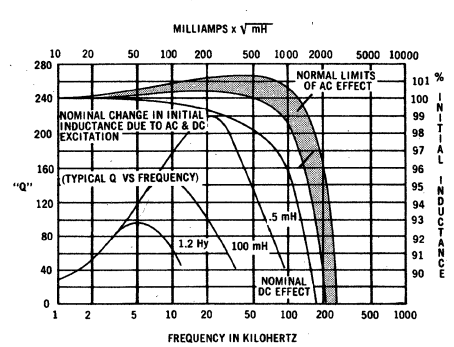
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
5.0	30-1	0.53	63
6.0	30-40	0.63	64
7.2	30-41	0.76	65
7.5	30-2	0.79	66
8.6	30-42	0.90	67
10.0	30-3	1.05	68
12.0	30-43	1.26	69
12.5	30-4	1.31	69
15.0	30-5	1.58	70
17.5	30-44	1.84	71
20.0	30-6	2.10	72
24.0	30-45	2.52	73
25.0	30-7	2.63	73
30.0	30-8	3.15	75
36.0	30-46	3.78	76
40.0	30-9	4.20	77
43.0	30-47	4.52	78
50.0	30-10	5.25	79
60.0	30-48	6.30	80
72.0	30-49	7.56	81
75.0	30-11	7.86	81
86.0	30-50	9.03	82
100.0	30-12	10.50	83
120.0	30-51	12.60	84
125.0	30-13	13.10	84
150.0	30-14	15.80	85
175.0	30-53	18.40	86
200.0	30-15	21.00	87
240.0	30-54	25.20	88
250.0	30-52	26.30	88
300.0	30-16	31.50	89
360.0	30-55	37.80	90
400.0	30-17	42.00	91
430.0	30-56	45.20	91
500.0	30-18	52.50	92
600.0	30-57	63.00	93
720.0	30-58	75.60	94
750.0	30-19	78.70	96
860.0	30-59	90.30	97
1.00 H	30-20	105.00	98
1.20 H	30-60	126.00	99
1.25 H	30-21	131.30	99
1.50 H	30-22	157.50	100
1.75 H	30-61	183.80	101
2.00 H	30-23	210.00	102
2.40 H	30 62	252.00	103
2.50 H	30-69	262.50	103
3.00 H	30-24	315.00	104
3.60 H	30-63	378.00	106
4.00 H	30-25	420.00	107
4.30 H	30-64	451.50	108
5.00 H	30-26	525.00	109
6.00 H	30-65	630.00	110
7.20 H	30-66	756.00	111
7.50 H	30-27	787.50	112
8.60 H	30-67	903.00	113
10.00 H	30-28	1050.00	114
12.00 H	30-68	1260.00	115
12.50 H	30-29	1312.50	116
15.00 H	30-30	1575.00	117
17.50 H	30-31	1837.50	118

CORE NO. 94

Recommended Frequency: Up to 75 KHz.
Maximum Inductance: 1 H.
Special Core Stabilization Available: B, D, M, W, L.

Inductance ±1% (mH)	Part Number	Typical DCR* (ohms)	Typical Distributed Capacity (pf)
5.0	94-1	1.05	32
6.0	94-2	1.26	32
7.2	94-3	1.51	33
7.5	94-4	1.58	34
8.6	94-5	1.80	35
10.0	94-6	2.10	35
12.0	94-7	2.52	36
12.5	94-8	2.63	37
15.0	94-9	3.15	38
17.5	94-10	3.67	39
20.0	94-11	4.20	40
24.0	94-12	5.04	41
25.0	94-13	5.25	41
30.0	94-14	6.30	42
36.0	94-15	7.56	43
40.0	94-16	8.40	44
43.0	94-17	9.03	44
50.0	94-18	10.50	45
60.0	94-19	12.60	46
72.0	94-20	15.10	46
75.0	94-21	15.80	47
86.0	94-22	18.00	47
100.0	94-23	21.00	48
120.0	94-24	25.20	49
125.0	94-25	26.30	49
150.0	94-26	31.50	50
175.0	94-27	36.80	51
200.0	94-28	42.00	52
240.0	94-29	50.40	53
250.0	94-30	52.50	54
300.0	94-31	63.00	54
360.0	94-32	75.60	56
400.0	94-33	84.00	57
430.0	94-34	90.00	57
500.0	94-35	105.00	57
600.0	94-36	126.00	58
720.0	94-37	151.00	58
750.0	94-38	158.00	59
860.0	94-39	181.00	59





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INDUCTORS

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TOROIDAL INDUCTORS

CORE NO. 28

Recommended Frequency: Up to 35 KHz.
Maximum Inductance: 25 H.
Special Core Stabilization: D, W, M, L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
7.2	28-1	0.64	60
8.6	28-2	0.70	64
10.0	28-3	0.97	66
12.0	28-4	1.06	68
15.0	28-5	1.19	70
17.5	28-6	1.66	74
20.0	28-7	1.78	76
24.0	28-8	1.95	78
30.0	28-9	2.57	80
36.0	28-10	2.82	84
43.0	28-11	3.86	86
50.0	28-12	4.16	88
60.0	28-13	4.55	90
72.0	28-14	6.33	94
86.0	28-15	6.91	96
100.0	28-16	9.36	98
120.0	28-17	10.30	100
150.0	28-18	11.50	102
175.0	28-19	16.20	104
200.0	28-20	17.30	106
240.0	28-21	18.90	108
300.0	28-22	26.50	110
360.0	28-23	29.00	114
430.0	28-24	31.70	116
500.0	28-25	42.10	118
600.0	28-26	46.20	120
720.0	28-27	64.50	124
860.0	28-28	70.50	126
1.00 H	28-29	93.90	128
1.20 H	28-30	103.00	130
1.50 H	28-31	115.00	134
1.75 H	28-32	154.00	136
2.00 H	28-33	164.00	140
2.40 H	28-34	229.00	144
3.00 H	28-35	256.00	146
3.60 H	28-36	281.00	148
4.30 H	28-37	388.00	150
5.00 H	28-38	419.00	152
6.00 H	28-39	510.00	154
7.20 H	28-40	624.00	156
8.60 H	28-41	682.00	158
10.00 H	28-42	930.00	160
12.00 H	28-43	1020.00	164
15.00 H	28-44	1440.00	166
17.50 H	28-45	1550.00	168
20.00 H	28-46	1660.00	170

CORE NO. 27

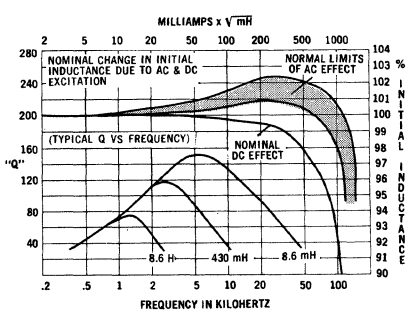
Recommended Frequency: Up to 20 KHz.
Maximum Inductance: 30 H.
Special Core Stabilization: D, W, M, L.

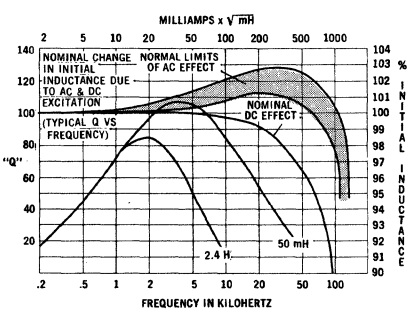
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
8.6	27-1	0.63	60
10.0	27-2	0.68	64
12.0	27-3	0.95	66
15.0	27-4	1.06	68
17.5	27-5	1.15	70
20.0	27-6	1.59	74
24.0	27-7	1.74	76
30.0	27-8	1.95	78
36.0	27-9	2.52	80
43.0	27-10	2.76	84
50.0	27-11	2.97	86
60.0	27-12	4.07	88
72.0	27-13	4.46	90
86.0	27-14	6.18	94
100.0	27-15	6.67	96
120.0	27-16	7.30	98
150.0	27-17	10.30	100
175.0	27-18	11.10	102
200.0	27-19	15.50	104
240.0	27-20	16.90	106
300.0	27-21	18.90	108
360.0	27-22	26.00	110
430.0	27-23	28.40	114
500.0	27-24	37.70	116
600.0	27-25	41.30	118
720.0	27-26	45.30	120
860.0	27-27	63.10	124
1.00 H	27-28	68.00	126
1.20 H	27-29	74.50	128
1.50 H	27-30	103.00	130
1.75 H	27-31	111.00	134
2.00 H	27-32	147.00	136
2.40 H	27-33	161.00	140
3.00 H	27-34	229.00	144
3.60 H	27-35	251.00	146
4.30 H	27-36	274.00	148
5.00 H	27-37	374.00	150
6.00 H	27-38	410.00	152
7.20 H	27-39	559.00	154
8.60 H	27-40	611.00	156
10.00 H	27-41	659.00	158
12.00 H	27-42	912.00	160
15.00 H	27-43	1020.00	164
17.50 H	27-44	1390.00	166
20.00 H	27-45	1490.00	168
24.00 H	27-46	1630.00	170

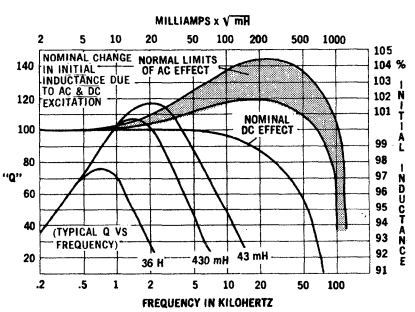
CORE NO. 25

Recommended Frequency: Up to 5 KHz.
Maximum Inductance: 40 H.
Special Core Stabilization: L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
12.0	25-1	0.60	80
15.0	25-2	0.67	84
17.5	25-3	0.94	86
20.0	25-4	1.00	88
24.0	25-5	1.10	90
30.0	25-6	1.59	94
36.0	25-7	1.74	96
43.0	25-8	1.91	98
50.0	25-9	2.42	100
60.0	25-10	2.66	104
72.0	25-11	2.91	106
86.0	25-12	3.98	108
100.0	25-13	4.29	110
120.0	25-14	5.96	112
150.0	25-15	6.67	114
175.0	25-16	7.20	116
200.0	25-17	9.67	118
240.0	25-18	10.60	120
300.0	25-19	15.50	124
360.0	25-20	16.90	126
430.0	25-21	18.50	128
500.0	25-22	25.00	130
600.0	25-23	27.40	132
720.0	25-24	30.00	134
860.0	25-25	40.40	136
1.00 H	25-26	43.50	138
1.20 H	25-27	60.80	140
1.50 H	25-28	68.00	144
1.75 H	25-29	73.40	146
2.00 H	25-30	97.00	150
2.40 H	25-31	106.00	154
3.00 H	25-32	147.00	156
3.60 H	25-33	161.00	158
4.30 H	25-34	224.00	160
5.00 H	25-35	241.00	166
6.00 H	25-36	264.00	168
7.20 H	25-37	367.00	170
8.60 H	25-38	401.00	174
10.00 H	25-39	432.00	176
12.00 H	25-40	589.00	178
15.00 H	25-41	658.00	180
17.50 H	25-42	900.00	184
20.00 H	25-43	970.00	186
24.00 H	25-44	1060.00	190
30.00 H	25-45	1490.00	196
36.00 H	25-46	1630.00	200







WHEN ORDERING, ADD CASE PREFIX (TYPE) TO PART NUMBER.†

EXAMPLE: U 30-1

CASE TYPE — PART NUMBER

† Add "C" to part number of molded inductor if clearance hole is desired.

CALL TOROTEL PRODUCTS FOR YOUR COMPETITIVELY PRICED CUSTOM MAGNETICS REQUIREMENTS

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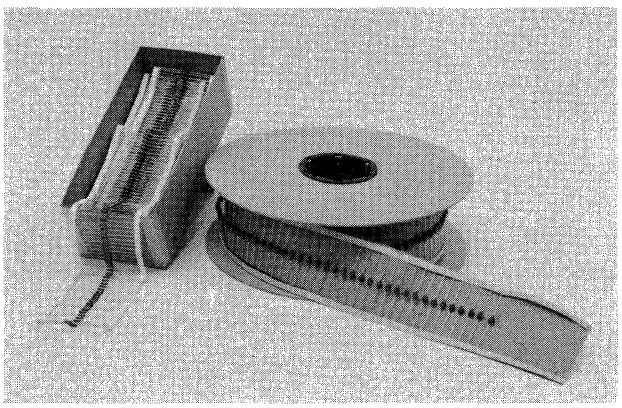
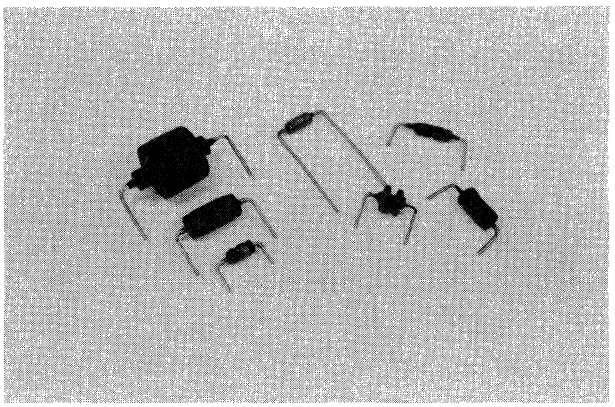
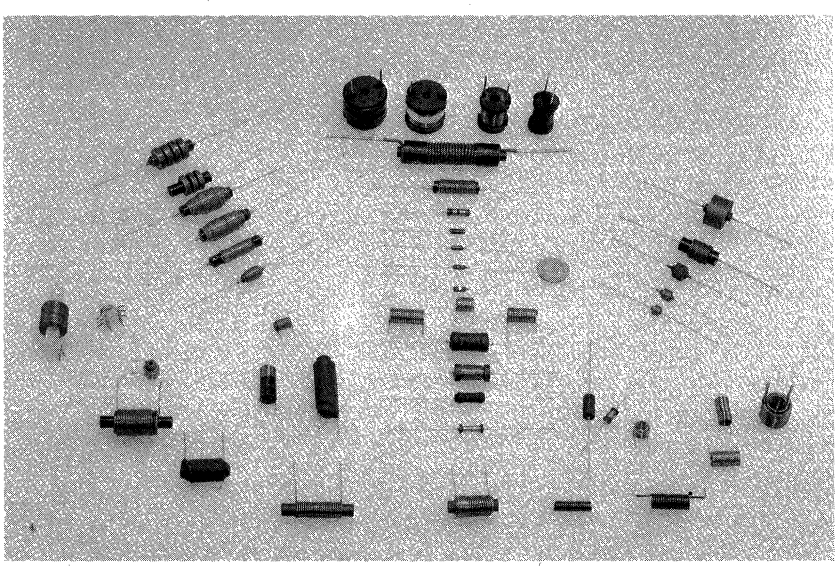
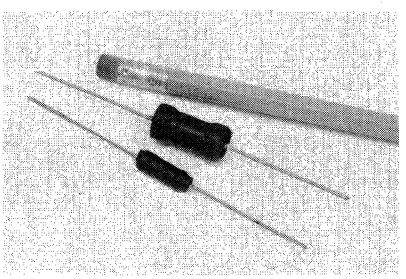
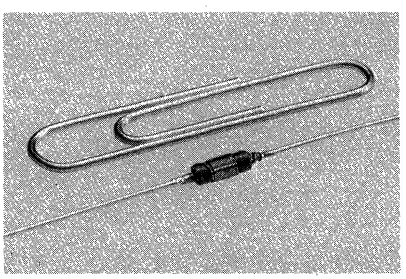




Special services include reel taping, cut & formed leads, custom prototypes, and engineering sample kits.







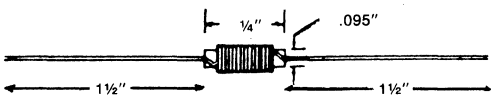
Custom inductive products include: high current filter chokes, hash chokes, shielded inductors and 3-section pi type windings.

For additional information on custom requirements at competitive pricing, contact Wilco Corporation.

WILCO CORPORATION

6451 SAGUARO COURT
INDIANAPOLIS, IN 46268
(317) 293-9300

COMMITMENT

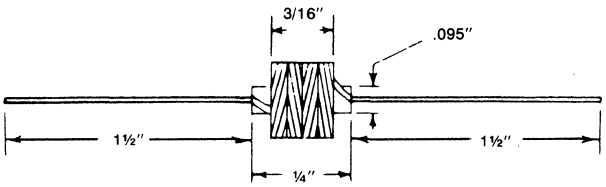


"ML" SERIES

WILCO PART # ML SERIES	L uh	Q NOM.	S.R.F. NOM. (MHz)	R.D.C. OHMs NOM.	I (MA) MAX	DIA. NOM.
ML 10S	.10	45	750+	.06	1489	.107
ML 15S	.15	45	712	.08	1290	.107
ML 22S	.22	47	541	.09	1216	.109
ML 33S	.33	44	428	.13	1012	.107
ML 47S	.47	45	387	.21	796	.105
ML 68S	.68	44	308	.23	760	.107
ML 10G	1.0	30.3	253	.33	635	.106
ML 15G	1.5	31.3	208	.58	479	.104
ML 22G	2.2	32.1	169	1.17	337	.102
ML 33G	3.3	33.3	137	2.68	223	.100
ML 47G	4.7	33.5	114	3.44	197	"
ML 68G	6.8	42.7	54.0	.43	557	.104
ML 100	10	39.1	48.6	.72	430	"
ML 150	15	64.5	36.5	1.43	300	.102
ML 270	27	64.8	27.0	3.54	194	.100

Intermediate Values Available

All choke coils in this series are the same size as the unit illustrated. Leads are of No. 21 tinned wire. Tolerances are ± 15% for ML10S through ML82S: ± 10% from ML10G through ML270. All units are impregnated with thermosetting varnish. Color coding available.

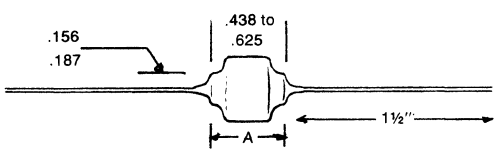


"MU" SERIES

WILCO PART #	L uh	Q NOM.	S.R.F. NOM. (MHz)	R.D.C. OHMs NOM.	I (MA) MAX	DIA. NOM.
MU 390	39	20.0	11.2	5.8	185	.156
MU 470	47	18.2	10.9	6.5	175	"
MU 560	56	17.7	10.6	7.1	162	"
MU 680	68	17.0	10.5	7.8	165	"
MU 820	82	16.0	10.4	8.6	163	.187
MU 101	100	15.5	10.3	9.3	159	"
MU 121	120	22.4	9.6	10.8	150	"
MU 151	150	22.8	9.0	12.2	143	"
MU 181	180	23.4	7.6	13.7	140	"
MU 271	270	23.9	5.7	16.9	130	.218
MU 331	330	24.4	5.2	18.9	126	"
MU 471	470	23.1	4.3	22.6	117	"
MU 681	680	49.0	2.9	12.7	141	.187
MU 102	1000	43.6	2.1	15.5	131	"
MU 152	1500	56.7	1.9	23.9	117	.218

Intermediate Values Available

All choke coils in this series are the same size as the unit illustrated. Leads are of No. 21 tinned wire. Tolerances are ± 10%. All units are impregnated with thermosetting varnish. Color coding available.

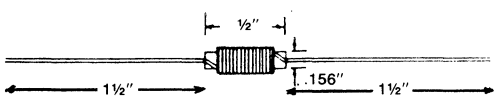


"U" SERIES

WILCO PART #	L uh	Q NOM.	S.R.F. NOM. (MHz)	R.D.C. OHMs NOM.	I (MA) MAX	DIA. NOM.
U 150	15	24.9	20.00	1.7	480	.218
U 350	35	20.5	14.00	2.6	420	.250
U 550	55	18.1	11.40	3.4	380	.281
U 101	100	15.6	8.80	4.4	350	.312
U 141	140	24.7	7.21	5.5	330	.343
U 181	180	24.4	6.52	6.3	320	.375
U 301	300	24.2	5.11	8.5	290	.437
U 501	500	23.6	4.02	11.0	270	.500
U 701	700	38.4	3.33	27.0	160	.562
U 901	900	36.4	2.87	31.0	150	.562
U 252	2.5 MH	70.8	1.02	32.0	150	.500
U 752	7.5 MH	64.6	.62	65.0	130	.500
U 153	15.0 MH	72	.44	64.8	110	.418
U 253	25.0 MH	70	.34	88	95	.512

Intermediate Values Available

All choke coils in this series are Durez covered and EIA color coded. They have an inductance tolerance of ± 10% and leads are No. 20 AWG tinned copper 1½" long. Parts U150 through U501 are wound on .156" dia. phenolic forms with "A" dimensions $^{7}/_{16}$". Parts U601 through U102 are wound on the same form with "A" dimensions ½". Parts U252 through U752 use .156" dia. powdered iron forms, "A" dimension ½". Parts U103 through U253 use .187" dia. iron forms, "A" dimension ⅝". Diameters of coils vary from ¼" to ⅝" depending on inductance value.



"W" SERIES

WILCO PART #	L uh	Q NOM.	S.R.F. NOM. (MHz)	R.D.C. OHMs NOM.	I (MA) MAX	DIA. NOM.
W 10 G	1.0	45	238	.11	1965	.179
W 12 G	1.2	45	218	.12	1882	.179
W 15 G	1.5	45	200	.14	1742	.179
W 22 G	2.2	45	165	.26	1278	.175
W 27 G	2.7	45	149	.34	1118	.175
W 39 G	3.9	45	127	.61	835	.172
W 47 G	4.7	50	114	.80	729	.170
W 68 G	6.8	50	94.8	1.35	561	.169
W 100	10	50	78.5	2.50	412	.167
W 150	15	30	63.9	5.10	288	.165
W 220	22	85	36.1	1.10	622	.170
W 330	33	80	30.6	1.38	555	.169
W 470	47	90	24.9	2.32	428	.167
W 680	68	90	21.6	3.00	376	.166
W 101	100	100	17.8	5.40	280	.165

Intermediate Values Available

All choke coils in this series are the same size as the unit illustrated. Leads are of No. 20 tinned wire. Tolerances are ± 20% for W10G through W22G: ± 10% from W27G through W101. All units are impregnated with thermosetting varnish and are EIA color coded.

Our more popular, cataloged stock units are available in quantity for immediate delivery.

SOFT FERRITE MATERIALS

GENERAL DESCRIPTION — Allen-Bradley offers ferrite cores produced from three materials — designated W5, R02 and R03. Each material is designed to fulfill specific applications, since no material can provide the specific magnetic properties needed for every circuit.

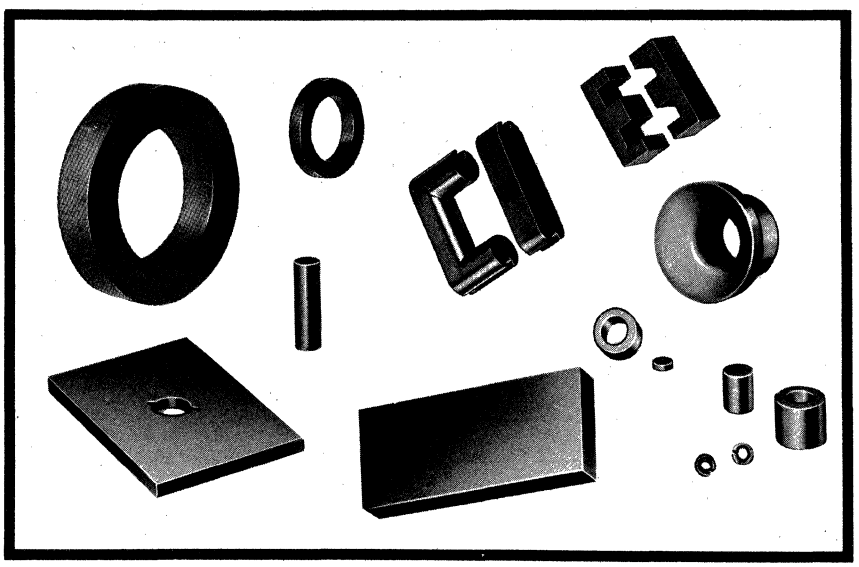
W5 MATERIAL — W5 is designed to be used in circuits where a low loss power ferrite is required. It is capable of operating at high flux densities at frequencies up to 500 KHz. Above 500 KHz, it may continue to provide useful performance when applied at low flux densities. Because of its low core losses, it is ideally suited for applications above 400 Hz where the excessive heating of laminated iron or tape wound cores becomes impractical. W5 also exhibits a linear B vs. H variation at flux densities less than 1500 gauss.

The versatility of W5 material is the major factor for the existence of the standard ferrite core program. This program offers W5 material in a variety of part shapes, namely Bar cores, E-cores, Pot cores, Toroidal cores, and U-cores.

R02 MATERIAL — For circuits operating at frequencies up to 10 MHz or where a temperature stable initial permeability material is required, R02 should be specified. R02 is ideally suited for demanding applications such as those requiring high Q and for temperature stable inductors. R02 material has core losses similar to those of W5 material cores, at frequencies between 500 KHz and 1 MHz. Between 1 MHz and 10 MHz core losses for R02 are less than those for W5. R02 is a desirable substitute for W5 at high frequencies.

R03 MATERIAL — This rectangular loop ferrite material exhibits high induction and low coercive force. It is useful in continuous switching applications which drive the core to saturation at frequencies less than 25 KHz. Rectangularity (Br/Bs) of greater than 80 percent makes R03 particularly suitable for magnetic amplifiers, frequency converters, and switching device applications.

Because of the increasing interest in R03 cores, this material is now available through the Standard Ferrite Core program. R03 is now available in eleven different sizes of toroids.



The following table is a summary of the typical characteristics of each material at 25° C.

Magnetic Properties	W5 16KHz	R02 4KHz	R03 1.5KHz
Saturation Flux Density (B_s) Gauss @ 10 Oersteds	4900	2750	3900
Initial Permeability (μ_i)	2800	290	325
Maximum Permeability (μ_{max})	4000	510	3500
Core Loss (P_{cl}) (μ watts/cm³-Hz) @ 1350 Gauss	2.5	—	—
Rectangularity (B_r/B_s)	—	—	≥.80
Temp Coefficient of μ_i (TC)%/°C	—	.02	—

APPLICATIONS:

W5 Material	R02 Material	R03 Material
Switching Power Supplies	Inductors	Magnetic Amplifiers
Transformers — All Types	Transformers	Frequency Converters
Inductors	Saturable Reactors	Magnetic Memories
Ignition Systems	Particle Accelerators	Voltage Feedback Inverters
Regulators	Induction Heaters	Magnetic Switches
Displays	Antennas	

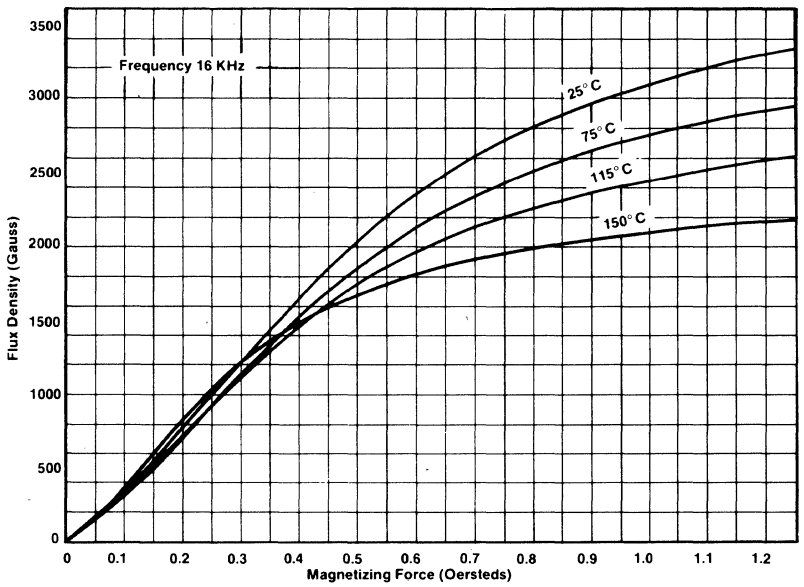
For more information request Publication R02-2.0, Publication R03-2.0 and Publication W5-2.0.

ALLEN-BRADLEY

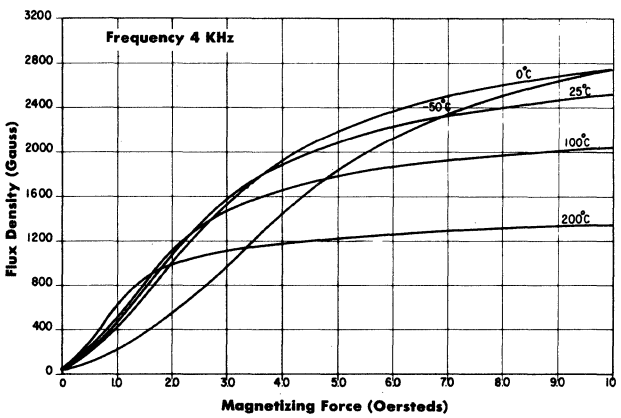
Shawnee, Oklahoma 74801

TYPICAL MAGNETIZATION CURVES

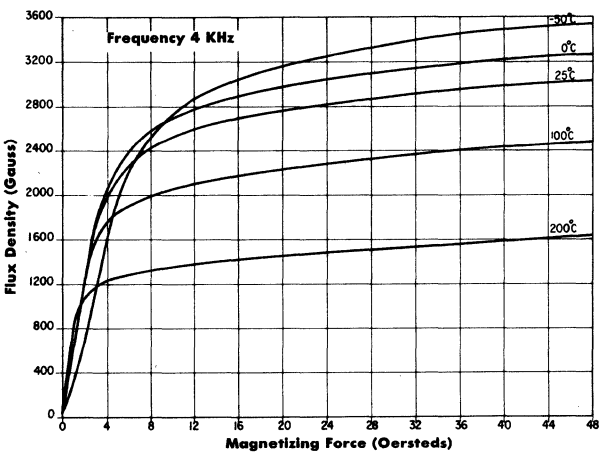
W5



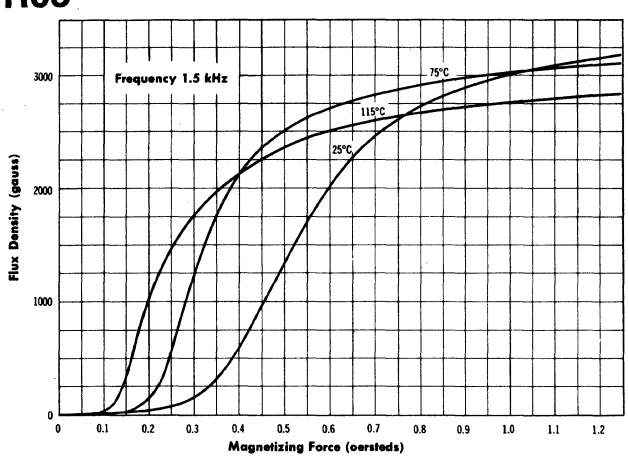
R02



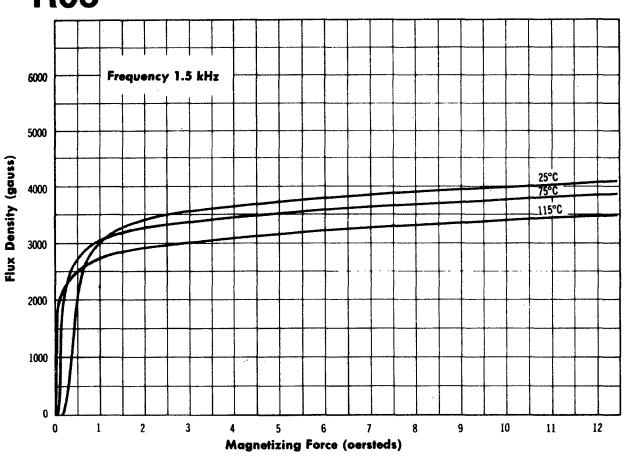
R02



R03



R03



ALLEN-BRADLEY

Shawnee, Oklahoma 74801

CERAMIC PERMANENT MAGNETS

GENERAL DESCRIPTION — Allen-Bradley offers a wide range of ferrite permanent magnets in material grades M6 through M10. Each is an oriented ceramic permanent magnet material ideally suited for specific requirements. This wide range of materials allows the design engineer to custom fit his magnet choice to the needs of the application and the severity of the operating environment.

This selection of permanent magnet materials represents the most technically advanced ceramic grades available in production quantities today. Typical configurations are angular arc segments, rings, bars, blocks, cylinders and slabs. Common applications are:

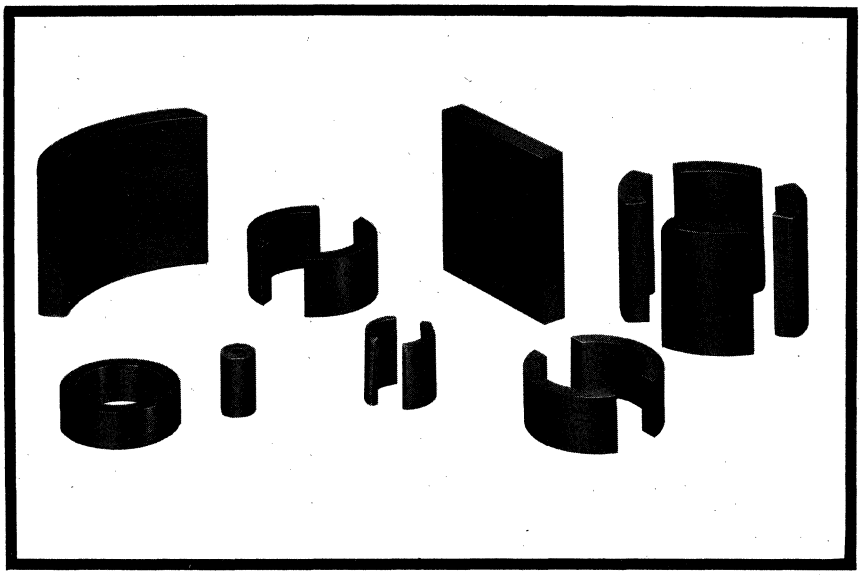
1. DC Commutator Motors
2. Brushless Motors
3. Synchronous Motors
4. Linear Actuators
5. Stepper Motors
6. Alternators and Generators
7. Magnetos
8. Magnetic Separators
9. Material Handling and Holding Devices

APPLICATIONS — Magnetic circuits that can be designed to take full advantage of the specific flux density and coercive force of each material offer opportunities for improved performance in the assembled product in one or more of the following ways:

1. Higher efficiency
2. Cooler operation
3. Greater output power
4. Smaller package size
5. Less weight
6. Lower cost

DESIGN VERSATILITY — A wide range of options using Allen-Bradley magnetic materials are available to the magnetic circuit designer.

- Large and small arcs - current sizes range from 1/10 oz. to over 5 lbs.
- Large and small blocks - current sizes range from roughly 1/100 oz. to over 10 lbs.
- Single or multiple pole patterns can be magnetized on a single magnet. The number of poles is limited only by the capability of magnetizing fixturing.
- Radial or transverse orientation.



MAGNETIZATION — It is usually desirable to magnetize the magnet after assembly to avoid handling problems. Since magnets are oriented in manufacture, they must be magnetized in the direction of orientation in order to obtain the listed magnetic properties. In other directions, only a fraction of the listed magnetic properties can be realized. These magnets require a magnetization force of 10,000 oersteds on 20,000 ampere turns per inch of magnet length in direction of orientation to secure proper magnetization.

DESIGN NOTES — The total flux produced by a magnet of any configuration is a function not only of the magnetic properties of the material from which it is made but also its physical dimensions, and the degree of orientation and other factors related to the manufacturing process. To insure delivery of flux as designed, the magnet must be magnetized to saturation and have sufficient coercive force to resist the demagnetizing effect of opposing magnetic fields to which it might be exposed.

The characteristics plotted on the next page show the normal and intrinsic demagnetization curves for each material at various temperatures. To avoid loss of flux, irreversible except by remagnetization, it is necessary that a magnet be operated above the knee of the demagnetization curve corresponding to the lowest temperature to which it may be subjected. The determination of this low temperature operating point must take into consideration not only the permeance coefficient of the magnetic circuit in which the magnet operates, but also any other demagnetizing m.m.f.'s which may exist.

COMPARATIVE PERFORMANCE —		M6	M7	M8	M9	M9B	M10
Peak Intrinsic Energy Product (BiHi), mega-gauss-oersteds		8.5	12.0	10.5	13.0	12.5	12.0
Peak Normal Energy Product (BdHd), mega-gauss-oersteds		2.7	2.7	3.5	3.2	3.4	3.8
Residual Induction (Br), gauss	typical [1]	3400	3400	3850	3700	3800	4000
Intrinsic Coercive Force (Hci), oersteds	typical	3200	4250	3150	4200	4000	3500
	minimum	3000	4000	3000	4000	3800	3300
Normal Coercive Force (Hc), oersteds	typical	2900	3250	2950	3425	3450	3350

[1] The flux performance of production magnets will be within ±7% of the flux produced by a magnet having nominal print dimensions and typical residual induction.

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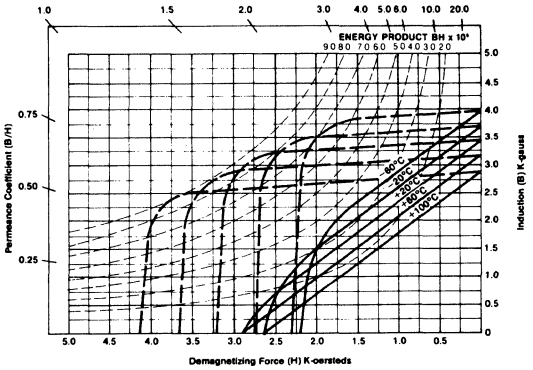
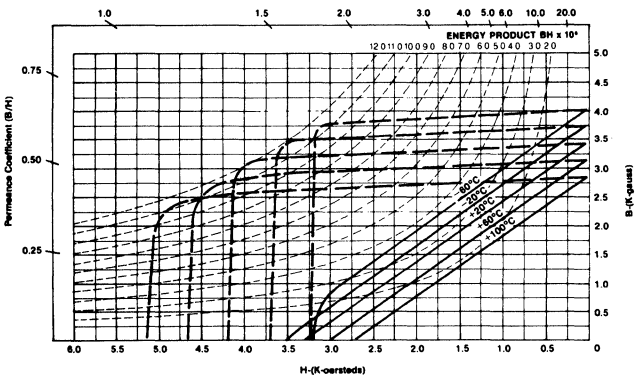
TYPICAL DEMAGNETIZATION CURVES

Normal Demagnetizing Curves
Intrinsic Demagnetizing Curves
Energy Product Curves

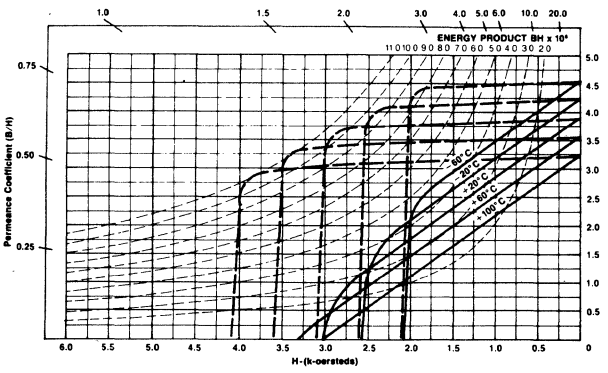
M6



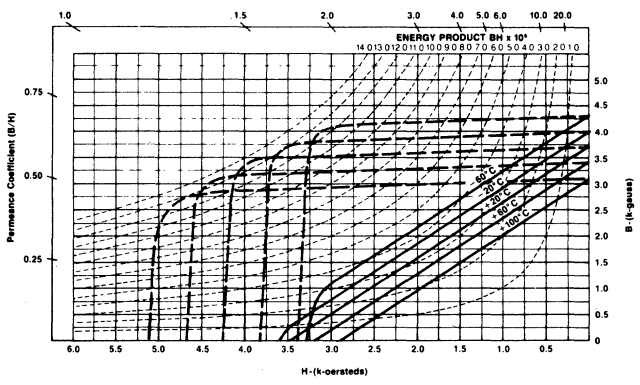
M7



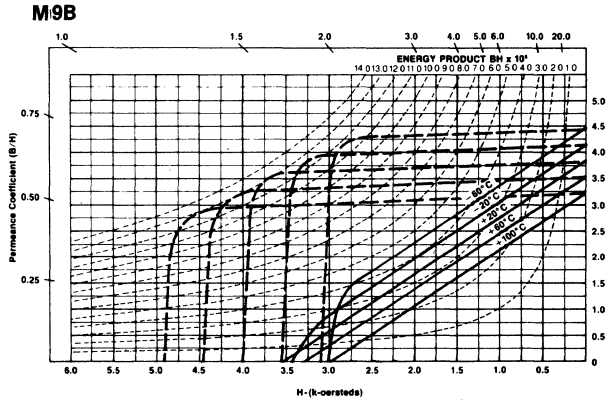
M8



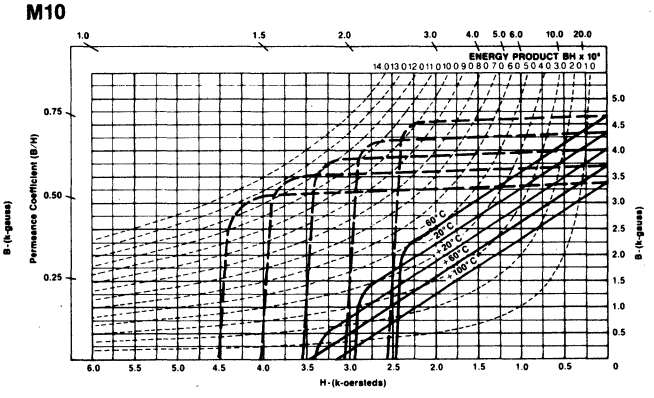
M9



M9B



M10



For more information request Publications M6-2.0, M7-2.0, M8-2.0, M9-2.0, M9B-2.0 and M10-2.0.

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K
kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L
LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microforad
MHz megahertz
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOSIGT metal-oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM nuclear instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLL phased lock loop
PPI plan position indicator
PROM programmable read only memory
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

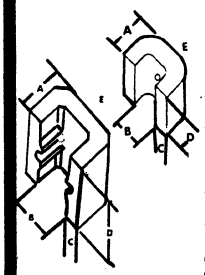
W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

JOBMASTER MAGNETS

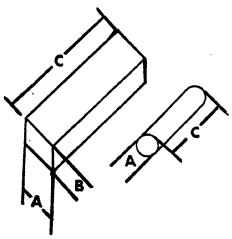
STOCK JOBMASTER MAGNETS



POWER MAGNET

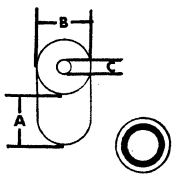
Cat. No.	A mm	A ins	B mm	B ins	C mm	C ins	D mm	D ins	E mm	E ins	Weight gr	Weight oz
811	19	¾	14.2	9/16	7.9	5/16	19	¾	4	5/32	71	2½
812	25.4	1	19	¾	9.5	⅜	25.4	1	4.7	3/16	142	5
813	28.6	1⅛	22.2	⅞	11.1	7/16	28.6	1⅛	4.7	3/16	226	8
814	35	1⅜	35	1⅜	11	7/16	44.5	1¾	8	5/16	368	13
815	41	1⅝	41	1⅝	14.3	9/16	57	2¼	8	5/16	709	25
816	54	2⅛	47.6	1⅞	16	⅝	82.5	3¼	9.5	⅜	1446	51

Hole centres 814 31.75 mm 1¼" 815 38 mm 1½" 816 43 mm 1 11/16"



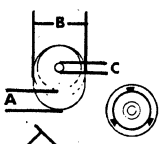
BAR MAGNET

Cat. No.	A mm	A ins	B mm	B ins	C mm	C ins	Weight gr	Weight oz
805	6	¼ diameter			20	13/16	4	.15
806	8	5/16 diameter			25	1	8	.30
807	10	⅜ diameter			30	1 3/16	16	.58
844	10	⅜	5	3/16	20	13/16	11	.38
845	12.5	½	5	3/16	40	1 9/16	21	.75
846	15	⅝	5	3/16	60	2⅜	56	2
842	15	⅜	10	⅜	50	2	70	2½
843	15	⅝	10	⅜	75	3	100	3½



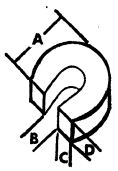
POT MAGNET

Cat. No.	A mm	A ins	B mm	B ins	C	Weight gr	Weight oz
831	15.8	⅝	17.5	11/16	Tapped Hole	28	1
832	19.0	¾	20.6	13/16	OBA/6 SI	47	1¾
833	25.4	1	27	1 1/16	or 10 NF	100	3½
834	30.1	1 3/16	35	1⅜		198	7



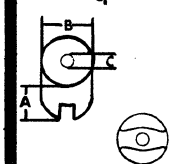
SHALLOW POT MAGNET

Cat. No.	A mm	A ins	B mm	B ins	C mm	C ins	Weight gr	Weight oz
826	8	5/16	19	¾	3.5	9/64	14	½
827	9.5	⅜	28.6	1⅛	4.7	3/16	50	1¾
828	11.1	7/16	38	1½	4.7	3/16	100	3½



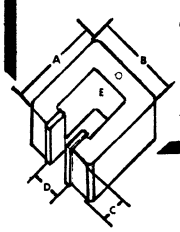
POCKET MAGNET

Cat. No.	A mm	A ins	B mm	B ins	C mm	C ins	D mm	D ins	Weight gr	Weight oz
802	25.4	1	6.35	¼	7.9	5/16	7.9	5/16	28.3	1



BUTTON MAGNET

Cat. No.	A mm	A ins	B mm	B ins	C mm	C ins	Weight gr	Weight oz
821	9.5	⅜	12.7	½	4.4	11/64	10	⅓
822	12.7	½	19	¾	4.8	3/16	28	1
823	15.9	⅝	25.4	1	4.8	3/16	56	2
824	25.4	1	31.7	1¼	6.4	¼	113	4



MAJOR MAGNET

Cat. No.	A mm	A ins	B mm	B ins	C mm	C ins	D mm	D ins	E mm	E ins	Weight gr	Weight oz
862	111	4⅜	103	4 1/16	52	2 3/16	40	1 9/16	6.3	¼	2835	100

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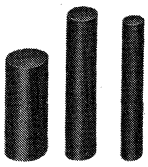
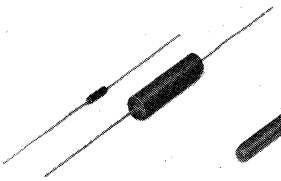
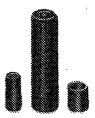
KRYSTINEL LINEAR FERRITE CORES


SLUGS


COIL FORMS

INSERT TUNING CORES


THREADED CORES

CUP CORES

BALUN CORES

BOBBINS

TOROIDS

WASHERS

SHIELD BEADS

SLEEVES

COIL FORMS • TOROIDS
BOBBINS • SLEEVES
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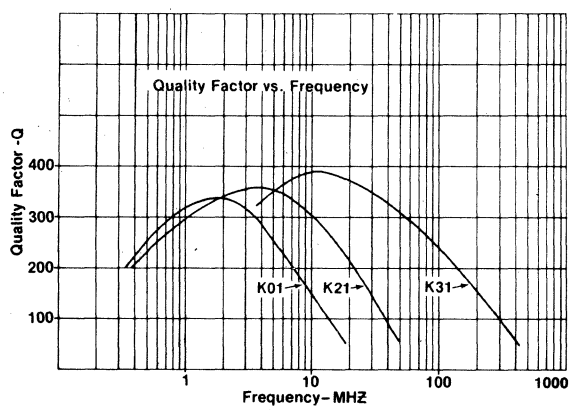
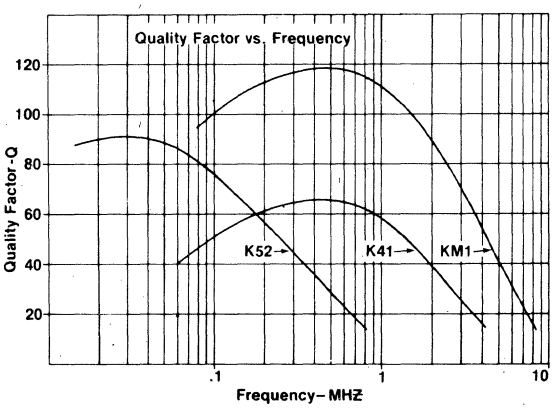


Quality Factor vs. Frequency



Quality Factor vs. Frequency

MAGNETIC CHARACTERISTICS

Characteristic	Unit	Symbol	Materials																			
Material			K31	K21	K01	KM1	K41	KA1	K51	K52	K11	K14	K61	K91	K92	K72	K81	K82	K83	K86	K87	K73	K84
Initial Permeability		μ_0	15	40	120	200	275	370	400	850	275	800	1500	1800	2400	3500	4400	5000	6000	7500	10,000	3000	4500
Maximum Permeability		μMAX.	40	100	300	750	1000	1200	1500	2500	700	1900	2500	6000	6200	4500	6300	7000	7500	10,000	13,000	4500	6300
Coercive Force	Oersted	Hc	23	4	2.5	1.5	1.0	1.0	0.5	0.4	0.8	0.4	0.4	0.15	0.15	0.15	0.13	0.1	0.08	0.1	0.1	0.1	0.1
Saturation Flux Density	Gauss	B_{SAT}	2200	2100	2800	2300	3100	3100	2100	3000	3000	3800	4750	4750	4750	4200	4200	4300	4400	4300	4300	4100	4200
@ H (Oersted)	Oersted	(H)	(50)	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(10)
Residual Flux Density	Gauss	B_R	1350	1000	1500	1250	1500	1400	1100	1300	1200	1300	1750	1600	1600	1200	1200	1100	900	1500	1200	700	800
Curie Temperature	°C	Tc	500	450	400	275	325	325	150	140	200	175	200	210	210	150	150	150	150	150	150	150	150
Volume Resistivity	Ω-CM	ρ	$2x10^4$	$1x10^4$	$1x10^7$	$1x10^6$	$1x10^8$	$1x10^8$	$1x10^7$	$1x10^4$	$3x10^3$	4x10	$1x10^2$	5x10	5x10	2x10	2x10	2x10	2x10	2x10	2x10	2x10	2x10
Temperature change of initial permeability (0°-60°C)	%	$\Delta\mu^o/\mu_o$ @ 25°C	±5	±5	±6	±3	25°-60° +50% 25°-0° −25%	25°-60° +50% 25°-0° −25%	±12	±10	±5	±8	±10	±30	±35	±20	±20	±25	±25	±30	±30	±15	±20
Loss Factor $x10^{-6}$ @ Frequency	MHz	Tanδ/μ_o	325 100	80 10	25 2	50 1	55 .4	50 .4	20 .1	20 .1	15 .1	20 .1	17 .1	15 .1	15 .1	15 .1	15 .1	15 .1	15 .04	10 .02	10 .02	Not Applicable Pulse Materials	
Preferred Core Shapes			All	All	All	All	Coil Forms Sleeves Threads Slugs	Beads Baluns Toroids	Coil Forms Sleeves Threads Slugs	All	Slugs Threaded Cores Cups	Toroids Beads	Toroids	Toroids Threaded Cores Bobbins	Toroids Threaded Cores Bobbins	All	All Except Coil Forms Threaded Cores Large Bobbins		◀ Restricted to Toroids < .5 in O.D. ▶				

NOTES: 1. Normal tolerance μ_o is ±20% except K87 ±30%. Permeability values vary with size if toroids used. A_L values listed in the toroid section (Group L) reflect this variation. 2. For extended temperature ranges in all materials or tighter temperature coefficients of permeability, contact Krystinel Engineering Dept. 3. Loss data include both coil and core losses as read on a one/half inch diameter toroid. 4. Hysteresis loop data were taken @ 25°C.

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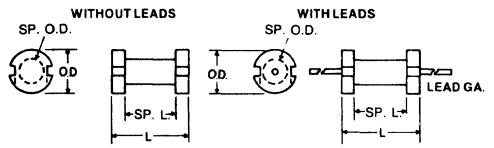
KRYSTINEL LINEAR FERRITE CORES

BOBBINS (ROUND)

This is just a partial listing of sizes and materials available



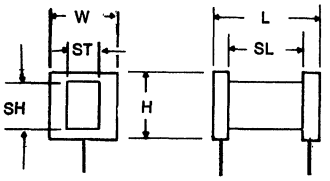
OVER-ALL LGTH.	FLANGE O.D.	SPINDLE LGTH.	SPINDLE DIA.	LEADS	PART NUMBER PRE-FIX	PART NUMBER BASE PART NO.
.946	.945	.650	.512	—		S1SO-IK
.788	.945	.492	.512	—		MISO-E2
.866	.710	.570	.433	—		PRKA-GA
.788	.710	.570	.433	—		MIKA-E2
.750	.375	.500	.187	20 GA. Axial		LFAQ-EAK2
.500	.200	.400	.110	22 GA. Axial		EA5Q-BFM4
.330	.107	.230	.075	22 GA. Axial		9F32-6KM4
.255	.290	.155	.130	22 GA. Radial		7A8A-4FMN
.184	.155	.092	.079	22 GA. Axial		594F-2MM4
.185	.160	.100	.110	—		5A4K-2V
.045	.070	.015	.045	—		1A20-OF

APPLICATIONS	PREFIX	MATERIAL
HIGH FREQUENCY INDUCTORS	H0	K01
LOW FREQUENCY INDUCTORS	H5	K51
RF CHOKES, MEDIUM "L"	H52	K52
RF CHOKES, HIGH "L"	H72	K72
RF CHOKES, HIGH "Bsat"	H91	K91

Matching sleeves are available for all bobbins.

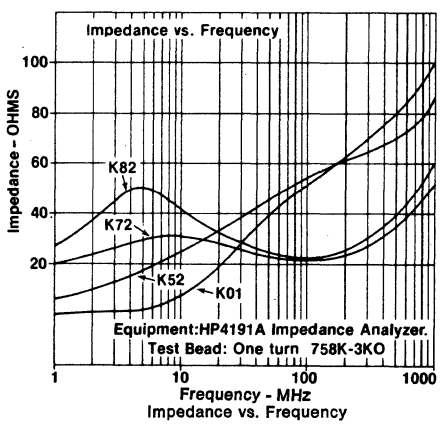
BOBBINS (RECTANGULAR)

This is just a partial listing of sizes and materials available

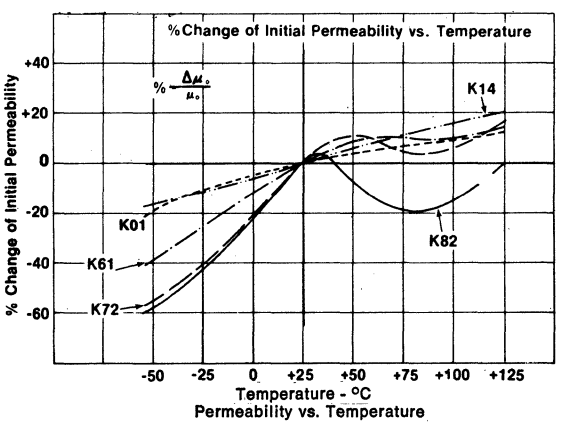


OVER-ALL LENGTH	FLANGE HEIGHT	FLANGE WIDTH	SPINDLE SHxSTxSL	LEADS	PART NO. PREFIX	PART NO. BASE P/N
.375	.250	.075	.185x.050x .225	24GAx.750	Add Prefix Here	75AQ-6FPC
.750	.312	.330	.210x.110x .500	—		8XLF-EA

APPLICATIONS	Prefix	Material
HIGH FREQUENCY INDUCTORS	H01	K01
RF CHOKES, MEDIUM "L"	H52	K52
RF CHOKES, HIGH "L"	H75	K75
RF CHOKES, HIGH "Bsat"	H91	K91



Impedance vs. Frequency



Permeability vs. Temperature

TOROIDS

This is just a partial listing of sizes and materials available

Pulse rated toroid cores also available. Write for complete information.

Dimensions Inches O.D.	I.D.	HT.*	Material	K31	K21	K01	KA1	K14	K52	K61	K91	K92	K72	K81	K82	K83	K86	K87	Cross Sectional Area CM²	Magnetic Path Length CM
			Prefix	L31	L21	L01	LA1	L14	L52	L61	L91	L92	L72	L81	L82	L83	L86	K87		
			Base P/N	AL (NH/N2²) ±20%																
.080	.050	.050	2A1F-1F	1.8	4.8	14.3	44	95	101	179	214	285	418	525	597	716	875	1188	.0048	.518
.100	.070	.050	2V20-1F	1.3	3.6	10.9	33	72	77	135	163	217	317	398	453	543	679	904	.0048	.678
.100	.050	.050	2V1F-1F	2.6	7.0	21.1	65	141	140	264	316	421	616	775	880	1056	1320	1754	.0081	.598
.130	.070	.050	3Q20-1F	2.4	6.3	18.8	58	126	133	236	282	376	550	692	786	943	1179	1565	.0097	.798
.130	.050	.050	3Q1F-1F	3.6	9.7	29.1	90	194	206	364	436	582	849	1067	1213	1456	1820	2429	.0129	.718
.138	.070	.050	3Y20-1F	2.5	6.8	20.7	63	137	146	258	309	412	603	757	862	1034	1293	1718	.0109	.829
.155	.087	.050	4F2H-1F	2.2	5.8	17.6	54	117	124	220	263	350	513	645	733	880	1100	1459	.0109	.965
.155	.070	.050	4F20-1F	3.0	8.1	24.2	75	161	171	303	362	483	706	889	1010	1211	1514	2012	.0137	.897
.162	.707	.050	4M20-1F	2.8	8.5	25.5	78	170	181	319	383	511	746	936	1065	1279	1598	2129	.0148	.925
.190	.090	.050	5F2K-1F	2.8	7.5	22.7	70	151	161	284	341	455	664	835	949	1139	1423	1894	.0161	1.116
.230	.120	.060	6K3F-1Q	2.9	7.9	23.8	73	158	168	297	356	474	694	872	991	1180	1487	1976	.0213	1.396
.300	.125	.125	8K3K-3K	8.3	22.2	66.7	205	444	472	834	1000	1333	1946	2446	2780	3336	4170	5553	.0705	1.695
.375	.187	.125	AQ5C-3K	6.6	17.7	53.0	163	353	375	663	794	1059	1547	1944	2209	2651	3314	4412	.0758	2.242
.500	.312	.187	EA8X-5C	6.7	17.9	53.7	165	358	381	672	807	1076	1568	1971	2240	2688	3360	—	.1132	3.239
.500	.312	.250	EA8X-75	8.9	23.9	71.8	220	478	509	898	1078	1437	2096	2635	2995	—	—	—	.1510	3.239
.500	.287	.187	EA87-5C	7.9	21.1	63.3	195	422	448	791	949	1265	1846	2320	2637	—	—	—	.1250	3.139
.500	.287	.250	EA87-75	10.5	28.2	84.6	226	564	599	1057	1268	1691	2468	3102	3524	—	—	—	.1670	3.139
.630	.325	.250	I09A-75	12.6	33.6	101.0	311	672	715	1261	1514	2019	2943	3110	3534	—	—	—	.2450	3.810
.820	.500	.250	NFEA-75	9.4	25.1	75.4	232	503	534	942	1131	1508	2199	2765	3142	—	—	—	.2450	5.265
.870	.540	.250	PVFF-75	9.1	24.2	72.7	224	484	515	908	1091	1454	2000	2657	3020	—	—	—	.2600	5.625
1.000	.500	.375	TKEA-AQ	19.2	51.4	154.0	475	1028	1092	1928	2312	3083	4499	5655	6427	—	—	—	.5850	5.984
1.000	.610	.375	TKHF-AQ	14.1	37.6	113.0	348	753	800	1412	1694	2259	3296	4144	4709	—	—	—	.4570	6.423
1.142	.748	.375	XMLD-AQ	12.1	32.2	97.0	298	645	685	—	1451	1935	2821	3547	4301	—	—	—	.4530	7.320
1.250	.750	.375	10QLF-AQ	14.6	38.8	117.0	360	779	827	—	1752	2336	3406	4282	4866	—	—	—	.5850	7.980
1.500	.750	.375	17VLF-AQ	19.8	52.7	159.0	488	1057	1122	—	2377	3170	4621	5810	6603	—	—	—	.8620	8.490

Add Prefix Here to Base Part No.

EXAMPLE: For K-21 toroid .155 OD x .087 ID x .050 HT, part number is L21-4F2H-1F. *Other core heights available. These are just a representative selection.
NOTE: All items also available in epoxy, add "E" to part number. High volume Parylene coating facilities in house, add "P" to part number.

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KRYSTINEL LINEAR FERRITE CORES

STANDARD COIL FORMS

This is just a partial listing of all sizes and materials available

PART NUMBER	DIMENSIONS — INCHES		
	LENGTH	O.D.	LEADS
C01-4A1H-R5P	.150	.052	#26
C01-5C1R-P5N	.187	.061	#24
C01-9725-M4N	.322	.075	#22
C01-AQ3K-M2N	.375	.125	#22
C01-EA4G-K26	.500	.156	#20
C01-LF5C-K2N	.750	.187	#20
C01-TK70-K2G	1.000	.245	#20
C01-10Q70-K2G	1.250	.245	#20

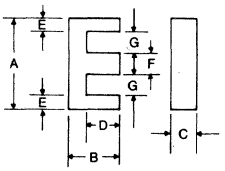
STANDARD SLEEVES

This is just a partial listing of all sizes and materials available

PART NUMBER	DIMENSIONS — INCHES		
	LENGTH	O.D.	I.D.
P01-4A3A-2G	.150	.115	.086
P01-8F3N-2T	.295	.128	.098
P01-AI49-35	.368	.149	.110
P01-CH7A-60	.437	.255	.210
P01-EA7A-60	.500	.255	.210
Matching sleeves are available for all coil forms.			

"E" CORES

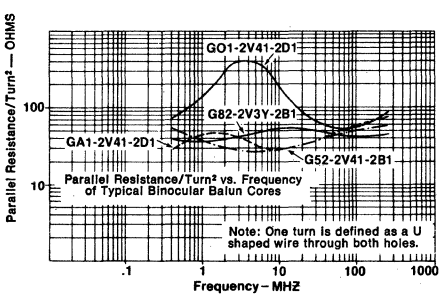
This is just a partial listing of sizes and materials available

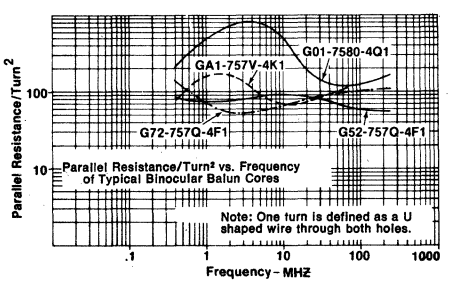


PART NO.	A	B	C	D	E	F	G
S82-75EA-6E	.500	.224	.250	.161	.0625	.125	.125
S91-75TK-AQ3	1.000	.375	.250	.250	.125	.250	.250

BINOCULAR BALUN CORES

This is just a partial listing of all sizes and materials available

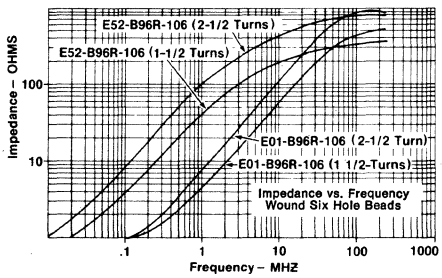


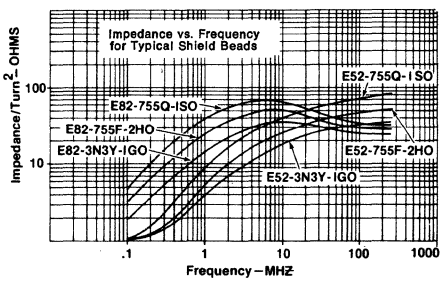


DIMENSIONS INCHES				MATERIAL	K01	KA1	K52	K72	K82
				PREFIX	G01	GA1	G52	G72	G82
HT	W	TH	I.D.	BASE P/N	A_L (NH/N²) @ 100 KHz				
.100	.141	.083	.031	2V41-2D1	60	185	—	—	—
.100	.141	.081	.031	2V41-2B1	—	—	414	—	—
.100	.138	.081	.030	2V3Y-2B1	—	—	—	1776	2523
.250	.280	.165	.073	7580-4Q1	124	—	—	—	—
.250	.275	.160	.070	757V-4K1	—	390	—	—	—
.250	.270	.155	.070	757Q-4F1	—	—	858	3534	5049
.545	.525	.295	.165	FKFO-8F1	190	595	—	—	—

SHIELD BEADS

This is just a partial listing of all sizes and materials available





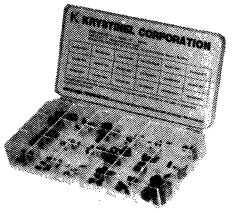
DIMENSIONS INCHES			MATERIAL	K01	KA1	K14	K52	K82
			PREFIX	E01	EA1	E14	E52	E82
HT	O.D.	I.D.	BASE P/N	A_L (NH/N²) ±25%				
.050	.138	.051	1F3Y-1G0	30	93	202	214	1264
.128	.138	.051	3N3Y-1G0	77	239	517	550	3237
.128	.138	.062	3N3Y-1S0	62	192	416	442	2601
.125	.163	.062	3K4N-1S0	73	227	491	521	3069
.250	.163	.062	754N-1S0	147	454	982	1043	6139
.125	.190	.090	3K5F-2K0	57	175	379	403	2373
.250	.190	.087	755F-2H0	114	351	759	806	4745
.250	.200	.062	755Q-1S0	178	550	1190	1264	7439
.250	.300	.125	758K-3K0	133	411	889	945	5560
.394	.236	.035	B96R-106	218	664	1458	1550	—

NOTE: B96R-106 has six holes — tolerances for these are ±30%.
Six-hole beads also available wound with 1½ and 2½ times of #22 or #24 ga. tinned copper wire.

PULSE RATED TOROID CORES

Wide variety available: Write for complete information

DESIGN KITS AVAILABLE



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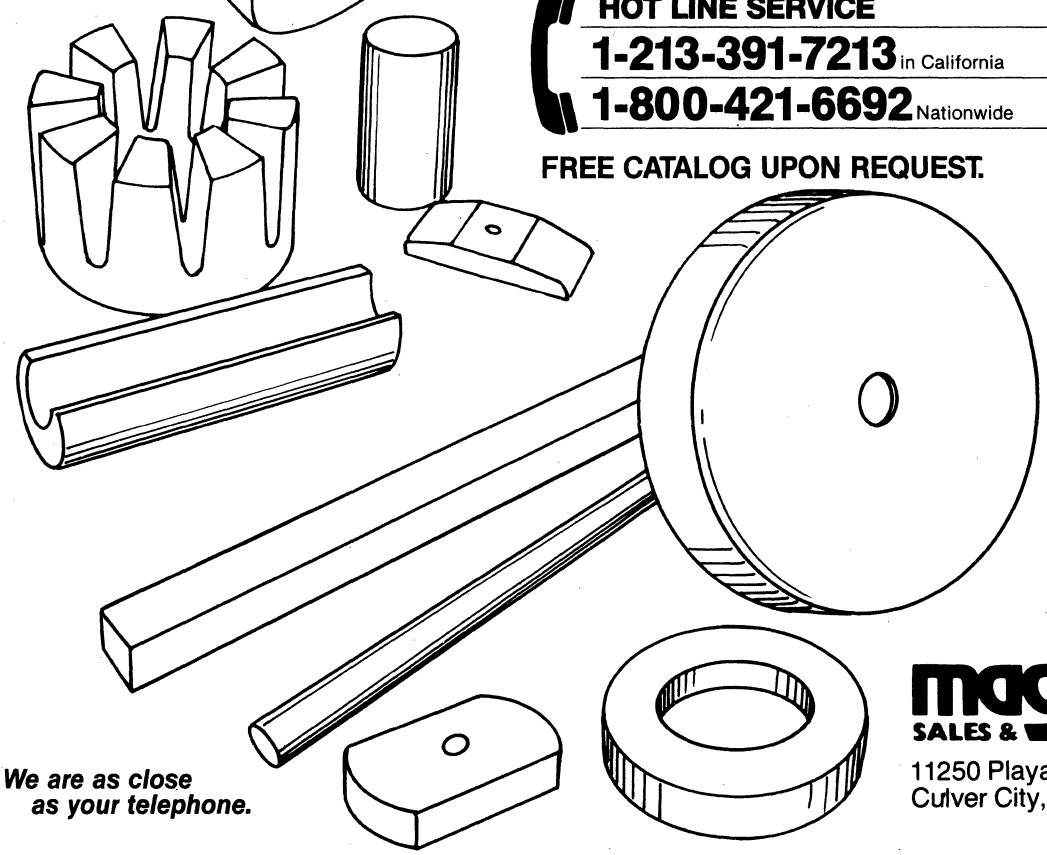

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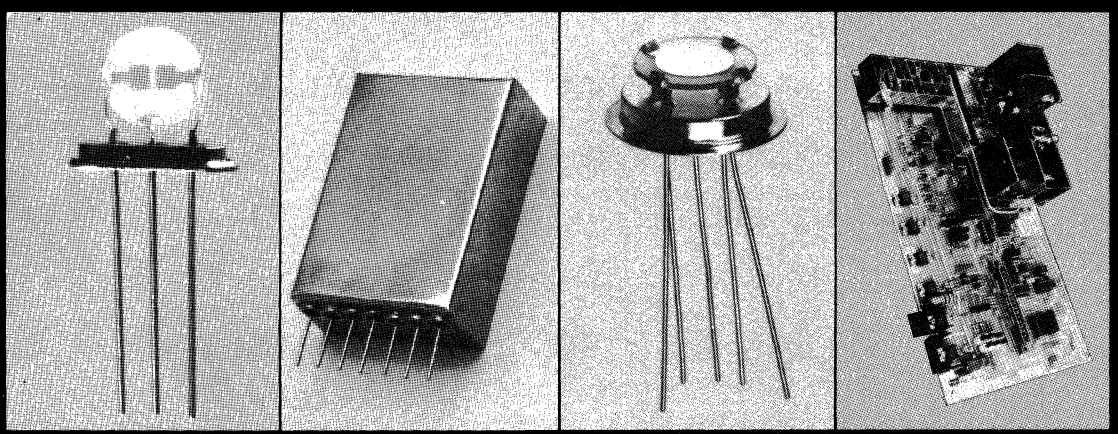

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crystal filters-2300

CRYSTAL FILTERS

Manufacturer	Active	AF	IF	UHF/ VHF	RF	Micro-wave	LC	Comb.	Single Side-band	Vesti-gial Side-band	Band-pass	Low Pass	High Pass	Notch (Band Elim.)	Linear Phase	Equal-izer	Hybrid	Other	Type
Comstron	A•1329	A•1329	A•1329	A•1329	A•1329	A•1329				A•1329	A•1329			A•1329					
Damon	A•1360		A•1360	A•1360	A•1360						A•1360	A•1360	A•1360	A•1360					
Fox Electronics			A•1363	A•1363							A•1363		A•1363	A•1363			A•1363		
Frequency Electronics				A•1367*	A•1367*				A•1367*		A•1367*			A•1367*					
Frequency Selective Networks	A•1369*						A•1369*		A•1369*		A•1369*	A•1369*	A•1369*	A•1369*	A•1369*	A•1369*	A•1369*		
CTS Knights			A•1356 A•1357	A•1356 A•1357	A•1356 A•1357						A•1356 A•1357							A•1336*	Resonators
Hughes Solid State		A•1370*									A•1370*			A•1370*					
McCoy Electronics		A•1381	A•1381	A•1381	A•1381	A•1381					A•1381						A•1382		
Microsonics							A•1386	A•1386			A•1386			A•1386	A•1386				
Monitor Products											A•1391*								
Motorola Components			A•1392		A•1392									A•1392					
Murata Erie			A•1396*		A•1396*													A•1397	Ceramic Filters
NTK Technical Ceramics																		A•1399	Piezo-ceramic Filters
OPT Industries		A•1401*	A•1401*	A•1401*	A•1401*		A•1401*				A•1401*	A•1401*	A•1401*	A•1410*	A•1401*				
Piezo Technology			A•1414		A•1414 A•1415	A•1413*					A•1413*			A•1415	A•1415			A•1413	Discrimi-nators, Frequency
Reeves-Hoffman	A•1425*								A•1425*		A•1425*	A•1425*	A•1425*	A•1425*		A•1425*		A•1425*	Discrimi-nators, Frequency
Sawtek			A•1432	A•1432	A•1432					A•1432	A•1432			A•1432	A•1432			A•1432	Filters, SAW Resonator
Sokol Crystal Prods.	A•1435-A•1437*			A•1435 A•1437*			A•1436										A•1435 A•1437	A•1435-A•1437	Filters, Time Delay Discrimi-nators, Frequency
Vernitron	A•1455										A•1455								

* Mil. Spec.

CRYSTALS

Manufacturer	Crystal Blanks	Microprocessor	Quartz	Quartz (watches)	Crystal Holders
Anderson Electronics			A•1313		
Bliley Electric		A•1320*	A•1316-A•1320*		A•1321*
Colorado Crystal			A•1324		
Croven Crystals	A•1335*		A•1335*		
CTS Knights		A•1339-A•1340	A•1337-A•1340*		
Fox Electronics			A•1363	A•1363	
ITT Components		A•1377	A•1377		
McCoy Electronics			A•1380*		
Midland Ross/Nel		A•1387	A•1387		
Monitor Products		A•1388	A•1388-A•1390*		
Motorola Components			A•1392		
M-tron		A•1395*	A•1395*		A•1395
Murata Erie		A•1396*	A•1396*		
Reeves-Hoffman			A•1423-A•1424		
SaRonix		A•1428, A•1429	A•1428, A•1429		A•1428, A•1429
Seiko Instruments		A•1433	A•1433	A•1433	
SFE Technologies	A•1434	A•1434	A•1434		
Sokol Crystal Prods.		A•1435-A•1437*	A•1435-A•1437		
Spectrum Technology			A•1426*		
Statek			A•1441-A•1443		

* Mil. Spec.

OSCILLATORS

Manufacturer	AF	LF	RF	Ultra-sonic	Micro-wave	Sinu-soidal	Square Wave	Pulse	UHF/VHF	Crystal Controlled (Module)	Tuning Fork Controlled	Ovenized	Voltage Controlled (VCXO)	Temp. Compnstd. (TCXO)	Volt. Con-trolled/ Temp. Compnstd.	Clock	LC	RC	Other	Type
Anderson		A•1313	A•1313			A•1313			A•1313	A•1313						A•1313				
Austron			A•1314*				A•1314*	A•1314*	A•1315*	A•1314*		A•1314*							A•1314	Standards, Frequency Time Code Instrumentation
Bliley Electric		A•1322	A•1322 A•1323			A•1322 A•1323	A-1322 A•1323		A•1322	A•1322 A•1323			A•1323	A•1323		A•1322				
Comclok							A•1325			A•1325						A•1325				
Comstron		A•1327 A•1328	A•1327 A•1328		A•1327 A•1328	A•1328			A•1327 A•1328	A•1327 A•1328		A•1327 A•1328		A•1327 A•1328						
Connor-Winfield		A•1331- A•1334	A•1331- A•1334			A•1331- A•1334	A•1331- A•1334	A•1331- A•1334	A•1331- A•1334	A•1331- A•1334		A•1334	A•1332 A•1333	A•1333			A1331- A•1334	A•1334		
CTS Knights		A•1345- A•1351*	A•1351 A•1352			A•1343- A•1350*	A•1343- A•1352	A•1345- A•1350*	A•1345*	A•1343- A•1350*		A•1343- A•1355*	A•1346- A•1355	A•1346- A•1351	A•1351	A•1342				
Dale Electronics			A•1358				A•1358 A•1359			A•1358 A•1359				A•1359		A•1348				
Damon			A•1360			A•1360		A•1360	A•1360	A•1360			A•1360							
Efratom																			A•1361*	Standards, Time & Frequency
Electronic Research			A•1362			A•1362				A•1362		A•1362								
Fox Electronics			A•1363				A•1363	A•1363	A•1363	A•1363						A•1363			A•1363	Resonators
Frequency Electronics		A•1367*	A•1367*		A•1367*					A•1367*		A•1367*	A•1367*	A•1367*	A•1367					
Hughes Solid State	A•1370* A•1371*	A•1370* A•1371*	A•1370* A•1371*			A•1370* A•1371*	A•1370* A•1371*	A•1370* A•1371*	A•1370* A•1371*	A•1370* A•1371*			A•1370*	A•1371*		A•1370* A•1371*				
Isotemp Research			A•1374 A•1375			A•1374 A•1375	A•1374 A•1375	A•1374 A•1375	A•1374 A•1375	A•1374 A.1375		A•1374 A•1375		A•1374 A•1375						
ITT Components										A•1377	A•1377					A•1377				
Leach Corp.		A•1378	A•1378			A•1378	A•1378		A•1378	A•1378						A•1378			A•1378*	Baud Rate Generator
McCoy Electronics	A•1382* A•1383*	A•1382* A•1383*	A•1382* A•1383*			A•1382* A•1383*	A•1382*	A•1382*	A•1382* A•1383*	A•1382* A•1383*		A•1382*	A•1382	A•1382 A•1383	A•1382*	A•1382* A•1383*				

* Mil. Spec.

OSCILLATORS

Manufacturer	AF	LF	RF	Ultra-sonic	Micro-wave	Sinu-soidal	Square Wave	Pulse	UHF/VHF	Crystal Controlled (Module)	Tuning Fork Controlled	Ovenized	Voltage Controlled (VCXO)	Temp. Compnstd. (TCXO)	Volt. Controlled/ Temp. Compnstd.	Clock	LC	RC	Other	Type
MF Electronics			A•1385* A•1386*				A•1385* A•1386*	A•1385* A•1386*	A•1385* A•1386*	A•1386 A•1386*							A•1385* A•1386*			
Microsonics			A•1386*			A•1386*	A•1386	A•1386*		A•1386*		A•1386*		A•1386*	A•1386*	A•1386*				
Midland Ross/ NEL							A•1387	A•1387		A•1387						A•1387			A•1387	Generators, Baud Rate
Monitor Products						A•1389 A•1390*	A•1388	A•1387 A•1388		A•1380- A•1390*		A•1391*		A•1388 A•1389		A•1388 A•1389				
Motorola Components						A•1392	A•1393	A•1393	A•1393	A•1392				A•1392		A•1393			A•1393	Generators, Baud Rate Resonator Crystals
M-tron		A•1395	A•1395	A•1395			A•1395			A•1395										
Murata Erie		A•1396	A•1396			A•1396	A•1396		A•1396	A•1396		A•1396	A•1396	A•1396		A•1396			A•1396	Ceramic Resonators
NTK Technical																			A•1398	Ceramic Resonators
Oscillatek	A•1402*	A•1402*	A•1402*			A•1402*	A•1402*	A•1402*		A•1402*			A•1402*	A•1402*		A•1402* A•1406			A•1404	Generators, Baud Rate
Ovenaire	A•1409 A•1410	A•1408- A•1410	A•1408 A•1410			A•1408- A•1410	A•1408- A•1410	A•1408 A•1410	A•1408 A•1410	A•1408- A•1410		A•1408	A•1410	A•1408			A•1410	A•1410	A•1411	Ovens
Piezo Technology			A•1413						A•1413	A•1417		A•1416	A•1417	A•1417					A•1418	Precision Resonators
Q-Tech Corp.			A•1420*		A•1420*		A•1420- A•1422*	A•1420- A•1422*	A•1420- A•1422*	A•1420			A•1420- A•1422*			A•1420- A•1422*			A•1420	Generators, Baud Rate
Reeves-Hoffman			A•1426 A•1427				A•1427	A•1427	A•1426 A•1427	A•1426 A•1427		A•1426 A•1427	A•1426 A•1427	A•1426 A•1427		A•1426 A•1427				
SaRonix		A•1430 A•1431	A•1430 A•1431			A•1430 A•1431	A•1430 A•1431	A•1430 A•1431		A•1430 A•1431						A•1430 A•1431			A•1430	Generators, Baud Rate
Sawtek					A•1432		A•1432	A•1432	A•1432	A•1432				A•1432		A•1432			A•1432 A•1432	Oscillators, SAW Resonators, SAW
Seiko Instruments																			A•1433	Custom
Sokol Crystal Prods			A•1435					A•1435	A•1435	A•1435						A•1435				
Spectrum Technology							A•1438* A•1439*	A•1438* A•1439*	A•1438* A•1439*	A•1438* A•1439*				A•1438* A•1439*		A•1438* A•1439*				
Statek		A•1441- A•1445				A•1441- A•1445	A•1441- A•1445	A•1441- A•1445		A•1441- A•1445	A•1441- A•1445					A•1441- A•1445				
Techtrol			A•1446 A•1447		A•1446 A•1447	A•1446 A•1447			A•1446 A•1447	A•1446 A•1447									A•1447	Frequency Multipliers
Vectron Labs.			A•1450 A•1451*			A•1451- A•1454*	A•1450 A•1452 A•1454*	A•1450 A•1452 A•1454*	A•1450- A•1453*	A•1450- A•1454*		A•1453* A•1454	A•1454	A•1452		A•1450 A•1452				
Xsis						A•1457*	A•1457*			A•1457*						A•1457*				

* Mil. Spec.

Anderson Electronics

MICROPROCESSOR CRYSTALS

FREQ. (MHz)	PART NO.	HOLDER	FREQ. (MHz)	PART NO.	HOLDER
1.0000	MAE10	HC 33/U	6.144	MAE61	HC 18/U
1.8432	MAE18	HC 33/U	6.400	MAE64	HC 18/U
2.0000	MAE20	HC 33/U	6.5536	MAE65	HC 18/U
2.097152	MAE21	HC 33/U	7.680	MAE76	HC 18/U
2.4576	MAE24	HC 33/U	8.000	MAE80	HC 18/U
3.2768	MAE32	HC 33/U or HC 18/U	10.000	MAE100	HC 18/U
3.579545	MAE35	HC 33/U or HC 18/U	12.000	MAE120	HC 18/U
4.0000	MAE40	HC 18/U	14.31818	MAE143	HC 18/U
4.0960	MAE41	HC 18/U	15.000	MAE150	HC 18/U
4.194304	MAE42	HC 18/U	16.000	MAE160	HC 18/U
4.9152	MAE49	HC 18/U	18.000	MAE180	HC 18/U
5.0000	MAE50	HC 18/U	18.432	MAE184	HC 18/U
5.0688	MAE51	HC 18/U	20.000	MAE200	HC 18/U
5.185	MAE52	HC 18/U	22.1184	MAE221	HC 18/U
5.9904	MAE59	HC 18/U	32.000	MAE320	HC 18/U
6.0000	MAE60	HC 18/U			
			36.000	MAE360	HC 18/U
			48.000	MAE480	HC 18/U

AE 404 QUARTZ CRYSTAL CLOCK OSCILLATORS

Model AE 404 is a low-profile resistance welded quartz crystal oscillator designed and manufactured to insure reliability.

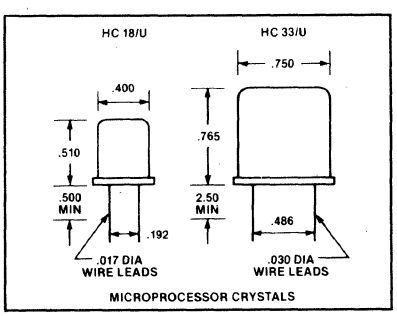
Output	Frequency Range	Frequency Stability	Temperature Range	Input Voltage	Input Current	Waveform Symmetry
TTL	1 Hz to 50 MHz	± .01%	0°C to + 70°C	+ 5 VDL ± 10%	25 mA to 125 mA	60/40 max.
LSTTL	1 Hz to 50 MHz	± .01%	0°C to + 70°C	+ 5 VDL ± 10%	20 mA to 70 mA	60/40 max.
CMOS	1 Hz to 8 MHz	± .01%	0°C to + 70°C	+ 5 to + 15 VDC	5 mA to 20 mA	60/40 max.

- Tighter Frequency Stability and Temperature Range available.
- Higher frequencies available.
- 14 pin + Dual-in-line package also available.
- Dual outputs available.

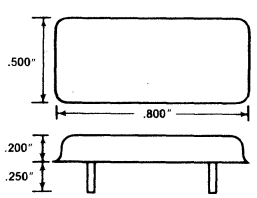
AE 808 MICROPROCESSOR CRYSTAL OSCILLATORS*

FREQUENCY	Pulse Width High (Min)	Pulse Width High (Max)	Pulse Width Low (Min)	Pulse Width Low (Max)	Rise Time (Max)	Fall Time (Max)	High Level (Min)	Low Level (Max)
2.5000 MHz	180ns	250ns	180ns	250ns	20ns	20ns	Vcc - .4V	0.4V
4.0000 MHz	105ns	200ns	105ns	200ns	20ns	20ns	Vcc - .4V	0.4V
6.0000 MHz	65ns	90ns	65ns	90ns	20ns	20ns	Vcc - .4V	0.4V

NOTE: All parameters measured under 150 pf. load over 0° to +70° C temperature range.
*For Zilog or Equivalent (Zilog is the trademark of Zilog, Inc.)



MICROPROCESSOR CRYSTALS



PIN	CONNECTION
1	No Connection
7	Ground
8	Output
14	Input

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310 Penn Street
Hollidaysburg, Pennsylvania 16648
Phone: 814-695-4428 TWX 510-691-2516
Serving Since 1959

When time is critical, count on Austron.

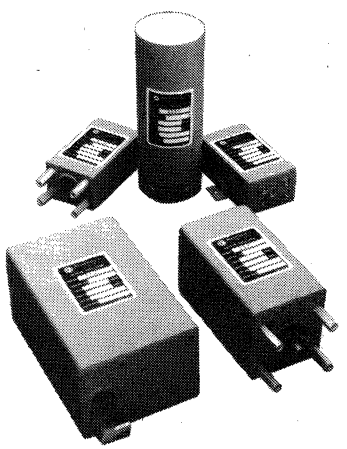
The fact is, customers have been counting on Austron for time determination and frequency control instruments and systems for over 20 years. Austron's design and test capabilities have won us contracts ranging from feasibility studies through design, manufacturing, support, training and equipment updates.

So if you're looking for a leading designer and subsystem manufacturer in time and frequency technology, look to Austron. When time is critical, count on Austron.

OSCILLATORS

Austron offers a complete family of high-precision, ovenized crystal oscillators.

- Up to 5×10^{-11}/24 hours aging
- Frequencies from 1 to 120 MHz
- MIL-SPEC, JANTX, Radiation hardened
- Custom engineering



Call or write for more information.

1100 SMALL LIGHTWEIGHT

Combines high stability with low power drain. Small, lightweight, plug-in package finds application whenever space is at a premium and performance cannot be compromised.
OUTPUT FREQUENCY: 5 MHz (standard)
SIZE: 1.25 x 1.75 x 3.25 inches
AGING RATE: 5, 2, or 1×10^{-9}/24 hrs. after 72 hrs. continuous operation
AMBIENT TEMPERATURE STABILITY:
$< 2.5 \times 10^{-8}$ from −20° to +65°C

1105 DIGITAL APPLICATIONS

Low profile, solid-state provides highly stable 1 MHz logic output for IC applications. Operates from a 5-volt power supply packaged with size, weight and stability performance in a configuration for the IC instrument designer.
OUTPUT FREQUENCY: 1 MHz, TTL logic
SIZE: 1.25 x 1.75 x 3.25 inches
AGING RATE: 10, 5, 2 or 1×10^{-9}/24 hrs. after 72 hrs. continuous operation
AMBIENT TEMPERATURE STABILITY:
$< 2 \times 10^{-8}$ from 0° to +55°C

1115 EXTREMELY LOW POWER

Specifically designed for undersea applications where high stability and minimal power drain are of prime importance.
OUTPUT FREQUENCY: 5 MHz
SIZE: Cylinder, 2" diameter, 5.5" length
AGING RATE:
3×10^{-9}/24 hrs. after 72 hrs. continuous operation
1×10^{-9}/24 hrs. after 30 days.
AMBIENT TEMPERATURE STABILITY:
$< 5 \times 10^{-9}$ from −2° to +25°C
(NOTE: Higher temperature models available)

1120 VERSATILITY

Compact, rugged and designed for a wide range of applications. Available in many different frequencies, input voltages and mechanical configurations.
OUTPUT FREQUENCY: 1 MHz through 10 MHz
SIZE: 2.27 x 2.14 x 4 inches
AGING RATE: 5, 2 or 1×10^{-9}/24 hrs. after 72 hrs. continuous operation
AMBIENT TEMPERATURE STABILITY:
$< 2 \times 10^{-8}$ from −20° to +65°C

1120L LOW PHASE NOISE

Features extremely low phase noise performance.
OUTPUT FREQUENCY: 5 or 10 MHz
PHASE NOISE (1 Hz BW):
135 dB, 10 Hz 155 dB, 100 Hz 160 dB, 1 kHz

1150 ULTRA HIGH STABILITY

Very rugged, high precision developed for use in satellite navigation systems. Required whenever system applications demand a precise time base or frequency reference. Ultimate aging of 5×10^{-11}/day, low phase noise and 5 MHz standard frequency.
OUTPUT FREQUENCY: 5 MHz (standard)
SIZE: 2.37 x 3.18 x 5 inches
AGING RATE:
5×10^{-10}/24 hrs. after 24 hours operation;
1×10^{-10}/24 hrs. after 30 days operation
AMBIENT TEMPERATURE STABILITY:
$< 2 \times 10^{-9}$ from −40° to +60°C
$< 5 \times 10^{-10}$ from 0° to +50° C
(Ultimate drift is typically 5×10^{-11} after 90 days operation.)

1170 HIGHER FREQUENCY

The latest addition to the Austron family, 1170 Series VHF, includes several units in the range of 35 MHz to 120 MHz. CALL FOR DETAILED INFORMATION AND AVAILABILITY.

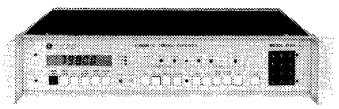
AUSTRON, INC. P.O. BOX 14766 AUSTIN, TEXAS 78761 • (512) 251-2313 • TWX 910/874-1356

TIMING & FREQUENCY INSTRUMENTS

Austron manufactures a full line of instruments for precise management of time and frequency.

2100/2100F LORAN-C RECEIVER/MONITOR

Austron receivers are microprocessor-based, automatic acquisition and tracking receivers that utilize the LORAN-C groundwave to provide a traceable reference for time epoch determination, frequency management, calibration and control. These receivers provide time accuracy to one microsecond and frequency accuracy to parts in 10^{12}.



AUSTRON 2100

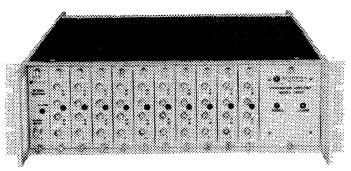
2110 DISCIPLINED FREQUENCY STANDARD

A state-of-the-art, microprocessor controlled system that automatically locks the frequency of its precision ovenized crystal oscillator to that of an externally applied reference having superior long-term stability. Uses a third-order servo technique to correct the frequency offset and aging of the internal oscillator. If the external reference is removed or fails, the 2110 will continue to apply corrections and will typically limit the frequency offset to parts in 10^{12} for several days following the reference loss.

AUSTRON 2110

1295C DISTRIBUTION AMPLIFIER

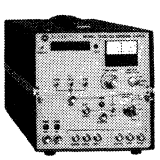
Provides the necessary noise immunity and drive capability to interface a local frequency standard to other equipment at distances up to 1000 feet. Four standard frequencies can be accommodated (10, 5, 1 and 0.1 MHz). For other frequencies consult factory. Input frequencies and number of outputs for each frequency are customer specified to provide a more cost effective system. Single frequency units can have up to 40 individual outputs, while units with 2 to 4 frequency inputs will have four or more outputs for each input.



AUSTRON 1295C

1210D SERIES PORTABLE CLOCKS

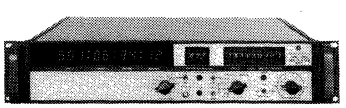
Compact, self-contained, self-powered time references providing stable time outputs at several pulse and sinusoidal frequencies with a digital time-of-day display.



AUSTRON 1210D

TIME CODE INSTRUMENTATION

A complete line of instruments from basic generators and readers to full complement tape search and control units. Available for bench, panel, rack or portable. All standard IRIG, XR3 and NASA codes are available to give these instruments the flexibility to meet any system requirement.



AUSTRON 8152

SYSTEMS

Complete systems for generation, management and distribution of precise time and/or frequency. Austron engineering has led to such sophisticated secure communication frequency control sets as AN/GSQ-174, AN/GSQ-183 and AN/GSQ-215.

Time and Frequency Receivers, Disciplined Standards, Distribution Amplifiers, Time Code Generators and Readers and all ancillary equipment along with Austron Engineering . . . put us to work, for you.

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For further information call (814) 838-3571 or TWX 510-696-6886
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CRYSTALS

Bliley

first name in frequency control

Coldweld Vacuum Sealed Transistor Case Styles

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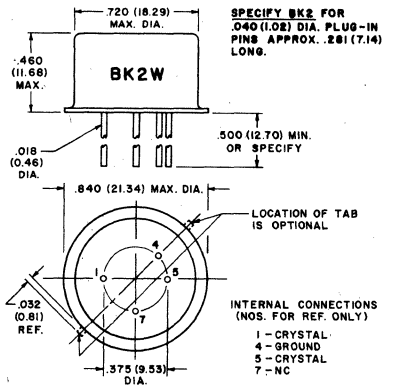

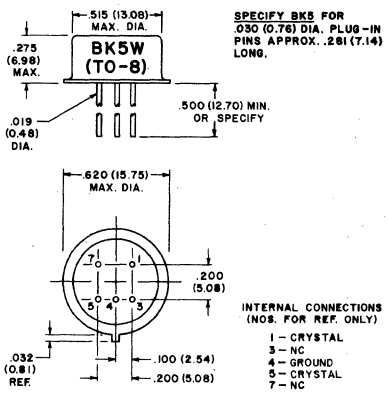

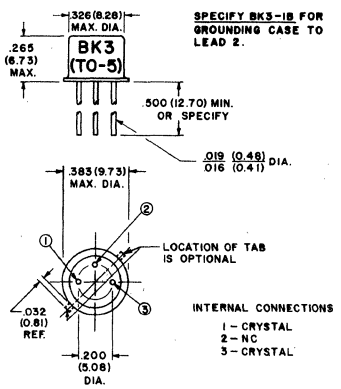

BLILEY TYPE	FREQUENCY RANGE (MHz)	FREQ. TOL. (%) vs TEMP. RANGE (°C) (INCLUDES CALIBRATION AT +25°C)				MAX. SERIES RES. (Ω)	CRYSTAL CUT-AT (MODE)	TYPICAL DRIVE LEVEL (mW)
		0 TO 50	0 TO 70	–40 TO +70	–55 TO +105			
BK2W	.86 – .99	±.0015	±.002	±.0025	±.003	300	FUNDAMENTAL	1.0
	1 – 1.9					150		
	2 – 2.9					40		
	3 – 6.0					25		
BK5W	2 – 2.9					250		
	3 – 3.9					120		
	4 – 4.9					60		
	5 – 5.9					30		
	6 – 7.9					22		
	8 – 15					15		
BK3	7 – 9.9					40		0.5
	10 – 25					25		
	25 – 75					40	3RD	
	75 – 125					60	5TH	
	125 – 150					100	7TH	

BLILEY TYPE	BK2W	BK3-1B	BK5W
MIL-H-10056 HOLDER DESIGNATION	HC-40/U	HC-35/U	HC-37/U
AGING GUIDELINES: 1ST MONTH FOLLOWING YEAR	2 PPM 1.5 PPM	2 PPM 3 PPM	2 PPM 2 PPM
VIBRATION	20G FROM 10-2000 Hz		
SHOCK	150G FOR 7 ms		

For further information call (814) 838-3571 or TWX 510-696-6886
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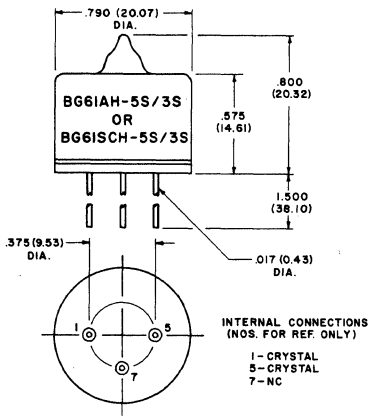
CRYSTALS

Bliley
first name in frequency control

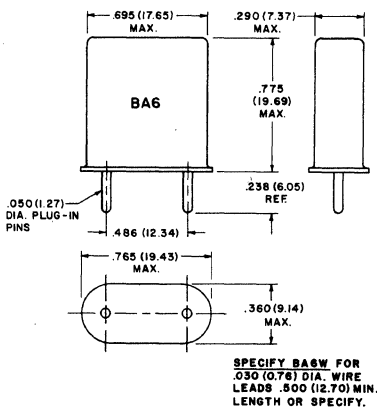
Vacuum Sealed
Ultra High Stability

Designed for optimum performance with temperature control

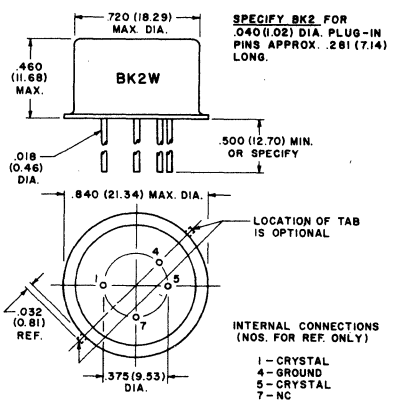
This outstanding group incorporates the technology and craftsmanship that has made Bliley famous for quality without compromise. Exceptionally low aging and high Q characteristics provide precision reference for frequency standards, synthesizers and ultra stable system clocks.



BG61AH-5S/3S OR BG61SCH-5S/3S
(GLASS ENCLOSURES)



BA6/BA6W
(COLDWELD SEALED METAL ENCLOSURES)

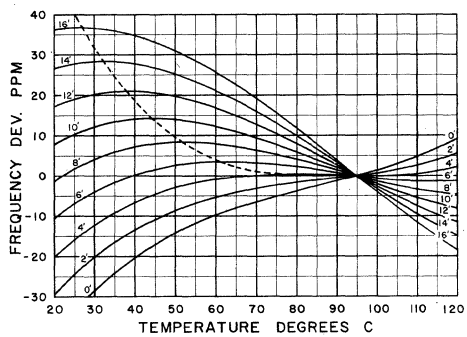


BK2/BK2W
(COLDWELD SEALED METAL ENCLOSURES)

	5TH OVERTONE (AT CUT)	3RD OVERTONE (AT CUT)					
BLILEY TYPE	BG61AH-5S	BG61AH-3S	BA6/BA6W		BK2/BK2W		
FREQ. MHz	5	3.8 – 6.0	3.8 – 7.9	8 – 12	3.8 – 6.0	6.1 – 10.9	11 – 15
AVERAGE Q (10^6)	2.5	1.5		0.6	1.0	0.6	0.4
MAX SERIES RESISTANCE (Ω)	140	50		35	50	40	35
FREQ. TOL. AT TURNING POINT	± 1 PPM	± 4 PPM	± 5 PPM				
TURNING POINT	AVAILABLE AT ANY TEMPERATURE (± 5°C) FROM +45° TO +90°C (TOLERANCE OF ± 3° OR ±4° AVAILABLE UPON REQUEST)						
TEMPERATURE COEFFICIENT	$< 1 \times 10^{-7}$/°C FOR 1° EACH SIDE OF TURNING POINT						
AGING AT +75°C	5×10^{-10}/DAY AFTER 3 DAYS 7×10^{-10}/WEEK AFTER 1 MONTH	2×10^{-9}/DAY AFTER 3 DAYS 2×10^{-9}/WEEK AFTER 1 MONTH	2×10^{-8}/WEEK AFTER 1 WEEK				
DRIVE LEVEL	70μA ± 20%	15μW MAX.	25μW MAX.				
FREQ. CHANGE 50G SHOCK OR 10G VIBRATION	$< \pm 1 \times 10^{-8}$	$< \pm 2 \times 10^{-8}$					
	10 – 200 Hz	10 – 1500 Hz	10 – 2000 Hz				

SC CUT

GENERALIZED TEMPERATURE/FREQUENCY CHARACTERISTICS



	STRESS COMPENSATED – DOUBLE ANGLE ROTATION				
	5TH OVERTONE (SC CUT)	3RD OVERTONE (SC CUT)			
BLILEY TYPE	BG61SCH-5S	BG61SCH-3S		BA6/BA6W AND BK2/BK2W	
FREQ. (MHz)	5	5	10	5	10
AVERAGE Q (x 10^6)	2.5	2.2	1.2	2.0	1.0
MAX SERIES RESISTANCE (Ω)	350	110	65	120	70
FREQ.TOL. (PPM) AT TURNING POINT	±0.5	±1.5	±1.5	±1.5	±1.5
TURNING POINT	WITHIN ±7.5°C OF ANY TEMP. IN THE RANGE OF 50°C TO 75°C			WITHIN ±7.5°C OF ANY TEMP. IN THE RANGE OF 30°C TO 75°C	
AGING AT +75°C	7×10^{-10}/WEEK AFTER 1 MO.	2×10^{-9}/WEEK AFTER 1 MO.		2×10^{-8}/WEEK AFTER 1 WEEK	

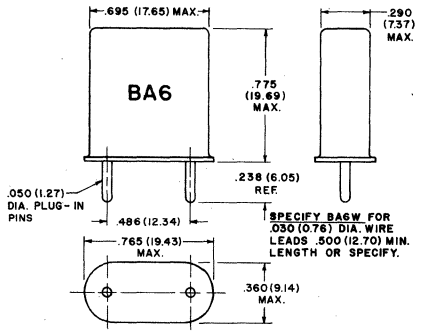
For further information call (814) 838-3571 or TWX 510-696-6886
BLILEY ELECTRIC COMPANY
2545 W. GRANDVIEW BOULEVARD
P. O. BOX 3428
ERIE/PENNSYLVANIA 16508

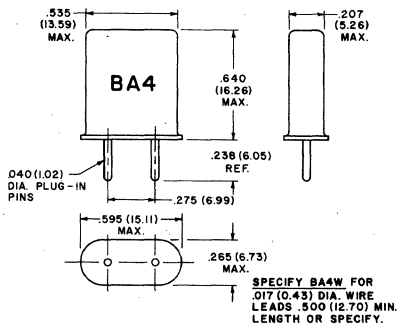
CRYSTALS

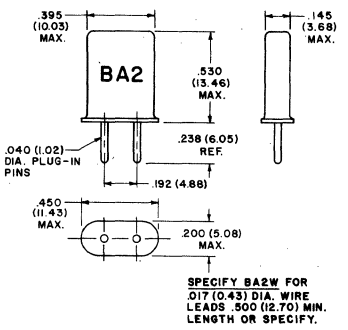
Coldweld Vacuum Sealed

Bliley — first name in frequency control

ALTHOUGH SIMILAR IN APPEARANCE AND CONFIGURATION TO A COMMONLY USED SOLDER-SEALED COUNTERPART, BLILEY'S **BA** SERIES FEATURES UNEXCELLED PROCESS CLEANLINESS AND FLUX-FREE SEALING IN VACUUM TO MINIMIZE CONTAMINATION. IMPROVED AGING AND RELIABILITY RESULT AT A MODEST COST PREMIUM. THE DATA FOLLOWING IS SUGGESTED FOR GENERAL GUIDANCE. SUPERIOR PERFORMANCE IN TEMPERATURE STABILITY AND AGING CAN BE PROVIDED IF REQUIRED.







BLILEY TYPE	FREQUENCY RANGE	FREQ. TOL. (%) vs TEMP. RANGE (°C) (INCLUDES CALIBRATION AT +25°C)				MAX. SERIES RES. (Ω)	CRYSTAL CUT	AGING (PPM)		MAX. DRIVE LEVEL (mW)
		0 TO 50	0 TO 75	−40 TO +70	−55 TO +90			1ST MONTH	NEXT 12 MONTHS	
BA6	200–299 kHz	±.007	±.008	±.01	±.015	3000	DT	20	40	2
	300–399 kHz					4000				
	400–500 kHz					5000				
	325–499 kHz	±.0025	±.003	±.005	±.007	1500	GT			
	500–600 kHz					2000				
BA6 & BA2	300–500 kHz	±.003	±.004	±.007	±.011	1000	SL			
	500–599 kHz					1500				
	600–800 kHz					2000				
BA6	1–2 MHz	±.0015	±.002	±.0025	−55 to +105	350	A_f	3	2	5
BA6 & BA4	2–3 MHz				±.004	175			3	
	3–4 MHz					75				
BA6, BA4, & BA2	4–7 MHz					50				
	7–10 MHz					30				
	10–20 MHz					25				
	20–60 MHz					40	A_3			2
BA2	60–87 MHz					50	A_5			1
	87–100 MHz					60				
	100–150 MHz					90	A_7			

AGING VALUES ARE BASED UPON CONTINUOUS OPERATION AT +85°C AND DRIVE LEVELS AS INDICATED.
A_f, A_3, A_5, A_7 DENOTE AT CUT-FUNDAMENTAL MODE, 3RD OVERTONE MODE, ETC.

BLILEY TYPE	BA6	BA6W	BA4	BA4W	BA2	BA2W
MIL-H-10056 HOLDER DESIGNATION	HC-36/U	HC-47/U	HC-46/U	–	HC-42/U	HC-43/U
VIBRATION	10G FROM 10–2000 Hz					
SHOCK	100G FOR 11 ms					

INTERNALLY RUGGEDIZED DESIGNS ARE AVAILABLE FOR HIGHER LEVEL SHOCK AND VIBRATION.

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CRYSTALS

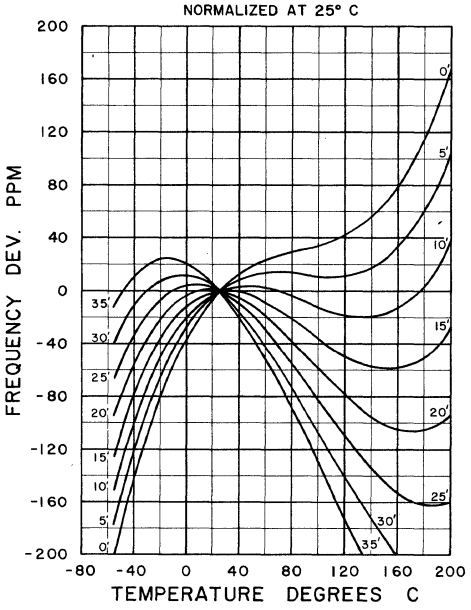
Bliley
first name in frequency control

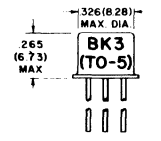
Stress Compensated Double Angle Rotation • SC Cut

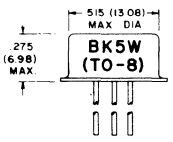
- IMPROVED FREQUENCY STABILITY DURING ACCELERATION AND VIBRATION
- HIGH DRIVE CAPABILITY — SEVERAL TIMES TYPICAL AT CUT LEVELS
- LOW PHASE NOISE
- LOW AGING RATE
- FAST WARM-UP

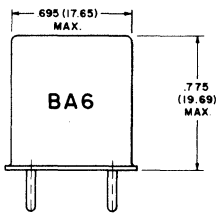
SC CUT

GENERALIZED TEMP./FREQ. CHARACTERISTICS
NORMALIZED AT 25° C







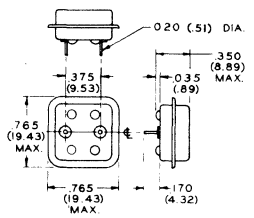


BLILEY TYPE	FREQUENCY RANGE (MHz)	MODE
BK5/BK5W	5—15	FUND.
BK3/BK3-1B	15—33	
BA6/BA6W	5—45	3RD
BK5/BK5W	33—45	
BK3/BK3-1B	45—100	
	75—140	5TH

TEMPERATURE RANGE (°C)	FREQUENCY TOLERANCE*
0 TO +50	±.0018%
–10 TO +60	±.0023%
–40 TO +85	±.0048%
–55 TO +85	±.006%
–55 TO +105	±.007%
–55 TO +125	±.0075%
–55 TO +200	±.01%
+20 TO +85	±.0023%
+60 TO +90	±.001%

*INCLUDES STABILITY OVER TEMP. RANGE & CALIBRATION TOLERANCE.

For PC Board Mount • Coldweld Sealed • DT-SL-AT Cuts



HB2
(HC-39/U)

BLILEY TYPE	FREQUENCY RANGE (kHz)	FREQ. TOL. (%) vs TEMP. RANGE (°C) 0 TO 50	0 TO 75	–40 TO +70	–55 TO +90	MAX. SERIES RES. (Ω)	CUT
HB2	200 - 299	±.007	±.008	±.01	±.015	4000	DT
	300 - 399					5500	
	400 - 450					6000	
	450 - 599	±.003	±.004	±.007	±.011	2000	SL
	600 - 800					2500	
	1 - 2 MHz	±.002	±.0025	±.003	±.004	400	A_f
	2 - 3 MHz					200	
	3 - 4 MHz					100	
	4 - 7 MHz					60	
	7 - 10 MHz					30	
	10 - 20 MHz					25	
	20 - 50 MHz					40	A_3

ALL FREQUENCY TOLERANCES INCLUDE INITIAL CALIBRATION AT +25°C.

A_f AND A_3 DENOTE AT CUT-FUNDAMENTAL MODE AND 3RD OVERTONE MODE.

For further information call (814) 838-3571 or TWX 510-696-6886
BLILEY ELECTRIC COMPANY
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CRYSTALS

General Purpose and Mil-Spec.

Bliley — first name in frequency control

Good performance and reliability plus versatility in mounting and economy pinpoint this group as the logical choice for most computer, data processing and general purpose applications. A variety of holder styles is available with the familiar Mil-Spec solder seal or our "Resistance-Weld" seal, a newer process ideally adapted to volume production at lowest cost with a reduced possibility of contamination.

BLILEY TYPE	FREQUENCY RANGE (kHz)	TEMPERATURE RANGE (°C) 0 TO 50 FREQ. TOL. (%)	0 TO 50 MAX. SERIES RES. (Ω)	0 TO 75 FREQ. TOL. (%)	0 TO 75 MAX. SERIES RES. (Ω)	−40 TO +70 FREQ. TOL. (%)	−40 TO +70 MAX. SERIES RES. (Ω)	−55 TO +90 FREQ. TOL. (%)	−55 TO +90 MAX. SERIES RES. (Ω)	CRYSTAL CUT	AGING (PPM) 1ST MONTH	AGING (PPM) NEXT 12 MOS.	MAX. DRIVE LEVEL (mW)
BH9	2.5–5	±.01	75k	±.015	85k	±.02	85k	±.025	100k	JT	40	100	0.1
	5–8		60k		75k		75k		90k				
	8–13.5		50k		60k		60k		75k				
	13.5–30	±.005	75k	±.009	100k	±.012	100k	±.02	125k	NT	20	50	
	30–50		65k		90k		90k		110k				
	50–100		55k		75k		75k		90k				
	90–175	±.015	3.5k	±.017	3.5k	±.02	4k	±.03	5k	+5°X	25	70	2
	175–250		4k		4k		4.5k		6k				
BH6	200–300		4k		4k		4.5k		6k				

		FREQ. TOL. (%) vs TEMP. RANGE (°C) 0 TO 50	0 TO 75	−40 TO +70	−55 TO +90	MAX. SERIES RES. (Ω)	CRYSTAL CUT	AGING (PPM) 1ST MONTH	AGING (PPM) NEXT 12 MOS.	MAX. DRIVE LEVEL (mW)
BH6/ BR6	200	±.007	±.008	±.01	±.015	4000	DT	20	40	2
	300–399					5000				
	400–500					6000				
BH6/BR6 & BX/BR2	300–500	±.003	±.004	±.007	±.011	1500	SL			
	500–599					2000				
	600–800					2500				
BH6/ BR6	325–499	±.0025	±.003	±.005	±.007	2000	GT			
	500–600					2500				
	450–599	±.007	±.009	±.01	±.02	2500	P			
	600–750					3000				
BH6/BR6 & BR4	1–2 MHz	±.002	±.0025	±.003	−55 to +105	400	A_f	4	3	5
	2–3 MHz				±.005	200				
	3–4 MHz					100				
BH6/BR6 BR4 & BX/BR2	4–7 MHz					60				
	7–10 MHz					30				
	10–20 MHz					25				
	20–60 MHz					40	A_3			2
BX/BR2	60–87 MHz					60	A_5	4	4	
	87–100 MHz					75				
	100–150 MHz					90	A_7			

ALL FREQUENCY TOLERANCES INCLUDE INITIAL CALIBRATION AT +25°C.
AGING VALUES ARE BASED UPON CONTINUOUS OPERATION AT +85°C AND DRIVE LEVELS AS INDICATED.
A_f, A_3, A_5, A_7 DENOTE AT CUT-FUNDAMENTAL MODE, 3RD OVERTONE MODE, ETC.

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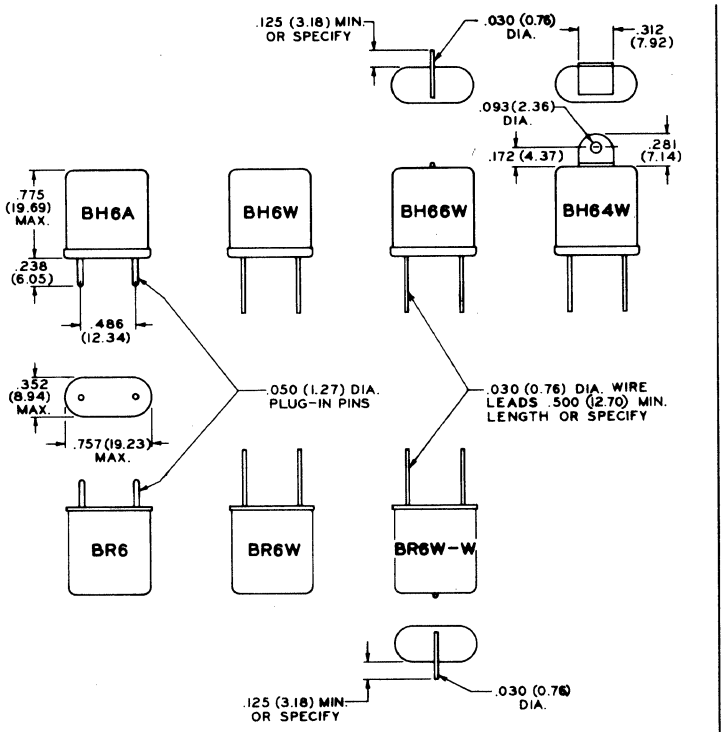
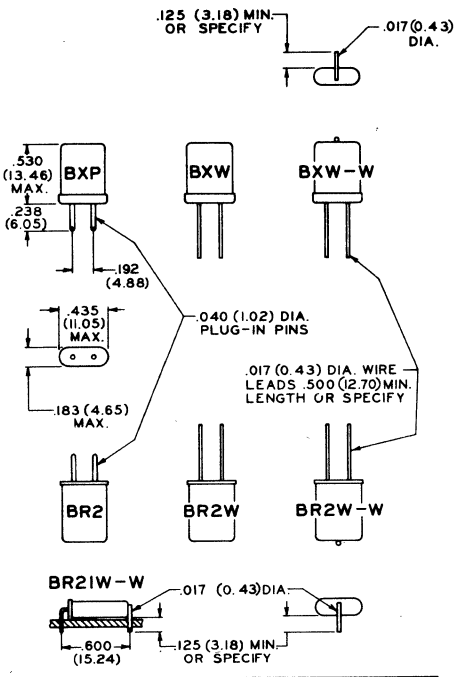
CRYSTAL HOLDERS

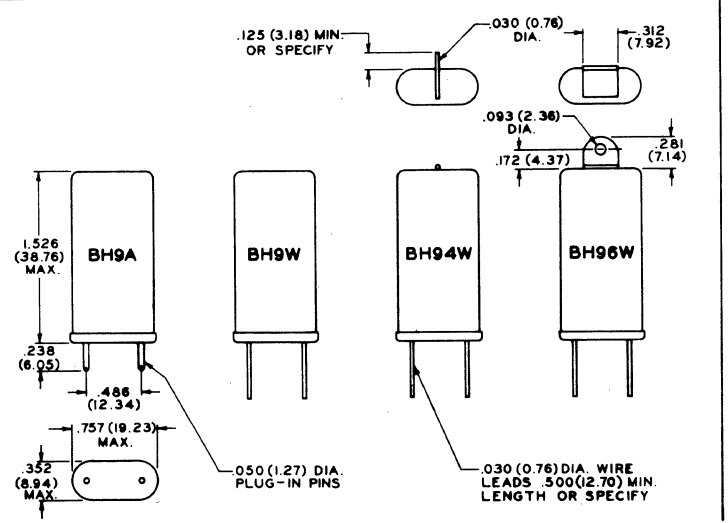
Bliley

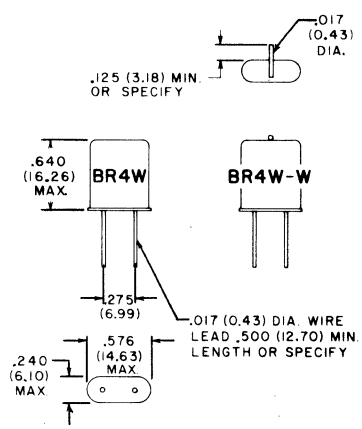
first name in frequency control

BH & BX Series • solder sealed
BR Series • resistance-weld sealed









BLILEY TYPE	BH6A	BH6W	BR6	BR6W	BXP	BXW	BR2	BR2W	BH9A	BH9W	BR4W
MIL-H-10056 HOLDER DESIGNATION	HC-6/U	HC-33/U	HC-48/U	HC-51/U	HC-25/U	HC-18/U	HC-50/U	HC-49/U	HC-13/U	HC-34/U	
VIBRATION	10 G FROM 10 TO 500 Hz										
SHOCK	100 G FOR 11 ms										

INTERNALLY RUGGEDIZED DESIGNS ARE AVAILABLE FOR HIGHER LEVEL SHOCK AND VIBRATION.

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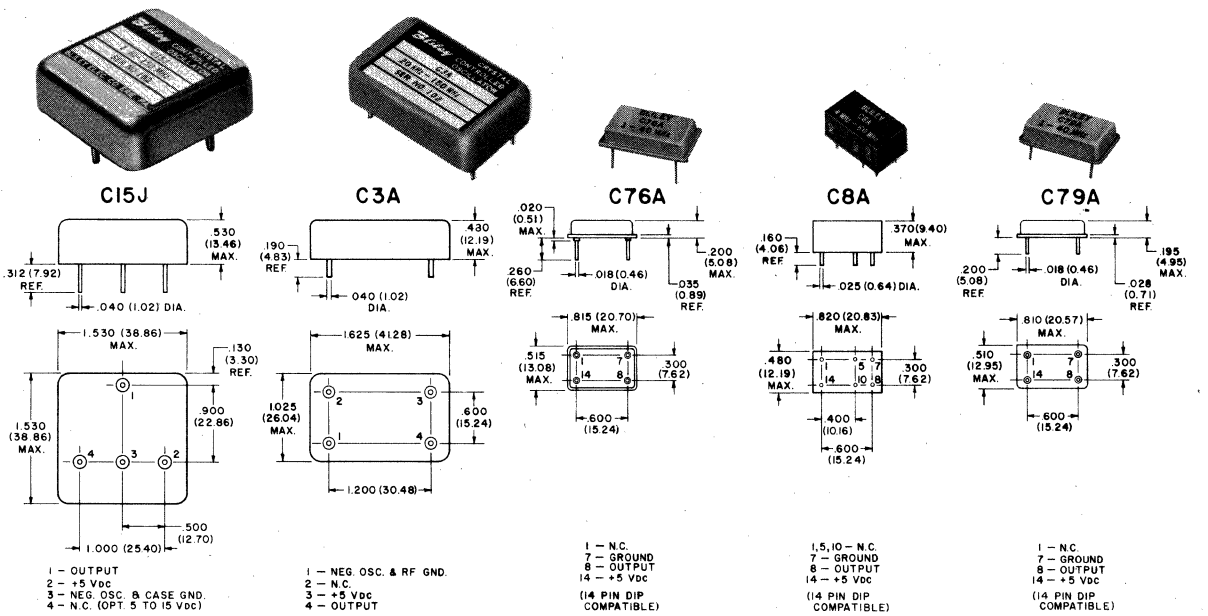
CRYSTAL OSCILLATORS

Bliley

General Purpose-Clock Oscillators

first name in frequency control

DESIGNED WITH PRIMARY EMPHASIS ON QUALITY — BACKED UP BY TOP TECHNOLOGY



BLILEY TYPE	FREQUENCY RANGE	FREQ. TOL. (%) vs TEMP. RANGE (°C) (INCLUDES CALIBRATION AT +25°C)				OUTPUT
		0 TO 50	0 TO 70	–20 TO +70	–40 TO +70	
C15J	1 Hz – 2 MHz	± .001	± .0015	± .002	± .0025	TTL LOGIC
	50 kHz – 70 MHz	± .001	± .0012	± .0015	± .002	
	3 MHz – 150 MHz					SINE WAVE
C3A	20 kHz – 25 MHz	± .001	± .0012	± .0015	± .002	TTL LOGIC
	25 MHz – 50 MHz	± .001	± .0012	± .002	–	
	3 MHz – 100 MHz	± .001	± .0012	± .0015	± .002	SINE WAVE
C76A	1 MHz – 25 MHz	–	± .01	–	–	TTL LOGIC
	25 MHz – 40 MHz	–	± .02	–	–	
C8A	4 MHz – 60 MHz	± .004	± .005	± .01	–	
C79A*	1 MHz – 25 MHz	–	± .01	–	–	
	25 MHz – 40 MHz	–	± .02	–	–	

*(CASE DESIGN INCORPORATES AN ALL METAL RESISTANCE – WELD HERMETIC SEAL ENCLOSURE.)

GENERAL SPECIFICATIONS

SUPPLY: +5 VDC
OUTPUT: TTL LOGIC "1" +2.4 V MIN., LOGIC "0" +0.4 V MAX.
SYMMETRY: 60/40 DUTY CYCLE WORST CASE
LOAD: 10 TTL GATES
SINE WAVE: 0.7 VRMS (1000 Ω LOAD), 800 kHz – 25 MHz
0.2 VRMS (50 Ω LOAD), 1 – 150 MHz
CUSTOM OPTIONS AVAILABLE: CMOS LOGIC, COMPLEMENTARY OUTPUTS, DUAL-FREQUENCY OUTPUTS
FREQUENCY ADJUSTMENT: ELECTRICAL OR MECHANICAL AVAILABLE ON C15J AS A CUSTOM OPTION
HERMETIC ENCLOSURES: C15J, C3A AND C79A

For further information call (814) 838-3571 or TWX 510-696-6886
BLILEY ELECTRIC COMPANY
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P. O. BOX 3428
ERIE/PENNSYLVANIA 16508

CRYSTAL OSCILLATORS

Bliley

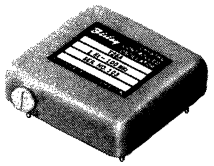
first name in frequency control

Temperature Compensated (TCXO) Crystal Oscillators

BLILEY TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS ARE DESIGNED TO INTEGRATE THE CHARACTERISTICS OF HIGH QUALITY COLDWELD SEALED CRYSTALS WITH TEMPERATURE COMPENSATED CIRCUITRY TO ACHIEVE IMPROVED FREQUENCY STABILITY WITHOUT TEMPERATURE CONTROL AND LOW AGING TO ASSURE LONG TERM RELIABILITY.

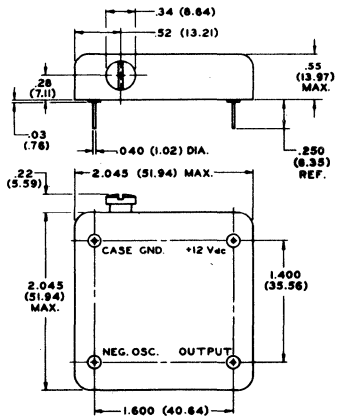
STOCK OSCILLATORS – FAST DELIVERY						
BLILEY TYPE NO.	FREQ. (MHz)	FREQ. STABILITY	SUPPLY (DC) VOLTS	REG.	mA	TTL LOGIC OUTPUT
T26A411	1	±1 x 10^{-6} OVER 0–50°C	+ 5	± 1%	35	"0": +0.4V MAX. "1": +2.4V MIN. T_r & T_f: 12 NS MAX. SYMMETRY: 60/40 LOAD: 10 TTL GATES
T26A412			+12	±10%	30	
T26A413/440*	5/10*		+ 5	± 1%	25	
T26A414/441*			+12	±10%	35	

FREQ. ADJUST. RANGE: ±5 X 10^{-6} MIN. AGING RATE: 1 X 10^{-6}/YR.



T26A

CUSTOM OSCILLATORS / BLILEY TYPE T26A SERIES		
FREQUENCY RANGE / OUTPUT WAVEFORM	FREQUENCY STABILITY vs TEMPERATURE RANGE	
1 MHz – 20 MHz SINEWAVE OR 50 kHz – 20 MHz TTL LOGIC	±1 x 10–6	0 to +60°C
	±5 x 10–7	
	±1 x 10–6	–20 to +70°C
	±5 x 10–7	
	±1 x 10–6	–40 to +70°C
	±2 x 10–6	–55 to +70°C
	±1 x 10–7	+20 to +40°C



SUPPLY REQUIREMENTS:
+12 VDC ±10% REG. AGING RATE: 1 X 10^{-6}/YR.

Options available:

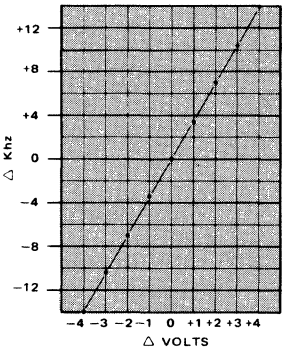
- CMOS logic output from 1 Hz – 20 MHz
- Sine Wave & TTL logic output from 20 MHz – 100 MHz
- Other Supply Voltages

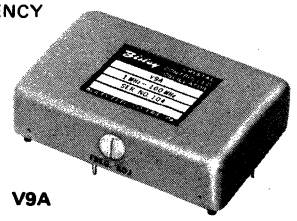
Voltage Controlled (VCXO) Crystal Oscillators

BLILEY VOLTAGE CONTROLLED CRYSTAL OSCILLATORS COMBINE INHERENT CRYSTAL STABILITY AND VOLTAGE CONTROLLED FREQUENCY DEVIATION IN A SINGLE SOLID STATE DEVICE. CENTER FREQUENCY RANGE FROM 1–100 MHz WITH PERFORMANCE CHARACTERISTICS TABULATED BELOW:

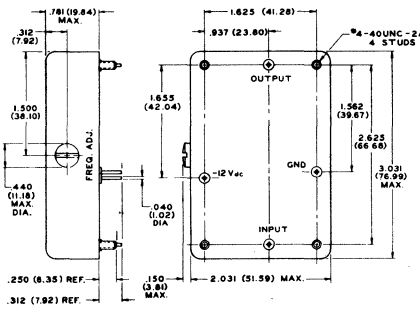
FREQUENCY DEVIATION	FREQUENCY STABILITY	TEMPERATURE RANGE
± .01%	± .001% ± .002%	0 to 50°C -20 to +70°C
± .05%	± .002% ± .005%	0 to 50°C -20 to +70°C
± .1%	± .004% ± .008%	0 to 50°C -20 to +70°C
± .2%	± .005% ± .01%	0 to 50°C -20 to +70°C

TYPICAL LINEARTY CHART (C.F. 45 MHz & ± 14 kHz DEVIATION)





V9A

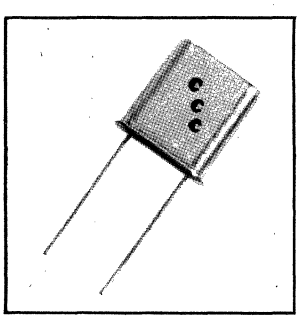


- Standard design parameters are based on operation with –12 Vdc; 25 mA supply. Other voltages may be specified as a custom option.
- Standard output is sine wave, typical 1V rms into 1000 ohms or .25V rms into 50 ohms.
- Mechanical trim is provided for center frequency adjustment.
- Typical modulation voltage is ±5V with a modulating input impedance of 10K ohms and modulation rate from DC to 20 kHz

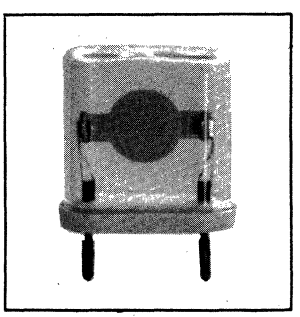
The CRYSTAL that's a cut above.

Colorado Crystal Corp., a leader in precision crystals, offers AT, SC, and AC cuts in a variety of holders ranging from the HC27/W glass to the HC40/W coldweld. Our innovative production methods give us a decisive edge in supplying high quality crystals in the 1 to 250 MHz range. We can meet your specifications. Call today and find out how better crystals mean better products.

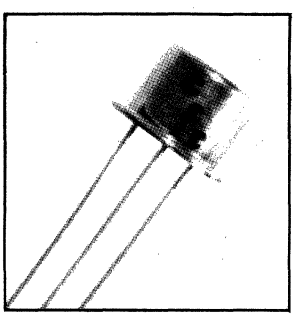
NEW in 1984—Ultra Q Crystals for your most demanding applications. Better resolution, improved stability and greater performance all the way round are available with this new generation of 10 MHz, 5th overtone quartz resonators. Manufactured in Colorado Crystal's new precision clean room, these crystals can make a difference in your product.



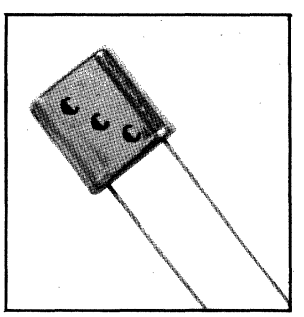
Resistance Weld Holders



Glass Holders



Coldweld Holders



Solder Seal Holders

Whatever your crystal needs, go with the leader and place your confidence in Colorado Crystal Technology.

COLORADO CRYSTAL CORP.

(303) 667-9248
2303 West 8th St. / Loveland, Colo. 80537

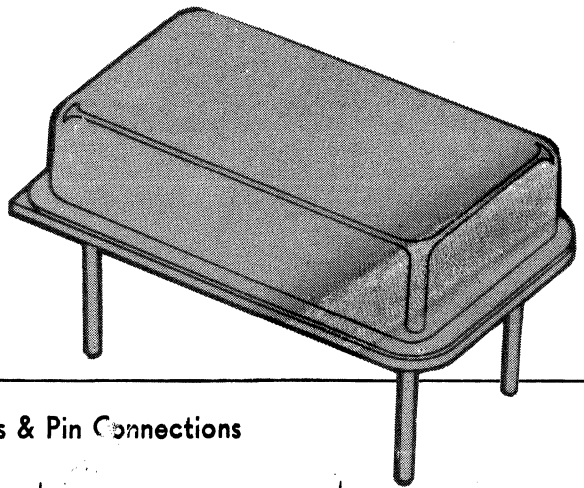
COMCLOK

1142 No. Gilbert St., Anaheim, CA 92801 • Technical Assistance (213) 820-7261
Order Placement (800) 854-XTAL — In Calif. (714) 991-1580 • TWX 9105911892

TTL Clock Oscillators

Models:

- ☐ CCO 100A (100 ppm)
- ☐ CCO 50A (50 ppm)
- ☐ CCO 25A (25 ppm)

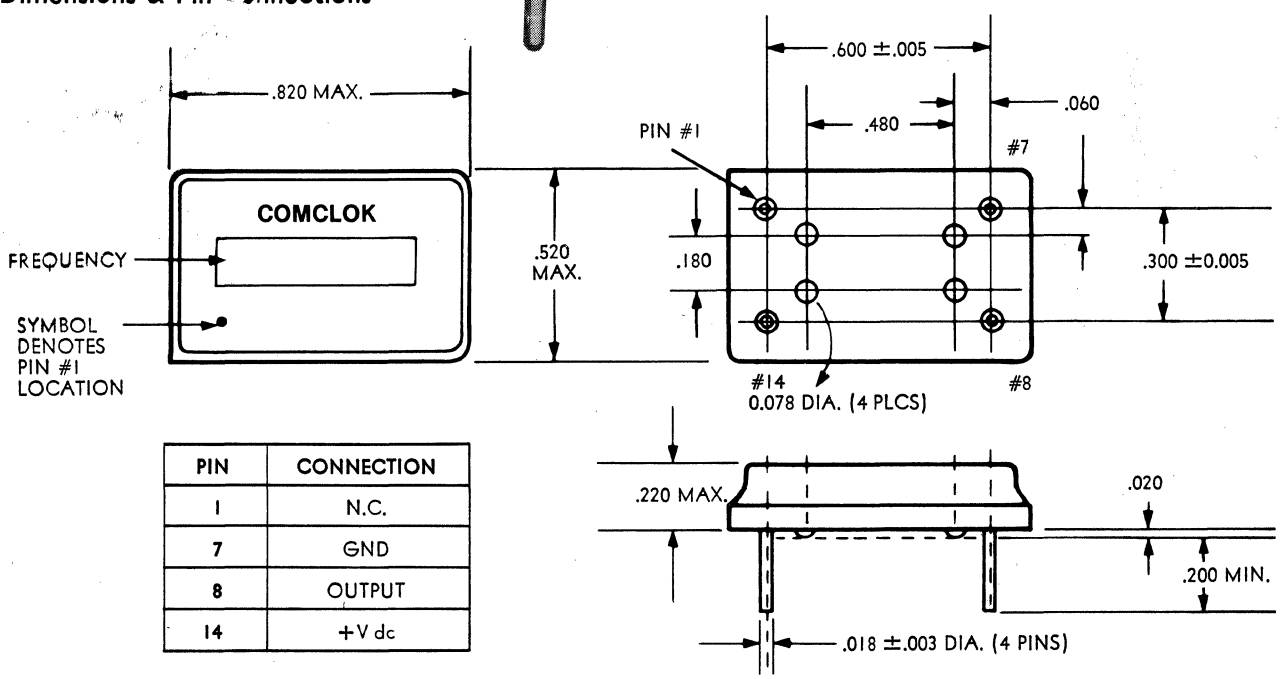


Features:

- ☐ 0.820"(L) x 0.520"(W) x 0.240"(H)*
- ☐ Dual In Line Spacing
- ☐ TTL Compatible Output
- ☐ High Reliability
- ☐ Resistance Welded

* INCLUDES INSULATED STAND OFF.

Dimensions & Pin Connections



PIN	CONNECTION
1	N.C.
7	GND
8	OUTPUT
14	+V dc

Specifications

Frequency Range ..... 250 KHz - 70 MHz

Frequency Stability ..... ±0.01%, ±0.005%, ±0.0025%

Temperature Range
Operating ..... 0° −70°C
Storage ..... −55° - +125°C

Input Current .. 80 mA Max. 250 KHz - 3.9 MHz
50 mA Max. 4.0 MHz - 31.9 MHz
60 mA Max. 32.0 MHz - 70.0 MHz

Input Voltage ..... +5 V DC ±10%

TTL Output
Symmetry ..... 60/40% @ 1.4 V DC level

Rise and Fall Time
10 ns Max. 250 KHz - 23.0 MHz
4 ns Typ, 10 ns Max. 23.0 MHz - 70.0 MHz

"0" Level ..... +0.5 V Max.

"1" Level ..... +2.4 V Min.

Output ..... 1 to 10 TTL Gates

EEM PRODUCT SELECTION GUIDES

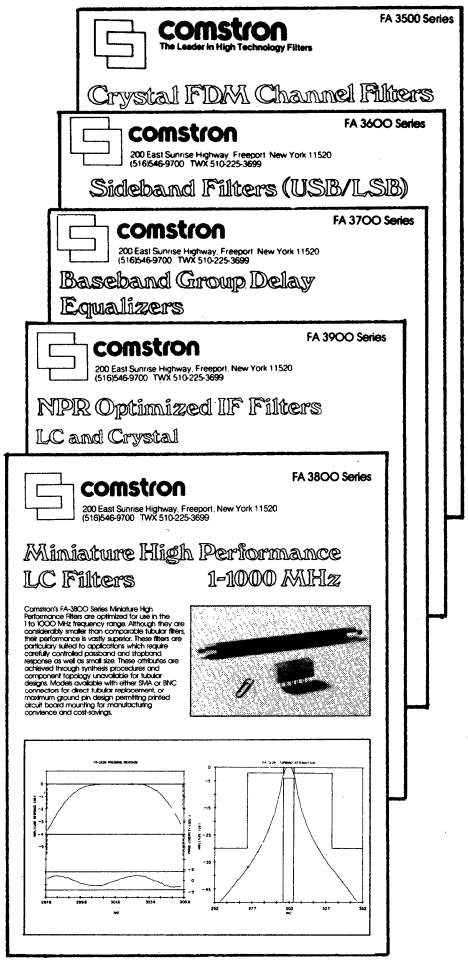
Use the EEM Product Selection Guides. There are 34 Guides in this edition of EEM. See page 2 (A•2, B•2, C•2, D•2) of each volume to locate the Product Selection Guides that pertain to your needs.

comstron corporation

TECHNOLOGY "+" FILTERS

The Extra Edge in Systems Performance DC to 1 GHz

Comstron has developed optimum frequency or time domain filters to produce near theoretical system performance. These technology + filters are available as catalog items or custom tailored to your needs.



Design

Comstron has implemented modern network synthesis and physical realization techniques to the point where highly reliable, compact, LC and crystal filters are available – quickly and economically. Proprietary computer analysis, modeling, and optimization programs efficiently arrive at near-optium solutions to spectral, time domain, and stochastic problems. The Company's Enhanced Synthesis Program (ESP), Filter Optimization Program (FOP) and Parameter Optimization Program (POP) provide design parameters for systems oriented functions. Requirements for group delay equalization, wide band arithmetic symmetry, $x/\sin x$ amplitude correction, corrected Nyquist filters, phase compensation, and time domain response designs are routinely and efficiently handled.

Test

The Company's commitment to excellence is evident in its extensive test facilities. Automatic computer based network analyzers cover the frequency range from dc to 1.3 GHz with full plotting and printer output capability. Parameters which are automatically measured include amplitude response, phase response, group delay, and return loss. Time domain testing can also be performed to verify impulse response or response to complex waveforms.
Computer directed environmental testing allows unattended measurements of performance over temperature on a production basis. Comstron's proprietary Automatic Filter Test (AFT) programs permits rapid and accurate generation of acceptance test procedures as well as full documentation and data files when required.

Quality Control

Comstron maintains a Quality Control Department that ensures compliance with MIL-I-45208A and MIL-Q-9858A when applicable. Microscopic inspection, controlled environment, material control and traceability, solder training programs, and strict configuration management all contribute to producing an exceptionally reliable product.
The quality control program is continuously monitored. Over the years since its inception, Comstron has assembled a dedicated, conscientious staff whose pride of workmanship and customer loyalty is the keynote of the Company.

Send for our complete Data Sheets.

Standard Filter Catagories

- FDM Channel
- Quad Phase Matched
- Miniature LC.
- USB/LSB
- Fiber Optic Repeater
- Group Delay Equalizer
- NPR Optimized
- Pulse Response Optimized
- Nyquist
- Video
- Speech Plus
- Group/Super Group/Master Group/Pilot Notch
- 70/140 MHz Satellite IF Filters
- 70 MHz Switchable Equalizer (Delay or Amplitude)

Call Comstron for applications assistance for your LC and Crystal Filter requirements.

comstron corporation

200 East Sunrise Highway, Freeport, New York 11520
(516)546-9700 TWX 510-225-3699

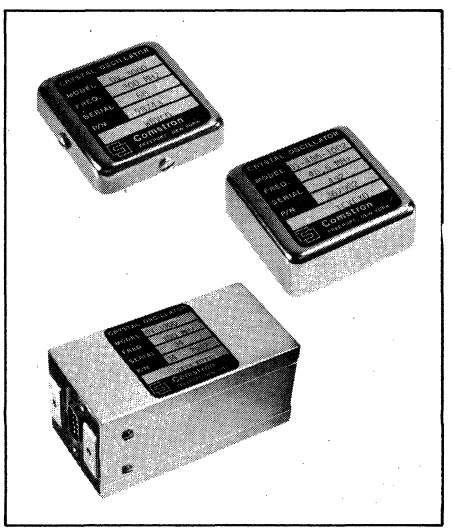
CRYSTAL OSCILLATORS

VCXO's To 1 GHz
TCXO's To 1 GHz

Comstron, the technology leader in oscillators for military, commercial, and deep-space applications, welcomes the opportunity to assist you with your crystal oscillator requirements. Through proprietary computer-generated design, testing and production techniques, Comstron delivers state-of-the-art low noise performance on VCXO's, TCXO's, Oven Controlled Crystal Oscillators and phase locked sources to 1 GHz. The Company's Design for Optimum Performance (DOP) programs provide optimization of performance attributes as well as sensitivity analysis. Our design and high reliability resources can make the difference in your system. Listed are typical standard designs from our Oscillator product library. However, modifications to suit your specific needs are easily accommodated.

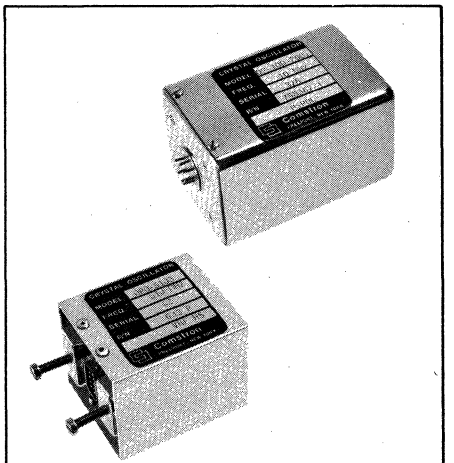
Voltage Controlled Crystal Oscillators

Frequency	1 - 25 MHz	25 - 150 MHz	150 MHz to 1 GHz
Mod Range	± .1%	± .01%	± .01%
	Wider or Narrower Mod Range Available		
Output	Sine 0dBm/ 50 ohm	0dBm/50 ohm	0dBm/50 ohm
	ECL	ECL	N/A
	CMOS to 10 MHz	N/A	N/A
	TTL	STTL to 100 MHz	N/A
Mod Voltage	± 5V	± 5V	± 5V
	Variation in Sensitivity Available		
Linearity	± 1%	± 2%	± 5%
Temperature Range	0 - 55°C	0 - 55°C	0 - 55°C
	Wider Temperature Range Available		
Stability	1 ppm	1 ppm	2 ppm
Size	2 x 2 x .75"	2 x 2 x .75"	3 x 1.5 x .75"
Connector	PC Mount	PC Mount	PC Mount
	Special Connectors Available		



Ovenized Crystal Oscillators

Frequency	.1 to 25 MHz	25 MHz to 500 MHz
Aging Rate	1 x 10^{-9}/day	1 x 10^{-8}/day
	Improved Stability Available	
Output	Sine 0dBm/50 ohm	0dBm/50 ohm
Temperature Range	– 20 to + 60°C	– 20 to + 60°C
Temperature Stability	3 x 10^{-8}	5 x 10^{-8}
Supply Voltage	28 V	28 V
Adjustment Range	± 1 ppm min.	± 1 ppm min.
Size	2" x 2" x 4"	2" x 2" x 4"

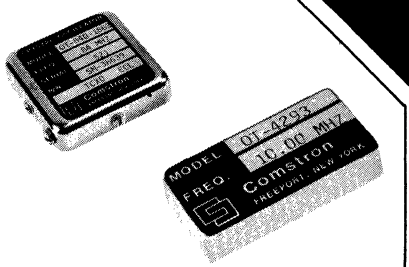


See our ads in Sections 2700 & 2900

comstron corporation
200 East Sunrise Highway, Freeport, New York 11520
(516) 546-9700 TWX 510-225-3699

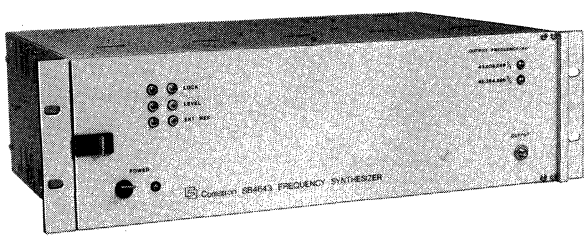
Temperature Compensated Crystal Oscillators

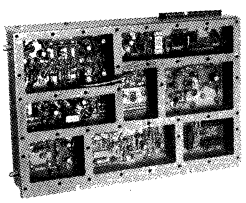
Frequency	.1 to 25 MHz	25 MHz 150 MHz	150 MHz to 1 GHz
Temperature Range	0°C - 60°C	0°C - 60°C	0°C - 60°C
	Wider Temperature Ranges Available		
Stability	5×10^{-7}	5×10^{-7}	1×10^{-6}
Output	Sine 0dBm/ 50 ohm	0dBm/50 ohm	0dBm/50 ohm
	ECL	ECL	N/A
	CMOS to 10 MHz	N/A	N/A
	TTL	STTL to 100 MHz	N/A
Aging Rate	1×10^{-6}/year	2×10^{-6}/year	2×10^{-6}/year
Supply Voltage	12 V	12 V	12 V
Current	10 ma	10 ma	10 ma
Size	2" x 2" x .75"	2" x 2" x .75"	3" x 1.5" x .75"
Connectors	PC Mount	PC Mount	PC Mount
	Special Connectors Available		

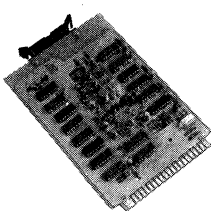


Phase Locked Crystal Oscillators

Comstron's preeminant technology in frequency synthesizers and locked sources can be put to use in your system. Modular building blocks are configurable to cover frequencies from low audio to 1 GHz. When system requirements dictate superior short term stability (phase noise), long term stability and reliability, Comstron's OEM line fills the need.







Ordering Information

How to Specify Part Number:

O for Oscillator;

plus one letter for type.

P = Oven controlled Crystal Oscillator
V = VCXO
T = TCXO

plus one letter for output

S = Sine
E = ECL
C = CMOS
T = TTL

plus four digits for frequency

XXXX in .1 MHz

Example:

OVS-0214

Oscillator VCXO Sine 21.4 MHz

Where requirements differ from listed models, choose the closest model and provide details regarding your specific needs.

See our ads in Sections 2700 & 2900.

comstron corporation

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(516) 546-9700 TWX 510-225-3699

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K
kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L
LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microforad
MHz megahertz
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOSIGT metal-oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM nuclear instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLL phased lock loop
PPI plan position indicator
PROM programmable read only memory
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

THE CONNOR–WINFIELD CORPORATION
West Chicago, IL 60185
CABLE: CONWINWCGO
PHONE (312) 231-5270
TWX # 910-230-3231

OSCILLATORS

For over twenty years, the CONNOR-WINFIELD Corporation has dedicated itself to producing HIGH QUALITY frequency control products for both military and commercial applications. Highly reliable products, consistently short lead times and reasonable prices are characteristics you can expect from CONNOR-WINFIELD. As you can see from the product information that follows, CONNOR-WINFIELD offers a wide range of oscillator products. In addition, most models are easily adaptable to special requirements where certain customized specifications are desired.

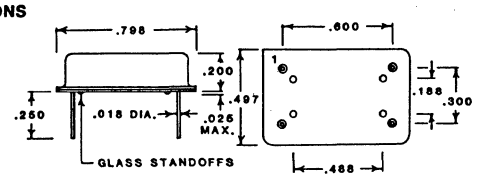
CONNOR-WINFIELD has, over the years, made a firm commitment to keeping abreast of the latest technology for our customers. We now have available a DIGITALLY COMPENSATED CRYSTAL OSCILLATOR which uses programmable memory to compensate the frequency of the oscillator for fluctuations in temperature. For the past two years, we have offered high frequency 10K or 100K ECL in the standard 14-pin DIP. And now, we have available the most recent packaging technology—SURFACE MOUNT OSICLLATORS.

We hope that in reviewing the product information that follows, you will find that CONNOR-WINFIELD has the CAPABILITY to produce what you need to satisfy your oscillator requirements!

DIP CRYSTAL OSCILLATORS

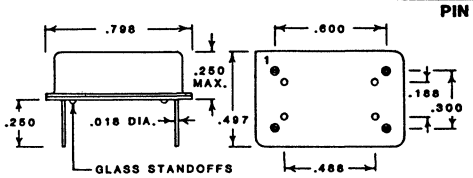
Package Outline 1

PIN CONNECTIONS
1 N/C
7 GROUND
8 OUTPUT
14 Vcc



Package Outline 2

PIN CONNECTIONS
1 OUTPUT
7 GROUND
8 OSC. MON.
14 Vcc



TTL SERIES

Output Load 1 – 10 TTL
Duty Cycle 50/50 ± 10%
Supply Voltage +5Vdc ±10%
Supply Current 85mA Max.

Available Options:

Gating Pin 1 Logic 0 enables Logic 1 disables.

Other Temperature Ranges and Frequency Tolerances Available.

Low Cost on Large Volume Orders.

* .25" high max.

LSTTL SERIES

Output Load 1 – 10 LSTTL 1 – 3 TTL
Duty Cycle 50/50 ± 10%
Supply Voltage +5Vdc ±10% Supply Current 50mA Max.

CMOS SERIES

Output Load CMOS
Duty Cycle 50/50 ± 10%
Supply Voltage +5Vdc to +15Vdc
Supply Current 3 – 20mA (C14R5L) ≤2mA at 5Vdc ≤15mA at 15Vdc

NON-CRYSTAL SOLID STATE

Output Load CMOS Supply Voltage 3 – 15Vdc ±10%
Duty Cycle 50/50 ± 10% Supply Current 25mA Max.

10K/100K ECL SERIES

Output Load 100K ECL
Duty Cycle 50/50 ±5%
Supply Voltage –4.5 or –5.2Vdc Current 50mA

SINEWAVE SERIES

DPS1 & DPS3 – Supply Voltage +5Vdc ±10%
Output Voltage 1Vrms 10K Load
DPS2 & DPS4 – Supply Voltage +8Vdc to +15Vdc
Output Voltage 1.5Vrms – 3Vrms 10K Load

Model	Package	Freq. Range	Freq. Toler.	Temp. Range
S14R6	1	255KHz to 60MHz	±.005%	–25°C to +75°C
S15R6	1		±.01%	0°C to +70°C
S14R7	1	1Hz to 255KHz	±.005%	–25°C to +75°C
S15R7	1		±.01%	0°C to +70°C
S16R6	1	255KHz to 60MHz	±.01%	–40°C to +85°C
S17R6*	1			–55°C to +125°C
SR721*		25MHz to 80MHz	±.01%	0°C to +70°C
SR722*			±.005%	
SR723*			±.01%	–40°C to +85°C
SR724*			±.005%	
SR725*			±.01%	–55°C to +125°C
S14P5	2	<1Hz to 10MHz	±.005%	–25°C to +75°C
S15P5	2		±.01%	0°C to +70°C
S14P6	1	20KHz to 20MHz	±.005%	–25°C to +75°C
S15P6	1		±.01%	0°C to +70°C
C14R5	1	200Hz to 8MHz	±.005%	–25°C to +75°C
C15R5	1		±.01%	0°C to +70°C
C14R5L	1	200Hz to 2MHz	±.005%	–25°C to +75°C
C15R5L	1		±.01%	0°C to +70°C
C14C5	2	<1Hz to 200Hz	±.005%	–25°C to +75°C
C15C5	2		±.01%	0°C to +70°C
C13R1	1	150Hz to 4MHz	±1.0%	0°C to +50°C
C13R2	1		±0.1%	
C13R3	1		±1.0%	
ECLA	1 for pin connections 2 for Height	8MHz to 150MHz	±.005%	0°C to +70°C
ECLB	1 for pin connections 2 for Height	8MHz to 180MHz	±.01%	0°C to +70°C
DPS1	2	1KHz to 75KHz	±.01%	–25°C to +75°C
DPS3	2		±.005%	
DPS2	2	100Hz to 100KHz	±.01%	
DPS4	2		±.005%	

All dimensions in inches. Specifications subject to change without notice.

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West Chicago, IL 60185
CABLE: CONWINWCGO
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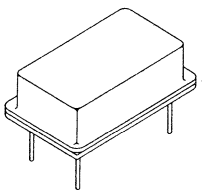
OSCILLATORS

FAST DELIVERY/LOW COST TTL DIP CRYSTAL CLOCKS



ARE YOU IN A HURRY? . . .

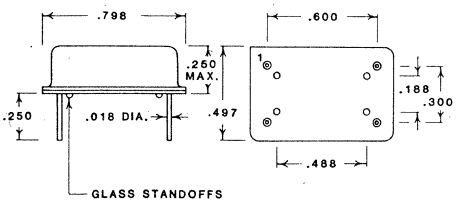
We have IMMEDIATE to ONE WEEK deliveries on the following frequencies:

1 MHz 2 MHz 2.048 MHz 4 MHz
5 MHz 6 MHz 8 MHz 10 MHz
12 MHz 20 MHz 40 MHz
16 MHz 24 MHz 70 MHz

Model	S14R8	S15R8
Freq. Tolerance	±.005%	±.01%
Temp. Range	0°C to +70°C	
Supply Voltage	+5Vdc ±10%	
Supply Current	60mA Maximum	
Load	1 to 10 TTL	

PIN CONNECTIONS: 1 N/C, 7 GROUND, 8 OUTPUT, 14 Vcc

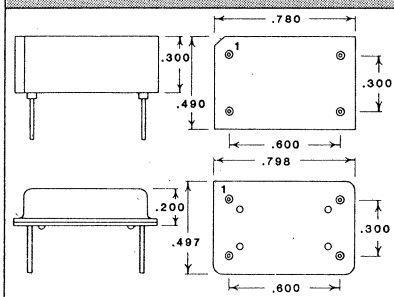
TIGHT TOLERANCE TTL/LSTTL DIP



PIN CONN.
1 N/C
7 GROUND
8 OUTPUT
14(+) SUPPLY

Model	S10	S09
Freq. Range	20 KHz– 25MHz	20 KHz–25 MHz
Freq. Tolerance & Temp. Range add suffix	C ±.001% 0°C to +50°C	
	D ±.0025% 0°C to +70°C	
	E ±.005% –40°C to +85°C	
Output Load	1 to 10 TTL	1 TTL/1 to 10 LSTTL
Symmetry	>10MHz 50/50±10% / <10MHz 50/50±1%	
Supply Voltage	+5Vdc ±5% 85mA Max. Typical 50mA	+5Vdc ±5% 50mA Max. Typical 20mA
Options add suffix	A) External freq. adjust (capacitive)/ N) Pin 1 & 8 Out/ G) Gating	

TTL DIP CRYSTAL CLOCKS

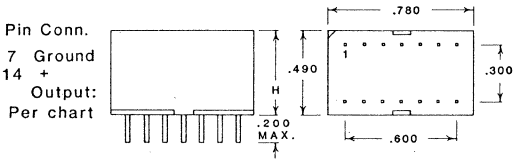


PIN CONNECTIONS
14 Vcc
7 GROUND
OUTPUT:
S13, D13, Pin 8 Output
S14, D14, Pin 1 Output

S13 & S14C, D & E
All metal package version of
D13 & D14C, D & E

Model Number	S13R1 S14R1	S13R1A S14R1A	S13R1B S14R1B	D13C D14C S13C S14C	D13D D14D S13D S14D	D13E D14E S13E S14E
Freq. Range	3MHz to 25MHz			15KHz to 20MHz		
Frequency Tolerance & Temp. Range	±0.1% –25°C to +75°C	±.005% 0°C to +70°C	±.01% –40°C to +85°C	±.005% 0°C to +50°C	±.0075% 0°C to +65°C	±.01% –25°C to +75°C
Output	TTL			1 to 10TTL		
Symmetry	50/50±10%					
Supply Voltage	+5Vdc ±10% <20mA			+5Vdc 20 to 75mA		

TIGHT TOLERANCE TTL/SINEWAVE DIP

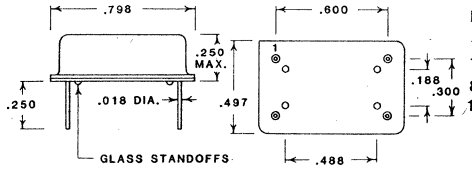


TTL or Sinewave Series
Tight Tolerance Crystal Oscillators

L11 through **L14 Series-Discrete Oscillators**
F11 through **F14 Series-Thick Film Oscillators**

Model	L12	F12	L14	F14	L11	F11	L13	F13
Output Logic	TTL (Suffix C, D & E) / Sinewave (Suffix F, G & I)							
Freq. Range	<1Hz to 70MHz for TTL / 200Hz to 70MHz for Sinewave							
Freq. Tolerance add suffix to model number	C & F ±.001% 0°C to +50°C							
	D & G ±.0025% 0°C to +65°C							
	E & I ±.005% –25°C to +75°C							
Output Pins	8	8	12	12	8	8	12	12
Pin Sizes	Flat Pins .016 = .023				Square Pins .017 = .017			
Output Load	1 to 10 TTL 50/50±10%				3Vrms ±1Vrms 10KΩ			
Supply Voltage	+5Vdc ±5%				20mA to 100mA			
H: Height	.44				.57			

TTL VCO DIP OSCILLATORS



PIN CONN.
1 Con. Volt.
7 Ground
8 Output
14 (+) Supply

Model	PL14R1	PL14R2	PL14R3
Freq. Range	20MHz to 80MHz		
Freq. Tolerance	±1%		±2%
Temp. Range	0°C to +70°C		
Supply Voltage	+5Vdc ±5%		
Control Voltage	0V to 5V F (nominal) at 2–3V		
Deviation	±1% to ±1.5%	±5% to ±10%	±10% to ±15%

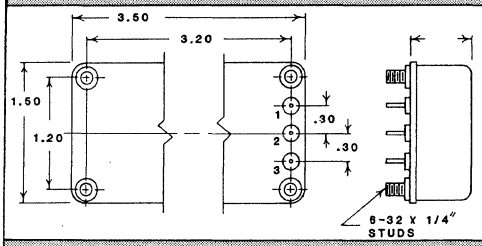
All dimensions in inches

Specifications subject to change without notice

THE CONNOR–WINFIELD CORPORATION
West Chicago, IL 60185
CABLE: CONWINWCGO
PHONE (312) 231-5270
TWX # 910-230-3231

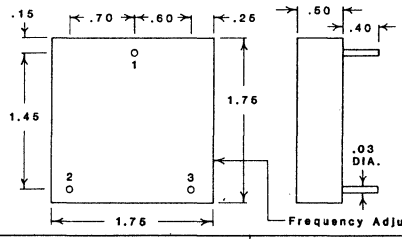
OSCILLATORS

DIGITALLY COMPENSATED CRYSTAL OSCILLATORS



Model	DTM2	DTC1	DCM2	DCC1
Freq. Range	15 KHz to 25 MHz		250 Hz to 6 MHz	
Temp. Range	–40ºC to +85ºC	0ºC to +70ºC	–40ºC to +85ºC	0ºC to +70ºC
Stability	±.0001%	±.00002%	±.0001%	±.00002%
Output	TTL		CMOS	
Supply Voltage	+7 to +15Vdc			
Supply Current	100mA Maximum			
Pin Connections	1 – (+) SUPPLY, 2 – OUTPUT, 3 – GROUND			

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

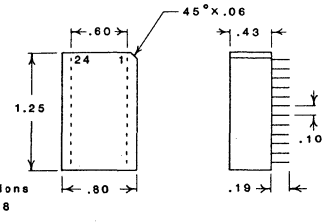


C12 PIN CONNECTIONS

1 OUTPUT
2 (+) SUPPLY
3 GROUND

C24 PIN CONNECTIONS

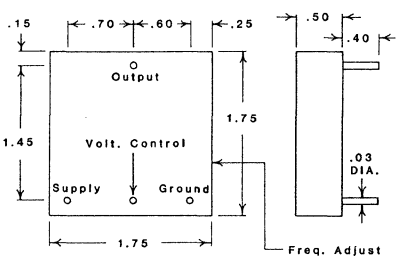
5 OUTPUT
12 GROUND
24 (+) SUPPLY



Outputs	TTL	CMOS		SINE	ECL
Frequency Range	C12's 1Hz to 30MHz C24's 15KHz to 30 MHz	1Hz to 8MHz	1Hz to 12HMz	(C12 only) 1Hz to 30MHz	C12's 1Hz to 30MHz C24's 4MHz to 30MHz
Output Load	1 to 10 TTL	CMOS		50Ω or 10KΩ	100K ECL
Supply Voltage	+5Vdc ±1%	+5 to +8Vdc ±1%	+8 to +15Vdc ±1%	+5Vdc to +30Vdc ±1%	–4.5Vdc or –5.2Vdc ±1%
Supply Current	<60mA	<25mA		<60mA	<150mA

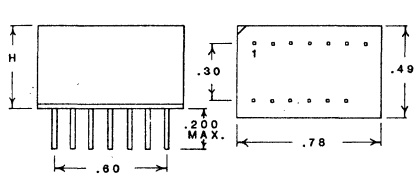
Frequency Tolerance add suffix to model number			
	A	±.00005%	+20ºC to +40ºC
	B	±.00015%	0ºC to +50ºC
	C	±.00025%	–25ºC to +65ºC

VOLTAGE CONTROLLED CRYSTAL OSCILLATORS



Model	V175A	V175B	V175C	V175D
Freq. Tolerance	±.001%	±.0025%	±.005%	±.0075%
Temp. Range	+20ºC to +40ºC	0ºC to +50ºC	0ºC to +65ºC	+25ºC to +65ºC
Freq. Range	<1Hz to 30MHz			
Output	TTL	CMOS		SINE
Supply	+5Vdc ±1% 10 to 75mA	+5Vdc to +15Vdc ±1% 25 to 50mA		+5Vdc to +30Vdc ±1% 25 to 50mA
Load	1 to 10 TTL	CMOS		50Ω or 10KΩ
Voltage Control	5 Vdc supply: 0 to +4V or ±2V		20ppm/V ±1ppm/V	
	12Vdc supply: 0 to +10V or ±5V		Wider deviations available	

SOLID STATE EPOXY ENCAPSULATED DIPS



PIN CONNECTIONS

7 Ground
12 Output
14 Vcc

L13-Square Pins
.017 x .017

L14-Flat Pins
.016 x .023

Model	L13LT L14LT	L13LC L14LC	L13SW L14SW	L13Q L14Q	L13QC L14QC	L13B L14B
Freq. Tolerance	<1Hz to 4MHz	<1Hz to 4MHz	500KHz to 4MHz	<1Hz to 4MHz	<1Hz to 4MHz	1KHz to 4MHz
Output	TTL 10 TTL	CMOS	Sinewave 3Vrms 10K OdBm 50Ω	TTL 10 TTL	CMOS	Sinewave 3Vrms 10K OdBm 50Ω
Supply Voltage	+5Vdc	+5 to +15Vdc	+5Vdc	+5Vdc	+5 to +15Vdc	+5Vdc
Freq. Stability	±0.1%			±1.0%		
Temp. Range	0ºC to +50ºC					
Freq. Trimmer	Internal ±2% minimum			External resistor ±2% minimum		
Height	.17 to .57 (depending on frequency)					

All dimensions in inches.

Specifications subject to change without notice

THE CONNOR–WINFIELD CORPORATION
West Chicago, IL 60185
CABLE: CONWINWCGO
PHONE (312) 231-5270
TWX # 910-230-3231

OSCILLATORS

SERIES 76

Fill in Blanks to Construct your Model Number

Example: XF3

When ordering Please Specify: Series No., Model No., Frequency & Supply Voltage

[X] FREQ. STAB. W, X or Z

[F] OUTPUT A, B, D, E, F or G

[3] PACKAGE 1, 2, 3, 4 or 5

Frequency Stability

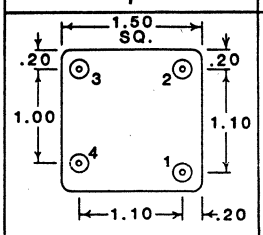
Parameter	Ordering Guide W	X	Z
Temperature Range	−55°C to +75°C	0°C to +60°C	+15°C to +35°C
Frequency Stability	±.005%	±.001%	±.0005%

Output Specifications

Parameter	Ordering Guide A	B	D	E	F	G
Frequency Range	1Hz to 5MHz	100Hz to 100MHz	10MHz to 300MHz	60Hz to 1MHz	1MHz to 400MHz	30MHz to 300MHz
Supply Voltage	+5 to +15Vdc (please specify)	+5Vdc ±5%	−5.2Vdc ±5%	+12Vdc ±5%	+12Vdc ±5%	−4.5Vdc ±5%
Supply Current	3 to 20mA	70mA	100mA	25mA	70mA	100mA @ No Load
Output	CMOS	TTL	10K ECL Compatible	Sine 1Vrms ±10%	Sine +10dBm ±3dBm	100K ECL
Rise/Fall Time	<100nS	<100nS	≤1.5nS	----	----	≤1ns
Symmetry/Distortion	50/50 ±10%	50/50 ±10%	----	<5%	−25 dBm	50/50 ±10%
Load	CMOS	1–10 TTL	ECL	10KΩ	50Ω	ECL
Termination	1 / 4 / 5	1 / 4 / 5	1 / 2 / 3	1 / 4 / 5	1 / 2 / 3	1 / 2 / 3
Height	.62 / 1.50 / 1.50	.62 / 1.50 / 1.50	.62 / 2.00 / 2.50	1.50 / 2.00 / 2.00	1.50 / 2.00 / 2.50	.62 / 2.00 / 2.50

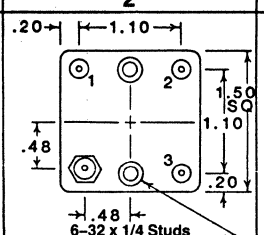
Terminations

1



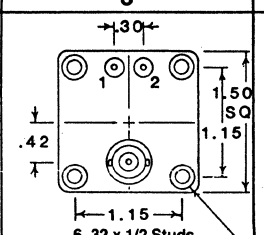
1 (+) Supply 2 Common
3 Common 4 Output

2



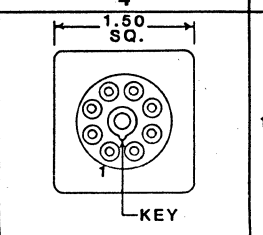
6–32 x 1/4 Studs
1 (+) Supply 2 Common
3 Common OSM Output

3



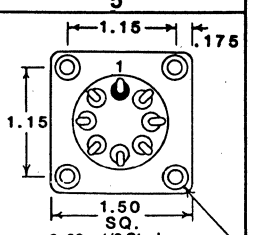
6–32 x 1/2 Studs
1 Common 2 (+) Supply
BNC Output

4



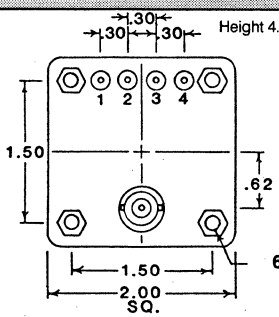
1 Common 2 (+) Supply
8 Output

5



6–32 x 1/2 Studs
1 Common 2 (+) Supply
8 Output

SERIES 79 OVENIZED



1 Osc. Supply 2 Osc. Common
3 Ovn. Common 4 Ovn. Supply
BNC Output

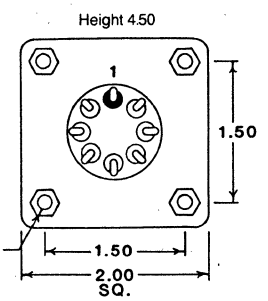
6–32 x 1/2 Studs

Frequency Stability

Parameter	Ordering Guide A	B	C
Frequency Range	1MHz to 20MHz	20MHz to 60MHz	60MHz to 150MHz
Temperature Range	0°C to +60°C	0°C to +60°C	0°C to +60°C
Frequency Stability	$\pm 5 \times 10^{-8}$	$\pm .1 \times 10^{-7}$	$\pm .5 \times 10^{-7}$

1 Osc. Common 2 Osc. Supply
5 Ovn. Supply 6 Ovn. Common
8 Output

6–32 x 1/2 Studs



Output Specifications

Parameter	Ordering Guide S	T	V	W	X	Y
Frequency Range	1MHz to 20MHz	20MHz to 60MHz	60MHz to 100MHz	100MHz to 150MHz	1MHz to 20MHz	20MHz to 60MHz
Osc. Supply	+12Vdc, 35mA	+12Vdc, 50mA	+12Vdc, 50mA	+12Vdc, 50mA	+12Vdc, 30mA	+12Vdc, 50mA
Ovn. Supply	+28Vdc, 6W Avg.	+28Vdc, 6W Avg.	+28Vdc, 6W Avg.	+28Vdc, 6W Avg.	+28Vdc, 6W Avg.	+28Vdc, 6W Avg.
Output, Load	Sine, 50Ω	Sine, 50Ω	Sine, 50Ω	Sine, 50Ω	TTL, 1–10 TTL	TTL, 1–10 TTL
Output Voltage	0dBm ±1.5dBm	0dBm ±1.5dBm	0dBm ±1.5dBm	0dBm ±1.5dBm	TTL	TTL
Harmonic Content	−20dBm	−20dBm	−20dBm	−20dBm	----	----

All Dimensions in Inches. Specifications subject to change without notice.

CROVEN CRYSTALS

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Whitby, Ontario
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MILITARY CRYSTAL UNITS

We are on the Qualified Products List (QPL) for the types below.

MILITARY CR-TYPE	MILITARY SPEC. NO.	FREQUENCY RANGE IN MHZ	CROVEN CODE
CR-5A/U*	3098/77	2.000- 10.000	A170 FWM-25
CR-6A/U*	3098/78	2.000- 10.000	A170 FWJ-13
CR-8A/U*	3098/111	1.000- 10.000	A170 FWJ-00
CR-18A/U*	3098/3	0.800- 20.000	A061 FWM-32
CR-19A/U*	3098/4	0.800- 20.000	A061 FWM-00
CR-52A/U*	3098/30	10.000- 61.000	B061 FWM-00
CR-55A/U*	3098/33	17.000- 62.000	B180 FWM-00
CR-56A/U*	3098/34	50.000-125.000	C180 FWM-00
CR-58A/U*	3098/36	0.800- 20.000	A170 FWM-32
CR-59A/U*	3098/37	50.000-125.000	C180 EBS-00
CR-60A/U*	3098/38	5.000- 20.000	A180 FWM-00
CR-61/U*	3098/39	17.000- 61.000	B180 EBS-00
CR-64/U*	3098/42	2.900- 20.000	A180 FWM-30
CR-65/U*	3098/43	10.000- 61.000	B061 CXP-00
CR-67A/U*	3098/45	17.000- 62.000	B180 CUM-00
CR-69A/U*	3098/47	2.900- 25.000	A180 CSM-30
CR-72/U*	3098/50	17.000- 61.000	B259 FWM-00
CR-76A/U*	3098/53	16.000- 61.000	B180 CSM-00
CR-77/U*	3098/55	17.000- 62.000	B251 CSM-00
CR-78A/U*	3098/62	2.200- 20.000	A251 FWM-30
CR-79/U*	3098/63	2.200- 20.000	A251 FWM-00
CR-80/U*	3098/57	50.000-125.000	C180 CSM-00
CR-81/U*	3098/58	17.000- 61.000	B251 FWM-00
CR-82/U*	3098/59	50.000-125.000	C251 FWM-00
CR-83/U*	3098/60	50.000-125.000	C251 CSM-00
CR-84/U*	3098/61	17.000- 61.000	B251 EBS-00
CR-89/U*	3098/67	2.120- 6.200	A321 FWM-30
CR-97/U*	3098/72	8.000- 10.000	A180 FWJ-32
CR-106A/U*	3098/82	10.500- 11.500	A180 FWM-32
CR-117/U*	3098/93	30.000- 63.000	B251 DEJ-00
CR-139/U*	3098/118	20.000- 22.000	A180 FWM-30
CR-140/U*	3098/119	3.500- 12.500	A061 FWM-60
CR-157/U*	3098/137	0.800- 20.000	A330 FWM-00

HOW TO SPECIFY A QUARTZ CRYSTAL

If the parameters for the crystal in question are not already covered by a MIL-SPECIFICATION or by a formal SPECIFICATION CONTROL DRAWING, then Items 1 through 6 are essential.

(1) **MODE OF OPERATION** i.e. fundamental, third, fifth, seventh, ninth or eleventh overtone.
(2) **HOLDER STYLE** i.e. HC-6/u, HC-18/u, HC-35/u, etc, depending on your individual application and the frequency.
(3) **CALIBRATION TOLERANCE AT REFERENCE TEMPERATURE** i.e. ± 20 ppm @ + 25°C, ± 5 ppm @ + 75°C, etc.
(4) **TEMPERATURE STABILITY** the allowable frequency deviation over a specified temperature range, with reference to the actual frequency measured at the calibration temperature. (i.e. ± 15 ppm, ± 2.0 ppm, etc.)
OR TOTAL TOLERANCE the total allowable deviation over a specified temperature range, with reference to the nominal frequency (i.e. calibration tolerance and temperature stability combined). (i.e. ± 50 ppm, ± 30 ppm, etc.)
(5) **OPERATING TEMPERATURE RANGE** the temperature range over which the temperature stability or the total tolerance is to be effective.
(6) **CIRCUIT CONDITION** will be either PARALLEL or SERIES resonance. If PARALLEL resonance, please state the load capacitance.

SPECIFICATION CODING

We use a system whereby we code the major parameters of a crystal specification using a combination of 9 digits. A typical code would be **A251DFE-32** and would be interpreted as follows. **A** = fundamental mode, **25** = HC-25/U holder, **1** = undercut pins per MIL-H-10056, **D** = calibration tolerance of ± 10 ppm @ + 25°C, **F** = temperature stability of ± 20 ppm with reference to the actual frequency measured @ + 25°C, **E** = temperature range of — 15°C to + 65°C over which the temperature stability is effective, **-32** = a circuit condition of parallel resonance and with a load capacitance of 32 pF.

MODE		HOLDER				CALIBRATION TOLERANCE AT REFERENCE TEMPERATURE		TEMPERATURE STABILITY OR TOTAL TOLERANCE		OPERATING TEMPERATURE RANGE (°C)		CIRCUIT CONDITION	
CODE	DESC.	CODE	DESCRIPTION	CODE	DESCRIPTION***	CODE	DESCRIPTION	CODE	DESCRIPTION	CODE	DESCRIPTION	CODE	DESCRIPTION
A	Fund	06	HC- 6 standard **	0	Standard			X	± 2PPM stability	X	+ 15 to + 35	00	Series resonance
B	3rd ot.	13	HC-13 standard	1	Undercut pins			Y	± 3PPM stability	Y	+ 10 to + 40		
C*	5th ot.	17	HC-17 standard	2	Modified can height			Z	± 4PPM stability	Z	+ 5 to + 45		
D*	7th ot.	18	HC-18 standard							A	+ 0 to + 50		
E*	9th ot.	25	HC-25 standard	3	Slimline	B	± 5 PPM	B	± 5PPM stability	B	— 5 to + 55		
		32	HC-32 standard	4	3rd wire	C	± 7PPM	C	± 7PPM stability				
		33	HC-33 (HC-6 wires)	5	Modified can height	D	± 10PPM	D	± 10PPM stability	D	— 10 to + 60	01	Parallel resonance load capacity 100pf or more.
		34	HC-34 (HC-13 wires)			E	± 15PPM	E	± 15PPM stability	E	— 15 to + 65		
		35	HC-35 (TO 5 - type)	6	Modified can height	F	± 20PPM	F	± 20PPM stability	F	— 20 to + 70		
		37	HC-37 (TO 8 - type)			G	± 25PPM	G	± 25PPM stability	G	— 25 to + 75		
		39	HC-39 (Flat-Pack)	7	Coldweld	H	± 30PPM	H	± 30PPM stability	H	— 30 to + 80		
		80	HC-45 (micro-min.)					J	± 40PPM stability	J	— 40 to + 90		
				9	Resistance Weld	M	± 50PPM	M	± 50PPM stability	M	— 55 to + 105		
								L	± 75PPM stability	L	+ 55/+ 65 Oven	10 to 90	Parallel resonance load capacity in pf as indicated by code.****
								K	±100PPM stability	T	+ 60/+ 70 Oven		
								N	±150PPM stability	N	+ 65/+ 75 Oven		
								S	Specific curve	P	+ 70/+ 80 Oven		
								T	± 20PPM‡ (B)†	R	+ 75/+ 85 Oven		
								U	± 25PPM‡ (C)†	S	+ 80/+ 90 Oven		
								V	± 30PPM‡ (D)†		Reference or Calibration temperature is the mid-point of the above ranges		
								W	± 50PPM‡ (F)†			99	Calibration at reference temperature in customer's oscillator.
								P	±100PPM‡ (H)†				
								R	±200PPM‡ (M)†				
								O	Not Specified	O	Not Specified		

† We use these calibration codes with corresponding total tolerances

* Available at series resonance only
** Standard types for all codes as per MIL-H-10056
*** Not all holders available with modifications
**** When using a Croven code only to describe your requirement, you must choose from one of the following standard load capacitance values, 10, 12, 14, 16, 18, 20, 24, 27, 30, 32, 35, 40, 45, 50, 55, 60, 70, 80, 90, 100 pf.
‡ Total tolerance (measured from nominal frequency)

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Precision Quartz Crystal Resonators

I. DESCRIPTION

CTS High Stability Precision Resonators are used where specific tight parameter control is required. These crystals are used in communication, instrumentation, and military applications where specialized performance, documentation, or testing demands extra attention. These crystals are either calibrated at room temperature, or at elevated temperature for ovenized oscillator applications. Holder types see Fig. 8 and Fig. 9.

II. ELECTRICAL PERFORMANCE

A. Q-VALUE $\left[\frac{1}{2\pi C_1 f_s R_s}\right]$	Standard	Tight	Special Designs
Fund. 1-50 MHz	75K	200K	750K
3rd O.T. 5-30	100K	200K	750K
3rd 30-85	60K	100K	125K
5th, 7th, 9th 50-200	40K	75K	100K

B. FREQUENCY TOLERANCE

Calibration Tolerance	±15 ppm	±5 ppm	±3ppm @ T.P.
Temperature Tolerance (Freq. Dev. from 25°C reading)			
0 +50°C	±6 PPM	±3 PPM	±2 PPM
−40° +85°C	±20 PPM	±15 PPM	±11 PPM
−55° +105°C	±30 PPM	±24 PPM	±20 PPM
T.P. @ 85°C (Ovenized Application)	±5°C	±3°C	±2°C

C. AGING

@ Room Temp.	≤1 PPM/yr	≤½ PPM/yr	—
@ Turning Point (Ovenized Application)	≤2 PPM/yr	≤1 PPM/yr	≤2 x 10^{-7}/yr ≤2 x 10^{-9}/day

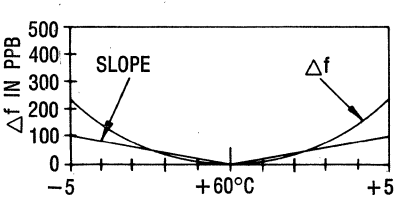
D. INHARMONIC MODES (SPURS)

	6 db (min) (2:1 R ratio)	15 db (min)	30 db (min) (Funds)

III. ENVIRONMENTAL PERFORMANCE (MIL-STD 202F)

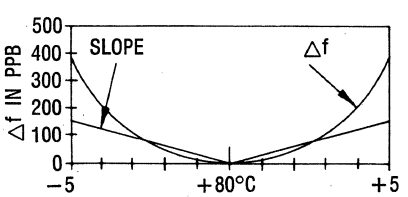
	Standard	Tight	Optimum Designs
Mech. Shock 213B	100g/6 msec	1000g/1 msec	10,000g/5 msec
Vibration 204D	10g; 10-500 Hz	20g; 20-2000 Hz	50g; 20-5000 Hz
Hermeticity (≤ 1 x 10^{-8}cc/sec/atm)	All Designs	All Designs	All Designs

IV. CRYSTAL FREQUENCY STABILITY NEAR TURNING POINT — OVENIZED APPLICATIONS



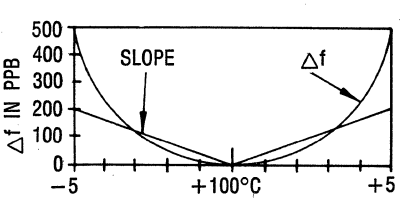
$\frac{\Delta f}{f}$ = (9.6 PPB/°C²) x ΔT^2

SLOPE = (19 PPB/°C) x ΔT



$\frac{\Delta f}{f}$ = (15.6 PPB/°C²) x ΔT^2

SLOPE = (31 PPB/°C) x ΔT



$\frac{\Delta f}{f}$ = (21.6 PPB/°C²) x ΔT^2

SLOPE = (43 PPB/°C) x ΔT

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Military Crystals

CTS KNIGHT'S test lab is government approved for qualification testing to military specification MIL-C-3098G, and includes equipment for environmental testing such as humidity, shock, vibration and aging.

Production test equipment conforms to maintenance and periodic re-calibration required by U.S. Government calibration system requirements in MIL-C-45662A.

CTS KNIGHTS is QPL Approved On The Following Military Types:

CR-18A/U (1-5, 10-20 MHz)
CR-19A/U (1-5, 10-20 MHz)
CR-52A/U (19-61 MHz)
CR-54A/U (50-110 MHz)
CR-55A/U
CR-56A/U (50-110 MHz)
CR-58A/U (1-20 MHz)
CR-60A/U
CR-64/U (2.9-20 MHz)
CR-67A/U
CR-72/U
CR-75/U (50-110 MHz)
CR-76A/U (17-61 MHz)
CR-78A/U (4.2-20 MHz)
CR-79/U (4.2-20 MHz)
CR-80/U (50-125 MHz)
CR-81/U (17-62 MHz)
CR-82/U (50-110 MHz)
CR-83/U (50-110 MHz)
CR-89/U
CR-97/U
CR-106/U
CR-111/U
CR-114/U
CR-117/U (30-62 MHz)
CR-124/U
CR-128/U
CR-139/U (20 MHz)
CR-140/U
CR-141/U (50-90 MHz)
CR-157/U (1-20 MHz)

MIL-Equivalent Crystals

MIL-C-3098G requires special testing to ensure compliance with the entire specification. Any crystal marked with the "CR" number must receive this testing.

If your required crystal details match those of a mil spec in general parameters, but your commercial application does not demand the exhaustive testing, you can order a mil equivalent crystal. The design will be the same. The crystal **will not** receive the detailed testing. Marking will be standard commercial marking. The "CR" number will not appear on the crystal.

A mil vs commercial cross reference is shown below:

SPEC SHEET MIL-C-3098	MIL TYPE	MIL HOLDER	CTS HOLDER	FREQUENCY RANGE - MHz	VIBRATION MODE	OPERATING TEMPERATURE RANGE (°C)	FREQ. TOL. VS. TEMP. (%)	LOAD CAP. OR SERIES
/3	CR-18A/U	HC-6/U	R17	1.0-20.0	Fund.	−55 to +105	±.005	32 pf
/4	CR-19A/U	HC-6/U	R17	1.0-20.0	Fund.	−55 to +105	±.005	Series
/30	CR-52A/U	HC-6/U	R17	15.0-61.0	3rd O.T.	−55 to +105	±.005	Series
/32	CR-54A/U	HC-6/U	R17	50.0-110.0	5th O.T.	−55 to +105	±.005	Series
/33	CR-55A/U	HC-18/U	R3W	17.0-62.0	3rd O.T.	−55 to +105	±.005	Series
/34	CR-56A/U	HC-18/U	R3W	50.0-110.0	5th O.T.	−55 to +105	±.005	Series
/36	CR-58A/U	HC-17/U	R17 Mod.	1.0-20.0	Fund.	−55 to +105	±.005	32 pf
/38	CR-60A/U	HC-18/U	R3W	5.0-20.0	Fund.	−55 to +105	±.005	Series
/42	CR-64/U	HC-18/U	R3W	2.9-20.0	Fund.	−55 to +105	±.005	30 pf
/45	CR-67A/U	HC-18/U	R3W	17.0-61.0	3rd O.T.	−55 to +105	±.0025	Series
/50	CR-72/U	HC-25/U Mod.	R3 Mod.	17.0-61.0	3rd O.T.	−55 to +105	±.005	Series
/52	CR-75/U	HC-6/U	R17	50.0-125.0	5th O.T.	−55 to +70 −(80 to 90) & +(70 to 80)	±.008	Series
/53	CR-76A/U	HC-18/U	R3W	17.0-61.0	3rd O.T.	−40 to +90	±.002	Series
/55	CR-77/U	HC-25/U	R3	17.0-62.0	3rd O.T.	−(55 to 40) & +(90 to 105)	±.003	Series
/62	CR-78A/U	HC-25/U	R3	4.2-20.0	Fund.	−55 to +105	±.005	30 pf
/63	CR-79/U	HC-25/U	R3	4.2-20.0	Fund.	−55 to +105	±.005	Series
/57	CR-80/U	HC-18/U	R3W	50-125.0	5th O.T.	−40 to +90 −(55 to 40) & +(90 to 105)	±.002 ±.003	Series
/58	CR-81/U	HC-25/U	R3	17.0-62.0	3rd O.T.	−55 to +105	±.005	Series
/59	CR-82/U	HC-25/U	R3	50.0-110.0	5th O.T.	−55 to +105	±.005	Series
/60	CR-83/U	HC-25/U	R3	50.0-110.0	5th O.T.	−40 to +90 −(55 to 40) & +(90 to 105)	±.002 ±.003	Series
/67	CR-89/U	HC-32/U	R5	2.12-6.2	Fund.	−55 to +90	±.005	30 pf
/72	CR-97/U	HC-18/U	R3W	8.0-10.0	Fund.	−40 to +85	±.005	32 pf
/82	CR-106/U	HC-18/U	R3W	10.5-11.5	Fund.	−55 to +105	±.005	32 pf
/87	CR-111/U	HC-18/U	R3W	17.0-62.0	3rd O.T.	−55 to +105	±.005	Series
/90	CR-114/U	HC-25/U Mod.	R3 Mod.	2.9-3.85	Fund.	−55 to +105	±.005	32 pf
/93	CR-117/U	HC-25/U	R3	30.0-63.0	3rd O.T.	Ref. 25°C −40 to +65	±.001 ±.0015	Series
/101	CR-124/U	HC-18/U	R3W	2.9-3.8	Fund.	−55 to +100	±.005	32 pf
/108	CR-128/U	HC-18/U	R3W	17.0-62.0	3rd O.T.	−55 to +105	±.005	Series
/118	CR-139/U	HC-18/U	R3W	20.0-22.0	Fund.	−55 to +105	±.005	30 pf
/119	CR-140/U	HC-6/U	R17	9.5-12.5	Fund.	−55 to +90	±.005	60 pf
/122	CR-141/U	HC-18/U Mod.	R3W Mod.	50.0-90.0	5th O.T.	−30 to +55 −(55 to 30) & +(55 to 65)	±.0025 ±.0045	Series
/137	CR-157/U	HC-33/U	R17W	1.0-20.0	Fund.	−55 to +105	±.005	Series

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Standard Crystals (CHART A)

CHART A shows standard parts numbers which can be purchased by specifying the Part Number and Frequency. Each of the following options must be specified: Calibration Tolerance, Load Capacity and Holder Style.

CALIBRATION TOLERANCE (@ 25°C)	HOLDER STYLE*	LOAD CAPACITY
1 — .001%	A — HC-50 (R3)	A — 20 pF
2 — .002%	B — HC-49 (R3W)	B — 32 pF
3 — .003%	C — HC-48 (R17)	C — Series
4 — .004%	D — HC-51 (R17W)	D — Other (Specify)
5 — .005%		
6 — .01%		

FREQUENCY MHz	MAX SERIES RESISTANCE	P/N	CAL. TOL.	HOLDER	LOAD CAPACITY
1.0-1.699 (Fund)	650/300	R1553-			
1.7-2.999 (Fund)	300/150	R1434-			
2.5-2.999 (Fund)	250/210	R1535-			
3.0-3.699 (Fund)	200/130 (HC-49) 130/75 (HC-51)	R1435-			
3.7-3.999 (Fund)	130/100 (HC-49) 75/60 (HC-51)	R1335-			
4.0-5.499 (Fund)	100/60 (HC-49) 75/50 (HC-51)	R1335-			
5.5-9.999 (Fund)	60/30 (HC-49) 40/25 (HC-51)	R1235-			
10.0-15.00 (Fund)	30	R1032-			
16.0-25.0 (Fund)	25	R1027-			
17.0-19.999 (3rd O.T.)	60	R3335-			
20.0-56.999 (3rd O.T.)	50	R3032-			
57.0-75.0 (3rd O.T.)	45	R3127-			
50.0-59.999 (5th O.T.)	80	R5132-			
60.0-125.0 (5th O.T.)	80	R5127-			
110.0-175.0 (7th O.T.)	130	R7127-			
Stability: .003% of 25°C frequency from −40 to +70°C.					

* See Mechanical Enclosure Table (Fig. 7) to determine enclosure style vs. frequency range.

Part Number Example: Specifications: 12.0 MHz, ±.002% @ 25°C, HC-49(R3W), Series P/N. R1032-2BC @ 12.0 MHz

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CTS Standard Microprocessor Crystals

CTS Knights offers 45 standard microprocessor crystals to use with many of the popular microprocessors on the market. CTS microprocessor crystals feature low start-up resistance. Reliability is assured by use of a MIL-approved Quality Control process. These are solder seal and resistance weld crystals with 0.5" minimum lead lengths.

Microprocessor crystals are available as "off-the-shelf" items from authorized CTS distributors.

Top wires and/or insulating sleeving can be ordered special with minimal cost and leadtime.

CTS P/N	FREQUENCY	CAL. TOL.	TOL. OVER TEMP.	LOAD CAP.	PKG.
MP010	1.0 MHz	±.01%	.01% 0-70°C	13 pf	HC33/51
MP018	1.8432	±.01%	.01% 0-70	13 pf	HC33/51
MP020	2.0	±.01%	.005% 0-70	20 pf	HC33/51
MP021	2.097152	±.01%	.005% 0-70	20 pf	HC33/51
MP024	2.4576	±.01%	.005% 0-70	32 pf	HC33/51
MP030	3.0	±.01%	.005% 0-70	18 pf	HC33/51
MP031	3.2	±.01%	.005% 0-70	20 pf	HC33/51
MP032	3.2768	±.01%	.005% 0-70	15 pf	HC33/51
MP036	3.579545	±.01%	.005% 0-70	18 pf	HC33/51
MP036S	3.579545	±.01%	.005% 0-70	18 pf	HC18/49
MP040	4.0	±.01%	.005% 0-70	20 pf	HC18/49
MP04A	4.0	±.01%	.005% 0-70	Series	HC18/49
MP041	4.194304	±.01%	.005% 0-70	12 pf	HC18/49
MP042	4.9152	±.01%	.005% 0-70	20 pf	HC18/49
MP043	4.032	±.01%	.005% 0-70	22 pf	HC18/49
MP05A	5.0	±.01%	.005% 0-70	20 pf	HC18/49
MP05B	5.0	±.01%	.005% 0-70	Series	HC18/49
MP050	5.0688	±.01%	.005% 0-70	Series	HC18/49
MP051	5.185	±.01%	.005% 0-70	20 pf	HC18/49
MP057	5.7143	±.01%	.005% 0-70	Series	HC18/49
MP060	6.0	±.01%	.005% 0-70	20 pf	HC18/49
MP061	6.144	±.01%	.005% 0-70	20 pf	HC18/49
MP062	6.250	±.01%	.005% 0-70	30 pf	HC18/49
MP080	8.0	±.01%	.005% 0-70	Series	HC18/49
MP080A	8.0	±.01%	.005% 0-70	20 pf	HC18/49
MP098	9.8304	±.01%	.005% 0-70	20 pf	HC18/49
MP100	10.0	±.01%	.005% 0-70	Series	HC18/49
MP101	10.0	±.01%	.005% 0-70	30 pf	HC18/49
MP107	10.738635	±.01%	.005% 0-70	32 pf	HC18/49
MP110	11.0	±.01%	.005% 0-70	18 pf	HC18/49
MP120	12.0	±.01%	.005% 0-70	Series	HC18/49
MP122	12.288	±.01%	.005% 0-70	32 pf	HC18/49
MP143	14.31818	±.01%	.005% 0-70	Series	HC18/49
MP147	14.7456	±.01%	.005% 0-70	Series	HC18/49
MP150	15.0	±.01%	.005% 0-70	Series	HC18/49
MP160	16.0	±.01%	.005% 0-70	Series	HC18/49
MP180	18.0	±.01%	.005% 0-70	Series	HC18/49
MP184	18.432	±.01%	.005% 0-70	Series	HC18/49
MP196	19.6608	±.01%	.005% 0-70	Series	HC18/49
MP200	20.0	±.01%	.005% 0-70	Series	HC18/49
MP221	22.1184	±.01%	.005% 0-70	Series	HC18/49
MP240	24.0	±.01%	.005% 0-70	Series	HC18/49
MP245	24.576	±.01%	.005% 0-70	Series	HC18/49
MP250	25.0	±.01%	.005% 0-70	Series	HC18/49
MP480	48.0	±.01%	.005% 0-70	Series	HC18/49

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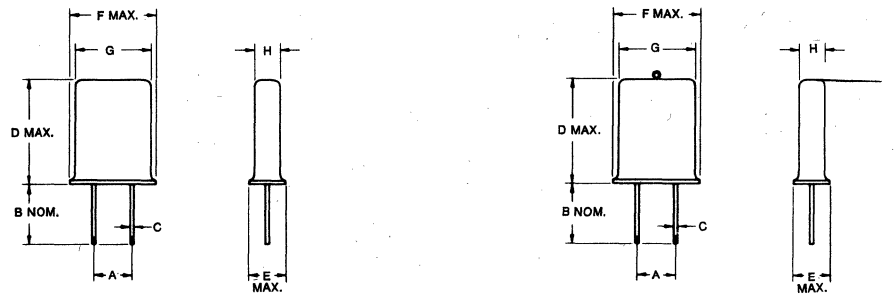
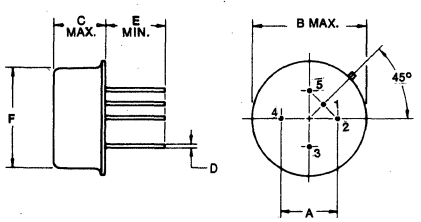
Package Outline and Specifications



Mil Type	CTS	A (nom.)	B (nom.)	C (nom.)	D (max.)	E (max.)	F (max.)	G (max.)	H (max.)
HC-49	R3-W	.192	.500	.018	.530	.183	.435	.405	.146
HC-43	K3-W	.192	.500	.018	.530	.188	.445	.393	.141
HC-50	R3	.192	.238	.040	.530	.183	.435	.405	.146
HC-42	K3	.192	.238	.040	.530	.188	.445	.393	.141
HC-32 (Sim)	R5-W	.268	.500	.019	.580	.240	.565	.530	.200
HC-46	K5-W	.268	.500	.019	.580	.220	.550	.515	.185
—	R5	.268	.238	.040	.580	.240	.565	.530	.200
—	K5	.268	.238	.040	.580	.220	.550	.515	.185
HC-51	R17-W	.486	.500	.030	.775	.342	.750	.708	.298
HC-47	K17-W	.486	.500	.030	.775	.342	.757	.693	.285
HC-48	R17	.486	.238	.050	.775	.342	.750	.708	.298
HC-36	K17	.486	.238	.050	.775	.352	.757	.693	.285
HC-45 (Sim)	R2-W	.148	.500	.018	.342	.128	.310	.275	.095

FIG. 8

TO-TYPE PACKAGES



Mil Type	CTS	A (nom.)	B (max.)	C (max.)	D (nom.)	E (nom.)	F (nom.)	PIN OUTS 1	2	3	4	5
—	RTO-5	.200	.360	.260	.019	.500	.325	na	xtal	nc	xtal	na
HC-35	KTO-5	.200	.370	.260	.019	.500	.328	na	xtal	na	xtal	GND
—	RTO-8	.282	.575	.265	.019	.500	.506		See diagram			
HC-37	KTO-8	.282	.595	.265	.019*	.500	.506	GND	xtal	nc	xtal	nc
HC-40	HC-40	.375	.835	.450	.019*	.250	.710	GND	xtal	nc	xtal	na

na — not applicable
nc — no connection
+.040/.050 also available

FIG. 9

CTS® CORPORATION SPECIALISTS IN FREQUENCY MANAGEMENT
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Hybrid Clock Oscillators

MXO-55 SERIES

TTL logic outputs
14 pin DIP compatible
19.2 KHz to 100 MHz

PIN CONNECTIONS

Pin 1: N/C, enable, or output
Pin 7: Ground/case
Pin 8: Output
Pin 14: +5 VDC

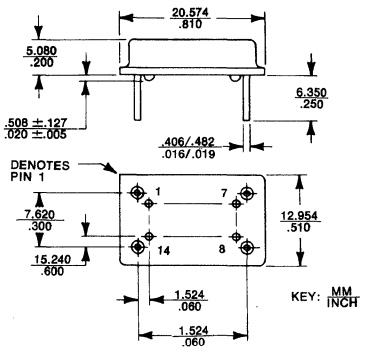

FIG. 9 MXO-55 PACKAGE

ORDERING INFORMATION

MXO-55 [ ] [ ] [ ] [ ] • [ ] SEE NOTE 1
OUTPUT FREQUENCY (PIN 8)

FREQUENCY, MODEL & OPTIONS	CODE
4.9152 MHz to 100 MHz Basic oscillator No enable	GA
4.9152 MHz to 70 MHz Basic oscillator with enable (NOTE 3)	GAE
19.2 KHz to 4.9152 MHz Basic oscillator with dividers	GB
2.4576 MHz to 24 MHz Complementary outputs	GC
Dual outputs Pin 8: 307.2 KHz to 1.25 MHz Pin 1: 16X Pin 8	GD16
Dual outputs Pin 8: 614 KHz to 2.5 MHz Pin 1: 8X Pin 8	GD18
Dual outputs Pin 8: 1.228 MHz to 5 MHz Pin 1: 4X Pin 8	GD28
Dual outputs Pin 8: 2.457 MHz to 10 MHz Pin 1: 2X Pin 8	GD48

FREQUENCY TOLERANCE(NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4
±.0025% (25 ppm) (0°C to 70°C only)	5

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

NOTE:
1. When ordering MIL-STD-883 screening option, add -883 after frequency.
2. Tolerances include: 25°C accuracy, changes in operating temperature, supply voltage, load, environmental conditions, and aging.
3. ENABLE FUNCTION
   HI: ENABLES OSCILLATOR
   LO Disables oscillator (output latches HI)

ELECTRICAL SPECIFICATIONS (MXO-55 SERIES)

SPECIFICATION	MODEL	FREQUENCY RANGE	TEMPERATURE RANGE	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
Operating Voltage	A, B, C, D	19.2 KHz to 100 MHz	−55°C to +125°C	V_{CC}	4.75	5.00	5.25	V
			−40°C to +85°C		4.50	5.00	5.50	
Maximum Supply Voltage			−55°C to +125°C	V_{CC} Max.			7.00	
Supply Current	A	4.9152 to 25 MHz	−55°C to +125°C	I_{CC}		20	30	mA
		>25 to 100 MHz				33	55	
	B	2.4576 to <4.9152 MHz				30	50	
		307.2 KHz to <2.4576 MHz				45	75	
		19.2 to <307.2 KHz				70	125	
	C	>12 to 24 MHz				22	30	
		2.4576 to 12 MHz				30	50	
	D	307.2 KHz to 10 MHz				45	75	
Output Voltage — HI	A, B, C, D	19.2 KHz to 100 MHz	−55°C to +125°C	V_{OH}	2.40	3.60		V
Output Voltage — LO				V_{OL}		0.30	0.50	
			−40°C to +85°C			0.25	0.40	
Rise & Fall Time (measured between 0.5V & 2.4V)	A	4.9152 to 25 MHz	−55°C to +125°C	t_R & t_F		3	5	nS
		>25 to 100 MHz				2	4	
	B	2.4576 to <4.9152 MHz				3	5	
		19.2 KHz to <2.4576 MHz				8	18	
	C	2.4576 to 24 MHz				3	5	
	D	307.2 KHz to 10 MHz				8	18	
Start-up Time	A, B, C, D	19.2 KHz to 25 MHz	−55°C to +125°C	t_S		2	5	mS
	A	>25 to 100 MHz				8	15	
Duty Cycle (uptime) (measured @ 1.5V)	A	4.9152 to 25 MHz	0°C to +70°C		45	50	55	%
			−55°C to +125°C		40	50	60	
		>25 to 100 MHz			40	50	60	
	B	2.4576 to <4.9152 MHz	−55°C to +125°C		40	50	60	
		19.2 KHz to <2.4576 MHz			40	50	60	
			0°C to +70°C		45	50	55	
	C	2.4576 to 12 MHz	−55°C to +125°C		45	50	55	
		>12 MHz to 24 MHz			40	50	60	
			0°C to +70°C		45	50	55	
	D	307.2 KHz to 10 MHz	−55°C to +125°C		40	50	60	
			0°C to +70°C		45	50	55	
Phase Delay (measured @ 1.5V)	C	>12 to 24 MHz	0°C to +70°C			6	10	nS
			−55°C to +125°C	$t\delta_1$ & $t\delta_2$		6	12	
		2.4576 to 12 MHz	0°C to +70°C			3	5	
			−55°C to +125°C			3	8	
Enable Input Load Factor	AE	4.9152 to 70 MHz	−50°C to +125°C	F_1			1	
Fanout (per output)	A, B, C	2.4576 to 70 MHz	−55°C to +125°C	F_0			10	S-TTL Gates
		>70 MHz to 100 MHz					2	
			−40°C to +85°C				5	
	A	19.2 KHz to <2.4576 MHz	−55°C to +125°C				10	TTL Gates
	D	307.2 KHz to 10 MHz	−55°C to +125°C				10	

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JKVXO-55 SERIES

TTL logic output
14 pin DIP compatible
(MXO-55 style)
765 KHz to 25 MHz

PIN CONNECTIONS

Pin 1: Frequency control voltage
Pin 7: Ground/case
Pin 8: Output
Pin 14: +5 VDC

ORDERING INFORMATION

JKVXO-55 [ ] [ ] [ ] [ ] [ ] OUTPUT FREQUENCY

FREQUENCY AND MODEL	CODE
12.25 to 25.0 MHz Basic Oscillator	GA
765 KHz to <12.25 MHz Basic oscillator with dividers	GB

FREQUENCY CONTROL SENSITIVITY*	CODE
60 ppm/volt min	1
100 ppm/volt min	2

* Positive slope

OPERATING TEMP. RANGE	CODE
0°C to +70°C	2C
−40°C to +85°C	2I

ELECTRICAL SPECIFICATIONS

SPECIFICATION	MODEL	FREQUENCY RANGE	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
Operating Voltage	A, B	765 KHz to 25 MHz	V_{CC}	4.50	5.00	5.50	V
Maximum Supply Voltage			V_{CC} Max.			7.00	
Supply Current	A	12.25 MHz to 25 MHz	I_{CC}		18	25	mA
	B	3.0625 MHz to <12.25 MHz			30	60	
		765 KHz to <3.0625 MHz			45	75	
Output Voltage — HI	A, B	765 KHz to 25 MHz	V_{OH}	2.40	3.60		V
Output Voltage — LO			V_{OL}		0.25	0.40	
Rise & Fall Time	A, B	3.0625 MHz to 25 MHz	t_R, t_F		3	5	nS
(measured between 0.5V to 2.4V)		765 KHz to <3.0625 MHz			8	18	
Duty Cycle	A, B	12.25 MHz to 25 MHz		40	50	60	%
(measured @ 1.5V)		765 KHz to <12.25 MHz		45	50	55	
Control Voltage	A, B	765 KHz to 25 MHz	V_C	0.0	2.5	5.0	V
Frequency Stability vs. Temp. (V_C = 2.5 ±.1V)	A, B	765 KHz to 25 MHz	Δf_T	−100		+100	ppm
Start-up Time	A, B	765 KHz to 25 MHz	t_S		5	15	mS
Control Voltage Input Impedance	A, B	765 KHz to 25 MHz		80K	100K	120K	Ω
Fanout	A	12.25 MHz to 25 MHz	F_O			10	TTL Loads
	B	765 KHz to <12.25 MHz				10	

JKTO-81 SERIES

TTL logic output
Electrically similar to MXO-55
TO-5 compatible
1 MHz to 25 MHz

PIN CONNECTION

Pin 1: NC
Pin 2: Internal connection
Pin 3: NC
Pin 4: Ground/case
Pin 5: Output
Pin 6: Internal connection
Pin 7: NC
Pin 8: +5 VDC

ORDERING INFORMATION

JKTO-81 [ ] [ ] [ ] [ ] [ ] OUTPUT FREQUENCY

FREQUENCY AND MODEL AND OPTION	CODE
16 to 25 MHz Basic oscillator	A
1 to <16 MHz Basic oscillator with dividers	B

FREQUENCY TOL. (NOTE 1)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

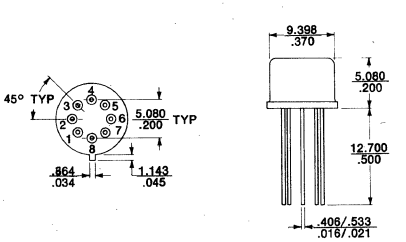

FIG. 10 TO-5 PACKAGE

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JKTO-79 SERIES

TTL logic outputs
Electrically similar to MXO-55
TO-8 compatible
500 KHz to 70 MHz

ENABLE FUNCTION

4 MHz to 12 MHz:
HI: Enables oscillator
LO: Disables oscillator (Q_A latches LO, Q_B latches HI)
500 KHz to <4 MHz:
LO: Enables oscillator
HI: Disables oscillator (Q_A & Q_B latch LO)

ORDERING INFORMATION

JKTO-79 [ ] [ ] [ ] [ ] • [ ]
OUTPUT FREQUENCY

FREQUENCY AND MODEL AND OPTION	CODE
8.0 MHz to 60.0 MHz Basic oscillator No enable	A
500 KHz to 8.0 MHz Oscillator with divider No enable	B
4.0 MHz to 12.0 MHz Oscillator with Complementary output No enable	C
Oscillator with dual outputs and no enable $Q_A = 4X\ Q_B$ Q_B = 1 to 3 MHz	D28
Oscillator with dual outputs and no enable $Q_A = 2X\ Q_B$ Q_B = 1 to 3 MHz	D48
Any of above (below 12 MHz) with enable	AE BE CE D28E D48E

FREQUENCY TOL. (NOTE 1)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4
±.0025% (25 ppm) (0°C to 70°C only)	5

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

PIN	CONNECTION
1	Enable/disable option (otherwise NC)
2	Internal connection
3	Output A (Q_A) (otherwise NC)
4	Ground
5	Output B (Q_B)
6	Internal connection
7	NC (Model A) Internal connection (Model B, C, D) Crystal frequency (Model C, D)
8	V_{CC}

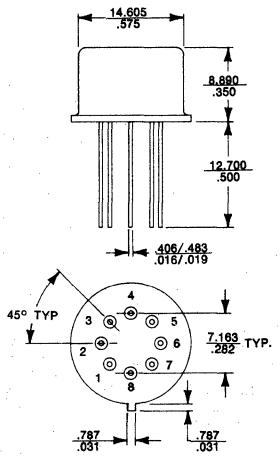

FIG. 11 TO-8 PACKAGE

MXO-53 SERIES

3-state, TTL logic output
14-pin DIP compatible
(MXO-55 style)
2.4576 MHz to 70 MHz

Designed for automated, in-circuit, and functional board test applications where a high impedance output state is required to allow the injection of external test signals.

PIN CONNECTIONS

Pin 1: Enable
Pin 7: Ground/case
Pin 8: Output
Pin 14: +5 VDC

ENABLE FUNCTION

HI: Enables oscillator
LO: Disables oscillator (HI impedance output)

ORDERING INFORMATION

MXO-53 [ ] [ ] [ ] [ ] • [ ]
OUTPUT FREQUENCY (PIN 5)

FREQUENCY & MODEL	CODE
4.9152 to 70 MHz Basic 3-state oscillator	GA
2.4516 to 4.9152 MHz 3-state oscillator with dividers	GB

FREQUENCY TOLERANCE	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4
±.0025% (25 ppm) (0°C to 70°C only)	5

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I

ELECTRICAL SPECIFICATIONS (SIMILAR TO MXO-55 EXCEPT AS NOTED BELOW)

SPECIFICATION	MODEL	FREQUENCY RANGE	TEMPERATURE RANGE	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
Supply Current	A	4.9152 to 25 MHz	−40°C to +85°C	I_{CC}		35	55	mA
		>25 to 70 MHz				50	80	
	B	2.4576 to <4.9152 MHz				60	100	
Duty Cycle (uptime) (measured @ 1.5V)	A, B	2.4576 to 70 MHz	0°C to +70°C		45	50	55	%
			−40°C to +85°C		40	50	60	
High Impedance Output Current	A, B	2.4576 to 70 MHz	−40°C to +85°C	$I_{O\ (OFF)}$			50	µA

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CXO-55 SERIES

Low power consumption
CMOS logic output
14-pin DIP compatible
(MXO-55 style)
200 Hz to 5 MHz

PIN CONNECTIONS

Pin 1: N/C
Pin 7: Ground/case
Pin 8: Output
Pin 14: +5 VDC to +15 VDC

ORDERING INFORMATION (SEE NOTE)

CXO-55 [ ] [ ] [ ] [ ] [ ] OUTPUT FREQUENCY (PIN 8)

FREQUENCY AND MODEL	CODE
3.5 to 5 MHz Basic oscillator	GA
200 Hz to <3.5 MHz Basic oscillator with dividers	GB

FREQUENCY TOLERANCE	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

ELECTRICAL SPECIFICATIONS

SPECIFICATION	MODEL	FREQ. RANGE	TEMP. RANGE	CONDITIONS		SYMBOL	MIN.	TYPICAL	MAX.	UNITS
Operating Voltage	A, B	200 Hz to 5 MHz	−55°C to +125°C			V_{DD}	4.50	5.00	15.50	V
Max. Supply Voltage						V_{DD} Max.			18	
Supply Current	A, B	200 Hz to <4 MHz	−55°C to +125°C	V_{DD} = 5V	C_L = 15 pf	I_{DD}			2	mA
				V_{DD} = 10V					5	
				V_{DD} = 15V					8	
	A	4 MHz to 5 MHz		V_{DD} = 5V					3	
				V_{DD} = 10V					7	
				V_{DD} = 15V					12	
Output Voltage—HI	A, B	200 Hz to 5 MHz	−55°C to +125°C	C_L = Max.		V_{OH}	V_{DD} −.5	V_{DD} −.1		V
Output Voltage—LO						V_{OL}		.1	.5	
Rise & Fall Times (measured from 10% to 90% waveform)	A, B	4 MHz to 5 MHz	−55°C to +125°C	V_{DD} = 5V	C_L = Max.	t_R & t_F			130	nS
				V_{DD} = 10V					70	
				V_{DD} = 15V					45	
Duty Cycle (uptime) (@ 50% of waveform)	A, B	200 Hz to 5 MHz	−55°C to +125°C	C_L = Max.			40	50	60	%
Output Load	A, B	200 Hz to <4 MHz	−55°C to +125°C			C_L			50	pf
	A	200 Hz to 5 MHz							15	
Output Current—HI (source)	A, B	200 Hz to 5 MHz	−55°C to +125°C	V_{DD} = 5V	V_{OH} = 4.5V	I_{OH}	−100			µA
				V_{DD} = 10V	V_{OH} = 9.5V		−250			
				V_{DD} = 15V	V_{OH} = 14.5V		−800			
Output Current—Lo (Sink)	A, B	200 Hz to 5 MHz	−55°C to +125°C	V_{DD} = 5V	V_{OL} = .5V	I_{OL}	300			
				V_{DD} = 10V			900			
				V_{DD} = 15V			2000			

NOTE: Frequency stability is guaranteed for ±10% supply voltage tolerance. Although the CXO-55 may operate from 5 to 15 VDC, standard frequency calibration is done at V_{DD} = 5 VDC. If your application requires V_{DD} to be other than 5 VDC, please specify nominal V_{DD}, when ordering, to insure proper frequency accuracy and stability.

CXO-65 SERIES (PRELIMINARY)

(Anticipated 2nd qtr. 85 release)
High speed CMOS logic output
14-pin DIP compatible
(MXO-55 style)
1 MHz to 25 MHz

PIN CONNECTIONS

Pin 1: N/C
Pin 7: Ground/case
Pin 8: Output
Pin 14: +5 VDC

ORDERING INFORMATION

CXO-65 [ ] [ ] [ ] [ ] [ ] OUTPUT FREQUENCY

FREQUENCY AND MODEL	CODE
4.0 to 25.0 MHz Basic oscillator	GA
1.0 to <4.0 MHz Basic oscillator with dividers	GB

FREQUENCY TOLERANCE	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4
±.0025% (25 ppm) (0°C to 70°C only)	5

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

SPECIFICATION	MODEL	FREQ. RANGE	TEMP. RANGE	CONDITIONS	SYMBOL	MIN.	TYPICAL	MAX.	UNITS
Operating Voltage	A, B	1 to 25 MHz	−55°C to +125°C		V_{DD}	4.50	5.00	5.50	V
Max. Supply Voltage					V_{DD} (Max.)			7.00	
Max. Supply Current	A, B	1 to 25 MHz	−55°C to +125°C	C_L = 50 pf @ 25 MHz	I_{CC}			25	mA
Supply Current vs. Frequency	A	4 MHz to 25 MHz	−55°C to +125°C	C_L = 50 pf	I_{CC}		1.00	1.2	mA/MHz
	B	2 MHz to <4 MHz					2.00	2.5	
		1 MHz to <2 MHz					4.00	4.5	
Output Voltage—HI	A, B	1 MHz to 25 MHz	−55°C to +125°C	C_L = 50 pf	V_{OH}	V_{DD} −.2V	V_{DD} −.1		V
				F_O = 10 LSTTL		3.8	4.5		
Output Voltage—LO				C_L = 50 pf	V_{OL}		.1	.2	
				F_O = 10 LSTTL			.2	.4	
Rise & Fall Times	A, B	1 MHz to 25 MHz	−55°C to +125°C	C_L = 50 pf (between 10% & 90%)	t_R & t_F			25	nS
				F_O = 10 LSTTL (0.5V to 2.4V)				5	
Duty Cycle (% uptime)	A, B	1 MHz to 25 MHz	−55°C to +125°C	@ 50% of waveform		45	50	55	%
				@1.5 Volts		40	50	60	
Fanout	A, B	1 MHz to 25 MHz	−55°C to +125°C		C_L	50			pf
					F_O	10			LSTTL
Output Current—HI	A, B	1 MHz to 25 MHz	−55°C to +125°C	V_{OH} = 3.7V	I_{OH}	−4.0			mA
Output Current—LO				V_{OL} = 0.4V	I_{OL}	4.0			

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Hybrid Clock Oscillators

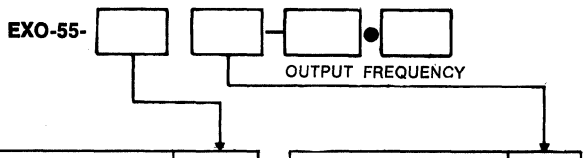
EXO-55 SERIES

10K ECL logic output
14-pin DIP compatible (MXO-55 style)
8 MHz to 125 MHz
*10KH ECL logic available

PIN CONNECTIONS

Pin 1: N/C
Pin 7: −5.2 VDC
Pin 8: Output
Pin 14: Ground

ORDERING INFORMATION



FREQUENCY TOLERANCE	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4

OPERATING TEMPERATURE RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I

ELECTRICAL CHARACTERISTICS (INTO 50Ω TO −2.0 VDC LOAD)

SPECIFICATION	FREQUENCY RANGE	OPERATING TEMPERATURE	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
Operating Voltage	8.0 to 125.0 MHz	−40°C to +85°C	V_{EE}	−4.94	−5.20	−5.46	V
Max. Supply Voltage			V_{EE} Max.			−7.0	
Supply Current			I_{EE}		52	65	mA
Output Voltage—HI			V_{OH}	−1.05	− .95	− .75	V
Output Voltage—LO			V_{OL}	−2.05	−1.80	−1.60	
Rise & Fall Times (measured between 20% & 80%)	8.0 to 100.0 MHz		t_R & t_F		2.2	3.3	nS
	>100.0 to 125 MHz				1.2	2.0	
Duty Cycle (uptime) (measured @ 50%)	8.0 to 125.0 MHz			40	50	60	%
Output Current—HI @ − .95V			I_{OH}	−19.0	−22.0		mA
Output Current—LO @ −1.75V			I_{OL}	−1.0	−5.0		
Output Load				50Ω to −2.0 VDC			
Start-up Time					2.0	8.0	mS

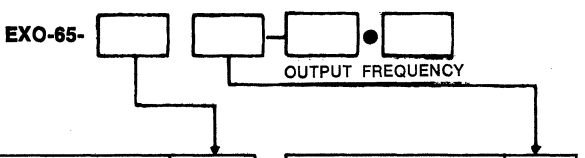
EXO-65 SERIES (PRELIMINARY)

(Anticipated 3rd qtr. 85 release)
100K ECL logic output
14-pin DIP compatible (MXO-55 style)
25 MHz to 150MHz

PIN CONNECTION

Pin 1: N/C
Pin 7: −4.5 VDC
Pin 8: Output
Pin 14: Ground

ORDERING INFORMATION



FREQUENCY TOLERANCE	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4

OPERATING TEMPERATURE RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I

ELECTRICAL CHARACTERISTICS (INTO 50Ω TO −2.0 VDC LOAD)

SPECIFICATION	FREQUENCY RANGE	OPERATING TEMPERATURE	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
Operating Voltage	25.0 to 150.0 MHz	−40°C to 85°C	V_{EE}	−4.20	−4.50	−4.80	V
Max. Supply Voltage			V_{EE} Max.			−5.70	
Supply Current			I_{EE}		58	70	mA
Output Voltage—HI			V_{OH}	−1.04	− .95	− .85	V
Output Voltage—LO			V_{OL}	−1.90	−1.80	−1.60	
Rise & Fall Times (measured between 20% & 80%)			t_R & t_F		1.0	2.0	nS
Duty Cycle (uptime) (measured @ 50%)				40	50	60	%
Output Current—HI @ −1.0V			I_{OH}	−19.2	−21.0		mA
Output Current—LO @ −1.7V			I_{OL}	−2.0	− 6.0		
Output Load				50Ω to −2.0 VDC			

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MXO-65 SERIES

MOS or MOS/TTL
logic outputs
Drives high capacitance loads
14-pin DIP compatible
(MXO-55 style)
2.4576 to 12 MHz

PIN CONNECTIONS

Pin 1: N/C (MXO-65GA)
TTL output
(MXO-65GAA)
Pin 7: Ground/case
Pin 8: MOS output
Pin 14: +5 VDC

ORDERING INFORMATION

MXO-65 [ ] [ ] [ ] [ ] [ ] OUTPUT FREQUENCY (PIN 8)

FREQUENCY AND MODEL	CODE
2.4576 to 12.0 MHz Single MOS output only	GA
Dual output Pin 8: MOS output 2.4576–12 MHz Pin 1: TTL output 2X pin 8 freq.	GAA

FREQUENCY TOLERANCE	CODE
±0%, −.2% (2000 ppm)	1
±0%, −.02% (200 ppm)	2
±0%, −.01% (100 ppm)	3
±0%, −.1% (1000 ppm)	4

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
−40°C to ±85°C	I

ELECTRICAL SPECIFICATIONS (SEE NOTE BELOW)

SPECIFICATION	MODEL	FREQUENCY RANGE	TEMP. RANGE	CONDITIONS	SYMBOL	MIN.	TYPICAL	MAX.	UNITS
Operating Voltage	GA	2.4576 to 12 MHz	−40°C to +85°C		Vcc	4.50	5.00	5.50	V
Max. Supply Voltage	GAA				Vcc Max.			7.00	
Supply Current	GA				Icc			65	mA
	GAA							90	
Output Voltage—HI	GA			CL = 150 pf	VOH	Vcc −0.4		Vcc +0.2	V
Output Voltage—LO	GAA				VOL	−0.2		+0.4	
Rise & Fall Times (measured between 10% and 90%)	GA GAA			CL = 50 pf	tR & tF			8	nS
				CL = 100 pf				10	
				CL = 150 pf				12	
				CL = 200 pf				15	
Duty Cycle (uptime) (measured @ 50%)	GA GAA			CL = 150 pf		45	50	55	%
Pule Width—HI (measured @ Vcc −0.6V)	GA			CL = 150 pf	tPH	110			nS
Pulse Width—LO (measured @ 0.4V)	GAA				tPL	110			
Output Load	GA GAA				CL	0	150	500	pf

NOTE: Output parameters are for MOS output only (Pin 8). See MXO-55 data for TTL output parameters (Pin 1) on MXO-65GAA Model.

CCXO SERIES

Leadless chip carrier package
TTL logic output
1.0 to 28.0 MHz
Electrically similar to
MXO-55

ORDERING INFORMATION

CCXO- [ ] [ ] [ ] [ ] [ ] OUTPUT FREQUENCY

PACKAGE STYLE	CODE
40-pin, .040″ spaced	140
28-pin, .050″ spaced	150
44-pin, .050″ spaced	250

FREQUENCY AND MODEL	CODE
14 to 28 MHz Basic oscillator	A
1 to <14 MHz Oscillator with dividers	B

FREQUENCY TOLERANCE	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4

OPERATING TEMPERATURE RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

STANDARD PIN ASSIGNMENT

CCXO-140 PINS	CCXO-150 PINS	CCXO-250 PINS	FUNCTION FOR FREQUENCY 1-7 MHz	7-14 MHz	14-28 MHz
1	2	1	NC	NC	Output
4			+5 VDC	+5 VDC	+5 VDC
5	4	6	NC	NC	NC
10	8	12	+5 VDC	+5 VDC	+5 VDC
15	12	18	NC	NC	NC
25	18	28	NC	NC	NC
31	22	34	GND	GND	GND
35			GND	GND	GND
37	26	40	GND	GND	GND
39	28	43	Output	Output	
40	1	44	NC		

NOTES:
1. NC — Indicates internal connection. No external electrical connection allowed.
2. Unspecified pins may have external electrical connections.
3. Multiple +5 VDC and GND pins are internally connected and redundant.
4. Non-standard pin assignments may be possible. Consult factory with requirements.

PACKAGE OUTLINES

FIG. 12 CCXO-140

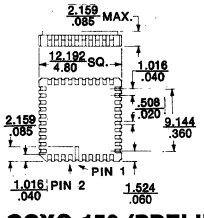


FIG. 13 CCXO-150 (PRELIMINARY)
(Anticipated 3rd qtr. 85 release)

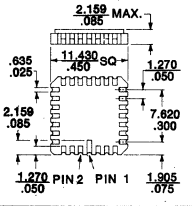
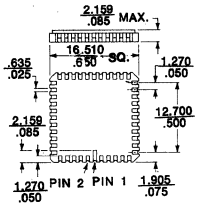


FIG. 14 CCXO-250 (PRELIMINARY)
(Anticipated 3rd qtr. 85 release)



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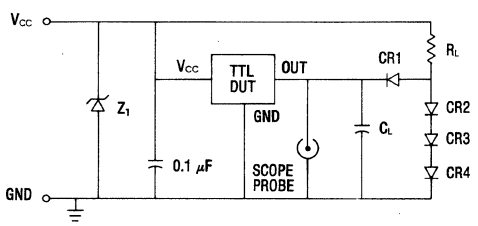
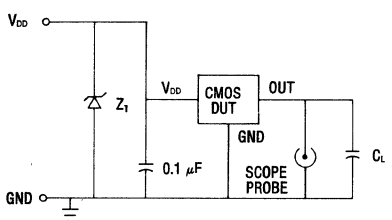
Engineering Data

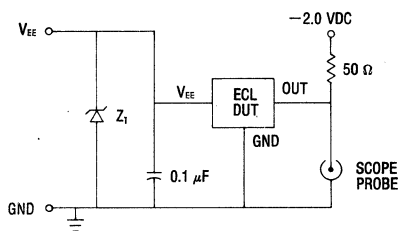
TYPICAL CHARACTERISTICS

- STORAGE TEMPERATURE: −65°C to +150°C.
- TEMPERATURE CYCLE: 25 cycles, −55°C to +125°C, per method 1010 of MIL-STD-883.
- CONSTANT ACCELERATION: 5000 G, Y1 direction, per method 2001 of MIL-STD-883.
- MECHANICAL SHOCK: 1500 G, 0.5 mS, 3 shocks per direction, per method 2002 of MIL-STD-883.
- SINUSOIDAL VIBRATION: 0.06″ D.A., 10 to 55 Hz and 30 G, 55 to 2000 Hz, 3 cycles per direction, per method 2007 of MIL-STD-883.
- RANDOM VIBRATION: 20 G_{RMS}, 20 to 2000 Hz, per method 2026 of MIL-STD-883.
- LEAD INTEGRITY: Per conditions B1 and B2 in method 2004 of MIL-STD-883.
- HERMETICITY: 5 x 10^{-8} ATM-cc/sec, per conditions A1 and C in method 1014 of MIL-STD-883.
- MOISTURE RESISTANCE: 10 cycles, per method 1004 of MIL-STD-883 with step 7 subcycle omitted.
- CORROSION RESISTANCE: 24 hours, per condition A in method 1009 of MIL-STD-883.
- SOLDERABILITY: Per method 2003 of MIL-STD-883, or method 208 of MIL-STD-202.
- RESISTANCE TO SOLDERING HEAT: Per conditions A and C in method 210 of MIL-STD-202.
- MARKING PERMANENCE: Per method 2015 of MIL-STD-883.
- THERMAL RESISTANCE: Per method 1013 of MIL-STD-883:
  MXO-55 style package = 12°C/watt typical.
  TO-5/TO-8 style package = 8°C/watt typical.
  CCXO style package = 7°C/watt typical.
- ELECTROSTATIC DISCHARGE SENSITIVITY: Per method 3015 of MIL-STD-883:
  TTL output models — > 4 KV (Class B — not sensitive)
  ECL output models — > 4 KV (Class B — not sensitive)
  CMOS output models — < 2 KV (Class A — sensitive)
- STEADY-STATE LIFE: 1000 hrs. @ 125°C per method 1005 of MIL-STD-883, disregarding frequency shift.
- Frequency Aging: < 10 ppm shift in 30 days @ 85°C ambient.

EQUIVALENT TEST LOAD DIAGRAMS



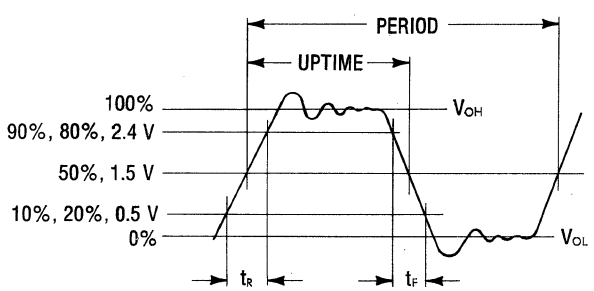


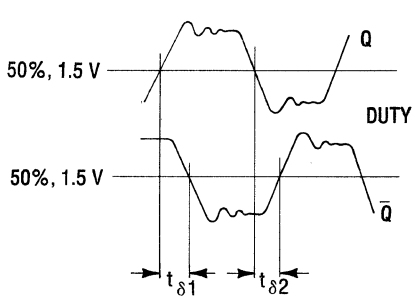


C_L = 15 pF (including probe and fixture)
CR1-CR4 = 1N3064 or equivalent
R_L = 270Ω for 10 STTL
390Ω for 10 TTL
560Ω for 5 STTL
2kΩ for 10 LSTTL

NOTES:
1. All lead length should be kept as short as possible.
2. Waveform measurement system should have a minimum bandwith of 5 times the frequency being tested.
3. Z_1 is a transient surge suppressor recommended on all test fixturing. Diode should clamp within 20% of the maximum rated operating voltage in less than 10 picoseconds.

WAVEFORM CONDITIONS





$$\text{DUTY CYCLE} = \frac{\text{UPTIME}}{\text{PERIOD}} \times 100\%$$

ALL VOLTAGES ARE MEASURED WITH RESPECT TO GROUND POTENTIAL.

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Engineering Data

SPECIAL REQUIREMENTS

- ELECTROMAGNETIC INTERFERENCE PROTECTION The metal package construction, used extensively on CTS Knights hybrid oscillators, effectively reduces radiated EMI due to the oscillator circuitry. Further reduction can be accomplished by connecting the case to circuit ground, which is standard on MXO and CXO series oscillators. Case grounding is specified by a "G" in the part number (eg. MXO-55GA, CXO-65GA). CTS Knights has also gained considerable experience in reducing conducted EMI in specific customer applications. Contact CTS with your EMI problems or requirements, we'll offer a solution.
- SURFACE MOUNT APPLICATIONS — CTS Knights presently offers a number of options to suit your surface mount needs. Besides the CCXO series, leadless chip carriers, we are offering the MXO-55 style package in an economical surface mountable configuration, through a simple lead formation operation. The surface mount option is specified by adding an "S" to the part number (eg. SMXO-55, SCXO-65).
- HIGH RELIABILITY SCREENING — All hybrid oscillators, at your option, may be screened to the Class B requirements in method 5008 of MIL-STD-883. Hybrid construction would be in accordance with appendix G of MIL-M-38510. To request this option, add "-883" after the part number (e.g. MXO-55GA-2C-16.0 MHz-883).
- VAPOR PHASE REFLOW — Although CTS Knights' hybrid oscillators are capable of withstanding hand and wave soldering processes, the standard devices are not manufactured to survive vapor phase reflow profiles without degradation to device reliability. A special, high-temperature construction process is available at your request, to allow vapor phase reflow with little effect on device performance and reliability.
- CUSTOM DESIGN CAPABILITIES — CTS Knights' in-house capabilities include circuit design and artwork generation, crystal and hybrid thick film manufacturing facilities, manual and automated manufacture and test techniques, and mechanical and environmental testing. This gives CTS a unique flexibility to design and manufacture to your custom hybrid oscillator specifications. Consult the innovative staff at CTS Knights with your special requirements.

NEW PRODUCTS UNDER DEVELOPMENT:

MINIATURE DUAL-IN-LINE OSCILLATORS

MXO-25 SERIES

(Anticipated 3rd qtr. 85 release)
TTL logic output
Electrically similar to MXO-55
310 KHz to 25 MHz

CXO-25 SERIES

(Anticipated 3rd qtr. 85 release)
Hi-speed CMOS logic output
Electrically similar to CXD-65
4 MHz to 25 MHz

SURFACE MOUNT PACKAGES

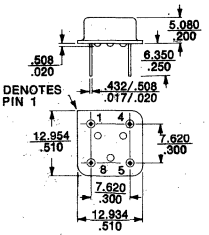

FIG. 5 MXO-25 PACKAGE

Pin 1 — N/C
Pin 4 — Ground/case
Pin 5 — Output
Pin 8 — +5 VDC supply

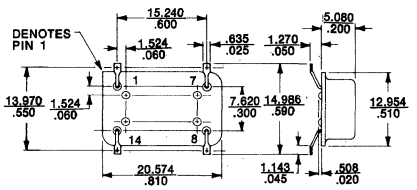

FIG. 6 SMXO-55

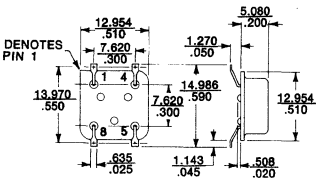

FIG. 7 SMXO-25

Military Oscillators

MIL-O-55310/16

CTS Knights is a Qualified Products List (QPL) supplier for MIL-O-55310/16.
14-pin dual-in-line package
TTL logic output
Frequencies up to 60.0 MHz
Class B and C screening

PIN CONNECTIONS

Pins 1-6: N/C
Pin 7: Ground/case
Pin 8: Output
Pins 9-13: N/C
Pin 14: +5 VDC

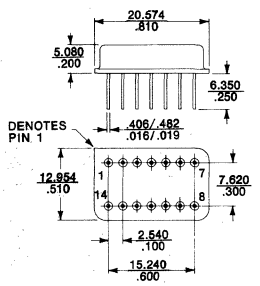

FIG. 8 MILITARY PACKAGE

CTS Knights also supplies product equivalent to the following MIL-O-55310 specifications with qualification anticipated:

SPECIFICATION	TYPE	ANTICIPATED QPL
M55310/8	TTL, 14-pin DIP	3rd qtr. '85
M55310/9	TTL, TO-5	3rd qtr. '85
M55310/10	TTL, TO-8	3rd qtr. '85
M55310/11	CMOS, 14-pin DIP	3rd qtr. '85
M55310/14	TTL, 14-pin DIP	3rd qtr. '85
M55310/15	CMOS, 14-Pin DIP	3rd qtr. '85
M55310/17	TTL, 14-pin DIP	3rd qtr. '85
M55310/18	CMOS, 14-pin DIP	3rd qtr. '85
M55310/19	TTL, 40-pin LCC	4th qtr. '85

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Precision Crystal Oscillators

JKVXO-220
HIGH STABILITY TCVCXO

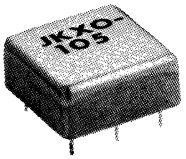
Size: 2" x 2" x .75"
Sealed metal can with PC mount pins — several pinouts available, contact factory.

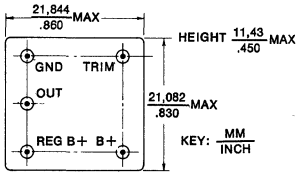
Designed for telecommunications use in phase locked and digital frequency locked loop applications where tight stability is needed during unlocked operation. Deviation range, temp. stability and aging rate combine to provide a highly stable TCVCXO with excellent free running stability and reference locking capability over an extremely long life.

SPECIFICATIONS

- Excellent long term Aging: <4 ppm in 20 yrs.
- Operating range: 0 to +50°C or 0 to +70°C.
- $\pm 3 \times 10^{-7}$ ΔF vs. temp. at any deviation voltage setting.
- 1 MHz to 25 MHz frequency range.
- Deviation: ±10 to ±15 ppm for 0 to +10V input, centered at +5 VDC.
- TTL or HCMOS output.
- Available with or without trim access port.
- +12V supply (other voltages available).

JKXO-105
HYBRID TCXO



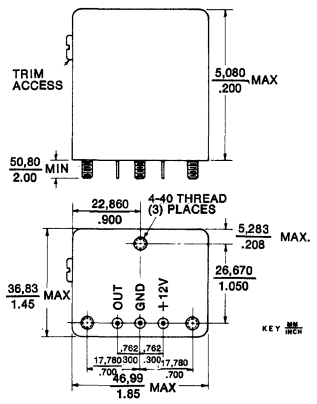


SPECIFICATIONS

The JKXO-105 is a subminiature TCXO designed to meet the requirements of modern battery operated systems. Its small size (0.32 cubic inches) and very low power consumption combine to form state-of-the-art TCXO performance for industry and military applications.

- Frequency Range: 10-20 MHz.
- Temp. Stability: −1) $\pm 1 \times 10^{-6}$, 0 to +60°C.
  −2) $\pm 1 \times 10^{-6}$, −28 to +70°C.
  −3) $\pm 2 \times 10^{-6}$, −55 to +85°C.
- Input: +12 VDC ±5% at 2.2 mA typ., 3 mA max.
- Output: Sinewave 1 vp-p into 1 KΩ.
- Stability vs time: $\pm 1 \times 10^{-6}$/yr.
- Stability vs. voltage: $\pm 5 \times 10^{-8}$/0.1 volt change.
- External trim sufficient for 10 yrs. aging via external 100Ω POT.

JKXO-200
HIGH STABILITY TCXO — 5 MHz*



* CONTACT FACTORY FOR OTHER FREQUENCIES.

The JKXO-200 is a precision TCXO designed to maintain state-of-the-art stability during variations in environment and electrical inputs. Temperature hysteresis, temperature slew, trim adjust effects and aging have been minimized. The very low power consumption and rugged construction make this oscillator ideal for battery operated portable use. The JKXO-200 can be manufactured using Hi-Rel military components providing an ultra stable TCXO capable of surviving the harshest of military environments.

CONDENSED SPECIFICATIONS

	−1	−2
Frequency vs. temp. −55°C to +85°C including hysteresis	$\pm 3 \times 10^{-7}$	$\pm 5 \times 10^{-7}$
1°C/min temp. slew −55°C to +85°C including trim adjust effect	$\pm 5 \times 10^{-7}$	$\pm 7 \times 10^{-7}$
Stability vs. time	$\pm 2 \times 10^{-7}$ 1st yr $\pm 5 \times 10^{-7}$/5 yrs	$\pm 3 \times 10^{-7}$ 1st yr $\pm 8 \times 10^{-7}$/5 yrs
Stability vs. voltage (12V ±1V)	$\pm 5 \times 10^{-9}$	$\pm 5 \times 10^{-9}$
Output level: 50Ω load	50 mV RMS	
1000Ω load	150 mV RMS	
Warm up to within $\pm 5 \times 10^{-8}$	10 seconds max.	
Input power at +12V	50 mW max.	

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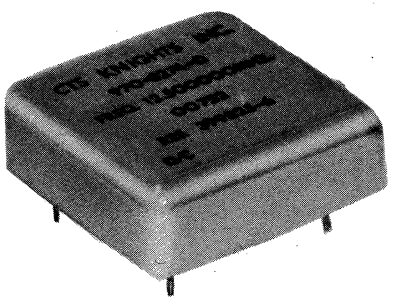
Precision Oscillators—TCXO/TCVCXO

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS (TCXO's) VOLTAGE CONTROLLED-TEMPERATURE COMPSENSATED CRYSTAL OSCILLATORS (TCVCXO's)

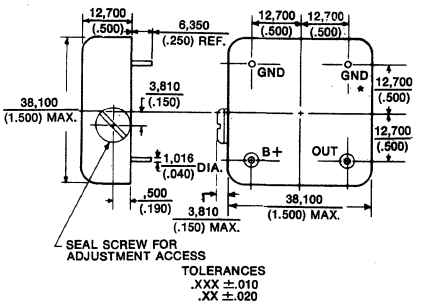
Low power consumption, high stability over wide temperature extremes, and small physical size characterize CTS Knights' TCXO and TCVCXO crystal oscillators. Add excellent environmental characteristics including immunity to humidity, vibration and shock, satisfying the requirements of the instruments and communications industries.

High reliability and stringent long term qualities common in military applications are available in a variety of designs. Note the options and modifications, the flexibility of design which offers the user choices to fulfill specific needs.

JKXO-12 (TCXO) JKVXO-12 (TCVCXO)



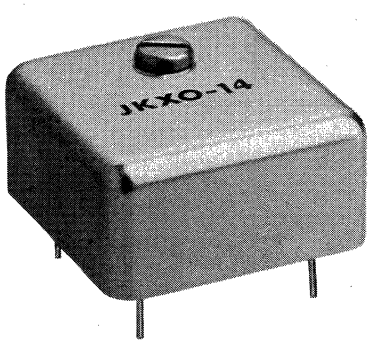
FEATURES:
- Low profile
- Solder seal
- Vibration 15G's, to 10-2000 Hz



* VCO INPUT ON TCVCO MODELS

Fig. 21

JKXO-14 (TCXO)



FEATURES:
- Top access hex drive trim adjustment
- Sine or TTL output
- Solder seal

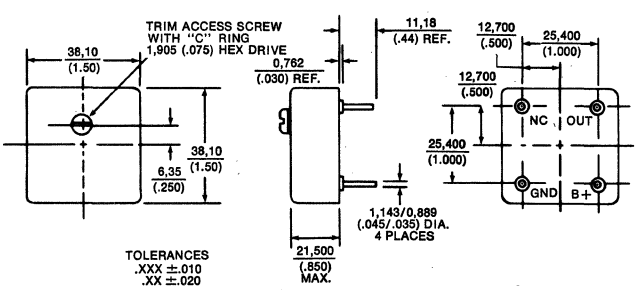
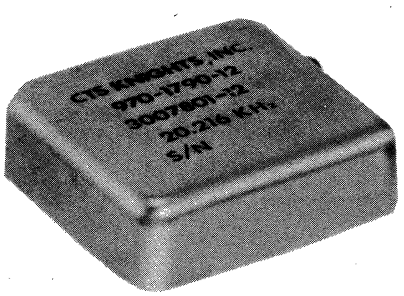
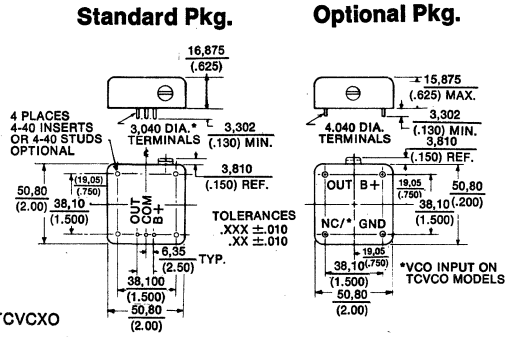


Fig. 22

JKXO-16 (TCXO) JKVXO-16 (TCVCXO)



FEATURES:
- Solder seal
- Wide frequency range
- Specialized outputs available



* 4 PINS FOR TCVCXO

Fig. 23

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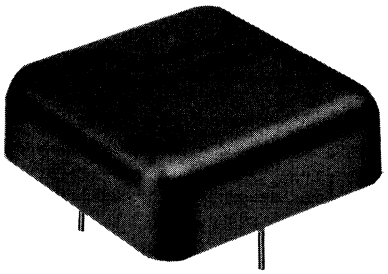
Precision Crystal Oscillators — TCXO/TCVCXO

JKVXO-22



FEATURES:

- Available as VCXO or TCVCXO. Temperature stability and deviation are customized per application. 5 volt supply, Mod voltage range 0 to +5 VDC.

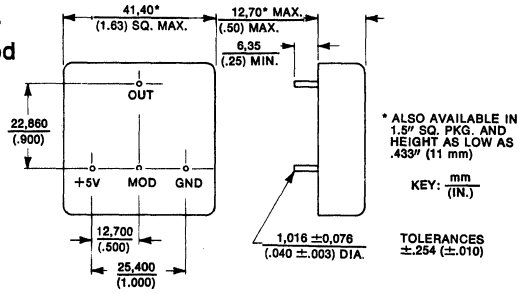
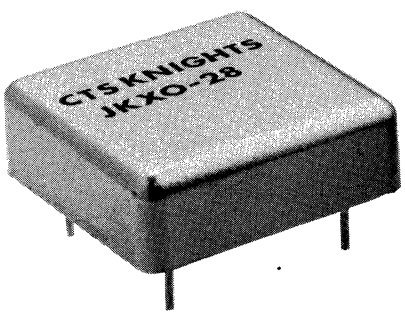


Fig. 24

JKXO-28 (TCXO)



FEATURES:

- 5 VDC supply
- ±1 ppm, 0°C to +70°C
- TTL or HCMOS output
- <±3 ppm aging in 10 yrs.
- 8-20 MHz freq. range

The JKXO-28 is a low cost design providing excellent long term stability without need for re-calibration over a long life.

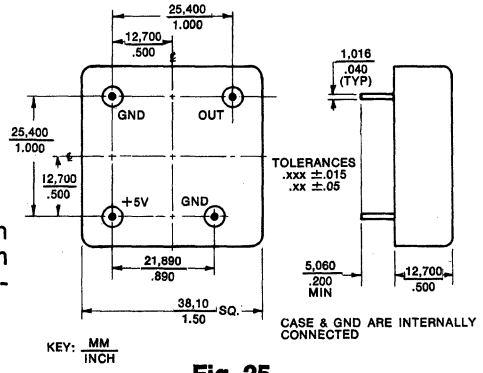


Fig. 25

FIG.	MODEL	FREQUENCY RANGE	SUPPLY VOLTAGE OPTIONS (VDC)	STABILITY WITH TEMPERATURE	VCXO DEVIATION OPTIONS	MAX. AGING 1st YR.	OUTPUT OPTIONS
21	JKXO-12A	3-30 MHz	12-20	±2 ppm, −55 to +85°C	NONE	1 ppm	Sine Wave, TTL CMOS (Below 10 MHz)
	JKXO-12B	3-30 MHz	12-20	±1 ppm, −40 to +75°C	NONE	1 ppm	
	JKXO-12C	3-50 MHz	12-20	±.5 ppm, 0 to +70°C	NONE	1 ppm	
22	JKXO-14A	3-30 MHz	12-28	±.5 ppm, 0 to +50°C	NONE	1 ppm	TTL or Sine
	JKXO-14B	3-30 MHz	12-28	±1 ppm, 0 to +70°C	NONE	1 ppm	
23	JKXO-16A	1 Hz to 30 MHz	12-28	±1 ppm, −40 to +75°C	NONE	1 ppm	Sine (Above 500 KHz) ECL, TTL, HCMOS CMOS (Below 10 MHz)
	JKXO-16B	1 Hz to 30 MHz	12-28	±1 ppm, −55 to +85°C	NONE	1 ppm	
	JKXO-16C	1 Hz to 30 MHz	12-28	±2 ppm, −40 to +75°C	NONE	1 ppm	
	JKXO-16D	30 to 100 MHz	15-28	±2 ppm, −20 to +70°C	NONE	1 ppm	
	JKXO-16E	1 KHz to 30 MHz	5	±2 ppm, −20 to +70°C	NONE	1 ppm	
25	JKXO-28	8-20 MHz	5	±1 ppm, 0 to +70°C	NONE	.75 ppm	TTL or HCMOS
21	JKVXO-12A	8-30 MHz	9-20	±10 ppm, 0 to +70°C	±100 ppm, ±5V Input	1 ppm	TTL
	JKVXO-12B	30 to 50 MHz	12-20	±5 ppm, 0 to +70°C	±15 ppm, ±3V Input	1 ppm	Sine Wave
	JKVXO-12C	8 to 35 MHz	12-20	±2 ppm, 0 to +70°C	±40 ppm, ±3V Input	1 ppm	Sine, TTL
23	JKVXO-16A	1 KHz to 30 MHz	5-20	±10 ppm, 0 to +70°C	±40 ppm, 0 to 5 VDC	1 ppm	TTL, ECL, HCMOS CMOS (Below 10 MHz) Sine (Above 500 KHz)
	JKVXO-16B	1 KHz to 30 MHz	9-20	±20 ppm, −20 to +70°C	±100 ppm, ±5V Input	1 ppm	
	JKVXO-16C	1 MHz to 30 MHz	5	±30 ppm, −55 to +85°C	±100 ppm, 0 to 5V Input	1 ppm	
	JKVXO-16D	30 MHz to 150 MHz	12-20	±5 ppm, 0 to +50°C	±15 ppm, ±5V Input	1 ppm	Sine, ECL
24	JKVXO-22A	1 MHz to 30 MHz	5	±10 ppm, 0 to +50°C	±40 ppm, 0 to +5 VDC	2 ppm	TTL, CMOS
	JKVXO-22B	30 MHz to 50 MHz	5	±5 ppm, 0 to +50°C	±12 ppm, 0 to +5 VDC	1 ppm	TTL ECL (−5V Supply Req.)
	JKVXO-22C	1 MHz to 30 MHz	5	±15 ppm, −20 to +70°C	±100 ppm, 0 to +5 VDC	2 ppm	

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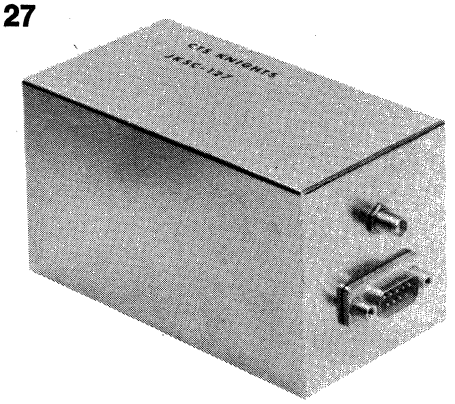
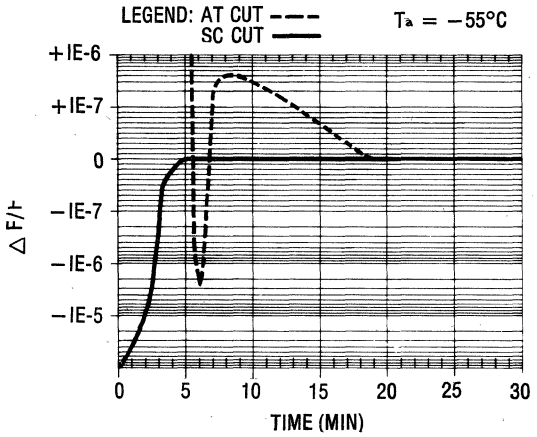
Fast Warm-Up SC Cut Ovenized Oscillator

JKSC-127





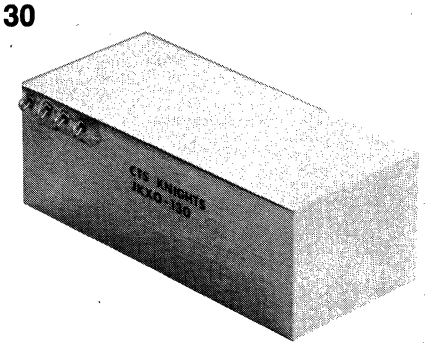
The JKSC-127 offers ultra fast warm-up with excellent long term, short term and phase noise characteristics. The design utilizes a 10 MHz coldweld sealed SC cut overtone crystal along with a uniquely designed proportionally controlled double oven which minimizes stabilized power consumption. The JKSC-127 is available fully militarized with an MTBF of greater than 100,000 hours in ground mobile and airborne environments.

GENERAL SPECIFICATIONS

FREQUENCY: 10.0 MHz or 10.230 MHz
INPUT VOLTAGE: Oven +28 VDC ±5%
Oscillator +15 VDC ±5%
INPUT CURRENT: Oven @ turn-on 1.2 amps maximum
@ −25°C 125 mA typical
@ −55°C 240 mA typical
Oscillator 20 mA maximum
FREQUENCY STABILITY VS. TEMPERATURE:
$\pm 5 \times 10^{-9}$ from −55°C to +71°C
FREQUENCY STABILITY VS. TIME:
$\pm 5 \times 10^{-12}$ RMS/sec
$\pm 5 \times 10^{-10}$/day at shipment
$\pm 3 \times 10^{-8}$/year
WARM UP: @ −55°C $< 5 \times 10^{-9}$ in 7 minutes
@ −32°C $< 5 \times 10^{-9}$ in 5 minutes
@ +25°C $< 5 \times 10^{-9}$ in 3 minutes
PHASE NOISE (1 HzBW): @ 10 Hz offset −120 dbc
@ 100 Hz offset −140 dbc
@ 1 KHz offset −150 dbc
@ 100 KHz offset −150 dbc
RF OUTPUT: +5 dbm minimum in 50 ohms
FREQUENCY ADJUSTMENT:
Coarse (mechanical) $\pm 5 \times 10^{-7}$ minimum
Fine (electrical) $\pm 5 \times 10^{-8}$ minimum for ±5 VDC
SIZE: 2.5″ x 4.5″ x 2.5″ H.
Modifications of the JKSC-127 available.

Ovenized Crystal Oscillator

JKXO-130



The JKXO-130 offers excellent long and short term stabilities at an economical price. The design utilizes a cold weld precision overtone crystal with a proportional oven controller.

GENERAL SPECIFICATIONS

FREQUENCY RANGE: 256 KHz to 10 MHz
INPUT VOLTAGE AND POWER: +15 VDC ±5%
10 Watts maximum at turn on 4.5 Watts typical at room temperature.
RF OUTPUT: TTL compatible 2 loads
FREQUENCY STABILITY VS. TIME:
5×10^{-11} RMS/10 seconds
$\pm 5 \times 10^{-10}$/day at shipment
$\pm 3 \times 10^{-8}$/year
FREQUENCY STABILITY VS. TEMPERATURE:
$\pm 1 \times 10^{-8}$ from 0°C to +60°C
SSB PHASE NOISE (measured in a 1 Hz bandwidth):
@ 10 Hz offset −114 dbc
@ 100 Hz offset −130 dbc
@ 1 KHz offset −135 dbc
@ 10 KHz offset −140 dbc
FREQUENCY ADJUSTMENT: Coarse $>1 \times 10^{-6}$
Fine $>1 \times 10^{-8}$
Resolution $<1 \times 10^{-10}$
FREQUENCY RETRACE:
(After 48 hours off at room temperature)
$<\pm 1 \times 10^{-8}$ of the turn off frequency 1 hour after turn on.
SIZE: 1.6″ x 4.5″ x 2.11″ H.
Numerous modification of the JKXO 130 available — consult factory to discuss your application.

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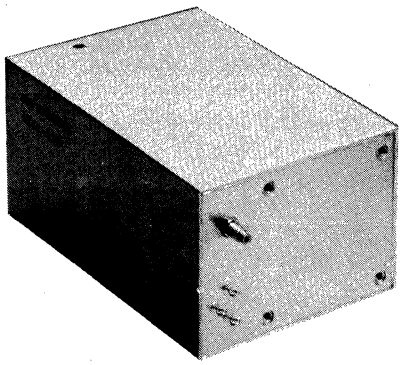
Precision Crystal Oscillators

JKSC-135

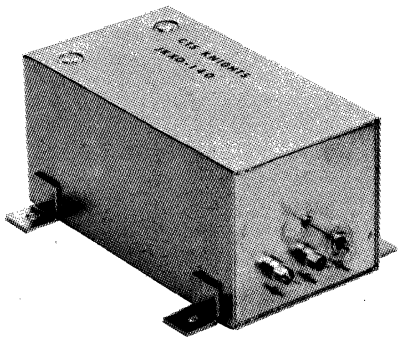


The JKSC-135 is an ultra stable 5 MHz double oven oscillator. Its utilization of a 5 MHz 3rd overtone SC cut crystal helps produce excellent long and short term stabilities. The JKSC-135 is well suited for portable battery operated systems.

SPECIFICATIONS

- FREQUENCY: 5.0 MHz
- INPUT VOLTAGE: +15 VDC
- INPUT POWER: 7 Watts maximum at turn on
  2.5 Watts @ 25°C
- FREQUENCY STABILITY:
  VS. TEMPERATURE: $\leq 1 \times 10^{-9}$ peak to peak
  −25°C to +60°C
  VS. TIME: $\pm 5 \times 10^{-10}$/day
  8×10^{-12} RMS/100 sec.
- OUTPUT: Sine, 1V RMS into 50 ohms
- Size: 5.0″ x 2.38″ x 3.20″ H

JKXO-140



The JKXO-140 is designed to meet the stringent frequency control requirements of modern telecommunications systems. Commonly used telecommunication output frequencies are standard.

SPECIFICATIONS

CENTER FREQUENCIES (MHz): 5.0, 5.12, 6.176, 10.0, 10.24, 12.352
INPUT VOLTAGE: +24 VDC
INPUT POWER: 8 Watts maximum at turn on
3.5 Watts stabilized @ +25°C

- FREQUENCY STABILITY:
  VS. TEMPERATURE: 3×10^{-10}/15°C (0°C to +55°C)
  VS. TIME: $\pm 3 \times 10^{-10}$/day after 30 days
  $\pm 2 \times 10^{-8}$/year
  $\pm 5 \times 10^{-8}$/20 years
- OUTPUT: 2 TTL loads
- ELECTRICAL ADJUSTMENT: $\pm 5 \times 10^{-8}$ minimum for ±5 VDC
- SIZE: 2.30″ x 4.50″ x 2.10″ H

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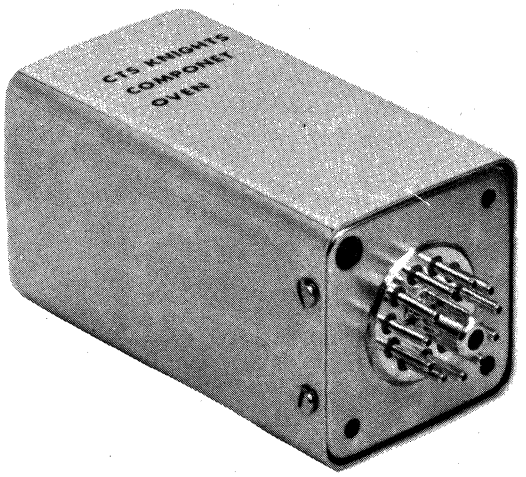
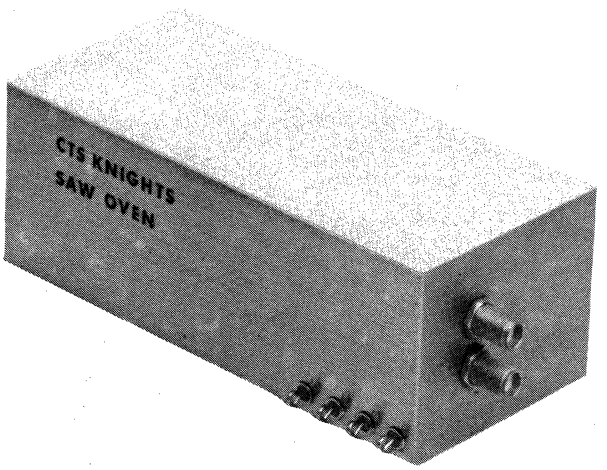
Oven Controlled Products

SAW RESONATOR AND COMPONENT OVENS

CTS Knights offers a broad range of proportionally controlled ovens. Uses include military and industrial temperature control applications with special emphasis on custom designed S.A.W. ovens. With our experience in the design of tactical ovenized oscillators, we can control critical oven performance parameters such as warm-up time, temperature gradients and power consumption. Support of Hi-Rel programs is available if required. For the best product performance, we encourage you to contact our engineers early in the design phase of your development program.





HIGH STABILITY OVENIZED CRYSTAL OSCILLATORS

CTS Knights ovenized oscillators are available in thermostatically controlled models as well as proportional control models. A variety of design options are available to the user, including very high stability, low power, small size and sine wave or square wave (TTL or CMOS) output. Contact CTS Knights for your special requirements.

MODEL	FREQUENCY RANGE	DIMENSIONS		OSCILLATOR INPUT*	OVEN INPUT*	TEMPERATURE CONTROL	STABILITY VS. TIME	STABILITY VS. TEMPERATURE
		INCHES	mm					
JKXO-23	60 Hz-4 MHz	1.578 x 1.875 x 4.442 HT	40,081x 47,625 x 112,32	+12 VDC	+28 VDC/AC 115 VAC 11 W.	Thermostat	$\pm 5 \times 10^{-8}$/day $\pm 2 \times 10^{-6}$/yr	−40 to +70°C $\pm 7.5 \times 10^{-7}$
JKXO-30	1-4 MHz	2.0 x 2.0 x 4.0	50,8 x 50,8 x 101,6	+ 28 VDC	+28 VDC or 115 VAC 10 W. Max.	Proportional	$\pm 1 \times 10^{-8}$/day $\pm 1 \times 10^{-6}$/yr	−10 to +55°C $\pm 5 \times 10^{-8}$
JKXO-30	4-10 MHz	2.0 x 2.0 x 4.0	50,8 x 50,8 x 101,6	+12 to +28 VDC	+28 VDC or 115 VAC 10 W. Max.	Proportional	$\pm 1 \times 10^{-8}$/day $\pm 1 \times 10^{-6}$/yr	−10 to +55°C $\pm 5 \times 10^{-8}$
JKXO-41	1-10 MHz	2.0 x 2.0 x 4.25	50,8 x 50,8 x 107,95	+28 VDC	+28 VDC 10 W. Max.	Proportional	$\pm 1 \times 10^{-9}$/day $\pm 1 \times 10^{-7}$/yr	−40 to +70°C $\pm 3 \times 10^{-8}$
JKXO-41	10-100 MHz	2.0 x 2.0 x 4.25	50,8 x 50,8 x 107,95	+28 VDC	+28 VDC 10 W. Max.	Proportional	$\pm 5 \times 10^{-8}$/day $\pm 1 \times 10^{-6}$/yr	−25 to +65°C $\pm 5 \times 10^{-8}$
JKXO-51	1-2 MHz	1.844x 2.0 x 3.436	46,838 x 50,8 x 87,274	+28 VDC	+28 VDC 10 W. Max.	Proportional	$\pm 1 \times 10^{-8}$/day $\pm 3 \times 10^{-7}$/yr	−55 to +75°C $\pm 5 \times 10^{-8}$
JKXO-88-1	1-10 MHz	2.0 x 2.25 x .800	50,8 x 57,15 x 20,32	5 & 12 VDC	+28 VDC 10 W. Max.	Proportional	$\pm 5 \times 10^{-9}$/day $\pm 3 \times 10^{-7}$/yr	−25 to +65°C $\pm 1 \times 10^{-7}$
JKSC-127	10 MHz	4.5 x 2.5 x 2.5	114,3 x 63,5	±15 VDC	+28 VDC 32 W. Max.	Double Oven Proportional	$\pm 5 \times 10^{-10}$/day $\pm 3 \times 10^{-8}$/yr	−55 to +71°C $\pm 5 \times 10^{-9}$
JKXO-130	256 KHz-10 MHz	4.5 x 1.6 x 2.11	114,3 x 40,6 x 53,6	+15 VDC	+15 VDC 10 W. Max.	Proportional	$\pm 5 \times 10^{-10}$/day $\pm 3 \times 10^{-8}$/yr	0 to +60°C $\pm 1 \times 10^{-8}$

* Other voltages available

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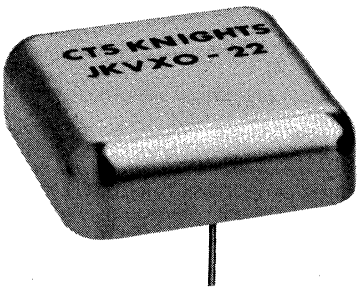
Voltage Controlled Crystal Oscillators—VCXO

JKVXO-22

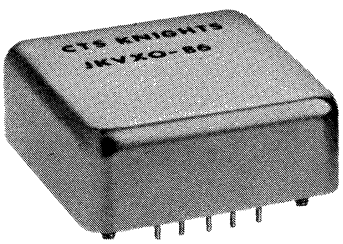


SIZE: 1.63″ x 1.63″ x .5″H

The JKVXO-22 is a low cost VCXO designed for phase locked loop applications. Temperature stability and deviation are customized per application. TTL, HCMOS or ECL outputs available. Operation is from +5V supply (−5V for ECL). Standard models are listed below.

MODEL	FREQUENCY RANGE	STABILITY	DEVIATION	AGING
JKVXO-22A	1 MHz to 30 MHz	±10 ppm, 0°C to +70°C	±40 ppm, 0 to +5 VDC	<2 ppm 1st yr
JKVXO-22B	30 MHz to 50 MHz	±5 ppm, 0°C to +50°C	±12 ppm, 0 to +5 VDC	<1 ppm 1st yr
JKVXO-22C	1 MHz to 30 MHz	±15 ppm, −20°C to +70°C	±100 ppm, 0 to +5 VDC	<2 ppm 1st yr

JKVXO-86



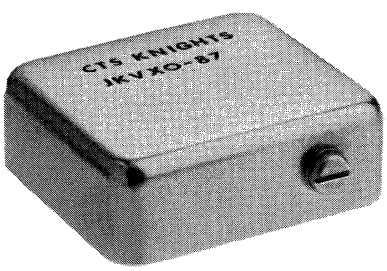
SIZE: 2″ x 2″ x .75″ H

The JKTO-86 is a compact, low cost VCXO designed to meet your requirements. The unit exhibits good stability over the temperature range of 0 to +55°C and provides excellent modulation characteristics.

SPECIFICATIONS

- FREQUENCY RANGE: 5 to 30 MHz
- FREQUENCY DEVIATION: ±1000 ppm
- MODULATION LINEARITY: ±10%
- FREQUENCY STABILITY: ±100 ppm, 0 to +55°C
- DC INPUTS: +12V @ 15 mA typ.
- MODULATION INPUT: ±3V P.P., DC to 20 KHz
- MODULATION RESPONSE: ±1 dB, DC to 20 KHz
- RF OUTPUT: Sine, 0 dBm/min.

JKVXO-87



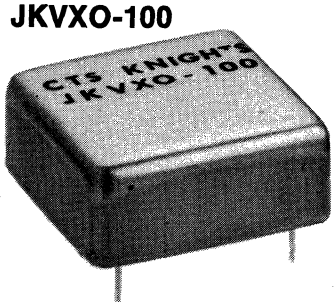
SIZE: 2″ x 2.5″ x .8″ H

The JKVXO-87 is a wide pull VCXO with an integral proportional oven. With its enhanced frequency temperature performance, the JKVXO-87 uses can be extended to those applications requiring a free run condition.

SPECIFICATIONS

- FREQUENCY RANGE: 10-30 MHz
- FREQUENCY DEVIATION: ±1000 ppm
- FREQUENCY VS. TEMPERATURE: ±10 ppm −40°C to +70°C
- MODULATING RESPONSE: DC to 20 KHz
- MODULATION LINEARITY: ±1%
- OUTPUT (sine): 0 dbm min.
- DC INPUT: oven +28 VDC 10 wts max.
  5 wts stabilized
  osc. +12 VDC 30 mA max.

JKVXO-100



SIZE: .86″ x .83″ x .35″ H

The JKTO-100 is a subminiature VCXO designed to meet requirements for wide pullability and good center frequency stability. Uses include digital phase locked loop applications for frequency synthesis and data reception.

SPECIFICATIONS

- FREQUENCY RANGE: 10 to 35 MHz
- CENTER FREQUENCY AT ROOM TEMPERATURE: ±10 ppm at time of shipment
- PULLABILITY: ±200 ppm minimum
- TEMP. STABILITY: 0°C to +60°C ±40 ppm
- OSCILLATOR INPUT: +12 VDC ±10% @ 10 mA max. +5 VDC ±10% @ 25 mA max.
- OUTPUT: TTL (5 loads)

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Custom-Built Filters

The basic building block for all custom built CTS Knights filters is the two-pole monolithic filter available in standard package styles as shown in figure 34.

Two-pole monolithic filters can be cascaded to produce four, six and eight or more pole filter responses with the addition of coupling capacitors between two-pole sections. Using the bandwidth and shape factor charts (fig's. 32, 33) the equipment designer can specify an inexpensive filter supplied by CTS Knights to his specifications as a set of two, three, four or more "Monolithics" (coupling capacitor information will also be provided). For applications requiring plug-in packaged filters, the filter specifier may select one of the five standard CTS Knights packages (fig's. 35, 36, 37, 38, 39) or supply dimensional, termination and mounting information on a package of his choice.

Input/Output impedances of packaged filters may be specified at 50 ohms minimum.

Filter parameters such as insertion loss, ripple, spurious response and ultimate attenuation are not easily chartable. However, some general guidelines to specifying these values are given below:

Insertion loss — typically 1.5 dB per 2-pole section
Ripple — 1 dB minimum for most designs
Ultimate attenuation — 35 dB maximum per 2-pole section for acoustically coupled designs
Spurious attenuation (Best attainable for most designs)

2-pole	20 dB	6-pole	45 dB	10-pole	75 dB
4-pole	35 dB	8-pole	60 dB		

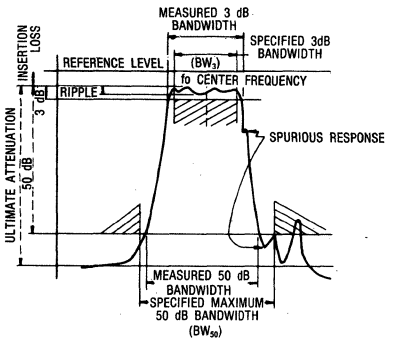


Fig. 31
Filter Parameters Normally Specified

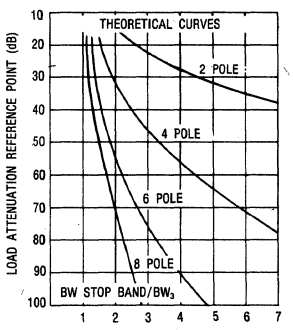


Fig. 32
.1 dB CHEBY Shape Factor
(Normalized to 3-dB Bandwidth)

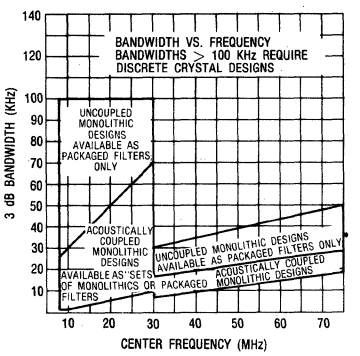
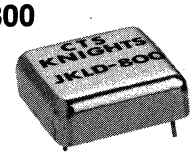
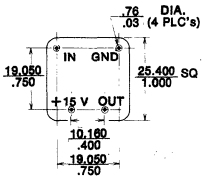


Fig. 33
Bandwidth vs. Frequency

JKLD-800





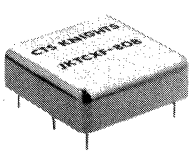
HYBRID LIMITER-DISCRIMINATOR

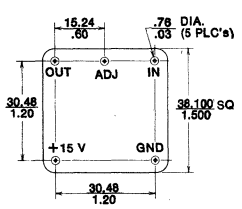
The JKLD-800 is a subminiature crystal discriminator designed to meet low distortion requirements (4% max. 2-3% typical) for detecting voice information in FM radio applications. This compact design (.35 cubic inches) offers high performance over a wide range of input level with internal limiting at −25 dbm input power. DC to 15 KHz video bandwidth is typical.

SPECIFICATIONS

- CENTER FREQ.: 17.0 MHz (available at 10 thru 18 MHz)
- LINEAR BW: ±10 KHz (peak to peak BW ±30 KHz min.)
- OUTPUT: ±1.0V ±.25V @ ±10 KHz deviation
- Z IN: 50Ω
- Z OUT: <100 KΩ min.
- SUPPLY: +15 VDC ±15%
- OPERATING TEMP. RANGE: −20°C to +85°C

JKTCXF-808





Narrow bandwidth, temp. compensated crystal filter voltage tunable center frequency and a clean gaussian response makes this 2 pole filter especially useful for signal processing and analyzing equipment. Total power consumption for compensation is less than 5 mw.

SPECIFICATIONS

- OPERATING TEMP. RANGE: 0°C to 70°C
- Fcenter: 10 MHz (available from 8 thru 27 MHz)
- Fc stability: ±1 ppm
- Fc tunability: ±10 ppm, min. for V_{ADJ} = 2 to 15V
- BW6: 300 Hz (available 25 to 50 ppm)
- SHAPE FACTOR 30/6: = 8.0 max.
- INPUT: +15 VDC ±2%
- CURRENT: = 0.2 mA max.
- Z IN/OUT: 50Ω
- INSERTION LOSS: 7.0 dB max.
- PACKAGE VOLUME: 1.2 cubic inches max.

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Standard Filters

10.7 MHz—1000 SERIES
21.4 MHz—2000 SERIES

1 411 A

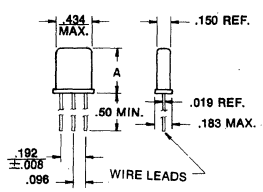
1 — 1ST DIGIT OF CTS SERIES
411 — ELECTRICAL RESPONSE CODE
A — STANDARD PACKAGE (USE M FOR MONOLITHIC SETS)

Over 100 different 10.7 MHz (CTS 1000 Series) and 21.4 MHz (CTS 2000 Series) filter configurations are available with virtually OFF-THE-SHELF delivery from CTS Knights. The basic building block for CTS Knights' standard filters is the R3W3 dual resonator monolithic crystal. Standard filters ordered as "Monolithic Sets," are supplied as loose R3W3 dual resonator crystals separated by type with instructions on how to couple the crystals together for total filter performance. Filters ordered in standard packages A, B, C, D, or E provide plug-in convenience. Order from table by part number as shown below.

ELECTRICAL RESPONSE CODE	3 dB BW_3 KHz MIN.	40 dB BW_{40} KHz MAX.	60 dB BW_{60} KHz MAX.	INSERTION LOSS dB MAX.	RIPPLE dB MAX.	INPUT/OUTPUT IMPEDANCE Ω NOM. 10.7 MHz 1000 SERIES	INPUT/OUTPUT IMPEDANCE Ω NOM. 21.4 MHz 2000 SERIES	MECHANICAL CONFIGURATION MONOLITHIC SETS SET OF ( ) H3W3	MECHANICAL CONFIGURATION STANDARD PACKAGE AVAILABLE
211	13	143	—	1.5	2	2200	600	(1)	A, B, C, D, E1
411	13	41	84	2.0	2	3200	810	(2)	A, B, C, D, E1
611	13	26	38	3.0	2	3400	860	(3)	A, B, C, D, E2
811	13	23	27	4.0	2	3400	860	(4)	A, B, C, D, E3
412	13	41	84	2.5	2	50	50	—	A, B, C
612	13	26	38	3.5	2	50	50	—	A, B, C
812	13	23	27	4.5	2	50	50	—	A, B, C
221	15	165	—	1.5	2	2500	690	(1)	A, B, C, D, E1
421	15	46	96	2.0	2	3400	850	(2)	A, B, C, D, E1
621	15	29	43	3.0	2	3700	930	(3)	A, B, C, D, E2
821	15	26	31	4.0	2	3700	930	(4)	A, B, C, D, E3
422	15	46	96	2.5	2	50	50	—	A, B, C
622	15	29	43	3.5	2	50	50	—	A, B, C
822	15	26	31	4.5	2	50	50	—	A, B, C
231	30	330	—	1.5	2	4000	1200	(1)	A, B, C, D, E1
431	30	90	185	2.0	2	5600	1800	(2)	A, B, C, D, E1
631	30	56	83	3.0	2	5900	1800	(3)	A, B, C, D, E2
831	30	50	60	4.0	2	5900	2000	(4)	A, B, C, D, E3
432	30	90	185	2.5	2	50	50	—	A, B, C
632	30	56	83	3.5	2	50	50	—	A, B, C
832	30	50	60	4.5	2	50	50	—	A, B, C
742	72	—	225	6.0	3	50	*	—	See Factory
452	240	1000	—	5.0	2†	50	*	—	See Factory

* Available as 1000 Series only.

† Filter designed for wide band FM use. Maximum deviation of measured phase shift from the best fit (least squares method) straight line is less than the greater of 5° or 10% of the phase value read from the straight line.



HOLDER	"A" DIM.	FREQ. RANGE
R3W3	.530 MAX.	7-75 MHz
R3Y3	.430 MAX.	7-75 MHz
R3T3	.380 MAX.	15-75 MHz

Fig. 34

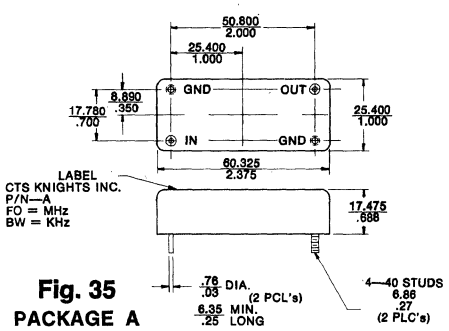


Fig. 35
PACKAGE A

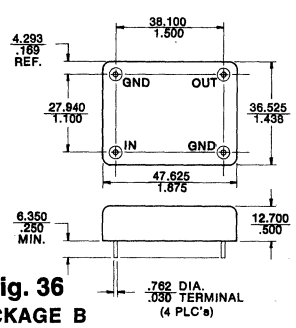


Fig. 36
PACKAGE B

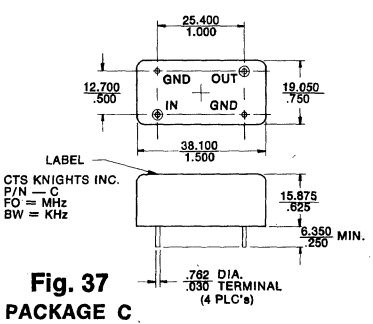


Fig. 37
PACKAGE C

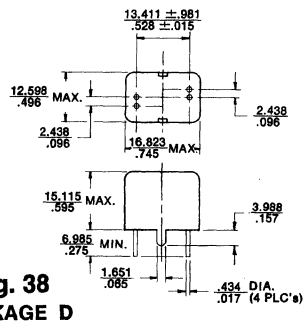
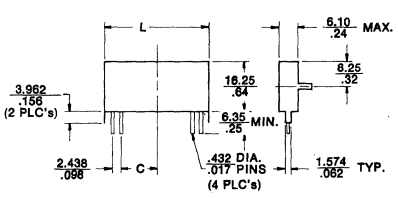


Fig. 38
PACKAGE D



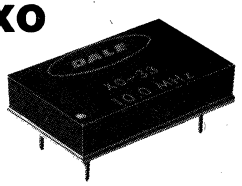
STYLE CASE	L (MAX.) IN	L (MAX.) MM	C IN	C MM
E1	.935	23.749	.235	5.969
E2	1.330	33.782	.425	10.795
E3	1.770	44.958	.669	16.993

Fig. 39
PACKAGE E

CTS — QUALITY, FREQUENCY CONTROL COMPONENTS FOR RELIABLE ELECTRONICS

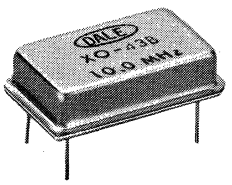
HYBRID CRYSTAL CLOCK OSCILLATORS

MODEL XO



XO-33
250 KHz to 60 MHz

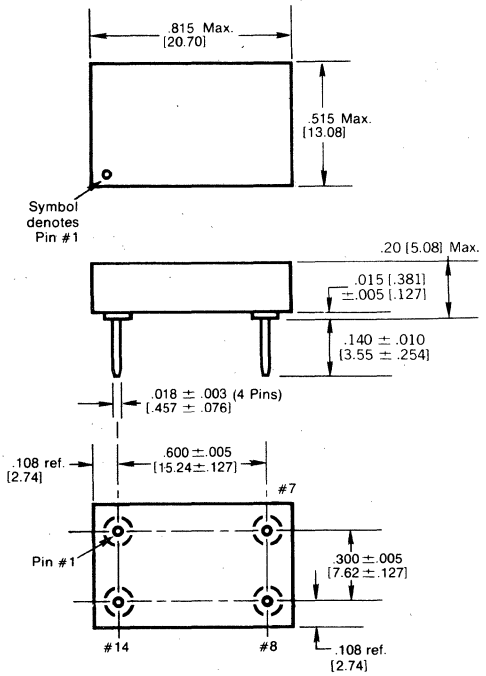
Hybrid, low profile. Stocking frequencies: (B accuracy only) 1.0, 1.2288, 2.0, 2.4576, 4.0, 4.9152, 5.0, 5.0688, 6.0, 8.0, 10.0, 12.0, 16.0, 16.384, 18.432, 19.6608, 20.0, 24.0, 25.0, 30.0, 32.0, 40.0, 50.0 MHz.

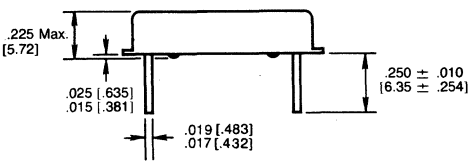


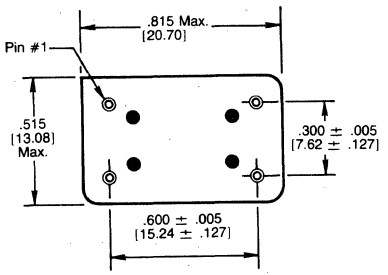
XO-43
250 KHz to 60 MHz
RESISTANCE WELDED METAL PACKAGE

Hybrid, low profile. Stocking frequencies: (B accuracy only) 1.0, 1.2288, 2.0, 2.4576, 4.0, 4.9152, 5.0, 5.0688, 6.0, 8.0, 10.0, 12.0, 16.0, 16.384, 18.432, 19.6608, 20.0, 24.0, 25.0, 30.0, 32.0, 40.0, 50.0 MHz.

DIMENSIONS







Pin #1 is identified by square corner

SPECIFICATIONS	Model XO-33	Model XO-43
Output Freq. as Specified	From 250 KHz to 60 MHz	From 250 KHz to 60 MHz
Frequency Accuracy and Stability all Conditions	XO-33A ±.005% XO-33B ±.01% XO-33C ±.05% XO-33D ±.1% XO-33H ± 1%	XO-43A ±.005% XO-43B ±.01% XO-43C ±.05% XO-43D ±.1% XO-43H ± 1%
Operating Temperature	0°C to +70°C	0°C to +70°C
Supply Voltage	+5Vdc ± 0.5V	+5Vdc ± 0.5V
Input Current	Below 4.0 MHz: 65 mA max. 4.0 MHz to 15.9 MHz: 40 mA max. 16 MHz to 25.0 MHz: 70 mA max. 25.1 MHz to 60.0 MHz: 50 mA max.	Below 4.0 MHz: 65 mA max. 4.0 MHz to 24.99 MHz: 40 mA max. 25.0 MHz to 60.0 MHz: 50 mA max.
Symmetry at 1.4 VDC Level	60/40 or better	*1
Rise and Fall Time	Below 16 MHz: 15 nS max. 16 MHz and above: 10 nS max.	Below 4.0 MHz: 15 nS max. 4.0 MHz to 24.99 MHz: 10 nS max. 25.0 MHz to 60.0 MHz: 6 nS max.
"Zero" Level Sinking 16 mA	Below 16 MHz: 0.4V max. 16 MHz and above: 0.5V max.	0.4V max.
"One" Level Sourcing 0.4 mA	2.4V min.	2.4V min.

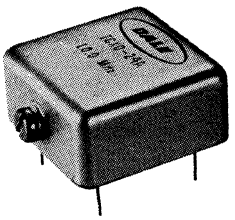
*1 250 KHz to 3.99 MHz: 55/45 or better, 4.0 MHz to 60.0 MHz: 60/40 or better

For additional information, contact
DALE ELECTRONICS, INC., 1155 West 23rd Street, Tempe, AZ 85282 • Phone 602-967-7874

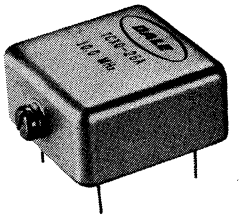
TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

MODEL TCXO: 4.0, 5.0 and 10.0 MHz stock frequencies

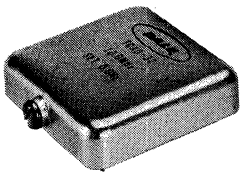
TCXO-22



TCXO-24



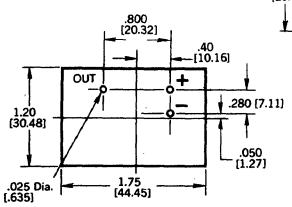
TCXO-26

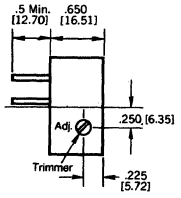


TCXO-32

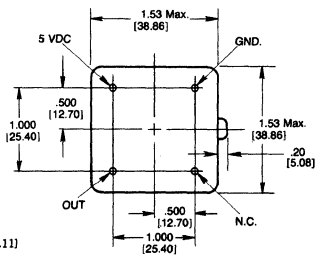
DIMENSIONS

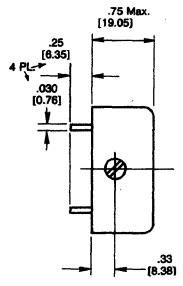
Model TCXO-22



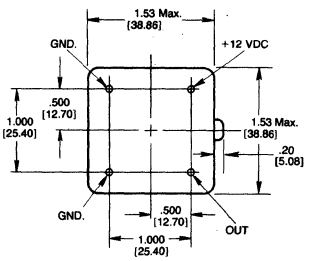


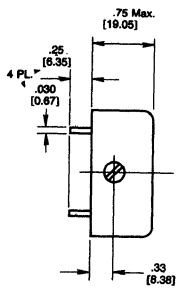
Model TCXO-24



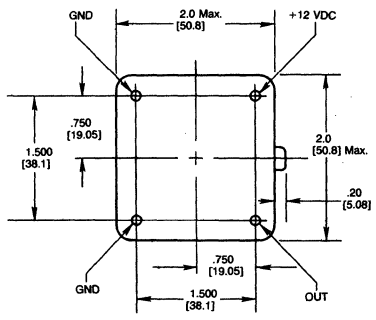


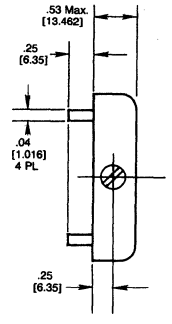
Model TCXO-26





Model TCXO-32





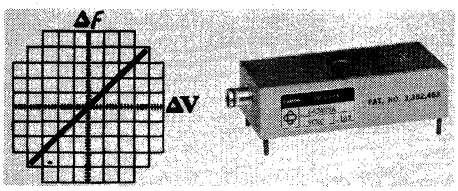
SPECIFICATIONS	Model TCXO-22 and Model TCXO-24 (A, B or C)	Model TCXO-26	Model TCXO-32
Frequency Range	4 to 15.0 MHz	4 to 15.0 MHz	3 to 15.0 MHz
Accuracy at +25°C	±1 PPM (Adjustable)	±1 PPM Adjustable with Trimmer	±1 PPM Adjustable with Trimmer
Stability vs. Input Voltage	±0.2 PPM for ±10% Volt. Change	±0.25 PPM for ±5% Volt. Change	±0.10 PPM for ±5% Volt. Change
Stability vs. Temp.	TCXO-22A, TCXO-24A ±1 PPM 0 to +55°C TCXO-22B, TCXO-24B ±1 PPM +15 to +50°C TCXO-22C, TCXO-24C ±5 PPM 0 to +55°C	±1 PPM 0 to 70°C	±1 PPM −40°C to +85°C for TCXO-32A ±3 PPM −40°C to +85°C for TCXO-32B
Stability vs. Time	1 PPM/Year Max.	1 PPM/Year Max.	1 PPM/Year Max.
Stability vs. Loading	±0.1 PPM for ±20% Load Change	±0.1 PPM for ±20% Load Change	±0.1 PPM for ±20% Load Change
Input Power	V = 5VDC ±10%/Current 16 mA Max.	12VDC ±5%/Current 26 mA Max.	12VDC ±5%/Current 15 mA Typ.
Output Signal	TTL Compatible, Drives 10 Loads	TTL Compatible, Drives 10 Loads	TTL Compatible, Drives 10 Loads
Rise and Fall Time	20 nS Max.	20 nS Max.	20 nS Max.
Symmetry	60/40 or Better at 1.4V Level	60/40 or Better at 1.4V Level	60/40 or Better at 1.4V Level

For additional information, contact
DALE ELECTRONICS, INC., 1155 West 23rd Street, Tempe, AZ 85282 • Phone 602-967-7874

DAMON *THE FORM FACTOR SPECIALISTS*

VCXOs — 1 KHz to 500 MHz

Damon VCXOs provide high stability over a broad range of center frequencies. An optional square wave or pulse output signal compatible with I. C. logic circuits is available.

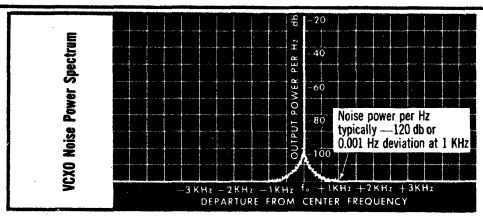


VCXO CHARACTERISTICS:

Center Frequency .. 1 KHz to 500 MHz
Deviation ..... .01% to 0.5% of Center Frequency
Linearity 1% to 5% of Peak Deviation
Frequency Stability .... Determined by Peak Deviation and Operating Temp.
Modulation Rates ..... DC to 2 MHz

Low Noise VCXOs

Damon low noise miniaturized VCXOs are all solid state quartz crystal stable oscillators whose frequencies can be varied linearly by an external DC or AC modulating signal. Only a source of power and control signal are required . . . no auxiliary compensating circuitry.

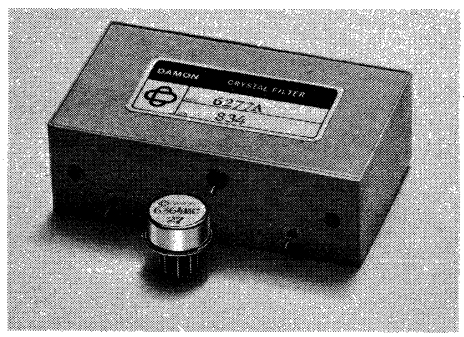


TYPICAL CHARACTERISTICS:

Center Frequency 10.000 MHz ±1 KHz
Deviation ..... ±10 KHz
Linearity ..... ±1%
Modulation Rate ..... Flat to 4 KHz
Output Power ..... >1 MW

Gaussian Crystal Filters

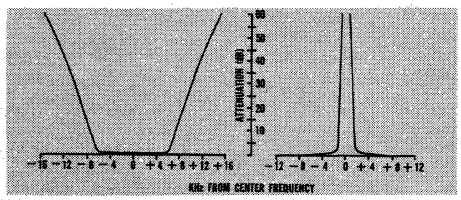
Gaussian Crystal Filters of either conventional or monolithic design. Useful in FM communications or radar systems where flat time delay is required. In a coherent pulsed radar, it can minimize return-pulse overshoot. Eliminates ringing problems in swept spectrum analysis. Available in 2 to 8 pole designs.



Center Frequency
Conventional ..... 10 KHz - 35 MHz
Monolithic ..... 3 - 30 MHz
3 dB Bandwidth ..... 100 Hz - 30 KHz
Shape Factor, 30 dB to 3 dB 3:1 to 7:1
Ringing, Pulse or Impulse 25 - 50 dB down
Phase Linearity ..... ±2%
No. of Poles
Conventional ..... 2 - 8
Monolithic ..... 2 - 4
Volume
Conventional ..... 1 - 6 cu. in.
Monolithic ..... 0.016 - 0.4 cu. in.

Band-Pass/Reject Crystal Filters

A wide variety of conventional crystal filters are produced at Damon. Standards designs such as Butterworth, Chebyshev, Gaussian, Bessel, and Legendre, as well as custom tailored designs are available.

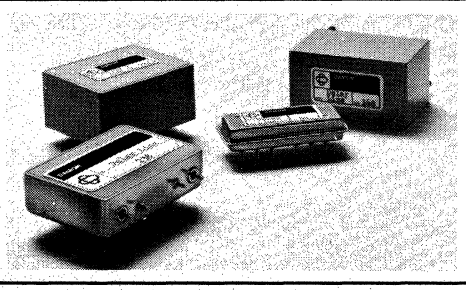


RANGE OF PARAMETERS:

Center Frequency .... 10 KHz - 75 MHz
Bandwidth ..... .01% - 3% of C.F.
Shape Factor ..... Down to 1.2:1
Differential Phase Shift ..... ±2°
Group Delay Uniformity ..... ±5%

Surface-Wave Delay Lines

With signal transfer **across** the surface instead of through the body (a state-of-the-art development), the new Surface-Wave concept results in substantially smaller packages, lower cost in production quantities and superior performance over a 20 MHz to 300 MHz range.

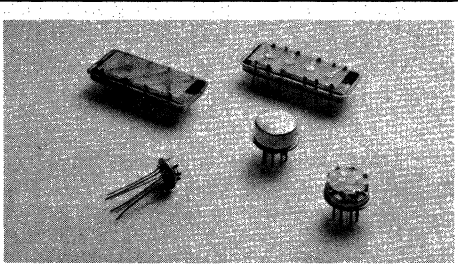


RANGE OF PARAMETERS:

Frequency Range .. 20 MHz - 300 MHz
Time Delay Range 0.5 - 20 Microsecs.
Bandwidth at −3 dB ..... 3% - 30% of Center Frequency
Insertion Loss ..... 10 - 20 dB
Spurious Responses 25 - 30 dB below Desired Response
Environment ..... Full Military Temp., Shock, Vibration Available
Typical Size ..... < 1 cu. in.

Monolithic Crystal Filters

Damon Monolithic Filters utilize a single quartz plate for multiple resonators and the coupling medium between them. Advantages over conventional crystal filters include smaller size, superior stability, and lower cost. Available in a wide variety of computer-assisted designs from Chebyshev to Gaussian characteristics and from 2 to 8 poles.



MONOLITHIC CHARACTERISTICS:

Center Frequency ..... 2.5 - 30 MHz
3 dB Bandwidth ..... 0.3 - 30 KHz
No. of Coupled Resonators ..... 2 - 6
Insertion Loss ..... 1 - 6 dB
Ripple ..... 0.5 dB Max.
Terminations .. 50 Ohms to 20 Kohms
Size ..... TO-5, TO-8, or Flat-Pack

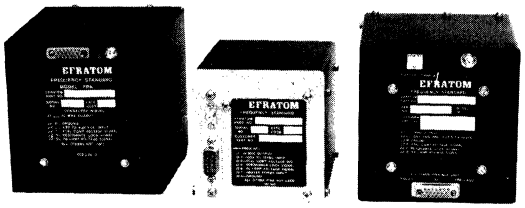
Write for technical bulletins.

DAMON/ELECTRONICS DIVISION
DEPT. EM, 80 WILSON WAY, WESTWOOD, MASS. 02090, TEL: (617) 449-0800, TWX (710) 348-6222

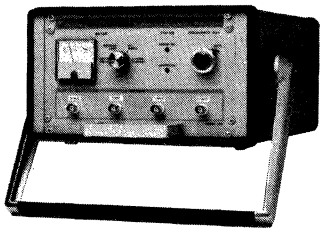
time and frequency systems

EFRATOM
A DIVISION OF Ball CORP.

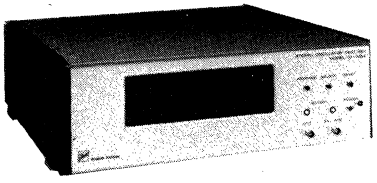
RUBIDIUM OSCILLATORS



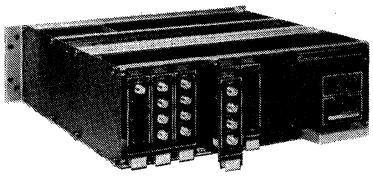
FRK M-1000 M-100



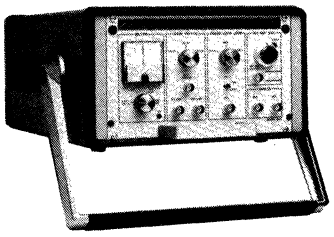
MODEL MRT
RUBIDIUM FREQUENCY STANDARD



MODEL TS-105A
ATOMIC OSCILLATOR TEST SET



MODEL MFS
MODULAR FREQUENCY SYSTEM



MODEL MNT
PHASE NOISE TEST SET

EFRATOM is the recognized world leader in precision time and frequency systems for military/aerospace and commercial applications. Utilizing state-of-the-art atomic oscillator technology, EFRATOM has conceived and developed a family of time and frequency references that find valuable application in radio navigation, geophysical survey positioning systems, satellite tracking and control, communication systems employing PCM and spread spectrum techniques and standard time and interval generation and transfer.

EFRATOM's Model M-1000 is the world's smallest military atomic oscillator measuring just 3.25 in x 3.25 in x 4.5 in (83 mm x 83 mm x 114 mm), yet this instrument has excellent long term stability and fast warm-up performance. Developed specifically for military use, the Model M-100 and M-1000 rubidium oscillators are radiation hardened and offer unparalled performance in the toughest of airborne and ground environments.

EFRATOM also offers a modular line of frequency components, Model MFS in a 19 inch rack, permitting the user to configure unique time and frequency systems including GPS and Omega calibration.

Complimentary to its range of precision oscillators, EFRATOM offers the Model MRT ultra-stable atomic frequency standard for laboratory and field calibration. More recently, EFRATOM introduced its Atomic Oscillator Test Set, Model TS-105A, for frequency stability (Allan Variance) measurements, and a Phase noise Test Set, Model MNT.

EFRATOM's scientists, in conjunction with NBS, have developed a Compact Passive Hydrogen Maser for commercial production (not pictured above, but specified below).

MODEL	FRK-L	FRK-H	MRT-L	MRT-H	M-100	M-1000	CPHM
Output Frequency	10 MHz		2 ea 10; 5; 1; 0.1 MHz		10 MHz	10 MHz	5 MHz
Long Term Drift/mo	$4x10^{-11}$	$1x10^{-11}$	$4x10^{-11}$	$1x10^{-11}$	$6x10^{-11}$/Opt. $1x10^{-11}$	$3x10^{-11}$	$<1x10^{-15}$/day
Short Term (100s)	$3x10^{-12}$	$1x10^{-12}$	$3x10^{-12}$	$1x10^{-12}$	$3x10^{-12}$	$4x10^{-12}$	$2x10^{-13}$
Phase Noise (1 Hz BW) SSB	>120 dB (100 Hz) >145 dB (1 KHz) from carrier				>120 dB @ 100 Hz >135 dB @ 1 KHz	>140 dB @ 100 Hz >150 dB @ 1 KHz	−113 dB (1 Hz) −155 dB (>100 Hz)
	Low Noise Option 155 dB (100 Hz)						
Warm-Up	<10 minutes for $2x10^{-10}$				*<10 min to $2x10^{-10}$	<2.5 min to $5x10^{-10}$	~24 Hrs
Operations Temperature	−25°C to +65°C Base Plate		−10°C to +50°C Ambient		−55°C to +55°C Ambient (+68°C Base Plate)	−55°C to +71°C Ambient (+80°C Base Plate)	0°C to +50°C
Power at 25°C	22 VDC to 32 VDC/13W		110/220 VAC/50W		22.5 to 32 VDC/18W	22 to 32 VDC/15W	<70W
Dimensions	~4x4x4.5 inches		6x9x16 inches		~4x4x4.8 inches	3.25x3.25x4.5 in.	19x10.5x24 in.
Weight	2.9 lbs		27 lbs		4 lbs	<2.3 lbs	~70 lbs

*5 min warm-up available

EFRATOM *USA/18851 Bardeen Ave./Irvine, CA 92715/Telephone (714) 752-2891/Telex 685-635*
Europe & W. Germany/AM Perlacher Forst-186/D-8000 Muenchen 90/Phone (089) 648059/Telex 529701

electronic research company

7618 Wedd, Overland Park, Kansas 66204
TWX: (910) 749-6477
Telephone: (913) 631-6700

GENERAL

Electronic Research Company Model ER8001 is a Precision Ovenized Crystal Oscillator utilizing a 5MHz third overtone crystal manufactured by E.R.C. Model ER8002 uses the same crystal except the output frequency is multiplied to 10MHz. These oscillators are ideal for applications where a precision time base is to be multiplied or synthesized requiring a low phase noise source.

SPECIFICATIONS

Output Frequency: Model ER8001, 5MHz; Model ER8002, 10MHz
Output Level: 1Vrms Minimum into a 50 ohm load
Waveform: Sine-Wave
Harmonic Distortion: 40dB below rated output
Frequency Adjustment: $\pm$2.5PPM Min. course mechanical; $\pm 2.0 \times 10^{-7}$ Min. fine mechanical; $\pm$1.0PPM Min. electrical option 3 only; By D.C. Voltage (-10 to $+10$V)
Input Voltage: +12VDC $\pm$10%, Current at Turn-on 340MA Max. Note input terminals No. 2 & 4 may be connected together externally.
Frequency Stability vs. Input: $\pm 3 \times 10^{-9}$ for a $\pm$10% change in input
Frequency Stability vs. Load: $\pm 1 \times 10^{-9}$ for a $\pm$10% change in load
Frequency Stability vs. Temperature: $\pm 5 \times 10^{-9}$ from -20°C to $+65$°C ambient
Warm-up Time: 1×10^{-7} in 15 Min.; $\pm 1 \times 10^{-8}$ in 20 Min.
Aging Rate: 1×10^{-9}/24 hours, after 72 hours on time
Short Term: 3×10^{-11} RMS for one second averaging time
Retrace: $\pm 1 \times 10^{-8}$ after 60 Min. warm-up following a 24 hour off time
Input Power: At turn-on 340MA — After warm-up operating at +25°C 135MA, After warm-up operating at -20°C 225MA
Frequency Stability vs. Orientation: 1.5×10^{-9} worst case
Size: Model ER8001 and Model ER8003 2″ x 2″ x 4″ H
Model ER8005 2.25″ x 2.25″ x 4.25″ H

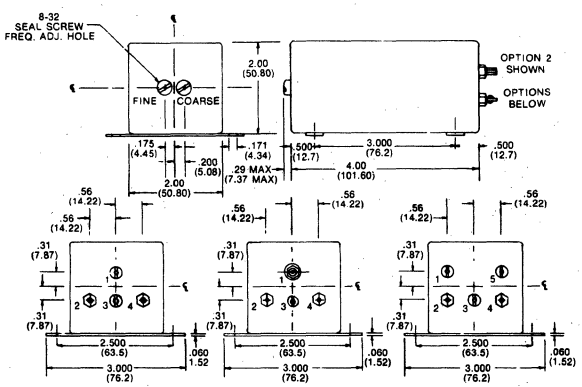
PHASE NOISE S.S.B. 1Hz BW

Offset From Carrier	S/N
10Hz	124dB
100Hz	135dB
1000Hz	145dB
5000Hz	150dB

OPTIONS AVAILABLE

Output Voltage: T.T.L.
Input Voltage: $\pm$12VDC, +15VDC, +24VDC, +30VDC
Mechanical: Various please specify
Long Term Stability: 5×10^{-10}/24 hours
Output Frequencies: 1MHz to 15MHz
Tuning: Electrical fine tune options

Technical specifications are subject to change without notice.



OPTION 1
PIN CONNECTIONS
1. OUTPUT RF
2. OSC. INPUT
3. GROUND + CASE
4. OVEN INPUT

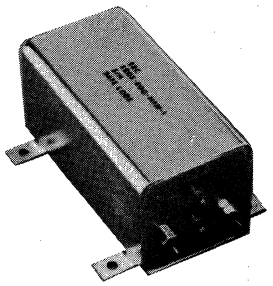
PINS 2 and 4
ERIE# 2499-008-502Z
PINS 1 and 3
104 - LOOP

OPTION 2
PIN CONNECTIONS
1. OUTPUT RF
2. OSC. INPUT
3. GROUND + CASE
4. OVEN INPUT

PINS 2 and 4
ERIE# 2499-008-502Z
PIN 1
SELECTRO
P/N 51-043-4300
PIN 3
104 - LOOP

OPTION 3
PIN CONNECTIONS
1. OUTPUT RF
2. OSC. INPUT
3. GROUND + CASE
4. OVEN INPUT
5. VCO INPUT

PINS 2 and 4
ERIE# 2499-008-502Z
PINS 1, 3 and 5
104 - LOOP



PRECISION CRYSTAL OSCILLATORS

SERIES 8000

Standard Frequency: 5.0MHz
Aging Rate: Model ER8001 1×10^{-9}/day
Model ER8003 1×10^{-10}/day
Model ER8005 5×10^{-11}/day
Phase Noise: SSB 1Hz BW at 10Hz offset
Model ER8001, 124dB
Model ER8003, 135dB
Input Voltage: 12VDC $\pm$10% standard
Output: Sine-wave 1VRMS into 50 ohm load
Size: Model ER8001 and Model ER8003 2″ x 2″ x 4″ H
Model ER8005 2.25″ x 2.25″ x 4.25″ H
Options: Many options are available to interface with your requirements

Electronic Research Company Series 8000 precision ovenized crystal oscillators are the ultimate choice where proven reliability and frequency stability is required. These oscillators are ideal for applications where a precision time base is to be multiplied or synthesized requiring a low phase noise source. All Electronic Research Company's oscillators utilize quartz crystals manufactured by ERC for maximum control on all parameters to insure performance specifications. If your application requires superior oscillator performance call us or write for our complimentary catalogue.

For information and prices, send your specifications to:

electronic research company
7618 Wedd, Overland Park, Kansas 66204
TWX: (910) 749-6477
Telephone: (913) 631-6700

...for the leading edge in quartz products.

Crystals
Standard • Custom • Tape & Reel • Surface Mount
Hermetic Ceramic Flat Pack Dip Crystals

Oscillators
TTL • CMOS • ECL • Standard • 14 Pin Dip Metal and IC Package
Enable / Disable • Dual Output • TCXO • VCXO • Auto Insertable • Surface Mount

Filters
Discrete • Two Pole • Multi Pole • Monolithic

Ceramic Resonators
Low Frequency • High Frequency • High Frequency with Built-in Capacitor

Surface Acoustic Wave
Custom & Standard Saw Devices
Filters • Resonators • Delay Lines

6225 Presidential Court, Fort Myers, Florida 33907
TWX 510-951-7386 • FAX 813-433-2824 • 800-237-8758 • 813-482-7212

FTS • FREQENCY AND TIME SYSTEMS, INC.

a DATUM company

ULTRA HIGH STABILITY OSCILLATORS (OCXO)

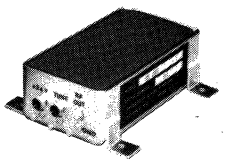
MODELS

FTS 1000A Series Oscillators
FTS 9000 Series Militarized/Aerospace Oscillators

FEATURES

- 4 to 12 MHz output signal frequency
- Analog and/or mechanical tuning
- 1 to 4 independently buffered outputs
- High performance options for aging to parts in 10^{11}
- Special options upon request

OVEN CONTROLLED CRYSTAL OSCILLATORS (OCXO)



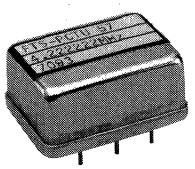
MODELS

FTS 2000 Series Oscillators
FTS PMT Series Oscillators

FEATURES

- 1 to 130 MHz output signal frequency
- Full range of performance specs
- Circuit board mountable

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS (TCXO)



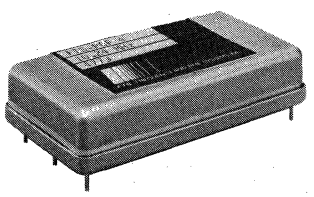
MODEL

FTS PCT Series Oscillators

FEATURES

- 4 to 165 MHz output signal frequency
- High stability without oven
- Instantaneous start-up

VOLTAGE CONTROLLED CRYSTAL OSCILLATORS (VCXO)



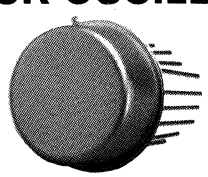
MODELS

FTS PCF Series Oscillator

FEATURES

- Small size
- Wide deviation
- High stability
- Good linearity

CLOCK OSCILLATORS



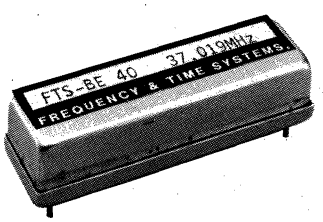
MODELS

FTS O Series Oscillator

FEATURES

- Small size
- Multi-output
- Low power consumption

CRYSTAL FILTERS



TYPES

Bandpass
Notch
Low-pass
High-pass

FEATURES

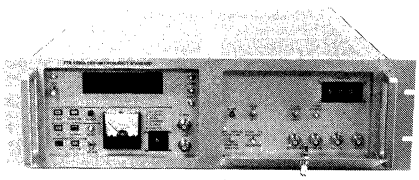
- Advanced technology
- Small size
- Reliable
- Wide-band or narrow band
- 0.4 to 300 MHz

34 TOZER ROAD, BEVERLY, MASSACHUSETTS 01915
Telephone (617) 927-8220 / Telex 94-0518 FTS BVLY

FTS • FREQENCY AND TIME SYSTEMS, INC.

a DATUM company

CESIUM BEAM STANDARDS FOR FREQUENCY AND TIME



FTS Cesium Standards are recognized for providing the ultimate in accuracy, stability, and signal purity for atomic time and frequency standards.

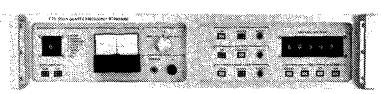
MODELS

FTS 4050A Primary Standard
FTS 4150 Militarized Primary Standard
FTS 5000 Modular Standard
FTS 4100 Militarized FTS 5000

FLEXIBILITY

- Multiple rf output signals
- Multiple pulse output signals
- Time-of-day display
- Internal battery/charger
- Multiple power inputs
- Fast warm-up
- Acceleration compensation
- 0 to 50°C or −28°C to +65°C
- Cesium beam tube retrofit kit for the HP5061A Cesium Standard
- Special options upon request

QUARTZ STANDARDS FOR FREQUENCY AND TIME



FTS Quartz Standards provide excellent value and high performance (aging to parts in 10^{11} per day) using quartz crystal resonator technology.

MODELS

FTS 1050A Quartz Standard
FTS 1050A/015 Disciplined Standard
FTS 9500 Militarized Quartz Standard

FLEXIBILITY

- Multiple rf output signals
- Multiple pulse and time code output signals
- Time-of-day display
- Internal battery/charger
- Multiple power inputs
- Extended temperature range
- Frequency/phase lock with memory
- Special options upon request

SATELLITE RECEIVERS FOR FREQUENCY AND TIME

FTS Satellite Receivers provide world-wide acquisition of time (UTC) to ±100 ns and frequency monitoring to parts in 10^{12}.

MODELS

FTS T-200 Transit Receiver
FTS 8200 Militarized Transit Receiver
FTS 8400 NAVSTAR (GPS) Receiver

FLEXIBILITY

- Time pulse and time code outputs
- Time-of-day display
- Position determination
- RS232C and IEEE-488 interface
- Special options upon request

Frequency and Time Systems, Inc. produces a complete line of state-of-the-art time and frequency standards. Included are primary cesium beam standards, quartz crystal oscillators, satellite timing receivers and integrated systems for the commercial as well as the military/aerospace markets.

Over a decade of design and production experience provides the basis for the company's present position of technological leadership. FTS offers a unique engineering and production facility. The modern, FTS-owned plant houses the very best in scientific and engineering capability, production control, quality asurance, restricted access production and customer service.

Specializing in satisfaction of individual customer requirements, FTS tailors its expertise in technology and production to meet exacting, customer defined specifications.

The company's products are in use today as: master frequency and time references for secure, high data rate telecommunications systems, satellite ground terminals, remote stations, metrology, laboratory research, offshore positioning and shipboard timing systems.

Militarized applications find FTS products employed in airborne, land-mobile, and space programs for navigation and communication.

Frequency and Time Systems, Inc. offers a total spectrum of commercial, military, and aerospace products — resulting from a total commitment as time and frequency specialists.

34 TOZER ROAD, BEVERLY, MASSACHUSETTS 01915
Telephone (617) 927-8220 / Telex 94-0518 FTS BVLY

Frequency Electronics' capability is from the basic quartz crystal to complete time and frequency systems.

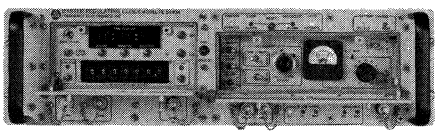
Timekeeper for Outer Space... Ask anyone who knows anything about this nation's deep space probe and satellite programs to mention any 10. Our instruments or equipment are aboard at least 8.

Hybridized Cesium Beam Primary Frequency Standard

Model FE-5440A, Option FH
Military Nomenclature (0-1824/U)

NEW

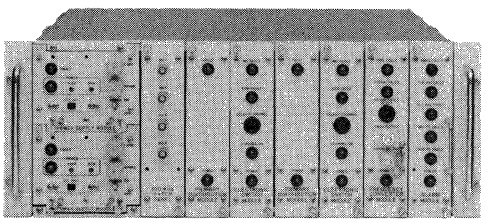
High Reliability, Militarized Cesium Beam Frequency Standards for aerospace, shipboard, laboratory and mobile applications.



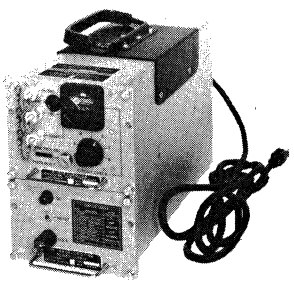
Frequency Distribution Systems

Models FE-798A/FE-799A

A militarized, high reliability RF distribution system for satellite ground stations and shipboard, mobile, and laboratory applications.



INSTRUMENTS

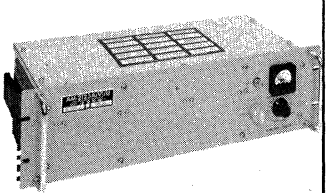


Model FE-1000Q
(AN/URQ-10A)
High Stability
Frequency Standards

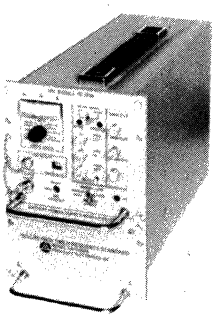
NEW

Model FE-7913A
Model FE-7914A

Low Noise,
High Isolation
Signal Distribution
Systems



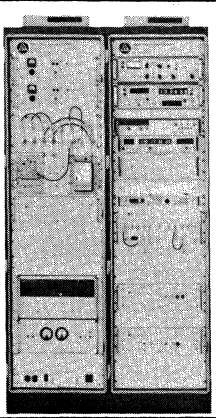
Model FE-70Q
(AM-2123A(V)/U)
Distribution
Amplifier



Model FE-1050A
(AN/URQ-23)
Disciplined Time
Frequency Standard

SYSTEM CAPABILITY

Model FE-5054A
(CTFS)
Communication
Time and Frequency
Standards



RUBIDIUM STANDARD

NEW

Model FE-5600A

MIL-E-5400, Class II
Fast Warm-up
MIL-SPEC Power
Low g Sensitivity

INSTRUMENTS
Disciplined Time Frequency Standards
High Stability Frequency Standards
Frequency Standard Carrying Cases
Digital Phase Comparators
Frequency Error Analyzers
Distribution Amplifiers
RF Switchovers
Passive Combiners
Digital Clocks
Microwave Frequency Multipliers
High Frequency Amplifiers
UHF Down-Converters
UHF Up-Converters

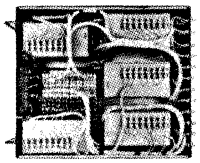
SYSTEMS
Time & Frequency Control Systems
UHF Synthesizers
Frequency Generators
Coherent Microwave Synthesizers
RF Switching Systems

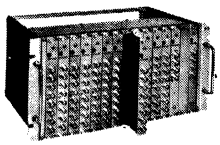
FREQUENCY ELECTRONICS, INC.

55 Charles Lindbergh Blvd.,
Mitchel Field, N.Y. 11553
TEL: (516) 794-4500
TWX: 510-223-0418

BROAD BAND MODULAR SWITCHING SYSTEMS

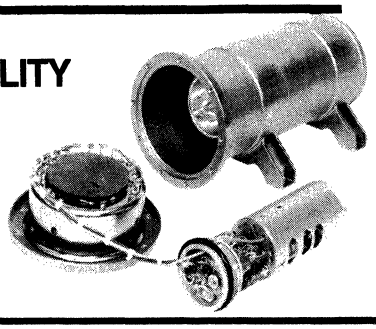
Complete systems with power supplies, digital interface converters, I/O equipment, control panels, and various other functions are available.



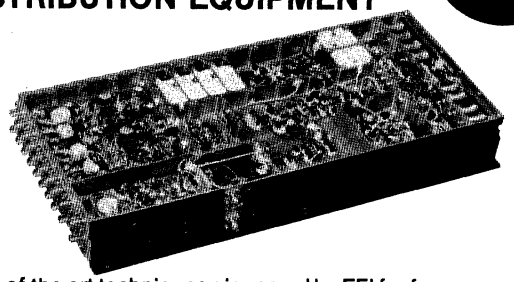


HIGH RELIABILITY PRODUCTS

Daily Aging
$<1x10^{11}$ /day

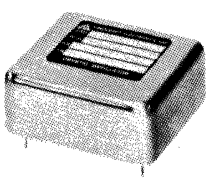


SATELLITE FREQUENCY GENERATION AND DISTRIBUTION EQUIPMENT

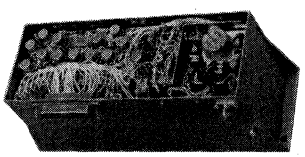


State-of-the-art techniques pioneered by FEI for frequency synthesis, processing, and distribution of low noise reference signals have been applied to the development of high reliability hardware for satellite applications. FEI systems consisting of precision oscillators and distribution equipment configured as redundant assemblies are presently being used on a wide variety of space programs resulting in performance capabilities previously unrealizable. The equipment incorporates FEI's high reliability hybrid techniques and results in light weight and low power consumption; considerations of primary importance in satellite applications.

OSCILLATORS

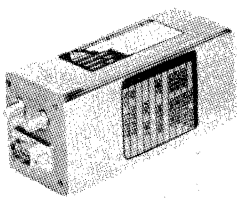


(TCXO and TCVCXO)
Temperature
Compensated/
Voltage Controlled
Crystal Oscillators



Space Application
High Stability
Remotely Settable
Crystal Oscillator.

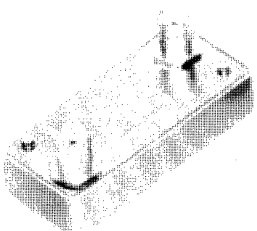
Daily Aging
<2 to $3x10^{11}$ /day

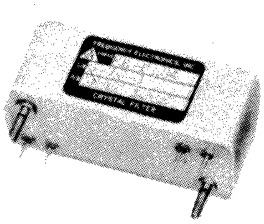


Proportionately
Controlled Ovenized
Oscillator

Daily Aging
$<1x10^{10}$ /day

CRYSTAL FILTERS AND DISCRIMINATORS



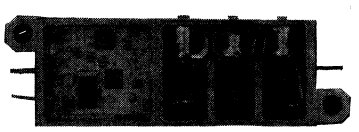


CLASS S & B CUSTOM HYBRID CAPABILITY

Multiple Technologies - DC to 22 GHz

Thick Film - DC to 2.5 GHz
Thin Film - 100 MHz to 22 GHz
Microwave, RF, Power, Analog, Digital
MIL-M-38510 Level "S" or Level "B"

NEW



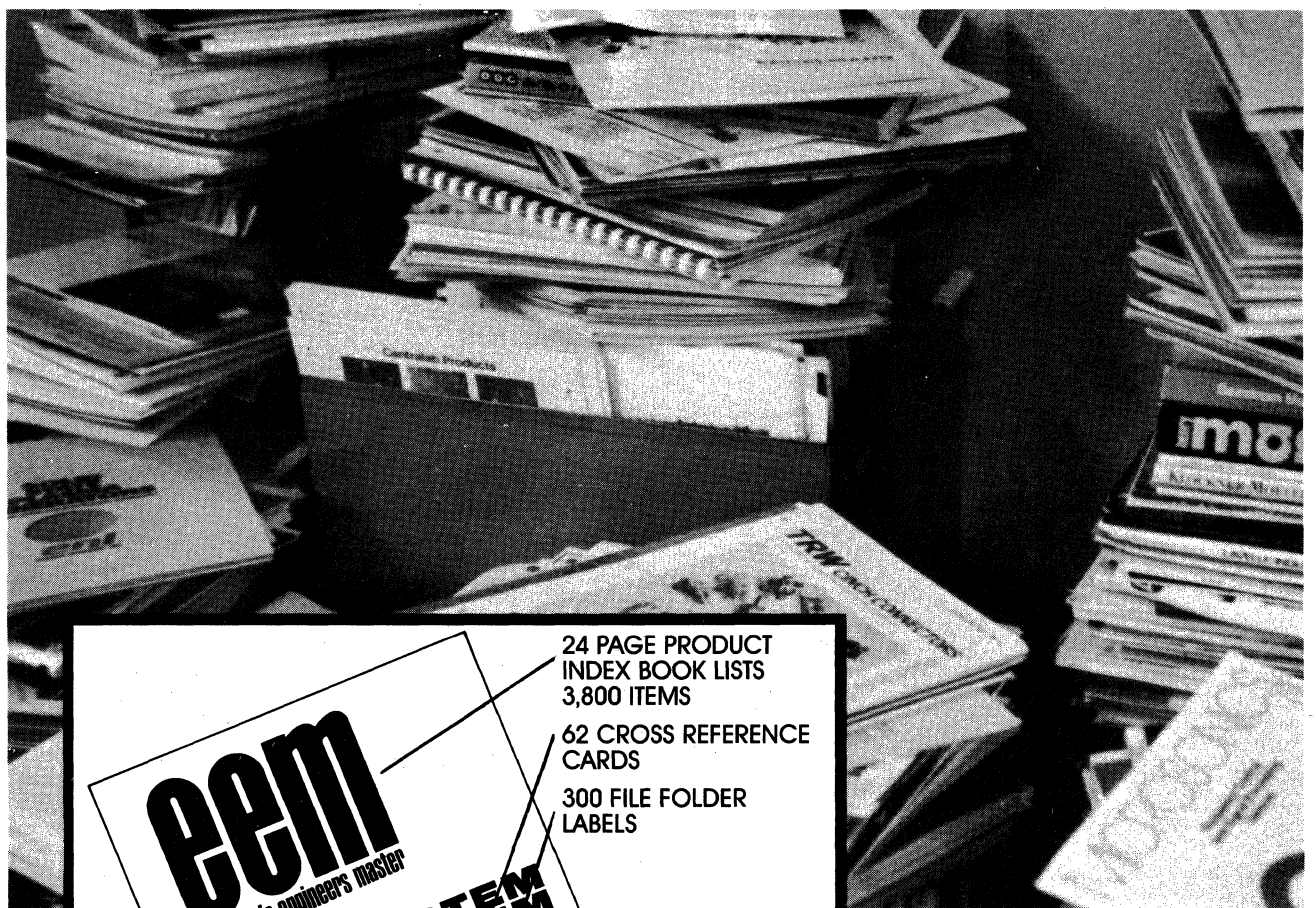
FREQUENCY ELECTRONICS, INC.

55 Charles Lindbergh Blvd.,
Mitchel Field, N.Y. 11553
TEL: (516) 794-4500
TWX: 510-223-0418

CRYSTAL FILTERS AND DISCRIMINATORS
Narrow Band Crystal Filters
Intermediate Wide Band Crystal Filters
Band Reject Crystal Filters
Single Side Band Crystal Filters
Discriminators

OSCILLATORS
Ovenized Crystal Oscillators
Ovenized Voltage Controlled Crystal Oscillators
Temperature Compensated Voltage Controlled Crystal Oscillators
Temperature Compensated Crystal Oscillators
Non-Ovenized Crystal Oscillators
LC Voltage Controlled Oscillators
Precision Low Power Oscillators
High Stability Proportional Ovens
Custom Engineered Oscillators

Low Phase-Noise Frequency Sources To 10 GHz



24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS

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Filters and Networks

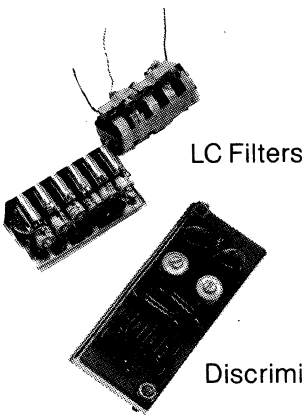
LC Filters • Crystal Filters
Delay Lines • Discriminators

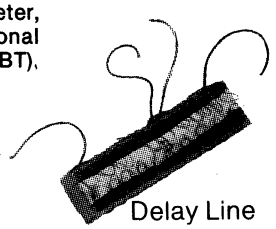
from **FSN** **FREQUENCY SELECTIVE NETWORKS, INC.**

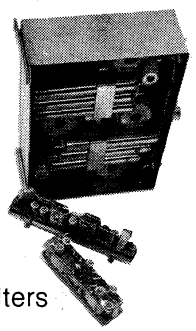
FSN is a filter and network house. We are strong in engineering. We are able and willing to work with system designers to apply state-of-the-art filter technology to optimize not just the filter but the application of filters to help our customers optimize their systems.

Use us as your filter specialist. We are knowledgeable in and have experience with all classes of filters, whether crystal or LC. We can select the proper type for best performance while optimizing the cost-vs-performance trade-off. We design and manufacture **all** the families such as: Butterworth, Chebyshev, Legendre, Cauer (elliptical), General Parameter, Gaussian, Bessel, Transitional Butterworth-Thompson (TBT), Bode, Lerner and others.

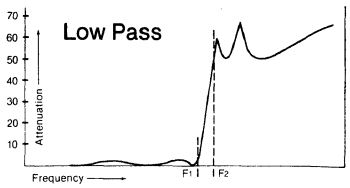
We also design and manufacture such other networks as delay lines, attenuators, phase and delay equalizers, discriminators, matching networks, etc.



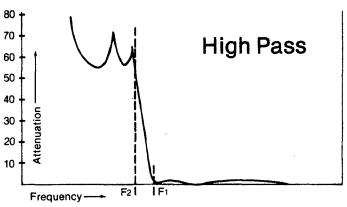




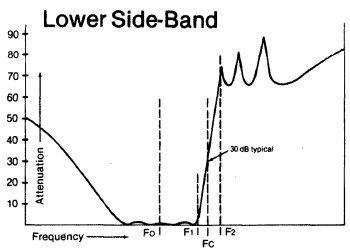
Representative Network Packages



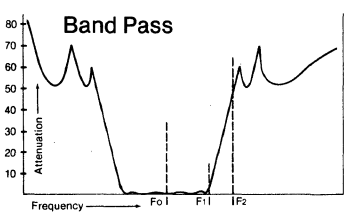
Shape Factor = $\frac{F_2}{F_1}$ As Low as 1.03



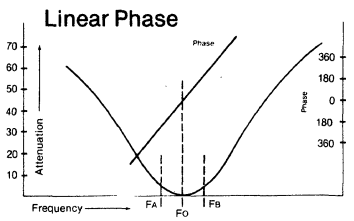
Shape Factor = $\frac{F_1}{F_2}$ As Low as 1.03



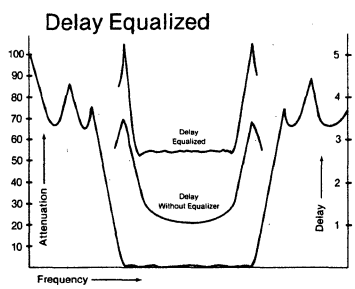
Shape Factor = $\frac{F_2 - F_0}{F_1 - F_0}$ As Low as 1.05



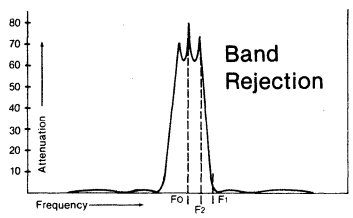
Shape Factor = $\frac{F_2 - F_0}{F_1 - F_0}$ As Low as 1.05



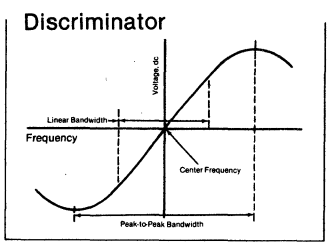
Phase Linearity better than 1°



Shape Factors better than 1.10
Delay Variation better than 2%



Shape Factor = $\frac{F_1 - F_0}{F_2 - F_0}$ As Low as 1.20



Wide and Narrow Band Linearity ± 1%

69-20 Garfield Avenue
Woodside, N.Y. 11377
(718) 424-7500

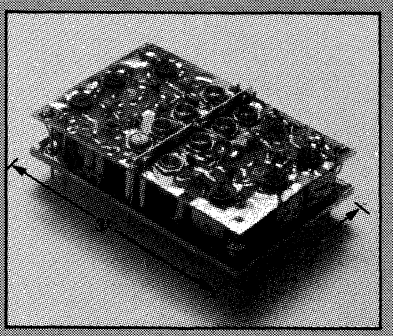
FSN
FREQUENCY SELECTIVE NETWORKS, INC.

LC Filters • Crystal Filters • Delay Lines • Discriminators

Hughes Custom Filters and Oscillators

Crystal Filters

Hughes has over 20 years of experience with all standard types of bandpass filters, including Butterworth, Chebychev, Elliptical, Gaussian and Bessel types, as well as band reject filters and crystal discriminators.

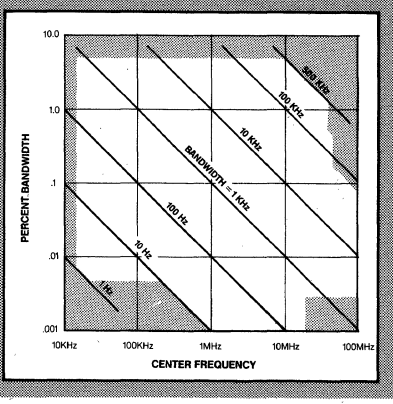


Characteristics

Hughes filters are designed using advanced computer-aided network synthesis and analysis techniques resulting in filters with sharp selectivity, controlled group delay or phase response, non-ringing pulse response and low insertion loss over wide temperature ranges. Hughes has also developed proprietary designs which permit tight control of phase and group delay characteristics or time domain response characteristics such as peak overshoot and ringing in response to pulsed RF signals. Hughes Frequency Control Devices meet the most stringent military standards, when required.

Applications

Hughes Frequency Control Devices are in use in satellites, radar systems, missiles, military and commercial communications and avionics systems.



Typical Specifications

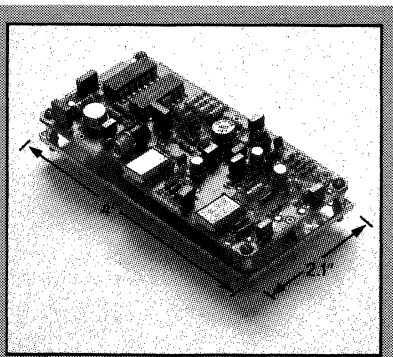
Fractional Bandwidth:	See Graph at right
Shape Factor:	As low as 1.15 to 1 (60 dB/3 dB ratio)
Passband Ripple:	Down to 0.2 dB
Phase or Delay Compensation:	To within ± 1%

How to Determine the Feasibility of Your Filter

The graph at right shows the general operating region of Hughes filters as determined by center frequency, bandwidth and/or percent of bandwidth. If your filter falls within the white area, Hughes can readily design and produce such a filter. If your filter falls outside the white area but near the boundaries of this chart, you should discuss your requirements with the Hughes design engineering staff, since your filter may still be practical to produce.

Voltage Controlled Crystal Oscillator

Hughes VCXOs offer wide frequency deviations, up to ±0.3% of the nominal oscillator frequency. For extended temperature ranges TCVCXOs are temperature compensated to provide exceptionally low frequency drift characteristics.



Typical Specifications

Frequency Range:	100 Hz to 120 MHz
VCXO Temperature Range:	−40°C to +70°C
TCVCXO Temperature Range:	−55°C to +85°C
Deviation:	±0.3%
Linearity:	± 1%
Spurious:	80 dBc
Supply Voltage:	8 to 27 V_{DC} available
Outputs available:	Sine, TTL, ECL
Size:	As small as 2 x 2 x 0.5 inches Hybrid versions available

Ovenized Oscillators

Hughes' Ovenized Oscillators, designated the HAC 5000 Series, are high stability devices with a frequency of 5 MHz and an output level of 1 vrms into 50 ohms. Warm-up time, electronic tuning, output levels, pin configuration and input dc voltages can be modified to meet our customer's specifications. Contact your local sales representative or Hughes Solid State Products for more information.

Contact:
Hughes Aircraft Company
Solid State Products Division
FREQUENCY CONTROL DEVICES
500 Superior Avenue
Newport Beach, California 92658-1420
Telephone (714) 759-2952 Telex: 910-596-1374

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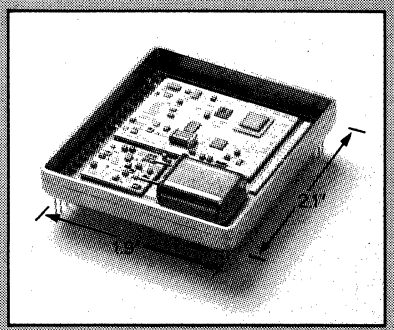
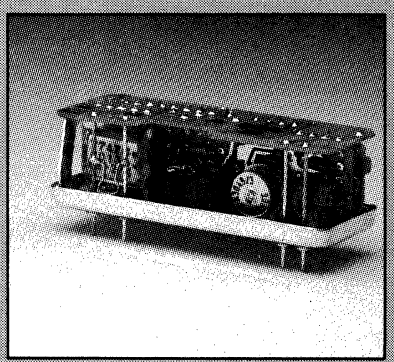
Hughes Oscillators



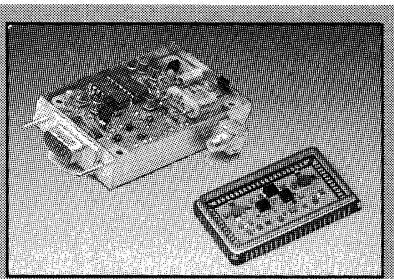


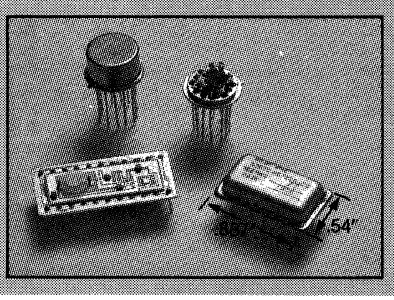
Temperature Compensated Crystal Oscillators

For portable or remote equipment requiring low power and high stability, Hughes offers both TCXO's and DCXO's. The TCXO's utilize analog compensation networks designed with computer aided techniques to achieve frequency stability over wide temperature ranges. Performance is ensured with automated component selection and test and fully automated testing of the finished product. DCXO's achieve even greater frequency stability through digital compensation techniques. Compensation data is stored in an Electrically Erasable Programmable Read Only Memory (EEPROM) which allows the DCXO to be recompensated or programmed a number of times.

Typical Specifications

Frequency Range:	0.1 Hz to 60 MHz
TCXO Frequency Stability:	
over −40°C to +85°C	±0.5 ppm
over −55°C to +85°C	±1.0 ppm
over −55°C to +125°C	±5.0 ppm
DCXO Frequency Stability:	
over 0°C to +70°C	±0.1 ppm
over −40°C to +85°C	±0.2 ppm
Short Term Stability:	$\pm 1 \times 10^{-8}$/sec
Long Term Stability:	±1 ppm/year
Supply Voltage:	5 to 27 V_{DC} available
Size:	as small as 1 x 1 x 0.5 inch Hybrid versions available
Outputs available:	Sinewave, CMOS, TTL, ECL





Custom Clock Oscillators

Hughes Custom Clock Oscillators are manufactured in both hybrid and discrete form. Packaging options include: TO-8, DIP, Flatpack, Leadless Chip carrier as well as larger formats for special mounting requirements. Hughes oscillators meet the general requirements of MIL-O-55310 and MIL-STD-883 Class B. Class S screening is available.

Typical Specifications

Frequency Range:	0.1 Hz to 160 MHz
Frequency Accuracy:	±0.01% to ±0.001% at +25°C
Frequency Stability:	±0.01% to ±0.005% over temperature
Temperature Range:	−55°C to +125°C
Outputs Available:	CMOS, TTL, ECL, Sinewave

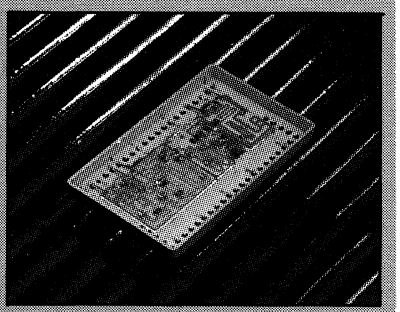
Contact:
Hughes Aircraft Company
Solid State Products Division
FREQUENCY CONTROL DEVICES
500 Superior Avenue
Newport Beach, California 92658-1420
Telephone (714) 759-2952 Telex: 910-596-1374

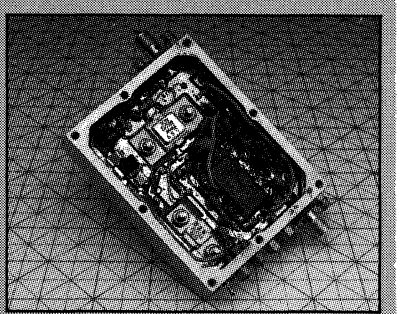
HUGHES
AIRCRAFT COMPANY
SOLID STATE PRODUCTS DIVISION
Industrial Electronics Group

Hughes RF Modules

RF Amplifiers

Hughes' RF Amplifiers are custom designed for applications in telecommunications, radar, telemetry and instrumentation systems. Using proprietary designs and modular construction techniques, Hughes' RF Amplifiers are available to meet a wide range of customer specified characteristics including up to 40 watts output power at 1GHz. Other options include pulse modulation or CW, AGC, custom packaging, output protection and full military screening.





Typical Specifications

Frequency Range:	100 MHz to 1 GHz
Temperature Range:	−55°C to +105°C*
P OUT:	40 watts maximum
P IN:	+10 dBm
V IN:	26 V_{DC} @ 2.2 A maximum
Harmonic Rejection:	>30 dBc
Out of Band Spurious:	>80 dBc
Input VSWR:	9.5 dB return loss 2.0:1 maximum

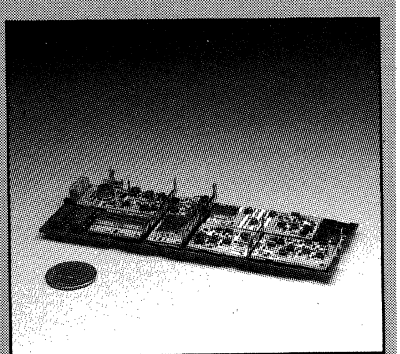
*Alternate temperature ranges also available.

RF Integrated Subassemblies

Hughes features complete design and manufacturing capabilities for a wide range of RF assemblies and integrated subsystems. Engineered for high reliability, Hughes RF products have been field-proven in many military and space applications.

A typical example is this 420-450 MHz Frequency Hopping Phase Locked, Time Ordered Receiver/Exciter. Using thick film circuitry and surface mount technology, this modular assembly contains an up/down converter, VCO, modulator, three stages each of RF and IF amplification, and an AGC.

Whether your requirements are for a complete subsystem or a single stage amplifier, let Hughes be your source.



Typical Specifications

Frequency Range:	1 MHz to 500 MHz
Temperature Range:	−55°C to +85°C
Power Requirements:	5 V to 25 V
Spurious Response:	>30 dBc (1 MHz-1.2 GHz)
Flatness:	≤ ±2.0 dB
Gain:	Up to 120 dB
Noise Figure:	≤ 5 dB
Dynamic Range:	−30 to +20 dBm

Contact:
Hughes Aircraft Company
Solid State Products Division
FREQUENCY CONTROL DEVICES
500 Superior Avenue
Newport Beach, California 92658-1420
Telephone (714) 759-2952 Telex: 910-596-1374

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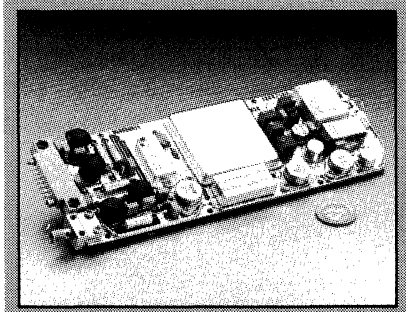
Industrial Electronics Group

Hughes Custom Frequency Synthesizers



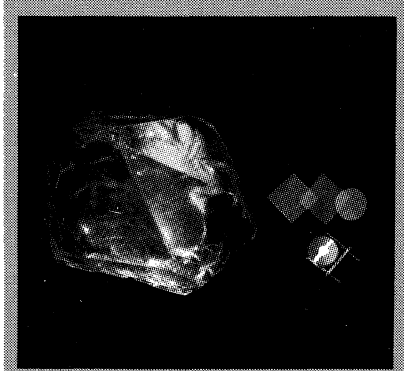
Frequency Synthesizers

Hughes offers a family of high performance Frequency Synthesizers for hi-reliability and military applications. Spanning a frequency range of 1 to 1800MHz and temperature range of −55°C to +85°C. Hughes Synthesizers feature single and multi-loop designs for extremely fast phase-lock and negligible post-tuning drift. Also available are special packaging and complete environmental testing.

Typical Specifications

Characteristics	Frequency	Phase Noise	Phase Lock Time	Spurs
Single Frequency Sources:	1 to 1800 MHz	*	50/ref. freq.**	> 60 dBc
Medium Speed Synthesizers:	1 to 1800 MHz	*	75/ref. freq.**	> 60 dBc
Fast Frequency Synthesizers:	500 to 1500 MHz	*	10/ref. freq.**	> 55 dBc
Fractional N Synthesizers:	1 to 1800 MHz	*	1 msec.	> 50 dBc
Direct Digital Synthesizers:	1.5 to 3.5 MHz	150 dBc/Hz	Instantaneous	> 60 dBc

* −157+20 log N = dBc/Hz
** See Figure 1



Crystal Processing

Hughes designs and processes our own crystals for use in our filters and oscillators. These crystals are either open construction (mounted to a substrate and hermetically sealed) or individually packaged. Computerized testing of crystal parameters over temperature range is utilized extensively for phase and gain matched filters.

Contact:
Hughes Aircraft Company
Solid State Products Division
FREQUENCY CONTROL DEVICES
500 Superior Avenue
Newport Beach, California 92658-1420
Telephone (714) 759-2952 Telex: 910-596-1374

HUGHES AIRCRAFT COMPANY
SOLID STATE PRODUCTS DIVISION
Industrial Electronics Group

ISOTEMP RESEARCH, INC.

Telephone (804) 295-3101
P. O. Box 3389 Charlottesville, Virginia 22901

Isotemp specializes in custom design crystal oscillators for all applications. High stability, low power ovenized oscillators are our specialty. Wide temperature range, tight tolerance TCXOs are standard fare. Sinusoid and square wave (TTL and/or C/MOS) are available in most models. Call us for help in determining your oscillator needs.

– PRODUCT DIRECTORY –

TCXO'S	Frequency Range	Major Feature	Stability Class	Supply Voltage	Output	Typical Current	Figure No.
TCXO30 Series	2 to 12 MHz	Low Cost	1 ppm	+5 VDC	TTL	15 ma	1
TCXO39 Series	.125 to 20 MHz	Precision Parts, High Performance	5 x 10^{-7} to 2 ppm	+12 VDC	TTL	20 ma	2
TCXO40 Series	2 to 10 MHz	Precision Parts, High Performance	1 ppm to 5 ppm	+15 VDC	Sine	20 ma	2
TCXO41 Series	10 to 30 MHz	3rd Overtone TCXO	1 ppm to 5 ppm	+15 VDC	Sine	20 ma	2
NCXO'S							
NCXO37 Series	2 to 60 MHz	Low Cost, High Performance	5 ppm to 30 ppm	+5 VDC	TTL	10 to 30 ma	Sim. to 1
NCXO46 Series	5 to 20 MHz	Lowest Cost	.01% to .05%	+5 VDC	TTL	15 to 30 ma	3
OCXO'S							
OCXO31 Series	10 MHz	Low Power	1 x 10^{-7} to 5 x 10^{-7}	+5 VDC	TTL	<1 watt	4
OCXO33 Series	10 MHz	Low Power	1 x 10^{-7} to 5 x 10^{-7}	+5 VDC	TTL	<1 watt	Sim. to 2
OCXO36 Series	8 to 15 MHz	High Stability	1 x 10^{-7} to 5 x 10^{-7}/year	+20 & +5 VDC	TTL	2 watts	5

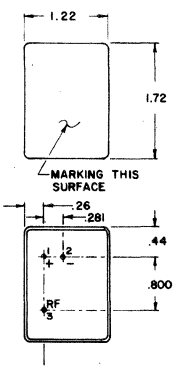


Figure 1

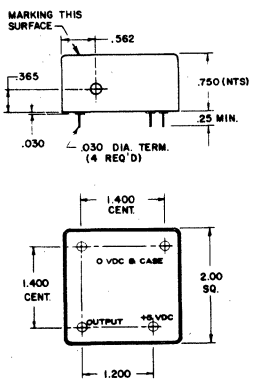


Figure 2

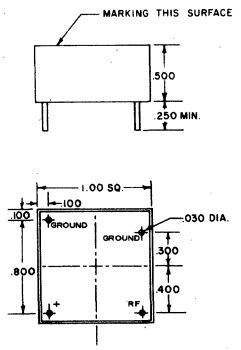


Figure 3

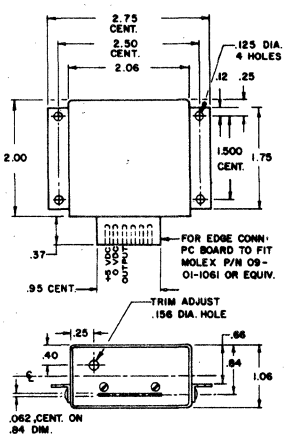


Figure 4

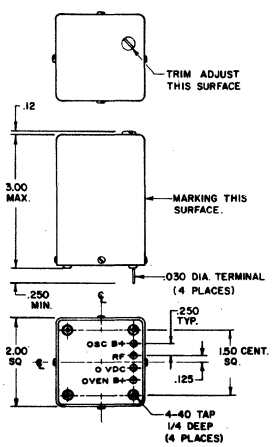


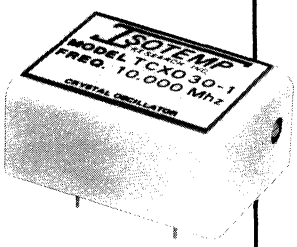
Figure 5

Note: Measurements are in inches.

inches	mm	inches	mm
.025	.635	.660	16.764
.030	.762	.750	19.050
.040	1.016	.800	20.320
.062	1.587	.840	21.336
.100	2.540	.950	24.130
.120	3.048	1.000	25.400
.125	3.175	1.060	26.924
.156	3.962	1.200	30.480
.250	6.350	1.220	30.988
.260	6.604	1.400	35.560
.281	7.143	1.720	43.688
.300	7.620	1.750	44.450
.315	8.001	2.000	50.800
.370	9.398	2.060	52.324
.400	10.160	2.500	63.500
.440	11.176	2.750	69.850
.500	12.700	3.000	76.200

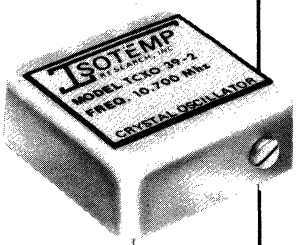
Oscillators

TCXO30 SERIES



Frequency (MHz)		10	10	2 to 12	2 to 12
Temperature range		0° to 50°C	0° to 55°C	0° to +50°C	0° to 55°C
Voltage stability (±5% change)		±2 x 10^{-7}	±2 x 10^{-7}	±2.5 x 10^{-7}	±2.5 x 10^{-7}
		MODEL NUMBERS			
Ambient stability	±1 ppm	TCXO30T-1	TCXO30T-3	TCXO30T-5	TCXO30T-7
Reference to +25°C	±2 ppm	TCXO30T-2	TCXO30T-4	TCXO30T-6	TCXO30T-8

TCXO39 SERIES

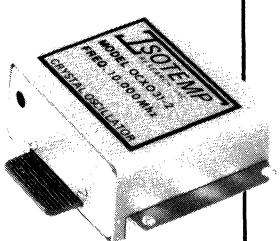


Frequency range (MHz)		.125 to 2	2 to 12	12 to 20	2 to 6
Aging (after 60 days operation)		±1 ppm/year	±1 ppm/year	±1 ppm/year	±5x10^{-7}/year
Short term stability (10 sec rms)		2 x 10^{-9}	2 x 10^{-9}	3 x 10^{-9}	1 x 10^{-9}
Voltage stability (per 5% change)		3 x 10^{-7} typical	2 x 10^{-7} typical	3 x 10^{-7} typical	1.5 x 10^{-7} typical
Trim range		±4 ppm min.	±4 ppm min.	±6 ppm min.	±3.5 ppm min.
Typical current drain		30 ma	20 ma	20 ma	20 ma
		MODEL NUMBERS			
Ambient stability	±5 x 10^{-7}	TCXO39-1	TCXO39-2	N.A.	TCXO39-3
0°C to +55°C	±1 ppm	TCXO39-4	TCXO39-5	N.A.	TCXO39-6
Reference to +25°C	±2 ppm	TCXO39-7	TCXO39-8	TCXO39-9	TCXO39-10

NCXO46 SERIES

Frequency range (MHz)		10 MHz	5 to 8	8 to 12	12 to 17	17 to 25
Current drain (typical)		17 ma	15 ma	17 ma	20 ma	30 ma
				Model Numbers		
Stability	±0.01%	NCXO46-1	NCXO46-2	NCXO46-3	NCXO46-4	NCXO46-5
All effects	±0.05%	NCXO46-6	NCXO46-7	NCXO46-8	NCXO46-9	NCXO46-10

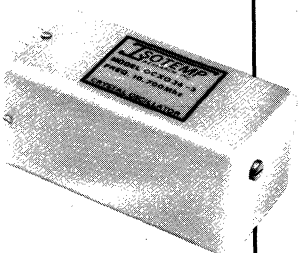
OCXO31 SERIES



Model number	OCXO31-1	OCXO31-2	OCXO31-3	OCXO31-4
Temperature stability (0°C to 65°C) *	±5 x 10^{-8}	±1 x 10^{-7}	±2 x 10^{-7}	±3 x 10^{-7}
Aging (per year after 60 days)	±5 x 10^{-7}	± 1 ppm	±1.5 ppm	±2 ppm
Short term stability (per 10 second count)	2 x 10^{-10} rms	5 x 10^{-10} rms	1 x 10^{-9} rms	2 x 10^{-9} rms
Voltage stability (+5 VDC ±10 %)	±3 x 10^{-8}	±5 x 10^{-8}	±1 x 10^{-7}	±1.5 x 10^{-7}
Trim range (at time of shipping)	±3 ppm	±4 ppm	±5 ppm	±6 ppm

*Reference to +25°C

OCXO36 SERIES



Model number	OCXO36-1	OCXO36-2	OCXO36-3	OCXO36-4
Frequency (MHz)	10	10	8 to 15	8 to 15
Aging (per week at time of shipping)	±3 x 10^{-9}	±5 x 10^{-9}	±1 x 10^{-8}	±1.5 x 10^{-8}
Aging (per year after 21 days)	±1 x 10^{-7}	±2 x 10^{-7}	±3 x 10^{-7}	±5 x 10^{-7}
Retrace (4 hours on after 24 hours off)	2 x 10^{-9} typ.	5 x 10^{-9} typ.	1 x 10^{-8} typ.	1.5 x 10^{-8} typ.
Ambient stability (0°C to +65°C)	1 x 10^{-10}/°C	2 x 10^{-10}/°C	5 x 10^{-10}/°C	1 x 10^{-9}/°C
Voltage stability (per 5% change)	7 x 10^{-10}	2 x 10^{-9}	2 x 10^{-9}	4 x 10^{-9}
Phase noise (100 Hz offset 1 Hz BW)	-143 db min.	-140 db min.	-130 db min.	-125 db min.
Short term (10 second counts)	2 x 10^{-11} rms	3 x 10^{-11} rms	1 x 10^{-10} rms	5 x 10^{-10} rms
Trim range (minimum)	±6 x 10^{-7}	±1.5 ppm	±2.5 ppm	±3 ppm

To order: Specify model number and frequency or contact factory for options.
Phone (804) 295-3101 P. O. Box 3389 Charlottesville, Virginia 22901

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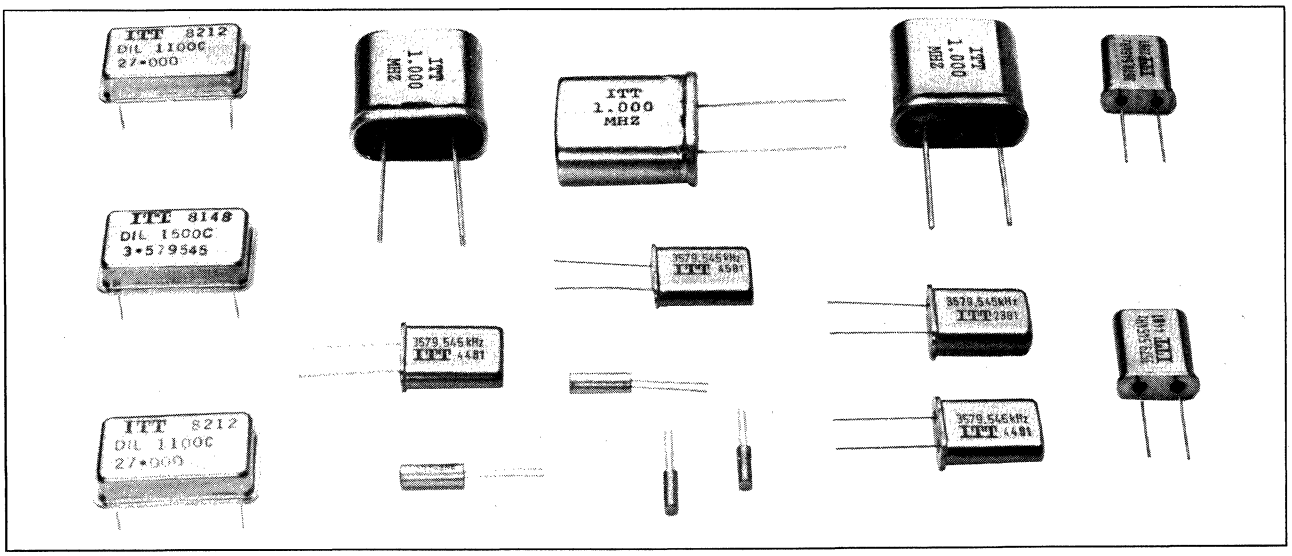
enclosures • capacitors • circuit boards • coils, chokes, inductors • connectors, electronic • sockets/ terminals • crystals • oscillators • crystal filters delay lines • panel hardware • displays • lamps/ lights • cooling equipment • filters • generators • multimeters • panel meters • oscilloscopes • gra phic recorders • interconnections • microwave components • motors/ drives • batteries • power supplies, dc • power supplies, ac • semiconductors • relays • solenoids • resistors • potentiometers/trimmers controls/rheostats • discrete semiconductors • switches • keyboards/keypads • transducers/en coders • transformers • wire & cable • enclosures capacitors • circuit boards • coils, chokes, induc tors • connectors, electronic • sockets/terminals

EEM PRODUCT SELECTION GUIDES

Use the EEM Product Selection Guides. There are 34 Guides in this edition of EEM. See page 2 (A•2, B•2, C•2, D•2) of each volume to locate the Product Selection Guides that pertain to your needs.

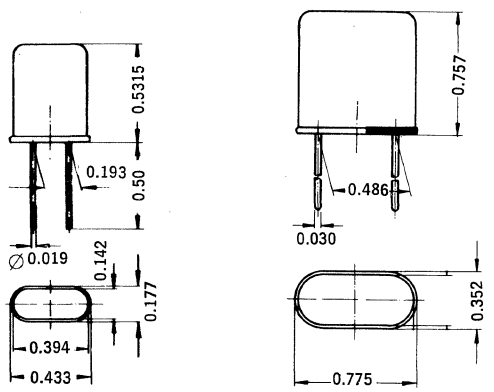
ITT Components
A Unit of ITT Corporation

Crystals and Oscillators



Quartz Crystal Units

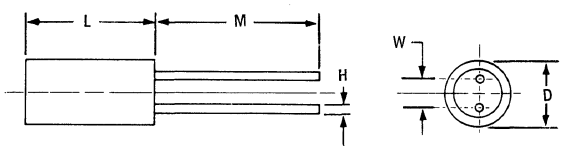
- Microprocessor clock type crystals covering a frequency spectrum from 1MHz to 200MHz.
- HC18 and HC33 type holders, resistance welded or solder cold weld or solder sealed.
- Frequency tolerance from .002% to .35%.



HC-18/U HC-33/U

ITT TF3 AND TF6
Tuning Fork Crystals

Used for microprocessors and micro computer real-time clock applications.



Type	L	M	H	W	D
TF3	.327 Max. (8.30 Max.)	.354 (9.00)	.012 ±.002 (0.30 ±0.05)	.043 ±.002 (1.10 ±0.05)	.118 ± .008 (3.00 ±0.08)
TF6	.260 ±.002 (6.70 ±0.05)	.295 (7.50)	.010 ±.001 (0.25 ±0.03)	.023 ±.004 (0.70 ±0.10)	.081 ±.002 (2.05 ±0.05)

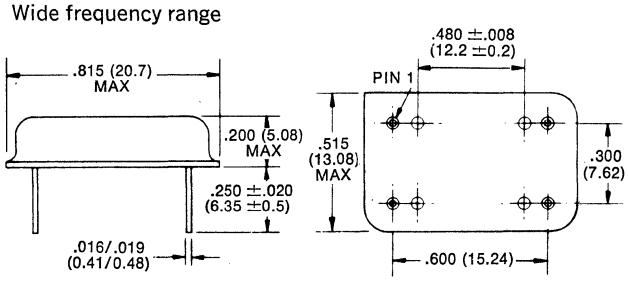
Dimensions are in inches (millimeters)

Quartz Crystal Oscillators

The ITT DIL oscillator series are miniature, low-profile, dual-in-line quartz crystal oscillators in a hermetic package. They are designed primarily, to meet the needs of the fast growing minicomputer and microprocessor markets, but are suitable for many other applications where a reliable, accurate clock input is required.

Frequency tolerances ranging from 1000ppm to 25ppm are available.

FEATURES
TTL compatible
Dual-in-Line pin spacing
Low profile — 5.8mm maximum seated height including insulating stand-offs
Hermetic welded metal package
Wide frequency range



Pin Connections
1 NC
7 Ground
8 Output
14 +5V

FREQUENCY RANGE: 250KHz — 90MHz

Family	Frequency Tolerance	
ITT 1000C	1000ppm	0.1%
ITT 1500C	500ppm	0.05%
ITT 1100C	100ppm	0.01%
ITT 1050C	50ppm	0.005%
ITT 1025C	25ppm	0.0025%

ITT COMPONENTS • 1201 E. McFadden Avenue • Santa Ana, California 92705 • Phone: (714) 836-0351 • TWX: 910-595-1744 • Telex: 69-1389

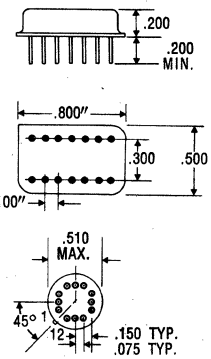
LEACH® CORP. **CONTROL PRODUCTS DIVISION**
6900 Orangethorpe Avenue, Buena Park, California 90620
Telephone: (714) 739-0770 TWX 910-596-2867

LEACH HYBRID FREQUENCY PRODUCTS

MILITARY • AEROSPACE • CUSTOM

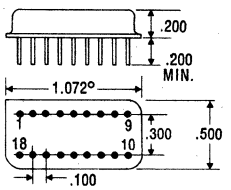
ALL PRODUCTS MANUFACTURED IN THE U.S.A.

HYBRID OSCILLATORS
MIL-O-55310 PROCESSING



Output Waveform:	C-MOS (Hi-Speed), TTL (Fast), ECL (10K, 100K, MECL III)
Frequency Range:	.1 Hz-300 MHz
Packaging:	14 Pin D.I.P., Flat Packs, TO5 and TO8
Typical Tolerance:	±10 ppm at R.T., ±50 ppm of R.T. from −55°C to +125°C
Typical Symmetry:	50/50% 1-30 MHz, 60/40% 31-300 MHz
Typical Processing:	883, 38510, Burn In, Lot Traceable
Typical Testing:	Programmable Auto-Test Over Full Temperature Range With Data. All Units Serialized.
Environmental:	Gross/Fine Leak Detection, Shock, Vibration, Acceleration and Radiation Exposure Available.

CRYSTAL CONTROLLED DUAL BAUD RATE GENERATOR



This Device Can Transmit and Receive Simultaneously on 2 Standard Baud Rates Which Are Manually or Soft Ware Selectable From 50 to 19,200 Baud Fully Processed to MIL-O-55310, 38510 and 883 With Burn In Available. Packaged in 18 Pin D.I.P. or Flat Pack.

Also Available With Independent C-MOS Clock up to 40 MHz in the Same 18 Pin Package Along With Baud Rate Generator.

LCC
LEADLESS CHIP CARRIER — OSCILLATORS

Our LCC Program Features a Kovar Ring Fired Onto a Ceramic Substrate Sealed With a Metal Lid for Maximum RFI/EMI Shielding. Either 40 or 50 Mil Spacing is Available Within the Same .480 Square LCC. Most All Standard Logics Are Covered:

C-MOS — .1 Hz to 50 MHz
TTL — .1 Hz to 120 MHz
ECL — 50 MHz — 140 MHz

All Processing to MIL-0-55310.

SAW HYBRID OSCILLATORS

Featuring Surface Accoustical Wave Technology for Frequency Control, This Hybrid Product Line Covers 100 MHz — 800 MHz in ECL.

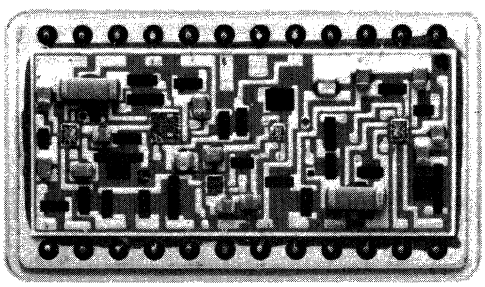
Packaging is Available in DIP, Flatpack, and LCC. ECL Output is Compatible With 10K, 100K, and MECL III.

LEACH® CONTROL PRODUCTS DIVISION — HYBRID CIRCUITS

LEACH Control Products Division — a complete hybrid micro-electronics manufacturer dedicated to forwarding advances in custom hybrid circuits, crystal clock oscillators, and frequency related products.

EXPERIENCE

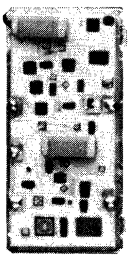
We're a hybrid ourselves, an organization built on more than 65 years of electronic experience and performance in major programs like the Space Shuttle and the B-1B, and for tomorrow's sophisticated industrial, military and aerospace applications.

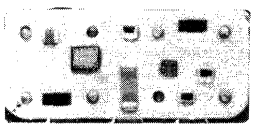


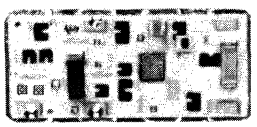
We represent progress — the kind of progress that makes reliability second nature. Progress that produces MIL-approved quality second to none.

CAPABILITY

One of the secrets to our success is our in-depth house design and manufacturing capability — a state-of-the-industry capability that has kept LEACH on the forefront of advanced microelectronics technology for more than a decade. Our 110,000 square foot facility houses a full complement of services: Design, Engineering, Manufacturing, Production, Environmental Testing, Quality Assurance and Program Management. Each coordinated for optimum quality and efficiency. Each integrated to guarantee project control. With certified clean room, inspection, and manufacturing capability, automatic testing, automatic wire bonding, auto laser trim, beam welding, and computerized production and inventory control.







DESIGN

We've designed circuits with seven metalization layers — with package density as high as 40 components per square inch. Metal and ceramic packages, TTL, MOS, ECL, CCD, bi-polar, and gate array technologies. Digital and analog frequencies. Thick and thin film.

RELIABILITY

LEACH CPD custom hybrid group has continued to demonstrate our ability to design and produce custom circuits to our customers' exact requirements. Manufactured to MIL-M-38510, our custom hybrids have satisfied the vigorous demands of companies like Rockwell, Hughes, General Dynamics, Martin Marietta and more — in numerous military and aerospace programs. On time within budget. Within specications.

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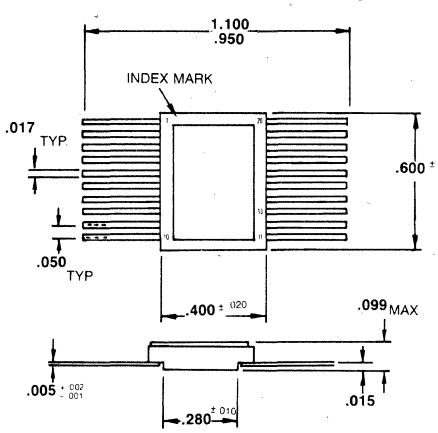
QUALIFIED PRODUCTS LIST MIL-C-3098

TYPE NO.	FREQ. RANGE
CR-5A/U	2 MHz - 10 MHz
CR-6A/U	2 MHz - 10 MHz
CR-8A/U	1.8 MHz - 10 MHz
CR-18A/U	1 MHz - 20 MHz
CR-19A/U	1.8 MHz - 20 MHz
CR-25B/U	200 KHz - 555 KHz
CR-26A/U	200 KHz - 500 KHz
CR-27A/U	3 MHz - 20 MHz
CR-28A/U	3 MHz - 20 MHz
CR-35A/U	3 MHz - 20 MHz
CR-36A/U	3 MHz - 20 MHz
CR-38A/U	16 KHz - 100 KHz
CR-46B/U	200 KHz - 550 KHz
CR-47A/U	190 KHz - 500 KHz
CR-50A/U	16 KHz - 100 KHz
CR-52A/U	10 MHz - 61 MHz
CR-55A/U	17 MHz - 62 MHz
CR-56A/U	75 MHz - 125 MHz
CR-58A/U	3 MHz - 20 MHz
CR-60A/U	5 MHz - 20 MHz
CR-62/U	3 MHz - 20 MHz
CR-63B/U	200 KHz - 555 KHz
CR-64/U	2.9 MHz - 20 MHz
CR-65/U	10 MHz - 61 MHz
CR-67A/U	17 MHz - 62 MHz
CR-69A/U	2.9 MHz - 20 MHz
CR-72/U	17 MHz - 61 MHz
CR-73/U	17 MHz - 61 MHz
CR-74/U	50 MHz - 125 MHz
CR-76A/U	17 MHz - 61 MHz
CR-77/U	17 MHz - 62 MHz
CR-78A/U	2.9 MHz - 20 MHz
CR-79/U	2.9 MHz - 20 MHz
CR-80/U	75 MHz - 125 MHz
CR-81/U	17 MHz - 62 MHz
CR-82/U	75 MHz - 125 MHz
CR-83/U	75 MHz - 125 MHz
CR-85/U	3 MHz - 20 MHz

TYPE NO.	FREQ. RANGE
CR-89/U	2.12 MHz - 6.2 MHz
CR-97/U	8 MHz - 10 MHz
CR-98/U	50 MHz - 134 MHz
CR-102/U	50 MHz - 125 MHz
CR-103/U	17 MHz - 61 MHz
CR-104/U	200 KHz - 580 KHz
CR-105/U	48 MHz - 125 MHz
CR-106/U	10.5 MHz - 11.5 MHz
CR-107/U	50 MHz - 125 MHz
CR-108/U	50 MHz - 93 MHz
CR-110A/U	62.5 MHz - 75 MHz
CR-111/U	17 MHz - 62 MHz
CR-112/U	5 MHz - 20 MHz
CR-113/U	14.5 MHz - 61 MHz
CR-116/U	50 MHz - 125 MHz
CR-117/U	30 MHz - 62 MHz
CR-118/U	7 MHz - 25 MHz
CR-119/U	3 MHz - 20 MHz
CR-122/U	50 MHz - 125 MHz
CR-123/U	50 MHz - 125 MHz
CR-125/U	3 MHz - 3.05 MHz
CR-127/U	10 MHz - 61 MHz
CR-128/U	17 MHz - 61 MHz
CR-129/U	9 MHz - 12 MHz
CR-130/U	3 MHz - 20 MHz
CR-131/U	3 MHz - 20 MHz
CR-134/U	18 MHz - 21 MHz
CR-136/U	8 MHz - 10 MHz
CR-137/U	8.5 MHz - 19 MHz
CR-139/U	20 MHz - 22 MHz
CR-140/U	9.5 MHz - 12.5 MHz
CR-141/U	75 MHz - 90 MHz
CR-142/U	833.333 KHz
CR-147/U	200 KHz - 500 KHz
CR-149/U	46 MHz - 100 MHz
CR-150/U	56 MHz - 100 MHz
CR-151/U	50 MHz - 100 MHz
CR-157/U	1.8 MHz - 20 MHz

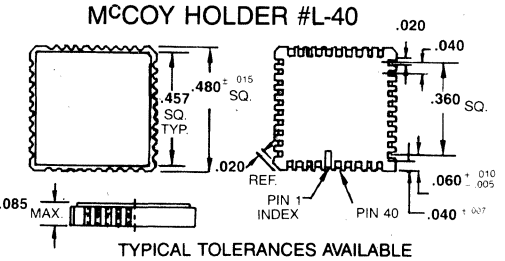
SURFACE MOUNTED CRYSTAL UNITS

LEADED PACKAGE
McCOY HOLDER #L-20



AVAILABLE FROM 10 MHz to 300 MHz
CRYSTAL CONNECTION = PINS 11 & 13
ALL OTHER PINS, NO CONNECTION

LEADLESS PACKAGE
McCOY HOLDER #L-40



TYPICAL TOLERANCES AVAILABLE

Calibration Accuracy @ RT
Choices: ± .001%
± .002% (Standard)
± .005 %

Frequency Tolerances vs Temperature
Choices ± .002% 0° to 70°C
± .005% 0° to 70°C
± .002% –40° to +90°C
± .005% –55° to +105°C (Standard)
± .01% –55° to +105°C

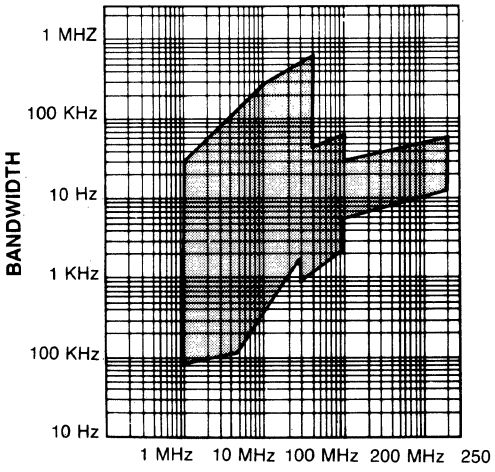
AVAILABLE FROM 10 MHz to 300 MHz

CRYSTAL CONNECTION - PINS 4/10 & 31/37
ALL ELSE, NO CONNECTION

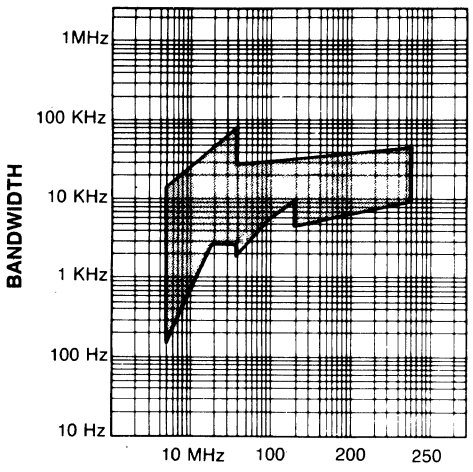
HIGH FREQUENCY CRYSTAL FILTERS

M^cCoy Electronics manufactures high frequency crystal filters from 1 MHz to over 250 MHz. Both discrete crystal design and monolithic filter designs are utilized to achieve the maximum in bandwidths, selectivity, miniaturization and competitive pricing.

DISCRETE FILTER BANDWIDTH



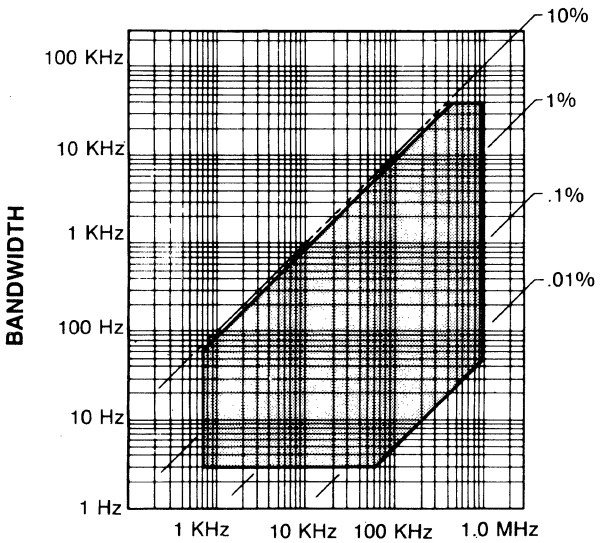
MONOLITHIC BANDWIDTH CHART



LOW FREQUENCY CRYSTAL FILTERS

Low Frequency crystal filters between 1 KHz and 1 MHz are routinely produced utilizing advanced computer design technology. All filters are custom designed to customer requirements including unique package designs to fit unusual conditions. We invite your challenge. Call our Sales or Engineering Department today with your application.

LOW FREQUENCY BANDWIDTH CHART



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CRYSTAL OSCILLATORS

McCoy's line of custom designed Crystal Controlled Oscillators is unexcelled in the industry. From clocks, TCXO's, VCXO's, TCVCXO's thru oven controlled units, we have a unit to meet your requirements. A complete in-house thick film facility coupled with the industries best crystal facility gives you miniaturization capabilities and quality controls unavailable elsewhere. Our QPL approvals on MIL-0-55310 allows the use of military approved unit where the requirement exists.

MIL-0-55310 OSCILLATORS OFFERED BY MCCOY ELECTRONICS

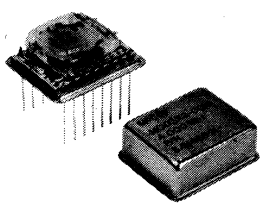
MIL-0-55310 SLASH SHEET NO.	CLASS # OF UNIT *	FREQUENCY RANGE COVERED	OUTPUT WAVEFORM	MCCOY CORRESPONDING MODEL NUMBER	PACKAGE SIZE AND STYLE
4	3	750 KHz - 10 MHz	C-MOS	MC128A2-( )	1.5″ × 1.5″ × .5″ PC MOUNT
5	3	1 MHz - 10 MHz	TTL	MC180X2-( )	2.0″ × 2.0″ × .7″ PC MOUNT or CHASSIS
6	3	15.7 KHz - 10 MHz	TTL	MC219A1-( )	1.55″ × 1.015″ × .7″ PC MOUNT
7	3	10 MHz - 90 MHz	SINE	MC178X2-( )	2.0″ × 2.0″ × .7″ PC MOUNT
8	1	50 Hz - 50 MHz	TTL	MC765A1-( )	.887″ × .54″ × .4″ 14 PIN DIP
9	1	10 MHz - 60 MHz	TTL	MC717-( )	.410″ dia. × .300″ TO-5 PACKAGE
10	1	1 KHz - 30 MHz	TTL	MC708A1-( )	.565″ dia. × .350″ TO-8 PACKAGE
11	1	.05 Hz - 10 MHz	C-MOS	MC751A1-( )	.887″ × .54″ × .4″ 14 PIN DIP
13	1	300 Hz - 10 MHz	C-MOS	MC714-( )	.565″ dia. × .350″ TO-8 PACKAGE
14	1	.1 Hz - 25 MHz	TTL	MC755A1-( )	.887″ × .54″ × .2″ 14 PIN DIP
15	1	.01 Hz - 10 MHz	C-MOS	MC752A1-( )	.887″ × .54″ × .2″ 14 PIN DIP
16	1	.1 Hz - 50 MHz	TTL	MC741A1-( )	.887″ × .54″ × .2″ 14 PIN DIP
17	1	250 KHz - 25 MHz	TTL	MC726A1-( )	.887″ × .54″ × .2″ 14 PIN DIP
18	1	.01 Hz - 15 MHz	C-MOS	MC745A1-( )	.887″ × .54″ × .2″ 14 PIN DIP
19	1	1 MHz - 60 MHz	TTL	MC070-( )	.480″ SQ. × .085″ 40 PAD LEADLESS CHIP CARRIER

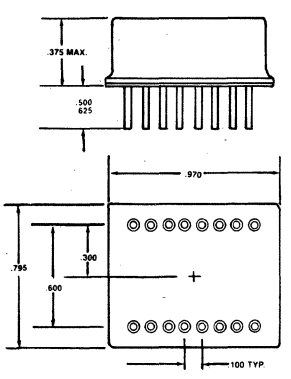
*MIL-0-55310 OSCILLATOR CLASSIFICATIONS
CLASS 1: CRYSTAL OSCILLATOR (XO)
CLASS 3: TEMPERATURE COMPENSATED CRYSTAL OSCILLATOR (TCXO)

ONLY A FEW UNITS ARE SHOWN, WRITE OR CALL FOR COMPLETE CATALOG.

MINIATURE THICK FILM HYBRID TCXO

MODEL MC103X2





PIN LOCATION

1. GND
2. REG B+
3. ADJ.
4. N/C
5. N/C
6. N/C
7. N/C
8. GND.
9. R.F. OUT
10. N/C
11. N/C
12. N/C
13. N/C
14. N/C
15. N/C
16. +5.0 VDC

FREQ. ADJ. (10 K POT)

NOTE: SQUARE CORNER INDICATES PIN #1

SPECIFICATIONS

Frequency Range: 3.2 to 25 MHz
Frequency Stability Options: (Select one)
A) ±1 PPM over 0° to +50°C
B) ±2 PPM over −15° to +70°C
C) ±3 PPM over −30° to +70°C
Input: +5.0 VDC ±2%, 15 ma MAX.

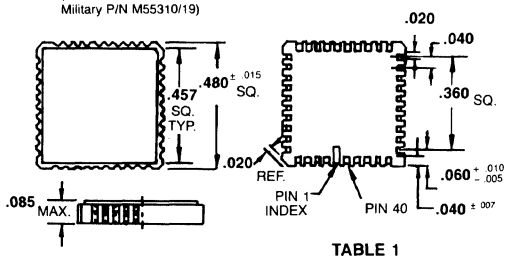
Output: TTL Compatible
Trim: Electrical, ±5 PPM, minimum, trimmed by external 10K pot connected to 3 terminals.
PACKAGE: 16 pin Dip, .375 High

SURFACE MOUNTED OSCILLATORS

MODEL MC070 LEADLESS CHIP CARRIER OSCILLATOR .040" PAD CTRS.

(This model also available as Military P/N M55310/19)

10 MHz to 100 MHZ



PAD NO.	FUNCTION
4	B+
10	B+
31	GND.
37	GND.
39	OUTPUT
1-3	NC
5-9	NC
11-30	NC
32-36	NC
38	NC
40	NC

SPECIFICATIONS

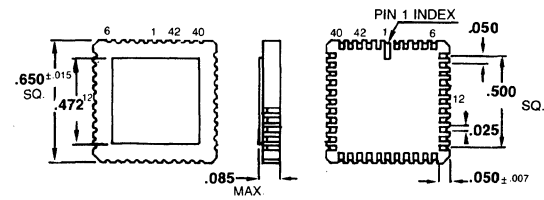
Frequency stability:
Vs temperature: See table I.
Vs supply voltage: ± 4 ppm maximum for a 5.0 V change in input voltage.
Aging: ± 10 ppm per year maximum
Seal: Hermetic.
Weight: 3 grams, maximum.
Temperature:
Operating: Within the specified limits over a temperature range of (see table I).
Storage: – 62° to + 125°C.
Oscillator load: Standard TTL loads (see table I).
Output waveform: Symmetrical square wave
Output voltage:
Logic 1: 2.4 Vdc Minimum at 400 µA source.
Logic 0: 0.5 Vdc maximum with 16 mA sink.
Vibration, high frequency: In accordance with MIL-0-55310 and MIL-STD-202, method 204.
Nonoperating - Test condition G.
Operating - Test condition G.
Constant acceleration: MIL-STD-883, Method 2001, test condition A (Y1 Plane).
Altitude:
Nonoperating - In accordance with MIL-0-55310.
Operating - MIL-STD-202, method 105, test condition C

TABLE 1

OUTPUT FREQUENCY RANGE	INPUT CURRENT MAX MA	PULSE CHARACTERISTICS RISE AND FALL TIME MAX NS	SYMMETRY %	LOAD MAX	AGING PPM/YR AFTER 30 DAYS	FREQUENCY STABILITY PPM -55°C +125°C A	-55°C +105°C B	-20°C +70°C C
10 MHz to 16.0 MHz	75	15	40 to 60	10 TTL	10	± 100	± 75	± 50
10 MHz to 16.0 MHz	75	15	40 to 60	10 TTL	10	± 200	± 150	± 100
16.0 MHz to 40 MHz	40	5	40 to 60	10 TTL	10	± 100	± 75	± 50
16.0 MHz to 40 MHz	40	5	40 to 60	10 TTL	10	± 200	± 150	± 100
40 MHz to 60 MHz	70	5	40 to 60	10 TTL	10	± 100	± 75	± 50
40 MHz to 60 MHz	70	5	40 to 60	10 TTL	10	± 200	± 150	± 100
60 MHz to 80 MHz	85	5	40 to 60	10 TTL	10	N/A	± 75	± 50
60 MHz to 80 MHz	85	5	40 to 60	10 TTL	10	N/A	± 150	± 100
80 MHz to 100 MHz	85	5	40 to 60	10 TTL	10	N/A	N/A	± 50
80 MHz to 100 MHz	85	5	40 to 60	10 TTL	10	N/A	N/A	± 100

MODEL MC085 LEADLESS CHIP CARRIER OSCILLATOR .050" PAD CTRS.

1 MHz to 100 MHz



PAD NO	FUNCTION
6	B+
12	B+
34	GND.
40	GND.
42	OUTPUT
1-5	NC
7-11	NC
13-33	NC
35-39	NC
41	NC
43-44	NC

SPECIFICATIONS

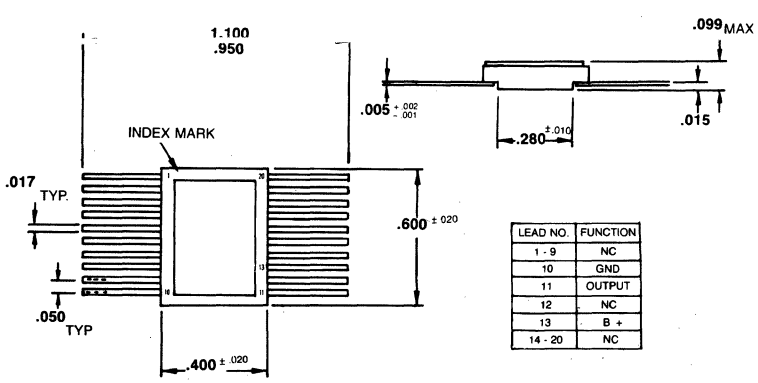
Frequency stability:
Vs temperature: See table I.
Vs supply voltage: ± 4 ppm maximum for a 5.0 V change in input voltage.
Aging: ± 10 ppm per year maximum
Seal: Hermetic.
Weight: 3 grams, maximum.
Temperature:
Operating: Within the specified limits over a temperature range of (see table I).
Storage: – 62° to + 125°C.
Oscillator load: Standard TTL loads (see table I).
Output waveform: Symmetrical square wave
Output voltage:
Logic 1: 2.4 Vdc Minimum at 400 µA source.
Logic 0: 0.5 Vdc maximum with 16 mA sink.
Vibration, high frequency: In accordance with MIL-0-55310 and MIL-STD-202, method 204.
Nonoperating - Test condition G.
Operating - Test condition G.
Constant acceleration: MIL-STD-883, Method 2001, test condition A (Y1 Plane).
Altitude:
Nonoperating - In accordance with MIL-0-55310.
Operating - MIL-STD-202, method 105, test condition C.

TABLE 1

OUTPUT FREQUENCY RANGE	INPUT CURRENT MAX MA	PULSE CHARACTERISTICS RISE AND FALL TIME MAX NS	SYMMETRY %	LOAD MAX	AGING PPM/YR AFTER 30 DAYS	FREQUENCY STABILITY PPM -55°C +125°C A	-55°C +105°C B	-20°C +70°C C
1.0 MHz to 16.0 MHz	75	15	40 to 60	10 TTL	10	± 100	± 75	± 50
1.0 MHz to 16.0 MHz	75	15	40 to 60	10 TTL	10	± 200	± 150	± 100
16.0 MHz to 40 MHz	40	5	40 to 60	10 TTL	10	± 100	± 75	± 50
16.0 MHz to 40 MHz	40	5	40 to 60	10 TTL	10	± 200	± 150	± 100
40 MHz to 60 MHz	70	5	40 to 60	10 TTL	10	± 100	± 75	± 50
40 MHz to 60 MHz	70	5	40 to 60	10 TTL	10	± 200	± 150	± 100
60 MHz to 80 MHz	85	5	40 to 60	10 TTL	10	N/A	± 75	± 50
60 MHz to 80 MHz	85	5	40 to 60	10 TTL	10	N/A	± 150	± 100
80 MHz to 100 MHz	85	5	40 to 60	10 TTL	10	N/A	N/A	± 50
80 MHz to 100 MHz	85	5	40 to 60	10 TTL	10	N/A	N/A	± 100

MODEL MC102A1 FLAT PACK CRYSTAL OSCILLATORS .050" LEAD CTRS.

14 MHZ to 60 MHz



LEAD NO.	FUNCTION
1 - 9	NC
10	GND
11	OUTPUT
12	NC
13	B +
14 - 20	NC

SPECIFICATIONS

STABILITY OPTIONS
± 50 ppm
± 100 ppm

TEMPERATURE RANGE
–20° to + 70°C
–55° to + 105°C
–55° to + 125°C

INPUT: + 5.0 VDC ± .50 volts

CURRENT DRAIN: 40 ma maximum 14 MHz to 40 MHz
70 ma maximum 50 MHz to 60 MHz

OUTPUT: Capable of driving 10 TTL loads

RISE AND FALL TIME: 5ns

SYMMETRY: 40/60 percent

ENVIRONMENTAL:

Hermetic Seal
Aging: 10 ppm/year maximum
Vibration: MIL-STD 202, Method 204 test condition G
CONSTANT ACCELERATION: MIL-STD 883, method 2001 test condition "A" (Y1 plane)

NOTE: For Military Applications, units can be screened IAW MIL-O-55310, Level B

CTS MCCOY ELECTRONICS COMPANY a subsidiary of CTS Industries Inc. 100 WATTS STREET, P.O. BOX B, MT. HOLLY SPRINGS, PA. 17065 717-486-3411 - TWX: 510-650-3548

MF DIP CRYSTAL OSCILLATORS

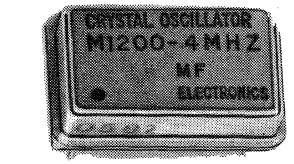
The Broadest line in the industry.

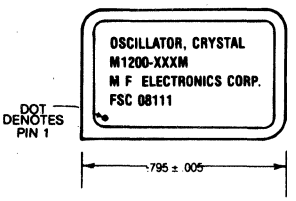
- Units use overtone crystals from 20 MHz to 100 MHz, very stable electrically and more reliable mechanically.
- All units guaranteed for one year to operate within specifications
- Units specified at temperatures exceeding 0 to 70°C are individually recorded 100% for freqency vs temperature insuring compliance.

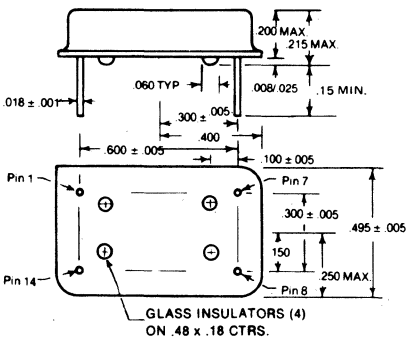
RESISTANCE-WELD CRYSTAL CLOCK OSCILLATORS • 250 KHz TO 100 MHz IN ALL METAL CASE

Series	Stability
M1200	± .01%
M1214	± .05%
M1215	± .10%
M1216	± 1.0%
M1244	± .0025% (25ppm)
M1245	± .0050% (50ppm)

- **All metal welded package with standoff insulator**
- **Area on PC board is one true TTL space-.795 X .495**
- **Seated height less than 0.215, including insulator**
- **Frequency from 250 KHz to 100 MHz**
- **TTL Compatible**
- **Stability options from 1.0% to .0025%**
- **Units at 4MHz and higher are simple and reliable using the exclusive MF Clock-chip**
- **Metal Package-Unit is hermetically seated by resistance weld, with glass-to-metal seal connector which may be soldered or plugged into socket.**



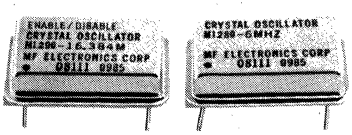




CMOS/TTL CRYSTAL CLOCK OSCILLATOR WITH ENABLE/DISABLE • 250 KHz-50 MHz

- Premium economy and reliability
- Same units may be used for either CMOS or TTL
- All devices are universal HCMOS process which can drive MOS (Rail-to-Rail) or TTL
- M1290 thru M1294 have Enable/Disable function to ease auto-testing in production (ATE)
- All-metal welded package with standoff insulator
- Area on PC board is one true DIL space 0.500″ x 0.800″ max.
- Seated height less than 0.215 including insulator
- Frequency from 250 KHz to 50 MHz
- Start up time less than 5 ms
- Stability options from 0.1% to .0025%

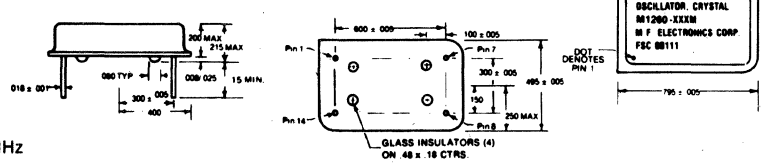
Series without Enable/Disable	Frequency Stability (0 to 75°)	Series With Enable/Disable
M1280	±.01%	M1290
M1281	±.0025%	M1291
M1282	±.005%	M1292
M1283	±.05%	M1293
M1284	±.1%	M1294



CRYSTAL CLOCK FOR MOS MICROPROCESSORS SERIES M1260, M1259, M1257

Same Dimensions as M1200

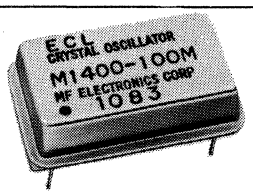
- Drives Z80a AND Z8000, Mostek MK3990-4, Sharp LH0080A, AMD AMz8000, NEC 780C-1
- 2 Times TTL frequency on M1259
- 4 Times TTL frequency on M1257
- MOS output drives 200pf.
- Other frequencies available from 1MHz thru 16MHz

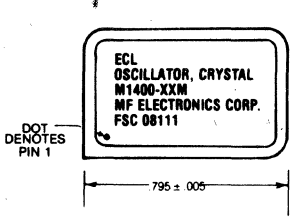


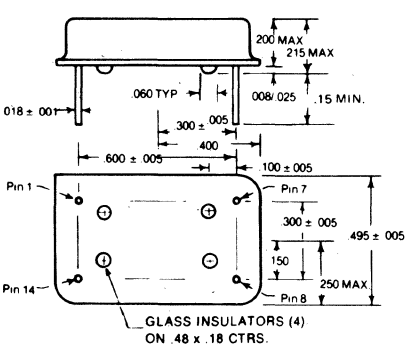
ECL SINGLE/COMPLEMENTARY OUTPUT: 10 MHz TO 125 MHz IN ALL METAL CASE

- **Reliable units for Commercial or Industrial application generating your frequency to 125 MHz and delivering standard 10.000 ECL output. Stability ranges ±.0025% to ±1.0%.**

Series	Stability
M1400, M2400	±.01%
M1410, M2410	±.02%
M1414, M2414	±.05%
M1415, M2415	±.10%
M1416, M2416	± 1.0%
M1444, M2444	±.0025% (25ppm)
M1445, M2445	±.0050% (50ppm)







MF ELECTRONICS CORP.
10 Renewal Place, New Rochelle, N.Y. • 10801 • (914) 576-6570 • TWX: 710-563-0643

DIP CRYSTAL OSCILLATORS

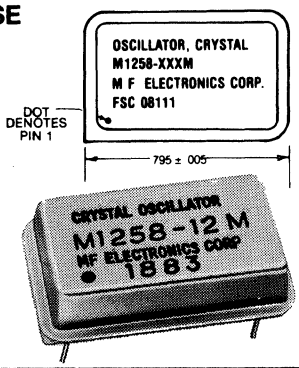
The Broadest line in the industry.

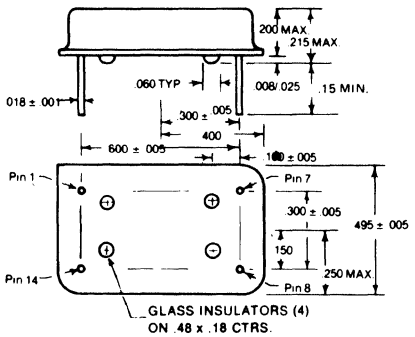
- Units use overtone crystals from 20 MHz to 100 MHz, very stable electrically and more reliable mechanically.
- All units guaranteed for one year to operate within specifications
- Units specified at temperatures exceeding 0 to 70°C are individually recorded 100% for freqency vs temperature insuring compliance.

EXTENDED TEMPERATURE RANGE CLOCK OSCILLATOR: 20 KHz TO 30 MHz IN ALL METAL CASE

Series	Stability	Temperature
M1258	± .01%	−40 to +85°C
M1256	± .0075%	−55 to +85°C

- **All-Metal welded package with Standoff Insulator design for for Extended Temperature industrial applications.**
- **Area on PC board is one true TTL space - .495" X .795" max.**
- **Seated height less than 0.215", including insulator.**
- **Frequency from 20Khz to 30 MHz.**
- **Start up time less than 10 ns.**
- **Stability options from 1.0% to .0025%.**
- **Units at 8MHz and higher are simple and reliable using the Exclusive MF Clock-Chip.™**



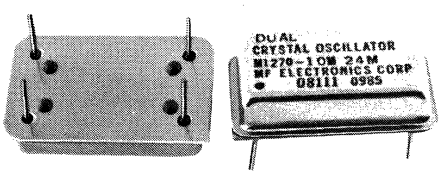


CRYSTAL CLOCK OSCILLATORS • 8 MHz to 35 MHz

2 FREQUENCIES IN 1 PACKAGE

- Two unrelated frequencies in one standard package is economical solution in small space-hungry applications
- Area on PC board is one true TTL space—0.500" x 0.800" max.
- Seated height less than 0.215, including standoffs
- Frequency from 8 MHz to 35 MHz
- Start up time less than 10 ms
- Stability options from 0.1% to .005%
- Units are simple and reliable using the exclusive MF Clock-chip®

Series	Stability
M1270	±.01% (100 ppm)
M1272	±.0050% (50 ppm)
M1273	±.05% (500 ppm)
M1274	±.10%



VOLTAGE CONTROLLED CRYSTAL OSCILLATOR (VCXO) • 8 MHz to 32.768 MHz

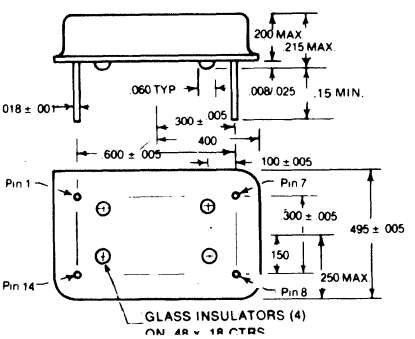
At least an order of magnitude more stable than phase-lock loop using conventional IC with resistor-capacitor control (NE 564)

Control Voltage	Frequency Deviation	Frequency Stability
M2001 .3 to +10V	±.175% (±175 ppm)	±.005% (50 ppm)
M2003 .3 to +10V	±.175% (±175 ppm)	±.005% (50 ppm)
M2002 .3 to +4V	±.0075% (75 ppm)	±.005% (50 ppm)
M2004 .3 to +4V	±.0125% (125 ppm)	±.005% (50 ppm)

Voltage Controlled Oscillator — This crystal oscillator generates a TTL Frequency which is controlled by an input voltage. Although the voltage-frequency relationship is not linear, the circuits for the end-point frequency/voltage parameters are defined, as is the center frequency voltage. Since the VCXO usually operates in a closed loop the exact input voltage vs. frequency transfer characteristic is less important.

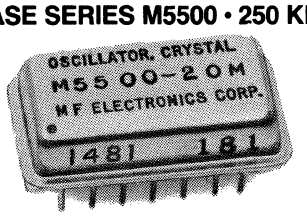
Uses:

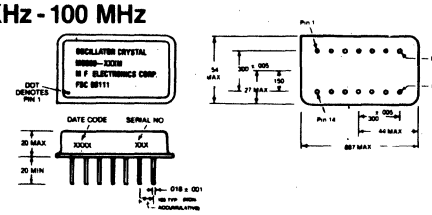
- To clean-up a noisy signal by precisely duplicating it without noise
- To multiply a frequency by a precise integer (N)
- To multiply a frequency by a fraction $\left(\frac{N}{M}\right)$ with zero error
- To detect the frequency modulation, within the frequency limits, of an incoming signal
- Any combination of the above



HIGH REL MILITARY CRYSTAL OSCILLATORS IN HERMETICALLY SEALED CASE SERIES M5500 • 250 KHz - 100 MHz

- Hermetically sealed resistance welded package
- Crystal specifically manufactured for oscillator with angle of cut controlled within ± 1 minute
- 168 hour Class B burn-in
- Simplified design with proprietary IC
- Capacitors to MIL-C-55681
- Extensive environment testing





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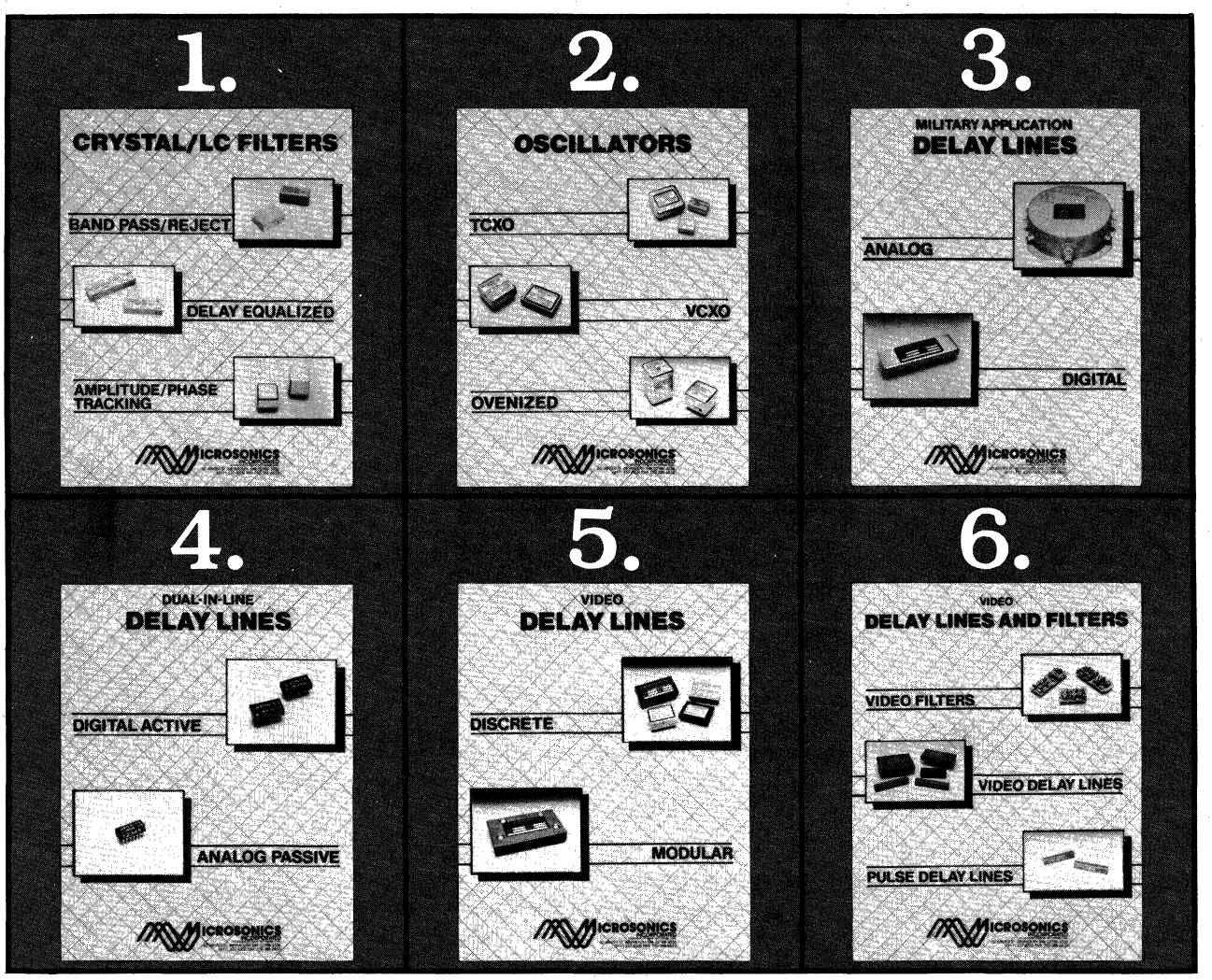
Six ways to know if you're buying the right Oscillators, Filters, and Delay Lines:



We have six new brochures on those very subjects. Not just typical specifications, but detailed presentations of all those elusive facts you need to decide what makes cost-effective sense for your application.

Where did we get all this data? From our twenty-eight years of design experience and our position as a leading supplier of RF components used in military and commercial systems.

Let us help you. A copy of each brochure is yours for the asking.

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60 WINTER ST. WEYMOUTH, MA 02188-3336
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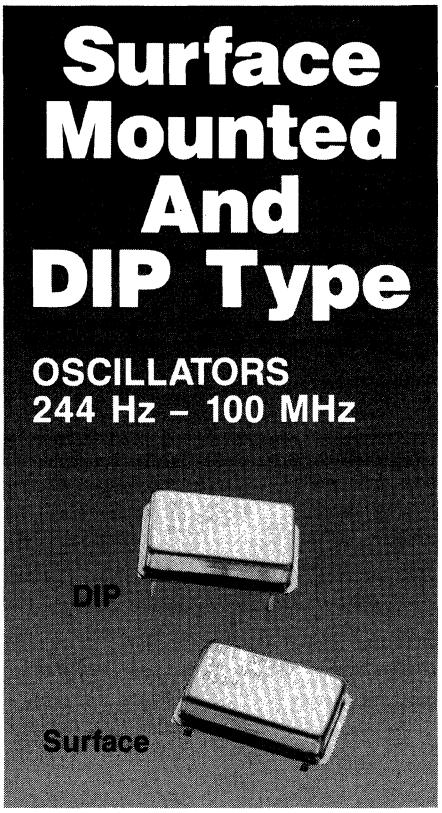
Surface Mounted And DIP Type

OSCILLATORS 244 Hz – 100 MHz



TTL & MOS Midland-Ross' latest design uses a high-quality custom integrated circuit which reduces the number of internal parts and wire bonds, improves reliability and performance. The custom IC reduces current drain, improves output waveform and has the ability to drive both MOS and TTL logic. This includes CMOS, HCMOS and NMOS.

Z80/8000 The 180 Series oscillators are designed to provide output levels compatible with the requirements of Z80/80A/80B/8000/8000A microprocessors. Proper operation is insured through active pull-up on the output logic levels.

ECL The 600 Series oscillators provide MECL 10,000 Series compatible signals. With pin 7 as case ground, the all metal welded package also provides improved RF shielding.

BAUD RATE GENERATORS The 1100 Series generators use a +5V input to provide stable reference frequencies needed by serial interface devices, such as UARTs, modems, teletypewriters, cassettes, etc. They feature choice of 16 output frequencies, direct UART/USRT compatibility and full duplex communications. 1100B has an F_0 output. 1100C has F_0 and $F_0 \div 4$ outputs with zero error at 19,200 baud.

ENABLE/DISABLE The 1300 Series oscillators provide enable/disable TTL compatible signals for bus connected systems. The HS-1300 has logic 0 enable. The HS-1310 has logic 1 enable. In the disabled state the output presents a high impedance to the bus (load).

DUAL OUTPUT COMPLEMENTARY TWO-PHASE The 2100 Series oscillators offer a complementary, non-overlapping output with guaranteed delay timing performance limits between the two outputs in a single package.

DUAL OUTPUT TTL The 2200 Series oscillators introduce F_0 and $F_0 \div 2$, 4, 8 or 16 . . . two different, discrete synchronous, TTL compatible clock sources in the same package.

DUAL OUTPUT SINGLE FREQUENCY The 2820 Series oscillators are intended to fill the need of digital systems or microcomputers for a dual output clock that is TTL and MOS compatible, using 5 volt single rail power source. They are particularly suited for Z80/8000 microprocessor systems, providing the same frequency for both TTL and MOS outputs.

DUAL OUTPUT DUAL FREQUENCY The 2840 Series oscillator is similar to the 2820 Series, but provides a TTL compatible clock at 2^n times the MOS clock, where n=1, 2, or 3.

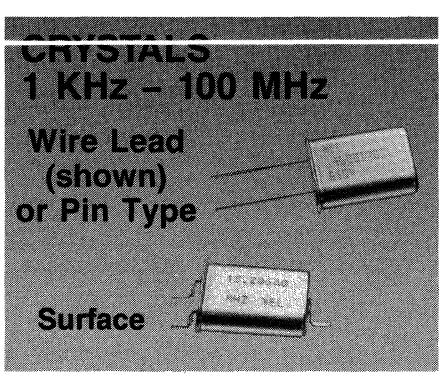
	SINGLE OUTPUT				DUAL OUTPUT				
	TTL/MOS	Z80/8000	ECL	ENABLE/ DISABLE	COMPLE-MENTARY TWO-PHASE TTL	CLOCK & DIVIDED TTL	SINGLE FREQ. TTL & MOS	DUAL FREQ. TTL & MOS	BAUD RATE GEN.
Surface Mount Type	SM-350	SM-180	SM-600	SM-1300	SM-2100	SM-2200	SM-2820	SM-2840	
DIP Type	HS-350	HS-180	HS-600	HS-1300	HS-2100	HS-2200	HS-2820	HS-2840	HS-1100
Frequency Range	500 KHz-40 MHz*	750 KHz-12 MHz	30 MHz-100 MHz	4 MHz-25 MHz	3.5 MHz-20 MHz	219 KHz-12 MHz	750 KHz-16 MHz	750 KHz-16 MHz	
Frequency Tolerance from . . .	±.0025%		±.005%	±.0025%	±.005%				±.01%
Operating Temperature Range**	0-70° C		0-75° C	0-70° C	0-70° C				0-70° C
Supply Voltage V_{cc}	5V DC ± 10%		5V DC ± 5%		5V DC ± 10%				5V DC ± 5%
Supply Current I_{cc} (max)	15 mA	120 mA	60 mA	50 mA	35 mA	90 mA	120 mA		65 mA
Symmetry (%)	60/40				55/45				51/49***
Rise & Fall Times T_R & T_F (max)	5 ns	15 ns	3.6 ns	10 ns	12 ns		15 ns		50 ns
Output Load	10 TTL or MOS	Z80	10K ECL	10 TTL	10 TTL		10 TTL pin 1 and MOS pin 8		TTL

* Additional designs available from 224 Hz to 70 MHz with other parameters. Contact NEL for more information.
** Other temperature ranges are also available.
*** Some baud rate symmetries are 60/40%.

MICROPROCESSOR
- 1 MHz to 48 MHz
- 48 frequencies in stock
- ±.01%, 0-70° C overall
- HC-18/U or HC-33/U
- With or without holddown pin

HIGH FREQUENCY
- 1 MHz to 100 MHz
- From ±.0025%, 0-70° C overall
- Other temperature ranges available
- Variety of enclosures

LOW FREQUENCY
- 1 KHz to 850 KHz
- Variety of cuts
- Many tolerances
- Just ask



APPLICATION ENGINEERING SUPPORT If you don't see what you need listed here, please call our Applications Engineering Team at 414/763-3591. We are continuously developing new products and eager to help you. Also, call or write for our publications *Writing Crystal Specifications* (8514) and *Frequency Tolerance Limitations with Logic Gate Clock Oscillators* (8510).

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357 Beloit Street, Burlington, WI 53105
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HI-REL CRYSTALS

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- MIL-O-55310 QPL
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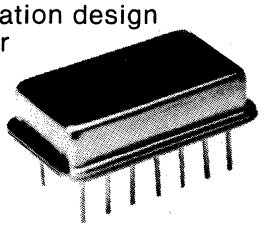
- In-house screening MIL-STD-883
- High shock and vibration design
- Designs to customer specifications
- Over 1000 designs



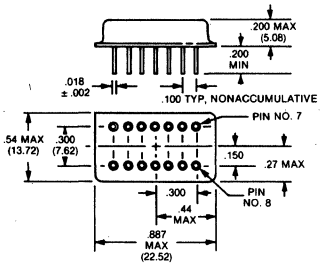
5400-5700 SERIES
MIL-O-55310 QPL

5400 Series:
TTL Oscillator
60 Hz to 25 MHz
MIL-O-55310/14

5700 Series:
Gated TTL Oscillator
60 Hz to 25 MHz
MIL-O-55310/17

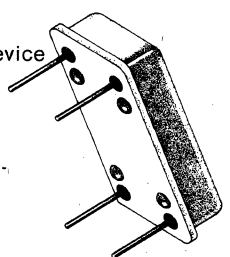
5600 Series:
TTL Oscillator
60 Hz to 25 MHz
MIL-O-55310/16

5500-5700 SERIES



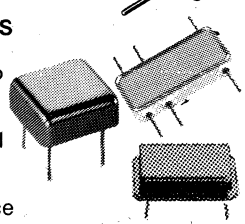
Inquiries invited:
MIL-O-55310/18 CMOS

MIL-O-55310/19 LCC Surface Mount Device

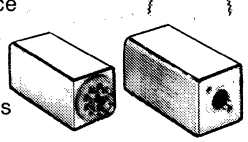


CUSTOM 970 - 250 Hz to 100 MHz Monitor's 970 (TTL, CMOS, ECL) series are available in customized frequency tolerances and temperature ranges. Tolerances to ±10 ppm, temperature −55° to +125°C. Reliability screening and test data are available.

CUSTOM APPLICATION OSCILLATORS
Monitor has over 1,000 designs available which can be used or modified to meet customer requirements. A full range of outputs available (Sine, TTL, CMOS). Units built to the most rugged military and environmental specifications. 30 years with many missile and space programs gives us the experience necessary for Hi-Rel custom designs.

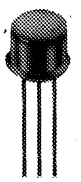


FREQUENCY STANDARDS
Precision ovenized oscillators to 1×10^{-9} per day. Standard frequencies from 1 MHz to 10 MHz are available.



- 58 years Crystal experience
- Special crystal parameter designs
- Shock to 15000G's vibration to 50G's
- Vacuum sealed in controlled environment
- In-house screening MIL-C-3098 and MIL-STD-883
- Low Aging

KTO-5
Military type HC-35/U, 7 MHz to 50 MHz. Features a four point blank mount design that has proven ability to withstand extremely high shock and vibration. The blank mount structure natural resonance is above 3,000 Hz.



Where small size and environment are a factor.

KX-43
Military type HC-43/U, 3.0 MHz to 50 MHz. Adds Koldweld performance and reliability to your frequency control requirements.

KX-43S
7 MHz to 50 MHz. Short version of Monitor's KX-43 with overall height of .395.

High rel replacement of military type HC-18/U and HC-49/U:

KTO-8
Military type HC-37/U, 2 MHz to 10 MHz. Is designed as a larger version of the KTO-5 to accommodate lower frequencies. High natural resonance frequency above 3,000 Hz enables it to withstand high shock, acceleration and vibration.

Deep well exploration, jet engine monitoring, missile and aircraft.

KX-46
Military type HC-46/U, 2 MHz to 10 MHz; 15 MHz to 25 MHz (3rd overtone). Used where special electrical parameters such as high Q or high motional capacities are required. It is also used for VCXO and TCXO requirements.

High rel replacement for the HC-32/U.

KX-6
Military type HC-36/U, 1.5 MHz to 50 MHz. Unit is a pin configuration of KX-46.

High rel replacement of military type HC-6/U.

Other Catalogs Available
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- Microprocessor
- Oscillator
- TCXO
- Filter
- Oven

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- MIL-STD-883 Screening Available
- TCXO ±.5 ppm −55° to +85°C
- MIL-STD-45662 Calibration System
- Engineering support available
- VCXO Custom Designs for:
  Phase Lock Loop Applications
  Carrier Modulation Applications
- Custom Hybrid Circuits Available
- State-of-the-Art Computer Testing

Stabilities: up to ±.2 ppm

Temperature Ranges: up to −55°C to +85°C
TO-116 Compatible Subminiature TCXO's

Supply Voltage: +5VDC to +15VDC

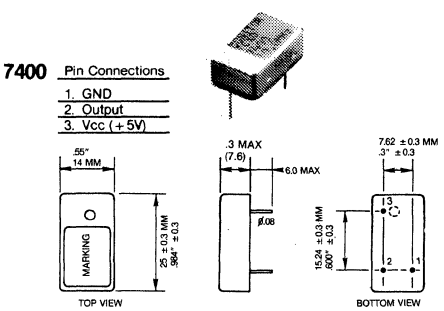
Outputs: TTL, CMOS, ECL, Sine Wave

Frequency Range: 200 KHz to 70 MHz

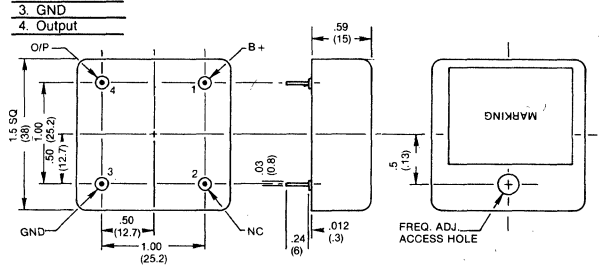
Environmental: MIL-STD-202, MIL-STD-883

INDUSTRIAL OEM TCXO

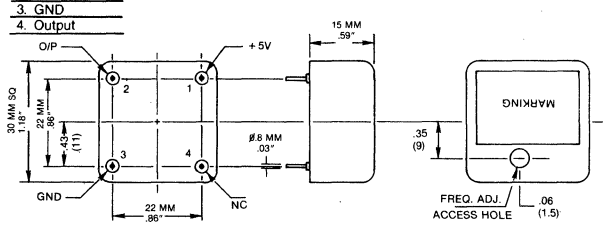
7400 Pin Connections
1. GND
2. Output
3. Vcc (+5V)



7401 Pin Connections
1. B+
2. N/C
3. GND
4. Output



7402 Pin Connections
1. +5VDC
2. N/C
3. GND
4. Output



As low as $18.50 in quantity.

MPC P/N	Frequency Range		Freq. TOL. (PPM) vs. Temp. Range Includes Calibration @ 25°C			Output	Optional	Features
		0°C To +55°C	+15°C To +35°C	−10 To +60°C	−20 To +70°C			
7400	5.0 MHz-20.0 MHz	±1 PPM	±0.5 PPM	±2 PPM		TTL	NA	Low Cost
7401	1.0 MHz-20.0 MHz	±1 PPM	NA	±1 PPM	±2 PPM	TTL	CMOS/Sinewave	Low Power Consumption
		−25°C To +60°C	−20°C To +70°C		−35°C To +75°C			
7402	1.0 MHz-20.0 MHz	±1.5 PPM	±2 PPM		±3 PPM	TTL	NA	High Long Term Stability

Other Catalogs Available
- Crystals
- Microprocessor
- Oscillator
- TCXO
- Filter
- Oven

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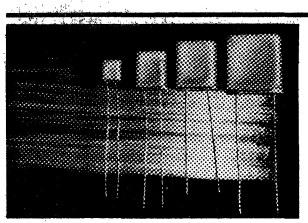
MICROPROCESSOR CRYSTALS

CLOCK OSCILLATORS

970 SERIES



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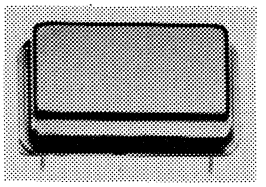
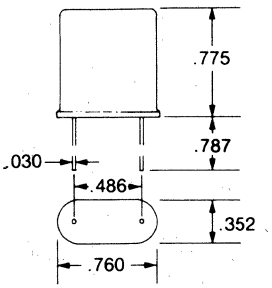
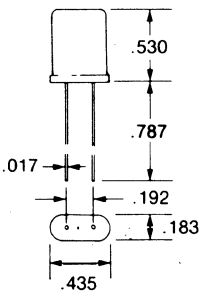


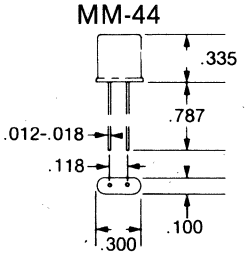
MM-33



MM-18



MM-44



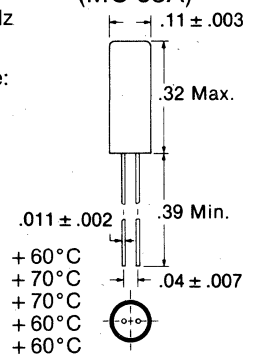
ORDERING INFORMATION
(1) Monitor Package Size
(2) Designer Callout
(3) Optional 3rd Lead
(4) Quantity

ELECTRICAL SPECIFICATIONS
MM-33 : 1.00 MHz to 4.00 MHz
MM-18 : 1.8432 MHz to 48.200 MHz
MM-44 : 6.000 MHz to 48.000 MHz
MC-38 : 25 KHz to 700 KHz
MC-38A: 4.000 MHz to 20.000 MHz

Frequency Calibration Tolerance:
MM-33 ±30 PPM at 25°C
MM-18 ±30 PPM at 25°C
MM-44 ±30 PPM at 25°C
MC-38A ±50 PPM at 25°C
MC-38 ±20 P°PM at 25°C

Frequency Stability Tolerance:
MM-33 ±50 PPM at −10°C to +60°C
MM-18 ±50 PPM at −20°C to +70°C
MM-44 ±50 PPM at −20°C to +70°C
MC-38A ±30 PPM at −10°C to +60°C
MC-38 ±60 PPM at −10°C to +60°C

MC-38
(MC-38A)



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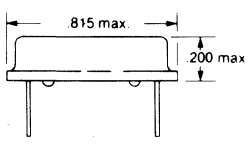
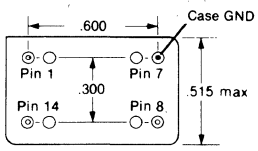
TTL/CMOS/HCS/ ECL CRYSTAL OSCILLATORS





Operating Temperature Range: 0°C to 70°C
Storage: −55°C to 125°C
Input Voltage: TTL: +5 ±.5 VDC (40 MA typ)
CMOS: +5 to 15 VDC (7 MA typ)
HCS: +5 ±.5 VDC (6 MA typ)
ECL: −5.2 VDC ±.2 VDC (30 MA max)

Frequency Range: TTL: 250 KHz to 80 MHz
CMOS & HCS: 1 MHz to 40 MHz
ECL: 30 MHz to 100 MHz

Environmental:
Shock: 1000 G's, 35 Milisec,
½ Sine Wave, 3 shocks each plane

Vibration: 10-55 Hz, 0.060° D.A.,
55-2000 Hz, 35 G's.
Duration Time 12 Hours

Humidity: 85% Relative Humidity,
85°C, 250 Hours.

Hermetically Sealed: Leak Rate Less than
2×10^{-8} Atmos. CC/Sec of Helium

Frequency Stability: ±100 ppm std.
0° to 70°C
Tighter tolerance to ±10 ppm available.

Pin Connections:
Pin 1 N/C, Enable or Output
Pin 7 Case Ground
Pin 8 Output
Pin 14 Input Voltage

Other Catalogs Available
- Crystals
- Microprocessor
- Oscillator
- TCXO
- Filter
- Oven

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MONOLITHIC CRYSTAL FILTERS

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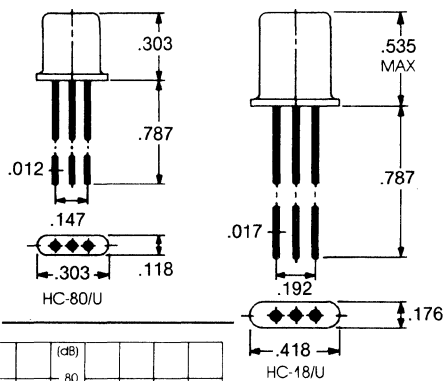
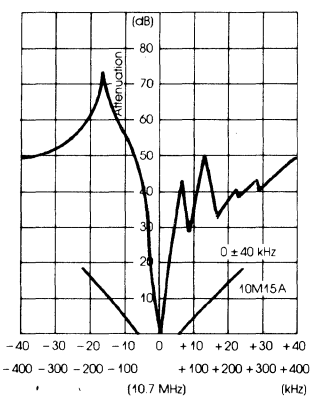
Monitor Products offers its new line of Monolithic Crystal Filters featuring sharp cut-off characteristics, low loss, and high stability over wide temperature range. Two pole filters can be cascaded to produce four, six and eight pole.

For custom made filters, please specify the following:
- Holder size
- Nominal Frequency
- Pass Bandwidth
- Insertion Loss/Attenuation
- Spurious Response
- Impedance
- Operating Temperature Range

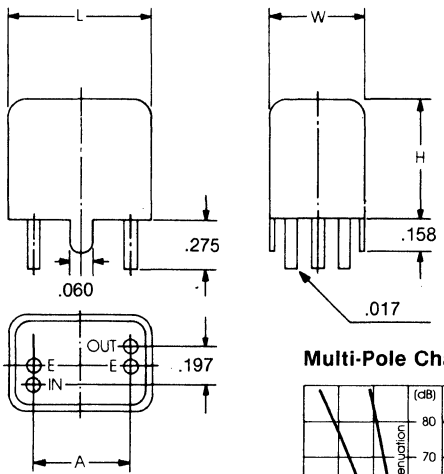
Two Pole Filters



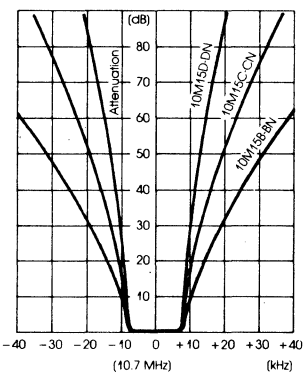
10.7 MHz Two Pole Characteristics



Multi-Pole Packages



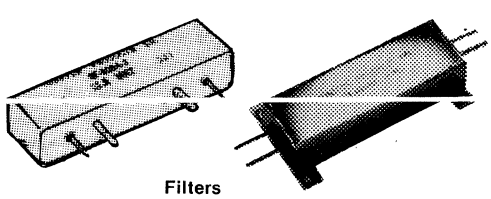
Multi-Pole Characteristics



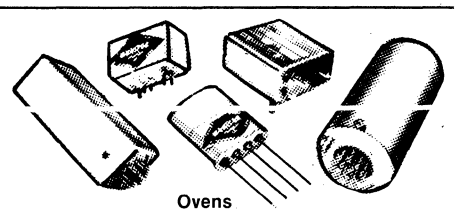
Multi-Pole Package Dimensions

Case Type	L	W	H	A
B	.600	.475	.600	.355
C	.730	.475	.600	.548
D	.906	.475	.600	.700
BN	.475	.435	.475	.296
CN	.630	.435	.475	.453
DN	.830	.435	.475	.650

SPECIAL* PRODUCTS



Filters
Crystal & LC



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*Designed to Customer Specifications

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- TCXO
- Filter
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MOTOROLA INC.

Components Division

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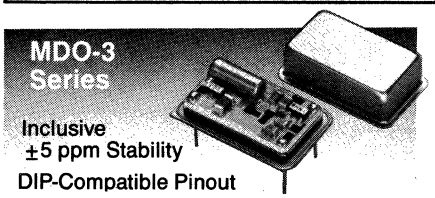
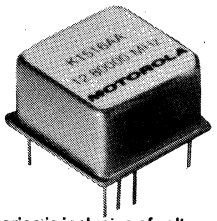
TCXOs, Quartz Crystals Monolithic Filters



The DIP-compatible MDO-3 Series TCXO is in an all-metal, welded package for full hermetic seal. Its ±5 ppm stability is inclusive of variations in temperature, voltage, load, and humidity over the full temperature range from −30°C to +70°C and over a frequency range of 10 MHz to 20 MHz. The MDO-3 makes use of the Motorola AT-Strip crystal to achieve reduction in size and improvement in mechanical shock survivability over earlier designs. Operates from +5V dc source.

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

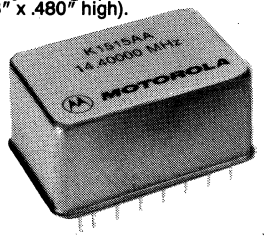
Specifications	MDO-1	MDO-2	MDO-3	MTO-1	MTO-2	MSO-1	MSO-2
Frequency (MHz)	10-20	10-20	10-20	10-20	45-60	10-20	44-88
Temp. Stability (ppm)	±1.0	±2	±5	±5	±5	±2	±5
Temp. Range (°C)	−30 to +90	−35 to +85	−30 to +70	−30 to +85	−30 to +60	−40 to +95	−30 to +70
Supply Voltage (Nom., Vdc)	10	10	5	10	8	10	5
Current Drain (Max., mA)	10	10	2	10	11	10	7
Dimensions (Inches) length	1.780	0.800	0.820	1.160	0.860	0.755	0.755
width	1.170	0.800	0.520	0.860	0.370	0.365	0.365
height	0.790	0.480	0.272	0.560	0.520	0.953	0.953
Freq. Adjust Range	Settable to 1 x 10^{-7}						
Aging Rate (Typical)	1 x 10^{-6}						



MDO-2 Series

Inclusive ±2 ppm Stability, Full Hermetic Seal

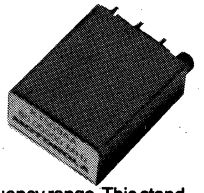
The ±2 ppm frequency stability of the MDO-2 oscillator series is inclusive of voltage and humidity variations while operating over a wide temperature range from −35°C to +85°c. The all-metal welded package offers a full hermetic seal which keeps the oscillator on frequency in environmental extremes of temperature and humidity — high performance with small size (0.8″ x 0.8″ x .480″ high).



MDO-1 Series

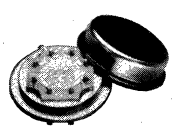
±1 ppm Stability Full Hermetic Seal

The MDO-1 Series oscillator is an ideal substitute for an ovenized oscillator in many applications while using considerably less space. The ±1 ppm stability is maintained over the full temperature range of −30°C to +90°C. The MDO-1 is contained in an all-metal, welded package for full hermetic seal and for minimized RFI.



MSO-1 & 2 Series

The MSO oscillator series, specially designed for communications equipment, is available over a wide frequency range. This stand-up version uses minimal boardspace area. Tight stability and frequency modulation are optionally available.



MFX Crystal Filters

The MFX filters offer 4-pole narrow bandwidth performance, from 45 MHz to 175 MHz, in a single TO-8 package. The MFX series filters are available (a) in a straight 4-pole configuration, (b) as two separated 2-pole filter configuration, or (c) as a custom circuit module, tested and adjusted by Motorola for your application.

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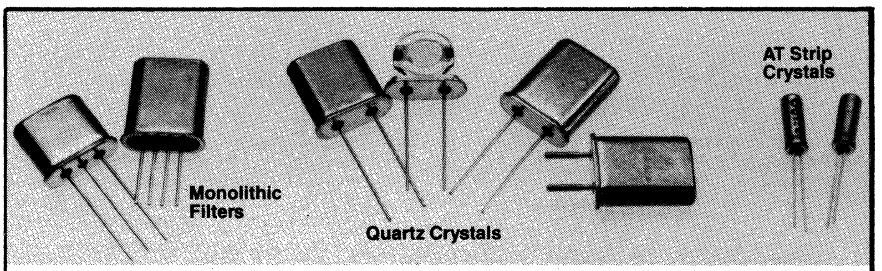
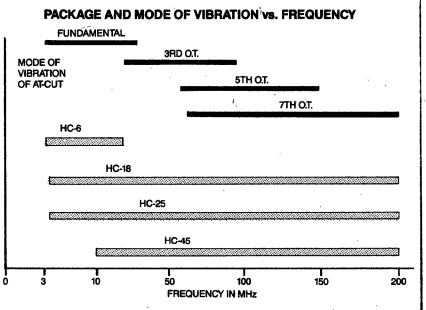


Quartz Crystals

Motorola is an integrated manufacturer of quartz frequency selectivity devices, with complete process control of all the manufacturing processes from growing of cultured quartz through sawing and lapping of the quartz plates to finishing the quartz into high quality crystals. Motorola quartz crystals are ideal for product applications that include FM radio communications equipment, microwave and satellite communications, as well as aerospace and military applications.

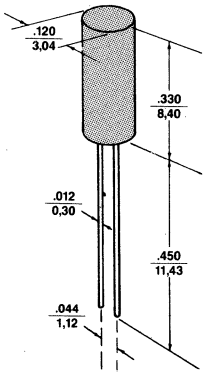
Freq. Stability: .0003% to .01%
Load Capacitance: series resonance 20 pF or 32 pF
Aging: ±2 ppm/year @ 25°C
Shock: meets or exceeds MIL C-3058 and MIL STD 883-B method 2002-2



AT-Strip Resonator Crystals

The 3,0 x 8,4 mm AT strip resonator crystal package is volumetrically 75% smaller than the standard HC-45 package and 90% smaller than the HC-18, making the AT strip crystal well-suited for applications which require small size at low cost. It is available in the fundamental frequency range of 10 MHz to 20 MHz. Nominal aging characteristic at 25°C is ±2 ppm/yr.

Freq. Stability: .002% to .01%
Load Capacitance: 20 pF or 32 pF
Aging: ±2 ppm/year nominal
Shock: 5000g @.3 msec duration



Monolithic Crystal Filters

The disciplines of physics, electrical engineering, and material science are combined with computer-aided Monte Carlo design techniques to create optimum state-of-the-art monolithic crystal filters. Several patented techniques have thus been developed to improve spurious response, stop-band rejection, and intermodulation levels. A broad capability exists to design discrete filters and monolithic filters from two to twelve poles, with frequency capabilities from 5 MHz to 200 MHz.

Motorola offers a complete line of standard filter models designed for use in communications equipment requiring IF filtering. Some of the more popular frequencies at 10.7 MHz, 21.4 MHz, and 45.0 MHz are readily available in a variety of package styles. Contact Motorola Components Division for further information and for specifications.

MOTOROLA INC.

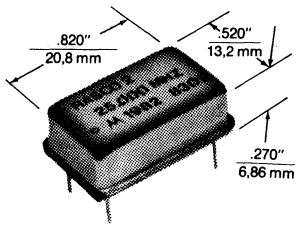
CRYSTAL CLOCK OSCILLATORS

SPECIFICATION / MODEL:	TTL COMPATIBLE: K1158AM K1144AM K1145AM K1100AM K1114AM K1115AM K1116AM	TTL COMPATIBLE: K1161AM K1163AM	TTL COMPATIBLE: RASCO (TTL SERIES)
Frequency Range:	250 kHz to 70 MHz (K1145AM 250 kHz to 50 MHz; K1158AM 1 MHz to 30 MHz; K1144AM 2.5 MHz to 20 MHz and 44 MHz to 70 MHz)	K1161AM 2.5 MHz-10 MHz K1163AM 10 MHz-15 MHz	1 MHz–25 MHz
Frequency Stability: (Inclusive of calibration tolerance at 25°C. operating temperature input voltage change, load change, aging, shock, and vibration.)	K1144AM ±.0025% K1145AM ±.005% K1114AM ±0.05% K1100AM ±0.01% K1115AM ±1% K1158AM ±0.01% K1116AM ±1.0%	±.01%	RASCO-0 ±0.005% RASCO-1 ±0.01% RASCO-2 ±0.05% RASCO-3 ±0.1% RASCO-4 ±1.0%
Temperature Range Operating: Storage:	K1158AM −40°C to +85°C 0°C to +70°C −55°C to +125°C	0°C to +70°C −55°C to +125°C	0°C to +70°C −55°C to +125°C
Input Voltage: Input Current, max. at 25°C:	+5V dc ±0.5V 105 mA (250-1,000 kHz) 90 mA (1-4 MHz) 60 mA (9-30 MHz) 40 mA (4-9 MHz) 70 mA (30-70 MHz)	+5V dc ±0.5V dc 66 mA max.; 70 mA	+5V dc ±0.5V dc frequency dependent
Output: Square Wave: Rise & Fall Time: Levels: Symmetry: (Worst Case) Fan Out:	15 nsec Maximum (.25 to 9 MHz) 10 nsec Maximum (9 to 30 MHz) 5 nsec Maximum (30 to 70 MHz) "0" = 0.4V max., "1" = 2.4V min. 60/40% at 1.4V dc level 1 to 10 gates, 1.6 mA/gate, 5 gates <20 MHz	See description "0" = 0.5V dc max. "1" = 2.4V dc min. 60/40% 1 to 5 gates	6 nsec .5V to 2.5V 60/40% @ 1.4V dc (55/45% RASCO-S) 1 to 10 gates, 1.6 mA/gate
Environmental Shock:	1,000 G's for 0.35 ms. 1/2 sine wave, 3 shocks each plane		
Vibration:	10-55 Hz, 0.060" double amplitude; 55 Hz-2 kHz, 35 G's 12 hours duration		

SPECIFICATION / MODEL:	MOS/TTL: K1160AA DRIVES Z80A, Z80B, Z80H Z8000-TYPE MICRO-PROCESSORS	CMOS COMPATIBLE: K1152AM	CMOS COMPATIBLE: K1144AM	CMOS COMPATIBLE: RASCO "C" SERIES
Frequency Range	2.5-10 MHz (MOS) TTL at 2X MOS	.825 kHz-10 MHz	2.5–20 MHz	1 MHz-25 MHz
Frequency Stability: (Inclusive of calibration tolerance at 25°C. operating temperature, input voltage change, load change, aging, shock, and vibration.)	+0%, −0.020%	±.01%	±0.0025%	RASCO-0C ±0.005% RASCO-1C ±0.01% RASCO-2C ±0.05% RASCO-3C ±0.1% RASCO-4C ±1.0%
Temperature Range Operating: Storage:	0°C to +70°C −55°C to +125°C	0°C to +70°C −55°C to +125°C	0°C to +70°C −55°C to +125°C	0°C to +70°C −55°C to +125°C
Input Voltage: Input Current/Power:	+5V dc, ±0.5V dc 357 mW max.	+5 to 15V dc 3-11 mA (typical)	+5V dc, ±10% frequency dependent	+5V dc ±0.5V dc frequency dependent
Output: Square Wave: Levels: Symmetry: Output Load:	Dual: MOS & TTL MOS "0" = 0.4V max. "1" = Vcc − 4V min. Vcc max. TTL: "0" = −0.2V min. 0.5V max. "1" = 2.5V min. MOS: 150pf* TTL 15pf	CMOS compatible "0" = Vss + .05V dc typ. "1" = Vdd − .05V dc typ. 60/40% @ 50% "1" 15 pf	CMOS compatible 60/40% @ 1.4V dc level	CMOS compatible 60/40% @ 1.4V dc (55/45% RASCO-S)
Environmental Shock	1.000 G's for 0.35 ms. 1/2 sine wave. 3 shocks each plane.			
Vibration:	10-55 Hz. 0.060" double amplitude; 55 Hz-2 kHz. 35 G's, 12 hours duration.			

*100 pf >6 MHz

RASCO
The new generation of data clock oscillators



Ultra-Reliable RASCO Oscillators feature drastic reduction in internal component count and minimal interconnects for greatly improved MTTF (Mean Time To Failure). The standard RASCO series is TTL compatible, driving up to 10 standard or LS logic gates. RASCO "C" series oscillators are compatible with high speed CMOS logic, capable of driving devices with highly capacitive loads. Both feature low current drain.

The rise and fall times of the RASCO oscillators are rigidly controlled so as to be compatible with the stringent requirements of microprocessors. Stabilities are available from ±0.005% to ±1.0% to suit application or budget requirements. Worst-case symmetry is 60/40% standard; 55/45% optional (RASCO-S series).

All-Metal Package — all current Motorola data clock oscillators are enclosed in all-metal, welded packages with full hermetic seal for excellent resistance to extremes of heat/humidity. Pin 7 is case ground, offering improved shielding to minimize RF radiation, helping to meet EMI specifications. The oscillators can be soldered in standard wave-line operations without damage; insulated standoffs permit proper defluxing. They can also be plugged into a standard DIP socket; dimensions are shown above.

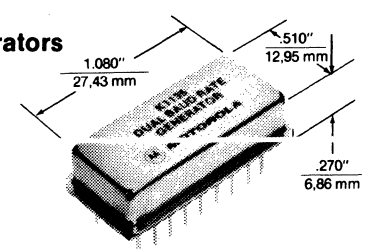
TTL Compatible K1100AM is available from 250 kHz to 70 MHz, has ±0.01% all-inclusive stability. **K1144AM, K1145AM, K1114AM, K1115AM,** and **K1116AM** offer differing stabilities. **K1158AM** (1 to 30 MHz) offers extended temperature range. **K1161AM** provides dual complementary outputs, while model **K1163AM** has a second output at half the clock frequency.

CMOS Compatible K1152AM is a low power clock oscillator available from .825 kHz to 10 MHz. K1144AM (2.5 MHz to 20 MHz) offers ±.0025% stability for CMOS applications.

μP Clock Driver

The **K1160AA** provides a 2.5 MHz to 10 MHz MOS output to drive Zilog or equivalent microprocessors. It also has a TTL output at twice the processor frequency for other systems timing.

Baud Rate Generators
K1135 Series

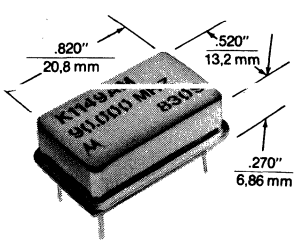


Also enclosed in all-metal, welded packages, these generators provide the stable reference frequencies needed by serial interface devices (UARTs, modems, teletype, cassettes, etc.). They feature choice of 2x16 output frequencies, direct UART/USRT compatibility, full duplex communications. Version B has an Fo output, Version C also has Fo and Fo÷4 outputs and has zero error at 19,200 baud.

Available in +5V only. K1135AA, K1135BA, and K1135CA are identical to standard models K1135AM, K1135BM, and K1135CM except that they do not require a +12V source.

K1149AM
ECL Compatible
Crystal Clock Oscillator

ECL 10KH Based Design — provides improved rise and fall times, duty cycle, noise margins and power supply rejection over earlier 10K family while retaining compatibility. The open emitter output allows the user to select the load termination to optimize performance.



Frequency Range: 60.0 MHz to 90.0 MHz
Frequency Stability: ±100 ppm
Operating Temperature Range:
0°C to +70°C
V_{EE} Supply Voltage: −5.2 ±5% typical
I_{EE} Supply Current: 28 mA typical, 60 mA max
Duty Cycle: 50% typical
Output Logic: "0": −1.8V typical
Output Logic "1": −0.9V typical
Rise and Fall Times (20%–80%):
1.0 ns typical, 2.0 ns max

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MOTOROLA INC.
Components Division

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K
kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L
LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microforad
MHz megahertz
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOSIGT metal-oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM nuclear instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLL phased lock loop
PPI plan position indicator
PROM programmable read only memory
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

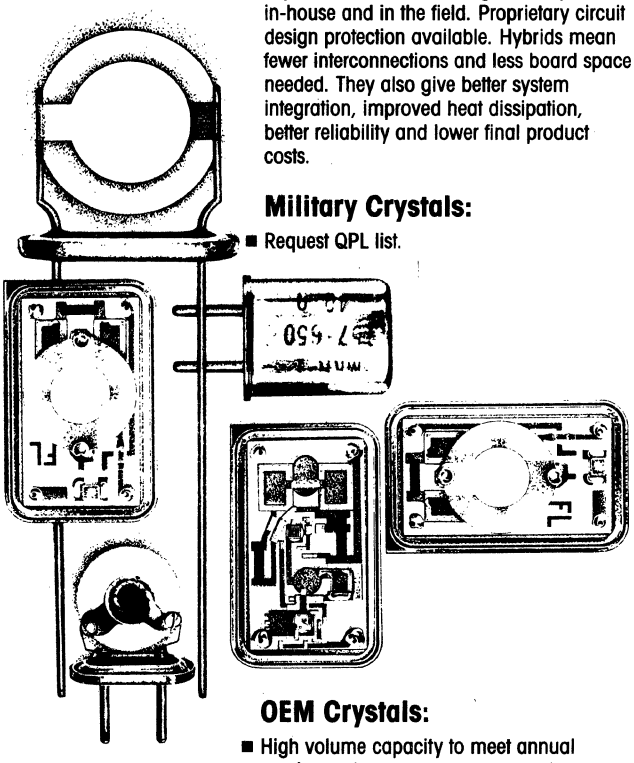
Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

WHERE QUALITY IS IN CONTROL M-tron

Custom Hybrid Capability:

M-Tron has years of experience in designing and manufacturing both thick film and thin film hybrids using single and mixed technologies. Design turnaround time is kept to a minimum. Testing can be provided in-house and in the field. Proprietary circuit design protection available. Hybrids mean fewer interconnections and less board space needed. They also give better system integration, improved heat dissipation, better reliability and lower final product costs.



Military Crystals:

- Request QPL list.

OEM Crystals:

- High volume capacity to meet annual requirements.
- Planned, reliable delivery with short start-up times.
- Standard units available from stock.
- Samples shipped quickly on request.
- Telephone for specifications based on your requirements.

Frequency	1 MHz to 170 MHz
Standard accuracy	±20 PPM @ 25°C
Stability	±25 PPM – 20°C to +70°C

- Tighter specifications are available.

Clock Oscillators:

- Competitive pricing; reliable delivery.
- Hermetic resistance-welded or solder-sealed standard 14-pin DIP packages.
- Surface mount leadless chip carrier or SOJ packages.
- Custom design capabilities.

M-Tron manufactures crystal clock oscillators using TTL, CMOS, HCMOS, HCT and Z80/8000 logic families. Dual-phase clocks and features such as enable/disable and tri-state are also available. Frequencies for TTL are 250 KHz to 60 MHz; for MCO 750 Hz to 12 MHz; for HCMOS 750 Hz to 25 MHz. Standard frequency stability is .01%; ± .0035% available. Standard temperature range is 0° to 70°C; −55° to 125°C available.

Microprocessor Crystals:

- Competitive pricing; reliable delivery.
- All popular frequencies for current microprocessors.
- Industry standard HC-33/U and HC-18/U holders with optional third lead.
- Surface mount leadless chip carrier or SOJ packages.
- Ultra-miniature, ultra-rugged AT-Cut strip resonators. (8mm x 8mm; 6mm x 2mm)
- Just-in-time delivery capability.
- 0.4 AQL standard; tighter AQL on request.
- Qualification samples on request.

New Dual Baud Rate Generator (Series MT1135) with On-Board Crystal Clocks

- Pinout compatible with Motorola K1135 Series, SMC 8136 Series, Western Digital BR1941L Series.
- Programmable 2 x 16 output frequencies.
- Single +5V power supply.
- Ideal for synchronous and asynchronous application.
- Direct UART/USART compatibility.
- Direct microprocessor bus interface.
- Full duplex operation.
- TTL and MOS compatible outputs.

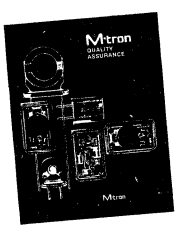
Unquestioned Quality is Standard

M-Tron is qualified as an N.I.V. (No Inspection Verification) supplier to a leading automotive manufacturer.* Our statistical quality control verifies quality in parts per million, well above industry norms. We can provide hard copy and computer drawn (1024 points) graphs of final testing on clock oscillators.

Send for the new M-Tron Quality Assurance Brochure for more details on:

Inspection procedures, sampling methods, calibration and documentation, qualification to industry and military specs, statistical process controls, and test equipment used.

*Documentation available



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M-tron

Competitive excellence in Quality Hybrids, Clock Oscillators and Quartz Crystals.

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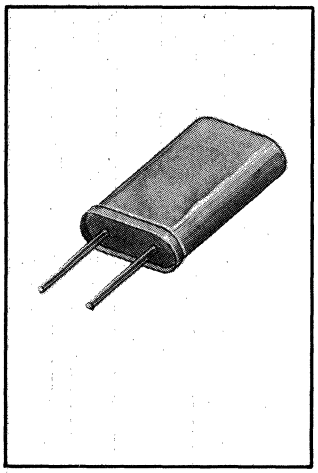
crystals, crystal oscillators, crystal filters & ceramic resonators

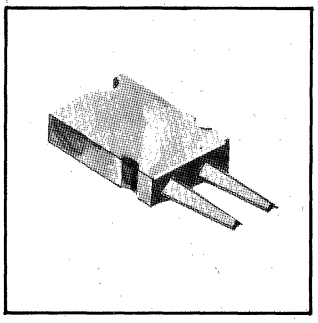
MURATA ERIE NORTH AMERICA, INC.



Crystals

Murata Erie North America, Inc. manufactures crystal cuts capable of handling the entire frequency spectrum from 1 KHz to 150 MHz. Specifications for crystals vary widely with regard to the equipment in which they are being used. Murata Erie manufactures to Military CR types and is qualified on the QPL list for most frequencies. It also manufactures crystals specifically to the customer's own specifications. Murata Erie welcomes the opportunity to quote on any type of crystal in solder seal, cold weld, and resistance weld holders.

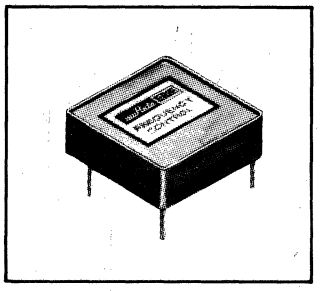
- Frequency Range: 1 KHz to 150 MHz
- Holders: HC-6, HC-13, HC-18, HC-25, HC-32, HC-35 (TO-5), HC-36, HC-39, HC-43, HC-44, HC-49
- Seal: Cold Weld, Solder, Resistance Weld
- Microprocessor Types: 1 MHz to 100 MHz



Ceramic Resonators

Murata Erie's ceramic resonators derive their frequency selective capability from mechanical vibration resulting from a piezoelectric effect in the ceramic material. They are particularly useful in applications where extremely tight frequency tolerances are not required such as clock oscillators and audio tone generators. They are extremely reliable and low cost.

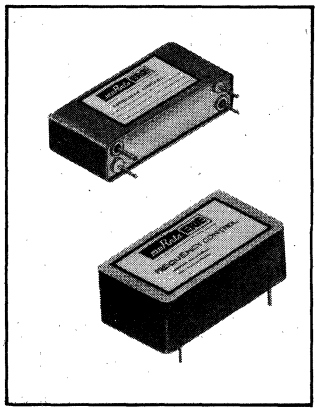
TYPE	CSA TYPE	CSB TYPE
Frequency Range	1 to 30 MHz	190 KHz to 1 MHz
Vibration Mode	Thickness Vibration Fundamental	Area Vibration Fundamental
Frequency Tolerance	±0.5%	±0.5%
Temperature Stability (−20°C to +180°C)	±0.5%	±0.5%
Time Stability (10 years)	+0.5%	+0.5%



Crystal Oscillators

Murata Erie North America, Inc. manufactures a complete line of oscillators ranging from digital DIP clock oscillators to high stability, high reliability frequency sources. As a majority of our oscillators are custom designed, we welcome your inquiries and specifications. Write for our complete catalog.

- Frequency Range: 200 Hz to 600 MHz
- Size: .5″ x .8″ x .25″ to 2″ x 4″ x 1″
- Types: Clock (TTL, ECL, C/MOS or SINE). Integral Oven, Temperature Compensated, Voltage Controlled (VCO)
- Stability: From ±100ppm to ±3pp 10^8



Crystal Filters

Murata Erie North America, Inc. offers a complete line of sophisticated, discrete crystal filters ranging in frequency from 1 KHz to 100 MHz. In addition, we specialize in handling custom design specifications to fit your demanding applications. These high reliability units are rugged and compact, and can be designed to meet the environmental requirements of Mil-F-18327 in most cases.

We invite your questions and encourage you to contact Murata Erie for your special design requirements.

- Center Frequency: 1 KHz to 100 MHz
- Bandwidth: .005% to 10% of F_o
- Shape Factor: As low as 1.25 to 1
- Ripple: Generally less than 1 dB
- Insertion Loss: Usually less than 3.0 dB
- Ultimate Attenuation: Up to 100 dB max
- Maximum Operating Temperature: −55°C to +105°C

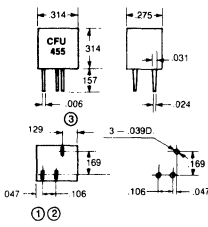
MURATA ERIE NORTH AMERICA, INC. 1148 Franklin Rd., S.E. Marietta, Georgia 30067 Tel: (404) 952-9777 Telex: 54-2329 TWX: 810-766-1531

ceramic filters

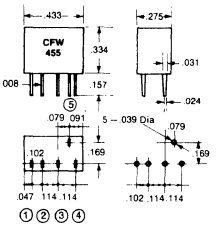
MURATA ERIE NORTH AMERICA, INC.

455 KHz Ceramic Filters for Tranceivers

CFU455



CFW455

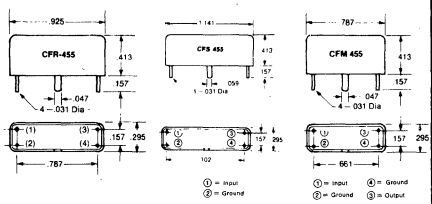


Part Number		6 db Band Width (KHz) min.	Att. Band Width (KHz) max.	Stop Band Att. (dB) min.		Insertion Loss (dB) max.	In./Output Impedance (KΩ)
CFU	CFW			CFU	CFW		
CFU455B2	CFW455B	±15	±30	27	35	4	1.5
CFU455C2	CFW455C	±12.5	±24	27	35	4	1.5
CFU455D2	CFW455D	±10	±20	27	35	4	1.5
CFU455E2	CFW455E	± 7.5	±15	27	35	6	1.5
CFU455F2	CFW455F	± 6	±12.5	27	35	6	2
CFU455G2	CFW455G	± 4.5	±10	25	35	6	2
CFU455H2	CFW455H	± 3	± 9	25	35	6	2
CFU455I2	CFW455I	± 2	± 7.5	25	35	6	2

- Stop band attenuation is specified within 455 ±100 KHz.
- Attenuation band width is specified by the width of CFU: 40 dB, CFW: 50 dB.
- SFG and SFH type are available as G.D.T. flat type for cellular automobile telephone.

455 KHz Ceramic Filters for General Use

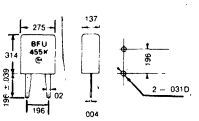
CFR455 CFS455 CFM455



Band Width Rank	Pass Band Width 3dB Band Width (KHz) min.	Pass Band Width 6dB Band Width (KHz) min.	Attenuation Band Width (KHz) max.	Insertion Loss (dB) max. CFR	CFS	CFM	In./Output Impedance (KΩ) CFR	CFS	CFM
A	±13	±17.5	±30	4	4	3	1	1.5	1
B	±10	±15	±25	4	4	3	1	1.5	1
C	± 9	±13	±23	4	4	3	1	1.5	1
D	± 7	±10	±20	4	4	3	1.5	1.5	1.5
E	± 5.5	± 8	±16 (CFS: ±15)	6	6	5	1.5	1.5	1.5
F	± 4.2	± 6	±12	6	6	6	2	2	2
G	—	± 4	±10	6	6	6	2	2	2
H	—	± 3	± 7.5	7	7	6	2	2	2
I	—	± 2	± 5	8	8	7	2	2	2

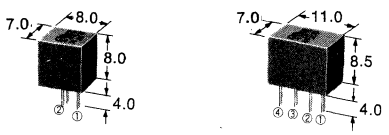
455 KHz Emitter Bypass

Part Number	3 dB Band Width (KHz)	Selectivity −9 KHz off (dB) min.	Selectivity +9 KHz off (dB) min.	Resonant Impedance (Ω) max.
BFU455K	8 ±2	(8)	(12)	30 (15)



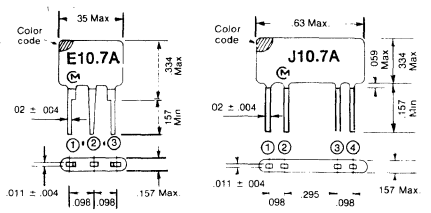
455 KHz Ceramic Filter for Digital Communications

SFG455 SFH455



Band Width Rank	Center Frequency (KHz)	6 dB Band Width (KHz) min.	50 dB Band Width (KHz) max.	Insertion Loss (dB) max. SFG	SFH	G.D.T. (μsec.) Typ. SFG	SFH	Output/Input Impedance (Kohms)
B	455 ±1.5	±15	±35	5	6	40	60	1.5
C	455 ±1.5	±12.5	±30	6	7	40	60	1.5
D	455 ±1	±10	±25	7	8	40	60	1.5
E	455 ±1	± 7.5	±20	8	9	35	60	1.5
F	455 ±1	± 6	±17.5	9	10	30	60	2.0
G	455 ±1	± 4.5	±15	10	11	30	60	2.0

10.7 MHz Ceramic Filters for FM-Stereo

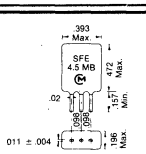


Model Specification	SFE 10.7MA5-Z	SFE 10.7MS2-Z	SFE 10.7MS3-Z	SFE 10.7MJ-Z	SFJ 10.7MA-Z	SFJ 10.7MA2-Z
Center Frequency	A:10.700 MHz ±30 KHz (Red) B:10.670 MHz ±30 KHz (Blue) C:10.730 MHz ±30 KHz (Orange)			D:10.640 MHz ±30 KHz (Black) E:10.760 MHz ±30 KHz (White)		
3 dB Band Width KHz	280 ±50	230 ±50	180 ±50	150 ±50	280 ±50	230 ±50
20 dB Band Width KHz Max.	650	570	520	500	—	—
50 dB Band Width KHz Max.	—	—	—	—	750	700
Insertion Loss	6 dB Max.	6 dB Max.	7 dB Max.	10 dB Max.	7 ±2 dB	7 ±3 dB
Spurious Response (8~12 MHz)	30 dB Min.	40 dB Min.	40 dB Min.	30 dB Min.	55 dB Min.	60 dB Min.
Input/Output Impedance	330 ohms	330 ohms	330 ohms	330 ohms	330 ohms	330 ohms
Temperature Range			−20~+80°C			
Withstanding Voltage			50 VDC			
Dimensions		< Fig. 1 >			< Fig. 2 >	

4.5 MHz Ceramic Filters for TV Sound

Specifications — SFE4.5MB

Nominal Center Frequency: 4.5 MHz. **3 dB Band Width:** ±60 KHz Min. **20 dB Band Width:** 530 KHz Max. **Insertion Loss:** 8.0 dB Max. **Spurious Response:** 20 dB Min. (within ±1 MHz). **Impedance:** 1000 ohms. **Temperature Range:** −20°C~+80°C. **Withstanding Voltage:** 50 VDC.



MURATA ERIE NORTH AMERICA, INC. 1148 Franklin Rd., S.E., Marietta, Georgia 30067 Tel: (404) 952-9777 Telex: 54-2329 TWX: 810-766-1531

TECHNICAL CERAMICS

NGK SPARK PLUGS (U.S.A.), INC.
1701 North Greenville Ave., #205 Richardson, TX 75081,
Phone: (214) 235-8332. TELEX: 170547UT

NTK CERAMIC RESONATOR

PART NUMBER CODE

R 455 C T

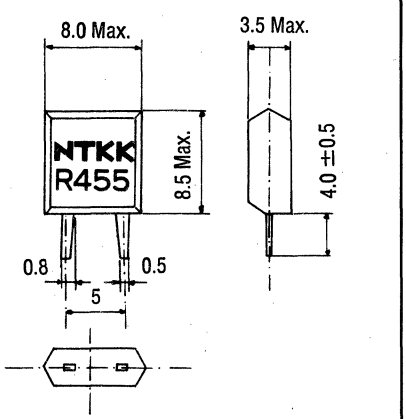
- R — NTKK RESONATOR FREQUENCY
- 455 — A, C, R: KHz; M: MHz
- C — A, C, R: KHz; M: MHz
- T — T: TTL; H: High Q

ELECTRICAL SPECIFICATION (Typical)

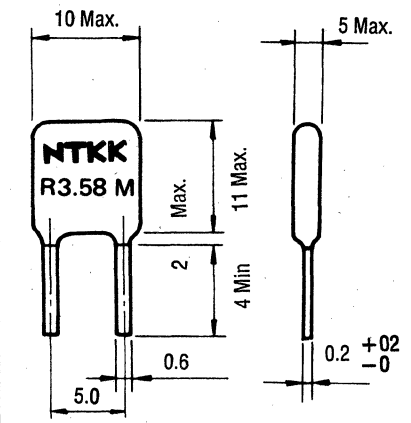
INITIAL FREQUENCY TOLERANCE: ±0.3%
TEMPERATURE STABILITY (−20°C to +80°C): ±0.3%
AGING STABILITY: ±0.3%

DIMENSIONS IN mm.

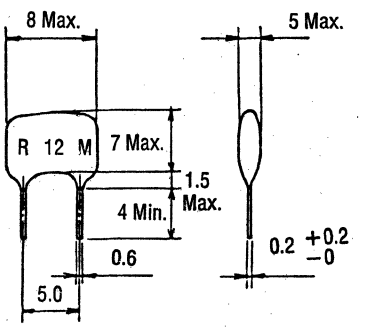
380-800 KHz



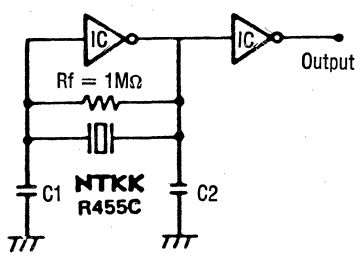
3.5-8 MHz



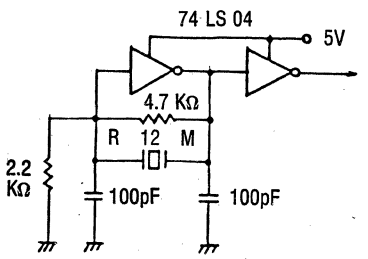
8-12 MHz

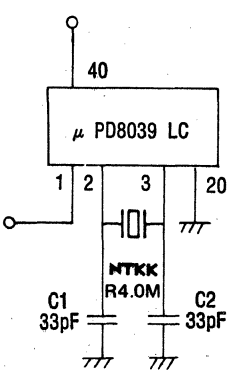


TYPICAL OSCILLATION CIRCUITS



IC: D4069C
VDD = 5V
C1: 100pF
C2: 100pF





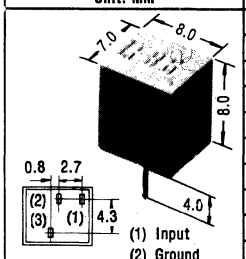
NTK TECHNICAL CERAMIC DIVISION
NGK SPARK PLUGS (U.S.A.), INC.
1701 North Greenville Ave., Suite 205, Richardson, Texas 75081
Phone: (214) 235-8332 Telex: 170547UT

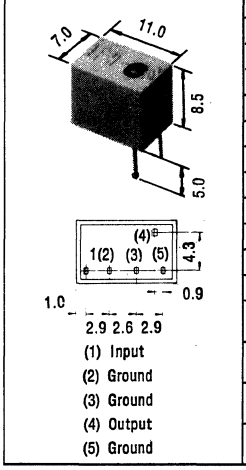
TECHNICAL CERAMICS

NGK SPARK PLUGS (U.S.A.), INC.
1701 North Greenville Ave., #205 Richardson, TX 75081,
Phone: (214) 235-8332. TELEX: 170547UT

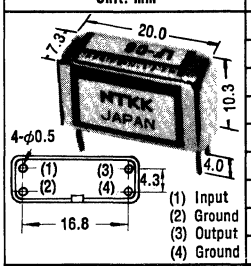
NTK PIEZO CERAMIC FILTERS FOR COMMUNICATIONS

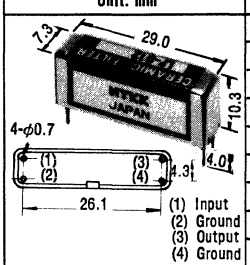
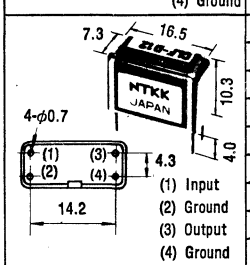
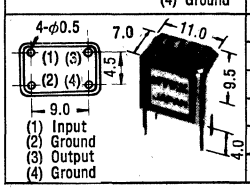
PLASTIC CASE FILTER

Dimensions Unit: mm	Item Model	Center Freq.	−6dB BW (KHz)	−40dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In. Out. Imp. (KΩ)
	LF-B4	455	4	15	25	9	2
	LF-B6	455	6	18	25	8	2
	LF-B8	455	8	21	25	7	2
	LF-B10	455	10	23	25	6	2
	LF-B12	455	12	26	25	6	2
	LF-B15	455	15	30	25	6	2
	LF-B20	455	20	40	25	5	2
	LF-B25	455	25	50	25	5	2
	LF-B4S	455	4	15	35	7	2
	LF-B6S	455	6	18	35	6	2
	LF-B8S	455	8	21	35	6	2

Dimensions Unit: mm	Item Model	Center Freq.	−6dB BW (KHz)	−50dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In. Out. Imp. (KΩ)
	LF-H4	455	4	15	40	8	2
	LF-H6	455	6	18	40	6	2
	LF-H8	455	8	21	40	6	2
	LF-H12	455	12	24	35	6	2
	LF-H15	455	15	30	35	6	1.5
	LF-H18	455	18	36	35	6	1.5
	LF-H4S	455	4	14	45	9	2
	LF-H6S	455	6	16	45	8	2
	LF-H8S	455	8	19	45	7	2
	LF-H12S	455	12	24	40	6	2
	LF-H15S	455	15	30	40	6	1.5
	LF-H18S	455	18	36	40	6	1.5
	LF-K9	400	9	@60dB 18	60	5	1.5
	LF-K12	400	12	@60dB 24	60	5	1.5
	LF-K14A	455	14	@70dB 25	50	6	1.5
	LF-K15	400	15	@60dB 30	60	5	1.5

METAL CASE FILTER

Dimensions Unit: mm	Item Model	Center Freq.	−6dB BW (KHz)	−50dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In. Out. Imp. (KΩ)
	LF-C4	455	4	12	40	9	2
	LF-C6	455	6	16	45	7	1.5
	LF-C8	455	8	20	45	6	1.5
	LF-C12	455	12	24	45	6	1.5
	LF-C15	455	15	28	45	6	1.5
	LF-C18	455	18	30	45	5	1.5
	LF-C20	455	20	38	50	5	1.5
	LF-C25	455	25	44	50	5	1
	LF-C30	455	30	50	50	5	1

Dimensions Unit: mm	Item Model	Center Freq.	−6dB BW (KHz)	−70dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In. Out. Imp. (KΩ)
	LF-D4	455	4	10	70	12	2
	LF-D6	455	6	15	70	10	1.5
	LF-D8	455	8	18	70	9	1.5
	LF-D12	455	12	22	70	8	1.5
	LF-D15	455	15	28	70	7	1.5
	LF-D18	455	18	34	70	6	1.5
	LF-D20	455	20	36	70	6	1.5
	LF-D25	455	25	44	70	6	1
	LF-D30	455	30	50	70	6	1
	CLF-D2	455	2	8	60	10	2
	CLF-D4	455	4	10	70	9	2
	CLF-D6	455	6	15	70	7	1.5
	CLF-D8	455	8	18	70	7	1.5
	CLF-D10	455	10	20	70	6	1.5
	CLF-D12	455	12	22	70	6	1.5
	CLF-D15	455	15	28	70	6	1.5
	CLF-D18	455	18	34	70	5	1.5
	CLF-D20	455	20	36	70	5	1.5
	SLF-D4	455	4	10	70	9	2
	SLF-D6	455	6	15	70	7	1.5
	SLF-D8	455	8	18	70	7	1.5
	SLF-D10	455	10	20	70	6	1.5
	SLF-D12	455	12	22	70	6	1.5
	SLF-D15	455	28	28	70	6	1.5

455 KHz Ceramic Discriminators (P/N D455) and MHz Filters (10.7 MHz, etc.) are also available.

LOW GROUP DELAY FILTERS

Dimension	Item Model	Center Freq.	−3dB BW (KHz)	−60dB BW (KHz)	Attn. (455 ±100) Min. (dB)	G.D. (μsec.) Max.	I.L. Max. (dB)	In. Out. Imp. (KΩ)
Same as CLF-D Type	CLF-G6	455	6	20	60	35	20	1.5
	CLF-G16	455	16	40	60	20	10	1.5
	CLF-G28	455	28	70	60	15	10	1.5
	CLF-G36	455	36	90	60	10	10	1.5

APPLICATIONS

- Cordless Telephones
- Radios
- Transceivers

FEATURES

- Compact Size
- High Performance
- Low Insertion Loss

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

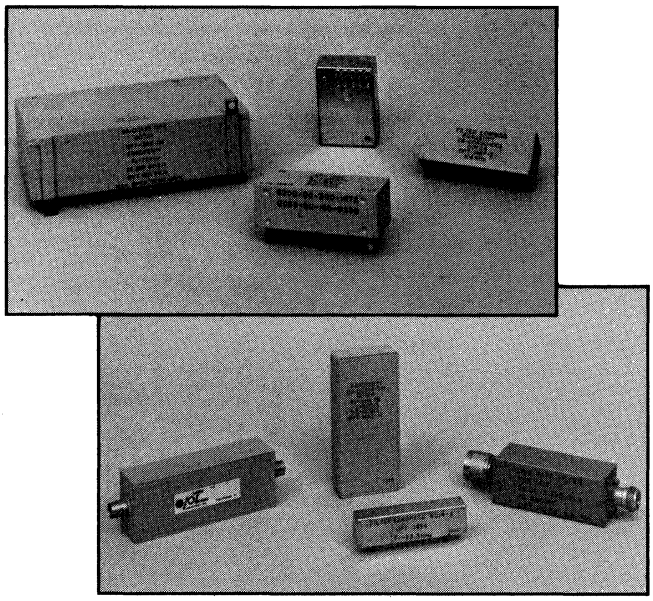
WHERE TO FIND THEM IN THE 85/86 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1166, **B**•1012, **C**•1028, **D**•1016
ASCII Code ..... **D**•1087
Batteries, Product Selection Guide ..... **D**•1413
Batteries & Fuel Cells, Characteristics ..... **D**•1430
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide ..... **A**•1003
Circuit Boards (Printed) Product Selection Guide ..... **C**•1099
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1205
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1863
Connectors, Miniglossary ..... **C**•1129
Connectors, Terminals, & Sockets, Product Selection Guide ..... **C**•1105
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Gude ..... **A**•1309
Delay Lines, Product Selection Guide ..... **A**•1459
Discrete Semiconductors, Product Selection Guide ..... **A**•2067
Displays, Readouts, Lamps, & Lights, Product Selection Guide ..... **B**•1015
EBCDIC Code ..... **D**•1092
Encapsulation, Miniglossary ..... **C**•1086
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide .. **C**•1623
Filters, Product Selection Guide ..... **A**•1583
Instruments, Graphic Recording Product Selection Guide ..... **D**•1401
Instruments, Panel Meters, Product Selection Guide ..... **D**•1329
Instruments, Test & Measuring Product Selection Guide ..... **D**•1175
Interconnection Systems, Product Selection Guide ..... **C**•1699
Keyboards & Keypads, Product Selection Guide ..... **B**•1705
Logofinder & Trademark Directories ..... **B**•901
Microwave Components, Product Selection Guide ..... **A**•1701
Military Qualified Products Lists ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1129
Opto Semiconductors, Miniglossary ..... **B**•1214
Oscilloscopes, Product Selection Guide ..... **D**•1385
Panel Hardware, Product Selection Guide ..... **C**•1589
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide ..... **A**•1991
Power Supplies, Miniglossary ..... **D**•1462
Power Supplies, AC, Product Selection Guide ..... **D**•1877
Power Supplies, DC, Product Selection Guide ..... **D**•1447
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide .... **B**•1225
Relay Contact Forms ..... **B**•1317
Relays, Electromechanical, Miniglossary ..... **B**•1308
Relays, Product Selection Guide ..... **B**•1261
Resistor Color Codes ..... **A**•1828
Resistors, Product Selection Guide ..... **A**•1785
Servo Components, Miniglossary ..... **D**•1985
Solenoids, Product Selection Guide ..... **B**•1463
Switches, Product Selection Guide ..... **B**•1477
Thermal Components, Product Selection Guide ..... **B**•1741
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1744
Thyristors/High Power Diodes, Miniglossary ..... **A**•2076
Transducers & Encoders, Product Selection Guide ..... **B**•1777
Transformers, Product Selection Guide ..... **A**•2099
Wire & Cable, Product Selection Guide ..... **C**•1743
Wire Gauges—Diameter, Area, Copper Weight ..... **C**•1844

opt INDUSTRIES INC.
300 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865 • (201) 454-2600 • TWX 510-235-2920

CUSTOM FILTERS
Engineering & Manufacturing

DISCRETE CRYSTAL FILTERS • LC FILTERS AND NETWORKS • MONOLITHIC CRYSTAL FILTERS



OPT's custom engineering and manufacturing capabilities for monolithic crystal filters range from 4.0 MHz to 30 MHz with relative bandwidths from .04% to .3% of center frequency. Discrete crystal filters range from 1 KHz to 70 MHz with relative bandwidths upwards from .005% of center frequency.

LC Filters and networks include low pass, band pass, high pass, band reject, amplitude and delay correcting, impedance matching in frequencies ranging from DC to 400 MHz with relative bandwidths higher than .2% of center frequency where design permits.

OPT's success in meeting and achieving new goals is reflected in our continued participation in many advanced military programs as well as high quality communication systems.

OPT, in addition to complying with MIL-F-18327 has on certain programs complied with MIL-Q-9858A requirements.

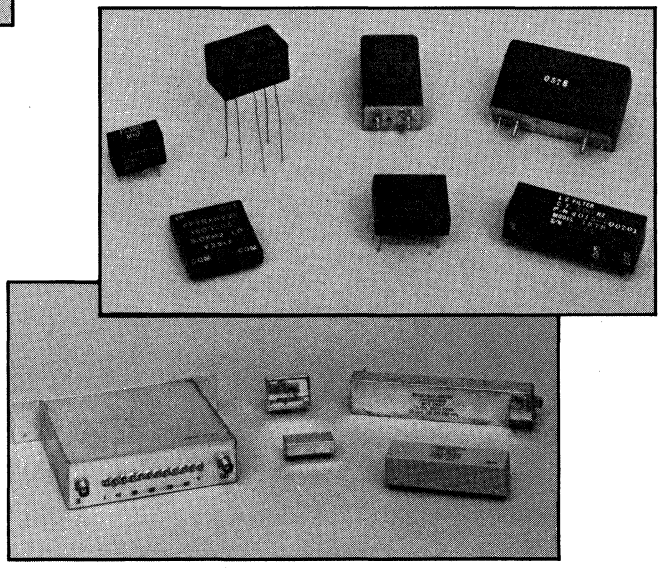
OPT is at the forefront of filter engineering as a result of company sponsored research and development in addition to the technology gained thru the acquisition of all engineering drawings and manufacturing rights from the following companies:

- Bulova Filter Co.
- Filtech
- Omnitec
- Burnell & Co.
- Nytronics
- Ortho Filter

Broad application experience supported by a library of computer synthesis, analysis and optimization programs, assist in supplying the best solution to specific requirements.

OPT is unique in being able to provide in depth engineering support on prototype development as well as quality controlled manufacturing capacity to supply high volume requirements.

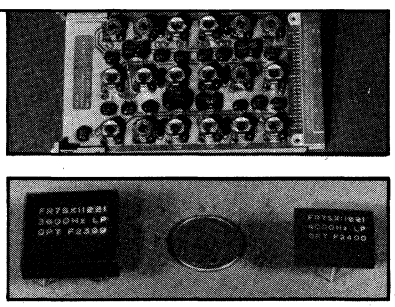
Component stabilization procedures permit guaranteeing maximum stability with operating life. Areas of specialization include delay correction, phase matching and time domain synthesis.

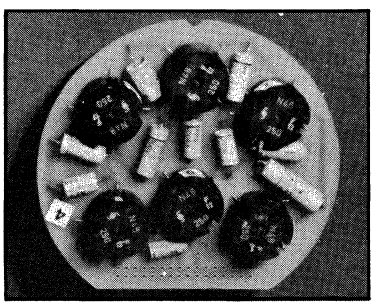


(Top Right) NASA high reliability bandpass filters for use in space shuttle telemetry system. Built to MIL-STD-810C, method 514.2, proc. 5, part 2, curve AH; shock MIL-STD-202, method 213B, cond. k; temp. −30°C to +75°C.

(Bottom Right) Ultraminiature passive low pass filters stable over temperature. Used in codec inputs and secure communications CVDT's.

(Far Right) Phase and amplitude matched filters for sonobuoys and phased array sonars. Temp. −20°C to +65°C. Phase is matched over temperature to <3° for any number of channels.





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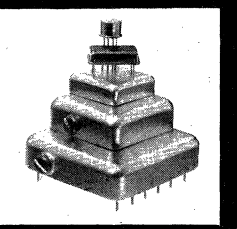
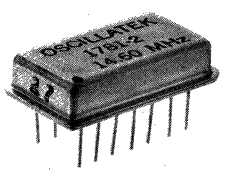
CRYSTAL CLOCK OSCILLATORS



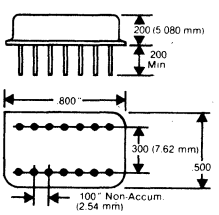
TCXO's

- Crystal controlled thick film hybrid oscillators (XO's).
- Baud rate generators and microprocessor drivers.
- Screening per MIL-O-55310 and MIL-STD-883B is available.
- QPL'd to MIL-O-55310/09/16
- Temperature compensated crystal oscillators (TCXO's).
- Custom designed oscillators to meet your specifications.
- Standard frequencies are available from stock.

DIP M80

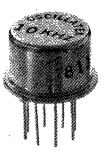


QPL'd to MIL-O-55310/16

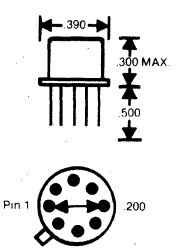


PIN 14 = VCC
PIN 8 = OUT
PIN 7 = GND
REST = NC/ITP
Military Pinouts are Available
M80 = .80" Length

TO5



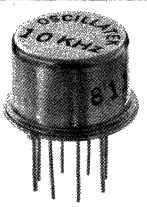
QPL'd to MIL-O-55310/09

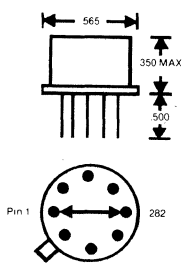


PIN 4 = GND
PIN 5 = OUT
PIN 8 = VCC
REST = NC/ITP

ITP = INTERNAL TIE POINT

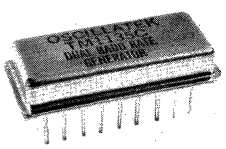
TO8

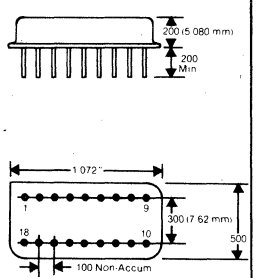




PIN 4 = GND
PIN 5 = OUT
PIN 8 = VCC
REST = NC/ITP

BAUD RATE GENERATOR

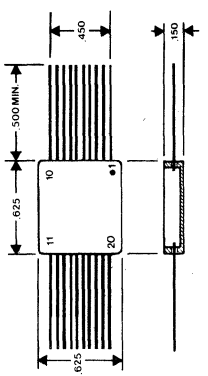




Pin for Pin compatible to the standard parts available in the market.

Request brochure for details.

FLAT PACK



PIN 10 = GND
PIN 11 = OUT
PIN 20 = VCC
REST = NC or ITP

● STANDARD SPECIFICATIONS

TTL

1. Load:
   10TTL up to 20 MHz
   6TTL above 20 MHz
2. Output: Squarewave
   "0" = .5V "1" = 2.4V
3. Input Current:
   .1 Hz to 1 MHz < 100mA
   1 MHz to 3.2 MHz < 70mA
   3.2 MHz to 25 MHz < 30mA
   25 MHz to 120 MHz < 70mA

ECL

1. Supply Voltage: $^{-}$5.2V ± 5%
2. Input Current: 50mA Typical
3. Output: ECL Compatible (from MC10105 Gate)

SINEWAVE

1. Supply Voltage: 5V ± 5% (Typical)
2. Input Current: 25 mA (Max) 5 mA to 10 mA Typical at 5.00 MHz
3. Output: .3V RMS min into 1K Ohms

CMOS - STANDARD

1. Input Voltage: 4.5V to 15V (Specify).
2. Output: 80 to 95% of supply voltage (Typical).
3. Input Current: Power required for CMOS oscillators is a function of frequency and operating voltage typical values are as shown in the table below.

FREQUENCY	AT 5V	AT 10V	AT 15V
1 Hz to 1 MHz	.7 mA	1.9 mA	3.3 mA
1 MHz to 3.2 MHz	.9 mA	3.0 mA	4.4 mA
3.2 MHz to 20 MHz	3.3 mA	7.4 mA	10.2 mA

CMOS LOW CURRENT

1. Supply Voltage: 1V to 8V (Specify).
2. Input Current: 100 uA to 900 uA depending upon frequency and operating voltage.
3. Load: Capable of driving standard CMOS and TTL at 5V supply.
4. Temperature stability: Consult factory.

1. Frequency at 25°C: ± .0015% (Typical)
2. Voltage stability: VCC ± 5% △F < 1PPM
   VCC ± 10% △F < 2PPM
3. Duty Cycle: 40 - 60%
4. Aging: ±5PPM/Year.
5. Storage: -55° to 125°C.
6. Environmental: Per MIL-O-55310/16
7. These are typical values for critical requirements. Consult factory.

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● ORDERING METHOD — DIP PACKAGES

OUTPUT LOGIC	PACKAGE STYLE	PACKAGE TYPE	PIN CONN.	TEMPERATURE STABILITY	TEMPERATURE RANGE	FREQUENCY RANGE
T = TTL C = CMOS E = ECL S = SINE	M80 = .80"Length MSP = Specify Note: Check factory for custom design mechanical Note: See Page 2 for dimensions on M80 - DIP package	14 = 14 PINS 04 = 4 PINS Pin dia. .018" Nominal	1 = PIN/CONN: 7 GND, 8 OUT, 14 VCC, REST NC/ITP 2 = PIN/CONN: 4 VCC, 5 OUT, 7 GND, REST NC/ITP 3 = PIN/CONN: 1 OUT, 2 CASE, 8 GND, 14 VCC, REST NC/ITP ITP = Internal Tie Point	A = ± .001% B = ± .0025% C = ± .005% D = ± .01% E = ± .05% F = ± .1% G = ± 1% H = ± 2% **NOTE:** "A" for 0°C to 50°C only "B" for −20°C to 70°C only.	R = 0°C to 50°C S = 0°C to 79°C X = −20°C to 70°C Y = −30°C to 85°C Z1 = −55°C to 105°C Z = −55°C to 125°C Note: For temperature range "S" in 4-pin DIP, see standard TM1100 series below.	TTL = 1Hz to 120MHz CMOS = 1Hz to 20MHz ECL = 3.2MHz to 120MHz SINE = 3.2MHz to 25MHz
C1 = CMOS (Very low Current)	M97 = .97"	16 = 16 PINS	1 = PIN/CONN: 8 GND, 9 OUT, 16 VCC, REST NC/ITP	Same as above except temperature stabilities A, B, C & D are applicable only over R, S and X temperature ranges.		CMOS = .0005 Hz to 1 MHz

EXAMPLE

T	M80	04	1	B	R	5.00 MHz	Write "Screened" here if screening to MIL.-STD.-883B is required.

TM80041BR 5.00 MHz

● ORDERING METHOD — T05, T08, FLAT-PACK

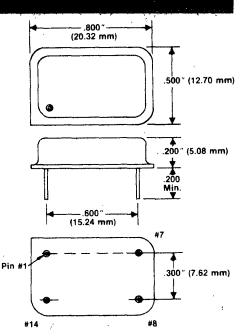
OUTPUT LOGIC	PACKAGE STYLE	PACKAGE TYPE	PIN CONN.	TEMPERATURE STABILITY	TEMPERATURE RANGE	FREQUENCY RANGE
T = TTL C = CMOS	05 = T05 08 = T08 Note: See Page 2 for dimensions	8 = 8 PINS	1 = *Standard* PIN/CONN: 4 GND, 5 OUT, 8 VCC, REST NC/ITP	Same as for DIP-Packages (Above)	Same as for DIP-Packages (Above)	TTL = 500kHz to 75MHz CMOS = 1kHz to 20MHz
T = TTL C = CMOS	625 = .625" × .625" × .15" Flat-Pack	20 = 20 PINS	1 = PIN/CONN: 10 VCC, 11 OUT, 20 GND, REST NC/ITP	Sames as for DIP-Packages (Above)	Same as for DIP-Packages (Above)	Consult Factory

EXAMPLE

T	05	8	1	D	Z	20 MHz	Write "Screened" here if screening to MIL.-STD.-883B is required.

T0581DZ20MHz "Screened"

STANDARD SERIES

STANDARD SERIES—TTL	STANDARD SERIES—ECL	STANDARD SERIES—CMOS	TEMPERATURE STABILITY 0°C to 70°C	FREQUENCY RANGE	DIMENSIONS
TM 1100A	EM 1100A	CM 1100A	± .01%	TTL = 1 Hz to 120 MHz ECL = 3.2 MHz to 120 MHz CMOS = 1 Hz to 25 MHz	
TM 1114A	EM 1114A	CM 1114A	± .05%		
TM 1115A	EM 1115A	CM 1115A	± .1%		
TM 1116A	EM 1116A	CM 1116A	± 1.00%		
TM 1144A	EM 1144A	CM 1144A	± .0025%		
TM 1145A	EM 1145A	CM 1145A	± .005%		

EXAMPLE:

TM1100A	–	5.00 MHz

TM 1100A–5.00 MHz

NOTE 1: Specify operating voltage for CMOS oscillators
For Example:
CM 1100 A - 5.00 MHz at 5V DC.

NOTE 2: For custom designs with different frequency or temperature stability or different mechanical requirements, see pages 2 & 3.

PIN	CONNECTION
1	N.C.
7	GND
8	OUTPUT
14	+ V dc

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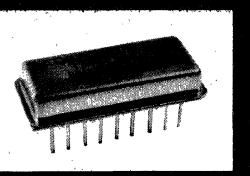
DUAL BAUD RATE GENERATOR



HERMETICALLY SEALED DIP PACKAGE

Dual Baud Rate Generators

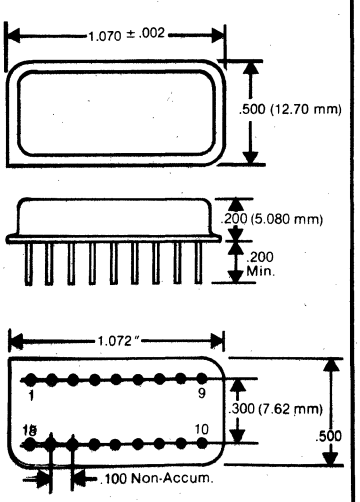
Programable Dividers
TM1135 Series

● FEATURES

- The OSCILLATEK CORPORATION TM1135 dual baud rate generator series is pin for pin compatible with most of the standard dual baud rate generators available in the market to provide a stable reference for serial interface devices (UART/USRT), teletypewriters, telephone modems and cassettes.
- Very versatile to be used a programmable oscillator with frequency choice within crystal frequency range of 3.20 MHz to 5.20 MHz
- Internal crystal oscillator fully tested to meet your variety of temperature stability requirements.
- CMOS, TTL Compatibility
- Choice of 2x16 output frequencies, selectable by manual or software control.
- Dual feature allows to receive and transmit simultaneously.
- Resistance weld, hermetically sealed 18 Pin - Dip package, can be screened to MIL-STD-883B.
- TM1135D has direct oscillator frequency available at Pin 1 along with divide by 4 (oscillator ÷ 4) available at Pin 10. TM1135C is similar to TM1135D except oscillator frequency is not available at Pin 1.
- TM1135E is same as TM1135D except crystal frequency is 4.9152M Hz to get zero error at 19,200 baud.
- TM1135C, TM1135D, and TM1135E operate from a single 5V DC supply.

● PIN FUNCTIONS

PIN NO.	CONN.	FUNCTION
1	NC F_O	No connection for TM1135C. Oscillator output for TM1135D and TM1135E
2	V_{CC}	Power supply; 5VDC
3	F_R	Receiver output selected by Receiver Divisor select data bits.
4-7	R_A, R_B, R_C, R_D	These inputs as shown in Table 1, select the receiver output frequency F_R.
8	STR	Strobing or hard wiring this Pin to high level loads the receiver data (R_A, R_B, R_C, R_D) into the receiver divisor select register
9	NC	No connection
10	$F_O/4$	Internal oscillator frequency divided by 4
11	GND	Ground
12	STT	Strobing or hard wiring this pin to high level, loads the transmitter data (T_A, T_B, T_C, T_D) into the transmitter-divisor select register.
13-16	T_A, T_B, T_C, T_D	These inputs as shown in Table 1, select the transmitter output frequency F_T.
17	F_T	This output runs at a frequency selected by the transmitter divisor select data bits.
18	NC	No connection



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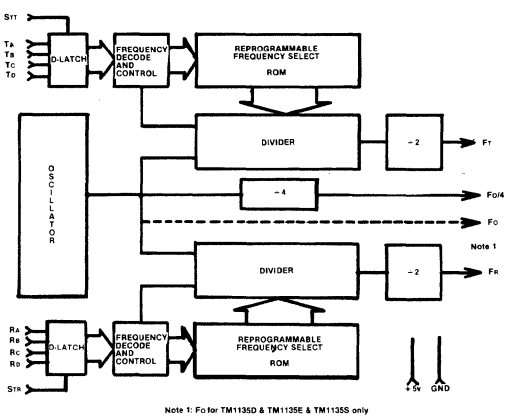
● OUTPUT OPTIONS

TABLE 1

Divisor Select DCBA	Desired Baud Rate	Desired Frequency (KHz)	TM1135C / TM1135D Fo = 5.0688 MHz, Fo ÷ 4 = 1.2672 MHz: Actual Baud Rate	Actual Frequency (KHz)	Deviation	Divisor	Duty Cycle	TM1135 E Fo = 4.9152 MHz, REF. = Fo ÷ 4 = 1.2288 MHz: Actual Baud Rate	Actual Frequency (KHz)	Deviation	Divisor	Duty Cycle
0000	50.00	0.80000	50.00	0.800000	0.0000%	6336	50-50	50.00	0.800000	0.0000%	6144	50-50
0001	75.00	1.20000	75.00	1.200000	0.0000%	4224	50-50	75.00	1.200000	0.0000%	4096	50-50
0010	110.00	1.76000	110.00	1.760000	0.0000%	2880	50-50	109.93	1.758983	0.0100%	2793	40-60
0011	134.50	2.15200	134.52	2.152357	0.0166%	2355	50-50	134.50	2.152000	0.0000%	2284	50-50
0100	150.00	2.40000	150.00	2.400000	0.0000%	2112	50-50	150.00	2.400000	0.0000%	2048	50-50
0101	300.00	4.80000	300.00	4.800000	0.0000%	1056	50-50	300.00	4.800000	0.0000%	1024	50-50
0110	600.00	9.60000	600.00	9.600000	0.0000%	528	50-50	600.00	9.600000	0.0000%	512	50-50
0111	1200.00	19.20000	1200.00	19.200000	0.0000%	264	50-50	1200.00	19.200000	0.0000%	256	50-50
1000	1800.00	28.80000	1800.00	28.800000	0.0000%	176	50-50	1796.49	28.743859	0.1949%	171	40-60
1001	2000.00	32.00000	2005.06	32.081013	0.2532%	158	50-50	1994.81	31.916883	0.2597%	154	50-50
1010	2400.00	38.40000	2400.00	38.400000	0.0000%	132	50-50	2400.00	32.000000	0.0000%	128	50-50
1011	3600.00	57.60000	3600.00	57.600000	0.0000%	88	50-50	3614.11	57.825882	0.3921%	85	40-60
1100	4800.00	76.80000	4800.00	76.800000	0.0000%	66	50-50	4800.00	76.800000	0.0000%	64	50-50
1101	7200.00	115.20000	7200.00	115.200000	0.0000%	44	50-50	7144.19	114.306976	0.7751%	43	40-60
1110	9600.00	153.60000	9600.00	153.600000	0.0000%	33	48-52	9600.00	153.600000	0.0000%	32	50-50
1111	19200.00	307.20000	19800.00	316.800000	3.1250%	16	50-50	19200.00	307.200000	0.0000%	16	50-50

● BLOCK DIAGRAM



Note 1: Fo for TM1135D & TM1135E & TM1135S only

● ELECTRICAL CHARACTERISTICS (TYPICAL)

■ MAXIMUM RATINGS

Operating Temperature Range ..... O° C to 70° C
Storage Temperature Range .....−55° C to 125° C
+ VE Voltage on any pin w.r.t. ground ..... + 8v
− VE Voltage on any pin w.r.t. ground ..... −.3v

■ STANDARD CONDITIONS (UNLESS OTHERWISE NOTED)

Temperature = 0° C to 70° C
V_{CC} = +5V ± 5%

■ D C CHARACTERISTICS

CHARACTERISTICS	MIN	TYP	MAX	UNIT	CONDITIONS
Input Voltage Low level = (V_{IL}) High level = (V_{IH})	— 2.0	— —	0.8 —	V V	
Output Voltage Low level = (V_{OL}) High level = (V_{OH})	— — 3.5	— — —	0.4 0.4 —	V V V	I_{OL} = 1.6mA, for Fo/4 = 3.4mA, for F_R, F_T I_{OM} = 100 µA
Input Current Low level (I_{IL})	—	—	−0.1	mA	V_{IN} = GND R_A, R_D, T_A, T_D
Input Capacitance (All inputs)	—	5	10	pF	V_{IN} = GND
Supply Current = (I_{CC})	—	—	50	mA	

■ ENVIRONMENTAL

Per MIL-0-55310/16 (Typical)
For special requirements consult factory

■ A C CHARACTERISTICS

CHARACTERISTICS	MIN	TYP	MAX	UNIT	CONDITIONS
Clock Frequency = (Fo)	.01	—	5.2	MHz	
Strobe Pulse Width	150	—	DC	nS	
Input Set Up Time	200	—	—	nS	
Input Hold Time	50	—	—	nS	
Strobe to New Freq. Delay	—	—	3.5	µS	at Fo = 5 MHz

● ORDERING METHOD

MODEL	–	TEMPERATURE STABILITY	TEMPERATURE RANGE	FREQUENCY RANGE
TM1135 C TM1135 D TM1135 E TM1135 S		B = ± .0025% C = ± .005% D = ± .01% E = ± .05% F = ± .1% **NOTE:** **B for 0°C to 50°C only**	R = 0°C to +50°C S = 0°C to +70°C X = −20°C to +70°C Y = −30°C to +85°C Z = −55°C to +125°C	TM1135 C = 5.0688 MHz only TM1135 D = 5.0688 MHz only TM1135 E = 4.9152 MHz only TM1135 S = specify from 3.2 MHz to 5.20 MHz to use as programmable oscillator

EXAMPLE

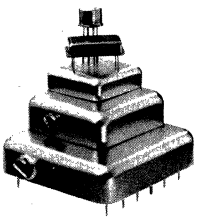
TM1135 C	–	D	S	5.0688 MHz	Write "Screened" if screening to MIL-STD-883B is required

OSCILLATEK

A DIVISION OF K & L MICROWAVE, INC.

620 North Lindenwood Drive • Olathe, Kansas 66062
Phone: (913) 829-1777 • TELEX: 437045

CRYSTAL CLOCK OSCILLATORS



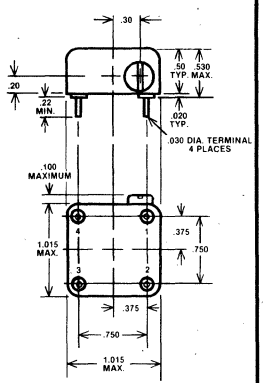
TCXO's

OSCILLATEK TCXO's have been designed for use in military, aerospace and commercial timing applications, where reliability, size, weight and power requirements are difficult to meet with ovenized oscillators. Our computer aided Compensation Network Synthesis Technique allows us to use minimum number of components most effectively to reduce compensation error to possible minimum.

● FEATURES

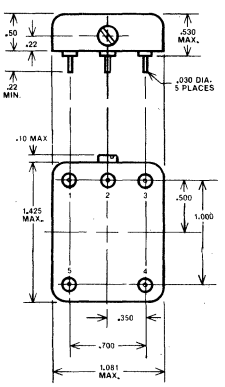
- Low power consumption.
- Frequency range .01 Hz to 125 MHz (Consult factory).
- TTL, CMOS, ECL and SINEWAVE output options.
- Low power CMOS.
- In addition to our standard product we offer custom design capability.
- Variety of temperature stabilities over multiple temperature range selections including full military range of – 55° C to 125° C.
- Fast warm up.
- High stability operation from 5V supply.

×101



PIN	CONNECTION
1	GND, CASE
2	GND
3	SUPPLY
4	OUTPUT

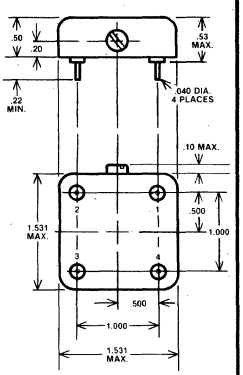
×114



PIN	CONNECTION
1*	NC
2*	NC
3	SUPPLY
4	OUTPUT
5	CASE, GROUND

* Pins 1 and 2 serve as VCO inputs or connections for an external potentiometer where external frequency adjust is required.

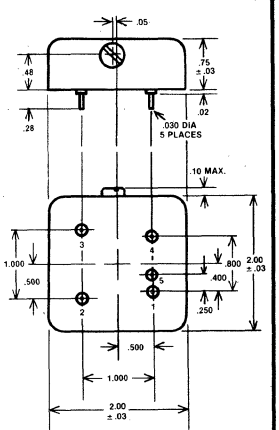
×151



PIN	FUNCTION
1	COMMON, CASE GND
2	SUPPLY
3	OUTPUT
*4	NC or ELECTRONIC FREQUENCY ADJUST

* With electronic frequency adjust option, frequency control voltage is applied from Pin 4 to Pin 1

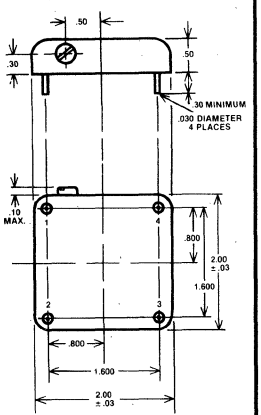
×202



PIN	FUNCTION
1	RF OUTPUT
2	SUPPLY
*3	SUPPLY COMMON
4	CASE
*5	RF RETURN

* Internally connected

×205



PIN	FUNCTION
1	COMMON, CASE
2	SUPPLY
3	OUT
4	COMMON, CASE

OSCILLATEK

ORDERING METHOD

OUTPUT	MODEL NO.	TEMPERATURE RANGE	FREQUENCY STABILITY OPTIONS	FREQUENCY RANGE
T = TTL C = CMOS E = ECL S = SINE	×205 ×202 ×151 ×114 ×101 **NOTE:** See page 2 for mechanical dimensions and pin outs.	A: 0° C to 50° C	17: $\pm1\times10^{-7}$, 27: $\pm2\times10^{-7}$, 57: $\pm5\times10^{-7}$ 16: $\pm1\times10^{-6}$, 26: $\pm2\times10^{-6}$, 56: $\pm5\times10^{-6}$	See Table Below.
		B: 0° C to 70° C	27: $\pm2\times10^{-7}$, 57: $\pm5\times10^{-7}$, 16: $\pm1\times10^{-6}$ 26: $\pm2\times10^{-6}$, 56: $\pm5\times10^{-6}$	
		C: −20° C to 70° C	27: $\pm2\times10^{-7}$, 57: $\pm5\times10^{-7}$, 16: $\pm1\times10^{-6}$ 26: $\pm2\times10^{-6}$, 56: $\pm5\times10^{-6}$	
		D: −40° C to 85° C	57: $\pm5\times10^{-7}$, 16: $\pm1\times10^{-6}$, 26: $\pm2\times10^{-6}$ 56: $\pm5\times10^{-6}$, 15: $\pm1\times10^{-5}$	
		E: −55° C to 85° C	16: $\pm1\times10^{-6}$, 26: $\pm2\times10^{-6}$, 56: $\pm5\times10^{-6}$ 15: $\pm1\times10^{-5}$	
		F: −55° C to 105° C	26: $\pm2\times10^{-6}$, 56: $\pm5\times10^{-6}$, 15: $\pm1\times10^{-5}$	
		G: −55° C to 125° C	56: $\pm5\times10^{-6}$, 15: $\pm1\times10^{-5}$, 25: $\pm2\times10^{-5}$	

EXAMPLE

T	×205	B	27	10 MHz

Frequency Range by Model Number and Output

MODEL NO.	TTL	CMOS	ECL	SINE
×205	0.01 Hz Thru 100 MHz	0.01 Hz Thru 30 MHz	1.0 MHz Thru 125 MHz	100 KHz Thru 125 MHz
×202	0.01 Hz Thru 100 MHz	0.01 Hz Thru 30 MHz	1.0 MHz Thru 125 MHz	100 KHz Thru 125 MHz
×151	1 Hz Thru 75 MHz	0.01 Hz Thru 30 MHz	5 MHz Thru 125 MHz	100 KHz Thru 125 MHz
×114	20 KHz Thru 75 MHz	300 Hz Thru 30 MHz	5 MHz Thru 125 MHz	5 MHz Thru 125 MHz
×101	20 KHz Thru 75 MHz	300 Hz Thru 30 MHz	5 MHz Thru 125 MHz	5 MHz Thru 125 MHz

• STANDARD SPECIFICATIONS

TTL	CMOS	ECL	SINE
"1" Level: 2.4V Min. "0" Level: 0.5V Min. Symmetry: 40/60 Load: To 20MHz: 10 Unit Loads Above 20MHz: 6 Unit Loads Supply Current: 12mA Typical As low as 4mA	"1" Level: Vcc − 1.0V "0" Level: 1.0V Max. Symmetry: 40/60 Load: 10pF Nominal 50pF Maximum Supply Current: 5mA Typical As low as 1.6mA	10,000 Series Symmetry: 40/60	Level: 100KHz to 10MHz: 1VRMS, 1K OHMS Above 10MHz: 0.5VRMS, 50 OHMS Harmonics: −20dBc, Minimum Supply Current: 10mA Typical As low as 3mA

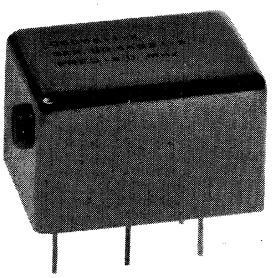
- **Aging:** ±1PPM Per Year (Typical)
- **Short Term Stability:** 1×10^{-9} per second (constant environment)
- **Voltage Stability:** $\pm2\times10^{-8}$ per percent change
- **Supply Voltage:** +15V DC ± 5%
  Optional: Any voltage in range of 5V thru 28V DC
- **Supply Current:** Output and frequency dependent
- **Frequency Adjustment (Trimmer):** Variable Glass; capacitor range adequate to compensate for 5 to 10 years aging. Electrical or external potentiometer adjust optional
- **Environmental:**
  Shock: 50G, 11m Sec
  MIL-STD-202, Method 213, Condition G
  Vibration: 10G to 500Hz
  MIL-STD-202, Method 204, Condition A
  Storage Temperature: −55 to +85° C
  (+125° C optional)
  Humidity: MIL-STD-202, Method 103, Condition B
  Altitude: Sea level to space

ovenaire oscillators

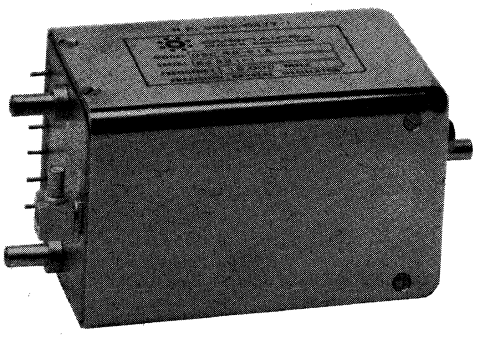
Ovenaire has the capabilities, experience and production techniques to meet the most exacting crystal oscillator requirements — from State-Of-The-Art Precision Crystal Oscillators to high volume, low cost TCXO's.
The following tables list condensed specifications on regular production models. For additional information on these and other crystal oscillators, call the Ovenaire factory.

PRECISION AND OVENIZED CRYSTAL OSCILLATORS

OSC94 SERIES



OSC85-1 SERIES



OSC49 SERIES

PRECISION CRYSTAL OSCILLATORS

Model Series	Frequency MHz	Aging	Power @ 25°C	Supply Voltage	Output	Max. Size mm	Ambient Range	Ambient Stability
OSC46-1A	1	$2x10^{-8}$/WK	2.2 Watts	+25VDC	Sine	75x75x93	−10°C to +60°C	$2x10^{-10}$/°C
OSC46-2A	1	$2x10^{-8}$/WK	2.2 Watts	+30VDC	Sine	75x75x93	−10°C to +60°C	$2x10^{-10}$/°C
OSC49-3	3 or 10	$1x10^{-8}$/WK	2.2 Watts	+28VDC	Sine	41x114x53	−15°C to +60°C	$\pm7.5x10^{-9}$
OSC49-5	10	$4x10^{-9}$/WK	2.2 Watts	+20VDC	Optional	(A) 51x51x54 (B) 49x75x54	0°C to +60°C	$7x10^{-9}$
OSC58-1	8 to 12		2.0 Watts	+13.2VDC ±15%	TTL or C'MOS	69x48x41	−10°C to +60°C	$\pm1x10^{-8}$
OSC74	7.5 to 15	$1.5x10^{-8}$/WK	2.0 Watts	+15VDC	TTL	(A) 64x81x32 (B) 51x51x79	−15°C to +60°C	$3x10^{-10}$/°C
OSC75	10	$1x10^{-8}$/WK	2.2 Watts	+28VDC	TTL	37x44x90	−40°C to +70°C	$3x10^{-10}$/°C
OSC78-12	5	$2x10^{-8}$/WK	0.6 Watts	+15VDC	TTL	65x75x114	0°C to +50°C	$5x10^{-10}$/°C
OSC94	5 or 10	$7x10^{-9}$/WK	1.8 Watts	+12VDC	Optional	54x54x97		$\pm7x10^{-9}$

OVENIZED CRYSTAL OSCILLATORS

Model Series	Frequency MHz	Aging	Power @ 25°C	Supply Voltage		Max. Size mm	Ambient Range	Ambient Stability
				OSC	Oven			
OSC11-3	1	$1.5x10^{-7}$/WK	3.5 Watts	+12 or +24VDC	115VAC	38x38x84	−20°C to +60°C	$5x10^{-9}$/°C
OSC11-5	1	$1.5x10^{-7}$/WK	1.9 Watts	+12 or +24VDC	+12 or +24VDC	57x57x93	−30°C to +60°C	$5x10^{-9}$/°C
OSC11-7A	1 thru 20	$5x10^{-7}$/WK	4.0 Watts	+12 or +24VDC	115VAC	38x38x84	−20°C to +60°C	$8x10^{-9}$/°C
OSC11-7B	3 thru 8	$5x10^{-8}$/WK	4.0 Watts	+12 or +24VDC	115VAC	38x38x84	−20°C to +60°C	$5x10^{-9}$/°C
OSC29-32	12 to 22	$8x10^{-7}$/YR	2.5 Watts	+24VDC	+24VDC	37x48x90	−20°C to +60°C	$\pm1x10^{-7}$
OSC29-1	10 to 25	$2x10^{-7}$/WK	2.2 Watts	+22.5VDC	+28VDC	37x48x83	−20°C to +60°C	$5x10^{-9}$/°C
OSC29-2	2 to 10	$1x10^{-7}$/WK	2.7 Watts	+22.5VDC	+28VDC	37x48x83	−20°C to +60°C	$2.5x10^{-9}$/°C
OSC32-1	2 to 10	$2x10^{-6}$/YR	.54 Watts	+12VDC	+24VDC	51x51x70	0°C to +55°C	$\pm2x10^{-8}$
OSC44-1	2 to 40	$1x10^{-6}$/YR	1.6 Watts	+9, +12 or +15VDC	+15, +20, +24 or +28VDC	Choice of 3 Compact Packages, Octal or Solder Pin Mounting	−20°C to +60°C	$\pm4x10^{-7}$
OSC44-2	2 to 40	$1x10^{-6}$/YR	1.6 Watts	+12 or +15VDC	+15, +20, +24 or +28VDC		−10°C to +60°C	$\pm4x10^{-7}$
OSC44-3	2 to 40	$1x10^{-6}$/YR	1.1 Watts	+9, +12 or +15VDC	+15, +20, +24 or +28VDC		−20°C to +55°C	$\pm3x10^{-7}$
OSC44-4	2 to 40	$1x10^{-6}$/YR	1.1 Watts	+12 or +15VDC	+15, +20, +24 or +28VDC		−20°C to +55°C	$\pm3x10^{-7}$
OSC45	2 to 12	$1x10^{-6}$/YR	1.8 Watts	+9 to +28VDC	+9 to +28VDC	(A) 43x64x33 (B) 32x44x70	0°C to +55°C	$\pm1x10^{-7}$
OSC55	10 to 55	$1x10^{-6}$/YR	1.4 Watts	+28VDC	+28VDC	33x67x19	−20°C to +50°C	$\pm1x10^{-6}$
OSC70	22 to 120	$2x10^{-6}$/YR	2.2 Watts	+28VDC	+28VDC	37x48x90	−20°C to +60°C	$\pm5x10^{-8}$
OSC73-1	9 to 15	$3.5x10^{-7}$/YR	2.0 Watts	+15VDC	+15VDC	33x79x54	−30°C to +65°C	$\pm7.5x10^{-8}$
OSC73-2	2 to 6	$5x10^{-7}$/YR	2.0 Watts	+15VDC	+15VDC	47x68x35	−10°C to +65°C	$\pm5x10^{-8}$
OSC73-3	12 to 25	$1.5x10^{-6}$/YR	2.3 Watts	+20VDC	+20VDC	36x75x41	−30°C to +65°C	$\pm1x10^{-7}$
OSC83	7.2 to 13.2	$1.5x10^{-6}$/YR	2.2 Watts	+28VDC	+28VDC	37x48x84	−10°C to +55°C	$\pm2x10^{-7}$
OSC85-1-1	1 to 16	$1x10^{-6}$/YR	1.8 Watts	+5VDC	+24VDC	27x32x45	0°C to +60°C	$\pm1x10^{-7}$
OSC85-6-1	10 to 40	$8x10^{-7}$/YR	1.1 Watts	+12.6VDC	+12.6VDC	37x48x54	0°C to +65°C	$\pm1x10^{-7}$

PCB MOUNT CRYSTAL OSOILLATORS

Model Series	Frequency MHz	Aging	Power	Supply Voltage	Output	Max. Size mm	Ambient Range	Ambient Stability
OSC51	1 to 60	N/S	300MW	+12VDC	Optional	38x38x13	0°C to +60°C	$\pm1x10^{-5}$
OSC52	10 to 150	N/S	300MW	+12VDC	Sine	38x38x25	0°C to +60°C	$\pm1x10^{-5}$
OSC69-2	5 to 20	$1x10^{-5}$/YR	75MW	+5VDC	TTL	25x38x13	−30°C to +85°C	$\pm5x10^{-5}$
OSC69-3	6 to 22	$8x10^{-6}$/YR	75MW	+5VDC	TTL	25x38x13	−30°C to +85°C	$\pm3.5x10^{-5}$

OVENAIRE-AUDIO-CARPENTER
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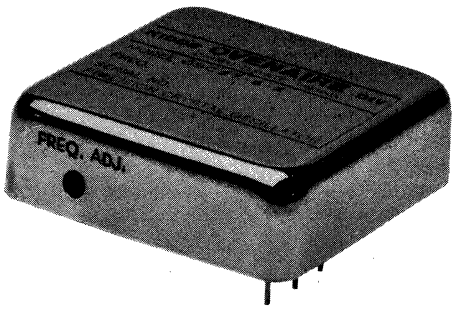
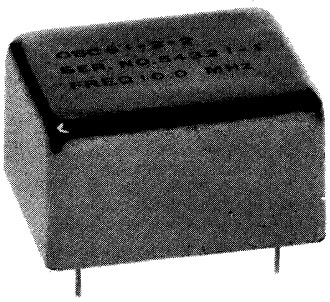
ovenaire oscillators

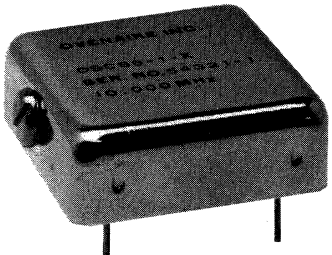
TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS



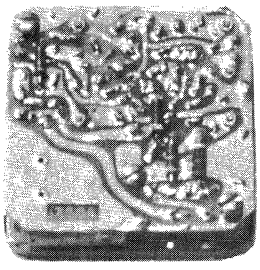
OSC27 SERIES



OSC61 SERIES



OSC88 SERIES



OSC34 SERIES

TCXO'S

Model Series	Frequency MHz	Aging	Power	Supply Voltage	Output	Max. Size mm	Ambient Range	Ambient Stability
OSC20-1	10 to 15	$3x10^{-6}$/YR	135MW	5 or 9VDC	Sine	26x15x54	−30°C to +75°C	$\pm5x10^{-6}$
OSC20-2	10 to 15	$3x10^{-6}$/YR	135MW	5 or 9VDC	Sine	26x15x54	0°C to +50°C	$\pm2x10^{-6}$
OSC27-5-1	2 to 12	$1x10^{-6}$/YR	300MW	+12VDC	TTL	51x51x15	0°C to +55°C	$\pm1x10^{-6}$
OSC27-5-2	2 to 12	$1x10^{-6}$/YR	300MW	+12VDC	TTL	51x51x15	0°C to +55°C	$\pm5x10^{-7}$
OSC27-5-3	2 to 5	$5x10^{-6}$/YR	300MW	+12VDC	TTL	51x51x15	0°C to +55°C	$\pm3x10^{-7}$
OSC27-6-1	2 to 12	$1x10^{-6}$/YR	360MW	+12VDC	TTL	51x51x15	−40°C to +85°C	$\pm1.5x\text{-}10^{-6}$
OSC27-6-2	2 to 12	$1x10^{-6}$/YR	360MW	+12VDC	TTL	51x51x15	−30°C to +75°C	$\pm1x10^{-6}$
OSC27-6-3	2 to 6	$5x10^{-7}$/YR	360MW	+12VDC	TTL	51x51x15	−15°C to +70°C	$\pm5x10^{-7}$
OSC34-2	10 to 20	$7.5x10^{-7}$/YR	240MW	+12VDC	Sine	45x45x15	0°C to +50°C	$\pm1x10^{-6}$
OSC35-1-1	2.5 to 12	$1x10^{-6}$/YR	300MW	+12VDC	TTL	51x51x13	−5°C to +60°C	$\pm1x10^{-6}$
OSC35-1-2	2.5 to 12	$1x10^{-6}$/YR	300MW	+12VDC	TTL	51x51x13	−5°C to +60°C	$\pm5x10^{-7}$
OSC35-1-3	2.5 to 6	$5x10^{-7}$/YR	300MW	+12VDC	TTL	51x51x13	0°C to +55°C	$\pm3x10^{-7}$
OSC35-2-X	15 to 22	$4x10^{-7}$/YR	300MW	+12VDC	Sine	58x51x16	−30°C to +60°C	$\pm1x10^{-6}$
OSC37-1-1	1 to 5	$1x10^{-6}$/YR	180MW	+12VDC	TTL	44x44x19	0°C to +55°C	$\pm2x10^{-6}$
OSC37-2-1	5.01 to 10	$2.5x10^{-6}$/YR	180MW	+12VDC	TTL	44x44x19	0°C to +55°C	$\pm2x10^{-6}$
OSC37-3-1	1 to 5	$1x10^{-6}$/YR	216MW	+12VDC	TTL	44x44x19	−5°C to +60°C	$\pm1x10^{-6}$
OSC37-1-2	1 to 5	$1x10^{-6}$/YR	180MW	+12VDC	TTL	44x44x19	−10°C to +65°C	$\pm1.5x\text{-}10^{-6}$
OSC37-2-2	5.01 to 10	$2.5x10^{-6}$/YR	180MW	+12VDC	TTL	44x44x19	−10°C to +65°C	$\pm1.5x\text{-}10^{-6}$
OSC39-1	2.5 to 12	$1x10^{-6}$/YR	125MW	+5VDC	TTL	48x31x17	0°C to +60°C	$\pm1x10^{-6}$
OSC40-1	4KHz to 1MHz	$1x10^{-6}$/YR	504MW	−18VDC	AC Square	57x51x21	0°C to +55°C	$\pm8x10^{-6}$
OSC61-2-2	6 to 16	$1x10^{-6}$/YR	180MW	+12VDC	Clipped Sine	37x28x19	−20°C to +70°C	$\pm2x10^{-6}$
OSC67-1-1	2 to 8	$1x10^{-6}$/YR	275MW	+12 & +5VDC	TTL	51x41x17	0°C to +55°C	$\pm2x10^{-6}$
OSC67-1-2	2 to 8	$1x10^{-6}$/YR	275MW	+12 & +5VDC	TTL	51x41x17	0°C to +55°C	$\pm1x10^{-6}$
OSC88-1-1	10	$.75x10^{-6}$/YR	230MW	+12VDC	TTL	38x38x14	0°C to +55°C	$\pm3x10^{-6}$
OSC88-1-2	10	$.75x10^{-6}$/YR	230MW	+12VDC	TTL	38x38x14	0°C to +55°C	$\pm1x10^{-6}$
OSC88-1-3	10	$.75x10^{-6}$/YR	230MW	+12VDC	TTL	38x38x14	0°C to +55°C	$\pm5x10^{-6}$
OSC88-1-4	10	$.75x10^{-6}$/YR	230MW	+12VDC	TTL	38x38x14	−5°C to +70°C	$\pm3x10^{-6}$
OSC88-1-5	10	$.75x10^{-6}$/YR	230MW	+12VDC	TTL	38x38x14	−5°C to +70°C	$\pm1x10^{-6}$
OSC88-1-6	10	$.75x10^{-6}$/YR	230MW	+12VDC	TTL	38x38x14	−5°C to +70°C	$\pm5x10^{-7}$
OSC88-2-1	10	$.75x10^{-6}$/YR	230MW	+12VDC	TTL	38x38x14	−40°C to +75°C	$\pm2x10^{-6}$
OSC88-2-2	10	$.75x10^{-6}$/YR	230MW	+12VDC	TTL	38x38x14	−40°C to +75°C	$\pm1x10^{-6}$
OSC88-2-3	10	$.75x10^{-6}$/YR	230MW	+12VDC	TTL	38x38x14	−55°C to +105°C	$\pm5x10^{-6}$
TCX0101	.0075Hz to 10MHz	$\pm2x10^{-8}$/DAY	Freq Dep	+12VDC	12V Square	Pkg B	0°C to +50°C	$\pm1x10^{-6}$
TCX0101A	.0075Hz to 10MHz	$\pm2x10^{-8}$/DAY	Freq Dep	+12VDC	12V Square	Pkg B	−55°C to +75°C	$\pm5x10^{-6}$
TCX034	.0005Hz to 40MHz	$\pm2x10^{-8}$/DAY	Freq Dep	+5VDC	4V Square	Pkg B	0°C to +50°C	$\pm1x10^{-6}$
TCX056	100KHz to 30MHz	$\pm2x10^{-8}$/DAY	Freq Dep	+5VDC	4V Square	Pkg A	0°C to +50°C	$\pm1x10^{-6}$
TCX0152	200Hz to 10MHz	$\pm1x10^{-8}$/DAY	Freq Dep	+15VDC	10V Square	Pkg OA	0°C to +50°C	$\pm1x10^{-7}$
TCX0152A	200Hz to 10MHz	$1x10^{-6}$/YR	Freq Dep	+15VDC	10V Square	Pkg OA	−40°C to +70°C	$\pm1x10^{-6}$

OVENAIRE-AUDIO-CARPENTER
A Division of Electronic Technologies Inc.
706 FORREST STREET – CHARLOTTESVILLE, VIRGINIA 22901
TELEPHONE 804-977-8050 TWX 510-587-5461 CABLE "OVENS"

ovenaire oscillators

PKG STYLE A
Printed ckt mount
Encapsulated
1.5″ x 2.0″ x .56″
(**AX:** Without mtg. hole)
(**AC:** 7 pin plug-in; stud mt.)

PKG STYLE B
Printed ckt mount
Encapsulated
1.9″ x 2.5″ x .5″
(**BY:** 1.9″ x 2.5″ x 1.0″)
(**BZ:** 1.9″ x 2.5″ x .375″)

PKG STYLE F & Q
Printed ckt mount
Encapsulated
F: 1.0″ x 1.25″ x .5″
Q: 2″ x 2″ x .6″

PKG STYLE G
I.C. plug-in
Encapsulated
.78″ x 1.125″ x .5″
(**GX:** .75″ x 1.5″ x .5″)

PKG STYLE H
Printed ckt mount
Encapsulated
.875″ x .875″ x .5″

PKG STYLE J
Printed ckt mount
Encapsulated
1.25″ x 1.25″ x .5″
(**JX:** 1.25″ x 1.25″ x .32″)

PKG STYLE L
Octal plug-in
Stud mount
Metal can
2″ x 2″ x .75″

PKG STYLE P
Special plug-in
Encapsulated metal can
.7″ x 1.3″ x 1.7″

PKG STYLE M, N, & O
Printed ckt mount
Encapsulated metal can
M: 2.5″ x 2.5″ x .625″
N: 2″ x 2″ x .75″
O: 2″ x 2.5″ x .75″
(stud mount)
OA: 2″ x 2.5″ x .65″

Model Series	Frequency Range	Stability	Temperature Range	PK-to-PK Output	Load	Supply Voltage	Pkg. Style
CRYSTAL CONTROLLED OSCILLATORS — NO OVEN REQUIRED							
X0128	7.5KHz to 85KHz	±.02%	0°C to +70°C	6.7V Sine	10K ohms	+15V	Q
X062	4KHz to 16MHz	±.01 to ±.025%[4]	−20°C to +70°C	5V Square	1.5K ohms	+12V	AX
X0110	4MHz to 10MHz	±.01%	0°C to +70°C	4V Square	10 TTL	+5V	F
X0111	250KHz to 3.99MHz	±.01%	0°C to +70°C	4V Square	10 TTL	+5V	J
X0112	63Hz to 249KHz	±.01%	0°C to +70°C	4V Square	10 TTL	+5V	AX
X0123	7.5KHz to 60KHz	±.01%	0°C to +50°C	1.5V Sine	10K ohms	+5V	A
X0100	.005Hz to 3MHz	±.007%	−40°C to +85°C[2]	12V Square[5]	50 CMOS[5]	+12V	A
X096	5MHz to 16MHz	±.005%	0°C to +70°C	1V Square	3 ECL	−5V	JX
X032	12.5KHz to 5.99MHz	±.003 to ±.01%[4]	0°C to +75°C[2]	4V Square[3]	25 DTL	+5V	A
X032C	6MHz to 40MHz	±.003%	0°C to +75°C[2]	4V Square[3]	9 TTL	+5V	A
X033	.001Hz to 30MHz	±.003%	0°C to +75°C[2]	4V Square[3]	9 DTL/TTL	+5V	B
X082	190KHz to 30MHz	±.003%	0°C to +75°C[2]	4V Square	9 DTL/TTL	+5V	F
X094	190KHz to 16MHz	±.003%	0°C to +75°C[2]	4V Square	9 DTL/TTL	+5V	H
X0181	12Hz to 12.49KHz	±.003%	0°C to +75°C[2]	4V Square	1 TTL	+5V	GX
X081	12.5KHz to 199KHz	±.003%	0°C to +75°C[2]	4V Square	9 DTL/TTL	+5V	GX
X071	200KHz to 20MHz	±.003%	0°C to +75°C[2]	4V Square	9 DTL/TTL	+5V	G
X081	20.1MHz to 30MHz	±.003%	0°C to +75°C[2]	4V Square	9 DTL/TTL	+5V	GX
X045	1MHz to 5MHz	±.001%	+10°C to +50°C	.63V Sine	50 ohms	+15V	AC
LC AND RC OSCILLATORS							
LC035	70KHz to 5MHz	±.5%	0°C to +85°C	2V Sine	10K ohms	+12V	A
LC01028	733KHz to 5MHz	±1%	−50°C to +100°C	2V Sine	1K ohms	+12V	J
PS057	10Hz to 40KHz	±1%/±2%[4]	0°C to +50°C	6V Sine	10K ohms	+12V	A
RC036A	1Hz to 1MHz	±2%	−20°C to +85°C	4V Square[3]	9 DTL/TTL	+5V	A
RC036B	1Hz to 1MHz	±1%	0°C to +75°C	4V Square[3]	9 DTL/TTL	+5V	A
UJ039A	.1Hz to 100Hz	±2%	0°C to +50°C	3V Square	1.5K ohms	+12V	A
RC0109	1Hz to 1MHz	±1%	0°C to +50°C	2.5V Sine	600 ohms	+15V	B
RC0168	1.5Hz to 30KHz	±.5%	0°C to +75°C	4V Square[3]	9 DTL/TTL	+10V	B
SINE WAVE OPTIONS — ADD "S" VERSION TO MODEL NUMBER (MAY REQUIRE LARGER PACKAGE[4])							
S11/12[4]	10KHz to 40MHz	5% Distortion	0°C to +75°C	1 mw into 50 ohms	+12V		
S13	5Hz to 100KHz	5% Distortion	−55°C to +75°C	1.75V RMS into 600 ohms	+15V		
S14	10KHz to 1MHz	3% Distortion	−55°C to +125°C	2V pk-to-pk into 10K ohms	None	May be Combined with Oscillator Voltage[4]	
S17	20Hz to 200KHz	5% Distortion	0°C to +50°C	3V pk-to-pk into 10K ohms	+5V		
S18	5Hz to 100KHz	3% Distortion	−55°C to +75°C	2.5V pk-to-pk into 600 ohms	+15V		
S19/20[4]	10KHz to 40MHz	5% Distortion	0°C to +75°C	2mw into 50 ohms	+15V		
S21	20Hz to 200KHz	5% Distortion	0°C to +50°C	3V RMS into 10K ohms	+15V		
S23	10KHz to 1MHz	1% Distortion	0°C to +75°C	8V pk-to-pk into 10K ohms	+12V		
S24	100KHz to 15MHz	5% Distortion	0°C to +75°C	.5V RMS into 5K ohms	None		

VOLTAGE CONTROLLED OSCILLATORS — CRYSTAL AND NON-CRYSTAL TYPES

Model Series	Center Frequency Range	Minimum Deviation	Input[6]	Linearity	Stability	Temperature Range	PK-to-PK Output	Load	Voltage Supply	Pkg. Style
VC0114	300Hz to 10KHz	±60%	+1.5V to +9V	±10%	±5%	+10°C to +44°C	3V Sine	125 ohms	+6V	B
VC0137	1Hz to 30MHz	±10%	−5V to +5V	±10%	±.5%	0°C to +50°C	4V Square[3]	9 TTL	+5V	B
VC047	1Hz to 75MHz	±10%	0V to −7V	±10%	±3%	0°C to +75°C	4V Square[3]	9 TTL	+5V	B
VC068	5Hz to 15KHz	±10%	0V to −7V	±1%	±.5%	0°C to +75°C	4V Square[3]	9 TTL	+15V	B
VC01019	.5MHz to 5MHz	±2%	+5V to −5V	±5% to ±10%[4]	±.5%	+55°F to +95°F	4V Square	5 TTL	+12V	A
VC01160	100KHz to 30MHz	±1.25%	−5V to +5V	±5%	±.5%	0°C to +50°C	.8V Sine	50 ohms	+12V	BM
VCX01095B	35MHz to 85MHz	±0.03%	−5V to +5V	±5%	±.01%	−40°C to +90°C	1V Square	3 ECL	+5V & −5.2V	BY
VCX0103	1Hz to 20MHz	±.01% to ±10%	±3V or 0V to +6V	±5% to ±10%	±.0001% to ±1%	0°C to +50°C	4V Square[3]	5 TTL	+5V	BY
VCX0255	1Hz to 40MHz	±.005%	0V to +6V	±5%	±.003%	0°C to +75°C	4V Square[3]	9 TTL	+5V	B

[2]For ±.01% over −55°C to +125°C add "A" to Model Number.

[3]Sine wave options listed above. S11/12/19/20 not available for voltage control ranges greater than ±1%.

[4]Depending on frequency.

[5]TTL option available.

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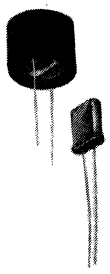
TELEPHONE 804-977-8050 TWX 510-587-5461 CABLE "OVENS"

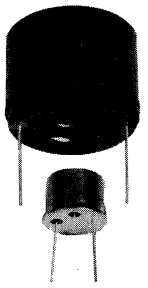
ovenaire ovens

Ovenaire's Circuit Design Technology is providing State-Of-The-Art Electronic Proportional Control Miniature Crystal and Component Ovens. Space-saving packages for PCB mount, low power consumption, low cost. A representative few of many available designs are shown. Most models are available with temperature setting from +35°C to +95°C, voltage from 5VDC to 36VDC. Ovenaire also offers a complete range of other ovens for commercial and military applications.



MODEL PCL1-43

For HC-18/U, HC-25/U, HC-42/U or HC-43/U crystals. 0.750″ dia., 0.562″ high. Temperature stability ±3°C over −30°C to +60°C typical. Also available with temperature adjustability of ±5°C of nominal.

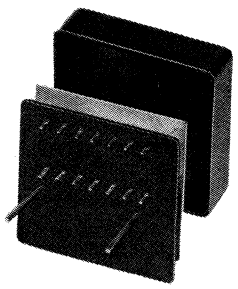


MODEL TO5P

For TO5 crystal, transistor or IC. 0.750″ dia., 0.500″ high. Temperature stability ±3°C over −30°C to +60°C ambient typical. Available with temperature adjustability of ±5°C nominal.

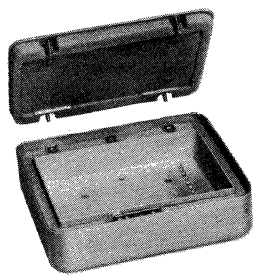
MODEL TO5C

For crystal, transistor or IC with TO5 case. Access to cavity by removing top cover. .750″ dia., .550″ high. Temperature stability ±3.0°C over −30°C to +60°C ambient typical.



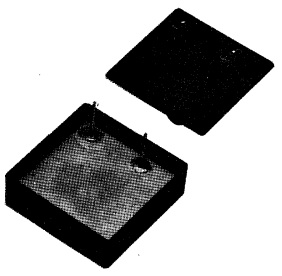
MODEL PC1-25

For 14 pin or 16 pin DIP IC or .375″ x .875″ x .156″ component. Overall size .312″ x 1″ x 1″. Temperature stability ±4°C over −30°C to +60°C ambient typical.



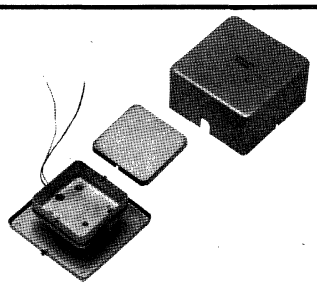
MODEL CO2001

High stability proportional control component oven. Temperature stability ±1°C over 0 to +60°C ambient. Cavity area 2.75″ x 3.93″ x .78″ high. Feed-thru pins for internal connections. O.D. 3.94″ x 4.63″ x 1.25″ high. 24VDC.



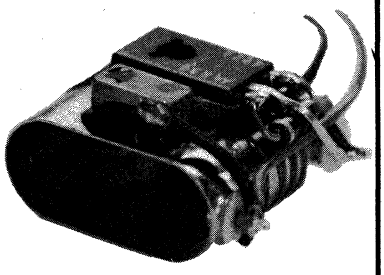
MODEL PC1-34

For 1 or 2 DIP's. Component area 1.45″ Sq. x .250″ tall. Overall dimensions 1.5″ Sq. x .50″ tall. Temperature stability is ±3°C over an ambient range of −30°C to within 10°C of the set-point. Various combinations of set-point temperature and DC operating voltage are available.



MODEL CO2106

Component oven with customer-adjustable set-point from 50°C to 90°C. Nominal operating voltage is 19-24 VDC. Heated cavity sizes available from 2″ Sq. x .75″ tall to 6″ Sq. x 1.75″ tall. Control is solid-state, proportional.



MODEL PCL1-21

Slip-on oven for HC-6/U crystal. Size .97″ x .53″ x .83″ high. Temperature stability ±3°C over −30°C to +60°C ambient typical. Models also available for HC-25/U crystal.

MODEL PC2-10

Low cost proportional control oven for 2 HC-6/U crystals. Temperature stability ±2°C over −30°C to +60°C ambient. Size 1.25″ dia. x 1.75″ seated height. Octal plug base.

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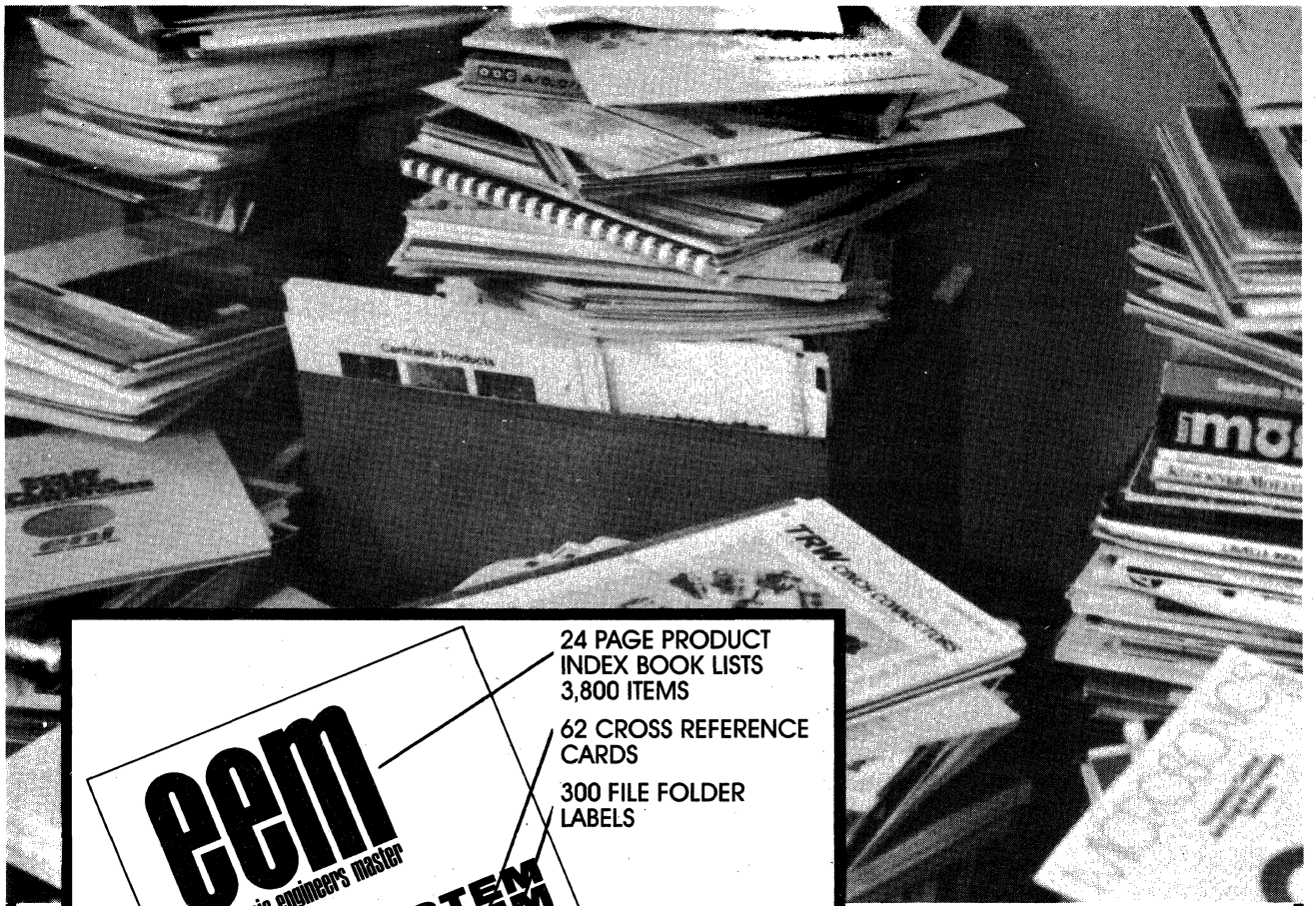

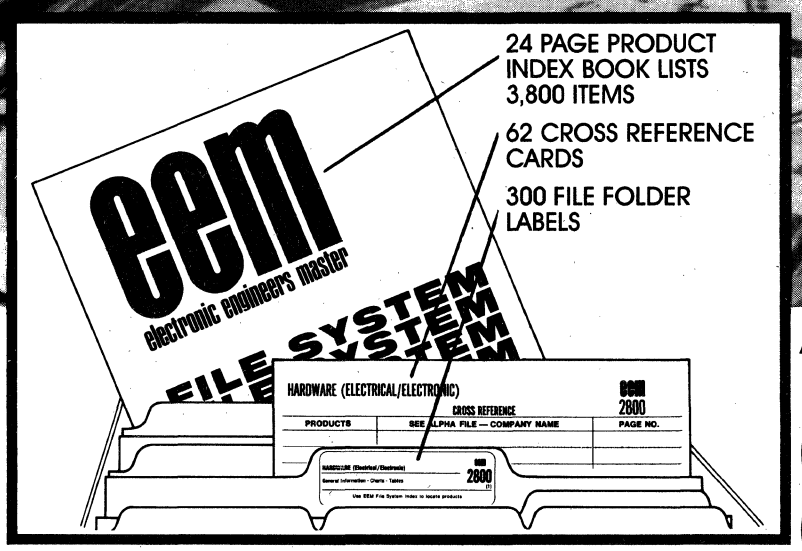

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•BULLETIN•

Piezo Technology, Inc., P.O.Box 7859, Orlando, Florida 32854, (305) 298-2000, TWX: 810-850-4136

PTI: CAPABILITIES MEAN STRENGTH

To be the leader in the crystal industry requires strengths in three areas: Product, Technical and Manufacturing. PTI has those strengths.

PRODUCT STRENGTH:

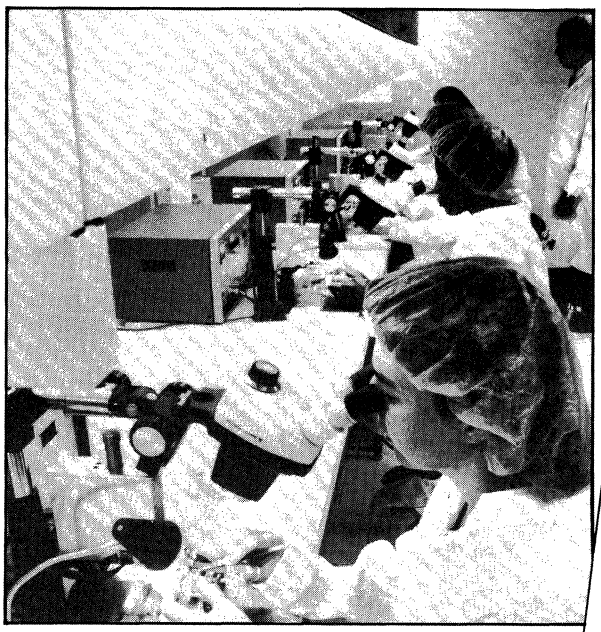
Large line of precision resonators, crystal filters, crystal oscillators, modules and sub-assemblies.

- Standard filters exceeding 200 models with various frequencies, bandwidths and packages.
- Custom filters to over 400 MHz with numerous designs.
- Standard oscillators from 120 kHz to 1000 MHz with various ovenized, temperature-compensated and voltage-controlled types.
- Custom oscillators of all types to precise customer specifications.
- Resonators with AT and SC cut quartz crystals and fundamental frequencies beyond 500 MHz.
- Modules for IF stages, switched filter banks and multiplexed filters.

TECHNICAL STRENGTH:

Engineering depth supported by experience and the latest equipment.

- Computer aided design techniques that provide quality products.
- Innovative, quality cost-effective custom designs.



- Rapid Prototype Capability.
- Pure research directed toward future products.

MANUFACTURING STRENGTH:

With an integrated facility utilizing the latest test and manufacturing equipment.

- Clean Rooms, Secure areas.
- Automated test and manufacturing equipment.
- Mil-Q-9858A
- Production Capacity

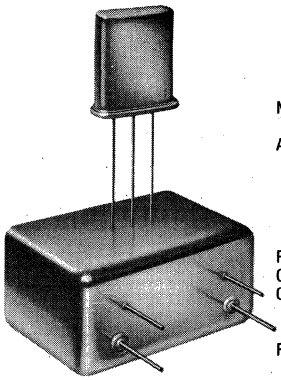
Together, these strengths challenge the industry and offer value beyond the product. Contact PTI today and use our strengths.

FILTERS

P.O. Box 7859, Orlando, Florida 32854, (305) 298-2000, TWX: 810-850-4136

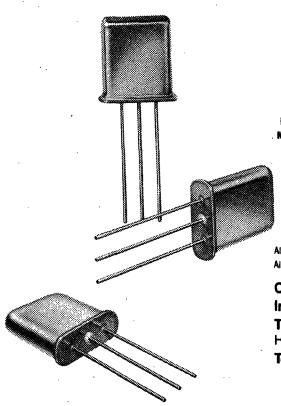
Piezo Technology, Inc.

Single Wafer Four-Pole Filters



Model	4102		4371		4171	
Nominal Center Frequency (Fun) (MHz): Standard	30		45		75	
Custom	28-32		40-45		60-100	
Attenuation Boundaries:						
3dB (kHz Min)	±50		±7.5		±13	
35dB (kHz Max)			±25			
50dB (kHz Max)			±50			
60dB (kHz Max)	+800 to +10MHz −400 to −10MHz				±300	
Ripple (dB Max)	2.0		1.0		2.0	
Operating Temperature (°C):	−20 to +60		−30 to +60		−55 to +85	
Case Style:	F	MVB	F	MVB	F	MVB
Terminations (ohms)	7000	50	7000	50	4000	50
Parallel Capacitance (pF)	−1	—	−1	—	−1	—
Flat Loss (dB Max)	4.0	5.0	3.0	4.0	6.0	7.0

45MHz Filters



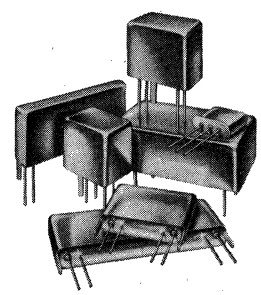
Model Number	Number of Poles	Attenuation Boundaries dB	kHz (Min.)	dB	kHz (Max.)	dB	kHz* (Max.)	dB	kHz*	Spurious Response (dB Min.)	Ultimate Attenuation (dB Min.)	Ripple (dB Max.)	Flat Loss‡ (dB Max.)	Termination (Ω // pF)	Case Style
2843	2	3	±6.5	15	±25	27	±50	60	±910	15	60	0.5	1.5	2300 // 0	A
2844	2	3	±7.5	13	±25	24	±50	60	±910	13	60	0.5	1.5	2600 // 0	A
4371	4	3	±7.5	—	—	35	±25	50	± 50	40	60	1.0	3.0	7000 // −1	F
3020	2	2	±16	15	±60	45	+910*	65	−910	—	40	0.5	2.0	860 // −1.7	A
6437	4	3	±15	—	—	35	±50	70	±910	40	75	1.0	4.0	1600 // 0	A**

All Models — ±10 kHz
All Models — ±2.0 pF Adjustable for best response.
‡Power-out/power available measured at point of minimum attenuation
**Model 6437 is comprised of 2 A-packages

Operating Temperature Range: −30°C to +80°C
Intermodulation Distortion Test Parameters (Optional)
Third Order IM Products at f_{on}: −100 dBm max.
Higher third-order IM attenuation is available at additional cost.
Test Tone Power: −25 dBm Each Signal

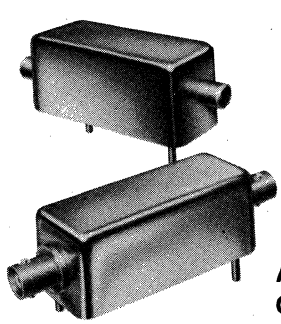
Test Tone Signals: $f_{on} + \Delta f$ and $f_{on} + 2\Delta f$ OR $f_{on} - \Delta f$ and $f_{on} - 2\Delta f$
Models 2843/2844: Δf = 25 kHz
Models 3020/6437: Δf = 60 kHz

10.7 MHz filters



This product type is designed for use in systems employing 12.5 KHz, 20 KHz, 25 KHz or 50 KHz channel spacings. Nearly 50 models are available as standards. Please call (305) 298-2000 for detailed specifications.

Front-End Filters



Model Number	Number of Poles	Center Frequency Range (MHz)	Attenuation Boundaries 20 dB Min. (kHz)	40 dB Min. (kHz)	Ultimate Attenuations (dB Min.)	Flat Loss (dB Max.)	Unwanted Modes (dB Min.)
2133	2	25.0 - 35.99	±40	—	30	3	20
2133	2	36.00 - 89.99	±40	—	30	4	20
2133	2	90.0 - 137.99	±60	—	30	4	20
2133	2	138.00 - 199.99	±60	—	30	4.5	20
4133	4	25.0 - 35.99	±26	±50	60	5	40
4133	4	36.00 - 89.99	±26	±50	50	6	40
4133	4	90.0 - 137.99	±30	±50	60	6	40
4133	4	138.00 - 199.99	±30	±50	60	7	40

Attenuation Boundaries: 3dB, F_{on} ± 6.75 kHz Min.
Operating Temperature: −20°C to +70°C
Passband Ripple: 1 dB Max.
Source/Load Termination: 50 ohms

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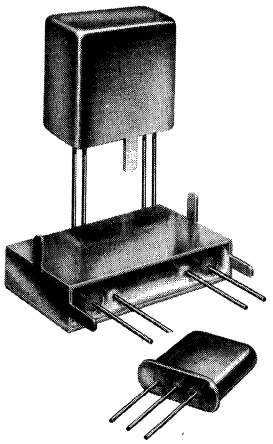
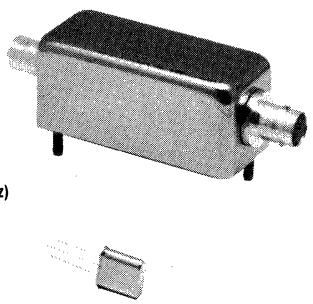
Linear Phase Filters



Nominal Center Frequency, f_{on}	**10.7 MHz**	**21.4 MHz**
Attenuation Boundaries		
3 dB	f_{on} ±6.0 kHz Min.	f_{on} ±6.0 kHz Min.
30 dB	f_{on} ±23 kHz Max.	f_{on} ±23 kHz Max.
50 dB	f_{on} ±45 kHz Max.	f_{on} ±45 kHz Max.
Ultimate Attenuation (Min.)	60 dB	60 dB
Unwanted Response (Min.)	40 dB	40 dB
Flat Loss (Max.)	3 dB	3 dB
Terminations:		
Resistance	5000 ohms ±5%	1900 ohms ±5%
Parallel Capacitance	−1.3 pF, ± 2 pF adjustable	−1.3 pF, ± 2 pF adjustable
Group Delay:		
Center Frequency Delay	55 μs Nominal	55 μs Nominal
Delay Variation, f_{on} ±6 kHz	10 μs Maximum	10 μs Maximum
Operating Temperature Range	−30°C to +80°C	−30°C to +80°C
Model Number/Case Style	5182/Tandem Set*	5446/Tandem Set*
	5261/UMB	6426/UMB
	5262/FPA	6427/FPA

*Tandem sets consist of two two-pole monolithic units, each packaged in case style "F" for four-pole response.

Spectrum Clean-up Filters



Frequency Range:	5 MHz to 160 MHz
Number of Poles:	2
Bandwidth at 3dB	±75 ppm max.
Bandwidth at 15dB	±375 ppm max.
Ripple:	1.0dB max.
Insertion Loss:	2dB to 6dB max.
Input Power:	0dBm
Operating Temperature:	0 to 75°C
SSB Phase Noise:	

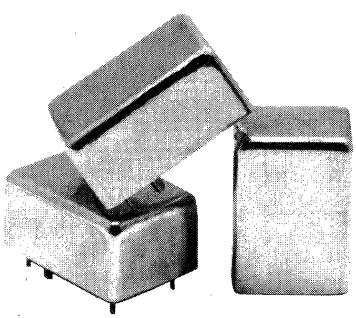
Offset (Hz)	**Phase Noise (dBc/Hz)**
10	−122
100	−132
1000	−132

Notes:

Operating temperature range may be increased depending on frequency and bandwidth requirements.

Phase noise measured at maximum input power.

Phase/Amplitude Matched Sets



Example of Specifications:

Filter Specs:

Fon: 2.2 MHz
Bandwidth at 6dB: ±0.85 KHz
Bandwidth at 80dB: ±4.0 KHz
Number of Poles: 6
Spurious: 60dB
Ultimate: 80dB
Ripple: 1.5
Insertion Loss: 4.5dB
Operating Temperature: −40 to +85°C
$Z_{S/L}$: 1000 ohms / /15 pF
Package: Dependent upon individual filter specifications

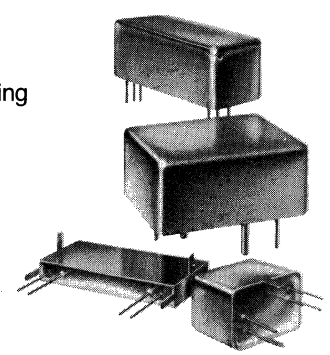
Matching Specs:

Set of 3 filters

	Phase	**Amplitude (dB)**
Initial offset at Fon at +25°C:	20°	1.0
Tracking over ±200 Hz over temperature[1]:	10°	0.5

21.4 MHz Filters

This product type is designed for use in systems employing 12.5 KHz, 20 KHz, 25 KHz or 50 KHz channel spacings. Over 100 models are available as standards. Please call (305) 298-2000 for detailed specifications.



FILTERS

PTI
Piezo Technology, Inc.

OSCILLATORS

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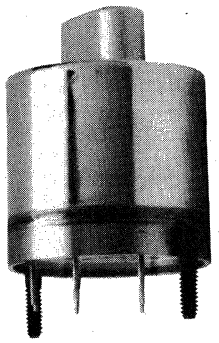
Tactical Miniature Crystal Oscillator



Frequency: 10.0 MHz and 10.23 MHz standard
5.0 MHz thru 10.23 MHz on request
Frequency Tolerance at 25°C: Better than $\pm 5x10^{9}$
Frequency Adjustment Range: $\pm 1x10^{7}$ min.
Frequency Stability (over temperature):

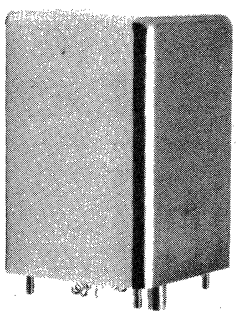
Stability	Temperature Range
better than $\pm 5x10^{9}$	−54° to +75°C

Retrace: Within $2x10^{9}$ in 1 hour, for less than 24 hours off time.
Frequency Start-Up: Within $\pm 1x10^{8}$ of final frequency within 4 minutes.
Power Supply: Oscillator: +12V +5%
Oven: +10 to 18V
Maximum Oven Current: 1.5A during warm-up
Power After Stabilization: 0.30W max.
Buffer: 5V +5%
Electronic Tuning Voltage: −5V to +5V
Package: 1.25 In. dia. x 1.55 In. High
SSB Phase Noise:

Offset (Hz)	Phase Noise Level (dBc/Hz)
1	− 90 Max.
10	−100 Max.
100	−110 Max.
1,000	−110 Max.
20,000	−120 Max.

Output Signal: Logic 0: −0.5V to + .5V
Logic 1: +4.5V to +5.0V
Aging: $1x10^{8}$/yr max.
$2x10^{10}$/day max.

High-Stability Ovenized Crystal Oscillator



Frequency: 10.0 MHz — Standard
Frequency Stability (over temperature):

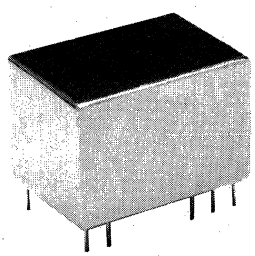
Stability	Temperature Range
better than $\pm 7x10^{9}$	0 to +70°C
better than $\pm 1.5x10^{8}$	−55 to +70°C

SSB Phase Noise:

Offset (Hz)	Phase Noise Level (dBc/Hz)
100	−140 Max.
10000	−160 Max.

Warm-up to better than $5x10^{9}$ within 10 minutes after turn on.
Short Term Stability: Better than $5x10^{12}$ for 1 second.
Power Consumption at 25°C: Less than 1W after warm-up
Power Supply: Oscillator: +11 to 13.5V
Oven: +20 to 30V
Aging: Less than $5x10^{10}$/day
Less than $1x10^{7}$/year
Output Level: +7dBm into 50 ohms
Electronic Frequency Control: Greater than $\pm 5x10^{8}$ for −5V to +5V
Package: 2x2x3 In.

Miniature Ovenized Crystal Oscillator

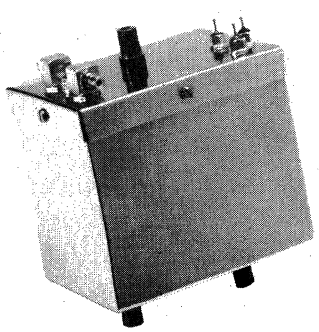


Frequency Range: 5 MHz to 20 MHz
Frequency Stability (over temperature):

Stability	Temperature Range
better than ±0.2 ppm	0 to +60°C
better than ±0.4 ppm	−40 to +70°C

Frequency stability better than $+3x10^{7}$ of final frequency within 5 minutes after turn-on.
Aging: Less than $3x10^{9}$/day after 30 days operation
Power Consumption: 2W typical at +25°C
8W max. during warm-up
Power Supply: Oscillator: +12V standard (+9 to +12V on request)
Oven: +12V standard (+9 to +24V on request)
Output Level: 0dBm into 50 ohms standard
Other power levels or logic outputs available upon request
Electronic Frequency Control: Standard — None
Option — Sensitivity 0.5 ppm/V over :5V to + 5V)
Package: 1.6x1.15x1.1 In.

Precision Ovenized Crystal Oscillator



Frequency: 10.0 MHz - Standard
10.23 MHz - Standard
Frequency Stability (over temperature):

Stability	Temperature Range
better than $\pm 7x10^{9}$	0 to +71°C
better than $\pm 1.5x10^{8}$	−55 to +71°C

SSB Phase Noise:

Offset (Hz)	Phase Noise Level (dBc/Hz)
100	−140 Max.
1000	−157 Max.

Warm-up to within $5x10^{9}$ of final frequency in 10 minutes.
Time Domain Stability: Better than $5x10^{12}$ for 1 second.
Power Supply: Oscillator: +11 to 13.50V at 4mA max. current
Oven: +20 to 30V at 120mA max. current
Aging: Less than $5x10^{10}$/day after 24 hours warm-up
Less than $1x10^{7}$/year continuous operation
Output: 0.55V ±0.05V rms into 50 ohms
Electronic Frequency Control: More than $1x10^{-7}$ total over control range −5V to +5V
Package: 2.83x2.08x2.45 In.

Piezo Technology, Inc.

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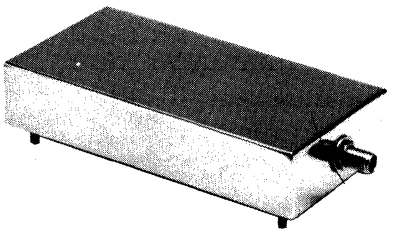
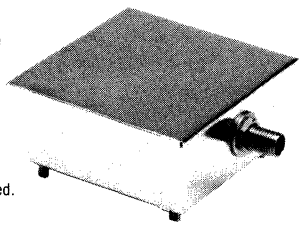
OSCILLATORS

Wide Range Voltage-Tuning Oscillator



Frequency Range: 100kHz to 120 MHz
Frequency Deviation: Up to ± 0.3%
Linearity: Better than ± 1% of peak deviation — standard
Better than ± 5% of peak deviation — lower cost options
Phase noise: Performance is dependent on deviation and output frequency.
Spurious: Less than − 75dBc
Supply Voltage: + 12V standard
+ 8 to + 28V available
Output Level: Sine, (0dBm in 50 ohms) or TTL or ECL
Electronic Frequency Control: Standard − 5V to + 5V
Optional other
Operating Temperature Range: − 40°C to + 70°C
Stability: Performance is dependent on deviation and temperature range.
Package: 4.0 × 2.0 × 0.8 In.

Voltage-Controlled Low Phase Noise Oscillator



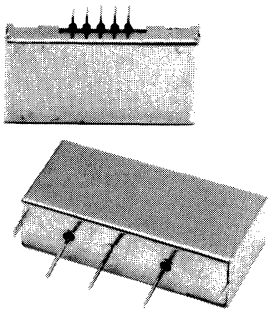
Frequency Range: 100 MHz to 1000 MHz
Frequency Deviation: Up to ± .005%
Linearity: Better than ± 5%
Frequency Stability (over temperature):

Stability	Temperature Range
better than ± .001%	0 to + 70°C

Supply Voltage: +15V standard
+10V to +20V available
Output Level: 0dBm sinewave (into 50 ohms)
Electronic Frequency Control: − 5V to + 5V
Package: 2.0 × 2.0 × 0.75 In.
Phase Noise:
Exact phase noise performance is dependent on output frequency and deviation required.
Typical SSB Phase Noise Performance:
Frequency: 250 MHz

Offset (Hz)	Phase Noise (dBc/Hz)
1	− 44 Max.
10	− 74 Max.
100	− 104 Max.
1,000	− 125 Max.
10,000	− 145 Max.
100,000	− 155 Max.

Miniature Temperature-Compensated Crystal Oscillator

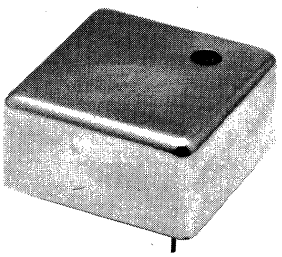


Frequency Range: 8 MHz to 25 MHz
Frequency Stability (oven temperature):

Stability	Temperature Range
better than ± 2.0 ppm	− 45 to + 85°C
better than ± 1.5 ppm	− 40 to + 75°C
better than ± 1.0 ppm	− 35 to + 65°C
better than ± 0.5 ppm	0 to + 50°C

Supply Voltage: + 8V standard
+ 7.5V to 12V available
Supply Current: 5mA max.
3.5mA typical
Output: 1V Rms ± 20% into Ik ohms//0 ± 10pF
or 3.4V ± 1V pk-pk into 2k ohms//0 ± 10pF Suitable for CMOS gates in linear mode
Package: 1.5 × .4 × .75 In.
1.4 × .35 × .75 In.
.772 × .368 × 1.10 In.

Temperature-Compensated Crystal Oscillator



Frequency Range:	10 MHz standard 8 to 20 MHz optional
Stability Over Temperature:	± 1.0 ppm Max.
Operating Temperature:	− 35°C to + 65°C
Aging Adjustment:	10 yrs. min.
Supply Voltage:	+ 9V (± .2V)
Output Level:	5V pk-pk Min.
Load:	600 ohms//0 pF
Shock:	50 G's for 6 msec. ½ sine
Package:	1.5 × 1.5 × 0.50 In. 1.5 × 1.5 × 0.75 In.

Piezo Technology, Inc.

RESONATORS & MODULES

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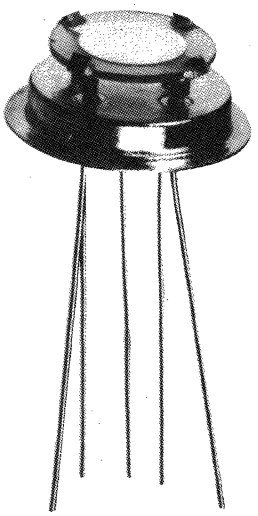
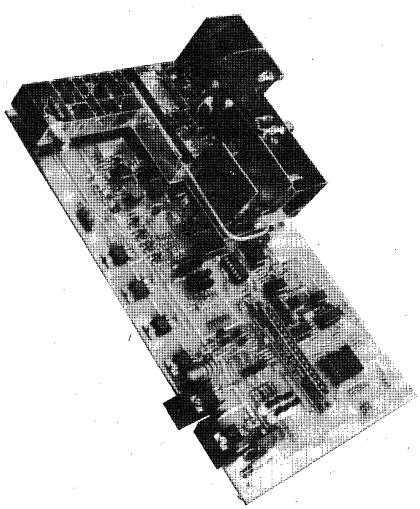


PRECISION RESONATORS

PTI precision resonators are used for exacting frequency control applications. PTI quality is designed into both standard and custom resonators.

- Precision Standards
  - 5 MHz
  - 10 MHz
  - 10.23 MHz
  - AT and SC-Cut
- AT-Cut Precision Custom Resonators
  - Fundamental Mode: 1.75 MHz to 400 MHz
  - Third and Fifth overtones: 1.0 MHz to 750 MHz
  - Seventh overtone: 1.75 MHz to 250 MHz
- SC-Cut Precision Custom Resonators
  - Fundamental Mode: 1.75 MHz to 400 MHz



MODULES AND SUBASSEMBLIES

PTI modules and subassemblies include IF stages, switched filter banks and multiplex filters. The IF stages can accept HF to UHF frequency input with audio frequency output. Switched filters allow digital selection between numerous center frequency and selectivity options. Multiplex filters process wideband RF signals into multiple narrow band audio outputs.

PTI design techniques incorporate performance and quality standards with a cost effective technical approach. With advanced products and advanced technology, PTI develops solutions to your frequency control problems.

Inquiries on these and other custom modules and sub-assemblies are invited.

Piezo Technology, Inc.

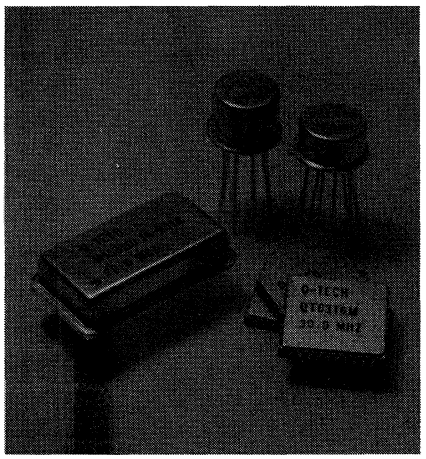
EEM PRODUCT SELECTION GUIDES

Use the EEM Product Selection Guides. There are 34 Guides in this edition of EEM. See page 2 (A•2, B•2, C•2, D•2) of each volume to locate the Product Selection Guides that pertain to your needs.

Q-Tech Corporation

PIONEERS IN HYBRID TECHNOLOGY
STATE OF THE ART DEVELOPMENT

EXCELLENCE IN MINIATURE CRYSTAL OSCILLATORS



INTRODUCTION

Through its 13 years in operation, Q-Tech has been the foremost supplier of military crystal clock oscillators as well as many custom hybrid products.

Q-Tech was the first supplier of high reliability clock oscillators and the first to receive QPL approval. Q-Tech oscillators fly on-board high performance jet fighters such as the F14, F15, F18, A6, B1 and a wide variety of missiles as well as virtually every other major military program. They also ride on every Space Shuttle flight and satellites.

Q-Tech is known not just for quality but also for service. Quick delivery has become not just a goal, but a way of life at Q-Tech. Custom oscillators can be designed and built quickly to meet your urgent needs. No order is too small, too large, too complex or too simple.

For product reliability and delivery, make Q-Tech your #1 source of crystal clock oscillators and custom hybrids.

FREQUENCY RANGE

Q-Tech oscillators can provide output frequencies from fractions of a Hertz to 30 MHz, operating on the fundamental mode of the internal crystal. TTL and ECL clock frequencies to over 135 MHz are available, using overtone modes of the crystal.

OPTIONS AVAILABLE:

- GATED OUTPUT
- MULTIPLE FREQUENCY OUTPUTS
- PRECISE DUTY CYCLE CONTROL
- MULTIPLE FREQUENCY OUTPUTS
- PRECISE PROGRAMMED OUTPUTS
- VCXO's
- FINE FREQUENCY ADJUSTMENT
- SPECIAL PACKAGING
- ECL CLOCKS
- UHF OUTPUTS
- RELIABLE START-UP TIME

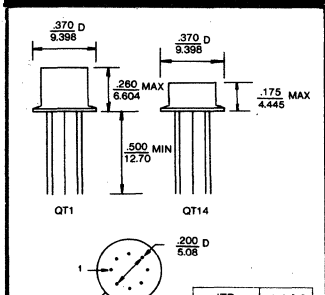
FREQUENCY VERSUS TEMPERATURE OPTION**		
1	±.01% (±100 PPM)	0° to +70°C
4	±.005% (± 50 PPM)	
2	±.005% (± 50 PPM)	0° to +50°C
*3	±.0005% (± 5 PPM)	
5	±.0025% (± 25 PPM)	−20° to +70°C
6	±.005% (± 50 PPM)	−55° to +105°C
9	±.005% (± 50 PPM)	−55° to +125°C
10	±.01% (±100 PPM)	
8 SPECIAL; TO CUSTOMER REQUIREMENTS		

* Requires tuning capacitor
** All units operate from −55°C to +125°C. Tolerance unspecified outside of temperature limits.

UPPER DIMENSIONS IN INCHES, LOWER DIMENSIONS IN MILLIMETERS.

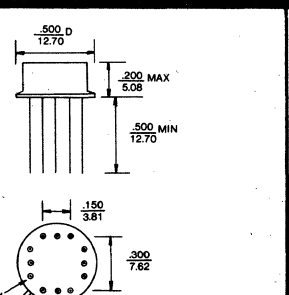
TO PACKAGES-RESISTANCE WELD AND COLD WELD

QT1, QT14



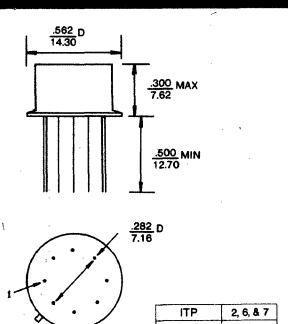
ITP	1, 2 & 6
GND	4
OUT	5
VCC/VDD	8

QT2



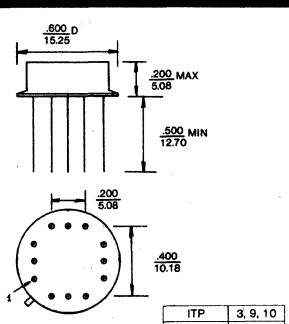
ITP	3, 9 & 10
GND	6
OUT	5
VCC/VDD	12

QT3



ITP	2, 6, & 7
GND	4
OUT	5
VCC/VDD	8

QT8



ITP	3, 9, 10
GND	6
OUT	5
VCC/VDD	12

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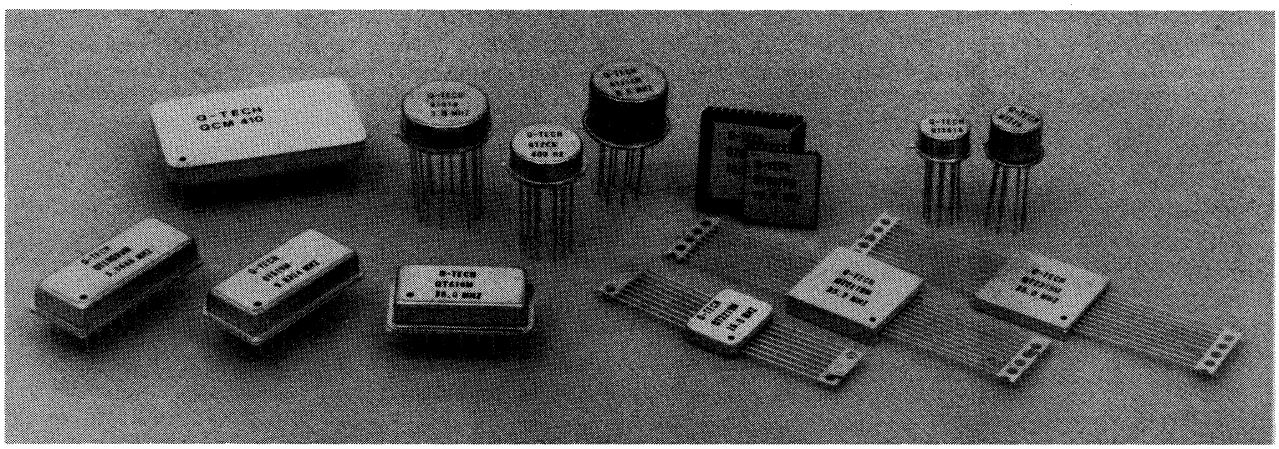
Q-Tech Corporation

PIONEERS IN HYBRID TECHNOLOGY
STATE OF THE ART DEVELOPMENT

QPL TO FULL MIL-O-55310/8 THRU /19
***SPECIAL: /20 and /21 WILL BE AVAILABLE SOON**



STANDARD STABILITIES	
2 x 10^{-6}	For 10% change of Vcc
1 x 10^{-6}	For 20% change of Load
5 x 10^{-6}	Aging—30days
1 x 10^{-5}	Aging—1year

Note: Tighter stabilities available. Consult factory.

MIL-O-CROSS REFERENCE TABLE

MIL-O-P/N	IS EQUIVALENT TO	Q-Tech P/N	MIL-O-P/N	IS EQUIVALENT TO	Q-Tech P/N
M55310/08-		QT10T	M55310/15-		QT10C
M55310/09-		QT1T	M55310/16		QT6T
M55310/10-		QT3T	M55310/17-		QT6T (w/gate)
M55310/11-		QT10C	M55310/18-		QT6C
M55310/12-		QT1C	M55310/19-		QT66T
M55310/13-		QT3C	*M55310/20 -		QT62T
M55310/14-		QT4T	*M55310/21-		QT21T

eg. M55310/14BO9A-16.000 MHz is equivalent to QT4T9M - 16.000 MHz

ECL/VHF/UHF CLOCKS & SOURCES

ECL and sinewave clocks and sources are available to 400 MHz. Q-Tech will work with you to provide hybrid versions of high stability sources and synthesizers up to 1 GHz. Phase noise and G-sensitivity data are taken when required. Full temperature range −55°C to +125°C is available for these clocks and sources.

TTL OUTPUTS

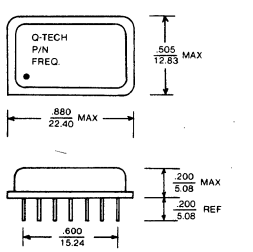
Standard TTL outputs can drive up to 10 TTL loads. Some Q-Tech clocks use low power Schottky (LS) dividers and gates to reduce internal power consumption. These units drive 2 TTL loads or 4 LS loads over the full military temperature range.

CONTINUED NEXT PAGE

UPPER DIMENSIONS IN INCHES, LOWER DIMENSIONS IN MILLIMETERS.

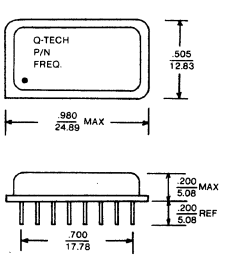
DIP PACKAGES

QT4, 6, 10, 12



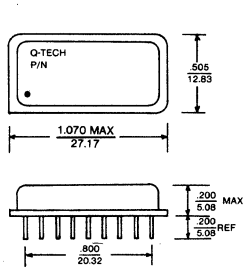
	QT4	QT6	QT10	QT12
ITP	3, 11, 12	4, 10, 11	3, 11, 12	3, 11, 12
GND	7	7	8	7
OUT	5	8	1	4
VCC/VDD	4	14	14	14
CASE	N/A	N/A	2	N/A

QT5, 7 QCM440, 450, 460



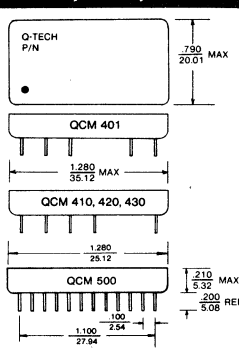
	QT5	QT7
ITP	3, 13, 14	5, 6, 11
GND	8	8
OUT	5	4
VCC/VDD	4	16

QT100 THRU QT105



FOR PIN CONFIGURATIONS REQUEST BROCHURE BRG

QCM 401, 410 420, 430, 500



FOR PIN CONFIGURATIONS REQUEST BROCHURE MCD

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Q-Tech Corporation

PIONEERS IN HYBRID TECHNOLOGY
STATE OF THE ART DEVELOPMENT

CUSTOM HYBRIDS & OTHER PRODUCTS

Z80 AND Z8000 DRIVERS

Q-Tech type QT4/QT6 devices can be supplied with the output capable of driving the capacitive load, with appropriate logic levels, and rise and fall times. Such devices are ordered as QT4 "Z" XX - frequency, or QT6 "Z" XX - frequency where XX refers to frequency/temperature tolerances.

CMOS CLOCK OSCILLATORS

Q-Tech clocks are available using high voltage CMOS (4000 series) or the newer, high speed CMOS. Extra outputs, gates and special digital functions can be included, often at small additional cost. Very accurate symmetry requirements can be met where required. Frequency ranges are available from fractions of a Hertz (Hz) to well above 20 MHz.

SPECIAL PACKAGES AND ENCLOSURES

We can provide units to unusual package requirements, including miniature units withstanding 10,000 psi and Flat Packs ("Butterfly") with less than .100" thickness, ultra-thin (.085") Ceramic Leadless Chip Carrier (LCC) packages and many others.

BAUD RATE GENERATORS

Baud rate generators are clock oscillators producing an output clock signal at a frequency which is selectable. The output frequency is selected or programmed by logic levels on four control pins of the generator. The output frequency is equal to 16 times the selected baud rate, from 50 baud to 19,200 baud.

Q-Tech's military quality Baud Rate Generators are dual units with two independently selectable outputs. These units, typically used in serial interface devices such as UARTS, modems, teletypes and cassettes, operate from a single 5 volt power supply. All units are built to the requirements of MIL-M-38510 and are available operational over the full military temperature range and screened to MIL-STD-883. For full details request Bulletin BRG.

MICROPROCESSOR CLOCK DRIVERS

Q-Tech has developed clock generators/drivers with crystal oscillator stability for almost all known microprocessors, including the recent 16- and 32-bit architectures. Versions are available with TTL and/or NMOS output levels (as required), plus internal logic to allow memory clock cycle stretching and system reset/refresh control. These microprocessor drivers are capable of driving high capacitance inputs and meeting other special clock requirements. They are available in both commercial and full MIL-spec designs. The MIL-spec versions comply with all the requirements imposed by a military or space environment, and are capable of meeting frequency tolerances as tight as ±50PPM over the extended temperature range of −55°C to +125°C. These units are manufactured to the qualification requirements of MIL-M-38510 and MIL-STD-883. For full details request bulletin MCD.

VCXO

Q-Tech clocks can be provided with frequency shift by external voltage capability. Often used to phase-lock a clock to a master frequency source, a typical "pulling" (frequency shift) range is ±150PPM (±.015%) for a control voltage range of 8V. Consult the factory for other range/capabilities. Also consider packaging your phase lock loop dividers, phase detector and loop amplifier in one custom hybrid to save cost and space.

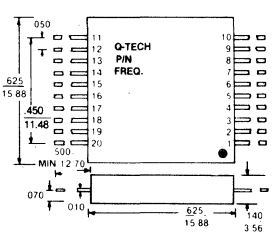
CUSTOM HYBRIDS

Q-Tech offers the opportunity to greatly reduce circuit board size and volume by converting a printed circuit design to a custom hybrid. We offer a range of services to accomplish this, including circuit consultation and in-house design. In addition, Q-Tech performs substrate screening, firing, and of course hybrid fabrication and testing. We would be pleased to bid on your hybrid needs.

UPPER DIMENSIONS IN INCHES, LOWER DIMENSIONS IN MILLIMETERS.

SURFACE MOUNT OSCILLATORS

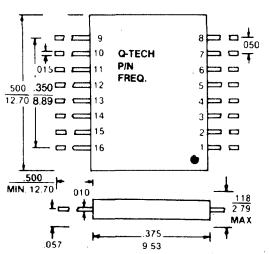
QT21*



ITP	7, 16
GND	10
OUT	11
VDD/VDD	13

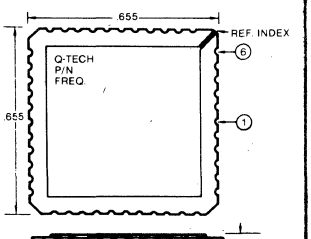
*SPECIAL: QT21 will be qualified to QPL/21

QT22



ITP	4, 13
GND	9
OUT	10
VCC/VDD	8

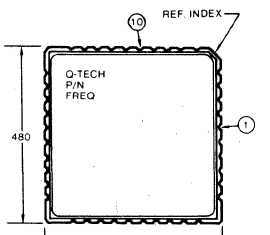
QT61, QT62*



	QT61	QT62
ITP	10, 36	N/A
GND	39	34, 40
OUT	7	42
VCC	43	6, 12

*SPECIAL: QT62 will be qualified to QPL/20

QT66



ITP	13, 33
GND	31, 37
OUT	39
VCC	4, 10

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MAY THE FORCE BE WITH YOU!

THE FORCE IN QUARTZ CRYSTAL TECHNOLOGY...

REEVES-HOFFMAN

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400 West North St., Carlisle, PA 17013 U.S.A.
Phone: 717-243-5929/TWX: 510-650-3510

REEVES-HOFFMAN
Division, Dynamics Corporation of America
400 West North St., Carlisle, PA 17013 U.S.A.
Phone: 717-243-5929/TWX: 510-650-3510

Crystal Products

Crystals of proven reliability for military and industrial applications

For 40 years, Reeves-Hoffman has been a leader in the design and manufacture of quartz crystals for government and industry. We are the only company offering the improved stability of coldweld sealing at a lower cost than conventional solder-sealed units.

All Reeves-Hoffman crystals are cut, ground, polished, plated, and mounted at the factory to exacting specifications. Shock, vibration, and hermeticity characteristics all exceed Mil-Spec C-3098. Crystals for oscillator and filter applications are available from 1 kHz to 200 MHz, with varying temperature coefficients, effective resistance, electrical equivalents, and Q values dependent on physical limitations and circuit requirements.

The staff of crystal engineers at Reeves-Hoffman welcomes the opportunity to quote on and discuss your particular application.

Ask for our free booklet, "A Specifier's Guide to Quartz Crystals," written to reduce your design problems.

When specifying crystals, please supply the following:	Crystal Categories
1. Frequency required 2. Holder style 3. Calibration temperature/ tolerance 4. Oscillator load capacitance 5. Temperature range 6. Maximum series resistance 7. Stability over temperature	**Oscillator Crystals** • **Industrial** Aging: 5 to 25 x 10^{-6} per year • **Precision** Aging: Less than 5 x 10^{-6} per year or less than 5 x 10^{-8} per day after first 30 days. • **Military** (per Mil C-3098) **Filter Crystals** See facing page

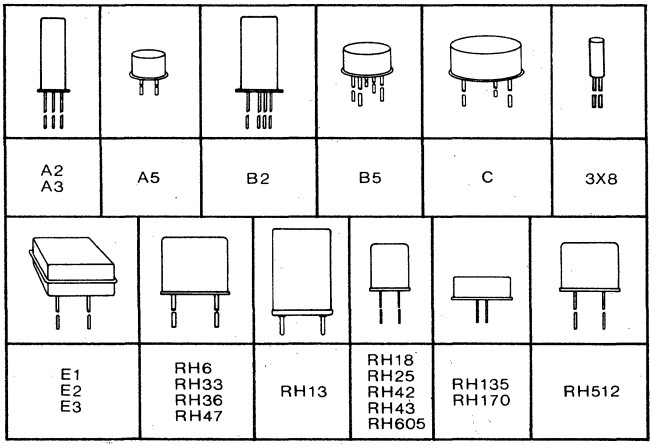
Low-Frequency Crystals

1.0 to 1200 kHz in standard and miniature holders

Throughout our long history as a quality supplier of low-frequency crystals, Reeves-Hoffman has dedicated our efforts towards responding to the changing needs of the electronics industry. As miniaturization reduced the size of electronic equipment, the traditionally large low-frequency crystal became one of the largest components in the system. To respond to this, Reeves-Hoffman worked closely with the crystal users. As a result, miniature crystal holders such as the RH135, RH170, RH605, and RH3X8 were developed. This is just one example of Reeves-Hoffman's ingenuity and responsiveness to the needs of our most important asset...our customers.

Recommended Element for Frequency Range		Holder Style vs. Frequency	
Frequency Range	**Element**	**Frequency**	**Holder**
1-10 kHz	J	1-1.4 kHz	RH13
10-100 kHz	NT, XY	1.4-1.8 kHz	RH13, E1, E2
100-250 kHz	5° X	1.8-20 kHz	RH13, E1, E2, B2
250-500 kHz	DT	20-86 kHz	RH13, E1, E2, B2, RH170, RH135, A2, A3
500-1000 kHz	SL	86-150 kHz	RH36, RH47, E1, E2, RH13, B2, A2, A3, RH6, RH33, RH170
		150-300 kHz	RH36, RH47, A3, E2, RH13, A2, RH6, RH33, B2, E1, E3
		300-450 kHz	RH36, RH47, RH6, RH33, RH512, E3
		450-900 kHz	RH42, RH43, RH18, RH25, RH36, RH47, RH512, RH6, RH33, E3
		900 kHz-1.2 MHz	RH42, RH43, A5, RH18, RH25, RH36, RH47, RH512, RH6, RH33, E3, RH605

The choice of element will vary. However, Reeves-Hoffman will choose the best element for your specific requirements based on cost and performance considerations.



High-Frequency Crystals

1.0 to 200.0 MHz

The use of high-frequency crystals has grown continually over the years as timing rates, tranmission frequencies, and data-processing speeds increased. Fortunately, Reeves-Hoffman is continually involved in this evolution to the extent that we possess the capabilities to respond to just about any requirement for high-frequency AT-cut crystals. In the past, many challenges have been presented to our engineering and manufacturing personnel. We are extremely proud of their response record, and look forward to working with you to continue this trend.

Frequency	Recommended overtone	Holder Style vs. Frequency	
		Frequency	**Holder**
1-30 MHz	AT, fundamental	1.0-2.5 MHz	RH36, RH47, E3, RH6, RH33, RH512, C
20-60 MHz	AT, third overtone	2.5-10 MHz	RH36, RH47, RH42*, RH43*, RH18*, RH25*, A5*, RH6, RH33, E3, RH512, B5, C
60-125 MHz	AT, fifth overtone	10-100 MHz	RH42, RH43, RH18, RH25, A5, B5, E3, RH512
125-160 MHz	AT, seventh overtone	100-200 MHz	RH42, RH43, RH18, RH25, A5, E3, RH512
160-200 MHz	AT, ninth overtone		

*Contact factory for details.

Holder Specifications

Holder Type	Seal*	Max. Height	Max. Length	Max. Width	Pin Dimensions Dia.	Pin Dimensions Spacing
A-2	CW	1.550		.400 dia.	.0185	.200
A-3	CW	1.000		.400 dia.	.0185	.200
A-5	CW	.260		.400 dia.	.0185	.200
B-2	CW	1.550		.600 dia.	.0185	.282
B-5	CW	.260		.600 dia.	.0185	.282
C	CW	.350		.830 dia.	.0185	.375
RH3X8		.327		.118 dia.	.012	.043
E-1	CW	.360	2.100	.730	.020	1.000
E-2	CW	.360	1.595	.730	.020	1.000
E-3	CW	.360	.770	.770	.020	.375
RH-6	SS	.775	.757	.352	.050	.486
RH-13	SS	1.526	.757	.352	.050	.486
RH-18	SS	.530	.435	.183	.0185	.192
RH-25	SS	.530	.435	.183	.040	.192
RH-33	SS	.775	.757	.352	.030	.486
RH-36	CW	.775	.757	.352	.050	.486
RH-42	CW	.530	.435	.183	.040	.192
RH-43	CW	.530	.435	.183	.017	.192
RH-47	CW	.775	.757	.352	.030	.486
RH-135	CW	.135	.500	.135	.010	.080
RH-170	CW	.170	.500	.135	.010	.080
RH-512	SS	.650	.564	.234	.030	.275
RH-605	CW	.261	.435	.183	.017	.192

*CW=coldweld
SS=solder seal

Alternate pin configurations and locations are available.

REEVES-HOFFMAN

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Crystal Filters

Reeves-Hoffman custom designs and manufactures passive quartz crystal filters to meet the exacting specifications of companies at the leading edge of technology.

By utilizing computer-aided design and analysis, our staff of professionals can solve your most perplexing problems. Computer controlled frequency synthesis and network analysis provide accurate testing of amplitude, phase, and delay to assure precise filter performance. Image parameter, modern network theory (Butterworth, Chebyshev, Bessel, Gaussian, Cauer) and Lerner synthesis techniques are employed to obtain the desired frequency response.

Because of Reeves-Hoffman's military approved crystal manufacturing capability, we are able to produce quartz crystals which will satisfy the demands of the filter design. The high standards of our Quality Control Department assure that both crystals and filters are manufactured and tested to applicable military specifications.

Contact our sales or engineering department; we welcome the opportunity to review your requirements.

Applications:

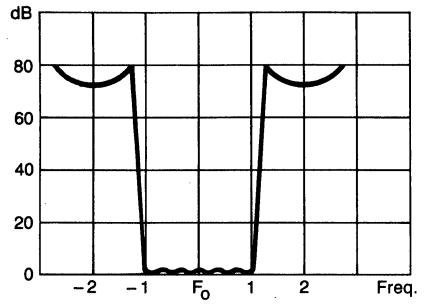
Missile Guidance	Satellite Communication
Fire Control	Telecommunications
Doppler Radar	Military Radios
ECM/ECCM	

To order filters, please specify:

1. Center frequency and tolerance.
2. 3 or 6 dB bandwidth.
3. 40 or 60 dB bandwidth and frequencies at these points if asymmetric.
4. Minimum attenuation in stopband.
5. Passband ripple.
6. Insertion loss.
7. Phase or delay requirements.
8. Input and output impedance (tolerance).
9. Operating temperature range.
10. Packaging details.
11. Additional electrical and environmental specifications as required.

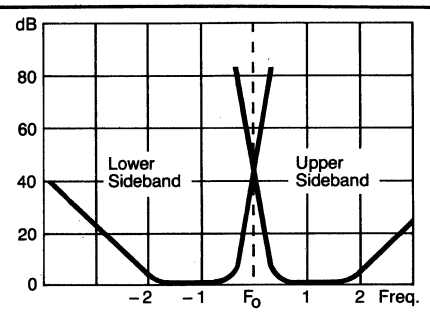
BAND PASS

F_O: 10 KHZ to 200 MHZ
Designs:
Chebyshev, Bessel, Butterworth, Gaussian



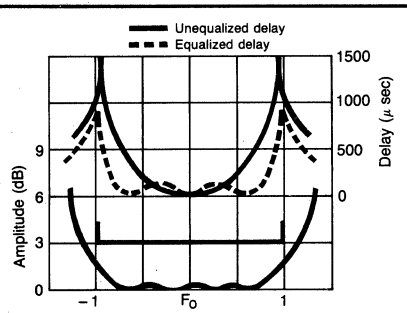
SIDE BAND

F_O: 10 KHZ to 30 MHZ
Carrier Attenuation:
According to specifications



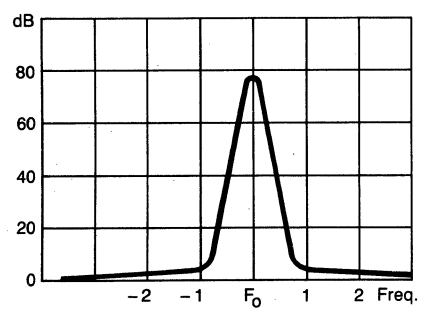
EQUALIZED DELAY FILTERS

F_O: 100 KHZ to 30 MHZ
Delay:
Equalized to specifications



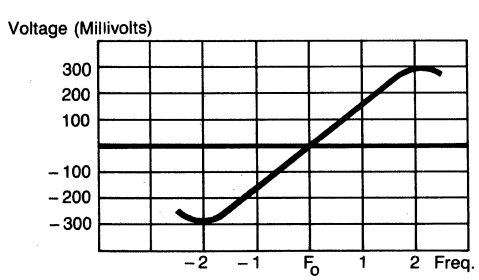
BAND REJECT

F_O: 50 KHZ to 100 MHZ
Rejection Band:
According to specifications



DISCRIMINATOR

F_O: 100 KHZ to 30 MHZ
Discrimination:
According to specifications



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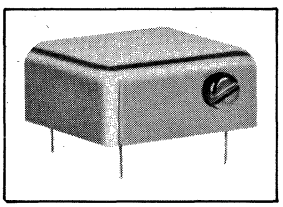
Crystal Oscillators Discrete

XO's



FREQUENCY RANGE:
3.00 MHZ thru 200.00 MHZ

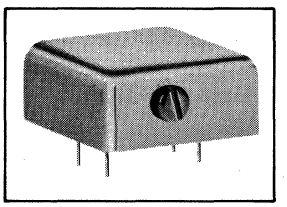
STABILITY:
△F/△Temp: See Below, Seven Std. Options

LOGIC FAMILIES:
T.T.L. CMOS ECL

LOGIC FAMILY	T.T.L.	CMOS	ECL
Frequency Range	3 MHZ to 100 MHZ	3 MHZ to 20 MHZ	3 MHZ to 200 MHZ
Output	Derived from TTL gate	Derived from CMOS gate	Derived from ECL gate
Symmetry	45/55 thru 55/45	40/60 thru 60/40	45/55 thru 55/45
Stability			
△f/△T Standard	← ±0.01% (0°C to +70°C) →		
Option 1	← ±0.005% (0°C to +70°C) →		
Option 2	← ±0.001% (0°C to +70°C) →		
Option 3	← ±0.01% (−55°C to +125°C) →		
Option 4	← ±0.005% (−55°C to +125°C) →		
Option 5	← ±0.0025% (−55°C to +125°C) →		
Option 6	← ±0.0005% (0°C to +50°C) →		

Notes: Sinewave Output also available, Std. Sinewave Output is Odbm into 50 Ω.
Sinewave Output Frequency can be extended to 600 MHZ.

TCXO's



FREQUENCY RANGE:
3.00 MHZ thru 30.00 MHZ

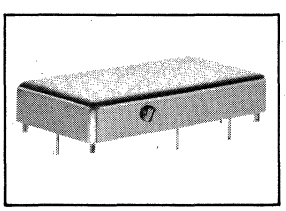
STABILITY:
△F/△Temp: See Below, Six Std. Options

LOGIC FAMILIES:
T.T.L. CMOS ECL

LOGIC FAMILY	T.T.L.	CMOS	ECL
Frequency Range	3 MHZ to 30 MHZ	3 MHZ to 20 MHZ	3 MHZ to 30 MHZ
Output	Derived from TTL gate	Derived from CMOS gate	Derived from ECL gate
Symmetry	45/55 thru 55/45	40/60 thru 60/40	45/55 thru 55/45
Stability	△F/△Temp.		
Option 1	← ±0.5 ppm (+10°C to +40°C) →		
Option 2	← ±1 ppm (0°C to +50°C) →		
Option 3	← ±2 ppm (−10°C to +60°C) →		
Option 4	← ±3 ppm (−15°C to +65°C) →		
Option 5	← ±4 ppm (−20°C to +70°C) →		
Option 6	← ±5 ppm (−25°C to +75°C) →		

Notes: Sinewave Output also available, Std. Sinewave Output is Odbm into 50 Ω.
Frequency Stability vs. Temp. Options can be extended to ±0.5 ppm over −40°C to +85°C at selected frequencies.
Output Frequencies to 60.00 MHZ, without built-in multipliers, are available.

VCXO's



FREQUENCY RANGE:
3.00 MHZ thru 90.00 MHZ

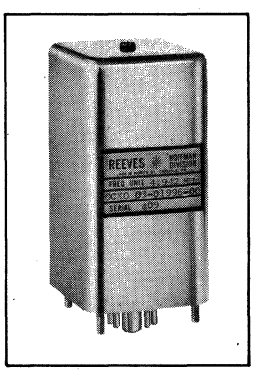
DEVIATION CAPABILITY:
From ±75 ppm thru ±1500 ppm

LOGIC FAMILIES AND SINEWAVE OUTPUTS

LOGIC FAMILY	T.T.L.	CMOS	ECL
Frequency Range	3 MHZ to 90 MHZ	3 MHZ to 20 MHZ	3 MHZ to 90 MHZ
Output: Logic	Derived from TTL gate	Derived from CMOS gate	Derived from ECL gate
Output: Sine	Standard Output is 0/dbm into a 50Ω Load		
AFC CHARACTERISTICS			
Input Impedance	Models available from 1KΩ to 50KΩ	1KΩ is Std.	
Modulation Slope	Both (+) and (−) are available	(+) is Std.	
Modulation Response	DC to 100KHZ on special frequencies	DC to 20 KHZ is Std.	
Modulation Voltage	Many options available:		
Demodulated Distortion	As low as 1% at ±1000 ppm dev.	3% is Std.	

Notes: Output Frequencies, for Sinewave Output, can be extended to 600 MHZ. Output Frequencies above 30.00 MHZ are generated with frequency multipliers.
Complete phase lock loops are available.
Very wideband VCXO's with deviations (up to ±10%) are available.

OCXO's



FREQUENCY RANGE:
1.00 MHZ to 10.00 MHZ

AGING RATES:
As low as $\pm 5 \times 10^{-10}$/day.

Frequency Range:	1 to 10 MHZ. Range can be extended to 100 MHZ with internal frequency multipliers.	
Output Voltage:	1.0 VRMS ±20% into 50Ω. All forms of logic are also available.	
Aging Rates:	$\pm 5 \times 10^{-9}$/24 hrs $\pm 1 \times 10^{-9}$/24 hrs $\pm 5 \times 10^{-10}$/24 hrs These aging rates are a selectable parameter.	after 72 hrs continuous operation after 72 hrs continuous operation after 120 hrs continuous operation
Stability:	Short Term △f/△B+ △f/△RL △f/△Temp.	3×10^{-11} rms/SEC $\pm 5 \times 10^{-9}$/ ±10% around B+ and B+ = +20 to +28 VDC $\pm 1 \times 10^{-9}$/ ±10% around 50Ω $\pm 1 \times 10^{-8}$/0°C to +60°C $\pm 2 \times 10^{-8}$ −20°C to 65°C
Input Voltage:	Any from +20 V.D.C. to +28 V.D.C. Selectable by P.O.	
Input Power:	5 watts maximum	
Timing:	Mechanical: $\pm 5 \times 10^{-6}$ min. Electrical: $\pm 5 \times 10^{-7}$ min. (+2VDC to +10 VDC)	

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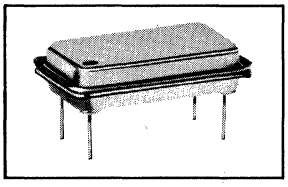
Crystal Oscillators Hybrid

Hybrid XO's

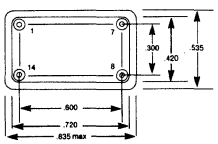


FREQUENCY RANGE:
200.00 HZ thru 200.00 MHZ

LOGIC FAMILY	T.T.L.	CMOS	ECL
Frequency Range	16 MHZ to 100 MHZ	200 HZ to 20 MHZ	3 MHZ to 200 MHZ
Output	From TTL gate	From CMOS gate	From ECL gate
Symmetry	45/55 thru 55/45	40/60 thru 60/40	45/55 thru 55/45
Stability			
△f/△T Standard	±0.01% (0°C to +70°C)		
Option 1	±0.005% (0°C to +70°C)		
Option 2	±0.001% (0°C to +70°C)		
Option 3	±0.01% (−55°C to +125°C)		
Option 4	±0.005% (−55°C to +125°C)		
Option 5	±0.0025% (−55°C to +125°C)		
Option 6	±0.0005% (0°C to +50°C)		

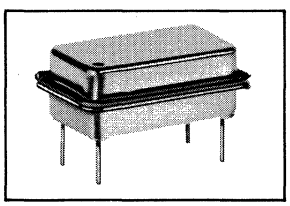
Notes: Initial accuracy on options (1) thru (6) is ±0.001% at room temp.
Models available with external frequency adjust capability. External capacitor between pin (1) and circuit ground.

PACKAGE HEIGHT
MAXIMUM .200



PIN CONNECTIONS
1. CASE & CIRCUIT GND.
7. CASE & CIRCUIT GND.
8. OUTPUT
14. VCC = +5.0 V.D.C.

TTL Hybrid Crystal VCXO's

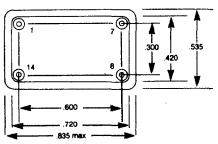


FREQUENCY RANGE:
4.00 MHZ thru 30.00 MHZ

FREQUENCY DEVIATION:
±75ppm min. with ±1.5 VDC

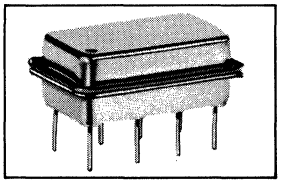
SPECIFICATIONS	
Frequency Range	4.00 MHZ thru 30.00 MHZ
Output (0 to 10 TTL Leads)	Square wave TTL compatible output is from a TTL gate
Symmetry	40/60 to 60/40
Input Voltage	+5.0 V.D.C. ±5%
Input Current	15 to 75 MA
Stability	±25 P.P.M. includes a combined effect of temperature, 1 year aging, initial set accuracy, load variations, and VCC variations.
Temperature Range	0°C to +70°C
AFC CHARACTERISTICS	
Input Voltage	+2.5 V.D.C. ±1.5 V.D.C. (On AFC pin #1)
Frequency Deviation	±75 P.P.M. min. with ±1.5 V.D.C.
Modulation Response	DC to 20KHZ
Linearity	Less than 5% from a straight line
Modulation Slope	(+) As input voltage goes positive, frequency increases
Input Impedance	50KΩ min.

PACKAGE HEIGHT
MAXIMUM .335



PIN CONNECTIONS
1. A.F.C. INPUT
7. CASE AND CIRCUIT GND.
8. OUTPUT
14. VCC = +5.0 V.D.C.

TTL Hybrid Crystal TCXO's

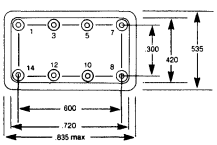


FREQUENCY RANGE:
12.50 MHZ thru 25.00 MHZ

STABILITIES: To ± 5 x 10^{-7}

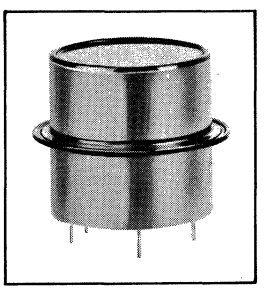
SPECIFICATIONS	
Frequency Range	12.50 MHZ thru 25.00 MHZ
Calibration	External 10K Potentiometer, ±7.0 P.P.M. Min.
Frequency Stability	
Option	△f / △Temp.
1	±2.5 P.P.M./(−35°C to +75°C)
2	±1.5 P.P.M./(−35°C to +75°C)
3	±1.0 P.P.M./(−35°C to +75°C)
4	±1.0 P.P.M./(0°C to +75°C)
5	±1.0 P.P.M./(0°C to +50°C)
6	±0.5 P.P.M./(0°C to +50°C)
△f / △B+	±0.01 P.P.M./(+10.0 ±1.0 V.D.C.)
△f / △RI	±0.05 P.P.M./(50Ω ± 5Ω any angle)
△f / △Time	±1.0 P.P.M./year @ 40°C average
(ℒ)	−130 dbc @ 25 KHZ
INPUT	+10.0 V.D.C. ±1.0 V.D.C./5 MA max.
OUTPUT	
Wave Shape	A-C coupled negative pulse
Amplitude	1.0 V.P.P. min. — 50Ω 3 V.P.P. max.

PACKAGE HEIGHT
MAXIMUM .335



PIN CONNECTIONS
1. REGULATED D.C.
3. ELECTRONIC FREQ. ADJ.
5. N.C. INTERNAL USE ONLY
7. CASE & CKT GROUND
8. OUTPUT
10. N.C. INTERNAL USE ONLY
12. N.C. INTERNAL USE ONLY
14. +10 V.D.C.

Hybrid OCXO's

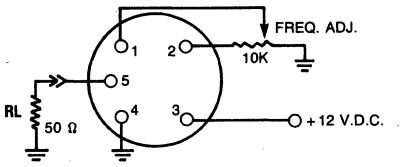


FREQUENCY RANGE:
8.00 MHZ thru 12.00 MHZ

VOLUME:
Less than 0.8 cu. in.

Frequency Range:	8.00 MHZ thru 12 MHZ.
Output Voltage:	Odbm — 50Ω.
Harmonic Distortion:	10% maximum.
Stability:	△f/△Temp: ±1 x 10^{-7}/(0°C to +70°C) △f/△Power: ±1 x 10^{-8}/±10% △f/△RL: ±1 x 10^{-8}/±10% △f/△Time: ±1 x 10^{-8}/year after 30 days, continuous operation
Input Voltage:	+12 V.D.C. ±10%.
Input Power:	.8W maximum at turn on. .5 watts typ at +25C after warm-up.
Warm-Up:	30 min. max. to within ±1 x 10^{-7} of 24 hr. frequency.
External Frequency Adj.:	External 10K potentiometer. A regulated voltage is provided for the external frequency adjustment potentiometer.
Size:	1.00" dia. x 1.00" high (dia. at sealing ring 1.2")

Notes: Fast warm-up units available to 3 min.
Frequency range can be extended to 20 MHZ at relaxed aging specifications.



Nymph Products by SaRonix

Quartz Crystals

SaRonix offers a broad line of crystal products with the best combination of price, quality, delivery, and service available. We carry a large stock of commonly used crystals, and feature rapid turn-around time on special units and large production runs.

In addition to the industry standard holders, many special configurations and a wide range of miniature units are available. We provide back-up stock for all scheduled orders.

Send your drawings and specifications, or call our Customer Service Department for ordering assistance and availability. Toll free
(800) 227-8974 or
(800) 422-3355 (CA)
(415) 856-4732 (FAX)
348465 SARONIX PLA (TLX)

Standard Microprocessor Crystals

The following selection chart lists NYMPH AT-cut quartz crystals for most common microprocessor applications available from stock.

FREQ. MHz	NYMPH PART NO.	FREQ. MHz	NYMPH PART NO.	FREQ. MHz	NYMPH PART NO.	FREQ. MHz	NYMPH PART NO.
HC-33/U		**HC-18/U**		**HC-18/U**		**HC-18/U**	
1.000000	NYP010-13	3.579545	NMP035A	9.216000	NMP092	27.000000	NMP270
1.000000	NMP010	3.600000	NYP036-30	9.830400	NMP098	30.000000	NMP300
1.843200	NYP018-13	3.600000	NMP036	10.000000	NMP100	32.000000	NMP320
1.843200	NMP018	3.686400	NYP037-20	10.738635	NYP107-32	36.000000	NMP360
2.000000	NYP020-20	3.686400	NMP037	10.738635	NMP107	40.000000	NMP400
2.000000	NMP020	3.932160	NYP039-12	11.000000	NMP110	48.000000	NMP480
2.097152	NYP021-20	3.932160	NMP039	11.059200	NMP111		
2.457600	NYP024-32	4.000000	NYP040-20	12.000000	NMP120	**HC-44/U**	
2.457600	NMP024	4.000000	NMP040	12.288000	NMP122		
3.579545	NYP035-18	4.194304	NYP041-12	13.516800	NMP135	6.000000	44N060
		4.433619	NYP044-20	14.318180	NMP143	8.000000	44N080
HC-18/U		4.915200	NMP049	14.745600	NMP147	10.000000	44N100
1.000000	NMP010A	5.000000	NYP050-20	15.000000	NMP150	12.000000	44N120
1.843200	NMP018A	5.068800	NMP051	16.000000	NMP160	12.500000	44N125
2.000000	NYP020A-20	5.185000	NYP052-20	16.384000	NMP163	14.318180	44N143
2.000000	NMP020A	5.714300	NMP057	17.360000	NMP173	14.400000	44N144
2.097152	NYP021A-20	5.990400	NMP059	18.000000	NMP180	15.000000	44N150
2.457600	NYP024A-20	6.000000	NMP060	18.432000	NMP184	16.000000	44N160
2.457600	NMP024A	6.144000	NYP061-30	19.354000	NMP193	18.000000	44N180
3.000000	NYP030A-30	6.400000	NYP064-20	19.660800	NMP196	18.432000	44N184
3.000000	NMP030A	6.553600	NMP065	20.000000	NMP200	19.354000	44N193
3.276800	NYP032A-15	7.000000	NMP070	22.118400	NMP221	19.660800	44N196
3.276800	NMP032A	7.159090	NYP071-20	23.400000	NMP234	20.000000	44N200
3.330000	NMP033A	7.372800	NMP073	24.000000	NMP240	22.118400	44N221
3.579545	NYP035A-18	8.000000	NYP080-18	24.576000	NYP245-18	24.000000	44N240
		8.000000	NMP080	25.000000	NMP250	25.000000	44N250

Miniature Quartz Crystals

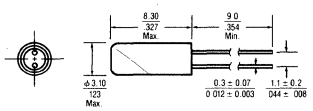
NTF Series

Designed for use in parallel resonant Pierce oscillators. Highly stable, low cost fundamental mode tuning fork type crystals for low power application.

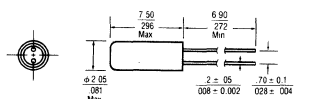
Electrical Specifications:

Frequency Range at 25°C-F	10 to 200kHz	Temperature Range:	
Turnover Temperature-T_o	25°C ±5°C	Storage	−55 to +125°C
Temperature Characteristics-K	−0.038ppm/°C², Typical	Operating (Industrial)	−40 to +80°C
Quality Factor-Q	80,000, Typical	Operating (Military)	−55 to +125°C
Load Capacitance-C_L	9.5 to 15pF, Typical	Aging during first year	10ppm max.
Series Resistance-R_s	50K Ohms, Typical	Shock Resistance	1000g, 1ms, ½ sine wave
Motional Capacitance-C_1	.0021pF, Typical	Vibration Resistance	10g, 10Hz to 2kHz random
Shunt Capacitance-C_o	1.1pF, Typical	Frequency Tolerance at 25°C	
Drive Level-P_d	≤1μW	"A" tolerance	±30ppm (0.003%)
		"B" tolerance	±100ppm (0.01%)
		"C" tolerance	±1000ppm (0.1%)

NTF3238



NTF3226

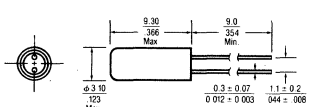


39A Series

An AT cut strip resonator crystal housed in a miniature 3.1x9.3mm tubular package. It has the same temperature characteristics as traditional AT cut crystals but requires only 20% of physical PC board space compared to the standard HC-18/U holders.

Electrical Specifications

Frequency Range at 25°C-F	4.0000 to 20.0000MHz ±20ppm	Effective Series Resistance-R_s	15-120 Ohms (Frequency dependent)
Temperature Characteristics-K	±20ppm −20° to +85°C	Drive Level-P_d	.5mW max.
Load Capacitance-C_L	20pF to 32pF	Shunt Capacitance-C_o	7pF max.

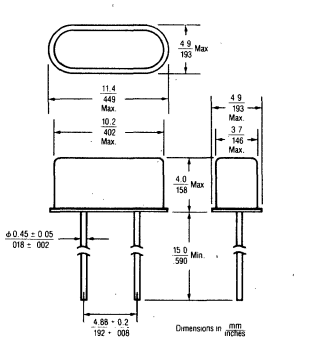


49S Series

Designed to replace the standard HC-18/U, HC-43/U and HC-49/U holder in applications where board height is a problem. This miniature AT cut strip resonator crystal is housed in a 4mm high package.

Electrical Specifications:

Frequency Range at 25°C-F	3.500 to 20.0000MHz ±30ppm	Effective Series Resistance-R_s	150 to 35 Ohms
Temperature Characteristics-K	±30ppm −20°C to +70°C	Drive Level-P_d	500 to 50μW max.
		Shunt Capacitance-C_o	7pF max.



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NYMPH®

Nymph Products by SaRonix

Miniature Quartz Crystals

Rugged hermetically sealed miniature ceramic package. Available in 2-pin DIL version with standard IC lead spacing or with leadless contacts for surface mounting by reflow solder or conductive epoxy and other techniques.

CX Series

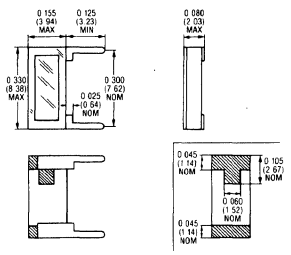
Features

- High Performance
- Excellent Stability
- Low Power Consumption
- Superior Quality Factor
- Extremely Low Aging
- Precision Tuned by Laser
- Rugged and Shock Resistant
- Small IC Compatible Dimensions

General Characteristics

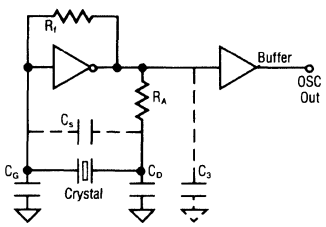
Temperature Range:	
Storage	−55 to +125°C
Operating (industrial)	−40 to +80°C
Operating (military)	−55 to +125°C
Parabolic Temperature Coefficient	typically −0.038ppm/(°C)²
Aging During First Year	10ppm max
Shock Resistance	1000g, 1ms, ½ sine wave
Vibration Resistance	10g rms, 10Hz to 2kHz random
Drive Level	≤1μW (10-499kHz), 10μW (500-2000kHz)
Typical Shunt Capacitance:	
CX-1V or 2V 10-499kHz	1.4pF
CX-1V or 2V 500-2000kHz	0.85pF
CX-1H or 2H 10-600kHz	1.4pF

Packages CX-1

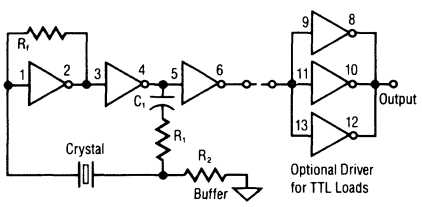


-03 Side Leads -01 No Leads

Application



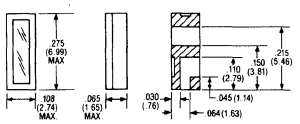
Parallel resonant Pierce oscillator (single inverter).



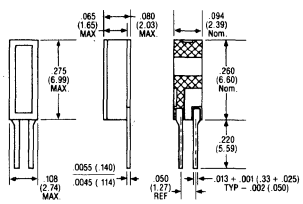
Series resonant oscillator (two inverters).

Packages CX-2

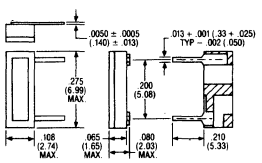
Dimensions and case styles — CX-2



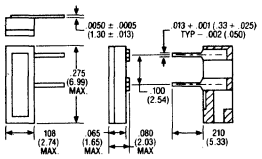
-01 No Leads



-02 End Leads



-03 Side Leads



-04 Side Leads

Standard marking is frequency plus V (Pierce) or H (Series).

Ordering Information

CX-1V B 01 49.131kHz — Typical part number

Package
CX = Ceramic Case

Package Size
1 = Standard size
2 = Miniature size

Oscillator Type
V = Pierce Oscillator
H = Series Oscillator

Frequency

Version
01-No Leads
02-End Leads (CX-2 only)
03-Side Leads
04-Side Leads (CX-2 only)

Calibration Tolerance
A, B, or C. See separate tabulation.

Note: For surface mount applications designate Version 01 -No Leads.

Standard Frequencies (kHz)

10.000*	25.000	60.000	500.000
12.800*	30.720	75.000	768.000
15.360*	31.500	76.800	1000.000
16.000	32.768	77.500	1048.576
16.384	38.400	100.000	1228.800
18.641	40.000	153.600	
19.200	40.960	240.000	
20.480	48.000	307.200	

*CX-1 only

Standard Calibration Tolerances

Frequency kHz	Calibration tolerances at 25°C A	B	C
10-74.9	±0.003%	±0.01%	±0.10%
75-169	±0.005%	±0.01%	±0.10%
170-249	±0.010%	±0.02%	±0.20%
250-499	±0.020%	±0.05%	±0.50%
500-2000	±0.050%	±0.10%	±1.00%

Special frequencies and tolerances available upon request.

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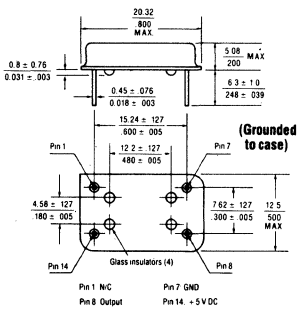
NYMPH®

Nymph Products by SaRonix

Crystal Clock Oscillators

The SaRonix NYMPH crystal clock oscillator family includes a wide variety of state-of-the-art thick film hybrid devices for generating TTL, CMOS, ECL, Baud Rates, and special output characteristics.



NCT Series (TTL)

Freq. Range:	250kHz to 70MHz
Freq. Stability:	±0.0025 to ±1.00% over operating temperature and voltage
Optg. Temp. Rnge:	0 to +70°C
Input Voltage:	+5VDC ±0.5V

TTL Output:	
Symmetry:	50% ±10% at 1.4VDC Level
Rise & Fall Times:	8ns max. for 250kHz to 25MHz, 6ns max. for 25MHz to 60MHz
"O" Level:	+0.4 Volts
"I" Level:	+2.4 Volts
Output Load:	1 to 10 TTL gates

NCC Series (CMOS)

Freq. Range:	250kHz to 24MHz
Freq. Stability:	±0.005 to ±0.05% over operating temperature and voltage
Optg. Temp. Rnge:	0 to +70°C
Input Voltage:	(V_{DD}) +3VDC to +7VDC

CMOS Output:	
Symmetry:	50% ±10% at 50% V_{DD}
Rise & Fall Times:	20% V_{DD} to 80% V_{DD}: Tr = 10ns max., Tf = 7ns max. (1 TTL) 0.4V to 2.4V: Tr = 6ns max., Tf = 6ns max. (1 TTL)

NCE Series (ECL)

Freq. Range:	
10kH Family	50MHz to 300MHz
10k Family	5.0MHz to 140MHz
Freq. Stability:	±0.0025 to ±1.00% over operating temperature and voltage
Temp. Range:	
Operating:	0 to +70°C
Storage:	−55°C to +125°C

Input Voltage:	−5.2V ±5%
Input Current:	30mA typical
Rise & Fall Times:	
10kH Family	1.5ns
10k Family	2.0ns
Symmetry:	50% ±10% at V_{BB}
Output Drive:	50Ω to −2.0VDC

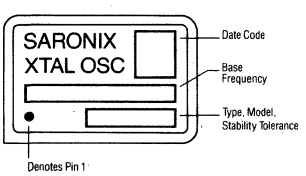
A crystal controlled, highly accurate and stable CMOS compatible oscillator. Device features include low power consumption, low aging, and a hermetically sealed all metal package. The 32.768kHz frequency, dividing conveniently to 1Hz, is selected for real time applications.

32.768 kHz Series (CMOS)

Part Number:	NCC 020C—32.7680
Frequency:	32.768kHz
Freq. Tolerance:	±0.0025% at 25°C
Optg. Stability:	±0.005%
Temperature Range:	
Operating:	0°C to +50°C
Storage:	−30°C to +85°C
Input Voltage:	
Rated:	+5VDC ±10%
Operating:	+3VDC min. +12VDC max.

Input Current:	100μA max., 75μA typical
CMOS Output:	
Symmetry:	50% ±10% at 50% V_{DD}
Rise & Fall Times:	60nsec max.
"O" Level:	V_{SS} +0.5V max.
"I" Level:	V_{DD} −0.5V min.
Output Load:	200kΩ at 15pF

Standard Marking Format



Scale: None (Dimensions in mm / inches)

Special Circuit Design Available:

- Dual Output
- Complementary Output
- Tri-State
- Enable-Disable
- Baud Rate
- Fast Rise/Fall Time

Call SaRonix for latest surface mounting and automatic insertion product information.

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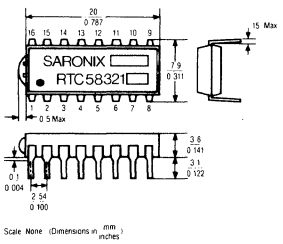
Nymph Products by SaRonix

Crystal Clock Oscillators

A Real Time Clock incorporating an on board quartz crystal in a single 16-pin DIP package, eliminating the need for external crystal, resistors and capacitors.



Scale None (Dimensions in mm / inches)

RTC Series (Real Time Clock)

- Built in 32.768kHz quartz crystal.
- Low power standby operation.
- Addressable counter start, stop, and reset function.
- 12-hour or 24-hour format.
- Automatic leap year selection.
- Microprocessor compatible 4-bit data bus.
- Standard 16-pin DIP package.
- Pin to pin compatible with MS58321RS.

Electrical Characteristics

Absolute Maximum Ratings

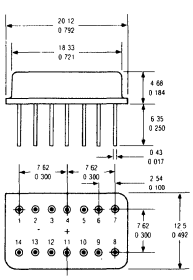
Item	Symbol	Conditions	Rated Value	Unit
Power voltage	V_{DD}	Ta = 25°C	−0.3~7	V
Input voltage	V_I	Ta = 25°C	GND −0.3~V_{DD} +0.3	V
Output voltage	V_O	Ta = 25°C	GND −0.3~V_{DD} +0.3	V
Storage temperature	Tstg	——	−30~+80	°C

Working Range

Item	Symbol	Conditions	Range	Units
Power voltage	V_{DD}	——	4.5~5.5	V
Data-holding voltage	V_{DH}	——	2.2~5.5	V
Quartz frequency	f_O	——	32.768	kHz
Working temperature	T_{OP}	——	−10~+60	°C

Note Data-holding voltage: Data outside the IC is not guaranteed. This voltage guarantees clock operation.

A multiple output crystal oscillator combining an AT cut crystal and CMOS IC circuitry in a standard 14-pin DIP package. The unit has a primary output between 10 and 20 MHz and an auxiliary divider system providing outputs of 1/2, 1/4, 1/8 and 1/16 of the primary frequency. Pin 7 is grounded to the case to reduce RFI.



NCM Series (Multiple Output)

Freq. Range:	625Hz to 20MHz	Output:	
Freq. Stability:	±0.010% over operating temperature and voltage	Symmetry:	50% ±10% at 50% V_{DD}
Temp. Range:		Rise & Fall Times:	20% V_{DD} to 80% V_{DD}: Tr = 15ns max., Tf = 15ns max. (1 TTL) 0.4V to 2.4V: Tr = 6ns max., Tf = 6ns max. (1 TTL)
Operating:	−10°C to +70°C		
Storage:	−30°C to +80°C		
Input Voltage:			
Rated:	+5VDC ±10%	"O" Level:	V_{SS} +0.5V max.
Operating:	+4VDC to +7VDC	"I" Level:	V_{DD} −0.5V min.
Input Current:	10mA max. at 25°C, 4mA typical 15mA max. over operating temperature		

Output Frequencies (in MHz)

Base Frequency	Output Dividing Ratios 1/1	1/2	1/4	1/8	1/16
10.0000	10.0000	5.0000	2.5000	1.2500	0.6250
12.0000	12.0000	6.0000	3.0000	1.5000	0.7500
12.2880	12.2880	6.1440	3.0720	1.5360	0.7680
14.31818	14.31818	7.15909	3.579545	1.789773	0.894886
16.0000	16.0000	8.0000	4.0000	2.0000	1.0000
17.734476	17.734476	8.867238	4.433619	2.216810	1.108405
18.4320	18.4320	9.2160	4.6080	2.3040	1.1620
19.6608	19.6608	9.8304	4.9152	2.4576	1.2288
20.0000	20.0000	10.0000	5.0000	2.5000	1.2500

Special frequencies available upon request.

..SaRonix..... 4010 Transport Street • Palo Alto, California 94303
(415) 856-6900 • (800) 227-8974 • (800) 422-3355 (CA)

SAW Resonator Products

Surface Acoustic Wave Technology provides performance advantages and design flexibility that has proven to be invaluable to engineers in need of reliable, reproducible components featuring linear phase, temperature stability, small size, low shape factor and excellent rejection. Increasingly, SAW technology is meeting the exacting requirements of modern systems with high performance resonators, resonator filters, oscillators, and other state-of-the-art signal processing components such as pulse compressors, delay lines, and bandpass filter products. In addition to this broad product line, Sawtek provides the total engineering support needed to make the proper design trade-offs among key parameters in order to achieve the optimum performance available from SAW technology.

Sawtek produces hundreds of standard SAW products for both low and high volume programs in Cable Television, Satellite Communications, Modems, Radar, EW, and many other signal processing applications. In addition, Sawtek's custom design capability can provide technical assistance and rapid response to new design and production requirements at frequencies from 10 MHz to more than 1 GHz. Sawtek also designs and produces custom subsystems which incorporate SAW components. These include filter banks comprised of cascaded filters packaged in a single assembly, amplifier-filter modules with adjustable gain, and SAW resonator-controlled oscillators. Some of the common SAW resonator products produced by Sawtek and their characteristics are summarized below.

SAW RESONATORS

Sawtek offers SAW resonators at fundamental frequencies from 100 MHz to more than 1000 MHz. These are high Q components which are primarily intended to be used in oscillators and are also used for both bandpass and notch filters. Sawtek resonators are inherently spur free in oscillator applications, exhibit low motional resistance, and have a pulling range comparable to a 3rd overtone bulk wave crystal. Typical values of R_S range from 15 Ω to 150 Ω and capacitance ratios are nominally 2000:1. Incorporation of special metalization improves oscillator noise performance by permitting drive levels up to +20 dBm. These quartz devices can achieve temperature stability of less than 50 PPM from 0°C to 60°C. Both one-port and two-port configurations are available.

Sawtek maintains a large inventory of pre-tooled SAW resonator crystals including many frequencies for CATV convertor applications. New designs can also be tooled rapidly to meet custom requirements. The 668 MHz resonator shown below is representative of Sawtek's low-cost standard products.

SAW OSCILLATORS

SAW resonator-controlled oscillators are currently produced by Sawtek for military and aerospace systems. Because they are able to operate at fundamentals of over 1000 MHz, SAW oscillators simplify design, reduce cost, and improve noise performance through the elimination of multiplier stages. In many applications it is also possible to achieve adequate power in one stage to directly drive a mixer and thereby eliminate the need for a buffer/amplifier stage.

Typical of the company's oscillator products is a fixed frequency, oven stabilized SAW resonator oscillator at 740 MHz. All spurious and harmonics are down 60 dB; the short-term stability is $\pm 2.5 \times 10^{-10}$ for 1.0 to 25 second averaging times and the phase noise is 120 dBc/Hz for a 2.5 kHz offset. The frequency versus temperature stability of this miniature ovenized unit is ±2 PPM from −15° to +60°C. A maximum power consumption of only 1.75 watts at −15°C ambient is achieved. Sawtek also offers assistance in oscillator design for low-cost consumer and commercial applications and is prepared to help evaluate the suitability of SAW oscillators for each new application.

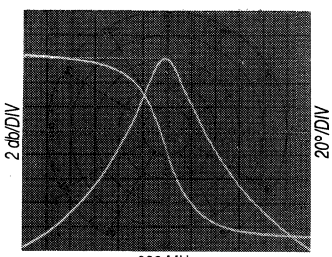
SAW RESONATOR FILTERS

SAW resonator filters provide high rejection and low loss for narrowband applications requiring 0.01% to 0.25% fractional bandwidths. This family of Sawtek's resonator filters is characterized by a "new shape" in narrowband filter technology. The unique shape demonstrated in the performance photographs below arises from the combination of transversal filter and resonator characteristics: the narrowband response produced by the resonant cavity emerges from the broader passband of the input and output transducers.

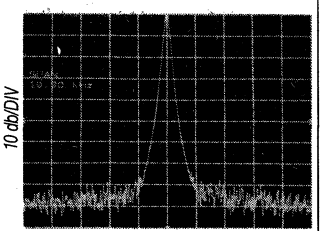
Two pole versions typically exhibit from 2 dB to 5 dB insertion loss with 15 dB to 20 dB near-in rejection and 55 dB to 75 dB ultimate rejection. The two-pole 537 MHz resonator filter shown on the left below has a matched insertion loss of only 4.5 dB, 18 dB close-in rejection, and 60 dB ultimate rejection.

Rejection which is beyond the measurable range of most test instruments can be achieved by cascading these two-pole units into multipole configurations. Depending on the number of poles, this technique provides from 20 dB to 60 dB of near-in rejection, improved shape factor and reduced flyback. Insertion loss generally increases at a rate of less than 1 dB per pole for these filters. The six pole 149.3 MHz filter on the bottom right has an insertion loss of only 5.7 dB and an ultimate rejection of over 100 dB.

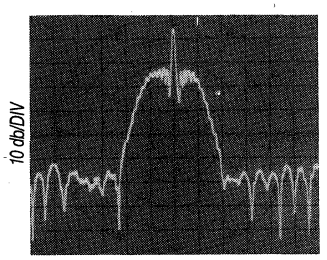
Sawtek's resonator filters are provided in individual two-pole stages in TO-8 and TO-5 packages and in custom modules when several of these 2 pole units are cascaded. Sawtek offers standard resonator filters and also rapid custom design.



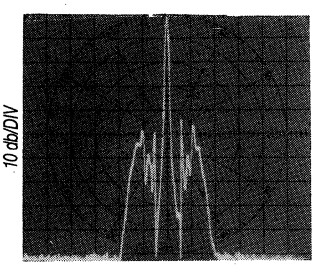
668 MHz
85 KHz/DIV



740 MHz
1 KHz/DIV



537.5 MHz
5 MHz/DIV



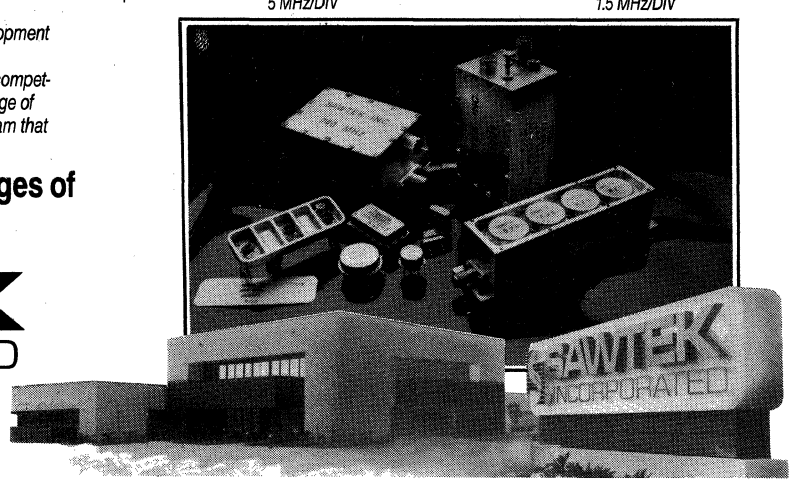
149.3 MHz
1.5 MHz/DIV

Sawtek maintains a leadership role in SAW technology through the development and production of superior SAW components and a proven track record of delivering these reliable, high performance products on time and at a very competitive price in production quantities. Product reliability for Sawtek's broad range of military and commercial parts is insured by a watchful quality control program that meets even the exacting requirements of military and space applications.

When your system demands the advantages of SAW Technology... Demand Sawtek.

SAWTEK INCORPORATED

P.O. Box 18000, Dept. EM, Orlando, FL 32860, (305) 886-8860

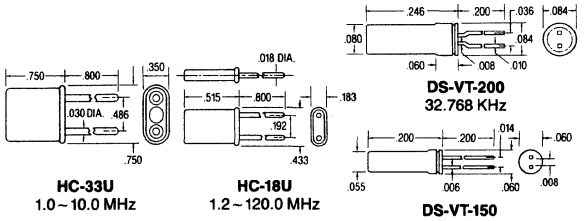


SEIKO INSTRUMENTS

STANDARD CRYSTALS/OSCILLATORS

QUARTZ CRYSTALS

Seiko Instruments offers a wide range of high quality, competitively priced quartz crystals. These units are particularly well suited for microprocessors, peripherals, clocks, and other time-based applications where small size, temperature stability, and high reliability are required.

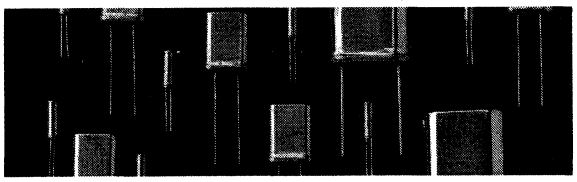


HC-33U
1.0 ~ 10.0 MHz

HC-18U
1.2 ~ 120.0 MHz

DS-VT-200
32.768 KHz

DS-VT-150
32.768 KHz



QUARTZ CRYSTAL SPECIFICATIONS

	HC-33U	HC-18U	DS-VT-150	DS-VT-200
Frequency Range	1—3 MHz	3—120 MHz	32.768 KHz	
Frequency Tolerance	± .002% at 25°C			
Temp. Stability	± .005%			
Temp. Range	0°C to 70°C		−10°C to +60°C	
ES Resistance	1 MHz Range 500Ω 2 MHz Range 300Ω	3 MHz Range 250Ω 4 MHz & above. 100Ω	30KΩ	50KΩ
Drive Level	50μW to 5mW		1.0μW Max.	0.4μW Max.
Shunt-Capacitance	7 pF Max.		0.86 pF Max.	
Storage Temp.	−55°C to 105°C		−30°C to +70°C	

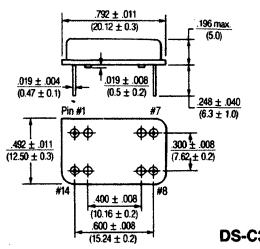
STANDARD FREQUENCY LIST

FREQ.	PART #	CASE	LOAD CAP.
1.000 MHz	DS-100	HC-33/U	16 pF
1.73	DS-173	IC-33/U	Series
1.8432	DS-184	HC-33/U	16 pF
2.00	DS-200	HC-33/U	16 pF
2.097152	DS-209	HC-33/U	16 pF
2.4576	DS-245	HC-33/U	32 pF
2.50	DS-250	HC-33/U	Series
3.00	DS-300	HC-18/U	16 pF
3.072	DS-307	HC-18/U	18 pF
3.12	DS-312	HC-18/U	12 pF
3.2768	DS-327	HC-18/U	16 pF
3.330	DS-333	HC-18/U	Series
3.330	DS-333A	HC-18/U	20 pF
3.579545	DS-357	HC-18/U	16 pF
4.00	DS-400	HC-18/U	Series
4.00	DS-400A	HC-18/U	16 pF
4.032*	DS-403	HC-18/U	22 pF
4.194304	DS-419	HC-18/U	16 pF
4.440	DS-444	HC-18/U	20 pF
4.550	DS-455	HC-18/U	20 pF
4.750	DS-475	HC-18/U	20 pF
4.9152	DS-491	HC-18/U	Series
4.9562	DS-495	HC-18/U	Series
5.000	DS-500	HC-18/U	20 pF
5.0688	DS-506	HC-18/U	Series
5.120	DS-512	HC-18/U	Series
5.1850	DS-518	HC-18/U	20 pF
5.5850	DS-558	HC-18/U	Series
5.5870	DS-558A	HC-18/U	20 pF
6.00 MHz	DS-600	HC-18/U	Series
6.144	DS-614	HC-18/U	30 pF
6.250	DS-625	HC-18/U	16 pF
6.400	DS-640	HC-18/U	16 pF
6.5536	DS-655	HC-18/U	16 pF
8.00	DS-800	HC-18/U	Series
8.00	DS-800A	HC-18/U	18 pF
8.33	DS-833	HC-18/U	Series
10.00	DS-1000	HC-18/U	Series
10.92	DS-1092	HC-18/U	10 pF
11.00	DS-1100	HC-18/U	10 pF
12.00	DS-1200	HC-18/U	10 pF
15.00	DS-1500	HC-18/U	10 pF
16.00	DS-1600	HC-18/U	Series
18.00	DS-1800	HC-18/U	Series
18.432	DS-1843	HC-18/U	Series
20.00	DS-2000	HC-18/U	Series
22.00	DS-2200	HC-18/U	Series
22.1184	DS-2211	HC-18/U	Series
23.40	DS-2340	HC-18/U	Series
24.00	DS-2400	HC-18/U	Series
25.00	DS-2500	HC-18/U	Series
27.00	DS-2700	HC-18/U	Series
32.00	DS-3200	HC-18/U	Series
36.00	DS-3600	HC-18/U	Series
48.00	DS-4800	HC-18/U	Series
32.768 KHz	DS-VT-200	6.2 × 2.0 mm (cylindrical)	6 pF
32.768 KHz	DS-VT-150	5.1 × 1.5 mm (cylindrical)	6 pF

*Special Spec.

CRYSTAL OSCILLATORS

Seiko Instruments clock oscillators provide all metal, hermetically sealed cases; notably low power consumption; and tight frequency stability for the most demanding applications and reliability. Units are TTL or CMOS compatible.



DS-C304A

SPECIFICATIONS

STANDARD	DS-C304A
Frequency Range	250 KHz to 50 MHz
Frequency Stability	± .007% @ 25°C
Temperature Stability	± .001%
Temperature Range	0°C to 70°C
Storage Temperature	−55°C to +125°C
Input Voltage	+5.0 ± 0.5V dc
Input Current	90mA over temp. range
Symmetry	60/40% @ 1.4V dc
Rise and fall time	15 ns maximum (250 KHz–8.999 MHz) 10 ns maximum (9.0 MHz–31.999 MHz) 6 ns maximum (32 MHz–50 MHz)
Output Load	1 to 10 TTL gates

STANDARD FREQUENCY LIST

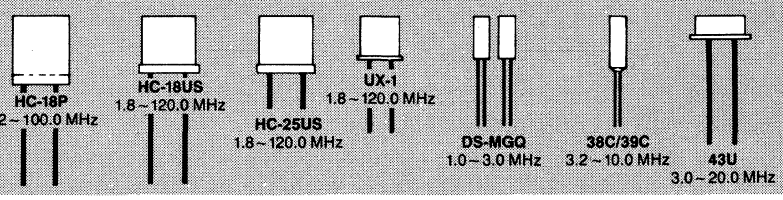
FREQ.	* STOCK #	FREQ.	* STOCK #
1.0	DSC100	10.000	DSC1000
1.2288	DSC122	12.000	DSC1200
1.8432	DSC184	16.000	DSC1600
2.0	DSC200	16.384	DSC1638
2.4576	DSC245	18.432	DSC1843
4.0	DSC400	19.6608	DSC1966
4.9152	DSC491	20.000	DSC2000
5.000	DSC500	22.1184	DSC2211
5.0688	DSC506	24.000	DSC2400
6.00	DSC600	25.000	DSC2500
6.144	DSC614	32.000	DSC3200
7.3728	DSC737	40.000	DSC4000
8.000	DSC800		

* Part No. DS-C304A.

CUSTOM CRYSTALS/OSCILLATORS

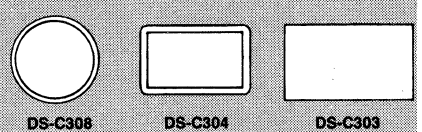
QUARTZ CRYSTALS

Seiko Instruments also offers the following custom cases for your special quartz crystal engineering needs. Plus, the smallest MHz quartz crystal units in the world...the DS-MGQ series with a frequency range of 1 to 3 MHz, and a temperature stability of ± 5 ppm from −30 to +70°C.



CRYSTAL OSCILLATORS

Seiko Instruments also offers tight tolerance oscillators in the cases shown below. Call for complete details.



DS-C308
0.5 ~ 64.0 Hz
3.0 ~ 16.0 MHz

DS-C304
250KHz ~ 50.0 MHz

DS-C303
3.0 ~ 24.0 MHz

SEIKO INSTRUMENTS U.S.A., INC., 2990 W. Lomita Blvd., Torrance, CA 90505 • (213) 530-8777

SFE TECHNOLOGIES
ELECTRO /// DYNAMICS
9075 Cody, Overland Park, KS 66214 • (913) 888-1750 • Telex 42254

STANDARD MICROPROCESSOR CRYSTALS

Electro Dynamics is America's largest manufacturer of industrial quartz crystals. We grow our own quartz bars—and then process them through to the finished product: standard or custom crystals for various markets, including the television, computer, and automotive industries. Since we control every step of the manufacturing process through vertical integration, **we can offer you the shortest lead times**—and about half the industry average!

FEATURES

- Short lead time on customs.
- "On line" engineering assistance.
- Dock-to-stock, Just In Time (JIT) programs.
- Volume production capability.

STANDARD SPECIFICATIONS

Frequency Calibration Tolerance: ± 0.005% at 25°C. • **Frequency Stability Tolerance:** ± 0.010% over 0° to 70°C. • **Load Capacitance:** See Table. • **Shunt Capacitance:** 7pF Maximum. • **Holder Type and Dimensions:** See Table and Drawings. • **Marking:** Part Number and Frequency.

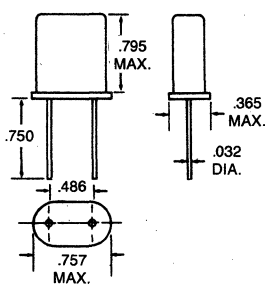
All microprocessor crystals are AT-cut for high frequency stability over a wide temperature range.

STANDARD MICROPROCESSOR CRYSTALS

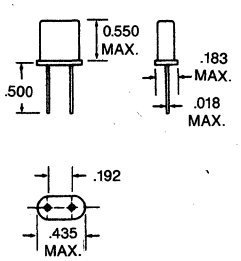
Available through Electrodynamics franchised dealers.

HOLDER STYLE

HC-33



HC-18/GB-18



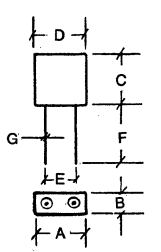
FREQUENCY	PART#	HOLDER STYLE	LOAD CAP IN pF
1.843200	ED018	HC33	13
2.000000	ED020	HC33	32
2.097152	ED021	HC33	20
2.457600	ED0246	HC33	32
3.000000	ED032G	GB18	32
3.276800	ED032G	GB18	12
3.579545	ED035G	GB18	18
3.686400	ED036G	GB18	20
4.000000	ED040G	GB18	20
4.000000	ED041G	GB18	SERIES
4.032000	ED0432G	GB18	22
4.194304	ED042G	GB18	12
4.915200	ED0491G	GB18	SERIES
5.068800	ED051G	GB18	SERIES
5.714300	ED057G	GB18	SERIES
6.000000	ED060G	GB18	SERIES
6.144000	ED061G	GB18	30
6.553600	ED065G	GB18	12
7.372800	ED073G	GB18	SERIES
8.000000	ED080G	GB18	20
8.000000	ED081G	GB18	SERIES
8.192000	ED0819G	GB18	SERIES
10.000000	ED100G	GB18	SERIES
10.738635	ED107G	GB18	SERIES
11.000000	ED110G	GB18	SERIES
12.000000	ED120G	GB18	SERIES
13.516800	ED1351G	GB18	SERIES
14.318180	ED143G	GB18	SERIES
15.000000	ED150G	GB18	SERIES
16.000000	ED160G	GB18	SERIES

Available through ElectroDynamics franchised distributors.

The specification below describes Electro Dynamics Division RW45 product. This device is a downsized AT Cut and has a frequency range of 10.000 MHz to 16.999 MHz.

Frequency Range: 10.000 MHZ to 16.999 MHz. • **Frequency Calibration:** ± 50 ppm at 25°C. • **Frequency Stability:** ± 100 ppm. • **Temperature Range:** – 20 to + 70°C. • **Load Capacity:** 15 to 35 pfd. • **Shunt Capacity:** 7.0 pfd maximum. • **Series Resistance:** 10.0 – 11.9 MHz (60 ohms); 12.0 – 13.9 MHz (50 ohms); 14.0 MHz up (40 ohms). **Marking:** Frequency, ED Code and Date Code.

RW-45



Holder	A	B	C	D	E	F	G
Tolerance	Max	Max	Max	Max	Max	Max	Max
RW45	0.325	0.135	0.345	0.274	0.148	0.550	0.018

Sizes are in inches.

Alternate package configurations are available upon request. These would include pin cut, lead forming, adhesive tape, third leads and special marking.

Performance in a Pinch

.12" diameter x .32" high

When you're in a space pinch for high-performance crystal filters, we've got the filters that fit. Discover how little room it takes to do a big job right.

Our crystals, monolithics, discretes, and time delay filters come in sizes tough to imagine. With specs tough to match. At prices tough to beat. And as for durability, they're just plain tough.

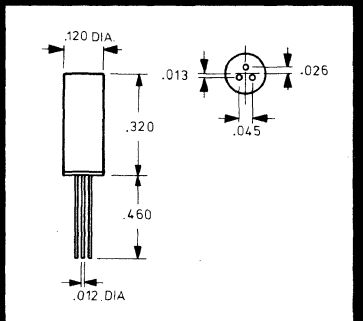
Besides our sub-mini tubular, we offer an HC45 package that meets or beats performance specs of similar fundamental crystal filters three times its size. We can also supply you with the industry's smallest matched filter sets.

Of course, our most important products take the form of optimum solutions to your design challenges. When what you need exists only as a problem on paper, give us a call. Or send us your specs. If the performance you require in the space you've got doesn't exist, we'll design to plug the hole in your schematic. No matter how small.

In a pinch for space?

At Sokol, we can get you out of a tight spot.

By fitting into one.



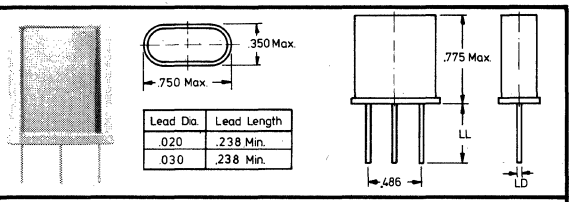
Sokol
Sub-Mini Tubular
Frequency range: 4.3 MHz to 250 MHz

Monolithics as fundamentals to 100 MHz and overtones to 500 MHz.

C.F. In MHz	3 dB B.W. In KHz	20 dB B.W. In KHz	Nominal Impedance In Ohms
17.90	15	80	2000
21.40	15	80	1400
25.50	70	400	5000
30.00	30	170	1000
43.50	13	85	3000
45.00	30	130	1200
70.00	30	170	5000
156.00	13	70	3600

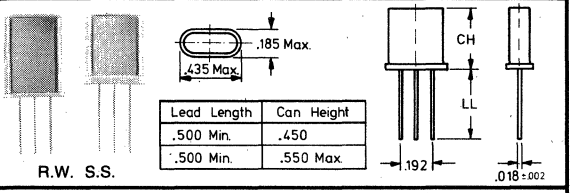
Sokol
Crystal Products, Inc.
"Where the Impossible Becomes the Ordinary."
121 Water St., P.O. Box 249
Mineral Point, WI 53565
Phone 608-987-3363

A



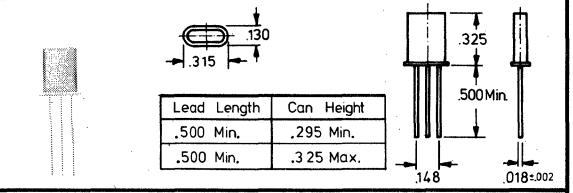
Lead Dia.	Lead Length
.020	.238 Min.
.030	.238 Min.

B



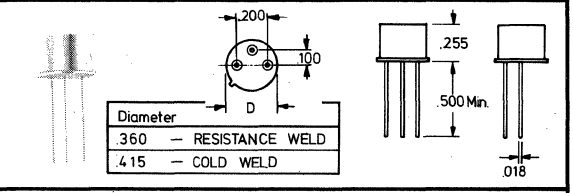
Lead Length	Can Height
.500 Min.	.450
.500 Min.	.550 Max.

C



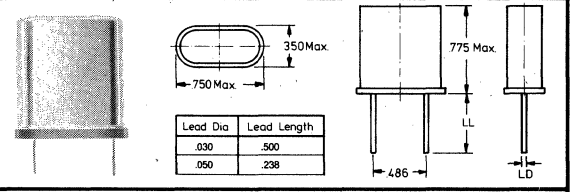
Lead Length	Can Height
.500 Min.	.295 Min.
.500 Min.	.325 Max.

D



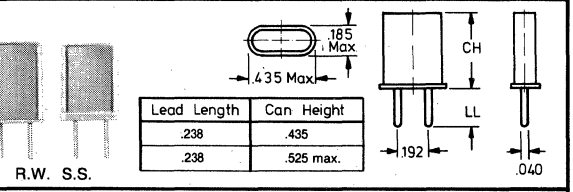
Diameter	
.360	— RESISTANCE WELD
.415	— COLD WELD

E



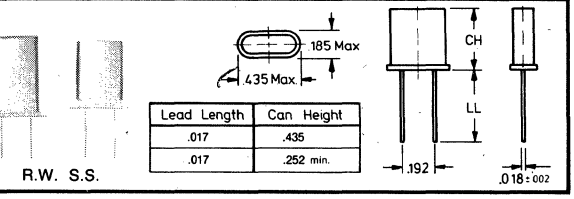
Lead Dia	Lead Length
.030	.500
.050	.238

F



Lead Length	Can Height
.238	.435
.238	.525 max.

G



Lead Length	Can Height
.017	.435
.017	.252 min.

Two Pole Monolithic Filters

Frequency range: 4.3 MHz to 250 MHz

Monolithics as fundamentals to 100 MHz and overtones to 500 MHz.

C.F. In MHz	3 dB B.W. In KHz	20 dB B.W. In KHz	Nominal Impedance In Ohms	Package Style
5.20	150	900	120	A
5.26	13	70	6000	A
9.00	15	80	4300	B, D
10.70	13	70	1800	B, D
10.70	13	70	3300	B, C, D
10.70	30	165	4300	B, D
10.70	30	165	6500	B, C, D
11.40	10.6	50	2000	B, D
15.1875	36	200	4700	B, C, D
16.90	13	70	390	B, C, D
17.90	15	80	2000	B, C, D
21.40	15	80	1400	B, C, D
25.50	70	400	5000	B, C, D
30.00	30	170	1000	B, C, D
43.50	13	85	3000	B, C, D
45.00	30	130	1200	B, C, D
70.00	30	170	5000	B, C, D
156.00	13	70	3600	B, C, D

Multipole Monolithic Filters

Frequency range: 4.3 MHz to 350 MHz

Miltipole Monolithics over a wide frequency range with varying frequencies; up to 16 poles.

Center Frequency In MHz	3 dB B.W. In KHz	60 dB B.W. In KHz	Nominal Impedance In Ohms	Qty.	Package Style
5.200	13.0	25	6000	4	A
5.260	13.0	25	6000	4	A
6.460	13.0	25	5000	4	A
9.000	15.0	40	4300	3	B, D
10.70	13.0	25	3300	4	B, D
10.70	13.0	25	6000	4	B, C, D
10.70	30.0	60	5000	4	B, D
11.40	2.7	6	470	3	B, D
11.40	2.7	6	820	3	B, C, D
12.428	3.0	12	390	2	B, D
12.428	3.0	12	750	2	B, C, D
15.1875	36.0	150	6000	2	B, C, D
16.90	13.0	30	600	3	B, C, D
18.05	46.0	120	6000	3	B, C, D
21.40	15.0	30	1500	4	B, C, D
25.50	22.0	44	1800	4	B, C, D
29.00	30.0	75	1400	3	B, C, D
30.00	50.0	100	2100	4	B, C, D
45.00	15.0	70	2700	2	B, C, D
75.00	13.0	60	3000	2	B, C, D

Four Pole on One Blank (Miniature Filters)

Frequency range: 15 MHz to 250 MHz Spurious greater than 40 dB below passband response.

C.F. In MHz	3 dB B.W. In KHz	60 dB B.W. In KHz	Insertion Loss	Characteristic Impedance	Pkg. Style
45.0	15	70	3 dB	4000 ohms	B
72.2	25	120	3 dB	3600 ohms	B
75.0	26	110	3 dB	4000 ohms	B
82.8	30	130	2 dB	3500 ohms	B
99.0	40	180	2 dB	3000 ohms	B
121.0	50	225	2 dB	3000 ohms	B

Wide Band Crystal and L-C Filter

Frequency range: 100 KHz and 500 MHz

Center Frequency	3 dB B.W.	60 dB B.W.	Insertion Loss	Characteristic Impedance	Package Size
3.0 MHz	3 KHz	3.4 KHz	6 dB	50 ohms	2.9 x 1 x 1
10.607 MHz	186 KHz	260 KHz	8 dB	50 ohms	2.4 x 1 x .9
10.700 MHz	210 KHz	400 KHz	8 dB	50 ohms	2.4 x 1 x .9
10.700 MHz	500 KHz	1000 KHz	8 dB	50 ohms	2.4 x 1 x .9
21.400 MHz	250 KHz	450 KHz	7 dB	50 ohms	2.0 x .9 x .5
21.400 MHz	500 KHz	900 KHz	9 dB	50 ohms	2.4 x 1 .9
21.400 MHz	150 KHz	350 KHz	6 dB	50 ohms	2.0 x .8 x .5
30.000 MHz	500 KHz	1000 KHz	6 dB	50 ohms	2.4 x 1 x .9
21.400 MHz	1000 KHz	4000 KHz	6 dB	50 ohms	1.105 x .496 x .500
21.400 MHz	2000 KHz	8000 KHz	6 dB	50 ohms	1.105 x .496 x .500
21.400 MHz	300 KHz	750 KHz	6 dB	50 ohms	1.105 x .496 x .500
21.400 MHz	500 KHz	2000 KHz	6 dB	50 ohms	1.105 x .496 x .500

Discriminators

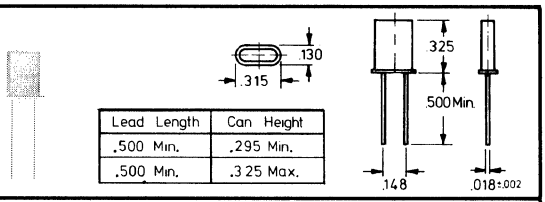
Frequency range: 5MHz to 250 MHz

Commercial and Military Discriminators to solve any demodulation problem.

C.F. in MHz	Distortion	B.W. In KHz	Package Style	C.F. in MHz	Distortion	B.W. In KHz	Package Style
5.26 MHz	1.0%	28	A, B	21.4 MHz	0.8%	34	B, C, D
10.7 MHz	1.0%	28	B, D	25.0 MHz	1.5%	60	B, C, D
10.7 MHz	0.8%	34	B, D	30.0 MHz	1.2%	28	B, C, D
11.5 MHz	3.5%	50	B, D	34.9 MHz	1.5%	70	B, C, D
16.9 MHz	1.2%	32	B, C, D	45.0 MHz	1.5%	28	B, C, D

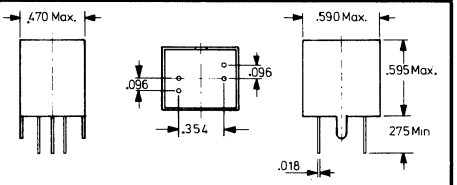
SCP Sokol Crystal Products, Inc. 121 Water Street, P.O. Box 249, Mineral Point, WI 53565 Phone 608-987-3363

H

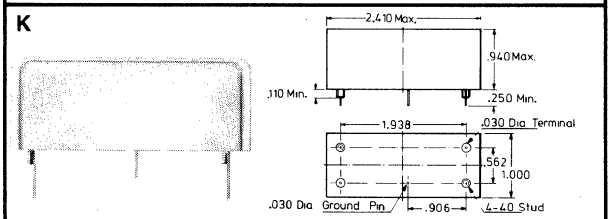


Lead Length	Can Height
.500 Min.	.295 Min.
.500 Min.	.325 Max.

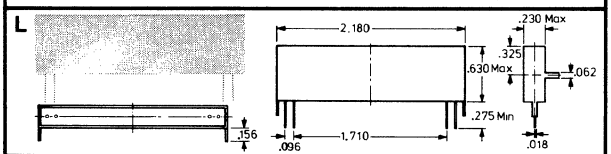
J



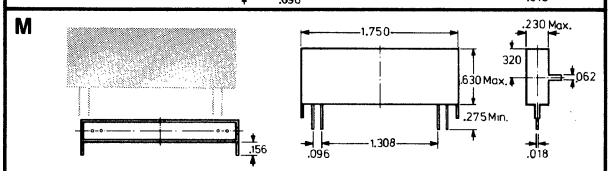
K



L



M



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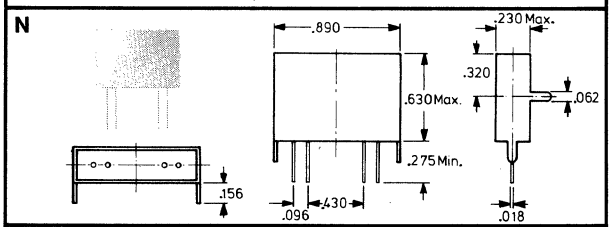
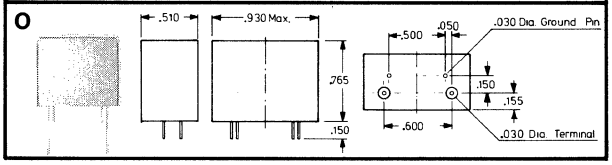


O



Packaged Monolithic Filters

Frequency range: 4.3 MHz to 350 MHz

Multipole Monolithics in standard and non-standard packages; 50 and 75 ohms as well as the filter characteristics available. Some standard are as shown below.

C.F. In MHz	3 dB B.W. In KHz	60 dB B.W. In KHz	Nominal Impedance In Ohms	Package Style
5.201	3.4	5.5	1000	2.375 x 1.000 x .940
5.201	3.4	6.0	1500	2.375 x 1.000 x .940
5.26	13.0	25.0	50	2.375 x 1.000 x .750
9.00	2.7	5.2	1000	.745 x .496 x .595
9.00	13.0	25.0	50	2.375 x 1.000 x .750
10.00	30.0	60.0	5000	1.75 x .230 x .630
10.70	22.0	40.0	4300	.745 x .496 x .595
10.70	13.0	25.0	3300	1.75 x .230 x .630
10.70	14.0	20.0	3300	1.105 x .496 x .630
11.10	34.8	70.0	5000	.745 x .496 x .595
11.50	36.0	90.0	50	2.312 x 1.000 x .750
15.1875	36.0	70.0	6000	.745 x .496 x .595
16.025	36.0	70.0	6000	1.750 x .230 x .630
16.90	13.0	25.0	1000	.745 x .496 x .595
21.40	22.0	42.0	2200	1.750 x .230 x .630
25.00	19.0	28.0	1300	2.187 x .230 x .630
30.112	25.0	50.0	50	
70.00	200.0	600.0	50	2.375 x 1.000 x .940
75.00	26.0	90.0	50	.930 x .510 x .765
112.50	25.0	90.0	50	.930 x .510 x .765

Military and Aircraft Radio Crystals

Frequency range: 1 MHz to 350 MHz

Rugged versions for high shock and vibration and all other military requirements.

Miniatures to meet all size requirements.

Frequency In MHz	Calibration Tolerance	Temp. Range	Stability Over Temp.	Package Style
1.0000	± .002%	-55 to + 105° C	± .005%	E
3.2000	± .002%	-55 to + 85° C	± .0025%	E
4.096	± .002%	-40 to + 100° C	± .003%	F, G
5.600	± .002%	-55 to + 105° C	± .005%	F, G
11.45	± .002%	-55 to + 105° C	± .005%	F, G
20.958	± .003%	-20 to + 55° C	± .002%	F, G
46.850	± .002%	-55 to + 90° C	± .005%	F, G
64.300	± .002%	-40 to + 71° C	± .003%	F, G
64.998	± .002%	-20 to + 55° C	± .003%	F, G
70.000	± .001%	+80 to + 90° C	± .002%	F, G
92.500	± .001%	+80 to + 90° C	± .002%	F, G
121.500	± .002%	-40 to + 71° C	± .003%	F, G
160.500	± .0015%	-55 to + 85° C	± .005%	F, G
161.670	± .0025%	-55 to + 85° C	± .005%	F, G

Packaged Time Delay Filters

Frequency range: 1 MHz to 350 MHz

Time Delay Filters as narrowband monolithics and wideband uniwafers to minimize size and weight.

C.F. In MHz	3 dB B.W. In KHz	60 dB B.W. In KHz	Differential Delay over 3 dB B.W. (In Microseconds)	Package Size
5.120	3.7	10	165	2.375 x 1 x .940
10.700	13.0	55	25	1.75 x .23 x .63
12.500	19.0	125	10	1.280 x .716 x .410
13.500	20.0	95	35	1.880 x .873 x .500
21.400	26.0	130	25	1.105 x .496 x .500
25.000	30.0	140	20	1.105 x .496 x .500
30.000	100.0	700	40	2.375 x 1 x .600
42.900	30.0	60	20	2.375 x 1 x .600

Microprocessor and Scanner Crystals

Frequency range: 1MHz to 100 MHz Some standards are as follows:

Frequency in MHz	Clock IC	Package Style	Frequency in MHz	Clock IC	Package Style
1.000	2650:6800:56860	E	6.1440	8085	F, G
1.8432	MC14411	E	8.000	CP 1600: IM 6100	F, G
2.000	F8/CPU3850	E	10.000	TTL Macrologic	D, F, G, H
2.4576	34702	E, F, G	14.3188	Hughes-Toys	D, F, G, H
3.5795	TV or Game	E, F, G	18.4320	8080A/8224	D, F, G, H
4.0000	4040/4201:6800:3870	F, G	20.000	AM 2900	D, F, G, H
4.9152	COM 5026/5046	F, G	22.1184	8080A/8224	D, F, G, H
5.0688	COM 5016/5036	F, G	48.0000	Special	D, F, G, H

Matched Filter Sets

Phase and Amplitude matched sets along with minimized size and weight.

Center Frequency	No. of Filters in matched set	3 dB B.W.	60 dB B.W.	Nominal Impedance	Amplitude Match	Phase Match	Size
5.0 MHz	4	3.0 KHz	10 KHz	1000 ohms	0.2 dB	±1°	2.4 x 1 x .9
5.6 MHz	3	4.5 KHz	13 KHz	50 ohms	0.2 dB	±1°	2.4 x 1 x .9
10.7 MHz	2	25 KHz	100 KHz	50 ohms	0.1 dB	±2°	1.06 x 5 x .6
21.4 MHz	2	10 KHz	20 KHz	1000 ohms	0.2 dB	±2°	1.75 x .6 x .2
21.4 MHz	2	25 KHz	50 KHz	2500 ohms	0.2 dB	±2°	1.75 x .6 x .2
21.4 MHz	2	50 KHz	100 KHz	3000 ohms	0.5 dB	±3°	1.75 x .6 x .2
28.0 MHz	3	5 KHz	15 KHz	50 ohms	0.2 dB	±2°	1.06 x .5 x .5

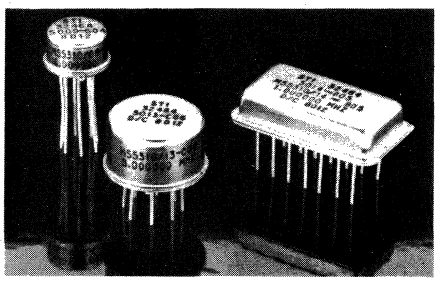
Sokol Crystal Products, Inc. 121 Water Street, P.O. Box 249, Mineral Point, WI 53565 Phone 608-987-3363

Spectrum Technology Inc

Spectrum Technology P.O. BOX 948 GOLETA, CA 93116 TEL. (805) 964-7791 TWX 910-334-1163

QPL to MIL-0-55310

Spectrum Technology is a QUALIFIED SUPPLIER of Crystal Oscillators to MIL-0-55310/4 thru /17. /4 thru /7 are TCXO's; /8 thru /17 are Hybrid Logic Clocks. These can be screened to Class S, B, or C. Spectrum has many standard TCXO and Hybrid Logic Clock designs; modifications are available.



M55310/xx	Package Type (7)	Frequency Range	Stability Option	Output Type	Pin Numbers			
					Out	Case	B−	B+
/08	14-pin DIP, .2″ H.	50 Hz, 50 MHz	(3)	TTL	1	2	8	14
/09	TO-5	400 KHz, 30 MHz	(3)	TTL	5	4	4	8
/10	TO-8	1 KHz, 30 MHz	(3)	TTL	5	4	4	8
/11	14-pin DIP, .4″ H.	.05 MHz, 10 MHz	(3)	CMOS	1	2	8	14
/12	TO-5	.05 MHz, 10 MHz	(4)	CMOS	5	4	4	8
/13	TO-8	300 Hz, 10 MHz	(4)	CMOS	5	4	4	8
/14	14-pin DIP, .2″ H.	.1 Hz, 25 MHz	(3)	TTL	5	7	7	4
/15	14-pin DIP, .2″ H.	.01 Hz, 10 MHz	(3)	CMOS	1	2	8	14
/16	14-pin DIP, .2″ H.	.1 Hz, 50 MHz	(1)	TTL	8	7	7	14
/17 (5)	14-pin DIP, .2″ H.	250 KHz, 80 MHz	(1)	TTL	8	7	7	14 (5)
/18 (6)	14-pin DIP, .2″ H.	.01 Hz, 15 MHz	(1)	CMOS	8	7	7	14
/19 (6)	40-pin LCC, .085″ H.	1.0 MHz, 60 MHz	(2)	TTL	39	—	31/37	4/10
/20 (6)	44-pin LCC, .085″ H.	40 KHz, 60 MHz	(2 & 3)	TTL	42	—	34/40	6/12
/21 (6)	20-pin FP, .120″ H.	1 MHz, 60 MHz	(2 & 3)	TTL	11	10	10	13 or 20

NOTES: STABILITY OPTIONS:

	(1)	(2)	(3)	(4)
A: −55 to +125°C;	±50 or 100 ppm	±100 or 200 ppm	±50 ppm	±100 ppm
B: −55 to +105°C;	±40 or 80 ppm	±75 or 150 ppm	±40 ppm	±70 ppm
C: −20 to +70°C;	±25 or 50 ppm	±50 or 100 ppm	±25 ppm	±55 ppm

(5) Gated Oscillator, Gate Input on pin 9.
(6) Pending approval.
(7) All package heights max.

14 PIN DIP PACKAGE, Resistance Weld Hermetically Sealed

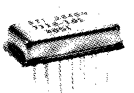
(Mfd. IAW MIL-O-55310) See QPL*
Stabilities to ±.005%, Temperature Range −55 to +125°C

TTL — 7116/7114*/7117† — 1 Hz to 65 MHz, 5 Vdc

CMOS — 4116/4114*/4117† — .015 Hz to 15 MHz (Specify Vdc, +5 to +15)

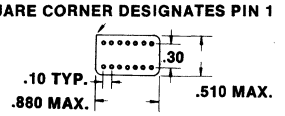
Package, 14 pin DIP pattern: .87″x.50″x.20″
Std. Pin Conn.: 7, Com; 8, Output; 14, +Supply
MIL-STD-883 Screening available. (Class "B" typical)
* 4-pin package † 7-pin package

Pins: .018″ dia.; .28″ min. length



.20 MAX HT

SQUARE CORNER DESIGNATES PIN 1



(.810 MAX available)

TO-5/TO-8 PACKAGE, Resistance Weld Hermetically Sealed

(Mfd. IAW MIL-O-55310) See QPL*
Stabilities to ±.005%, Temperature Range −55 to +125°C

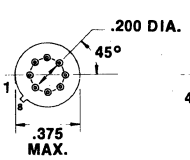
TTL — 7181/7180(TO-8) — 28 Hz to 65 MHz
7150(TO-5) — 625 KHz to 65 MHz

CMOS — 4181/4180(TO-8) — 3.5 Hz to 15 MHz (Specify Vdc)
4150(TO-5) — 80 KHz to 15 MHz (Specify Vdc)
Std. Pin Conn.:
7150/4150, 7181/4181 — 4, Com; 5, Output; 8, +Supply
7180/4180 — 6, Com; 5, Output; 12, +Supply
MIL-STD-883 Screening available. (Class "B" typical)

(All pins .018″ dia.; .480 min. length)

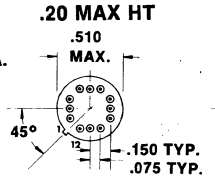
7150/4150

.20 MAX HT



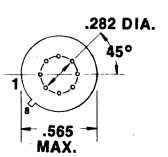
7180/4180

.20 MAX HT



7181/4181

.20 MAX HT



Spectrum Technology

P.O. BOX 948
GOLETA, CA 93116

TEL. (805) 964-7791
TWX 910-334-1163

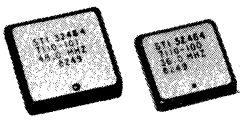
Crystal Oscillators/IC Logic Clocks

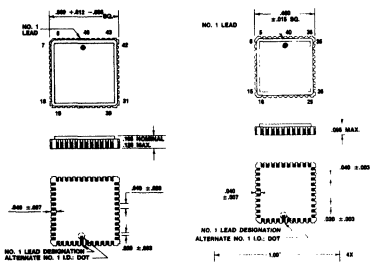
LEADLESS CHIP CARRIER (LCC) CRYSTAL OSCILLATOR/LOGIC CLOCK (Mfd. IAW MIL-O-55310) See QPL*

Stabilities to ±.005%, Temperature Range −55 to +125°C

TTL — 7110, 39 Hz to 65 MHz

CMOS — 4110, 600 Hz to 15 MHz (Specify Vdc, +5 to +15)
.480" sq. — Pin 37 Com; 39 Output; 4 Supply
.560" sq. — Pin 44 Com; 47 Output; 5 Supply
MIL-STD-883 Screening Available (Class "B" typical)



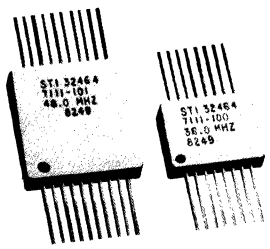


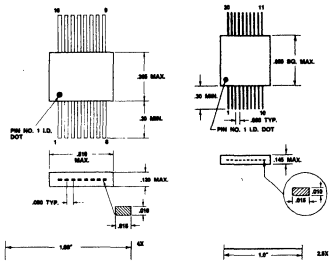
FLAT PACK CRYSTAL OSCILLATOR
(Mfd. IAW MIL-O-55310) See QPL*

Stabilities to ±.005%, Temperature Range −55 to +125°C

TTL — 7110, 39 Hz to 65 MHz

CMOS — 4111, 3.5 Hz to 15 MHz (Specify Vdc, +5 to +15)
16 Lead — Pin 8 Com; 9 Output; 16 Supply
20 Lead — Pin 10 Com; 11 Output; 20 Supply
MIL-STD-883 Screening Available (Class "B" typical)





Temperature Compensated Crystal Oscillators

For applications requiring high stability, low power and zero warm-up time. Designed for P.C. Board mounting.

Input Voltage: +10 to +20 volt range - regulation to ±10%

Output Signal: TTL standard; CMOS, SINE-WAVE or ECL available

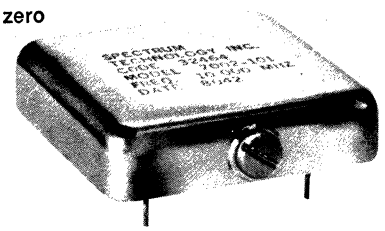
Temp Stability: ±2 x 10^{-7}, 0 to +50°C;
±5 x 10^{-7}, −20 to +65°C;
±1 x 10^{-6}, −55 to +85°C;
±5 x 10^{-6}, −55 to +125°C.
Other ranges available

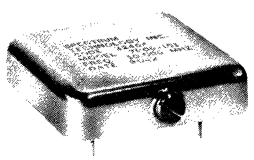
Freq Range:
7002: 10 KHz to 20 MHz; 1 Hz to 100 MHz available special
7006: 500 KHz to 20 MHz; 10\KHz to 100 MHz available special

Trim Adjust: 5 to 10 years aging range

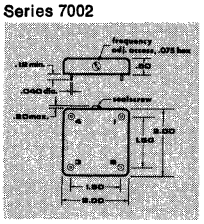
SPECIAL PACKAGES: Many special configurations are available including smaller packages, units with mounting studs, brackets, inserts, and special electrical characteristics. Contact Spectrum Technology for further information.

QPL TCXO's:
Spectrum is an approved QPL Supplier to M55310/4, /5, /6 & /7.



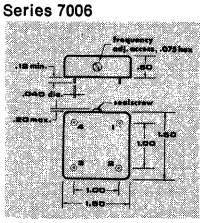


Series 7002



PIN CONNECTIONS
Series 7002
1 — Pos. Supply
2 — Com. and Case
3 — N/C
4 — Output

Series 7006

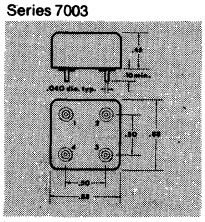


PIN CONNECTIONS
Series 7006
1 — Pos. Supply
2 — Com. and Case
3 — N/C
4 — Output

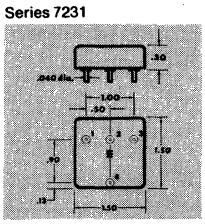
SPECIAL PACKAGE CONFIGURATIONS

Spectrum Technology utilizes conventional P.C. Board or proven reliability Hybrid Circuits as required to supply most of the alternate oscillator packages previously designed into many commercial and military programs. Most packages can provide CMOS, TTL, Sinewave or ECL outputs from 1 Hz to 100 MHz.

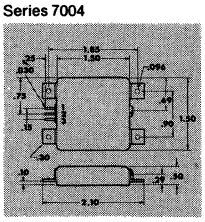
Series 7003



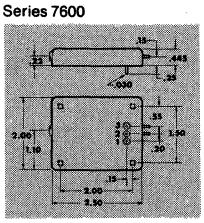
Series 7231



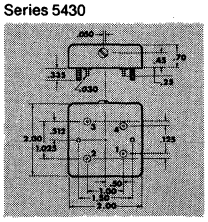
Series 7004



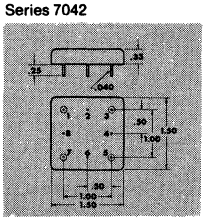
Series 7600



Series 5430



Series 7042



HIGH RELIABILITY oscillators use proven conservative designs and "ER" components. MIL-S-19500 transistors, JTX or JTXV; MIL-M-38510 I.C.'s or screened to MIL-STD-883. Soldering per N.H.B. 5300.4(3A) as specified.

QUALITY CONTROL exceeds requirements of MIL-I-45208A and MIL-STD-45662A. Workmanship and soldering per Requirements 5 and 9 of MIL-STD-454F. Design and testing to MIL-O-55310. MIL-STD-883 or MIL-O-55310 screening.

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K
kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L
LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microforad
MHz megahertz
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOSIGT metal-oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM nuclear instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLL phased lock loop
PPI plan position indicator
PROM programmable read only memory
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

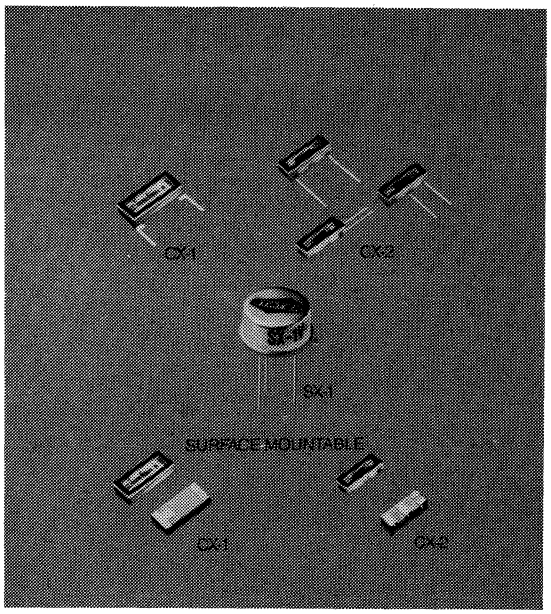
W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

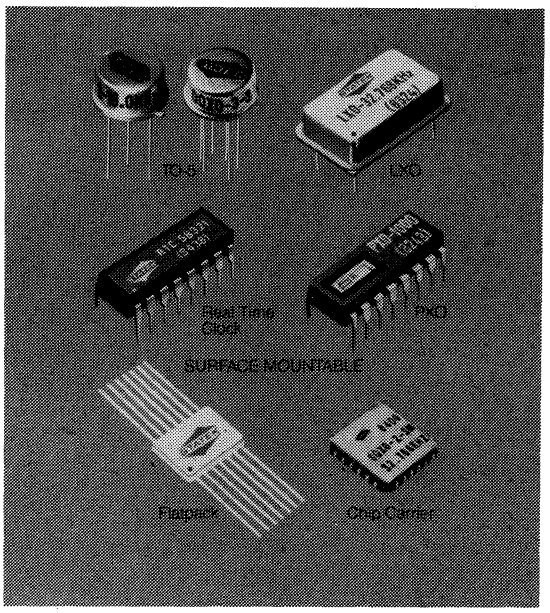
Quartz Crystals and Crystal Oscillators

Quartz Crystals
10 kHz to 2 MHz



Actual size

Crystal Oscillators
0.0006 Hz to 2 MHz



Actual size

On the next four pages you will find the most complete line of miniature, low-frequency quartz crystals and crystal oscillators in the world.

STATEK

Short Form Catalog

Statek has the most complete line of miniature, low-frequency quartz crystals and crystal oscillators in the world!

0.0006 Hz to 2 MHz

Quartz Crystals: 10 kHz to 2 MHz • High accuracy • Produced in volume by photolithography • Low aging • High Q • Rugged, hermetically sealed ceramic package • Designed for hybrid or PC board packaging.

Quartz Crystal Oscillators: Miniature (TO-5) series • Low power series • Programmable, multi-frequency series • CMOS/TTL compatible series • Very low frequency series.

Miniature Quartz Crystals

CX Series
10 kHz to 2 MHz
Statek's CX Series crystals consist of a miniature quartz resonator, hermetically sealed in a rugged, ceramic package.

Types Available (See Table 1)
The CX Series is available in two case sizes: CX-1 and CX-2. The CX-1 is available from 10 kHz to 2 MHz and the CX-2 is available from 16 kHz to 2 MHz.

"H" models are designed for series (two cascaded inverters) oscillators. "V" models are designed for Pierce (single inverter) oscillator applications. See Table 1 for case size and configuration options and other special features

TABLE 1: Miniature Low-Frequency Crystal Selection Chart: CX Series

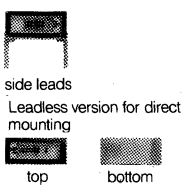
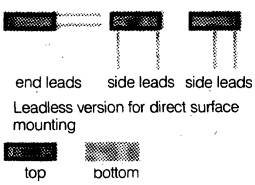
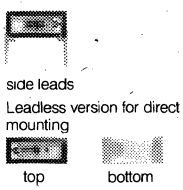
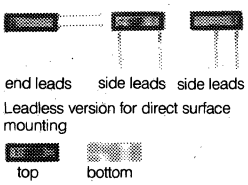
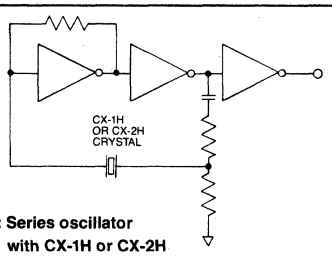
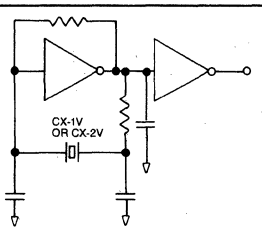
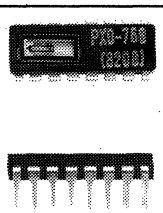
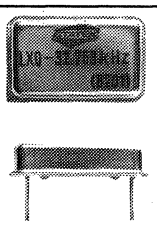
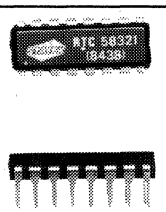
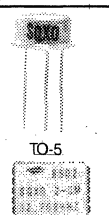
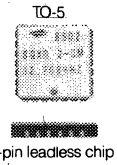
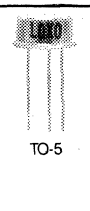
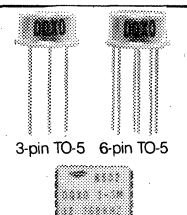
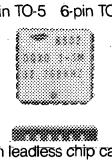
SERIES	CX-1H SERIES	CX-2H SERIES	CX-1V SERIES	CX-2V SERIES
PACKAGE AND LEAD CONFIGURATIONS AVAILABLE (Photos are actual size.)	 side leads Leadless version for direct surface mounting top bottom	 end leads side leads side leads Leadless version for direct surface mounting top bottom	 side leads Leadless version for direct surface mounting top bottom	 end leads side leads side leads Leadless version for direct surface mounting top bottom
FREQUENCY RANGE	10 kHz to 2 MHz	16 kHz to 2 MHz	10 kHz to 2 MHz	16 kHz to 2 MHz
PRINCIPAL FEATURES	Standard IC lead spacing: 0.300 in. (7.62mm)	Smallest possible size for dense PC board or hybrid packaging	Standard IC lead spacing: 0.300 in. (7.62mm)	Smallest possible size for dense PC board or hybrid packaging.
OTHER SPECIAL FEATURES	• H Series designed for long service/storage life • High reliability		• V Series designed for lowest possible power consumption • High stability • Ideal for battery-operated applications	
OSCILLATOR CIRCUIT	 **FIG 1A: Series oscillator with CX-1H or CX-2H**		 **FIG 1B: Pierce oscillator with CX-1V or CX-2V**	

TABLE 2: Low Frequency Crystal Oscillator Selection Chart

SERIES	PXO SERIES	LXO SERIES	REAL TIME CLOCK RTC-58321	SQXO-2 SERIES	LQXO-4 SERIES	DQXO SERIES
PRINCIPAL FEATURES	Generates 57 discrete, programmable frequencies from one crystal	• High accuracy • Low aging • Low power	•Built-in crystal oscillator •Low current consumption	•TTL and CMOS compatible •Choice of two packages: TO-5 or 16-pin leadless chip carrier	• Low power • CMOS compatible • TO-5 package	•Low-frequency oscillator/timer •Two packages: TO-5 or 24-pin leadless chip carrier. TO-5 comes with 3 or 6 leads depending on frequency.
PACKAGE STYLE (Photos are actual size.)	 16-pin DIP	 4-pin metal case—pins on 14-pin DIP centers	 16-pin DIP	 TO-5  24-pin leadless chip carrier	 TO-5	 3-pin TO-5 6-pin TO-5  24-pin leadless chip carrier
FREQUENCY RANGE	0.002 Hz to 2 MHz	10 kHz to 2 MHz		10 kHz to 2 MHz	10 kHz to 2 MHz	0.0006 Hz to 10 kHz

Miniature Low-Frequency Quartz Crystals

TABLE 3: CX Series Specifications 10 kHz to 2 MHz

Specifications are typical at 25°C unless otherwise noted.
Specifications subject to change without notice.

Frequency (see Table 4)[1]	10 kHz to 2 MHz*
Calibration Tolerance[2] (see Table 5)	A, B or C Tolerance
Motional Resistance, R_1	Figure 4
Maximum:	
10-169 kHz	2 x typical
170-600 kHz	2.5 x typical
600 kHz-2 MHz	
H Model	5 KΩ maximum
V Model	3 KΩ maximum
Motional Capacitance, C_1	Figure 5
Quality Factor, Q	Figure 6
Shunt Capacitance, C_0	
10-600 kHz	1.4 pf typical
600 kHz-2 MHz	1.0 pf typical
Drive Level	
10-25 kHz	
H Model	1.5 μw maximum
V Model	0.5 μw maximum
25-600 kHz	
H Model	3 μw maximum
V Model	1 μw maximum
600 kHz-2 MHz	
H Model	5 μw maximum
V Model	3 μw maximum
Turning Point, T_0	Figure 7
Temperature Coefficient, K	-0.035 (ppm/°C²)
Aging, first year	
10-600 kHz	5ppm maximum
600 kHz-2 MHz	10ppm maximum
Shock Survival	
10-600 kHz	1000g, 1ms, ½ sine
600 kHz-2 MHz	750g, 1ms, ½ sine
Vibration Survival	
10-600 kHz	20g rms, 10-2000 Hz
600 kHz-2 MHz	10g rms, 10-2000 Hz
Operating Temperature	
Industrial	-40 to +85°C
Military	-55 to +125°C
Storage Temperature	-55 to +125°C
Maximum Temperature[3]	
Lead/Package Junction	175°C
Lid Seal	210°C
1. Tuning Fork Flexure Mode	10-600 kHz
Extentional Mode	600 kHz-2 MHz

2. Frequency specified for Statek standard oscillator circuit. Tighter calibration tolerances available.
3. Higher temperature capabilities available in surface mountable crystals, see below.
*10-15.9 kHz not available in CX-2 case size.

TABLE 4: Standard Frequencies, CX Series

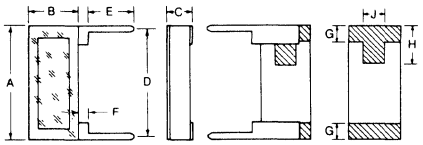
FREQUENCY	COMMON DIVISION	APPLICATION
10* kHz	10	1 kHz audio
12.8* kHz	2^8	50 Hz time base
15.36* kHz	2^8	60 Hz time base
16 kHz	2^4	1 kHz audio
16.384 kHz	2^{14}	1 Hz time base
18.641 kHz	2^{26}	1 cycle per hour
19.2 kHz	$2^{6,5,4}$	300, 600, 1200 baud modem
20.48 kHz	2^{12}	5 Hz clock motor
25 kHz	–	Ultrasonic alarm transducer
30.72 kHz	2^9	60 Hz time base
31.5 kHz	–	TV. raster
32.768 kHz	2^{15}	1 second time base
38.4 kHz	$2^{6,5,4}$	600, 1200, 2400 baud modem
40 kHz	–	Ultrasonic alarm transducer
40.96 kHz	2^{12}	10 Hz clock motor
60 kHz	–	WWVB PLL
76.8 kHz	$2^{6,5,4}$	1200, 2400, 4800 baud modem
100 kHz	–	Calibrator
153.6 kHz	$2^{6,5,4}$	2400, 4800, 9600 baud modem
240 kHz	2^7	Motor control
307.2 kHz	$2^{7,6,5}$	2400, 4800, 9600 baud modem
500 kHz	–	Microprocessor
1 MHz	–	Microprocessor
1.048576 MHz	2^{20}	Microprocessor, real time clock
1.2288 MHz	–	Microprocessor, baud rate generator
1.8432 MHz	–	Baud rate generator
2.0 MHz	–	Microprocessor
2.097152 MHz	2^{21}	Microprocessor, real time clock

*CX-1 only

TABLE 5: Calibration tolerances at 25°, CX Series

CALIBRATION	10-74.9 kHz	75-169 kHz	170-249 kHz	250-600 kHz	600 kHz-2 MHz
A	±0.003%	±0.005%	±0.01%	±0.02%	±0.05%
B	±0.01%	±0.01%	±0.02%	±0.05%	±0.1%
C	±0.1%	±0.1%	±0.2%	±0.5%	±1.0%

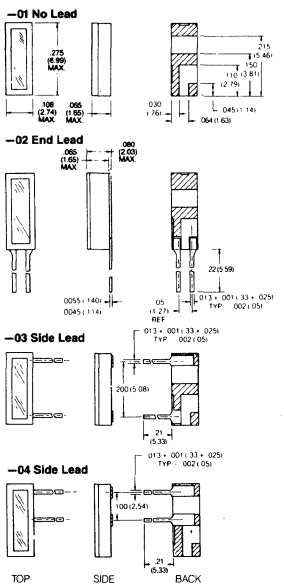
FIG 2A: Dimensions and case styles—CX-1 Series



DIM.	IN.	MM	NOTES
A	0.330	8.38	Max
B	0.155	3.94	Max
C	0.080	2.03	Max
D	0.300 ± 0.01	7.62 ± 0.25	
E	0.125	3.23	Min
F	0.040	1.02	Max
G	0.045	1.14	Nom
H	0.105	2.67	Nom
J	0.060	1.52	Nom

Leads 0.010" x 0.018" (0.25 x 0.46 mm) nom.

FIG 2 B: Dimensions and case styles—CX-2 Series

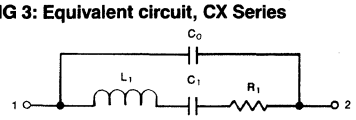


Surface Mountable Crystals and Oscillators

CX-1 and CX-2 Series crystals are available in higher-temperature leadless versions for surface mounting. SQXO-2 series oscillators are available in a 24-pin leadless ceramic chip carrier for surface mounting. Surface-mountable crystals are designated CX-1 (H or V)-SM or CX-2 (H or V)-SM, and surface-mountable oscillators are designated SQXO-2-SM or DQXO-3-SM.

All Statek surface-mountable devices are designed for use with vapor phase solder reflow processes and wave solder processes up to 260°C. See individual data sheets for specifications.

FIG 3: Equivalent circuit, CX Series



R_1 Motional Resistance L_1 Motional Inductance
C_1 Motional Capacitance C_0 Shunt Capacitance

FIG. 4: Typical Motional Resistance R_1, CX Series

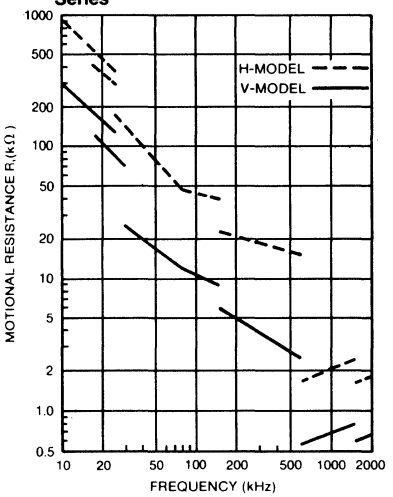


FIG. 5: Typical Motional Capacitance C_1, CX Series

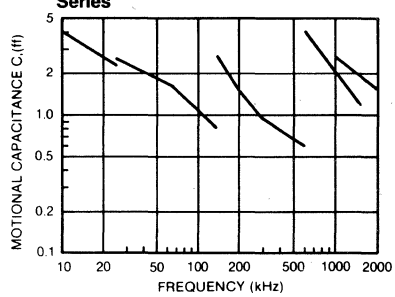


FIG. 6: Typical Quality Factor Q, CX Series

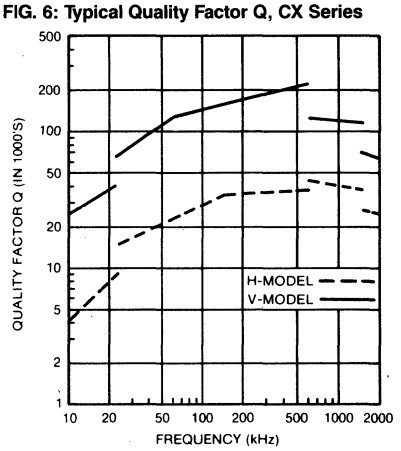
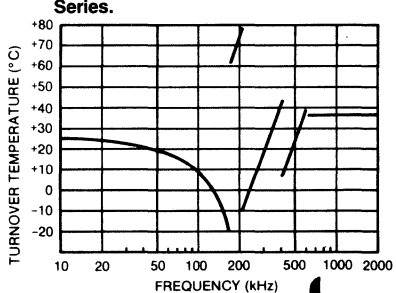


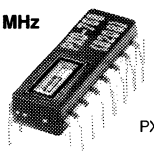
FIG. 7: Typical Turning Point Temperature, CX Series.



Low Frequency Crystal Oscillators

Programmable Crystal Oscillators

PXO Series
0.002 Hz to 2 MHz



PXO-768

Generates 57 discrete, programmable frequencies from a single crystal • Packaged in standard 16-pin DIP • Low power • Low aging • TTL compatible.

All frequencies generated are derived from a single built-in quartz crystal oscillator and exhibit the same high levels of accuracy and stability as those of the base frequency.

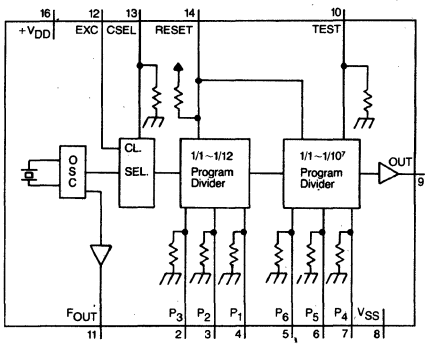
Standard calibration tolerance for PXO 32768,A: ±10 ppm, All others ±100 ppm. Tighter tolerances available • Frequency stability: ±0.015%*, -10 to +70°C • Supply voltage 4-6V • Supply current 1 mA max • Rise time: 70 nsec typ • Fall time: 30 nsec typ • Aging: 10 ppm max first year.
*Does not include calibration tolerance

Standard Frequency Ranges, PXO Series*

MODEL	BASE FREQUENCY	OUTPUT FREQUENCY RANGE
PXO-32768	327.68 kHz	0.00273 Hz to 327.68 kHz
PXO-600	600 kHz	0.005 Hz to 600 kHz
PXO-768	768 kHz	0.0064 Hz to 768 kHz
PXO-1000	1 MHz	0.0083 Hz to 1 MHz

*Other frequencies available. Consult factory.

Block Diagram, PXO Series



Output Frequencies, PXO Series

Example–Model PXO-1000
UNIT: Hz

PROGRAM PIN SETTINGS	P4	0	0	0	0	1	1	1	1
	P5	0	0	1	1	0	0	1	1
P1 P2	P6 / P3	0	1	0	1	0	1	0	1
0 0	0	1M	100K	10K	1K	100	10	1	0.1
0 0	1	100K	10K	1K	100	10	1	0.1	0.01
0 1	0	500K	50K	5K	500	50	5	0.5	0.05
0 1	1	333.3̄K	33.3̄K	3.3̄K	333.3̄	33.3̄	3.3̄	0.33̄	0.033̄
1 0	0	250K	25K	2.5K	250	25	2.5	0.25	0.025
1 0	1	200K**	20K	2K	200	20	2	0.2	0.02
1 1	0	166.6̄K	16.6̄K	1.6̄K	166.6̄	16.6̄	1.66̄	0.16̄	0.016̄
1 1	1	83.3̄K	8.3̄K	833.3̄	83.3̄	8.3̄	0.83̄	0.083̄	0.0083̄

*33% duty cycle **40% duty cycle

Pin Functions, PXO Series

Prog 1 through Prog 6 control divide ratio of base frequency.

P_1	P_2	P_3	DIVIDING RATIO	P_4	P_5	P_6	DIVIDING RATIO
0	0	0	1/1	0	0	0	1/1
0	0	1	1/10	0	0	1	1/10
0	1	0	1/2	0	1	0	$1/10^2$
0	1	1	1/3	0	1	1	$1/10^3$
1	0	0	1/4	1	0	0	$1/10^4$
1	0	1	1/5	1	0	1	$1/10^5$
1	1	0	1/6	1	1	0	$1/10^6$
1	1	1	1/12	1	1	1	$1/10^7$

OUT: Supplies programmed output frequency with rectangular pulse shape (50% duty cycle).

TEST: Setting this terminal Hi multiplies programmed output frequency by 1,000, except when programmed divide ratio is less than 1/1000.

F_{OUT}: Supplies base frequency of internal crystal oscillator.

EXC: Input for counting external clock instead of internal clock.

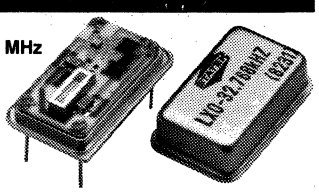
CSEL: Clock select. Setting this terminal Hi causes the divider to count the frequency of an external clock instead of the internal clock.

$\overline{RESET}$: Setting this terminal Lo resets all counters and sets output switches to Lo.

(All inputs except EXC and RESET have internal pull-down resistor. RESET has pull-up resistor.)

High Accuracy Crystal Oscillators

LXO Series
10 kHz to 2 MHz



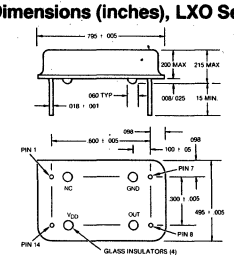
Laser tuned for high accuracy • Low aging • Low power • CMOS compatible • Low profile, hermetically-sealed package.

The LXO Series has the highest accuracy and stability of all Statek oscillators.
Specifications and characteristics of the LXO Series vary with frequency. Characteristics of the LXO-32.768 kHz model are presented below as an example. Contact factory for other frequencies.

Standard calibration tolerances: A: ±10 ppm; B: ±25 ppm; C: ±100 ppm. Tighter tolerances available • Frequency stability: -0.012%, -20 to +70°C* • Supply voltage: 3-6V • Rise time: 1.0 μsec max • Fall time: 1.0 μ sec max. • Supply current: 50 μA typical at 5V, 20 μA typical at 3V • Aging: 1 ppm/yr typical, 3 ppm max.

*Does not include calibration tolerance.

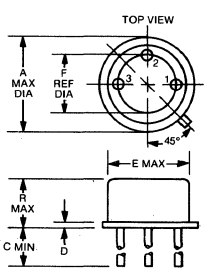
Package Dimensions (inches), LXO Series



Miniature Quartz Crystal Oscillators

Statek manufactures three series of oscillators in TO-5 packages: SQXO-2 Series, LQXO-4 Series and DQXO Series. They all have these features in common: Laser tuning for high accuracy • Hybrid construction • Low aging • Operating temperature: industrial –40 to +85°C; military: –55 to +125°C* • Shock (survival): 1 Hz to 600 kHz: 1000 g, 1mS, ½ sine; 600 kHz to 2 MHz: 750g, 1mS, ½ sine. Vibration (survival): 10g, 10 to 2000 Hz.

TO-5 Dimensions



PIN	CONNECTION	DIM	INCHES	MILLIMETERS
1	V_{DD}	A	0.380	9.19
2	Output	B	0.185	4.70
3	Gnd.	C	0.500	12.70
		D	0.029	0.74
		E	0.326	8.28
		F	0.200	5.08

1. All metal parts are gold plated.
2. Leads are 0.019" (0.48mm) dia. max.

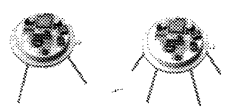
SQXO-2 Series
10 kHz to 2 MHz

TTL and CMOS compatible • Standard calibration tolerances: A: ±0.01%; B: ±0.03% • Frequency stability: ±0.02 typ., –40 to +85°C* • Supply voltage: 4-6V • Supply current: 200 uA-3mA • Standard frequencies: same as CX-1 crystals • Available in TO-5 or 24-pin leadless chip carrier. See SQXO-2-SM Data Sheet.
*Does not include calibration tolerance.

Low Power
LQXO-4 Series
10 kHz to 2 MHz

Low power • CMOS compatible • Standard calibration tolerance: A: ±0.01%, B: 0.03%, • Frequency stability: ±0.02% typ., –40 to +85°C** • Supply voltage: 4-6V • Supply current: 10 uA-1.5mA • Standard frequencies: same as CX-1 crystal.
*Does not include calibration tolerance.

Low Frequency
DQXO Series
0.0006 Hz to 10 kHz*

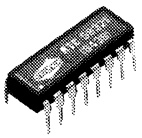


CMOS compatible • Low power • Standard calibration tolerances: A: ±0.01%; B: 0.03% • Frequency stability: ±0.02% typ., –40 to +85°C** • Supply voltage 4-6V • Supply current 10 uA to 3 mA • Available in 3-pin TO-5 (or 6-pin TO-5 for frequencies below 1 Hz) and 24-pin leadless chip carrier. See DQXO-SM Data Sheet.
*Lower frequencies available.
**Does not include calibration tolerance.

Low Frequency Crystal Oscillators

Real Time Clock Module

Model RTC-58321



Features

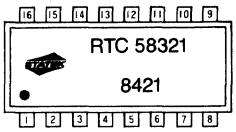
Built-in crystal oscillator
- eliminates need for external components
- eliminates design time
- reduces board space

Low current consumption
Low-voltage battery backup function
4-bit bidirectional multiplexed address/data bus
Counter start, stop and reset functions
12 or 24 hour format, automatic leap year selection
Standard 16-pin DIP, pin-compatible with MSM 58321RS

Description

The RTC-58321 Real Time Clock Module incorporates a CMOS real time clock and a complete crystal oscillator in a standard 16-pin DIP. The combination of the real time clock and crystal oscillator in one package eliminates the need for an external crystal, resistors, and capacitors, resulting in a substantial reduction in design time and board space, as well as procurement, inventory, testing, and assembly costs.

Pin Connections



(Top View)

1. CS_2	16. V_{DD}
2. WRITE	15. NC
3. READ	14. NC
4. D_0	13. CS_1
5. D_1	12. TEST
6. D_2	11. $\overline{STOP}$
7. D_3	10. $\overline{BUSY}$
8. V_{SS}	9. ADDRESS WRITE

NC: Do not connect externally.

Surface Mountable Crystal Oscillators

Model SQXO-2-SM: 10 kHz to 2 MHz
Model DQXO-3-SM: 1 kHz to 10 kHz

Features

Standard 24-pin ceramic leadless chip carrier
Designed for surface mounting using vapor phase solder reflow or wave solder
TTL and CMOS compatible
Low power consumption
High shock resistance
Full military testing available

Description

Statek surface-mountable crystal oscillators consist of a CMOS-compatible hybrid circuit and a miniature, low-frequency quartz crystal in a standard 24-pin ceramic leadless chip carrier. They are compatible with conventional vapor phase solder reflow and wave solder processing techniques and offer small size, low power consumption, high shock resistance and excellent long-term stability.

Specifications

Specifications are typical at 25°C unless otherwise noted.
Specifications are subject to change without notice.

Calibration Tolerance	A: ± 0.01% B: ± 0.03%
Temperature coefficient	−0.035 (ppm/°C²)
Supply voltage	4 to 6 V
Frequency range	1 Hz to 2 MHz*
Supply current**	0.5 mA at 10 kHz 2.0 mA at 2 MHz
Operating temperature	
Industrial	−40 to +85°C
Military	−55 to +125°C
Shock	
1 Hz to 600 kHz	1000g, 1mS, 1/2 sine
600 kHz to 2 MHz	750g, 1 mS, 1/2 sine
Vibration	10g, 10 to 2000 Hz
Storage temperature	−55 to +125°C
Aging, first year	10 ppm maximum
Typical processes	
vapor phase	215°C or 253°C for 10 sec to 5 min
wave solder	260°C for 10 sec

*Lower frequencies available, contact factory
**5V supply voltage; 10pf, 10 MΩ load

Additional products and services available.

Products

Custom hybrid oscillators:
- very low current
- high/low voltages
- multiple outputs
- special packaging

High temperature oscillators – to 200°C

Ruggedized, high-shock crystals (15,000g and above)

Custom-designed quartz crystal sensors

Services

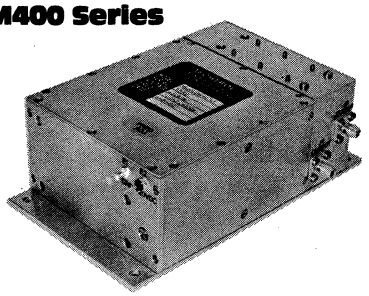
Full military testing
Circuit evaluation
Design assistance

SFC-B-4/85

TECHTROL CYCLONETICS INC.

Microwave Frequency Sources

M400 Series



SPECIFICATIONS

Fixed Frequency Output: Crystal controlled oscillators to meet your exact requirements.
Stability: ±.001% over temperature range.
Temperature Range: −20°C to +55°C.
Power Output: 100 mW, 20 mW, or, 5 mW min. as specified.
Harmonics and Subharmonics: −40 dBc for all sources with output frequency in range of 1 GHz to 8 GHz.
Harmonics and Subharmonics: −30 dBc for all sources with output frequency in rage of .5 GHz to 1 GHz.
DC Input: 12 to 28 VDC Case ground plus or minus (as required).
Output Connectors: SMA.
All units have mechanical frequency adjustment to compensate for aging.
Spurious Levels: −60 dBc.

OPTIONS AVAILABLE

1. Secondary Standard (Oven Controlled)
±.001% frequency stability over temperature range of −20°C to +60°C.
Utilizes a small solid state oven enclosing the crystal only. Phase noise same as standard unit.
Additional Requirements:
+24 VDC to +28 VDC oven power (may be unregulated).
Add 1.0" to length.
Model number becomes MK.

2. Frequency Standard (Oven Controlled) High Stability
$\pm 2 \times 10^{-8}$ frequency stability over temperature range of −20°C to +55°C.
Utilizes a tight tolerance proportional type oven and AGC, crystal is designed for long term aging characteristics.
Additional Requirements:
+24 VDC to +28 VDC oven power (maybe unregulated).
Add 1.5" to length.
Model number becomes MH.

3. Low Phase Noise
±.003% over temperature range of −20°C to +60°C.
Add 1.0" to length.
Model number becomes MN.

4. Low Phase Noise/High Stability
$\pm 2 \times 10^{-8}$ over temperature range of −20°C to +55°C.
Additional Requirements:
+24 VDC to +28 VDC oven voltage (may be unregulated).
Add 1.5" to length.
Model number becomes MHN.

5. Voltage Control Crystal Oscillator
÷ 3 options are available.
Tuning voltage ±3.
Modulation rate 100 KHz.
Linearity 5% best straight line.

Model MVA.
±.003% frequency swing.
±.002% frequency stability 0° to +50°C.
Add 1.0" to length.

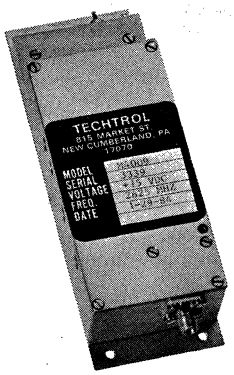
Model MVB.
±.01% frequency swing.
±.002% frequency stability 0°C to +50°C.
Add 1.5" to length.

Model MVC.
±.1% frequency swing.
±.005% frequency stability 0°C to +50°C.
Add 2.0" to length.

6. Multi-Channel Crystal Source
Up to 7 independent frequencies available.
TTL compatible frequency selection.
±.005% frequency stability.
Temperature range of −20°C to +50°C.
Add 2.6" to length.
Model number becomes MM.

MODEL NUMBER	FREQUENCY	MIN. POWER OUTPUT	SIZE (IN) LWH
M401	.5-1 GHz	5 mw	2.2-3.4-2
M402	.5-1 GHz	20 mw	2.2-3.4-2
M403	.5-1 GHz	100 mw	2.2-3.4-2
M404	1.01-2 GHz	5 mw	3.2-3.4-2
M405	1.01-2 GHz	20 mw	3.2-3.4-2
M406	1.01-2 GHz	100 mw	3.2-3.4-2
M407	2.01-4 GHz	5 mw	3.2-3.4-2
M408	2.01-4 GHz	20 mw	3.2-3.4-2
M409	2.01-3 GHz	100 mw	3.2-3.4-2
M410	3.01-4 GHz	100 mw	3.2-3.4-2
M411	4.01-8 GHz	5 mw	3.2-3.4-2
M412	4.01-8 GHz	20 mw	3.2-3.4-2
M413	4.01-8 GHz	100 mw	4.3-3.4-2
M414	8.01-14 GHz	5 mw	3.2-3.4-2
M415	8.01-14 GHz	20 mw	4.3-3.4-2
M416	8.01-14 GHz	50 mw	4.3-3.4-2

M4000 Series

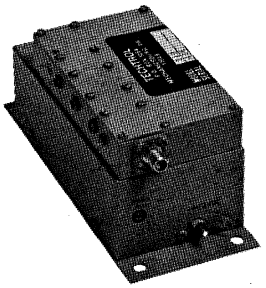


SPECIFICATIONS

Frequency Range: 500 MHz to 3 GHz.
Frequency Stability:
±.003% −20°C to +60°C.
±.005% −55°C to +85°C.
Harmonic Rejection: −60 dBc.
Subharmonic Rejection: −60 dBc.
Connectors: SMA and Filtercon.
Size: 1.05 × 1.75 × 4.38.

Model	Frequency	Output Power	Voltage
M4001	500-1000 MHz	10 mw	+15 VDC
M4002	500-1000 MHz	50 mw	+15 VDC
M4003	500-1000 MHz	100 mw	+24 VDC
M4004	1000.01 MHz-2 GHz	10 mw	+15 VDC
M4005	1000.01 MHz-2 GHz	50 mw	+24 VDC
M4006	1000.01 MHz-2 GHz	100 mw	+24 VDC
M4007	2000.01 MHz-3 GHz	10 mw	+15 VDC
M4008	2000.01 MHz-3 GHz	50 mw	+24 VDC
M4009	2000.01 MHz-3 GHz	100 mw	+24 VDC

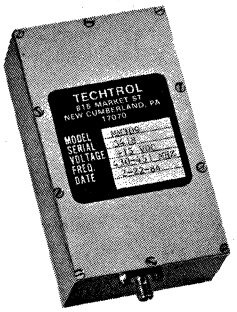
Model 112



SPECIFICATIONS

Frequency Range: 3 GHz to 6 GHz.
Frequency Stability: ±.005%.
Temperature Range: 0°C to +50°C.
Power Output: 5 mW min., 10 mW typ.
Operating Voltage: +15 VDC.
Subharmonic Rejection: −35 dBc.
Harmonic Rejection: −50 dBc.
Size: 4" × 2.1" × 2".

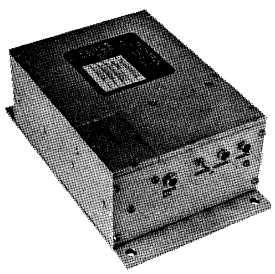
Model MM309



SPECIFICATIONS

Multiple Channel Crystal Source, BCD Selectable.
Output Frequency: 350-500 MHz.
Bandwidth: 7%.
Frequency Stability: ±.005%.
Minimum Power Output: 10 mw.
Harmonic Rejection: −26 dBc.
Subharmonic Rejection: −26 dBc.
Operating Voltage: +15 VDC.
Operating Temperature: −55°C to +85°C.
Connectors: SMA & Multi-pin.
Size: 3.88" × 2.38" × 1.13".

Model PLC-140A



Wide Band Phase Locked Source

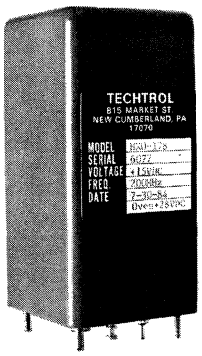
SPECIFICATIONS

Frequency Range: 400 MHz to 1500 MHz (Any 200 MHz Band).
Power Output: 20 mW.
Frequency Stability: ±.003%.
Temperature Range: 0°C to +50°C.
Subharmonic Rejection: −50 dBc.
Harmonic Rejection: −26 dBc.
Operating Voltage: +15 VDC.
Connector: SMA.
Size: 4" × 3.375" × 2".

TECHTROL CYCLONETICS INC.

Microwave Frequency Sources

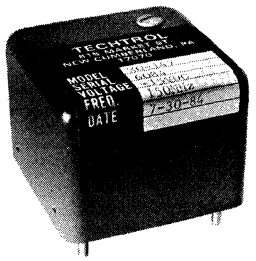
Model HXO-178A



SPECIFICATIONS

Frequency Range: 1 MHz to 600 MHz.
Power Output: 10 mw min.
Frequency Stability: $\pm 2 \times 10^{-8}$, °C to +55°C.
Aging Rate: $\pm 1 \times 10^{-7}$/day.
Phase Noise:
122 dBc/Hz, 100 Hz.
150 dBc/Hz, 1 KHz.
159 dBc/Hz, 10 KHz.
159 dBc/Hz, 100 KHz.
Harmonics: Less than –26 dBc.
Voltage: +15 VDC and +28 VDC.
Connectors: SMA and Filtercon.
Size: 2" x 2" x 4".

Model XO-147A



SPECIFICATIONS

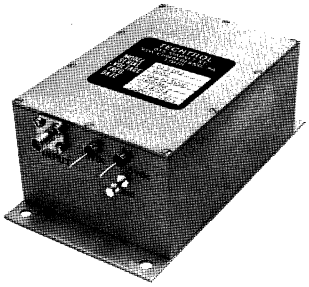
Frequency Range: 1 MHz to 600 MHz.
Power Output: 10 mw min.
Frequency Stability:
±.003%, –20°C to +60°C.
±.005%, –40°C to +70°C.
Harmonics: –26 dBc.
Voltage: +5 VDC to +28 VDC (specify).
Connectors: SMA and Filtercon.
Size: 2" × 2" × 1.75".

TECHTROL CYCLONETICS INC.

Multipliers

SPECIAL REQUIREMENTS
PROTOTYPE QUANTITIES

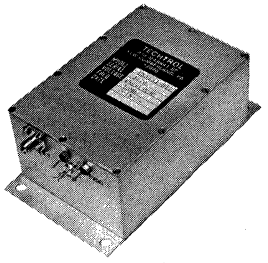
Phase Locked Multiplier Model PLX-102



SPECIFICATIONS

Phase Coherent Transfer Multiplier.
Output Frequency: 5-125 MHz, phase locked.
Power Output: 10 mw (TTL available).
Input: 100 KHz to 50 MHz.
Harmonic Rejection: –26 dBc.
Subharmonic Rejection: –60 dBc.
Spurious Rejection: –90 dBc.
Operating Voltage: +5 VDC, +15 VDC.
Connectors: SMA & Filtercon.
Size: 1.85" × 2.75" × 4.00".

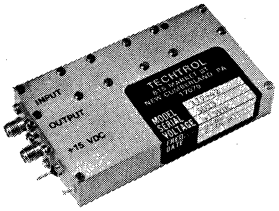
Phase Locked Multiplier Model FXA-151A



SPECIFICATIONS

Frequency Range: 10 MHz to 1500 MHz.
Input Level: 0 dBm ±3 dB 50 ohms, 100 kHz to 10 MHz.
Power Output: +10 dBm.
Operating Temperature Range: 0°C to 50°C.
(–20°C to +75°C optional).
Subharmonics: Less than –50 dBc (–70 dBc optional).
Harmonics: Less than –26 dBc (–60 dBc optional).
Operating Voltage: +15 VDC and +5 VDC.
Connectors: SMA and Filtercon.
Mounting: Flange.
Sizes: 4" × 2" ·× 1.50".
4" × 2.75" × 1.85".

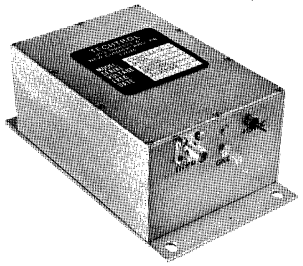
Discrete Multiplier Model 117



SPECIFICATIONS

Frequency Range: 1 MHz to 8.0 GHz.
Band Width: Typically 1%, 1 dB; 3%, 3 dB. Up to 10% available.
Power Input: 0 dBm ±3 dB. (Inputs from –10 dBm to +20 dBm ranges available).
Power Output: 0 dBm to +20 dBm.
Spurious Rejection: –60 dBc.
Harmonic Rejection: –40 dBc (Higher rejection available).
Subharmonic Rejection: –40 dBc (Higher rejection available).
Operating Voltage: +12 VDC to +28 VDC range.
Connectors: SMA and Filtercon.
Size: 4" × 2" × 1.38".
Length depends on requirement.

Discrete Multiplier Model FXA-217-1A



SPECIFICATIONS

Output Frequency: X2 through X25.
Output Power: +10 dBm minimum.
Power Stability: ±0.5 dB –20°C to +60°C.
Input Frequency: 5 MHz to 50 MHz.
Input Power: 0 dBm ±3 dB.
Harmonic Rejection: –60 dBc.
Subharmonic Rejection: –50 dBc.
Operating Voltage: +15 VDC.

TCI

Techtrol Cyclonetics Inc.

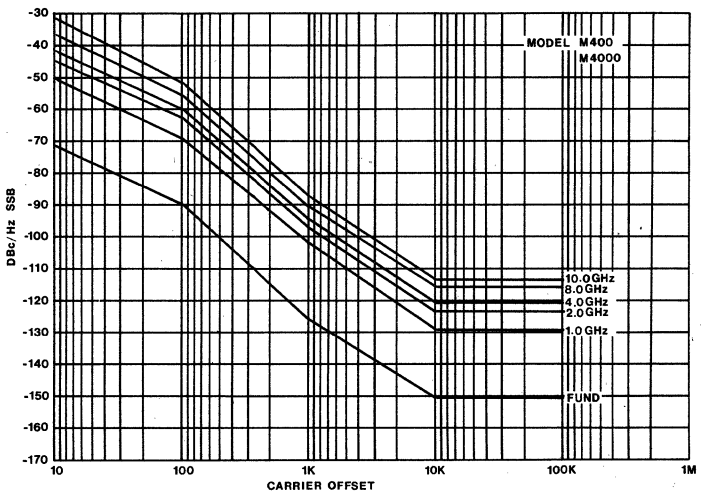
815 Market Street New Cumberland, Pennsylvania 17070

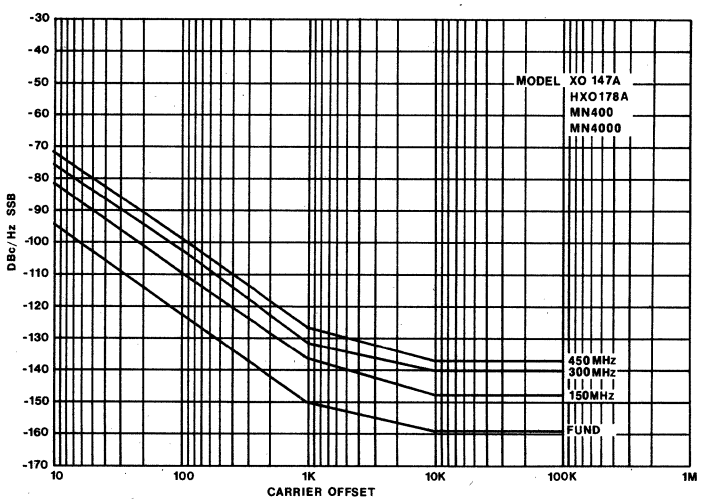
(717) 774-2746

TECHTROL CYCLONETICS INC.

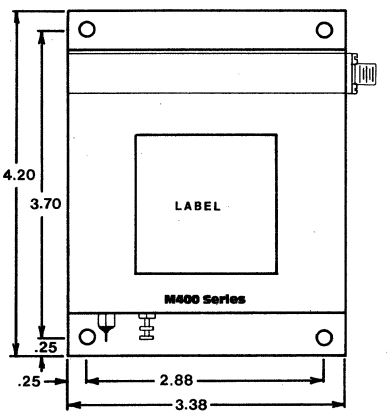
Microwave Frequency Sources

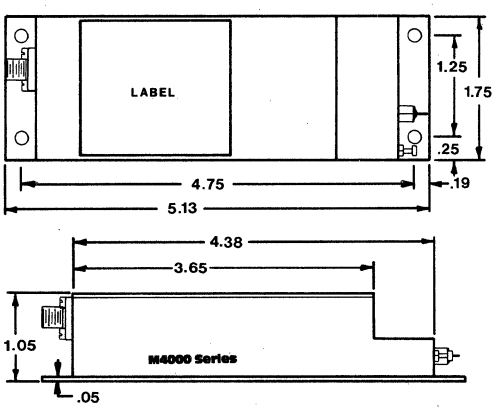
PHASE NOISE

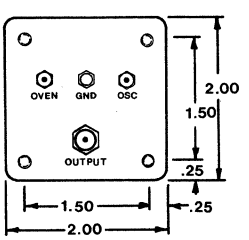


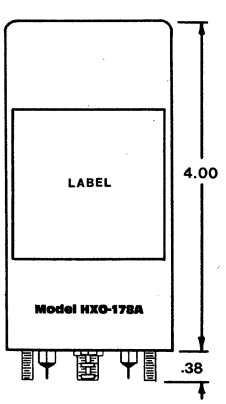


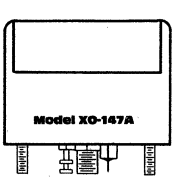
OUTLINE

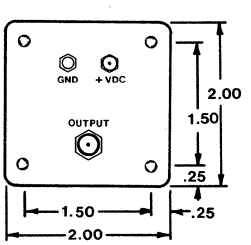












QUOTATION REQUEST FORM

Date _____

Name _____ Dept./M.S. _____

Company _____ Phone No. _____

Address _____ Ext. No. _____

City _____ State _____ Zip Code _____

QUOTATION REQUEST FORM—SOURCES

Output Frequency(s) _____ Stability _____

Output Level _____ Load _____

Harmonics _____ dBc Sub-Harmonics _____ dBc Spurious _____dBc

Operating Voltage _____ Temperature Range _____ °C to _____ °C

Oven Voltage (if required) _____ VCO Deviation _____ MHz to _____ MHz

VCO Input Control Voltage _____

Additional Requirements _____

_____

QUOTATION REQUEST FORM—FREQUENCY MULTIPLIERS

Input Frequency _____ Output Frequency(s) _____

Band Width (±.5% @ 1 dB Typical) _____

Subharmonic Rejection _____ Harmonic Rejection _____

(Special Band Rejection) _____

Spurious (unrelated) Signal Rejection 65 dBc _____

Multiplier Noise Degradation Typically 20 log N _____

RF Power Input (range) _____ Impedance _____

RF Output(s) (range or stability) _____ Impedance _____

DC Input Voltage _____ RF Input Connector _____

RF Output Connector(s) _____ Temperature Range _____

(MIL Spec. Requirements) _____

(Case Size And Mounting) _____

(Special Requirements) _____

Description of Application and Input Signal _____

_____

MECHANICAL REQUIREMENTS

Size _____ Connectors _____

Mounting _____

ITEMS IN PARENTHESES CAN INCREASE COST SUBSTANTIALLY

TCI

Techtrol Cyclonetics Inc.

815 Market Street New Cumberland, Pennsylvania 17070

(717) 774-2746

VECTRON TTL Clock Oscillators

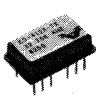
QPL'd to MIL-O-55310/16

	PCB MOUNT	DIP COMPATIBLE	
Series	**CO-231** **CO-231H**	**CO-238** **CO-234**	**CO-401** (4 pins) **CO-402** (14 pins)
Features	*Broadest range of frequencies & options*	*Vectron's lowest price DIP clocks*	*0.2" high, full MIL CO-402 is QPL'd*
Frequency	**CO-231:** 1 Hz-75 MHz **CO-231H:** 75.1-100 MHz	**CO-238:** 16 KHz-100 MHz **CO-234:** 16 KHz-30 MHz	16 KHz-100 MHz
Output	Drives 10 TTL loads (above 50 MHz, drives 2 Schottky loads).		
Supply	5VDC ± 5% at 30-90 ma depending upon frequency.		
Accuracy (at 25°C)	**CO-231:** ± 10 ppm ***CO-231T:** ± 1 ppm **CO-231H:** ± 10 ppm ***CO-231HT:** ± 1 ppm *Tuning settable to ± 1 ppm; available only in CO-238T to 30 MHz, and CO-231T to 100 MHz.	**CO-23☐A:** ± 50 ppm **CO-23☐C:** ± 25 ppm **CO-23☐D:** ± 15 ppm **CO-23☐B:** ± 10 ppm ***CO-23☐T:** ± 1 ppm height: [8] = 0.35" [4] = 0.28"	**CO-40☐A:** ± 50 ppm **CO-40☐C:** ± 25 ppm **CO-40☐D:** ± 15 ppm **CO-40☐B:** ± 10 ppm ****CO-40☐E:** ± 1 ppm [1] = 4 pin base [2] = 14 pin base **Set to ± 1 ppm via external capacitor (< 20 MHz only)
Stability	**STANDARD:** 0°C to + 70°C: ± 25ppm Option 1: −55°C to + 85°C: ± 50ppm Option 2: −55°C to + 125°C: ± 50ppm (N/A > 70MHz, except for CO-231) Option 3: 0°C to + 50°C: ± 3ppm (N/A in CO-401 or CO-402) Option 4: 0°C to + 50°C: ± 1ppm (only for CO-231, 12KHz-20MHz) Option 5: 0°C to + 50°C: ± 5ppm Option 6: 0°C to + 50°C: ± 10ppm Option 7: −55°C to + 125°C: ± 100ppm (N/A > 70 MHz, except for CO-231) ***Option 8: 0°C to + 70°C: ± 100ppm (N/A in CO-401 or CO-402) ***Option 9: −55°C to + 200°C: ± 300ppm (only for CO-401/402 in 4-20MHz range) Option Y: Aging improved from 5 to 1 ppm/yr typical (CO-231/CO-238 only). ***Includes initial accuracy; do not specify A, B, C, D, E or T accuracy.		
Size	1½" x 1½" x ½"	**CO-238:** 0.5" x 0.8" x 0.35" **CO-234:** 0.5" x 0.8" x 0.28"	0.5" x 0.8" x 0.2"
Package	metal can, epoxy base Option C: solder sealed case, ⅝" high	epoxy case Option C: solder sealed case	resistance welded metal case
Environment	See chart on next page		

VECTRON CMOS Clock Oscillators

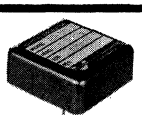
	PCB MOUNT	LOW PROFILE DIP PACKAGE		
Series	**CO-236**	**CO-411** (4 pins) **CO-412** (14 pins) *QPL'd to MIL-O-55310/16	**CO-421** (4 pins) **CO-422** (14 pins)	**CO-441** (4 pins) **CO-442** (14 pins)
Features	*Broadest range of options*	*Standard CMOS 8-15V supply*	*Standard CMOS 5V supply*	*High Speed CMOS 5V supply*
Frequency	.01 Hz-15 MHz	1 Hz-15 MHz	1 Hz-8 MHz	1 Hz-50 MHz
Output	Standard CMOS	Standard CMOS	Standard CMOS	High Speed CMOS
Supply	5-15VDC	8-15VDC	5VDC	5VDC (3VDC optional to 20 MHz)
Accuracy (at 25°C)	**CO-236:** ± 10 ppm ***CO-236T:** ± 1 ppm *Tuning settable to ± 1 ppm	**CO-41☐A:** ± 50 ppm **CO-41☐C:** ± 25 ppm **CO-41☐D:** ± 15 ppm **CO-41☐B:** ± 10 ppm ****CO-41☐E:** ± 1 ppm	**CO-42☐A:** ± 50 ppm **CO-42☐C:** ± 25 ppm **CO-42☐D:** ± 15 ppm **CO-42☐B:** ± 10 ppm ****CO-42☐E:** ± 1 ppm	**CO-44☐A:** ± 50 ppm **CO-44☐C:** ± 25 ppm **CO-44☐D:** ± 15 ppm **CO-44☐B:** ± 10 ppm ****CO-44☐E:** ± 1 ppm
		[1] for 4 pin base, [2] for 14 pin base **E option allows setting via external capacitor (≤ 20 MHz only)		
Stability	**STANDARD:** 0°C to + 70°C: ± 25ppm Option 1: −55°C to + 85°C: ± 50ppm Option 2: −55°C to + 125°C: ± 50ppm Option 3: 0°C to + 50°C: ± 3ppm (only available in CO-236) Option 4: 0°C to + 50°C: ± 1ppm (only available in CO-236, specify supply voltage) Option 5: 0°C to + 50°C: ± 5ppm Option 6: 0°C to + 50°C: ± 10ppm Option 7: −55°C to + 125°C: ± 100ppm ***Option 8: 0°C to + 70°C: ± 100ppm (only available in CO-236) ***Option 9: −55°C to + 200°C: ± 300ppm (N/A in CO-236 or above 20 MHz in CO-441/442) Option Y: Aging improved from 5 to 1 ppm/yr typical (CO-236 only). ***Includes initial accuracy; do not specify A, B, C, D, E or T accuracy.			
Size	1½" x 1½" x ½"	0.5" x 0.8" x 0.2"		
Package	Metal can epoxy base. Option C: solder sealed case, .68" high	resistance welded metal case		
Environment	See chart on next page			

CO-400 Series Resistance Welded



DIP epoxy case

DIP solder sealed case "C"


PCB MOUNT

VECTRON ECL Clock Oscillators

	PCB MOUNT		DIP COMPATIBLE	
Series	**CO-233ME** **CO-233MEH**	**CO-533KE** **CO-533ME**	**CO-633**	**CO-431** (4 pins) **CO-432** (14 pins)
Features	*Wide range of options*	*Sub-nanosecond 100K ECL*	*DIP to 200 MHz*	*Lowest profile (0.2") MIL design*
Frequency	**ME:** 5-149.9 MHz **MEH:** 150-200 MHz	150-500 MHz	5-200 MHz	5-150 MHz
Output	ECL	100K ECL	ECL	ECL
Supply	−5.2V	**CO-533KE:** −4.5V **CO-533ME:** −5.2V	−5.2V	−5.2V
Accuracy (at 25°C)	**CO-233ME:** ± 10 ppm ***CO-233MET:** ± 1 ppm **CO-233MEHA:** ± 50 ppm **CO-233MEHB:** ± 10 ppm *Tuning settable to ± 1 ppm	**CO-533ME:** ± 10 ppm **CO-533KE:** ± 10 ppm ***CO-533MET:** ± 1 ppm ***CO-533KET:** ± 1 ppm	**CO-633A:** ± 50 ppm **CO-633C:** ± 25 ppm **CO-633D:** ± 15 ppm **CO-633B:** ± 10 ppm	**CO-43☐A:** ± 50 ppm **CO-43☐C:** ± 25 ppm **CO-43☐D:** ± 15 ppm **CO-43☐B:** ± 10 ppm [1] for 4 pins [2] for 14 pins
Stability	**STANDARD:** 0°C to + 70°C: ± 25ppm Option 1: −55°C to + 85°C: ± 50ppm (−30/+85°C above 110 MHz; 0/85°C for 100K ECL) Option 2: −55°C to + 125°C: ± 50ppm (N/A above 110 MHz) Option 3: 0°C to + 50°C: ± 3ppm (N/A in CO-431/432 or above 150 MHz) Option 5: 0°C to + 50°C: ± 5ppm Option 6: 0°C to + 50°C: ± 10ppm Option 7: −55°C to + 125°C: ± 100ppm (N/A above 110 MHz) **Option 8: 0°C to + 70°C: ± 100ppm (N/A in CO-431/432) Option Y: Aging improved from 5 to 1 ppm/yr typical (N/A in CO-431/432, or above 125 MHz in CO-233/CO-633) **Includes initial accuracy; do not specify A, B, C, D or T accuracy.			
Size	1½" x 1½" x ⅝"	2" x 3" x ¾"	.5" x .8" x .42"	.5" x .8" x .2"
Package	metal case "C" option for fully sealed	fully sealed metal case	epoxy case "C" option for fully sealed	resistance welded case
Environment	See chart on next page			

HOW TO ORDER VECTRON CLOCK OSCILLATORS

CO-400 SERIES

CO-4☐☐☐ – ☐☐ at ☐

- TTL; 5V = 0
- Standard CMOS; 8-15V = 1
- Standard CMOS; 5V = 2
- ECL; −5.2V = 3
- Hi-Speed CMOS; 5V = 4

- 4 pin base = 1
- 14 pin base = 2

Initial accuracy at 25°C (A, B, C, D, or E)

Temperature stability (0 for standard, or option 1, 2, 5, 6, 7 or 9)

*Screen test option (X, B, C, or D)

Frequency

*SCREEN TEST	MIL STD 883 METHOD	Standard LEVEL X	Options LEVEL C	LEVEL D	LEVEL B
Internal Visual	**2017**	X	X	X	X
Stabilization Bake (24 Hours @ 150°C)	1008, Cond C	X	X	X	X
Seal Test (Gross and Fine)	1014	X	X	X	X
Temperature Cycling (Thermal shock)	1010, Cond B		X	X	X
Burn-in, operating 168 hours @ 125°C	—			X	X
Acceleration (5000g in Y1 axis)	2001, Cond A				X
			Complies with Class C Screen Test requirements of MIL-O-55310/16 & MIL-O-55310/18		Complies with Class B Screen Test requirements of MIL-O-55310/16 & MIL-O-55310/18

All other clock oscillator types

CO-☐ ☐ – ☐☐☐ at ☐

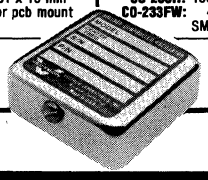
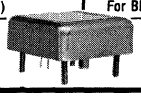
- Basic Model
- *Accuracy/tuning (A, B, C, D or T)
- *Stability option (1, 2, 3, 4, 5, 6, 7 or 8)
- *C for solder sealed case
- *Y for improved aging
- Frequency

*leave blank if not applicable to your requirement

VECTRON Sinewave Oscillators 50 Hz—1 GHz

(for higher stability see TCXO and Oven Sections)

	Low Frequency CO-281	VHF CO-233 SERIES	UHF CO-283W	VHF High Power CO-284W
Frequency:	50 Hz-4 MHz	4 MHz-500 MHz	500.1-1000 MHz	4-500 MHz
Output Level:	Std: 1 vrms/1KΩ Opt: 0.5 vrms/50Ω above 10 KHz	Standard: 0.5 vrms/50Ω (+ 7 dBm) Option R: 1 vrms/50Ω (+13 dBm)	Standard: 0.5 vrms/50Ω (+ 7 dBm) Option R: 1 vrms/50Ω (+13 dBm)	1 watt into 50Ω (+30 dBm) (In 250-500 MHz range, above +70°C, level derates to +27 dBm minimum)
Supply:	+15 VDC. Any supply in 15-28 VDC range optional; supply less than 15 VDC subject to reduced output level			+15 VDC (18-28 VDC optional to 250 MHz)
Accuracy:	±10 ppm at 25°C. Add "T" to model number for tuning adjustment with setability of ±1 ppm			
Stability:	**Standard:** 0°C to + 70°C: ±.0025% **Option 1:** −55°C to + 85°C: ±.005% **Option 2:** −55°C to +125°C: ±.005% (N/A for CO-283W or CO-284W) **Option 3:** 0°C to + 50°C: ±.0003% (N/A for CO-284W) **Option 4:** 0°C to + 50°C: ±.0001% (only for CO-281) **Option 5:** 0°C to + 50°C: ±.0005% **Option 6:** 0°C to + 50°C: ±.001% **Option Y:** Aging improved from 5 ppm/year typical to 2 ppm/year			
Noise:	To 100 MHz; 6 dBm per octave degradation above 100 MHz Offset / Standard / *L2 Option 100 Hz / −100 dBc/Hz / −115 dBc/Hz 1 KHz / −125 dBc/Hz / −140 dBc/Hz 50 KHz / −150 dBc/Hz / −160 dBc/Hz *Only available in CO-233FW and not above 200 MHz.			
Size:	2" x 2" x ¾" 51 x 51 x 19 mm pins for pcb mount	**CO-233:** 5-149 MHz, 1½" x ½" x ⅝", pins for pcb mount **CO-233H:** 150-300 MHz, 1½" x ½" x ⅝", pins for pcb mount **CO-233FW:** 4-500 MHz, 2" x 2" x ¾", chassis mount with SMA output connector (SMC or BNC optional)	2" x 3" x ¾" (51 x 76 x 19 mm) Chassis mount with SMA output connector For SMC connector, replace "W" with "U" For BNC connector, replace "W" with "X"	2" x 3" x ¾" (51 x 76 x 19 mm) Chassis mount with SMA output connector For SMC connector, replace "W" with "U" For BNC connector, replace "W" with "X"

Environmental Characteristics of Vectron Oscillators

	CO-400 SERIES LOW PROFILE CLOCKS	ALL OTHER MODELS
Operating Temperature	Per temperature stability specification (from +15/+35°C to −55/+200°C depending upon model and option selected)	
Storage Temperature	−55°C to +125°C	−55°C to +85°C (+125°C optional)
Shock	100g 6msec per MIL-STD-202 Method 213, Condition C	Standard: MIL-STD-202, Method 213, Condition J (30g, 11msec) Optional: same as left column for most types
Vibration	sine—20g to 2 KHz per MIL-STD-202 Method 204, Condition D and random—20grms to 2 KHz per MIL-STD-202 Method 214, Condition I-F	Standard: MIL-STD-202, Method 201A plus 5g to 500 Hz Optional: same as left column for most types
Humidity	100% per MIL-STD-202, Method 103, Condition B	All models: 95%, no condensation Sealed models: same as left column
Seal	Hermetic per MIL-STD-883, Method 1014, 10^{-8} atm cc/second	Sealed models: MIL-STD-202, Method 112, Condition D N/A to non-sealed models
Altitude	Sea level to space	Sea level to space

NOTE: Vectron has produced oscillators for airborne, shipboard, manpack, mobile, spacecraft, rocket and missile applications.

About Vectron . . .

Facility

Vectron is housed in a new 60,000 square foot facility in which engineering, manufacturing and quality control have at their disposal the most advanced equipment and instrumentation available, including:

- Hybrid manufacturing and clean room facilities.
- Master frequency standard, internally calibrated to the National Bureau of Standards, from which reference signals are distributed to every test station.
- Automated test system comprised of a network of more than 70 temperature chambers controlled by a series of central computers.
- Scientific computer for engineering circuit design, analysis and data reduction.
- Environmental test laboratory including humidity, acceleration, shock, sinusoidal vibration, and random vibration equipment.

Military and Space Programs

Military and space applications represent approximately forty percent of Vectron's business. A few among the many vehicles and programs for which Vectron has delivered oscillators are the following:

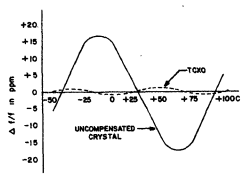
Shipboard:	AEGIS, MARISAT, OMEGA, TERRIER M, NAVSTAR, TRIDENT, MARK-48 TORPEDO.
Aircraft:	F14, F16, P2V, P3V, B52, E2C, P3C, B-1B.
Missile:	ATHENA H., PAVE-STRIKE, PEACE KEEPER.
Spacecraft:	SKYLAB, SPACE SHUTTLE, GPS.
Manpack:	PRC-70, PRC-104, PRC-113.

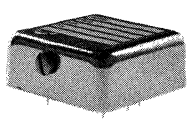
Our quality control program meets the requirements of MIL-I-45208 and MIL-Q-9858 and our equipment calibration program conforms to MIL-C-45662.

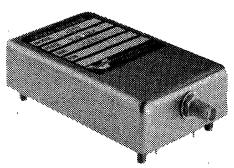
VECTRON LABORATORIES, INC. The CRYSTAL OSCILLATOR COMPANY
166 Glover Avenue, Norwalk, CT 06850 • Telephone: 203/853-4433 • TWX: 710/468-3796

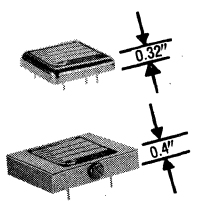
VECTRON TCXOs Temperature Compensated Crystal Oscillators

Temperature Stability:	50 Hz to 20 MHz CO-251 SERIES Moderate Stability Lower Cost	50 Hz to 20 MHz CO-252 SERIES High Stability	20+ MHz to 140 MHz CO-254 SERIES	140 MHz to 420 MHz CO-255 SERIES	420 MHz to 630 MHz CO-256 SERIES	LOW PROFILE HYBRID TCXOs CO-258, CO-259 SERIES
(Temp. Range A) +15°C to +35°C:	CO-251A57: ±5 x 10–7 CO-251A27: ±2 x 10–7	CO-252A17: ±1 x 10–7 CO-252A58: ±5 x 10–8	CO-254A57: ±5 x 10–7 CO-254A17: ±1 x 10–7	CO-255A57: ±5 x 10–7 CO-255A17: ±1 x 10–7	CO-256A57: ±5 x 10–7 CO-256A17: ±1 x 10–7	
(Temp. Range B) 0°C to +50°C:	CO-251B16: ±1 x 10–6	CO-252B57: ±5 x 10–7 CO-252B27: ±2 x 10–7 CO-252B17: ±1 x 10–7	CO-254B16: ±1 x 10–6 CO-254B57: ±5 x 10–7 CO-254B27: ±2 x 10–7	CO-255B16: ±1 x 10–6 CO-255B57: ±5 x 10–7 CO-255B27: ±2 x 10–7	CO-256B16: ±1 x 10–6 CO-256B57: ±5 x 10–7 CO-256B27: ±2 x 10–7	
(Temp. Range C) 0°C to +70°C:	CO-251C36: ±3 x 10–6	CO-252C16: ±1 x 10–6 CO-252C57: ±5 x 10–7 CO-252C37: ±3 x 10–7	CO-254C36: ±3 x 10–6 CO-254C16: ±1 x 10–6 CO-254C37: ±3 x 10–7	CO-255C36: ±3 x 10–6 CO-255C16: ±1 x 10–6 CO-255C37: ±3 x 10–7	CO-256C36: ±3 x 10–6 CO-256C16: ±1 x 10–6 CO-256C37: ±3 x 10–7	Stabilities are similar, but not identical, to those available in CO-252 Series. Contact factory or your local representative for more detailed literature.
(Temp. Range D) –20°C to +70°C:	CO-251D56: ±5 x 10–6	CO-252D16: ±1 x 10–6 CO-252D57: ±5 x 10–7	CO-254D56: ±5 x 10–6 CO-254D16: ±1 x 10–6 CO-254D57: ±5 x 10–7	CO-255D56: ±5 x 10–6 CO-255D16: ±1 x 10–6 CO-255D57: ±5 x 10–7	CO-256D56: ±5 x 10–6 CO-256D16: ±1 x 10–6 CO-256D57: ±5 x 10–7	
(Temp. Range E) –40°C to +75°C:	CO-251E15: ±1 x 10–5	CO-252E56: ±5 x 10–6 CO-252E26: ±2 x 10–6 CO-252E16: ±1 x 10–6	CO-254E56: ±5 x 10–6 CO-254E26: ±2 x 10–6 CO-254E16: ±1 x 10–6	CO-255E56: ±5 x 10–6 CO-255E26: ±2 x 10–6 CO-255E16: ±1 x 10–6	CO-256E56: ±5 x 10–6 CO-256E26: ±2 x 10–6 CO-256E16: ±1 x 10–6	
(Temp. Range F) –55°C to +85°C: (Higher temperature operation available)	CO-251F25: ±2 x 10–5	CO-252F56: ±5 x 10–6 CO-252F26: ±2 x 10–6 CO-252F16: ±1 x 10–6	CO-254F56: ±5 x 10–6 CO-254F26: ±2 x 10–6 CO-254F16: ±1 x 10–6	CO-255F56: ±5 x 10–6 CO-255F26: ±2 x 10–6 CO-255F16: ±1 x 10–6	CO-256F56: ±5 x 10–6 CO-256F26: ±2 x 10–6 CO-256F16: ±1 x 10–6	
Output Level & Frequency:	TTL: 50 Hz -20 MHz CMOS: 50 Hz -15 MHz SINE: 1 MHz-20 MHz		SINE: 20 MHz-140 MHz TTL: 20 MHz-100 MHz ECL: 20 MHz-140 MHz	SINE: 140 MHz-420 MHz ECL: 140 MHz-280 MHz	SINE: 420 MHz-600 MHz	TTL: 20 KHz-60 MHz CMOS: 400 Hz-15 MHz
Supply:	Any supply voltage in 5-28 VDC range; current as low as 3 ma for some models		12-28 VDC		12-28 VDC	5-24 VDC
Frequency Adjustment:	Screwdriver adjustment, setable to 1 x 10-7. Electronic tuning (TC/VCXO) capability optional.					
Aging Rate:	5 x 10–7 to 1 x 10–6 per year		1 to 2 x 10–6/year	1 to 2 x 10–6/year	1 to 2 x 10–6/year	1 x 10–6/year
Size:	2″ x 2″ x ¾″ (51 x 51 x 19 mm) smaller size available		2″ x 2″ x ¾″ (51 x 51 x 19 mm)	2″ x 3″ x ¾″ (51 x 76 x 19 mm)	2″ x 4″ x ¾″ (51 x 102 x 19 mm)	CO-258: 1.5″ x 1.5″ x 0.32″ max (38 x 38 x 8.2 mm) CO-259: 1.5″ x 2.0″ x 0.4″ max (38 x 51 x 10.2 mm)







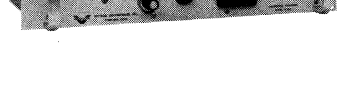


Selecting Basic Model:
1. Determine appropriate column by frequency desired.
2. Determine appropriate row by operating temperature range desired.
3. Select a basic model from those available at the desired frequency and temperature range.
4. Specify supply voltage, output level and whether pcb mount or chassis mount with rf connector.

VECTRON Frequency Standards

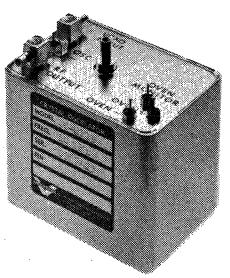
FS-321 SERIES

Aging Rate:	3 x 10^{-10}/day at time of shipment 1 x 10^{-10}/day typical within 60 days
Option 1:	1 x 10^{-10}/day at time of shipment
Option 2:	5 x 11^{-10}/day at time of shipment
Frequencies:	5, 1 & 0.1 MHz
Output Level:	1 vrms/50 ohms
Temperature:	± 5 x 10^{-10} over 0-50°C
Noise Floor:	– 160 dB below 5 MHz output
Oven Control:	Double proportional
Supply:	115/230 VAC or 22-30 VDC
Battery:	**FS-321C:** None **FS-321D:** 12 hour rechargeable **FS-321E:** 24 hour rechargeable
Size:	5¼″x19″x14″ (13.4x48.3x35.6 cm)



VECTRON Replacement for Hewlett Packard Model 10811B

Vectron type CO-811B offers mechanical and electrical-interface interchangeability with discontinued HP10811B



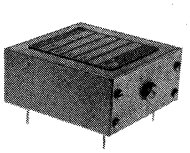
Aging:	5x10–10/day 1x10–7/year
0/+71°C:	2.5x10–9 p-p
–55/+71°C:	4.5x10–9 p-p
Noise:	100 Hz: –140dBc/Hz 10 KHz: –160dBc/Hz
Crystal:	SC-cut for fast stabilization

VECTRON Hybrid Oven Low Profile Oscillator

- PCB Mounting
- Small (1″ high)
- Low power drain

CO-311 SERIES

Stability:	Same aging and temperature stability specs as CO-211 Series (see top of next page)
Output: **TTL** **CMOS** **SINE**	**Frequency Range** 250 KHz - 17 MHz 4-6 & 8-15 MHz 4-6 & 8-17 MHz
Supply:	15 VDC for oscillator 5 VDC also, if TTL out (5-28 VDC optional)
Input Power:	3 watts at turn-on 1.3 watts stabilized (25°C)
Frequency Adjust:	Mechanical; electronic optional
Size:	2¼″ x 2¼″ x 1″ (58 x 58 x 26mm)



VECTRON Oven Controlled Oscillators (with Ultra-Low Noise Options *)

High Frequency (to 25 MHz)

	HIGH STABILITY (to 5 x 10^{-10}/day)			ULTRA-STABLE (to 1 x 10^{-10}/day)	
	Most economical CO-211 SERIES	**Higher stability and output CO-200 SERIES**	**Superior temp. stability CO-244 SERIES**	**Best aging: single oven CO-206 SERIES**	**Best aging; double oven CO-246 SERIES**
Frequency:	1, 2, 4, 5 or 10 MHz standard (broad range of frequencies available)			5 MHz standard (other frequencies available)	
Temperature:					
(Temp. Range A) +15/+35°C:	CO-21 ☐ A38: ±3 x 10^{-8} CO-21 ☐ A59: ±5 x 10^{-9}	CO-20 ☐ A39: ±3 x 10^{-9} CO-20 ☐ A19: ±1 x 10^{-9}	CO-24 ☐ A510: ±5 x 10^{-10}	CO-20 ☐ A39-V: ±3 x 10^{-9} CO-20 ☐ A510-V: ±5 x 10^{-10}	CO-24 ☐ A210-V: ±2 x 10^{-10}
(Temp. Range B) 0/+50°C:	CO-21 ☐ B58: ±5 x 10^{-8} CO-21 ☐ B18: ±1 x 10^{-8}	CO-20 ☐ B59: ±5 x 10^{-9} CO-20 ☐ B39: ±3 x 10^{-9}	CO-24 ☐ B19: ±1 x 10^{-9}	CO-20 ☐ B59-V: ±5 x 10^{-9} CO-20 ☐ B19-V: ±1 x 10^{-9}	CO-24 ☐ B510-V: ±5 x 10^{-10}
(Temp. Range D) −20/+70°C:	CO-21 ☐ D17: ±1 x 10^{-7} CO-21 ☐ D38: ±3 x 10^{-8}	CO-20 ☐ D18: ±1 x 10^{-8} CO-20 ☐ D59: ±5 x 10^{-9}	CO-24 ☐ D39: ±3 x 10^{-9}	CO-20 ☐ D18-V: ±1 x 10^{-8} CO-20 ☐ D39-V: ±3 x 10^{-9}	CO-24 ☐ D19-V: ±1 x 10^{-9} (−20/+60°C)
(Temp. Range G) −55/+75°C:	CO-21 ☐ G27: ±2 x 10^{-7} CO-21 ☐ G58: ±5 x 10^{-8}	CO-20 ☐ G38: ±3 x 10^{-8}	CO-24 ☐ G18: ±1 x 10^{-8}	CO-20 ☐ G38-V: ±3 x 10^{-8} CO-20 ☐ G18-V: ±1 x 10^{-8}	
Aging:	4: 1 x 10^{-8}/day 5: 5 x 10^{-9}/day 6: 3 x 10^{-9}/day 7: 1 x 10^{-9}/day *8: 5 x 10^{-10}/day	1: 1 x 10^{-8}/day 2: 5 x 10^{-9}/day 3: 3 x 10^{-9}/day 4: 1 x 10^{-9}/day *5: 5 x 10^{-10}/day	4: 1 x 10^{-9}/day *8: 5 x 10^{-10}/day	6: 3 x 10^{-10}/day 5 x 10^{-8}/year *7: 1 x 10^{-10}/day 3 x 10^{-8}/year	6: 3 x 10^{-10}/day 5 x 10^{-8}/year *7: 1 x 10^{-10}/day 3 x 10^{-8}/year
	*5 x 10^{-10}/day average aging rate models are only available at 1, 2, 4, 5 or 10 MHz			*1 x 10^{-10}/day models available only at 1, 5 and 10 MHz	
Output Level:	Standard: ≥1 vrms into 500Ω Optional: 0 or +7 dBm/50Ω; TTL or CMOS	Standard: ≥1 vrms into 50Ω Optional: TTL, CMOS, or ECL	Standard: ≥1 vrms into 500Ω Optional: 0, 7 or +13 dBm/50Ω TTL, CMOS or ECL	Standard: ≥1 vrms into 50Ω Optional: TTL or CMOS	
Supply Voltage:	24 VDC standard (Operation from any voltage in 5-28 VDC range optional)			24 VDC standard (Operation from any voltage in 15-28 VDC range optional)	
Input Power:	<6 watts at turn-on (−20/+70°C); <3 watts stabilized (25°C) reduced power drain available			<6 watts at turn-on (−20/+70°C) <3 watts stabilized (25°C)	<11 watts at turn-on (0-50°C) <5 watts stabilized (25°C)
Frequency Adjustment:	Screwdriver adjustment settable to 1 x 10^{-8} nominal. Electronic tuning (VCXO) option "V"			Screwdriver adjustment and electronic tuning	
Size:	2" x 2" x 3" (51 x 51 x 76 mm)	2" x 2" x 4" (51 x 51 x 104 mm)	2¼" x 2¼" x 4¼" (57 x 57 x 110 mm)	2¼" x 2¼" x 4¼" (57 x 57 x 110 mm)	3" x 3" x 5½" (76 x 76 x 140 mm)

*** Phase noise (typical):** with sine output in 4-12 MHz range for "High Stability" Series and in 4-6 MHz range for "Ultra-Stable" Series

Offset from Carrier	Standard	Low Noise Option (L1)	*Ultra Low Noise Option (L2)
100 Hz	−130 dB/Hz	−135 dB/Hz	−145 dB/Hz
1 KHz	−140 dB/Hz	−145 dB/Hz	−155 dB/Hz
10 KHz	−143 dB/Hz	−148 dB/Hz	−160 db/Hz
50 KHz	−145 dB/Hz	−150 dB/Hz	−163 dB/Hz

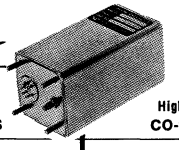
*L2 option N/A in CO-211 Series; output is ≥10 dBm

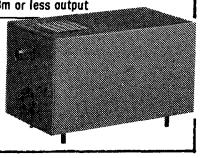
Offset from Carrier	Standard	*Ultra-Low Noise Option (L2)
10 Hz	−115 dB/Hz	−140 dB/Hz
100 Hz	−135 dB/Hz	−150 dB/Hz
1 KHz	−145 dB/Hz	−155 dB/Hz
10 KHz	−148 dB/Hz	−160 dB/Hz
50 KHz	−150 dB/Hz	−163 dB/Hz

*L2 option restricted to +10 dBm or less output

SELECTING BASIC MODEL:

1. Select "Ultra Stable" if 3 x 10^{-10}/day aging or better is required; otherwise select "High Stability".
2. Select operating temperature range required (**A, B, D** or **G** from left column under "Temperature").
3. Select frequency stability desired over temperature, this determines the oscillator. (Temperature stability improves from left to right).
4. Select desired aging rate within Series to complete basic model number.
5. Determine whether you desired a low-noise option or any characteristic which is not standard (e.g., supply voltage, output level, etc.).





VHF (25-400MHz)

	Most economical CO-228/CO-229 SERIES			Higher level and frequency CO-223/CO-224 SERIES			Superior aging and stability CO-220/CO-225 SERIES		
Frequency:	25 MHz to 200 MHz			25 MHz to 400 MHz			25 MHz to 200 MHz		
Aging:		3 x 10^{-8}/day 5 x 10^{-6}/year	1 x 10^{-8}/day 3 x 10^{-6}/year		3 x 10^{-8}/day 5 x 10^{-6}/year	1 x 10^{-8}/day 3 x 10^{-6}/year		3 x 10^{-9}/day 1 x 10^{-6}/year	1 x 10^{-9}/day 3 x 10^{-7}/year
(Temp. Range A): +15°C to +35°C:	±3 x 10^{-8}: ±5 x 10^{-9}:	CO-228A38 CO-228A59	CO-229A38 CO-229A59	±3 x 10^{-8}: ±5 x 10^{-9}:	CO-223A38 CO-223A59	CO-224A38 CO-224A59	±1 x 10^{-8}: ±1 x 10^{-9}:	CO-220A18 CO-220A19	CO-225A18 CO-225A19
(Temp. Range B): 0°C to +50°C:	±5 x 10^{-8}: ±1 x 10^{-8}:	CO-228B58 CO-228B18	CO-229B58 CO-229B18	±5 x 10^{-8}: ±1 x 10^{-8}:	CO-223B58 CO-223B18	CO-224B58 CO-224B18	±5 x 10^{-8}: ±1 x 10^{-8}: ±2 x 10^{-9}:	CO-220B58 CO-220B18 CO-220B29	CO-225B58 CO-225B18 CO-225B29
(Temp. Range D): −20°C to +70°C:	±1 x 10^{-7}: ±3 x 10^{-8}:	CO-228D17 CO-228D38	CO-229D17 CO-229D38	±1 x 10^{-7}: ±3 x 10^{-8}:	CO-223D17 CO-223D38	CO-224D17 CO-224D38	±3 x 10^{-8}: ±1 x 10^{-8}: ±5 x 10^{-9}:	CO-220D38 CO-220D18 CO-220D59	CO-225D38 CO-225D18 CO-225D59
(Temp. Range G): −55°C to +75°C:	±2 x 10^{-7}: ±5 x 10^{-8}:	CO-228G27 CO-228G58	CO-229G27 CO-229G58	±2 x 10^{-7}: ±5 x 10^{-8}:	CO-223G27 CO-223G58	CO-224G27 CO-224G58	±1 x 10^{-7}: ±3 x 10^{-8}:	CO-220G17 CO-220G38	CO-225G17 CO-225G38
Output Level:	Standard: >0.5 vrms into 50Ω (+7 dBm) Optional: TTL to 100 MHz			Standard: ≥1 vrms into 50Ω (+13 dBm) Optional: ECL, higher sinewave level			Standard: >0.5 vrms into 50Ω (+7 dBm) Optional: +13 dBm ("R"), TTL, ECL		
Supply Voltage:	24 VDC standard. Operation from any specified voltage in 12-28 VDC range optional.								
Input Power:	<6 watts at turn-on (−20/ + 70°C); <3 watts stabilized (25°C)								
Frequency Adjustment:	Screwdriver adjust, settable to <1 x10^{-8} nominal. Electronic tuning (VCXO) option "V".								
Size:	2" x 2" x 3" (51 x 51 x 77 mm)			2" x 2" x 4" (51 x 51 x 104 mm)			2" x 2" x 4" (51 x 51 x 104 mm)		

*** Phase noise:** typical, with sine output in 75-125 MHz range

Offset from Carrier	Standard	
100 Hz	−120 dB/Hz	Ultra-low noise option not available
1 KHz	−135 dB/Hz	
10 KHz	−140 dB/Hz	
50 KHz	−145 dB/Hz	

Offset from Carrier	Standard	*Ultra Low Noise Option (L2)
100 Hz	−120 dB/Hz	−130 dB/Hz
1 KHz	−135 dB/Hz	−145 dB/Hz
10 KHz	−140 dB/Hz	−150 dB/Hz
50 KHz	−145 dB/Hz	−155 dB/Hz

*L2 option is restricted to 300 MHz with sine output of +10 dBm or less

Offset from Carrier	Standard	*Ultra Low Noise Option (L2)
100 Hz	−105 dB/Hz	−120 db/Hz
1 KHz	−115 dB/Hz	−130 dB/Hz
10 KHz	−120 dB/Hz	−135 dB/Hz
50 KHz	−125 dB/Hz	−140 dB/Hz

*L2 option is available to 125 MHz

FOR PRICE OR TECHNICAL INFORMATION...CALL (203) 853-4433

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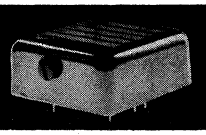
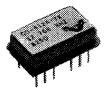
166 Glover Avenue, Norwalk, CT 06850 • Telephone: 203/853-4433 • TWX: 710/468-3796

VECTRON VCXOs Voltage Controlled Crystal Oscillators



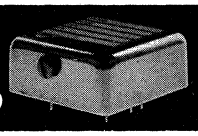
	WIDE DEVIATION AND/OR LINEAR APPLICATIONS				NARROW DEVIATION PHASE LOCK APPLICATIONS				TTL DIP
	BASIC MODELS		OVEN CONTROLLED	EXTRA WIDE DEVIATION	SINEWAVE OUTPUT	TTL OUTPUT	CMOS OUTPUT	ECL OUTPUT	
Model:	**CO-271V**	**CO-275V**	a) **CO-272V** b) **CO-276V**	c) **CO-273V** d) **CO-274V**	**CO-233V SERIES**	e) **CO-231V** f) **CO-231VH**	**CO-236V**	**CO-233MEV**	
Range of Available Center Frequencies:	2-20 MHz	20-400 MHz	a) 2-20 MHz b) 20-400 MHz	c) 0.5-8 MHz d) 8-80 MHz	***CO-233V:** 5-149 MHz ***CO-233VH:** 150-200 MHz ****CO-233VFW:** 5-400 MHz *****CO-283VW:** 401-600 MHz	e) 32 KHz-25 MHz f) 25.1 MHz-70 MHz	300 Hz-15 MHz	5-200 MHz	**Frequency:** 32 KHz-24 MHz
	(higher and lower frequencies available)								**Electrical:** Same as Model CO-231V
Output Level:	1 vrms into 1K	0.5 vrms into 50Ω	a) 1 vrms into 1K b) 0.5 vrms/50Ω	c) 1 vrms into 1K d) 0.5 vrms/50Ω	0.5 vrms into 50Ω Option "R": 1 vrms into 50Ω	TTL compatible	CMOS compatible	ECL compatible	**Package:** 4 or 14 pin resistance welded 0.2" Low profile DIP case
	(Option "R": 1 vrms into 50Ω; TTL, CMOS or ECL logic compatible output available on some models)								
Deviation:	±0.1%	±0.1%	±0.1%	±0.5%	>±.003%. This allows correcting to specified center frequency over 0-50°C for 5-10 years. Wider deviation optional; for significantly wider deviation, see models on left side of page).				
	(wider and narrower deviation available)								
Modulation Voltage:	±5 Volts, negative transfer function (either higher or lower sensitivity available)				0 to +6V (±3V to ±10V optional)	0 to +5V	0 to +5V	0 to −5V (±3 to ±10V optional)	
Linearity:	±1% (For ±5% linearity, resulting in reduced cost, add "N" to Model No.)				±20% (±10% with bipolar input)	±20%	±20%	±20% (±10% with bipolar input)	
					Smooth monotonic characteristic. For improved linearity see models on left side of page.				
Transfer Function:	Negative; frequency decreases with increasing modulation voltage.				Positive (frequency increases with increasing control voltage) (units with bipolar input have negative transfer function)			Negative	
Stability 0-50°C:	**CO-271VA:** ± .01% **CO-271VB:** ±.001%	**CO-275VA:** ± .01% **CO-275VB:** ±.001%	±.0001%	±.025%	±.001%	±.001%	±.001%	±.001%	
	(higher stability and wider temperature range optional)				(wider temperature range optional)				
Supply:	+24 VDC standard (operation from any specified voltage in +12 VDC to +32 VDC range optional)				+15 VDC standard	+5 VDC	+12 VDC standard	−5.2 VDC	
Size:	2" x 2" x ¾" (51 x 51 x 19 mm)	2" x 3" x ¾" (51 x 77 x 19 mm)	2" x 2" x 4" (51 x 51 x 102 mm)	c) 2" x 3" x ¾" d) 3" x 3½" x ¾"	*1½"x1½"x⅝" **2"x2"x¾" ***2"x3"x¾"	e) 1½"x1½"x½" f) 1⅝"x1⅝"x½"	1½"x1½"x½"	2"x3"x½"	
Mounting:	For P.C. Board mounting (rf connector optional)	For P.C. Board mounting (rf connector optional)	Octal plug-in or solder header and rf connector	For P.C. Board mounting (rf connector optional)	*For P.C. Board mounting **SMA output connector, studs for chassis mount	For P.C. Board mounting	For P.C. Board mounting	For P.C. Board mounting	

CO-401V



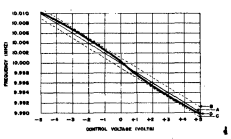
CO-402V

VECTRON VCOs Voltage Controlled Oscillators (Non-crystal)

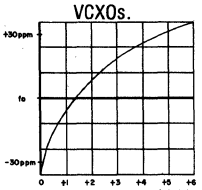


	BASIC MODEL **VC-371**	OVEN CONTROLLED **VC-372**	LOW FREQUENCY **VC-381**
Range of available center frequencies:	500 KHz to 500 MHz		50 Hz to 500 KHz
Output Level:	>0.5 vrms into 50Ω (+7 dBm) Option "R": +13 dBm. TTL, CMOS and ECL also optional		>1 vrms into 1000Ω TTL and CMOS optional
Deviation:	±10% (Wider and narrower deviation optional; deviation as large as an octave). For deviation less than ±1%, consider a crystal controlled VCXO rather than a VCO.		±10%
Modulation Voltage:	±5V (both higher and lower sensitivity optional)		±5V
Linearity:	**Standard:** ±10% Option "A": ± 3% (only for deviation ≤±20%) Option "B": ± 1% (only for deviation ≤±10%) (smooth monotonic characteristics with no discontinuities)		±1%
Transfer Function:	negative		positive
Accuracy: Standard:	±0.5% at 25°C for units with deviation up to ±10%. For wider deviation units, accuracy is 10% of deviation.	Tuning adjustment setable to 0.1%.	±0.5% at 25°C for units with deviation up to ±10%. For wider deviation units, accuracy is 10% of deviation.
Optional:	"T": Tuning adjustment setable to 0.1%.		"T": Tuning adjustment setable to 0.1%.
	Standard: 0/+50°C: ±1% Option 1: −20/+70°C: ±2% Option 2: −55/+85°C: ±4% *Option 3: 0/+50°C: ±0.3% *Option 4: −20/+70°C: ±0.5% *Only for deviation ≤ ±10%	**Standard:** 0/+50°C: ±0.1% Option 1: −20/+70°C: ±0.2% Option 2: −55/+85°C: ±0.5% other temperature ranges available	**Standard:** 0/+50°C: ±1.5% Option 1: −20/+70°C: ±3% Option 2: −55/+85°C: ±6%
Supply Voltage:	+15 VDC (Operation from any supply in 12 to 28 VDC range is optional.)		+15 VDC
Size:	2" x 2" x ¾" (51 x 51 x 19 mm)	2" x 2" x 4" (51 x 51 x 104 mm)	2" x 2" x ¾" (51 x 51 x 19 mm)
Mounting:	Pins for p.c. board mounting, RF connector optional.	Chassis mount with SMA output connector. SMC or BNC optional	Pins for p.c. board mounting.

General characteristics of CO-270V Series Linear VCXOs and VC-371 Series VCOs.



General characteristics of CO-230V Series VCXOs.

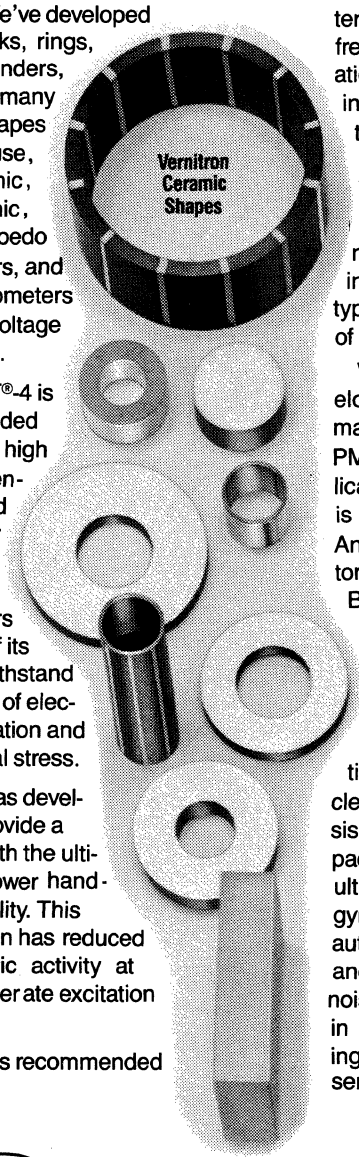


VECTRON **VECTRON LABORATORIES, INC.** The CRYSTAL OSCILLATOR COMPANY
166 Glover Avenue, Norwalk, CT 06850 • Telephone: 203/853-4433 • TWX: 710/468-3796

Electronic components and piezo ceramics by Vernitron. Over 45 years of innovation.

In piezo ceramics of diverse shapes. In Bimorphs and Unimorphs. Also in ceramic bandpass and ladder filters. In ceramic resonators. And in piezo igniters. That's Vernitron Piezoelectric Division.

We've been making innovations in electronic components and piezo ceramics since 1938. And we're still doing it. Take a look at some of our accomplishments in modern ceramic shapes. We've developed discs, blocks, rings, plates, cylinders, tubes and many custom shapes for sonar use, as ultrasonic, hydrophonic, and as torpedo transducers, and in accelerometers and high voltage generators.



Our PZT®-4 is recommended for use in high voltage generators and high power acoustic radiating transducers because of its ability to withstand high levels of electrical excitation and mechanical stress.

PZT-8 was developed to provide a material with the ultimate in power handling capability. This composition has reduced piezoelectric activity at low to moderate excitation levels.

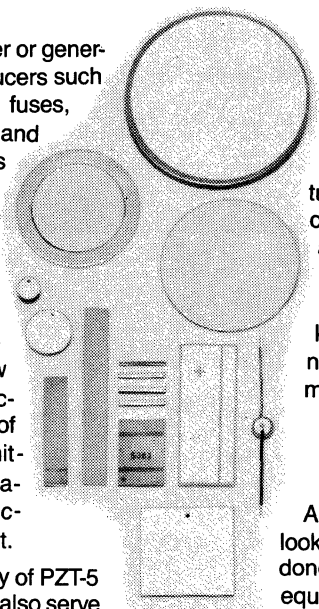
PZT-5A is recommended for use in receiver or generator type transducers such as hydrophones, fuses, accelerometers, and vibration pickups in general etc., because of its high sensitivity, permittivity and time stability.

PZT-5H is better suited to low frequency applications because of increased permittivity, accompanied by a reduced Curie point.

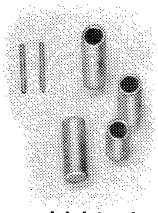
The family of PZT-5 materials may also serve in very low power motor-type transducers because of high motion sensitivity.

Vernitron also has developed lead metaniobate materials, PMN-1 and PMN-2, for diverse applications. Their feature is higher Curie points. And we are the originators of Unimorphs and Bimorphs to serve as compact transducers for audio tones.

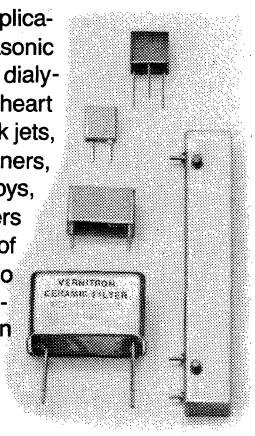
The above compositions are used in such applications as ultrasonic cleaners, kidney dialysis equipment, heart pacemakers, ink jets, ultrasound scanners, gyros, sonobuoys, automatic erasers and a variety of noisemakers. Also in laser positioning and as motion sensors.



Shapes, Unimorphs, Bimorphs



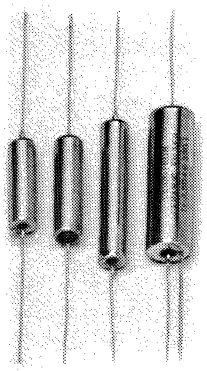
Ink Jet and Ceramic Tubes



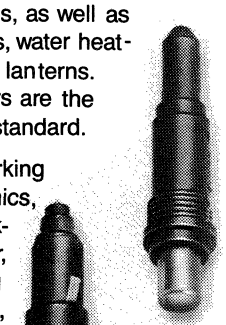
Bandpass Filters and Resonators

Innovation is also true of our work in bandpass filters, ladder filters, and ceramic resonators. We offer light weight, stable, fixed tuned, miniature ceramic filters and resonators with varieties for almost any kind of communications equipment: consumer — commercial — military.

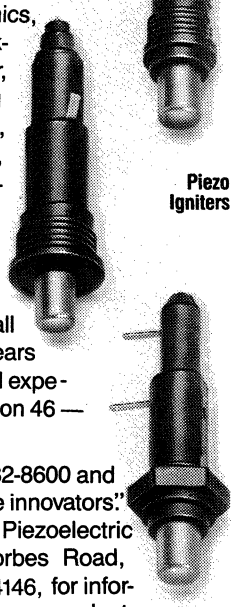
Ceramic Ladder Filters



And don't overlook what we've done in piezo igniters for gas fired equipment of all types. Vernitron igniters are original equipment in most makes of barbeque grills, as well as in many furnaces, water heaters and camping lanterns. Vernitron igniters are the world industry standard.



So if you're working with piezo ceramics, in alarms, speakers, lasers, sonar, ink jet printing data processing, communications, telephone development, gyros, or hydrophones, pacemakers or gas-fired equipment give us a call and put our 45 years of innovation and experience — going on 46 — to work.



Piezo Igniters

Just call (216) 232-8600 and ask for "one of the innovators." Or write Vernitron Piezoelectric Division, 232 Forbes Road, Bedford, Ohio 44146, for information on any of these products.

Vernitron Piezoelectric Division

232 Forbes Rd. / Bedford OH 44146-5478 / 216-232-8600 / TWX 810-427-2274

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 85/86 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1166, **B**•1012, **C**•1028, **D**•1016
ASCII Code ..... **D**•1087
Batteries, Product Selection Guide ..... **D**•1413
Batteries & Fuel Cells, Characteristics ..... **D**•1430
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide ..... **A**•1003
Circuit Boards (Printed) Product Selection Guide ..... **C**•1099
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1205
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1863
Connectors, Miniglossary ..... **C**•1129
Connectors, Terminals, & Sockets, Product Selection Guide ..... **C**•1105
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Gude ..... **A**•1309
Delay Lines, Product Selection Guide ..... **A**•1459
Discrete Semiconductors, Product Selection Guide ..... **A**•2067
Displays, Readouts, Lamps, & Lights, Product Selection Guide ..... **B**•1015
EBCDIC Code ..... **D**•1092
Encapsulation, Miniglossary ..... **C**•1086
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide .. **C**•1623
Filters, Product Selection Guide ..... **A**•1583
Instruments, Graphic Recording Product Selection Guide ..... **D**•1401
Instruments, Panel Meters, Product Selection Guide ..... **D**•1329
Instruments, Test & Measuring Product Selection Guide ..... **D**•1175
Interconnection Systems, Product Selection Guide ..... **C**•1699
Keyboards & Keypads, Product Selection Guide ..... **B**•1705
Logofinder & Trademark Directories ..... **B**•901
Microwave Components, Product Selection Guide ..... **A**•1701
Military Qualified Products Lists ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1129
Opto Semiconductors, Miniglossary ..... **B**•1214
Oscilloscopes, Product Selection Guide ..... **D**•1385
Panel Hardware, Product Selection Guide ..... **C**•1589
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide ..... **A**•1991
Power Supplies, Miniglossary ..... **D**•1462
Power Supplies, AC, Product Selection Guide ..... **D**•1877
Power Supplies, DC, Product Selection Guide ..... **D**•1447
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide .... **B**•1225
Relay Contact Forms ..... **B**•1317
Relays, Electromechanical, Miniglossary ..... **B**•1308
Relays, Product Selection Guide ..... **B**•1261
Resistor Color Codes ..... **A**•1828
Resistors, Product Selection Guide ..... **A**•1785
Servo Components, Miniglossary ..... **D**•1985
Solenoids, Product Selection Guide ..... **B**•1463
Switches, Product Selection Guide ..... **B**•1477
Thermal Components, Product Selection Guide ..... **B**•1741
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1744
Thyristors/High Power Diodes, Miniglossary ..... **A**•2076
Transducers & Encoders, Product Selection Guide ..... **B**•1777
Transformers, Product Selection Guide ..... **A**•2099
Wire & Cable, Product Selection Guide ..... **C**•1743
Wire Gauges—Diameter, Area, Copper Weight ..... **C**•1844

ADVANCED DESIGN MICROCIRCUIT CRYSTAL OSCILLATORS

XSIS microcircuit crystal oscillators are not "JUST ANOTHER CLOCK OSCILLATOR" but are hi-rel devices using a premier design that is documented to be virtually without failure. Customers call it EXPERIENCED RELIABILITY.

In house capabilities for destructive, non-destructive bond pull test, PIND test and constant monitoring of critical crystal parameters and 100% electrical temperature testing are only a few of the reasons why most major hi-rel programs using digital processing techniques use "THE-XO" (**XSIS** Oscillator).

XSIS microcircuit oscillators are manufactured to the electrical parameters of MIL-O-55310, workmanship standards are in accordance with MIL-M-38510, the quality system is as required by MIL-I-45208.

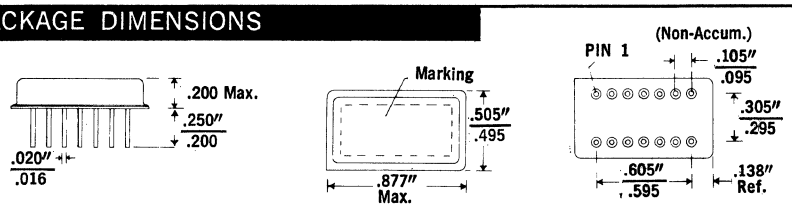
XSIS is a QPL source for microcircuit crystal oscillators to MIL-O-55310/8,/11,/14,/15,/16,/17,/18.

TYPICAL SPECIFICATIONS AVAILABLE

	100 Series-TTL	200 Series-CMOS**	300 Series-ECL
Frequency Range	100Hz to 70MHz	250Hz to 10MHz	20MHz to 100MHz
Frequency @ +25°C	±.0015%	±.0015%	±.0015%

** Specify supply voltage when ordering.

PACKAGE DIMENSIONS



NOTE: T100 SERIES (4 PIN) HAS THE SAME DIMENSIONS.

PART NUMBER ORDERING EXAMPLE

X 1 4 3 - 20.0 MHz

- 14 PIN with Option 'X' PINOUT
- TTL Compatible
- ± .005% Stability
- −55° to +125°C Temperature Range

PACKAGE TYPE + PIN CONNECTIONS

OPTION 'X'	OPTION/'E'	OPTION 'M'	OPTION 'T' (4 PIN)
PIN 7 GRD 8 Output 14 B+ 1 thru 6 N/C 9 thru 13 N/C Same As M55310/16/18	PIN 4 B+ 5 Output 7 GRD/Case 1, 2, 3, 6, N/C 8 thru 14 N/C Same As M55310/14	PIN 1 Output 2 Case 8 GRD 14 B+ 3 thru 7 N/C 9 thru 13 N/C Same As M55310/8/11/15	PIN 1 N/C 7 GRD 8 Output 14 B+ 2 thru 6 Missing 9 thru 13 Missing

STABILITIES AVAILABLE

P/N	
1	±.1%
2	±.05%
3	±.01%
4	±.005%
5	±.0025% not available with −55 to +125°C

TEMPERATURE RANGES

P/N	
1	0° to 70°C
2	−30° to +85C°
3	−55° to +125°C

QPL TO MIL-O-55310

±.0015% CALIBRATION ACCURACY

HERMETICALLY SEALED METAL PACKAGE

.200 SEATED HEIGHT

LOW POWER CONSUMPTION

WIDE FREQUENCY RANGE

VARIETY OF STABILITIES

MULTIPLE TEMPERATURE RANGE SELECTION

TTL-CMOS-GATED SCHOTTKY-ECL

CUSTOM PACKAGE CONSIDERATIONS

DUAL-IN-LINE SPACING

CUSTOM ELECTRICAL PARAMETERS

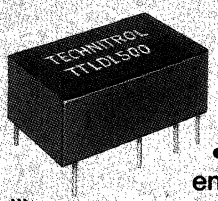
AT XSIS — QUALITY IS CONSTANT

XSIS ELECTRONICS

12620 W. 63rd St.
Shawnee, Kansas 66216
913-631-0448/Telex: 437227

Circuit timing.

Why adjust it when you can perfect it?



Let's say you've just designed the fastest, tightest digital circuit you've ever seen. But it needs a super delay line to tie into your overall scheme. Something special. Certainly high-performance.

You need Technitrol. For leading- or trailing-edge timing of any logic-based circuit.

• Only Technitrol can give you a selection of lumped-constant active delay lines with 5 ns to 2000 ns delay times that are ±1 ns or ±1% repeatable over −55° to +125°C, at rated voltage input ±10%. That's full voltage and temperature compensation!

(We aren't just telling you they perform this well—we'll put it on the part if you wish.)

• Our programmable delay lines, up to 100k ECL, give you a selection of up to 15 different delay times per module, differing by as little as 500 ps.

• Technitrol chip-carrier delay modules enable tighter board stacking and the use of vapor-phase reflow technology.

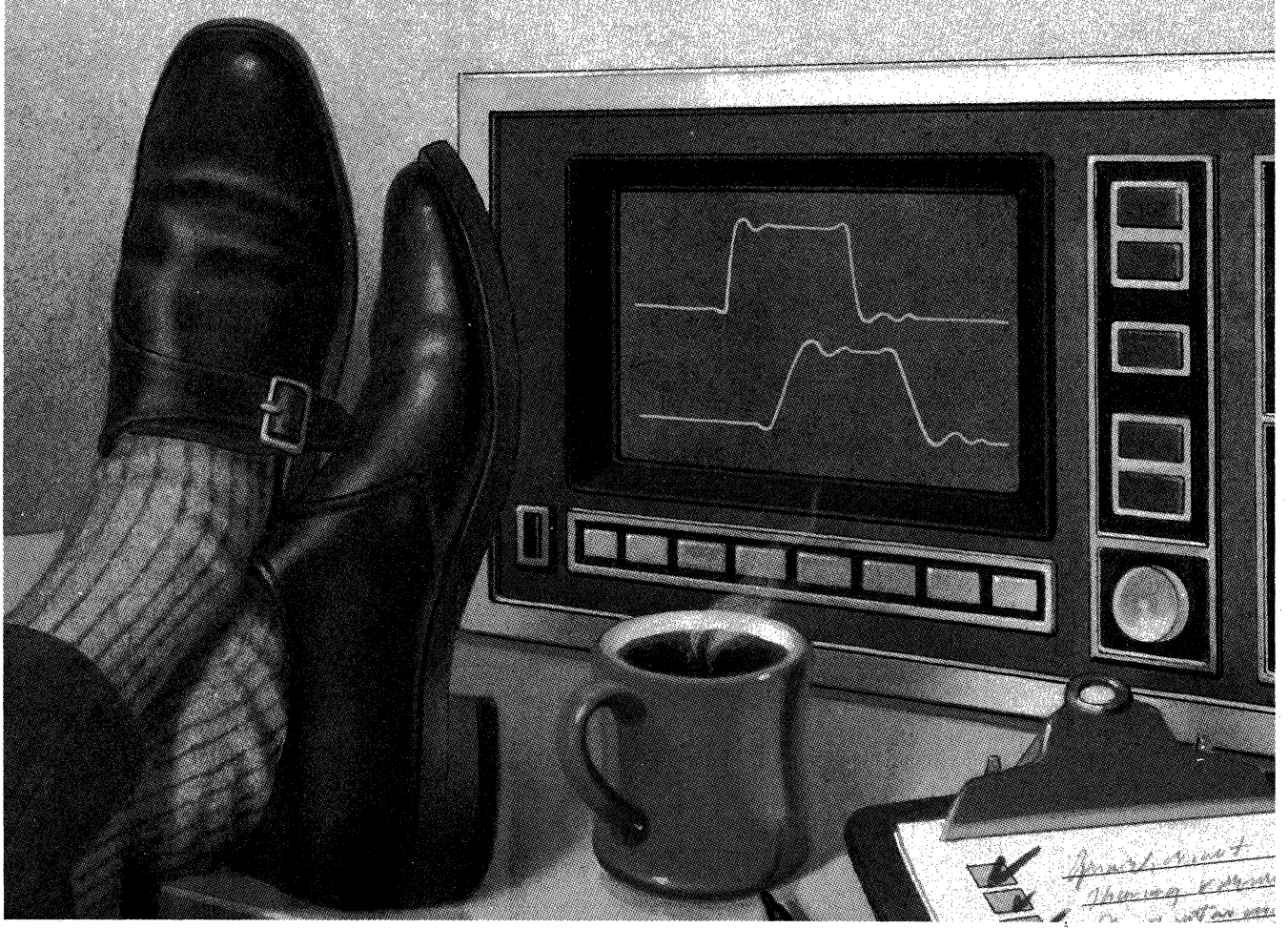
If you're really serious about quality and performance, you'll appreciate our meticulously balanced designs that produce consistent lows and highs for both positive- and negative-going logic signals. And our low failure rates are unheard of elsewhere. Who else can give you all this?

You'll find the same performance and reliability in all of our military- and commercial-grade products. Our toughest customers demand this. You should, too.

Technitrol, Inc.

1952 E. Allegheny Ave.
Philadelphia, PA 19134 USA
215-426-9105 • Telex 834245

active and passive delay lines • pulse transformers • Manchester encoder/decoders • data bus couplers • pulse-width regulators • high voltage, Scott T, and ferroresonant transformers



Manufacturer	Passive				Digital		Video	Glass & Quartz	Other	Types
	Distributed Constant		Lumped Constant							
	Fixed	Variable	Fixed	Variable	Tapped	Programmable				
Allen Avionics	A•1460 A•1461		A•1461 A•1463	A•1463			A•1462			
Andersen Labs.								A•1591	A•1591*	BAW, SAW, IMCON
Automatic Coil	A•1467*				A•1464- A•1467					
Bel Fuse			A•1478 A•1479		A•1468- A•1474* A•1480 A•1481 A•1483	A•1475 A•1477*			A•1482 A•1484 A•1485 A•1486	Digital Delay Oscillator DRAM DRAM Timer Autoinsertable & Surface Mount
Computer Devices			A•1487*	A•1487					A•1487	ATC Transponder & Beacon Coding
Control Electronics	A•1488*	A•1488							A•1488	Dispersive Audio Magnetostrictive Transponder Decoder Networks
Damon								A•1360		
Data Delay Devices	A•1500 A•1501*	A•1500			A•1496- A•1498	A•1489 A•1492- A•1493 A•1495				
Datamax					A•1502- A•1507	A•1503				
ESC Electronics	A•1508*	A•1508*	A•1508*	A•1508	A•1508	A•1508			A•1508*	Trimmer
Hytek Microsys.					A•1522	A•1523				
JBM Electronics	A•1528*	A•1528*	A•1528*	A•1528*	A•1528* A•1529*					
Kappa Networks	A•1542- A•1544*		A•1545		A•1530- A•1539		A•1545*		A•1540 A•1545*	Surface Mount Trimmers, Transponder Sonar
Microsonics								A•1386	A•1386	Ultrasonic
Nano Pulse					A•1546- A•1549					
Nytronics Comps.			A•1552* A•1553		A•1550* A•1551*					
PCA Electronics	A•1558 A•1564- A•1566				A•1556 A•1562					
Rhombus					A•1568 A•1569	A•1568 A•1570		A•1360	A•1569 A•1571- A•1573	Oscillators & Pulse Width Generators Electromagnetic Delay Lines
Sawtek					A•1432				A•1432	SAW, Dispersive* Ultrasonic
Technitrol			A•1577		A•1574- A•1574*	A•1578 A•1579				
Toko America			A•1581		A•1581					

* Mil. Spec.

ALLEN AVIONICS, INC.

224 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • PHONES: 516-248-8080 OR 516-747-5450

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SPIRADEL®* THE MOST COMPACT Highest Time Delay to Rise Time Ratio DISTRIBUTED DELAY LINE

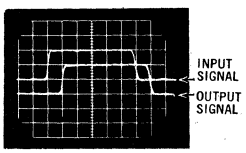
FOR IMMEDIATE DELIVERY!

SPIRADEL is a small diameter, distributed constant fixed delay line, featuring higher delay to rise time ratio and excellent pulse fidelity. Its new shape offers greater package design versatility than most other delay lines available, and the entire unit is encapsulated for maximum environmental protection.

SPIRADEL covers a delay range of 20 to 6000 nanoseconds. Any delay within this range may be selected.

Time delay to rise time ratios range up to 30 to 1. Any impedance from 50 to 1000 ohms is available. Standard delay tolerance is 5%, although tighter tolerances can be held.

SPIRADEL is designed for operation from −55°C up to +105°C. Temperature coefficient over this range is 150 parts/million/°C. Bandwidth is from DC to frequency f = .35/rise time.



TO ORDER SPECIFY PART NUMBER **STANDARD HEIGHT OF ALL UNITS: 7/16"**

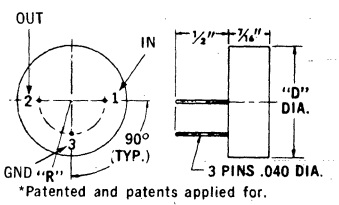
Part Number	Time Delay (Nanoseconds)	Rise Time (Nanoseconds) Maximum	Bandwidth Minimum (MHz)	Diam. Inches
IMPEDANCE 50 OHMS				
SP0050Z050	50	10.0	35.0	1.60
SP0100Z050	100	13.0	26.9	2.00
SP0150Z050	150	14.0	25.0	2.50
SP0200Z050	200	16.0	21.9	2.50
SP0250Z050	250	19.0	18.4	3.25
SP0300Z050	300	21.0	16.7	3.25
SP0350Z050	350	24.0	14.5	3.25
SP0400Z050	400	27.0	12.9	3.75
SP0450Z050	450	28.0	12.5	3.75
SP0500Z050	500	29.0	12.0	3.75
IMPEDANCE 75 OHMS				
SP0025Z075	25	4.5	77.7	1.20
SP0050Z075	50	6.0	58.3	1.20
SP0100Z075	100	9.5	36.8	1.60
SP0150Z075	150	11.5	30.4	2.00
SP0200Z075	200	13.0	26.9	2.00
SP0250Z075	250	14.0	25.0	2.50
SP0300Z075	300	16.0	21.8	2.50
SP0350Z075	350	18.0	19.4	2.50
SP0400Z075	400	20.0	17.5	3.25
SP0450Z075	450	21.9	15.9	3.25
SP0500Z075	500	24.0	14.5	3.25
SP0550Z075	550	26.0	13.4	3.75
SP0600Z075	600	28.0	12.5	3.75
SP0650Z075	650	30.0	11.6	3.75
SP0700Z075	700	32.0	10.9	3.75
IMPEDANCE 100 OHMS				
SP0050Z100	50	7.3	47.9	1.20
SP0060Z100	60	7.5	46.6	1.20
SP0070Z100	70	7.7	45.4	1.20
SP0080Z100	80	8.2	42.6	1.20
SP0090Z100	90	9.1	38.4	1.20
SP0100Z100	100	10.0	35.0	1.60
SP0150Z100	150	12.5	28.0	1.60
SP0200Z100	200	14.0	25.0	2.00
SP0250Z100	250	16.0	21.8	2.00
SP0300Z100	300	18.0	19.4	2.50
SP0350Z100	350	20.0	17.5	2.50
SP0400Z100	400	22.0	15.9	2.50
SP0450Z100	450	24.5	14.2	2.50
SP0500Z100	500	27.0	12.9	3.25
SP0550Z100	550	29.5	11.8	3.25
SP0600Z100	600	31.0	11.2	3.25
SP0650Z100	650	32.5	10.7	3.25
SP0700Z100	700	34.0	10.2	3.25
SP0750Z100	750	36.0	9.7	3.75
SP0800Z100	800	38.0	9.2	3.75
SP0850Z100	850	39.5	8.8	3.75
SP0900Z100	900	41.0	8.5	3.75
SP0950Z100	950	42.5	8.3	3.75
SP1000Z100	1000	44.0	7.9	3.75

Part Number	Time Delay (Nanoseconds)	Rise Time (Nanoseconds) Maximum	Bandwidth Minimum (MHz)	Diam. Inches
IMPEDANCE 150 OHMS				
SP0020Z150	20	5.0	70.0	1.20
SP0030Z150	30	6.5	53.8	1.20
SP0040Z150	40	7.5	46.6	1.20
SP0050Z150	50	7.7	45.4	1.20
SP0060Z150	60	7.9	44.3	1.20
SP0070Z150	70	8.0	43.7	1.20
SP0080Z150	80	8.2	42.6	1.20
SP0090Z150	90	8.5	41.1	1.20
SP0100Z150	100	9.0	38.8	1.20
SP0150Z150	150	12.0	29.1	1.60
SP0200Z150	200	14.0	25.0	1.60
SP0250Z150	250	15.0	23.3	2.00
SP0300Z150	300	17.5	20.0	2.00
SP0350Z150	350	19.0	18.4	2.00
SP0400Z150	400	20.0	17.5	2.00
SP0450Z150	450	22.0	15.9	2.50
SP0500Z150	500	24.0	14.5	2.50
SP0550Z150	550	25.6	13.6	2.50
SP0600Z150	600	27.0	12.9	2.50
SP0650Z150	650	28.6	12.2	2.50
SP0700Z150	700	30.0	11.6	2.50
SP0750Z150	750	31.6	11.0	3.25
SP0800Z150	800	33.0	10.6	3.25
SP0850Z150	850	34.5	10.1	3.25
SP0900Z150	900	36.0	9.4	3.25
SP0950Z150	950	38.0	9.2	3.25
SP1000Z150	1000	40.0	8.7	3.25
IMPEDANCE 325 OHMS				
SP0100Z325	100	12.0	29.2	1.20
SP0150Z325	150	14.0	25.0	1.20
SP0200Z325	200	17.0	20.6	1.20
SP0250Z325	250	19.0	18.4	1.60
SP0300Z325	300	21.0	16.7	1.60
SP0350Z325	350	23.0	15.3	1.60
SP0400Z325	400	24.0	14.6	1.60
SP0450Z325	450	26.0	13.5	2.00
SP0500Z325	500	28.0	12.5	2.00
SP0550Z325	550	29.0	12.1	2.00
SP0600Z325	600	31.0	11.3	2.00
SP0650Z325	650	33.0	10.6	2.50
SP0700Z325	700	34.0	10.3	2.50
SP0750Z325	750	35.0	10.0	2.50
SP0800Z325	800	37.0	9.5	2.50
SP0850Z325	850	39.0	9.0	2.50
SP0900Z325	900	41.0	8.5	2.50
SP0950Z325	950	43.0	8.1	2.50
SP1000Z325	1000	45.0	7.8	2.50
SP1100Z325	1100	49.0	7.1	3.25
SP1200Z325	1200	52.0	6.7	3.25
SP1300Z325	1300	55.0	6.3	3.25
SP1400Z325	1400	59.0	5.9	3.25
SP1500Z325	1500	62.0	5.6	3.25

Part Number	Time Delay (Nanoseconds)	Rise Time (Nanoseconds) Maximum	Bandwidth Minimum (MHz)	Diam. Inches
IMPEDANCE 500 OHMS				
SP0300Z500	300	33.0	10.6	1.20
SP0400Z500	400	40.0	8.7	1.60
SP0500Z500	500	44.0	7 9	1.60
SP0600Z500	600	50.0	7.0	1.60
SP0700Z500	700	55.0	6.3	2.00
SP0800Z500	800	57.0	6.1	2.00
SP0900Z500	900	60.0	5.8	2.00
SP1000Z500	1000	66.0	5.3	2.00
SP1500Z500	1500	87.0	4.0	2.50
SP2000Z500	2000	110.0	3.1	2.50
SP2500Z500	2500	120.0	2.9	3.25
SP3000Z500	3000	137.0	2.5	3.25
SP3500Z500	3500	154.0	2.2	3.25
SP4000Z500	4000	165.0	2.1	3.25
IMPEDANCE 600 OHMS				
SP0400Z600	400	46.0	7.6	1.20
SP0500Z600	500	48.0	7.2	1.60
SP0600Z600	600	54.0	6.4	1.60
SP0700Z600	700	58.0	6.0	1.60
SP0800Z600	800	60.0	5.8	1.60
SP0900Z600	900	65.0	5.3	2.00
SP1000Z600	1000	70.0	5.0	2.00
SP1500Z600	1500	85.0	4.1	2.50
SP2000Z600	2000	100.0	3.5	2.50
SP2500Z600	2500	115.0	3.0	2.50
SP3000Z600	3000	125.0	2.8	3.25
SP3500Z600	3500	140.0	2.5	3.25
SP4000Z600	4000	150.0	2.3	3.25
SP4500Z600	4500	165.0	2.1	3.75
SP5000Z600	5000	170.0	2.0	3.75
SP5500Z600	5500	185.0	1.8	3.75
SP6000Z600	6000	200.0	1.7	3.75
IMPEDANCE 1000 OHMS				
SP0500Z01K	500	58.0	6.0	1.20
SP0600Z01K	600	63.0	5.5	1.20
SP0700Z01K	700	72.0	4.8	1.20
SP0800Z01K	800	80.0	4.3	1.20
SP0900Z01K	900	87.0	4.0	1.60
SP1000Z01K	1000	95.0	3.6	1.60
SP1500Z01K	1500	116.0	3.0	1.60
SP2000Z01K	2000	126.0	2.7	2.00
SP2500Z01K	2500	147.0	2.3	2.00
SP3000Z01K	3000	158.0	2.2	2.00
SP3500Z01K	3500	182.0	1.9	2.50
SP4000Z01K	4000	203.0	1.7	2.50
SP4500Z01K	4500	220.0	1.5	2.50
SP5000Z01K	5000	240.0	1.4	3.25

"TAPPED" UNITS AVAILABLE IN IMPEDANCES FROM 50 TO 325 OHMS INCLUSIVE. CALL OR WRITE FOR COMPLETE CATALOG.

"D"	"R"
1.20"	.400"
1.60"	.600"
2.00"	.800"
2.50"	1.050"
3.25"	1.425"
3.75"	1.675"



*Patented and patents applied for.

ALLEN AVIONICS, INC.

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DUAL-IN-LINE "MIDI" SPIRADEL®*

These LOW COST units offer the same excellent pulse fidelity and phase linearity as Standard Spiradel. Low silhouette and dual-in-line mounting permit packaging with semiconductor and comparable components.

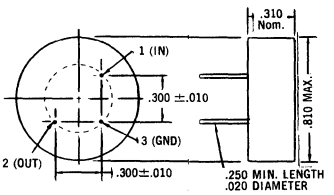
PART NO.	Time Delay (Nano-seconds)	Rise Time (Nano-seconds) Maximum	Bandwidth Minimum (MHz)	Impedance (Ohms)
MD005Z100	5	2.0	180.0	100
RD005Z125	5	2.0	180.0	125
MD010Z100	10	2.5	144.0	100
RD010Z125	10	2.5	144.0	125
MD015Z100	15	3.0	120.0	100
MD020Z100	20	4.0	90.0	100
RD020Z200	20	4.0	90.0	200
MD025Z100	25	5.0	72.0	100
MD030Z100	30	6.0	60.0	100
RD030Z250	30	6.0	60.0	250
MD040Z100	40	7.5	48.0	100
RD040Z300	40	8.0	45.0	300
MD050Z100	50	9.0	40.0	100
RD050Z350	50	10.0	36.0	350
MD060Z175	60	11.0	32.7	175
RD060Z400	60	12.0	30.0	400
MD070Z175	70	12.0	30.0	175
RD070Z400	70	14.0	25.7	400
MD080Z175	80	13.0	27.7	175
RD080Z475	80	16.0	22.5	475

PART NO.	Time Delay (Nano-seconds)	Rise Time (Nano-seconds) Maximum	Bandwidth Minimum (MHz)	Impedance (Ohms)
MD090Z175	90	14	25.7	175
RD090Z500	90	18	20.0	500
MD100Z175	100	15	24.0	175
RD100Z500	100	20	18.0	500
MD125Z500	125	25	14.4	500
MD150Z500	150	29	12.1	500
RD150Z01K	150	30	12.0	1000
MD175Z500	175	32	11.3	500
RD175Z01K	175	35	10.3	1000
MD200Z500	200	35	10.3	500
RD200Z01K	200	40	9.0	1000
MD250Z500	250	40	9.0	500
MD300Z01K	300	60	6.0	1000
MD350Z01K	350	67	5.4	1000
MD400Z01K	400	74	4.9	1000
MD450Z01K	450	78	4.6	1000
MD500Z01K	500	81	4.4	1000
MD550Z01K	550	83	4.3	1000
MD600Z01K	600	85	4.2	1000

TO ORDER SPECIFY PART NUMBER

STOCKED

Epoxy Encapsulated. Temperature Coefficient: Less than 200 PPM/°C from −55°C to +105°C.



DUAL-IN-LINE "MINI" SPIRADEL®* FOR IMMEDIATE DELIVERY!

STOCKED

*Patented and patents applied for.

EXCELLENT PULSE FIDELITY • FLAT DELAY OVER WIDE FREQUENCY RANGE

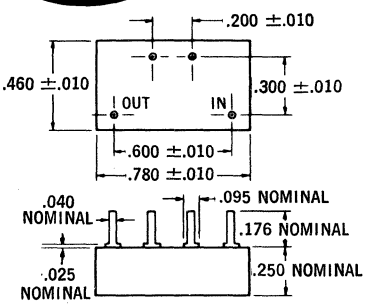
Operation from −55°C up to +105°C. Units exhibit a change of less than 175 parts/million/°C over this temperature range. Dual-in-line mounting. Compatible with integrated circuits. Maximum attenuation for all delays: 7%.

TO ORDER SPECIFY PART NUMBER

PART NO.	Time Delay (Nano-seconds)	Rise Time (Nano-seconds)	Impedance (Ohms)
MN005Z125	5	2.0	125
MN010Z125	10	2.5	125
MN020Z200	20	4.0	200
MN030Z250	30	6.0	250
MN040Z300	40	8.0	300
MN050Z350	50	10.0	350
MN060Z400	60	12.0	400
MN070Z400	70	14.0	400

PART NO.	Time Delay (Nano-seconds)	Rise Time (Nano-seconds)	Impedance (Ohms)
MN080Z475	80	16.0	475
MN090Z500	90	18.0	500
MN100Z500	100	20.0	500
MN125Z500	125	25.0	500
MN150Z01K	150	30.0	1000
MN175Z01K	175	35.0	1000
MN200Z01K	200	40.0	1000
MN250Z01K	250	50.0	1000

STANDARD DELAY TOLERANCE 10% (5% ON SPECIAL ORDERS)



"LC DIP 20" DUAL-IN-LINE 24 PIN TAPPED LUMPED CONSTANT DELAY LINE

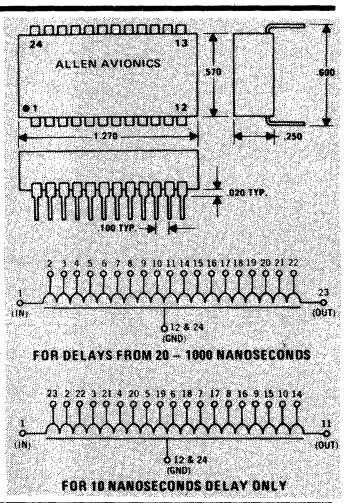
IMPEDANCE 100 OHMS

Part No.	Time Delay (Nanoseconds)	Rise Time (Nanoseconds)	Bandwidth Minimum (MHz)	Attenuation Maximum (%)
LCB010Z100	10	2.0	180.0	5
LCB020Z100	20	2.5	144.0	5
LCB030Z100	30	3.0	120.0	5
LCB040Z100	40	4.0	90.0	5
LCB050Z100	50	5.0	72.0	5
LCB060Z100	60	6.0	60.0	10
LCB070Z100	70	7.0	51.4	10
LCB080Z100	80	8.0	45.0	10
LCB090Z100	90	9.0	40.0	10
LCB100Z100	100	10.0	36.0	10
LCB150Z100	150	15.0	24.0	5
LCB200Z100	200	20.0	18.0	5
LCB250Z100	250	25.0	14.4	10
LCB500Z100	500	50.0	7.2	10
LCB750Z100	750	75.0	4.8	10
LCB01KZ100	1000	100.0	3.6	10

TO ORDER SPECIFY PART NUMBER

- Time delay to rise time ratios — 10 to 1.
- Temperature Coefficient — less than 100PPM/°C from 0°C to 80°C.
- Total delay tolerance 5% or 1 nanosecond, whichever is greater.
- 20 equal delay increments.
- TTL & DTL compatible.
- Low attenuation.
- Excellent pulse fidelity.
- Exceeds applicable portions of MIL-D-23859.
- Voltage rating 50 WVDC.

Where high bandwidths and low rise times are required in a small package, the "LC DIP 20" excels. It offers excellent pulse fidelity and low attenuation. Its compatibility with TTL & DTL along with its low profile makes for an extremely popular and adaptable unit for semiconductor and other related applications. Other delays and impedances are available on special order.



THE ULTIMATE IN MINIATURIZATION

T05 SERIES LUMPED CONSTANT DELAY LINE

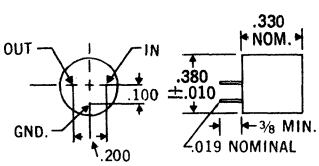
Lumped Constant, completely passive, delay lines housed in a commercial T05 package (.385 dia. x .330 high). Designed for compatibility with semiconductor and logic assemblies where space and good performance are prime considerations. Stocked in delays from 10 to 100 nanoseconds.

Delay Tolerance: ±5%.

Working Voltage: 50 volts DC.

Temp. Coefficient Over 0 to 80°C: 100 parts/million/°C.

Part No.	Time Delay (Nano-seconds)	Rise Time Max. (Nano-seconds)	Band-width (MHz)	Impe-dance (Ohms)	Atten-uation (%)
T010	10	3	120.0	100	4
T020	20	4	90.0	100	5
T030	30	6	60.0	100	6
T040	40	8	45.0	100	7
T050	50	10	36.0	100	8
T060	60	12	30.0	50	8
T070	70	14	25.7	50	9
T080	80	16	22.5	50	10
T090	90	18	20.0	50	11
T01C	100	20	18.0	50	12



ALLEN AVIONICS, INC.

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FILTERS
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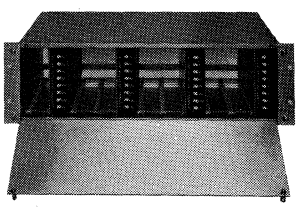
THE MOST COMPLETE LINE OF VIDEO DELAY LINES AVAILABLE FROM STOCK!

Allen Avionics, an established leader in the design and manufacture of Electromagnetic Delay Lines and L-C Filters has now developed a specialized group of products for the video market.

In color television broadcasting, accurate timing of signals is essential. This was initially achieved by the use of 75 ohm coaxial cable. The cost in time and materials to accomplish precise trimming and the lack of a rapid and convenient method of changing delays is currently responsible for the decline in cable usage. Television studios, studio equipment manufacturers and others engaged in the video industry are changing from 75 ohm cable to a more suitable method of achieving precise short delays. Allen Avionics now offers a line of Video Units for this purpose. Their use will result in a reduction of size, weight, installation cost and an overwhelming saving in time and effort to make delay changes.

Models VP0635, VP1270 and VP2075 are padded to provide a flat loss at any setting. As a result of this padding, these units will exhibit a maximum variation of ±.2db at any delay setting. **New Model VAR256** is designed specifically to provide for infinitely small delay adjustments from 0 to 256 nanoseconds. It accomplishes this by the use of a continuously variable one nanosecond delay, added to 8 additional binary toggle delays. Unlike other units on the market, this unit introduces absolutely no video distortion due to the continuously variable delay adjustment. Combine this feature with low insertion loss (less than .15dB) and you have a unit with unparalleled specifications that everyone in the video field will find very useful.

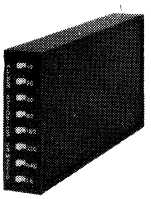
RACK MOUNTABLE UNITS



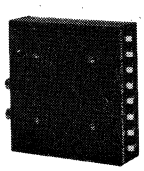
RACK MOUNT showing delay units with switches and terminals available for delay changes. Up to 11 delay units can be housed. Cards for mounting units in rack are purchased separately. Note hinged front panel.

This rack mountable series of video and pulse delay lines has the capability of replacing up to 1450 feet of cable.

Four variable slide switch units are being offered with total delays of 255, 637.5, 1275 and 2270 nanoseconds. Each unit contains 8 individual delay units. **Four strappable units** are also manufactured with total delays of 317.5, 635, 1270 and 2260 nanoseconds. The strappable units consist of 7 separate delay lines each having their own input and output terminals. The slide switches or terminal strapping provide methods for adding the individual lines together so that the output is always the summation of the individual lines. This eliminates most video distortions and assures good chrominance to luminance delay. Precision delay changes of as small as one nanosecond are easily accomplished. Low insertion loss, amplitude and delay flatness, along with excellent pulse fidelity, are characteristic of this series.



Showing 8 individual slide switches for rapid delay changes.



Units are rack mounted by attaching a durable plastic card to the large surface.

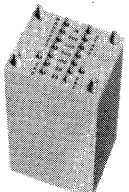
All units are manufactured to fit standard 19 inch racks and are provided with additional inserts to satisfy almost any mounting requirement. Delay units and racks can be purchased separately. The rack is manufactured with a hinged panel so that fast delay adjustments can be made. However, once adjustments are made, the front panel prevents further tampering with the slide switches or terminals.

These new delay units feature extremely flat amplitude response to 5.5 MHz, small increments of delay variation, low signal distortion and tight delay tolerance. The delay networks are ideal for pulse applications because of their fast rise times and low distortion. Amplitude equalization is employed to achieve excellent flatness over the video frequency range. The delayed output of any model in this group is the summation of individual lines. It is not the result of a tapped line. This feature insures that output pulse distortions are minimized. Units will match to any 75 ohm system and can be directly connected into the video signal path by means of BNC connectors.

Part No.	Delay Range (Nano-Sec.)	Delay Steps (Nano-Sec.)	Method of Variation	Maximum Insertion Loss @ 100 KHz (db)	Amplitude Flatness At Any Delay Setting 100 KHz to 5.5 MHz (db)	Max. Rise Time (Nano-Sec.)	Package Size (Inches)
VAR005	3-7	Continuous	Trimmer	.20	.2 Max.	N.A.	3⅝ x 1½ x 1¼
VAR011	0-11	Continuous	Trimmer & Toggle	.20	.25	N.A.	4⅜ x 2⅜ x 1 1/16
VAR256	0-256	Continuous	Trimmer & Toggle	.15	.4	18	4⅜ x 2⅜ x 1 1/16
VP0010	0-10.5	.5	Toggle	.15	.2	3	4⅜ x 2⅜ x 1 1/16
VP0127	0-127	1.0	Toggle	.15	.3	14	4⅜ x 2⅜ x 1 1/16
VP0255	0-255	1.0	Toggle	.15	.3	16	4⅜ x 2⅜ x 1 1/16
VP0317	0-317.5	2.5	Toggle	.15	.3	20	4⅜ x 2⅜ x 1 1/16
VP0635	0-635	5.0	Toggle	* .50	.4	25	4 1/16 x 3 1/16 x 2 1/16
VP1100	0-1100	10.0	Rotary	1.25	.4	30	4 1/16 x 3 1/16 x 2 1/16
VP1270	0-1270	10.0	Toggle	*3.00	.4	30	4 1/16 x 3 1/16 x 2 1/16
VP2075	0-2075	25.0	Toggle	*3.00	.5	40	7⅜ x 4 1/16 x 2 3/16
VS0315	0-315	5.0	Strap	.25	.4	28	4 x 2 x 1¼
VS0635	0-635	5.0	Strap	.60	.5	33	5 x 2 x 1¼
VS1275	0-1275	5.0	Strap	1.25	.5	33	5 x 3 x 1¼
VS2075	0-2075	25.0	Strap	2.50	.5	40	6½ x 3½ x 2
RACK MOUNTABLE UNITS							
VRM011	0-11	Continuous	Trimmer & Slide Switch	.30	.3 Max.	N.A.	1¼ x 4 5/32 x 4
VRM0255	0-255	1.0	Slide Switch	.40	.4	20	1¼ x 4⅛ x 4
VRM0637	0-637.5	2.5	Slide Switch	*1.00	.4	28	1¼ x 4⅛ x 6
VRM1275	0-1275	5.0	Slide Switch	*3.00	.4	33	1¼ x 4⅛ x 9
VRM2270	0-2270	10.0	Slide Switch	*3.00	.5	40	1¼ x 4⅛ x 9
VRS0317	0-317.5	2.5	Strap	.40	.5	26	1¼ x 4⅛ x 4
VRS0635	0-635	5.0	Strap	.75	.5	35	1¼ x 4⅛ x 6
VRS1270	0-1270	10.0	Strap	1.50	.5	37	1¼ x 4⅛ x 9
VRS2260	0-2260	20.0	Strap	3.00	.5	40	1¼ x 4⅛ x 9

Impedance: 75 ohms. * ±.2 db variation at any delay setting.
Pulse Distortion: Less than 4% with an input pulse rise time of 20 nanoseconds.
Working Voltage: 50 volts maximum.
Return Loss: 20 db minimum.
Delay Tolerance: 5% or 1 nanosecond, whichever is greater.

TYPE AV-397 and 75-2A PULSE and VIDEO DELAY LINES



AV-397
2" x 2½" x 5½"

Maximum Delay: 2.075 microseconds ±3% variable in .025 μs. steps from .025 to 2.075 microseconds.
Time Delay of Individual Lines: 1, .5, .2, .2, .1, .05, .025 microseconds.
Rise Time for Entire Line: .06 microseconds maximum.
Frequency Response: 3 db down at 5 megahertz for 2.075 microseconds delay.
Distortion: 2% maximum with .2 microsecond input pulse.
Impedance: 75 ohms ±5%.
Working Voltage: 100.
Temperature Coefficient: 50 parts/million/°C from −55°C to 105°C.
Attenuation: 7% maximum for 2.075 microsecond delay.

75-2A
7⅜" x 4 1/16" x 2 3/16"

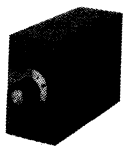
ALLEN AVIONICS, INC.

224 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • PHONES: 516-248-8080 OR 516-747-5450

SEE OUR PAGES UNDER FILTERS SECTION 2700 WRITE FOR CATALOG

ATTN. COMMUNICATION FIELD: VARIABLE DELAY FOR RADIO PAGING

In recent years, the communication industries have directed a good deal of attention to the development of devices suitable for delay correction of signals sent to remote transmitters. Paging systems use this form of delay correction and are one of the popular fields to employ these delay units.



10 steps x 5 μs plus Fixed Delay	
Part No.	Fixed Delay Micro-seconds
AV400-0-50	0
AV400-50-50	50
AV400-100-50	100
AV400-150-50	150
AV400-200-50	200
AV400-250-50	250
AV400-300-50	300
AV400-350-50	350
AV400-400-50	400
AV400-450-50	450

10 steps x 10 μs plus Fixed Delay	
Part No.	Fixed Delay Micro-seconds
AV400-0-100	0
AV400-50-100	50
AV400-100-100	100
AV400-150-100	150
AV400-200-100	200
AV400-250-100	250
AV400-300-100	300
AV400-350-100	350
AV400-400-100	400

Total Delay Tolerance 5%.
Impedance 600 ohms unbalanced.
Bandwidth — greater than 3.2 KHz.
Units are supplied in metal can 2 x 3½ x 5 inches.
Four 8/32 inserts and the switch are located on one of the 2 x 3½ inch surfaces.
Four turret terminals (input, output and 2 grounds) are located on the opposite 2 x 3½ inch surface.

PART NO. AV-1031-0-1100

Total Delay Tolerances 5% — Insertion Loss 6db

This unit has two rotary switches. One rotary adjusts the delay in steps of one hundred microseconds for a total of 1000 microseconds. The second switch steps the delay up in 10 microsecond increments to 100 microseconds.

All delay outputs are the summation of individual lines. Impedance is 600 ohms unbalanced. Bandwidth for total delay of 1100 microseconds is greater than 3.2 KHz. Units are supplied in a metal can 2" x 11" x 4". Four inserts and 2 switches are located on one of the 11" x 2" surfaces. Four turret terminals (input, output and 2 grounds) are located on the opposite 11" x 2" surface.

PART NO. AV-1031R-0-1100

Same as above except designed for 2 adjacent units to be rack mounted. Size: 3" x 8" x 8"

"LC DIP" THE WORLD'S SMALLEST DUAL-IN-LINE 14 PIN TAPPED LUMPED CONSTANT DELAY LINE

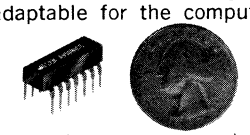
The "LC DIP" represents the smallest delay line currently available. It is a lumped constant delay line offering the ultimate in high density packaging and tapping capabilities.

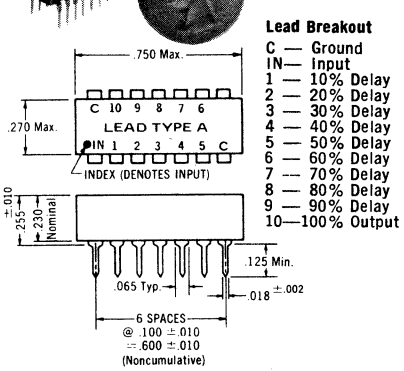
These units are excellent for high frequency applications. The availability of 10 equal delay increments and the dual-in-line packaging along with its low silhouette make for compatibility with semiconductor and other assemblies where circuit board height must be held to a minimum. The foregoing makes the "LC DIP" extremely adaptable for the computer and allied industries.

Part Number	Time Delay (Nano-seconds)	Rise Time (Nano-seconds)	Band-width (MHz)	Max. Atten-uation (%)
IMPEDANCE: 50 OHMS				
LC010Z050B*	10	3.0	120.0	3
LC020Z050B*	20	4.5	80.0	4
LC025Z050B*	25	5.0	72.0	5
LC030Z050 A or B	30	6.0	60.0	6
LC040Z050 A or B	40	8.0	45.0	7
LC050Z050 A or B	50	10.0	36.0	8
LC060Z050 A or B	60	12.0	30.0	10
LC070Z050 A or B	70	14.0	25.7	12
LC080Z050 A or B	80	16.0	22.5	14
LC090Z050 A or B	90	18.0	20.0	15
LC100Z050 A or B	100	20.0	18.0	16
LC150Z050 A or B	150	30.0	12.0	19
LC200Z050 A or B	200	40.0	9.0	22
LC250Z050 A or B	250	50.0	7.2	25
LC300Z050 A or B	300	60.0	6.0	28
LC400Z050 A or B	400	80.0	4.5	34
LC500Z050 A or B	500	100.0	3.6	40

Part Number	Time Delay (Nano-seconds)	Rise Time (Nano-seconds)	Band-width (MHz)	Max. Atten-uation (%)
IMPEDANCE: 100 OHMS				
LC010Z100B*	10	2.5	144.0	4
LC020Z100 A or B	20	4.0	90.0	5
LC025Z100 A or B	25	5.0	72.0	5
LC030Z100 A or B	30	6.0	60.0	6
LC040Z100 A or B	40	8.0	45.0	7
LC050Z100 A or B	50	10.0	36.0	8
LC060Z100 A or B	60	12.0	30.0	9
LC070Z100 A or B	70	14.0	25.7	10
LC080Z100 A or B	80	16.0	22.5	11
LC090Z100 A or B	90	18.0	20.0	12
LC100Z100 A or B	100	20.0	18.0	12
LC150Z100 A or B	150	30.0	12.0	15
LC200Z100 A or B	200	40.0	9.0	23
LC250Z100 A or B	250	50.0	7.2	30
IMPEDANCE: 200 OHMS				
LC025Z200 A or B	25	5.0	72.0	3
LC050Z200 A or B	50	10.0	36.0	5
LC075Z200 A or B	75	15.0	24.0	8
LC100Z200 A or B	100	20.0	18.0	10
LC150Z200 A or B	150	30.0	12.0	14
LC200Z200 A or B	200	40.0	9.0	18

To order specify Part No. followed by the letter "A" or "B".
* Units with asterisk available in "B" Lead Configuration only.
For Lead Configuration "B", call factory and request catalog.





Lead Breakout
C — Ground
IN — Input
1 — 10% Delay
2 — 20% Delay
3 — 30% Delay
4 — 40% Delay
5 — 50% Delay
6 — 60% Delay
7 — 70% Delay
8 — 80% Delay
9 — 90% Delay
10 — 100% Output

Delay Tolerance:
For delays less than 50 nanoseconds: ±10% or 1 nanosecond (whichever is greater).
For delays of 50 nanoseconds or more: ±5% or 4 nanoseconds (whichever is greater).

SERIES "HF", "HR" & "VHR" LUMPED CONSTANT DELAY LINES

HIGHEST TIME DELAY / RISE TIME RATIO EVER BUILT!

These Delay Lines have the highest ratio of time delay to rise time that has ever been built in a Lumped Constant Line. Unlike other types of high ratio lines, the Lumped Constant Delay Line has a passband from D.C. to its cutoff frequency and maintains a constant delay over these frequencies. These lines are also unique in that they offer relatively low insertion loss. The units are characterized by tight time delay tolerances, low pulse distortion, excellent phase linearity and good temperature stability.

To calculate rise time in microseconds, divide the ratio into the delay. To calculate bandwidth, divide rise time in microseconds into .36. Answer will be in MHz. Attenuation range 9 to 20db.

"HF"

50/1 RATIO
Delay Range .25 to 10 microseconds.

75/1 RATIO
Delay Range .5 to 10 microseconds.

100/1 RATIO
Delay Range 1 to 10 microseconds.

"HR"

100/1 RATIO
Delay Range 11 to 500 microseconds.

130/1 RATIO
Delay Range 5 to 500 microseconds.

"VHR"

150/1 RATIO
Delay Range 5 to 500 microseconds.

200/1 RATIO
Delay Range 10 to 75 microseconds.

250/1 RATIO
Delay Range 20 to 100 microseconds.

TTL Digital Delay Module, 5 TAP

- TTL input and outputs
- Precise and stable delays
- Reliable hybrid construction
- No external components required
- Fan out 10 TTL loads/tap, 20 TTL loads/package
- Operating temperature 0° to 70°C
- Storage temperature −55° to +125°C

Electrical Characteristics:

VIH (High level input voltage) ..2.0 to 5.0V
IIH (High level input current) ..50 μA Max.
VIL (Low level input voltage) ....0.8V Max.
IIL (Low level input current) . −2 ma Max.
VOH (High level output voltage) ..2.5V Min.
VOL (Low level output voltage) ..0.5V Max.
VCC (Supply voltage) .....5.0V ±0.25 VDC
ICC (Supply current) ..... 75 ma Max.
Specifications subject to change without notice.

Test Conditions:

1) All measurements are made @ 25°C
2) VCC is maintained @ 5.0 VDC
3) All measurements are made with no loads on outputs
4) Delays are measured @ 1.5V level
5) Delays and tolerances for leading edges only (TPLH) — falling edges (TPHL) closely matched to TPLH

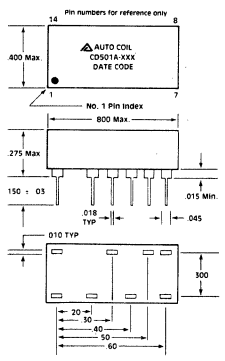
Input Conditions:

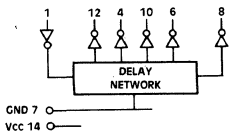
1) Pulse amplitude 3.20V
2) Input rise time 3.0 NS (10 to 90%)
3) Pulse width 2 x total delay
4) Duty cycle < 25%

Input and test conditions are not limiting parameters.

CD501 SERIES, 14 PIN DIP

COMMERCIAL VERSION





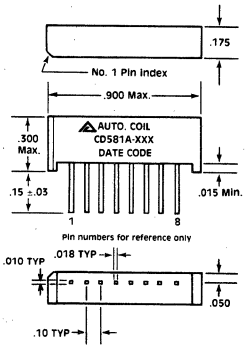
Mechanical Specifications:
Case: Epoxy filled D.A.P.
Leads: Alloy 42 or equiv. solder coated
Marking: White epoxy ink
Also Available:
Intermediate delays
Non symmetrical tap delays
Tighter delay tolerances
Failing edge delay specifications
Non tapped modules
Military versions
LS and ALS versions
Auto insertable modules

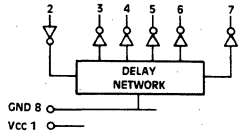
Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater					
Automatic Coil Part Number	PIN 12	PIN 4	PIN 10	PIN 6	PIN 8
CD501A-101	5	10	15	20	25
CD501A-102	6	12	18	24	30
CD501A-103	7	14	21	28	35
CD501A-104	8	16	24	32	40
CD501A-105	9	18	27	36	45
CD501A-106	10	20	30	40	50
CD501A-107	15	30	45	60	75
CD501A-108	20	40	60	80	100
CD501A-109	25	50	75	100	125
CD501A-110	30	60	90	120	150
CD501A-111	40	80	120	160	200
CD501A-112	50	100	150	200	250
CD501A-113	60	120	180	240	300
CD501A-114	70	140	210	280	350
CD501A-115	80	160	240	320	400
CD501A-116	90	180	270	360	450
CD501A-117	100	200	300	400	500

Output rise times (TPLH) 4.0 NS Max. (0.75 to 2.4V level)

CD581 SERIES, 8 PIN SIP

ULTRA THIN SPACE SAVER





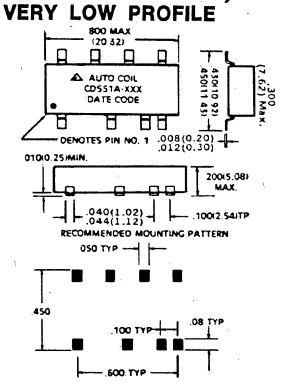
Mechanical Specifications:
Case: Epoxy filled D.A.P.
Leads: Phosphor bronze or equiv. solder coated
Marking: White epoxy ink
Also Available:
Intermediate delays
Non symmetrical tap delays
Tighter delay tolerances
Failing edge delay specifications
Non tapped modules

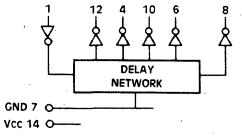
Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater					
Automatic Coil Part Number	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7
CD581A-101	5	10	15	20	25
CD581A-102	6	12	18	24	30
CD581A-103	7	14	21	28	35
CD581A-104	8	16	24	32	40
CD581A-105	9	18	27	36	45
CD581A-106	10	20	30	40	50
CD581A-107	15	30	45	60	75
CD581A-108	20	40	60	80	100
CD581A-109	25	50	75	100	125
CD581A-110	30	60	90	120	150
CD581A-111	40	80	120	160	200
CD581A-112	50	100	150	200	250
CD581A-113	60	120	180	240	300
CD581A-114	70	140	210	280	350
CD581A-115	80	160	240	320	400
CD581A-116	90	180	270	360	450
CD581A-117	100	200	300	400	500

Output rise times (TPLH) 4.0 NS Max. (0.75 to 2.4V level)

CD551 SERIES, 14 PIN SMD

VERY LOW PROFILE





Mechanical Specifications:
Case: Transfer molded epoxy
Leads: Phosphor bronze or equiv. solder coated
Marking: White epoxy ink
Also Available:
Intermediate delays
Non symmetrical tap delays
Tighter delay tolerances
Falling edge delay specifications
Non tapped modules

Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater					
Automatic Coil Part Number	PIN 12	PIN 4	PIN 10	PIN 6	PIN 8
CD551A-101	5	10	15	20	25
CD551A-102	6	12	18	24	30
CD551A-103	7	14	21	28	35
CD551A-104	8	16	24	32	40
CD551A-105	9	18	27	36	45
CD551A-106	10	20	30	40	50
CD551A-107	15	30	45	60	75
CD551A-108	20	40	60	80	100
CD551A-109	25	50	75	100	125
CD551A-110	30	60	90	120	150
CD551A-111	40	80	120	160	200
CD551A-112	50	100	150	200	250
CD551A-113	60	120	180	240	300
CD551A-114	70	140	210	280	350
CD551A-115	80	160	240	320	400
CD551A-116	90	180	270	360	450
CD551A-117	100	200	300	400	500

Output rise times (TPLH) 4.0 NS Max. (0.75 to 2.4V level)

COMPLETE TECHNICAL SPECIFICATIONS SHOWN IN CATALOG AC-37, AVAILABLE FREE UPON REQUEST.

Automatic Coil Corp.
SUBSIDIARY OF DESIGNATRONICS, INC.
Dept. E 455 East 10th Avenue, Hialeah, Florida 33010
Telephone: (305) 883-5311, TWX: 810-848-8097, FAX: (305) 885-2449

TTL Digital Delay Module

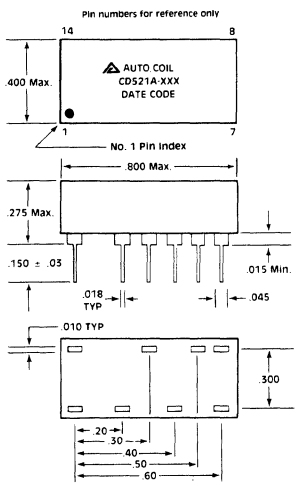
- TTL input and outputs
- Usable for pulse widths to 20% of total delay
- Precise and stable delays
- Reliable hybrid construction
- No external components required
- Fan out 10 TTL loads/tap, 20 TTL loads/package
- Operating temperature 0° to 70°C
- Storage temperature −55° to +125°C

Electrical Characteristics:

VIH (High level input voltage) ..2.0 to 5.0V
IIH (High level input current) ..50 μA Max.
VIL (Low level input voltage) ....0.8V Max.
IIL (Low level input current) . −2 ma Max.
VOH (High level output voltage) ..2.5V Min.
VOL (Low level output voltage) ..0.5V Max.
VCC (Supply voltage) .....5.0V ±0.25 VDC
Specifications subject to change without notice.

CD521 SERIES 14 PIN, 5 TAP

CONTROLLED LEADING AND FALLING EDGES



Test Conditions:

1) All measurements are made @ 25°C
2) VCC is maintained @ 5.0 VDC
3) All measurements are made with no loads on outputs
4) Delays are measured @ 1.5V level
5) Delays and tolerances for leading and falling edges

Input Conditions:

1) Pulse amplitude: 3.20V
2) Input rise time: 3.0 NS (10 to 90%)
3) Pulse width 2 x total delay delay
4) Duty cycle: < 25%

Also Available:

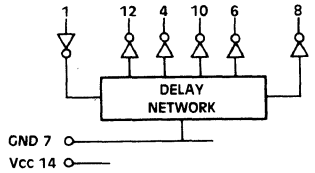
Intermediate delays
Non symmetrical tap delays
Tighter delay tolerances
Non tapped modules
Input and test conditions are not limiting parameters.

ICC (Supply Current) ..... 75 ma Max.

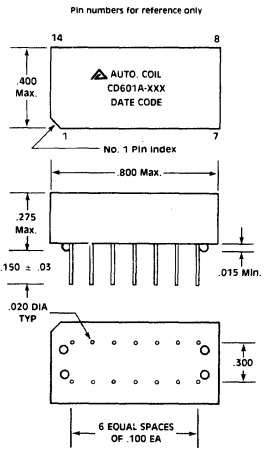
Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater

Automatic Coil Part Number	PIN 12	PIN 4	PIN 10	PIN 6	PIN 8
CD521A-101	5	10	15	20	25
CD521A-102	6	12	18	24	30
CD521A-103	7	14	21	28	35
CD521A-104	8	16	24	32	40
CD521A-105	9	18	27	36	45
CD521A-106	10	20	30	40	50
CD521A-107	15	30	45	60	75
CD521A-108	20	40	60	80	100
CD521A-109	25	50	75	100	125
CD521A-110	30	60	90	120	150
CD521A-111	40	80	120	160	200
CD521A-112	50	100	150	200	250
CD521A-113	60	120	180	240	300
CD521A-114	70	140	210	280	350
CD521A-115	80	160	240	320	400
CD521A-116	90	180	270	360	450
CD521A-117	100	200	300	400	500

Output rise times (TPLH) 4.0 NS Max. (0.75 to 2.4V level)



CD601 SERIES 14 PIN, 10 TAP



Test Conditions:

1) All measurements are made @ 25°C
2) VCC is maintained @ 5.0 VDC
3) All measurements are made with no loads on outputs
4) Delays are measured @ 1.5V level
5) Delays and tolerances for leading edges only (TPLH) — falling edges (TPHL) closely matched to TPLH

Input Conditions:

1) Pulse amplitude: 3.20V
2) Input rise time: 3.0 NS (10 to 90%)
3) Pulse width: 2 x total delay
4) Duty cycle: < 25%

Also Available:

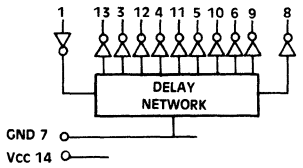
Intermediate delays
Non symmetrical tap delays
Tighter delay tolerances
Falling edge delay specifications
Input and test conditions are not limiting parameters.

ICC (Supply Current) .....150 ma Max.

Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater

Automatic Coil Part Number	Total Delay	Tap Delay
CD601A-101	50	5.0
CD601A-102	75	7.5
CD601A-103	100	10.0
CD601A-104	150	15.0
CD601A-105	200	20.0
CD601A-106	250	25.0
CD601A-107	300	30.0
CD601A-108	350	35.0
CD601A-109	400	40.0
CD601A-110	450	45.0
CD601A-111	500	50.0
CD601A-112	600	60.0
CD601A-113	700	70.0
CD601A-114	800	80.0
CD601A-115	900	90.0
CD601A-116	1000	100.0

Output rise times (TPLH) 4.0 NS Max. (0.75 to 2.4V level)



Ask about our military version.

COMPLETE TECHNICAL SPECIFICATIONS SHOWN IN CATALOG AC-37, AVAILABLE FREE UPON REQUEST.

Automatic Coil Corp.
SUBSIDIARY OF DESIGNATRONICS, INC.
Dept. E, 455 East 10th Avenue, Hialeah, Florida 33010
Telephone: (305) 883-5311, TWX 810-848-8097, FAX (305) 885-2449

TTL Digital Delay Module

CD500/502 Series
14 PIN, SINGLE & MULTI DELAY MODULE

- TTL input and outputs
- Precise and stable delays
- Reliable hybrid construction
- No external components required
- Fan out 10 TTL loads/tap, 20 TTL loads/package
- Operating temperature 0° to 70°C
- Storage temperature −55° to +125°C

Electrical Characteristics:

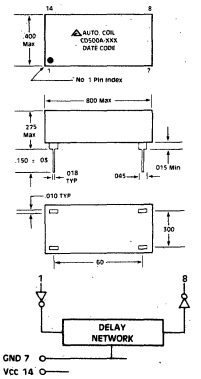
VIH (High level input voltage) ..2.0 to 5.0V
IIH (High level input current) ..50 μA Max.
VIL (Low level input voltage) ....0.8V Max.
IIL (Low level input current) . −2 ma Max.
VOH (High level output voltage) ..2.5V Min.
VOL (Low level output voltage) ..0.5V Max.
VCC (Supply voltage) .....5.0V ±0.25 VDC
Specifications subject to change without notice.

Also Available:

Intermediate delays
Lower profiles
Tighter delay tolerances
Falling edge delay specifications
tapped modules
Military versions, LS, AS and ALS modules

CD500A SERIES

Pin numbers for reference only



Test Conditions:
1) All measurements are made @ 25°C
2) VCC is maintained @ 5.0 VDC
3) All measurements are made with no loads on outputs
4) Delay measured @ 1.5V level
5) Delay and tolerance for leading edges only (TPLH) — falling edges (TPHL) closely matched to TPLH

Input Conditions:
1) Pulse amplitude: 3.20V
2) Input rise time: 3.0 NS (10 to 90%)
3) Pulse width: 2 x total delay
4) Duty cycle: < 25%

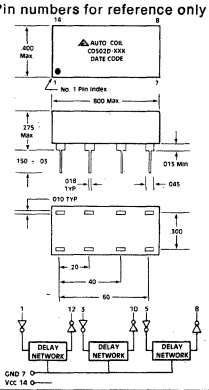
Input and test conditions are not limiting parameters.

Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater			
Automatic Coil Part Number	PIN 1 to 8	Automatic Coil Part Number	PIN 1 to 8
CD500A-101	6	CD500A-118	60
CD500A-102	8	CD500A-119	70
CD500A-103	10	CD500A-120	80
CD500A-104	12	CD500A-121	90
CD500A-105	14	CD500A-122	100
CD500A-106	16	CD500A-123	110
CD500A-107	18	CD500A-124	120
CD500A-108	20	CD500A-125	130
CD500A-109	22	CD500A-126	140
CD500A-110	24	CD500A-127	150
CD500A-111	26	CD500A-128	200
CD500A-112	28	CD500A-129	250
CD500A-113	30	CD500A-130	300
CD500A-114	35	CD500A-131	350
CD500A-115	40	CD500A-132	400
CD500A-116	45	CD500A-133	450
CD500A-117	50	CD500A-134	500

Output rise times (TPLH) 4.0 NS Max. (0.75 to 2.4V level)

CD502D SERIES

Pin numbers for reference only



Test Conditions:
1) All measurements are made @ 25°C
2) VCC is maintained @ 5.0 VDC
3) All measurements are made with no loads on outputs
4) Delays are measured @ 1.5V level
5) Delays and tolerances for leading edges only (TPLH) — falling edges (TPHL) closely matched to TPLH

Input Conditions:
1) Pulse amplitude: 3.20V
2) Input rise time: 3.0 NS (10 to 90%)
3) Pulse width: 3 x total delay
4) Duty cycle: < 25%

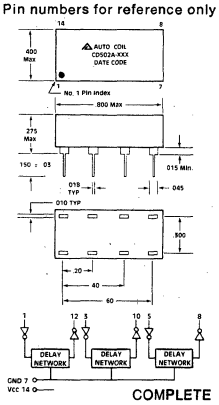
Input and test conditions are not limiting parameters.

Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater		
Automatic Coil Part Number	PIN 1 to 12	PIN 5 to 8
CD502D-151	5	5
CD502D-152	10	10
CD502D-153	20	20
CD502D-154	30	30
CD502D-155	40	40
CD502D-156	50	50
CD502D-157	60	60
CD502D-158	70	70
CD502D-159	80	80
CD502D-160	90	90
CD502D-161	100	100
CD502D-171	5	20
CD502D-172	10	20
CD502D-173	10	30
CD502D-174	20	50
CD502D-175	50	100

Output rise times (TPLH) 4.0 NS Max. (0.75 to 2.4V level)

CD502A SERIES

Pin numbers for reference only



Test Conditions:
1) All measurements are made @ 25°C
2) VCC is maintained @ 5.0 VDC
3) All measurements are made with no loads on outputs
4) Delays are measured @ 1.5V level
5) Delays and tolerances for leading edges only (TPLH) — falling edges (TPHL) closely matched to TPLH

Input Conditions:
1) Pulse amplitude: 3.20V
2) Input rise time: 3.0 NS (10 to 90%)
3) Pulse width: 3 x total delay
4) Duty cycle: < 25%

Input and test conditions are not limiting parameters.

Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater			
Automatic Coil Part Number	PIN 1 to 12	PIN 3 to 10	PIN 5 to 8
CD502A-101	5	5	5
CD502A-102	10	10	10
CD502A-103	20	20	20
CD502A-104	30	30	30
CD502A-105	40	40	40
CD502A-106	50	50	50
CD502A-107	60	60	60
CD502A-108	70	70	70
CD502A-109	80	80	80
CD502A-110	90	90	90
CD502A-111	100	100	100
CD502A-121	5	10	20
CD502A-122	10	20	20
CD502A-123	10	10	30
CD502A-124	20	30	50
CD502A-125	50	50	100

Output rise time (TPLH) 4.0 NS Max. (0.75 to 2.4V level)

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Telephone: (305) 883-5311, TWX: 810-848-8097, FAX: (305) 885-2449

Passive Delay Line

- Standard packages
- Compatible with various logic systems including TTL and video
- Precise and stable delays
- Reliable hybrid construction
- Designed to meet MIL-D-23859
- Operating temperature −55° to +125°C

Electrical Characteristics:

Total delay tolerances: ±2 NS or 5%, whichever is greater
Tap interval tolerances:
Below 5.0 NS: ±0.5 NS or ±20%, whichever is greater
5 NS and above: ±1.0 NS or ±10%, whichever is greater
Impedance tolerance: ±10%
Temperature coefficient: 100 PPM/°C
Dielectric strength: 100 VDC @ 50 ma 5 Sec. Min.
Insulation resistance: 1000MΩ Min.
Attenuation: 10% Max.

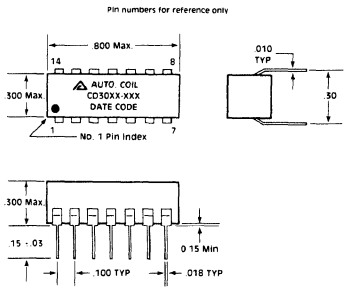
Specifications subject to change without notice.

Test Conditions:

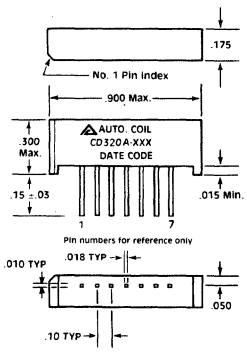
1) All measurements are made @ 25°C
2) Delays are measured @ 50% points
3) Rise times are measured from 10% to 90% points
4) Pulse width 3 x total delay

Input and test conditions are not limiting parameters.

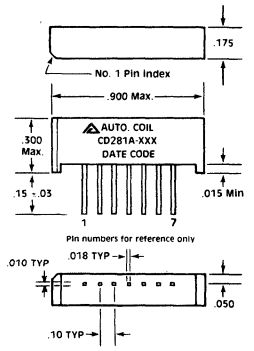
CD300 SERIES 14 PIN DIP



CD320 SERIES 14 PIN SMD

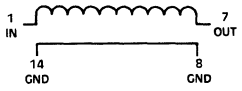


CD281 SERIES 7 PIN SIP

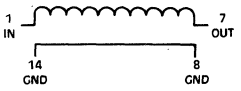


Total Delay (nsec)	Tap Interval (nsec)	Rise Time (nsec)	Automatic Coil Part Number				
			50Ω	100Ω	200Ω	350Ω	500Ω
5	.5	2.5	CDXXXX-101	CDXXXX-121	CDXXXX-141	CDXXXX-201	CDXXXX-221
10	1.0	3.5	CDXXXX-102	CDXXXX-122	CDXXXX-142	CDXXXX-202	CDXXXX-222
15	1.5	4.5	CDXXXX-103	CDXXXX-123	CDXXXX-143	CDXXXX-203	CDXXXX-223
20	2.0	5.5	CDXXXX-104	CDXXXX-124	CDXXXX-144	CDXXXX-204	CDXXXX-224
25	2.5	6.0	CDXXXX-105	CDXXXX-125	CDXXXX-145	CDXXXX-205	CDXXXX-225
30	3.0	6.5	CDXXXX-106	CDXXXX-126	CDXXXX-146	CDXXXX-206	CDXXXX-226
35	3.5	7.0	CDXXXX-107	CDXXXX-127	CDXXXX-147	CDXXXX-207	CDXXXX-227
40	4.0	8.0	CDXXXX-108	CDXXXX-128	CDXXXX-148	CDXXXX-208	CDXXXX-228
45	4.5	9.0	CDXXXX-109	CDXXXX-129	CDXXXX-149	CDXXXX-209	CDXXXX-229
50	5.0	10.0	CDXXXX-110	CDXXXX-130	CDXXXX-150	CDXXXX-210	CDXXXX-230
60	6.0	12.0	CDXXXX-111	CDXXXX-131	CDXXXX-151	CDXXXX-211	CDXXXX-231
70	7.0	14.0	CDXXXX-112	CDXXXX-132	CDXXXX-152	CDXXXX-212	CDXXXX-232
80	8.0	16.0	CDXXXX-113	CDXXXX-133	CDXXXX-153	CDXXXX-213	CDXXXX-233
90	9.0	18.0	CDXXXX-114	CDXXXX-134	CDXXXX-154	CDXXXX-214	CDXXXX-234
100	10.0	20.0	CDXXXX-115	CDXXXX-135	CDXXXX-155	CDXXXX-215	CDXXXX-235
125	12.5	25.0	CDXXXX-116	CDXXXX-136	CDXXXX-156	CDXXXX-216	CDXXXX-236
150	15.0	30.0	CDXXXX-117	CDXXXX-137	CDXXXX-157	CDXXXX-217	CDXXXX-237
200	20.0	40.0	CDXXXX-118	CDXXXX-138	CDXXXX-158	CDXXXX-218	CDXXXX-238
250	25.0	50.0	CDXXXX-119	CDXXXX-139	CDXXXX-159	CDXXXX-219	CDXXXX-239
300	30.0	60.0	CDXXXX-120	CDXXXX-140	CDXXXX-160	CDXXXX-220	CDXXXX-240

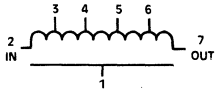
STYLE CD300D



STYLE CD320D

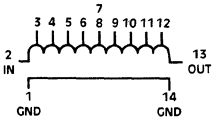


STYLE CD281A

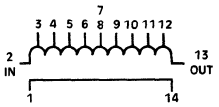


Tap delay 2 x listed interval.

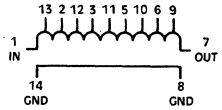
STYLE CD301K



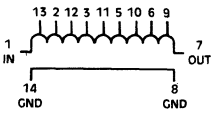
STYLE CD321K



STYLE CD301A



STYLE CD321A



Also Available:
Intermediate delays
Special taps
Electrical parameters other than listed
Independent delay increments
Internal terminations
Tighter tolerances
Auto insertable versions

COMPLETE TECHNICAL SPECIFICATIONS SHOWN IN CATALOG AC-37, AVAILABLE FREE UPON REQUEST.

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bel defining a degree of excellence

series 0447 DIGITAL

14 PIN - 5 TAP

TECHNICAL INFORMATION

Bel Fuse Digital Delay Lines Series 0447 features five equally tapped delay lines with total delays of 25 to 500 nanoseconds. The lines are compatible with TTL and DTL circuits. Either Logic "1" or Logic "0" inputs are accepted. Cascading of units causes no undesirable reflections. The reduced dimensions, with standard Dip Pin-Out permits dense packaging on your circuit board.
Special designs upon request.

INPUT TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec.
Pulse Width	Min. 40% of Total Delay
Supply Current	60 ma typ
Supply Voltage	5.0 Volts

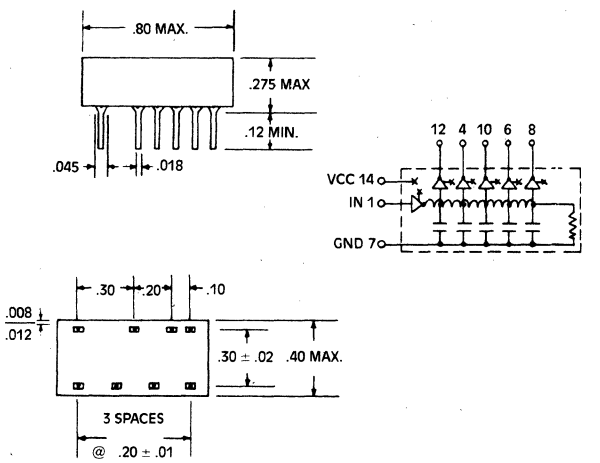
ELECTRICAL CHARACTERISTICS

Supply Voltage Vcc	4.75 to 5.25 Volts
Logic 1 Input Current	50 Microamps Max.
Logic 0 Input Current	−2 Milliamps Max.
Logic 1 Output Voltage	2.6 Volts Min.
Logic 0 Output Voltage	.5 Volts Max.

DRIVE CAPABILITIES

Logic 0 Output	10 TTL Loads/Tap Max. (20 TTL) Loads/Unit Max.)
Logic 1 Output	10 TTL Loads/Unit Max.

- COMPATIBLE WITH TTL AND DTL CIRCUITS
- DELAY TOLERANCE ± 2Nsec or 5% WHICHEVER IS GREATER FROM INPUT TO TAP
- TAP TO TAP DELAY ± 2Nsec or 7% WHICHEVER IS GREATER
- OPERATING TEMPERATURE RANGE 0°C to 70°C
- OTHER DELAYS UPON REQUEST



Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
0447-0025-02	25NS	5NS	4NS
0447-0050-02	50NS	10NS	4NS
0447-0100-02	100NS	20NS	4NS
0447-0150-02	150NS	30NS	4NS
0447-0200-02	200NS	40NS	4NS
0447-0250-02	250NS	50NS	4NS
0447-0300-02	300NS	60NS	4NS
0447-0350-02	350NS	70NS	4NS
0447-0400-02	400NS	80NS	4NS
0447-0450-02	450NS	90NS	4NS
0447-0500-02	500NS	100NS	4NS

1 Delays measured at 1.5 Volt level on Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on taps.

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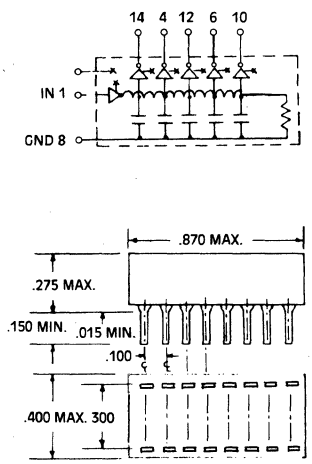
DELAY LINES

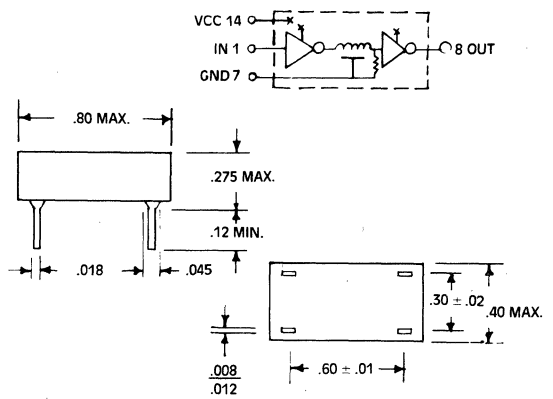
16 PIN - 5 TAP



Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
0447-0025-01	25NS	5NS	4NS
0447-0050-01	50NS	10NS	4NS
0447-0100-01	100NS	20NS	4NS
0447-0150-01	150NS	30NS	4NS
0447-0200-01	200NS	40NS	4NS
0447-0250-01	250NS	50NS	4NS
0447-0300-01	300NS	60NS	4NS
0447-0350-01	350NS	70NS	4NS
0447-0400-01	400NS	80NS	4NS
0447-0450-01	450NS	90NS	4NS
0447-0500-01	500NS	100NS	4NS

1 Delays measured at 1.5 Volt level on Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on taps.

FIXED DELAY



Part Number	Total Delay 4, 3	Rise Time 2, 3	Part Number	Total Delay 4, 3	Rise Time 2, 3
0447-0010-06	10NS	4NS	0447-0125-06	125NS	4NS
0447-0020-06	20NS	4NS	0447-0150-06	150NS	4NS
0447-0030-06	30NS	4NS	0447-0175-06	175NS	4NS
0447-0040-06	40NS	4NS	0447-0200-06	200NS	4NS
0447-0050-06	50NS	4NS	0447-0250-06	250NS	4NS
0447-0060-06	60NS	4NS	0447-0300-06	300NS	4NS
0447-0070-06	70NS	4NS	0447-0350-06	350NS	4NS
0447-0080-06	80NS	4NS	0447-0400-06	400NS	4NS
0447-0090-06	90NS	4NS	0447-0450-06	450NS	5NS
0447-0100-06	100NS	4NS	0447-0500-06	500NS	5NS

2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on taps.
4 Delays measured at 1.5 Volts on Leading Edge and Trailing Edge.

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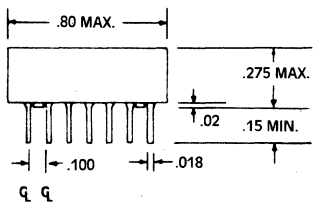
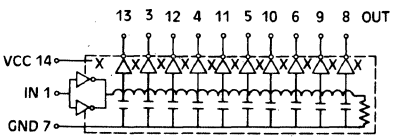
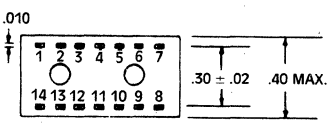
bel defining a degree of excellence

DIGITAL DELAY LINE SERIES 0447
10 TAP

- Compatible with TTL and DTL circuits
- Delay tolerance ± 2NSec or 5% whichever is greater from input to tap
- Tap to Tap Delay ± 2NSec or 7% whichever is greater
- Operating temperature range 0°C to 70°C
- Other delays upon request







Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
0447-0050-10	50NS	5NS	4NS
0447-0100-10	100NS	10NS	4NS
0447-0150-10	150NS	15NS	4NS
0447-0200-10	200NS	20NS	4NS
0447-0250-10	250NS	25NS	4NS
0447-0300-10	300NS	30NS	4NS
0447-0350-10	350NS	35NS	4NS
0447-0400-10	400NS	40NS	4NS
0447-0500-10	500NS	50NS	5NS
0447-0750-10	750NS	75NS	5NS
0447-1000-10	1000NS	100NS	5NS

1 Delays measured at 1.5 Volt level on Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on taps.

INPUT TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec.
Supply Current	120 ma TYP
Pulse Width	Min. of 40% Delay

ELECTRICAL CHARACTERISTICS

Supply Voltage Vcc	4.75 to 5.25 Volts
Logic 1 Input Current	100 Microamps Max.
Logic 0 Input Current	−4 Milliamps Max.
Logic 1 Output Voltage	2.6 Volts Min.
Logic 0 Output Voltage	.5 Volts Max.

DRIVE CAPABILITIES

Logic 0 Output	10 TTL Loads/Tap Max. (20 TTl Loads/Unit Max.)
Logic 1 Output	10 TTL Loads/Unit Max.

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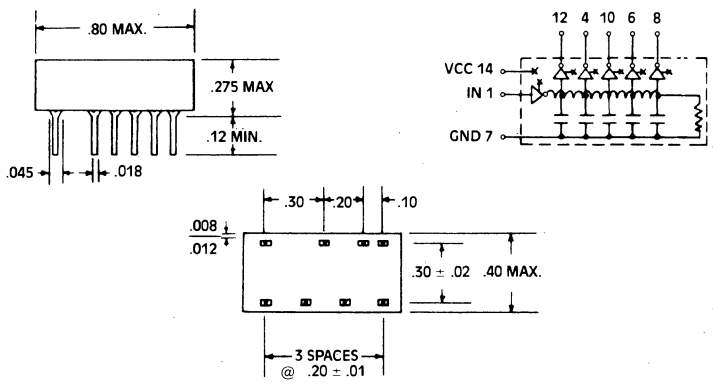
DIGITAL DELAY LINE SERIES 0447
CONTROLLED LEADING AND TRAILING EDGE DELAY MODULE
5 TAP

- Compatible with TTL and DTL circuits
- Delay tolerance ± 2Nsec or 5% whichever is greater from input to tap
- Tap to Tap Delay ± 2Nsec or 7% whichever is greater
- Operating temperature range 0°C to 70°C
- Other delays upon request



Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
0447-0025-A1	25NS	5NS	4NS
0447-0050-A1	50NS	10NS	4NS
0447-0100-A1	100NS	20NS	4NS
0447-0150-A1	150NS	30NS	4NS
0447-0200-A1	200NS	40NS	4NS
0447-0250-A1	250NS	50NS	4NS
0447-0300-A1	300NS	60NS	4NS
0447-0350-A1	350NS	70NS	4NS
0447-0400-A1	400NS	80NS	4NS
0447-0450-A1	450NS	90NS	4NS
0447-0500-A1	500NS	100NS	5NS

1 Delays measured at 1.5 Volt level on Leading and Trailing Edge.
2 Rise and Fall Times measured from .75 to 2.4 Volts.
3 Measured with 1 STTL (15PF) load per tap.

INPUT TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec.
Pulse Width	Min. of 40% of Total Delay
Supply Current	60 ma typ
Supply Voltage	5.0 Volts
PRR	Min 3 × Pulse Width

ELECTRICAL CHARACTERISTICS

Supply Voltage Vcc	4.75 to 5.25 Volts
Logic 1 Input Current	50 Microamps Max.
Logic 0 Input Current	−2 Milliamps Max.
Logic 1 Output Voltage	2.6 Volts Min.
Logic 0 Output Voltage	.5 Volts Max.

DRIVE CAPABILITIES

Logic 0 Output	10 TTL Loads/Tap Max. (20 TTL Loads/Unit Max.)
Logic 1 Output	10 TTL Loads/Unit Max.

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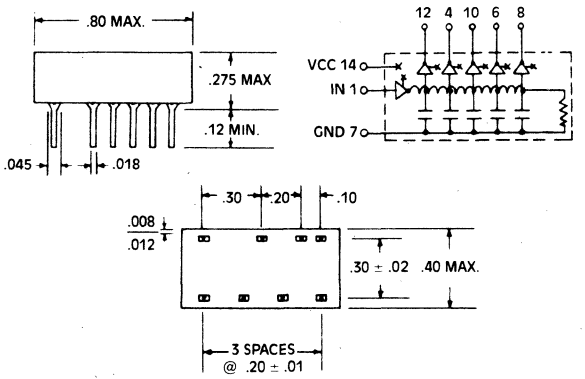
DIGITAL DELAY LINE SERIES 0447
LOW POWER MODULE 20MA TYP

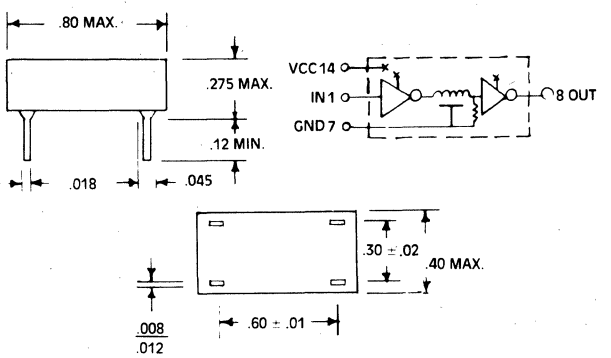
- Compatible with TTL and DTL circuits
- Delay tolerance ± 2Nsec or 5% whichever is greater from input to tap
- Tap to Tap Delay ± 2Nsec or 7% whichever is greater
- Operating temperature range 0°C to 70°C
- Other delays upon request

5 TAP



Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
0447-0025-09	25NS	5NS	8NS
0447-0050-09	50NS	10NS	8NS
0447-0100-09	100NS	20NS	8NS
0447-0150-09	150NS	30NS	8NS
0447-0200-09	200NS	40NS	8NS
0447-0250-09	250NS	50NS	8NS
0447-0300-09	300NS	60NS	8NS
0447-0350-09	350NS	70NS	8NS
0447-0400-09	400NS	80NS	8NS
0447-0450-09	450NS	90NS	8NS
0447-0500-09	500NS	100NS	8NS

FIXED DELAY



Part Number	Total Delay 1, 3	Rise Time 2, 3	Part Number	Total Delay 1, 3	Rise Time 2, 3
0447-0010-08	10NS	8NS	0447-0125-08	125NS	8NS
0447-0020-08	20NS	8NS	0447-0150-08	150NS	8NS
0447-0030-08	30NS	8NS	0447-0175-08	175NS	8NS
0447-0040-08	40NS	8NS	0447-0200-08	200NS	8NS
0447-0050-08	50NS	8NS	0447-0250-08	250NS	8NS
0447-0060-08	60NS	8NS	0447-0300-08	300NS	8NS
0447-0070-08	70NS	8NS	0447-0350-08	350NS	8NS
0447-0080-08	80NS	8NS	0447-0400-08	400NS	8NS
0447-0090-08	90NS	8NS	0447-0450-08	450NS	8NS
0447-0100-08	100NS	8NS	0447-0500-08	500NS	8NS

[1] Delays measured at 1.5 Volt level on Leading Edge only.
[2] Rise Times measured from .8 Volts to 2 Volts.
[3] Measured with no loads on taps.

INPUT TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec.
Pulse Width	Min. of 40% of Total Delay
Supply Current	20 ma typ.
Supply Voltage	5.0 Volts

ELECTRICAL CHARACTERISTICS

Supply Voltage Vcc	4.75 to 5.25 Volts
Logic 1 Input Current	20 Microamps Max.
Logic 0 Input Current	−.4 Milliamps Max.
Logic 1 Output Voltage	2.6 Volts Min.
Logic 0 Output Voltage	.5 Volts Max.

DRIVE CAPABILITIES

Logic 0 Output	10 TTL Loads/Tap Max. (20 TTL Loads/Unit Max.)
Logic 1 Output	10 TTL Loads/Unit Max.

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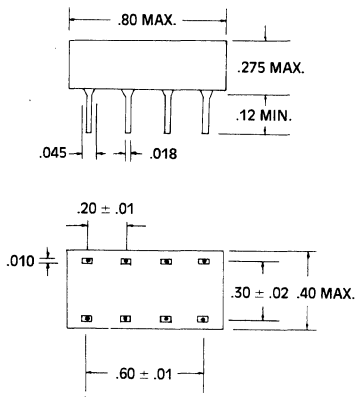
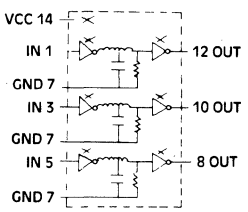
DIGITAL DELAY LINE SERIES 0447
TRIPLE OUTPUT MODULE

- Compatible with TTL and DTL circuits
- Operating temperature range 0°C to 70°C
- Other delays upon request





Part Number	Delay Time 1, 3	Rise Time 2, 3
0447-0010-A3	10 NS ± 1.5 NS	3 NS
0447-0020-A3	20 NS ± 1.5 NS	3 NS
0447-0030-A3	30 NS ± 2.0 NS	3 NS
0447-0040-A3	40 NS ± 2.0 NS	3 NS
0447-0050-A3	50 NS ± 2.5 NS	3 NS
0447-0060-A3	60 NS ± 3.0 NS	4 NS
0447-0070-A3	70 NS ± 3.5 NS	4 NS
0447-0080-A3	80 NS ± 4.0 NS	4 NS
0447-0090-A3	90 NS ± 4.0 NS	4 NS
0447-0100-A3	100 NS ± 5.0 NS	4 NS
0447-0125-A3	125 NS ± 6.0 NS	4 NS

1 Delays measured at 1.5 Volt Leading Edge only.
2 Rise Times measured from .75 to 2.4 Volts.
3 Measured with 1 STTL load (15PF) on each output.

INPUT TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3 Nsec.
Pulse Width	Min. 100% of Total Delay
Supply Current	Constant "0" in 115 ma max. Constant "1" in 90 ma max.
Supply Voltage	5.0 Volts

ELECTRICAL CHARACTERISTICS

Supply Voltage Vcc	4.75 Volts to 5.25 Volts
Logic 1 Input Current	50 μa max.
Logic 0 Input Current	−2 ma max.
Logic 1 Output Voltage	2.6 Volts min.
Logic 0 Output Voltage	.5 Volts max.
Temperature Coefficient	1.5 Nsec + 100 ppm/°C max.

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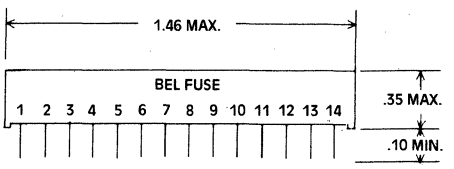
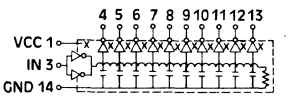
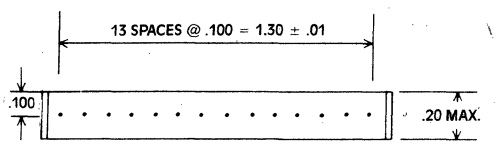
DIGITAL DELAY LINE SERIES 0447
SINGLE-IN-LINE
10 TAP

- Compatible with TTL and DTL circuits
- Delay tolerance ± 2Nsec or 5% whichever is greater from input to tap
- Tap to Tap Delay ± 2Nsec or 7% whichever is greater
- Operating temperature range 0°C to 70°C
- Other delays upon request





Pins .012 × .020 flat lead
or 24 awg tinned copper



Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
0447-0050-07	50NS	5NS	4NS
0447-0100-07	100NS	10NS	4NS
0447-0150-07	150NS	15NS	4NS
0447-0200-07	200NS	20NS	4NS
0447-0250-07	250NS	25NS	4NS

1 Delays measured at 1.5 Volt level Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on taps.

INPUT TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec.
Pulse Width	Min. 40% of Total Delay
Supply Current	120 ma typ
Supply Voltage	5.0 Volts

ELECTRICAL CHARACTERISTICS

Supply Voltage Vcc	4.75 to 5.25 Volts
Logic 1 Input Current	100 Microamps Max.
Logic 0 Input Current	−4 Milliamps Max.
Logic 1 Output Voltage	2.6 Volts Min.
Logic 0 Output Voltage	.5 Volts Max.

DRIVE CAPABILITIES

Logic 0 Output	10 TTL Loads/Tap Max. (20 TTL Loads/Unit Max.)
Logic 1 Output	10 TTL Loads/Unit Max.

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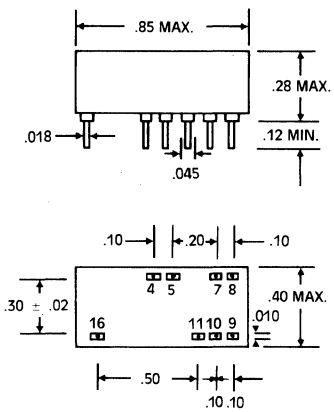
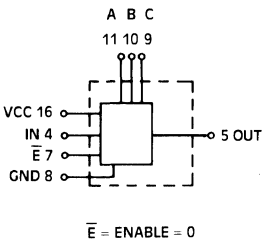
DIGITAL DELAY LINE SERIES 0449
TTL PROGRAMMABLE LOGIC DELAY MODULE
3 BIT





Part Number	*Min. Delay 1, 2	**Max. Delay 1, 2	ΔDelay/Step 1, 2
0449-0014-07	7 ± .5NS	14NS	1 ± .5NS
0449-0021-07	7 ± .5NS	21NS	2 ± .6NS
0449-0028-07	7 ± .5NS	28NS	3 ± .7NS
0449-0035-07	7 ± .5NS	35NS	4 ± .8NS
0449-0042-07	7 ± .5NS	42NS	5 ± 1.0NS
0449-0049-07	7 ± .5NS	49NS	6 ± 1.2NS
0449-0056-07	7 ± .5NS	56NS	7 ± 1.4NS
0449-0063-07	7 ± .5NS	63NS	8 ± 1.6NS
0449-0070-07	7 ± .5NS	70NS	9 ± 1.8NS
0449-0077-07	7 ± .5NS	77NS	10 ± 2.0NS

Max. Delay Tolerances ± 2NS or 5% whichever is greater

1 Delays measured at 1.5 Volt level on Leading Edge only.
2 Measured with no loads on taps.

C	B	A	
0	0	0	*
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	**

INPUT TEST CONDITIONS

Pulse Voltage	3 Volts
Rise Time	3 Nsec.
Pulse Width	150% of Max. Delay
Supply Current	40 ma typ
Supply Voltage	5.0 Volts

ELECTRICAL CHARACTERISTICS

Supply Voltage Vcc	4.75 to 5.25 Volts
Logic 1 Input Voltage	2.5 Volts Min. 5.5 Volts Max.
Logic 0 Input Voltage	.8 Volts Max.
Logic 1 Output Voltage	2.5 Volts Min.
Logic 0 Output Voltage	0.5 Volts Max.
Temperature Range	0°C to 70°C
Temperature Coefficient	400 PPM/°C Max.

DRIVE CAPABILITIES

Fan Out	10 TTL Loads Max.

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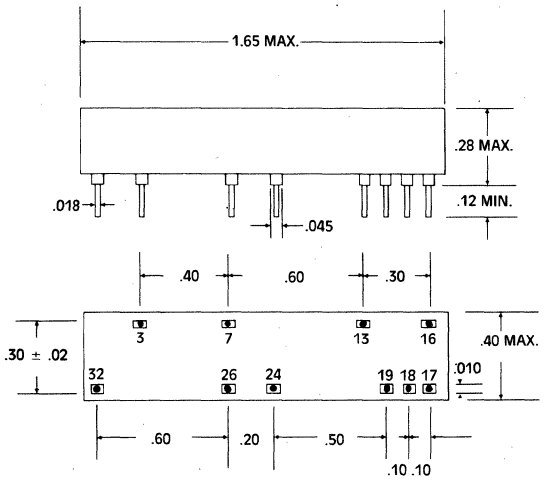
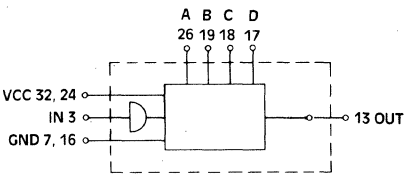
DIGITAL DELAY LINE SERIES 0449
TTL PROGRAMMABLE LOGIC DELAY MODULE
4 BIT





Part Number	Min. Delay 1, 2	**Max. Delay 1, 2	ΔDelay/Step 1, 2
0449-0030-15	15 ± .1NS	30NS	1 ± .7NS
0449-0045-15	15 ± .1NS	45NS	2 ± .7NS
0449-0060-15	15 ± .1NS	60NS	3 ± .7NS
0449-0075-15	15 ± .1NS	75NS	4 ± .8NS
0449-0090-15	15 ± .1NS	90NS	5 ± 1.0NS
0449-0105-15	15 ± .1NS	105NS	6 ± 1.2NS
0449-0120-15	15 ± .1NS	120NS	7 ± 1.4NS
0449-0135-15	15 ± .1NS	135NS	8 ± 1.6NS
0449-0150-15	15 ± .1NS	150NS	9 ± 1.8NS
0449-0165-15	15 ± .1NS	165NS	10 ± 2.0NS

Max. delay tolerances ± 2NS or 5% whichever is greater

1 Delays measured at 1.5 Volt level on Leading Edge only.
2 Measured with no loads on taps.

D	C	B	A	
0	0	0	0	*
0	0	0	1	
0	0	1	0	
0	0	1	1	
0	1	0	0	
0	1	0	1	
0	1	1	0	
0	1	1	1	
1	0	0	0	
1	0	0	1	
1	0	1	0	
1	0	1	1	
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	**

INPUT TEST CONDITIONS

Pulse Voltage	3 Volts
Rise Time	3 Nsec.
Pulse Width	150% of Max. Delay
Supply Current	100 ma typ
Supply Voltage	5.0 Volts

ELECTRICAL CHARACTERISTICS

Supply Voltage Vcc	4.75 to 5.25 Volts
Logic 1 Input Voltage	2.5 Volts Min., 5.5 Volts Max.
Logic 0 Input Voltage	.8 Volts Max.
Logic 1 Output Voltage	2.5 Volts Min.
Logic 0 Output Voltage	0.5 Volts Max.
Temperature Range	0°C to 70°C
Temperature Coefficient	400 PPM/°C Max.

DRIVE CAPABILITIES

Fan Out	10 TTL Loads Max.

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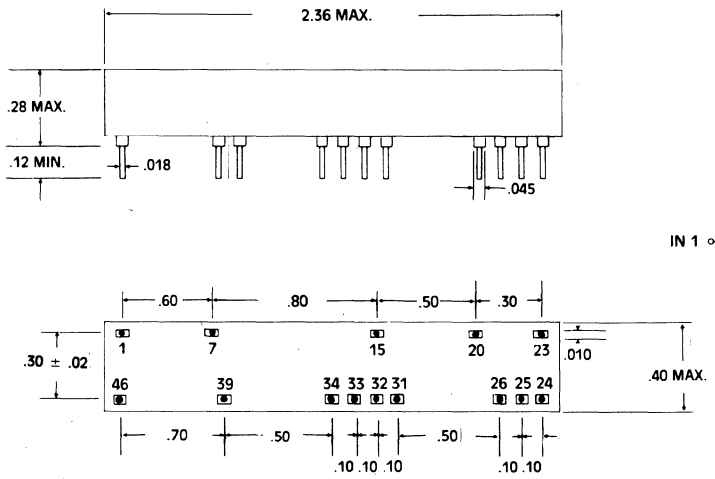
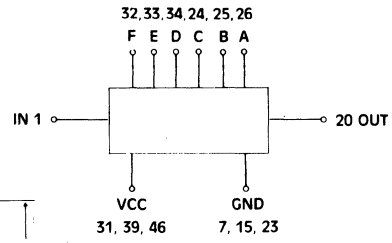
DIGITAL DELAY LINE SERIES 0449
TTL PROGRAMMABLE LOGIC DELAY MODULE
6 BIT





PART NUMBER	*MIN. DELAY 1, 2	**MAX. DELAY 1, 2	Δ DELAY PER STEP 1, 2
0449-0078-15	15NS ± 1	78NS	1 ± .7NS
0449-0141-15	15NS ± 1	141NS	2 ± .7NS
0449-0204-15	15NS ± 1	204NS	3 ± .7NS
0449-0267-15	15NS ± 1	267NS	4 ± .8NS
0449-0330-15	15NS ± 1	330NS	5 ± 1.0NS
0449-0393-15	15NS ± 1	393NS	6 ± 1.2NS
0449-0456-15	15NS ± 1	456NS	7 ± 1.4NS
0449-0519-15	15NS ± 1	519NS	8 ± 1.6NS
0449-0582-15	15NS ± 1	582NS	9 ± 1.8NS
0449-0645-15	15NS ± 1	645NS	10 ± 2.0NS

Max. Delay Tolerances ± 2NS or 5% whichever is greater

F	E	D	C	B	A	
0	0	0	0	0	0	*
0	0	0	0	0	1	
0	0	0	0	1	0	
0	0	0	0	1	1	
0	0	0	1	0	0	
1	1	1	1	0	0	
1	1	1	1	0	1	
1	1	1	1	1	0	
1	1	1	1	1	1	**

64 STEPS

1 Delays measured at 1.5 Volt level Leading Edge only.
2 Measured with no loads on taps.

INPUT TEST CONDITIONS

Pulse Voltage	3 Volts
Rise Time	5 Nsec.
Pulse Width	100% of Max. Delay
Supply Current	120 ma typ
Supply Voltage	5.0 Volts

ELECTRICAL CHARACTERISTICS

Supply Voltage Vcc	4.75 to 5.25 Volts
Logic 1 Input Voltage	2.5 Volts Min., 5.5 Volts Max.
Logic 0 Input Voltage	.8 Volts Max.
Logic 1 Output Voltage	2.5 Volts Min.
Logic 0 Output Voltage	0.5 Volts Max.
Temperature Range	0°C to 70°C
Temperature Coefficient	400 PPM/°C Max.

DRIVE CAPABILITIES

Fan Out	10 TTL Loads Max.

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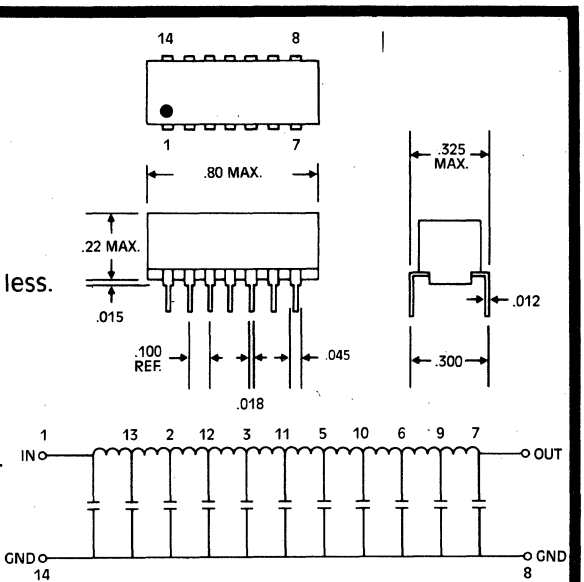
DELAY LINES

LUMPED CONSTANT

14 PIN DIP

- Built to conform to MIL-D-23859.
- Temperature Range −55°C to +125°C.
- Temperature Coefficient of delay 100 ppm/°C or less.
- Will meet most stringent MIL requirements.
- Low attenuation.
- Excellent pulse fidelity.
- Compatible with TTL and other logic modes.
- Other delays available upon request.
- Contact Bel Engineering for special applications.
- Untapped units available upon request.
- 16 PIN DIP Also available.



Total Delay ± 5%	Tap to Tap Delay	Distortion ± Max. %	Attenuation Max. %	50 OHMS	Impedance ± 10% 100 OHMS	200 OHMS
5NS	.5 ± .3NS	10%	5%	0446-0005-50 Tr = 3	0446-0005-01 Tr = 3	0046-0005-02 Tr = 3.5
10NS	1 ± .35NS	10%	5%	0446-0010-50 Tr = 3.8	0446-0010-01 Tr = 3.8	0446-0010-02 Tr = 4
20NS	2 ± 1NS	10%	5%	0446-0020-50 Tr = 5	0446-0020-01 Tr = 5	0446-0020-02 Tr = 5
30NS	3 ± 1NS	10%	5%	0446-0030-50 Tr = 7	0446-0030-01 Tr = 7	0446-0030-02 Tr = 7
40NS	4 ± 1NS	10%	5%	0446-0040-50 Tr = 8.5	0446-0040-01 Tr = 8.5	0446-0040-02 Tr = 8.5
50NS	5 ± 2NS	10%	5%	0446-0050-50 Tr = 10	0446-0050-01 Tr = 10	0446-0050-02 Tr = 10
60NS	6 ± 2NS	10%	8%	0446-0060-50 Tr = 12	0446-0060-01 Tr = 12	0446-0060-02 Tr = 12
70NS	7 ± 2NS	10%	8%	0446-0070-50 Tr = 14	0446-0070-01 Tr = 14	0446-0070-02 Tr = 14
80NS	8 ± 2NS	10%	8%	0446-0080-50 Tr = 16	0446-0080-01 Tr = 16	0446-0080-02 Tr = 16
90NS	9 ± 2NS	10%	8%	0446-0090-50 Tr = 18	0446-0090-01 Tr = 18	0446-0090-02 Tr = 18
100NS	10 ± 3NS	10%	10%	0446-0100-50 Tr = 20	0446-0100-01 Tr = 20	0446-0100-02 Tr = 20
150NS	15 ± 3NS	10%	10%	0446-0150-50 Tr = 30	0446-0150-01 Tr = 28	0446-0150-02 Tr = 30
200NS	20 ± 3NS	10%	10%	0446-0200-50 Tr = 40	0446-0200-01 Tr = 35	0446-0200-02 Tr = 40
250NS	25 ± 3NS	10%	10%	0446-0250-50 Tr = 50	0446-0250-01 Tr = 45	0446-0250-02 Tr = 50
300NS	30 ± 3NS	10%	10%	0446-0300-50 Tr = 60	0446-0300-01 Tr = 60	0446-0300-02 Tr = 60
400NS	40 ± 3NS	10%	10%	0446-0400-50 Tr = 80	0446-0400-01 Tr = 80	0446-0400-02 Tr = 80
500NS	50 ± 3NS	10%	10%	0446-0500-50 Tr = 100	0446-0500-01 Tr = 100	0446-0500-02 Tr = 100

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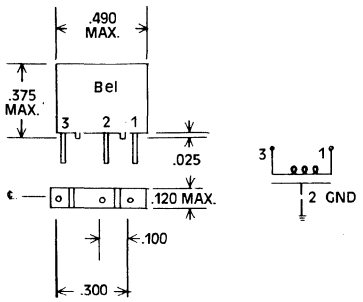
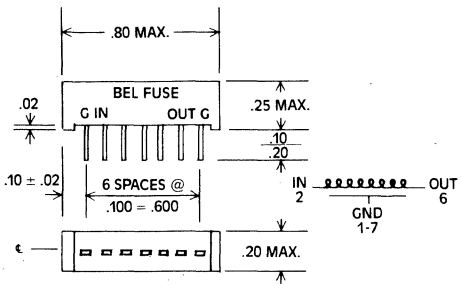
SINGLE-IN-LINE DELAY LINES

- Compatible with ECL and TTL circuits
- Temperature coefficient of delay = 100 PPM/°C or Less
- Operating temperature range −55°C to +125°C
- Built to conform to MIL D-23859



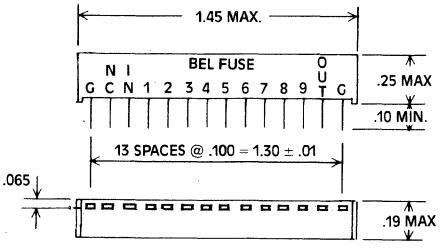
- Rise Time = 20-80%
- DWV = 50 VDC
- Pins 24 AWG tinned copper
- DIST. = 7.5% max.
- Bi-Directional

Time Delay	Rise Time	D.C.R. Max. in OHMS	55 OHMS ± 10%	93 OHMS ± 10%
1 ± .2NS	1.6NS	.20	0402-0001-55	0402-0001-93
2 ± .2NS	1.6NS	.25	0402-0002-55	0402-0002-93
3 ± .2NS	1.7NS	.37	0402-0003-55	0402-0003-93
4 ± .2NS	1.7NS	.50	0402-0004-55	0402-0004-93
5 ± .25NS	1.8NS	.62	0402-0005-55	0402-0005-93
6 ± .3NS	2.0NS	.75	0402-0006-55	0402-0006-93
7 ± .3NS	2.2NS	.80	0402-0007-55	0402-0007-93
8 ± .3NS	2.4NS	.85	0402-0008-55	0402-0008-93
9 ± .3NS	2.6NS	.90	0402-0009-55	0402-0009-93
10 ± .3NS	2.8NS	.95	0402-0010-55	0402-0010-93



- Rise Time = 10 to 90%
- DWV = 50 VDC
- DIST = 10% max.
- Taps available upon request
- Other delays upon request
- Other PIN OUTS Available
- Pins .012 × .020

Time Delay	Rise Time	Atten. Max. in %	55 OHMS ± 10%	100 OHMS ± 10%	200 OHMS ± 10%
1 ± .3NS	2.6NS	3	0403-0001-55	0403-0001-01	0403-0001-02
2 ± .3NS	2.75NS	3	0403-0002-55	0403-0002-01	0403-0002-02
3 ± .3NS	2.9NS	3	0403-0003-55	0403-0003-01	0403-0003-02
4 ± .3NS	3.15 NS	3	0403-0004-55	0403-0004-01	0403-0004-02
5 ± .3NS	3.2NS	5	0403-0005-55	0403-0005-01	0403-0005-02
10 ± .5NS	4.0NS	5	0403-0010-55	0403-0010-01	0403-0010-02
15 ± .7NS	5.25NS	5	0403-0015-55	0403-0015-01	0403-0015-02
20 ± 1NS	6.1NS	5	0403-0020-55	0403-0020-01	0403-0020-02
25 ± 1.2NS	7.5NS	5	0403-0025-55	0403-0025-01	0403-0025-02
30 ± 1.5NS	9.0NS	6	0403-0030-55	0403-0030-01	0403-0030-02
35 ± 1.7NS	10.5NS	6	0403-0035-55	0403-0035-01	0403-0035-02
40 ± 2NS	12.5NS	6	0403-0040-55	0403-0040-01	0403-0040-02
45 ± 2.3NS	13.5NS	6	0403-0045-55	0403-0045-01	0403-0045-02
50 ± 2.5NS	15.0NS	6	0403-0050-55	0403-0050-01	0403-0050-02



- Rise Time = 10-90%
- DWV = 50 VDC
- DIST. = 10% max.
- Other delays upon request
- Pins .012 × .020

Time Delay ± 5%	Tap to Tap Delay	Rise Time	Zo ± 10% in OHMS	D.C.R. in OHMS	Part Number
10NS	1 ± .25NS	2.5NS	50	.8	0438-0010-50
20NS	2 ± .4NS	4NS	50	1	0438-0020-50
50NS	5 ± 1.5NS	9NS	50	2	0438-0050-50
100NS	10 ± 2NS	18NS	50	3	0438-0100-50
10NS	1 ± .25NS	2.5NS	100	1.6	0438-0010-01
20NS	2 ± .4NS	4NS	100	2	0438-0020-01
50NS	5 ± 1.5NS	9NS	100	4	0438-0050-01
100NS	10 ± 2NS	19NS	100	9	0438-0100-01
20NS	2 ± .4NS	4.5NS	200	5	0438-0020-02
50NS	5 ± 1.5NS	10NS	200	12	0438-0050-02
100NS	10 ± 2NS	20NS	200	17	0438-0100-02

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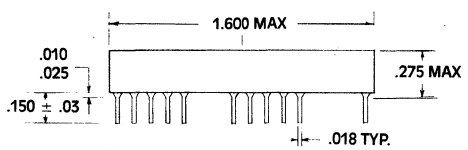
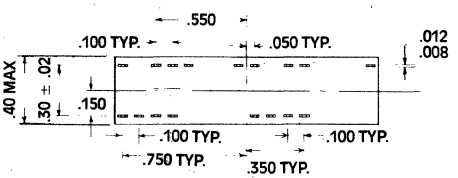
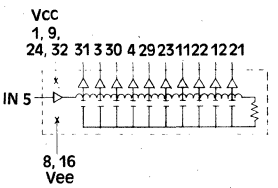
NEW!

DIGITAL DELAY LINE SERIES 0443
HIGH SPEED ECL DELAY MODULE
10 TAP

- Compatible with ECL circuit
- Operating temperature range −30°C to +85°C
- Other delays upon request







Part Number	Tap 1 1, 3, 4	Tap 2 1, 3, 4	Tap 3 1, 3, 4	Tap 4 1, 3, 4	Tap 5 1, 3, 4	Tap 6 1, 3, 4	Tap 7 1, 3, 4	Tap 8 1, 3, 4	Tap 9 1, 3, 4	Output 1, 3, 4	Rise Time
0443-0011-10	2 ± .5	3 ± .5	4 ± .5	5 ± 1	6 ± 1	7 ± 1	8 ± 1	9 ± 1	10 ± 1	11 ± 1	4
0443-0020-10	2 ± .5	4 ± .5	6 ± 1	8 ± 1	.10 ± 1	12 ± 1	14 ± 1	16 ± 1	18 ± 1	20 ± 1	4
0443-0030-10	3 ± .5	6 ± 1	9 ± 1	12 ± 1	15 ± 1	18 ± 1	21 ± 1	24 ± 1.5	27 ± 1.5	30 ± 1.5	4
0443-0040-10	4 ± .5	8 ± 1	12 ± 1	16 ± 1	20 ± 1	24 ± 1.5	28 ± 1.5	32 ± 1.5	36 ± 1.5	40 ± 2	4
0443-0050-10	5 ± 1	10 ± 1	15 ± 1	20 ± 1	25 ± 1.5	30 ± 1.5	35 ± 1.5	40 ± 2	45 ± 2	50 ± 2	4
0443-0060-10	6 ± 1	12 ± 1	18 ± 1	24 ± 1.5	30 ± 1.5	36 ± 1.5	42 ± 2	48 ± 2	54 ± 2	60 ± 2.5	4
0443-0070-10	7 ± 1	14 ± 1	21 ± 1	28 ± 1.5	35 ± 1.5	42 ± 2	49 ± 2	56 ± 2	63 ± 2	70 ± 2.5	4
0443-0080-10	8 ± 1	16 ± 1	24 ± 1.5	32 ± 1.5	40 ± 2	48 ± 2	56 ± 2	64 ± 2.5	72 ± 2.5	80 ± 3	4
0443-0090-10	9 ± 1	18 ± 1	27 ± 1.5	36 ± 1.5	45 ± 2	54 ± 2	63 ± 2	72 ± 2.5	81 ± 3	90 ± 3	5
0443-0100-10	10 ± 1	20 ± 1	30 ± 1.5	40 ± 2	50 ± 2	60 ± 2.5	70 ± 2.5	80 ± 3	90 ± 3	100 ± 3	5
0443-0150-10	15 ± 1	30 ± 1.5	45 ± 2	60 ± 2.5	75 ± 2.5	90 ± 3	105 ± 4	120 ± 4	135 ± 4	150 ± 5	8
0443-0200-10	20 ± 1	40 ± 2	60 ± 2.5	80 ± 3	100 ± 3	120 ± 4	140 ± 5	160 ± 5	180 ± 6	200 ± 6	10
0443-0250-10	25 ± 1.5	50 ± 2	75 ± 2.5	100 ± 3	125 ± 4	150 ± 5	175 ± 5	200 ± 6	225 ± 7	250 ± 8	15
0443-0300-10	30 ± 1.5	60 ± 2.5	90 ± 3	120 ± 4	150 ± 5	180 ± 6	210 ± 7	240 ± 7	270 ± 8	300 ± 9	15
0443-0350-10	35 ± 1.5	75 ± 2.5	105 ± 4	140 ± 5	175 ± 5	210 ± 7	245 ± 8	280 ± 9	315 ± 10	350 ± 11	20
0443-0400-10	40 ± 2	80 ± 3	120 ± 4	160 ± 5	200 ± 6	240 ± 7	280 ± 9	320 ± 10	360 ± 11	400 ± 12	20
0443-0450-10	45 ± 2	90 ± 3	135 ± 4	180 ± 6	225 ± 7	270 ± 8	315 ± 10	360 ± 11	405 ± 12	450 ± 14	25
0443-0500-10	50 ± 2	100 ± 3	150 ± 5	200 ± 6	250 ± 8	300 ± 9	350 ± 11	400 ± 12	450 ± 14	500 ± 15	25

1 Delays measured at 50% of the pulse on leading edge only
2 Rise times measured from 20% to 80%
3 All outputs terminated with 100Ω to −2V or equivalent
4 All delays in NS

INPUT TEST CONDITIONS

Logic 1	−0.8 Volts
Logic 0	−1.7 Volts
Rise Time 20%-80%	2NS
Pulse Width	Total Delay +10NS, Min.
Supply Voltage	−5.2 Volts

ELECTRICAL CHARACTERISTICS

Supply Voltage VEE	−5.2V ± 5%
Logic 1 Input Voltage	−0.98V Min.
Logic 1 Input Current	2.65 μA Max.
Logic 0 Input Voltage	−1.63V Max.
Logic 1 Output Voltage	−0.96V Min.
Logic 0 Output Voltage	−1.65V Max.

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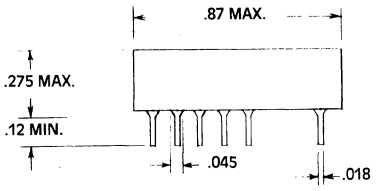
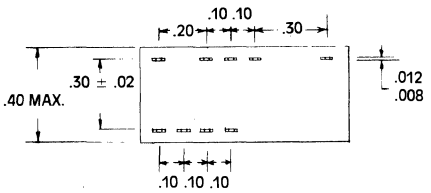
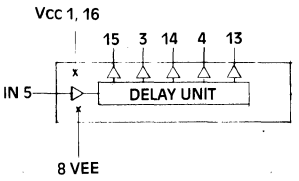
NEW!

DIGITAL DELAY LINE SERIES 0443
HIGH SPEED ECL DELAY MODULE
5 TAP

- Compatible with ECL circuit
- Operating temperature range −30°C to +85°C
- Other delays upon request







Part Number	Tap 1 1, 3, 4	Tap 2 1, 3, 4	Tap 3 1, 3, 4	Tap 4 1, 3, 4	Output 1, 3, 4	Rise Time 2, 3, 4
0443-0006-02	2 ± .2	3 ± .2	4 ± .2	5 ± .2	6 ± .2	4
0443-0010-02	2 ± .5	4 ± .5	6 ± .5	8 ± .5	10 ± .5	4
0443-0015-02	3 ± .5	5 ± .5	9 ± .5	12 ± .5	15 ± .5	4
0443-0020-02	4 ± .5	8 ± .5	12 ± .5	16 ± .5	20 ± .5	4
0443-0025-02	5 ± 1	10 ± 1	15 ± 1	20 ± 1	25 ± 1	4
0443-0030-02	6 ± 1	12 ± 1	13 ± 1	24 ± 1	30 ± 1	4
0443-0035-02	7 ± 1	14 ± 1	21 ± 1	28 ± 1.5	35 ± 1.5	4
0443-0040-02	8 ± 1	16 ± 1	25 ± 1.5	32 ± 1.5	40 ± 1.5	4
0443-0045-02	9 ± 1	18 ± 1	27 ± 1.5	36 ± 1.5	45 ± 2	5
0443-0050-02	10 ± 1	20 ± 1	30 ± 1.5	40 ± 2	50 ± 2	5
0443-0075-02	15 ± 1	30 ± 1.5	45 ± 2	60 ± 2.5	75 ± 2.5	8
0443-0100-02	20 ± 1	40 ± 1.5	60 ± 2	80 ± 3	100 ± 3	10
0443-0125-02	25 ± 1	50 ± 2	75 ± 2.5	100 ± 3	125 ± 4	15
0443-0150-02	30 ± 1.5	60 ± 2	90 ± 3	120 ± 4	150 ± 5	15
0443-0175-02	35 ± 1.5	70 ± 2.5	105 ± 4	140 ± 5	175 ± 5	20
0443-0200-02	40 ± 1.5	80 ± 2.5	120 ± 4	160 ± 5	200 ± 6	20
0443-0225-02	45 ± 2	90 ± 3	135 ± 4	180 ± 6	225 ± 7	25
0443-0250-02	50 ± 2	100 ± 3	150 ± 4.5	200 ± 6	250 ± 8	25
0443-0300-02	60 ± 2	120 ± 4	180 ± 5	240 ± 7	300 ± 9	30
0443-0350-02	70 ± 2	140 ± 4.5	210 ± 7	280 ± 9	350 ± 11	30
0443-0400-02	80 ± 3	160 ± 5	240 ± 7	320 ± 10	400 ± 12	35
0443-0450-02	90 ± 3	180 ± 6	270 ± 8	360 ± 11	450 ± 14	35
0443-0500-02	100 ± 3	200 ± 6	300 ± 9	400 ± 12	500 ± 15	40

1 Delays measured at 50% of the pulse on leading edge only
2 Rise time measured from 20% to 80%
3 All outputs terminated with 100Ω to −2V or equivalent
4 All delays in NS

ELECTRICAL CHARACTERISTICS

Supply Voltage VEE	−5.2V ± 5%
Logic 1 Input Voltage	−0.98V Min.
Logic 1 Input Current	265. μA Max.
Logic 0 Input Voltage	−1.63V Max.
Logic 1 Output Voltage	−0.96V Min.
Logic 0 Output Voltage	−1.65V Max.

INPUT TEST CONDITIONS

Logic 1	−0.8 Volts
Logic 0	−1.7 Volts
Rise Time 20%-80%	2NS
Pulse Width	Total Delay +10NS Min.
Supply Voltage	−5.2 Volts

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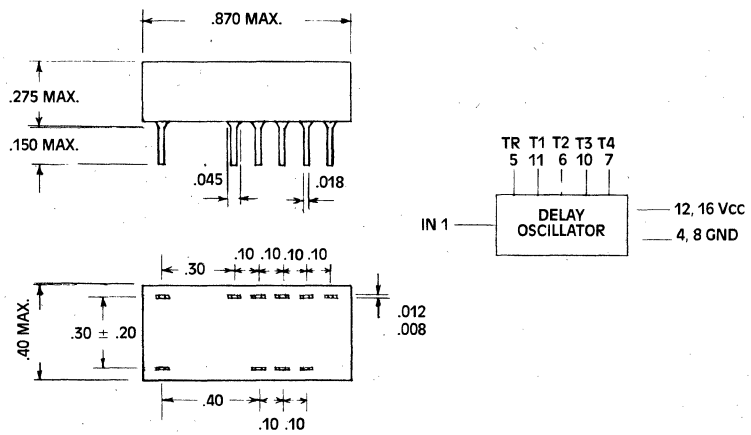
NEW!

SERIES 0458—DIGITAL DELAY OSCILLATOR

This day oscillator works as an asynchronous start-stop free running clock pulse generator. The oscillator is intended as the primary control element of state machines used in digital controllers. The assertion of the input (high) trigger causes the oscillator to free run, producing TR thru T4 clock pulses for as long as the input is asserted. Oscillation ceases when the input trigger is negated.

- Square wave on all outputs
- Tap to tap delay tolerance ± 2NS or 5% whichever is greater
- Period tolerance ± 7%
- Operating temperature range 0°C to 70°C
- Other delays upon request



Part Number	Period 1, 3	Tap 1 1, 3, 4	Tap 2 1, 3, 4	Tap 3 1, 3, 4	Tap 4 1, 3, 4	Rise Time 2, 3
0458-0060-01	60NS	20NS	30NS	40NS	50NS	4NS
0458-0070-01	70NS	20NS	35NS	50NS	60NS	4NS
0458-0080-01	80NS	20NS	40NS	60NS	70NS	4NS
0458-0090-01	90NS	20NS	45NS	65NS	80NS	4NS
0458-0100-01	100NS	30NS	50NS	70NS	90NS	4NS
0458-0110-01	110NS	30NS	55NS	75NS	100NS	4NS

1 All times measured at 1.5V leading edge only
2 Rise time measured from .75V to 2.4V level
3 Measured with no leads on taps
4 Delays are relative to Tap R (The delay from input to Tap R is referenced at, 7 ± 2NS)

INPUT TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0NSec.
Supply Voltage	5 Volts
Pulse Width	250% of Period Min.

ELECTRICAL CHARACTERISTICS

Supply Voltage Vcc	4.75 to 5.25 Volts
Logic 1 Input Current	50 Microamps Max.
Logic 0 Input Current	−2 Milliamps Max.
Logic 1 Output Voltage	2.6 Volts Min.
Logic 0 Output Voltage	.5 Volts Max.

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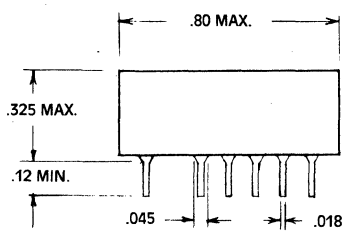
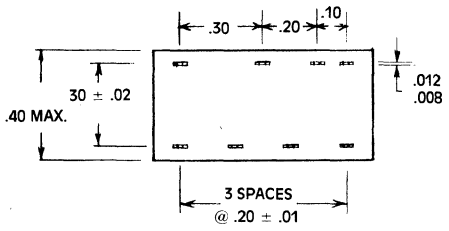
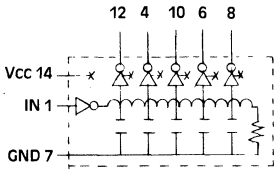
NEW!

DIGITAL DELAY LINE SERIES 0450
HIGH SPEED CMOS (HC) DELAY MODULE
5 TAP

- Compatible with 5V CMOS and TTL circuits
- Delay tolerance ± 2NS or 5% whichever is greater from input to tap
- Tap-to-tap delay ± 2NS or 7% whichever is greater
- Operating temperature range −40°C to +85°C
- Diode protection on input
- Low power consumption
- Low input current
- Other delays upon request







NOTE: For use with TTL logic inputs, pullup resistor required between Vcc and Pin 1

PART NUMBER	TOTAL DELAY 1, 3	DELAY TAP 1, 3	RISE TIME 2, 3
0450-0050-02	75NS	15NS	6NS
0450-0100-02	100NS	20NS	6NS
0450-0125-02	125NS	25NS	6NS
0450-0150-02	150NS	30NS	6NS
0450-0175-02	175NS	35NS	6NS
0450-0200-02	200NS	40NS	6NS

1 Delays measured at 50% of the pulse on the leading edge only
2 Rise times measured from 10% to 90% of the pulse
3 Measured with No Load on Taps.

INPUT TEST CONDITIONS

Pulse Voltage	5.0 Volts
Rise Time	6NS
Pulse Width	Min. of 40% of Total Delay
Supply Current	10 MA Max.
Supply Voltage	5.0 Volts

ELECTRICAL CHARACTERISTICS

Supply Voltage VCC	4.75 to 5.25 Volts
Input Leakage Current	± 1 Microamp Max.
Logic 1 Output Voltage	4 Volts Min.
Logic 0 Output Voltage	.3 Volts Max.

DRIVE CAPABILITIES

10 LSTTL Min.

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NEW!

SERIES 0455 DRAM DELAY LINES

System performance specifications are improved dramatically in the NEW Bel Fuse series of DRAM delay lines which integrate the standard delay line and miscellaneous gating into a single part. ALL Timing pulses required to access the DRAM are generated internally thus minimizing the tolerances on the critical timing edges. Since access time is directly related to the row/column multiplex switching time, this ram timer series generates all timing edges required by this sequence in addition to providing auxiliary timing for latching read data. These pulses may also be used to guarantee other RAM timing such as the hold time of RAS relative to CAS.

The applications of these lines are for both the small and the large system users. Users of systems requiring only a single row of rams will find the 01 series satisfactory, while users of larger systems who need to support multiple rows of rams will require the 02 series. Using a suitable, externally generated RAS signal, the ram delay will then generate all appropriate timing signals referenced to ras, for accessing the ram.

TABLE 1 • DELAY SPECIFICATION

Part Number	Tap 1	Tap 2	Tap 3	Tap 4	Tap 5	Tap 6	Tap 7	Tap 8	Tap 9
0455-0100-01	30 ± 3	10 ± 2	5 ± 1.5	25 ± 2	65 ± 6	65 ± 5	100 ± 8	10 ± 2	80 ± 6
0455-0120-01	35 ± 3	10 ± 2	5 ± 1.5	25 ± 2	70 ± 6	80 ± 6	110 ± 9	10 ± 2	90 ± 7
0455-0150-01	35 ± 3	10 ± 2	5 ± 1.5	25 ± 2	70 ± 6	95 ± 7	130 ± 10	10 ± 2	110 ± 9
0455-0200-01	35 ± 3	10 ± 2	5 ± 1.5	25 ± 2	70 ± 6	120 ± 10	180 ± 14	10 ± 2	160 ± 13
0455-0100-02	30 ± 3	12 ± 2	6 ± 1.5	38 ± 3	80 ± 7	65 ± 5	105 ± 8	10 ± 2	85 ± 7
0455-0120-02	35 ± 3	12 ± 2	6 ± 1.5	38 ± 3	85 ± 7	80 ± 6	115 ± 9	10 ± 2	95 ± 8
0455-0150-01	35 ± 3	12 ± 2	6 ± 1.5	38 ± 3	85 ± 7	95 ± 7	130 ± 10	10 ± 2	110 ± 9
0455-0200-02	35 ± 3	12 ± 2	6 ± 1.5	38 ± 3	85 ± 7	120 ± 10	180 ± 14	10 ± 2	160 ± 13

Rise Times measured from .75 to 2.4 Volts.
All delays measured with 1 STTL load (15PF) on each output.

TABLE 2 • INPUT PULSE WIDTH AND CYCLE REQUIREMENT

Rise Time	Pulse Width (minimum)	Pulse Period (maximum)
4	120	240
4	135	270
4	150	300
4	200	400
4	135	270
4	150	300
4	165	330
4	200	400

INPUT TEST CONDITIONS

Pulse Voltage	3 Volts
Rise Time	3 Nsec.
Pulse Width	See Table
Supply Voltage	5.0 Volts

ELECTRICAL CHARACTERISTICS

Supply Voltage Vcc	4.75 to 5.25 Volts
Logic 1 Input Current	50 Microamps Max.
Logic 0 Input Voltage	−2 Milliamps Max.
Logic 1 Output Voltage	2.6 Volts Min.
Logic 0 Output Voltage	.5 Volts Max.

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DRAM TIMER

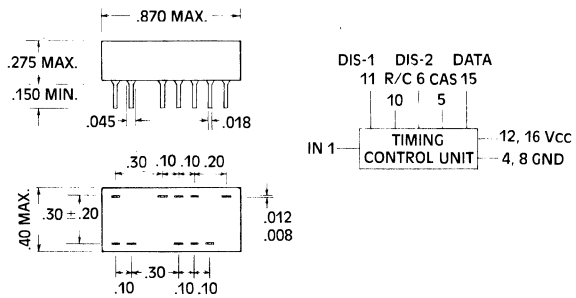


FIGURE 1—TIMING DEFINITION

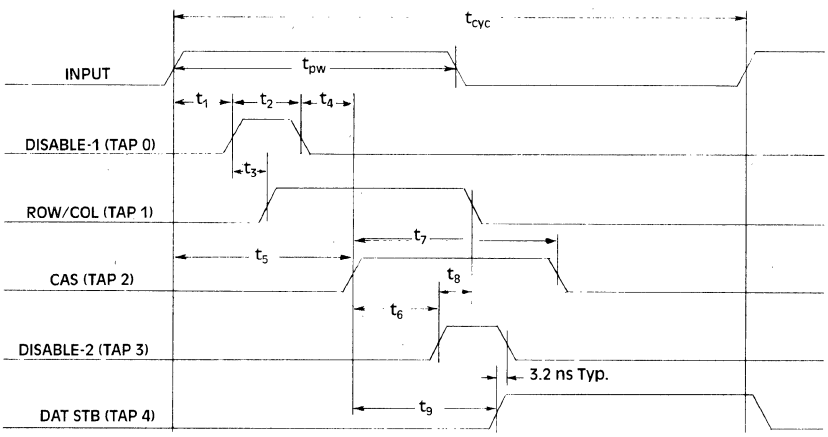
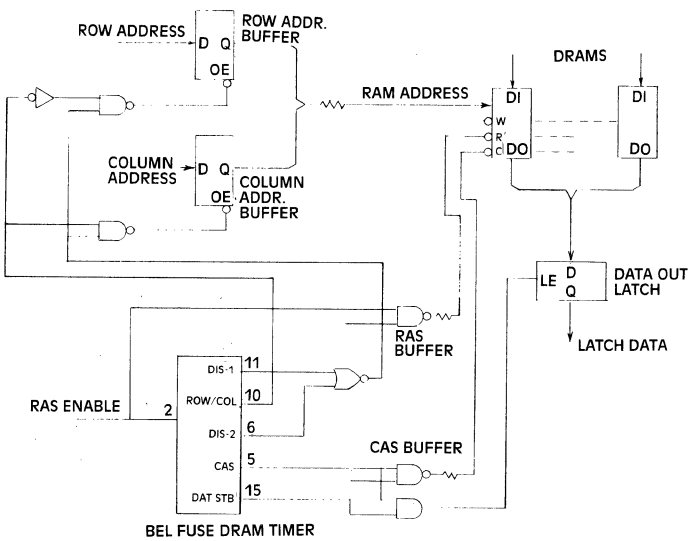


FIGURE 2—TYPICAL TIMER CONTROL SCHEME.



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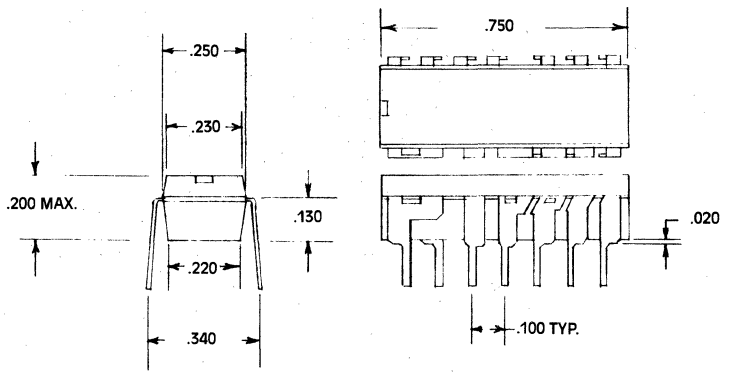
bel defining a degree of excellence

NEW!

AUTOINSERTABLE "L" SERIES PACKAGE

- Autoinsertable (14 pin DIP footprint)[2]
- Meets military environmental standards
- 5 tap & 10 tap active versions available[1]

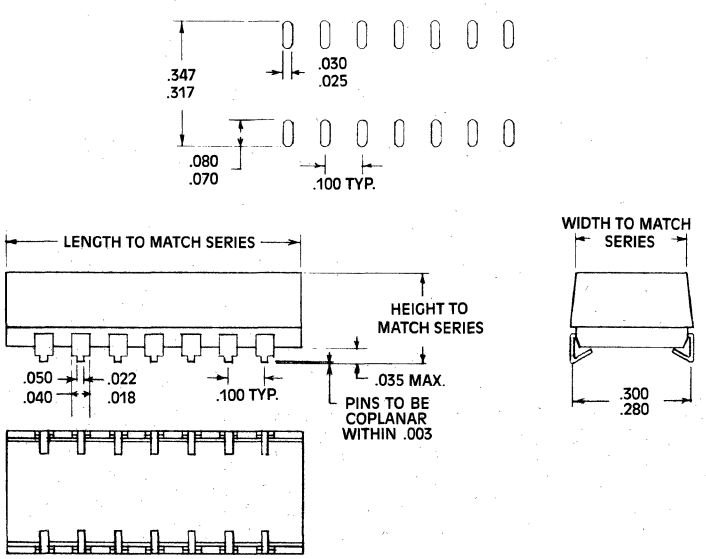


1 Consult engineering for available delays, price & delivery.

NEW!

DELAY LINES FOR SURFACE MOUNTING
SERIES S

- Electrical & environmental specifications identical to standard series!
- Leaded configuration provides adequate standoff for effective cleaning
- Footprint compatible with existing standards
- Designed for vapor phase soldering
- Available in most series (except SIP)



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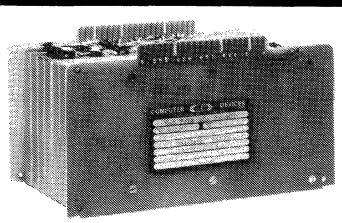
FIXED AND TAPPED DELAY LINES

MODEL	DELAY RANGE	RISE TIME OR FREQ. RESP.	IMPED-ANCE OHMS	SIZE INCHES
SUB-MINIATURE DUAL-IN-LINE TAPPED LUMPED CONSTANT LINES				
Each line has 10 tap delays spaced at equal intervals. Attenuation less than 1 dB. Temp. Coeff. less than 50 PPM/°C. DIP configuration compatible with automatic inserting equipment. Commercial and MIL Spec. models available.				
D1900-10	10 Nsec	2 Nsec	100	.21 x .30 x .78
D1900-20	20	3	100	.21 x .30 x .78
D1900-40	40	6	100	.21 x .30 x .78
D1900-60	60	9	100	.21 x .30 x .78
D1900-80	80	10	100	.21 x .30 x .78
D1900-100	100	20	100	.21 x .30 x .78
D8001	5	1	50	.21 x .30 x .78
D8004	10	2	100	.21 x .30 x .78
D8005	25	5	100	.21 x .30 x .78
D8007	30	6	100	.21 x .30 x .78
TAPPED DELAYS				
Each line provides 10 tap delays spaced at equal intervals.				
D1511-1	10 Nsec	3 Nsec		
D1511-2	20	6		
D1511-4	40	13		Dual-In-Line
D1511-6	60	20	100	Pin Spacing
D1511-8	80	26		.21 x .39 x .7
D1511-10	100	33		
MINIATURE LUMPED CONSTANT				
Hermetically sealed in a metal container. Delay tolerance ±5%. Temperature stability less than 50 PPM/°C, P.C. Mounting.				
D647-110	50 Nsec	12 Nsec	50	.30 x 1.0 x 1.25
D647-211	100	12.5	50	.30 x 1.0 x 2.45
D647-312	250	21	50	.30 x 1.0 x 3.45
D647-323	500	42	150	.30 x 1.0 x 3.45
D647-334	750	63	500	.30 x 1.0 x 3.45
D647-115	1,000	250	50	.30 x 1.0 x 1.25
D647-236	1,450	180	500	.30 x 1.0 x 2.45
D647-327	2,900	240	150	.30 x 1.0 x 3.45
D647-338	4,350	360	500	.30 x 1.0 x 3.45
ATC TRANSPONDER AND BEACON CODING DELAY LINES				
Standard 1.45 μsec tap spacings plus other special delay points are provided. Hermetically sealed steel cased, plastic encapsulated and P.C. mounted units are offered.				
D1560	10.15 μsec	.33 μsec	400	.55 x 2.25 x 3.62
D1365	20.3	.5	180	.87 x 3.5 x 3.5
D1000	20.3	.5	330	.35 x 2 x 4
D120	25.0	.55	180	.75 x 5 x 4.37
D298A	25.3	.6	500	1.62 x 2.87 x 4.25
D637	20.3	.3	180	2.37 x 2.75 x 3.18
D1190	20.3	.4	400	.63 x 4 x 5
D1191	24.65	.5	500	.63 x 4 x 5
D1210	8.0	.5	500	5 x 1 x 4

VARIABLE DELAY LINES

DUAL-IN-LINE COMPATIBLE VARIABLE DELAY LINES				
Sealed in plastic case. Temp. coeff. less than 50 PPM/°C. .020″ P.C. mounting pins.				
V1570-1	0 - 10 Nsec	2 Nsec	100	.25 x .75 x 1.5
V1570-2	0 - 20	4	100	.25 x .75 x 1.5
V1570-3	0 - 40	8	100	.25 x .75 x 1.5
V1570-4	0 - 80	16	100	.25 x .75 x 1.5
V1570-5	0 - 160	32	200	.25 x .75 x 1.5
V1570-6	0 - 320	64	200	.25 x .75 x 1.5
MIL VERSION				
Hermetically sealed in a metal case.				
V1768-1	0 - 10 Nsec	2 Nsec	100	.25 x .87 x 1.6
V1768-2	0 - 20	4	100	.25 x .87 x 1.6
V1768-3	0 - 40	8	100	.25 x .87 x 1.6
MINIATURE LUMPED VARIABLE Nanosecond Range				
Hermetically sealed in a metal case. Lumped constant parameter. Temperature coefficient less than 50 PPM/°C. .030″ P.C. mounting pins.				
V447-1	0 - 55 Nsec	15 Nsec	150	.31 x 1 x 1.25
V447-2	0 - 100	30	50	.31 x 1 x 1.25
V447-3	0 - 150	25	150	.31 x 1 x 2.45
V447-4	0 - 250	30	50	.31 x 1 x 2.45
V447-5	0 - 300	30	150	.31 x 1 x 3.45
V447-6	0 - 500	60	50	.31 x 1 x 3.45
NOVEL INFINITE RESOLUTION				
With input and output impedance of equal value. Voltage standing wave ratio less than ½ db to 45 MHz.				
DV575-1	2 - 25 Nsec	70 MHz	200	1 x 1.25 x 5.37
DV575-2	2 - 50	70	100	1 x 1.25 x 5.37
DV575-3	2 - 50	70	200	1 x 1.25 x 5.37
DV575-4	2 - 50	70	93	1 x 1.25 x 5.37
DV575-5	2 - 25	70	50	1 x 1.25 x 5.37
DV575-6	2 - 50	70	93	1 x 1.25 x 5.37

DELAY LINE COMPUTER MEMORIES DELCOMS



THE DELAY LINE COMPUTER MEMORY (DELCOM) offers the **Lowest Price Per Bit** of any high speed memory device. Computer Devices Corp. offers convenient standard packages for all practical storage capacities from 10 bits to 20,000 bits in single delay line units as well as multi delay line units with massive storage capacities. All Delcoms are compatible with DTL and T²L logic. Normal power requirements are +12 and −12 VDC and +5 VDC. However, Delcoms are tailored to your bit rate, delay, input-output logic and power requirements.

MANY OTHER MODELS AND SPECIALTY Delay Lines are available. If exactly what you want is not listed, please call.

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Control Electronics
Military and Commercial
DELAY LINES

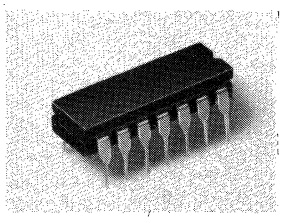
MINIATURE TAPPED DELAY LINES • MILITARY DELAY LINES • DISPERSIVE DELAY LINES • VARIABLE DELAY LINES
TRANSPONDER DECODER NETWORKS • PRECISION AUDIO DELAY LINES • VARIABLE MAGLINES

MILITARY DELAY LINES

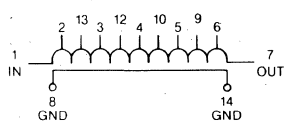
Series MIL-23 Low Profile to MIL-D-23859/23

SPECIFICATIONS

Total Time Delay Tolerance:	±2 ns below 40 ns Delay ±5% above 40 ns Delay
No. of Taps:	10
Distortion:	±10% max
Attenuation:	10% max
Temperature Coefficient:	100 ppm/°C max
Temperature Range:	−55°C to +125°C
Dielectric Strength:	50 VDC
Environmental Conditions:	per MIL-D-23859/23
Dimensions:	14 PIN, .750"L x .300"W x .187"H



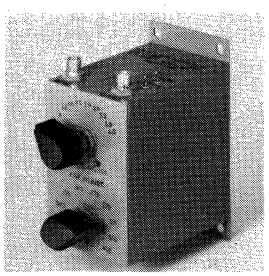
SCHEMATIC



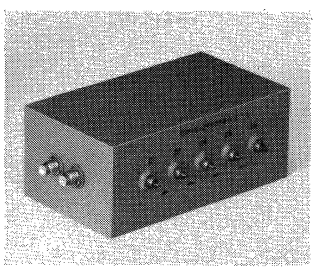
Total Td ns	Rise Time max (ns)	P/N M23859/23- Impedance ±10% 50 Ω	100Ω	200Ω
20	5.5	004	104	
25	6	005	105	
30	6.5	006	106	
35	7	007	107	
40	8	008	108	208
45	9	009	109	209
50	10	010	110	210
55	11	011	111	211
60	12	012	112	212
65	13	013	113	213
70	14	014	114	214
75	15	015	115	215
80	16	016	116	216
85	17	017	117	217
90	18	018	118	218
95	19	019	119	219
100	20	020	120	220
110	22	021	121	221
120	24	022	122	222
130	26	023	123	223
140	28	024	124	224
150	30	025	125	225
160	32	026	126	226
170	34	027	127	227

Total Td ns	Rise Time max (ns)	P/N M23859/23- Impedance ±10% 50 Ω	100Ω	200Ω
180	36	028	128	228
190	38	029	129	229
200	40	030	130	230
210	45		131	231
220	45		132	232
230	50		133	233
240	50		134	234
250	50		135	235
260	55		136	236
270	55		137	237
280	60		138	238
290	60		139	239
300	60		140	240
310	65		141	241
320	65		142	242
330	70		143	243
340	70		144	244
350	70		145	245
360	75		146	246
370	75		147	247
380	80		148	248
390	80		149	249
400	80		150	250

VARIABLE DELAY LINES



V1434
Sectional tap with discrete calibrated delays.

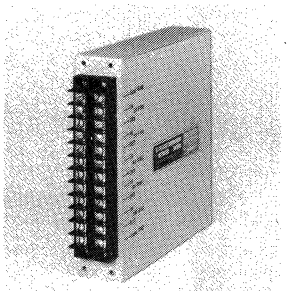


V1703
Unique calibrated switched line, in and out.

Model	Delay Adjustment	Rise Time	Adjustment Resolution	Impedance (Ohms)	Comments
VR903	0 to 950 nsec	90 nsec	1.5 nsec	500	Note 1
V1254	0-176 nsec	10 nsec	10 nsec	95	Notes 4 & 5 5 switches
V1434	0 to 4.4 μsec	0.2 μsec	.045 μsec	100	Notes 2 & 5
V1535	0 to 1280 nsec	25 nsec	2.5 nsec	95	Notes 4 & 5 9 switches
V1554	2 to 6.4 μsec	0.25 μsec	.045 μsec	100	Notes 2 & 5
V1611	10 to 150 nsec	15 nsec	.25 nsec	200	Note 1
V1702	0 to 200 nsec	10 nsec	10 nsec	95	Note 3 & 5
V1703	0 – 200 nsec	10 nsec	10 nsec	95	Notes 4 & 5 5 switches
V1743	100-250 nsec	20 nsec	10 nsec	500	Notes 4 & 5 4 switches

NOTES
1. Continuously variable output, high impedance tap.
2. Variable output via a coarse control 10 steps of 0.4 μsec and a fine control of 10 steps of .045 μsec.
3. Delay adjustment programmable by remote control.
4. Variable output via discrete screw driver slotted switches.
5. No high impedance tap necessary.

PRECISION AUDIO DELAY LINES



Over the years Control Electronics has developed a special skill in precise audio delay lines, including sectional balanced and unbalanced units ranging into the millisecond region. The sectional line terminals are arranged so as to conveniently enable the user to externally connect and disconnect the various sections for proper delay.

Model	Total Delay μsec	Tol. %	Impedance (Ohms)	3 dB Bandwidth KHz	Dimensions (Inches)
F344	74.60	1	1170	25	4x2.31x1.31
F416	1700	1	1000	6	10x5x5
F483	1000	1	600*	15	19x3 9/32x5½ Rack Mounted
FA784	5000	1	600*	5	19x5¼x10 Rack Mounted
FA573	25,000	1	1000	1	19x5¼x10 Rack Mounted
FA1772	10, 20, 40, 60, 100	3	600*	10	6½x6¾x2
FA1787	40, 80, 160, 320, 640	3	600*	10	6½x15x2¾
FA1812	50, 100, 200, 200	3	600*	10	6x5x3
FA1839	50, 100, 200 200 (6 sets)	3	600*	10	5¼ Rack Mounted
FA1840	50, 100, 200 200 (3 sets) + 1100	3	600*	10	5¼ Rack Mounted

*Balanced

Control Electronics Co., Inc.
107 Allen Blvd., Farmingdale, N.Y. 11735 (516) 694-0125
An Atrium Industries Inc. Company

atrium industries

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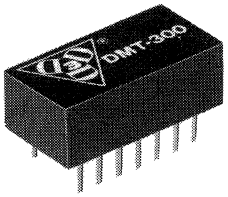
Call or write for a complete catalog of our products.

data delay devices, inc.

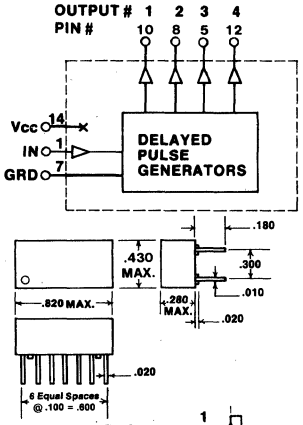
DRAM TIMER

SERIES DMT-300 (TTL Interfaced) 14 pins DIP



Specifications

- **Input requirement:** TTL logic, rising-edge triggered
- **Input pulse width:** 4 NS min.
- **Max. rep. rate of (MREQ)** = T_E of latch strobe
- **Output fan-out:** TTL Schottky load
- **Time delay tolerance:** ± 5% or 2 NS whichever is greater
- **Supply voltage (Vcc):** 5 Vdc ± 5%
- **Operating temperature:** 0°C to 70°C
- **Temperature Coefficient:** 100 PPM/°C
- **Power dissipation:** 740 MW max.

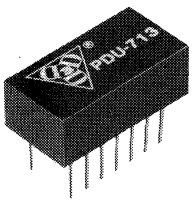


Part No.	Output 1 (RAS) LE	Output 1 (RAS) TE	Output 2 (MUX control) LE	Output 2 (MUX control) TE	Output 3 (CAS) LE	Output 3 (CAS) TE	Output 4 (Latch Strobe) LE	Output 4 (Latch Strobe) TE
DMT-301-1	15	190	40	190	65	190	140	190
DMT-301-2	15	165	40	165	65	165	115	215
DMT-301-3	15	190	40	190	65	190	190	240
DMT-301-4	15	215	40	215	65	215	165	265
DMT-301-5	15	265	40	265	115	265	215	315
DMT-301-6	15	215	40	215	65	215	165	335
DMT-301-7	15	165	30	165	50	165	115	265
DMT-301-8	15	135	30	135	50	135	85	235
DMT-301-9	15	275	40	275	65	275	220	370
DMT-302-1	15	265	65	265	90	265	215	315
DMT-302-2	15	290	65	290	115	290	240	340
DMT-302-3	15	315	65	315	140	315	265	365
DMT-303-1	25	300	75	300	125	300	250	350

1. All timing above in NS.
2. Many more customized designs available upon request.

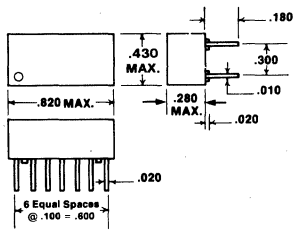
DIGITALLY PROGRAMMABLE DELAY LINES

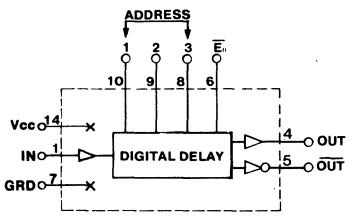
SERIES PDU-713 (TTL Interfaced) 3 BIT



Specifications:

- **Input signal requirement:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Delay variation:** Monotonic in one direction.
- **Total programmed delay tolerance:** 5% or 1 NS whichever is greater.
- **Inherent delay:** 14 NS on pin 4 } typical
  11 NS on pin 5 }
- **Operating temperature:** 0° to 70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Supply voltage Vcc:** 5 Vdc ± 5%.
- **Power dissipation:** 740 MW max.





TRUTH TABLE

Enable	Address (Bit No.) 3	2	1	Delay Out
0	0	0	0	T_0
0	0	0	1	T_1
0	0	1	0	T_2
0	0	1	1	T_3
0	1	0	0	T_4
0	1	0	1	T_5
0	1	1	0	T_6
0	1	1	1	T_7
1	ϕ	ϕ	ϕ	0

1 = High
0 = Low
ϕ = Don't care
T_0 = Reference or inherent delay of circuit.
T_1 to T_7 = Multiplier of incremental delay.

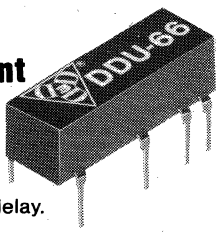
Part Number	Incremental Delay Per Step	Total Delay* Change	Part Number	Incremental Delay Per Step	Total Delay* Change
PDU-713-.5	.5 NS ± .3 NS	3.5NS	PDU-713-10	10 NS ± 1.0 NS	70 NS
PDU-713-1	1 NS ± .4 NS	7 NS	PDU-713-15	15 NS ± 1.3 NS	105 NS
PDU-713-2	2 NS ± .4 NS	14 NS	PDU-713-20	20 NS ± 1.5 NS	140 NS
PDU-713-3	3 NS ± .5 NS	21 NS	PDU-713-40	40 NS ± 2.0 NS	280 NS
PDU-713-5	5 NS ± .6 NS	35 NS	PDU-713-50	50 NS ± 2.5 NS	350 NS

***This delay value does not include T_0 delay.**

DATA DELAY DEVICES Inc. ■ 385 Lakeview Avenue, Clifton, New Jersey 07011 ■ (201) 772-1106 ■ TWX 710-989-7008

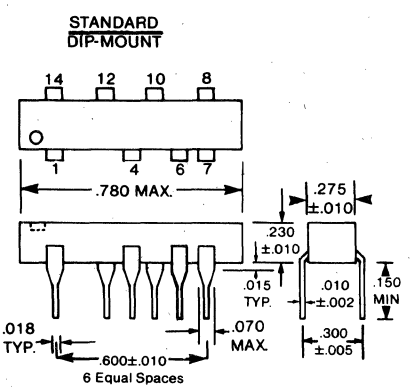
NEW PRODUCTS

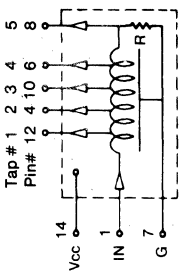
SERIES DDU-66
T^2L Interfaced, 5 Outputs
14 pin DIP & Surface Mount

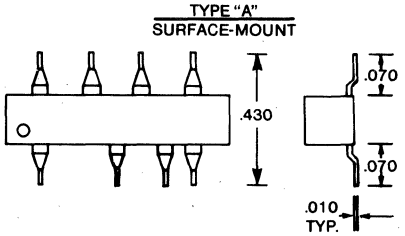


Specifications:

- **Outputs:** 5, equally spaced.
- **Delay tolerance:** see table.
- **Rise-time:** 4 NS typically.
- **Minimum pulse width:** 40% of total delay.
- **Temperature range:** 0°C to 70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Supply voltage:** 4.75 to 5.25 Vdc.
- **Input signal:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Power dissipation:** 375 MW max.
- **Leads:** Alloy 42, tin plated.



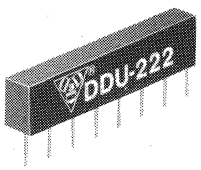




DDU-66 (Standard)	DDU-66 (Type "A")	DDU-66 (Type "B")	Total Delay (NS)	Tap Delay (NS)
*DDU-66-4	*DDU-66-4A	*DDU-66-4B	4 ± 1	1 ± 0.5
*DDU-66-6	*DDU-66-6A	*DDU-66-6B	6 ± 1	1.5 ± 0.5
*DDU-66-8	*DDU-66-8A	*DDU-6-8B	8 ± 2	2 ± 1
*DDU-66-10	*DDU-66-10A	*DDU-66-10B	10 ± 2	2.5 ± 1
*DDU-66-12	*DDU-66-12A	*DDU-66-12B	12 ± 2	3 ± 1
*DDU-66-16	*DDU-66-16A	*DDU-66-16B	16 ± 2	4 ± 1.5
*DDU-66-20	*DDU-66-20A	*DDU-66-20B	20 ± 3	5 ± 2
DDU-66-25	DDU-66-25A	DDU-66-25B	25 ± 3	5 ± 2
DDU-66-30	DDU-66-30A	DDU-66-30B	30 ± 3	6 ± 2
DDU-66-35	DDU-66-35A	DDU-66-35B	35 ± 3	7 ± 2
DDU-66-40	DDU-66-40A	DDU-66-40B	40 ± 3	8 ± 2
DDU-66-45	DDU-66-45A	DDU-66-45B	45 ± 3	9 ± 3
DDU-66-50	DDU-66-50A	DDU-66-50B	50 ± 3	10 ± 3
DDU-66-60	DDU-66-60A	DDU-66-60B	60 ± 3	12 ± 3
DDU-66-75	DDU-66-75A	DDU-66-75B	75 ± 4	15 ± 3
DDU-66-100	DDU-66-100A	DDU-66-100B	100 ± 5	20 ± 3
DDU-66-125	DDU-66-125A	DDU-66-125B	125 ± 6.5	25 ± 3
DDU-66-150	DDU-66-150A	DDU-66-150B	150 ± 7.5	30 ± 3
DDU-66-175	DDU-66-175A	DDU-66-175B	175 ± 8	35 ± 4
DDU-66-200	DDU-66-200A	DDU-66-200B	200 ± 10	40 ± 4
DDU-66-250	DDU-66-250A	DDU-66-250B	250 ± 12.5	50 ± 5

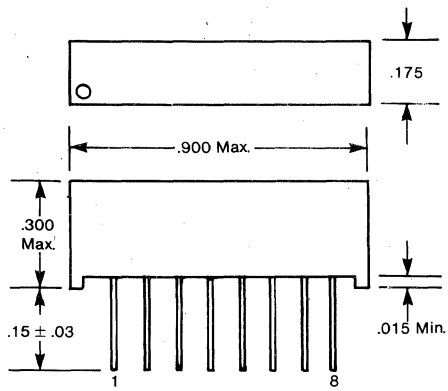
*Time delay measured with respect to 1st tap.

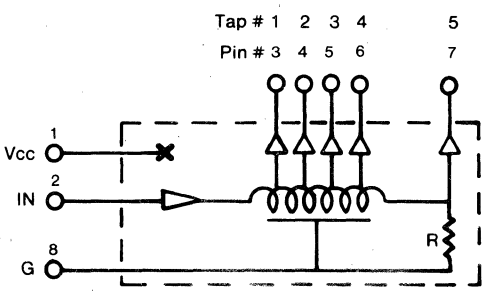
SERIES DDU-222
(T^2L Interfaced)
8 pins SIP



Specifications:

- **Outputs:** 5, equally spaced.
- **Delay tolerance:** see table.
- **Rise-time:** 4 NS typ.
- **Minimum pulse width:** 40% of total delay.
- **Temperature range:** 0°C to + 70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Supply voltage:** 4.75 to 5.25 Vdc.
- **Input signal requirement:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Power dissipation:** 375 MW max.





Part No.	Total Delay (NS)	Tap Delay (NS)	Part No.	Total Delay (NS)	Tap Delay (NS)
*DDU-222-4	4 ± 1	1 ± 0.5	DDU-222-75	75 ± 4	15 ± 3
*DDU-222-6	6 ± 1	1.5 ± 0.5	DDU-222-100	100 ± 5	20 ± 3
*DDU-222-8	8 ± 2	2 ± 1	DDU-222-125	125 ± 6.5	25 ± 3
*DDU-222-10	10 ± 2	2.5 ± 1	DDU-222-150	150 ± 7.6	30 ± 3
*DDU-222-12	12 ± 2	3 ± 1	DDU-222-175	175 ± 8	35 ± 4
*DDU-222-16	16 ± 2	4 ± 1.5	DDU-222-200	200 ± 10	40 ± 4
*DDU-222-20	20 ± 3	5 ± 2	DDU-222-250	250 ± 12.5	50 ± 5
DDU-222-30	30 ± 3	6 ± 2	DDU-222-300	300 ± 15	60 ± 6
DDU-222-35	35 ± 3	7 ± 2	DDU-222-350	350 ± 17	70 ± 7
DDU-222-40	40 ± 3	8 ± 2	DDU-222-400	400 ± 20	80 ± 8
DDU-222-45	45 ± 3	9 ± 3	DDU-222-450	450 ± 22	90 ± 9
DDU-222-50	50 ± 3	10 ± 3	DDU-222-500	500 ± 25	100 ± 10
DDU-222-60	60 ± 3	12 ± 3			

*Time delay measured with respect to 1st tap.

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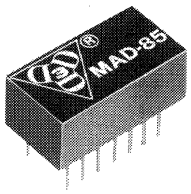
NEW PRODUCTS

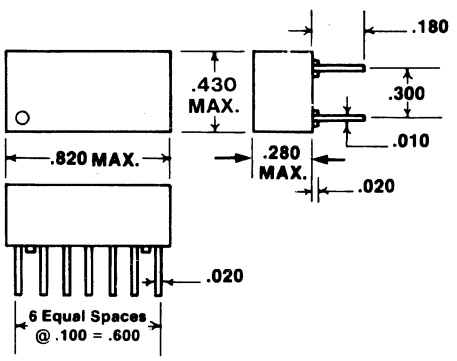
MANCHESTER DECODER

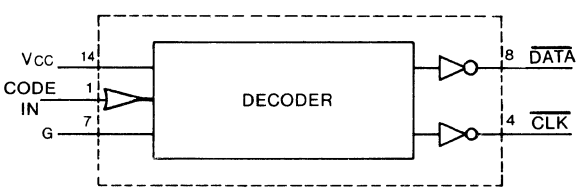
SERIES MAD-85 (TTL Interfaced) 14 pins DIP



Specifications

- **Input signal requirement:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Operating temperature:** 0° to 70° C.
- **Temperature coefficient:** 100 PPM/°C.
- **Supply voltage V_{CC}:** 5Vdc ± 5%.
- **Power dissipation:** 740 MW max.

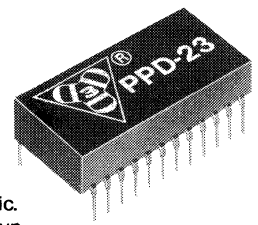




Part No.	Operating Data Rates	Part No.	Operating Data Rates
MAD-85-1	1 MB/S	MAD-85-14	14 MB/S
MAD-85-2	2 MB/S	MAD-85-15	15 MB/S
MAD-85-3	3MB/S	MAD-85-16	16 MB/S
MAD-85-4	4 MB/S	MAD-85-17	17 MB/S
MAD-85-5	5 MB/S	MAD-85-18	18 MB/S
MAD-85-6	6 MB/S	MAD-85-19	19MB/S
MAD-85-7	7 MB/S	MAD-85-20	20 MB/S
MAD-85-8	8 MB/S	MAD-85-21	21 MB/S
MAD-85-9	9MB/S	MAD-85-22	22 MB/S
MAD-85-10	10 MB/S	MAD-85-23	23 MB/S
MAD-85-11	11 MB/S	MAD-85-24	24 MB/S
MAD-85-12	12 MB/S	MAD-85-25	25 MB/S
MAD-85-13	13 MB/S		

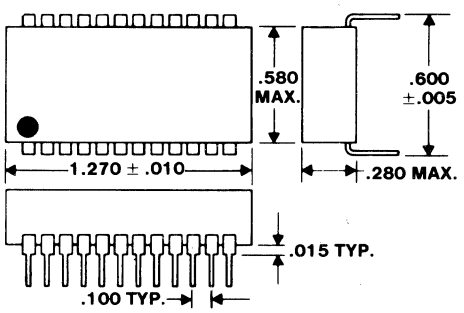
PROGRAMMABLE PULSE DISCRIMINATOR

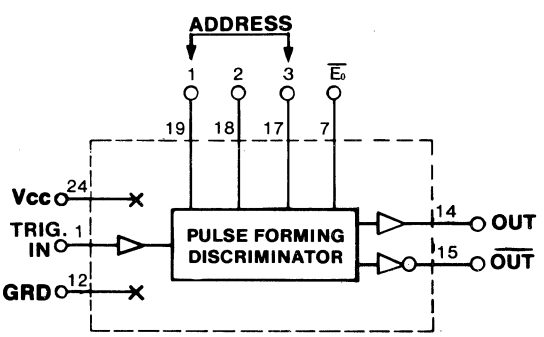
SERIES PPD-23 (TTL Interfaced) 3-BIT



Specifications

- **Input requirements:** TTL logic.
- **Inherent pulse width:** 5 NS typ.
- **Supply voltage:** 5 Vdc ± 5%.
- **Operating temperatures:** 0°C to 70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Power Dissipation:** 850 MW max.





Part Number	Incremental Pulse Width Per Step	Total Programmed Pulse Width
PPD-23-1	1 NS ± 4 NS	7 NS
PPD-23-2	2 NS ± 4 NS	14 NS
PPD-23-3	3 NS ± 5 NS	21 NS
PPD-23-5	5 NS ± 6 NS	35 NS
PPD-23-10	10 NS ± 1.0 NS	70 NS
PPD-23-15	15 NS ± 1.3 NS	105 NS
PPD-23-20	20 NS ± 1.5 NS	140 NS
PPD-23-40	40 NS ± 2.0 NS	280 NS
PPD-23-50	50 NS ± 2.5 NS	350 NS

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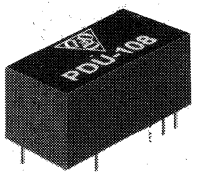
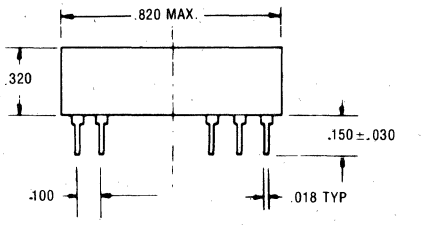
DIGITALLY PROGRAMMABLE DELAY LINES

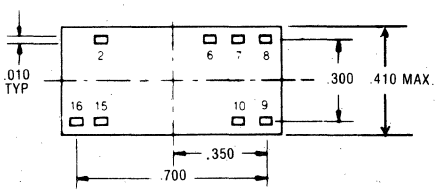
SERIES PDU-108 (ECL Interfaced) 3 BIT

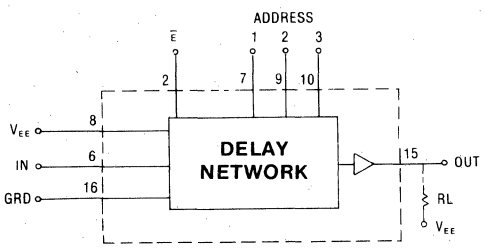


Specifications

- **Operating temperature:** 0° to 70°C.
- **Storage temperature:** −55° to +125°C.
- **Power dissipation:** 290 MW typ. (no load).
- **Temperature coefficient:** 100 PPM/°C
- **Delay variation:** Monotonic in one direction.
- **Total delay tolerance:** ±5% or 1 NS whichever is greater.
- **Inherent delay:** 5 NS typ.







TRUTH TABLE

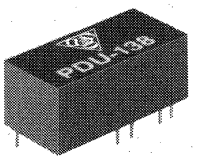
Enable	Address (Bit No.) 3	2	1	Delay Out
0	0	0	0	T_0
0	0	0	1	T_1
0	0	1	0	T_2
0	0	1	1	T_3
0	1	0	0	T_4
0	1	0	1	T_5
0	1	1	0	T_6
0	1	1	1	T_7
1	0	0	0	0

1 = High
0 = Low
0 = Don't care
T_0 = Reference or inherent delay of circuit.
T_1 to T_7 = Multiplier of incremental delay.

Part No.**	Min. Delay Increment	Total Delay* Change	Part No.**	Min. Delay Increment	Total Delay* Change
PDU-108.5	.5 NS ± .3 NS	3.5 NS	PDU-108-10	10 NS ± 1.0 NS	70 NS
PDU-108-1	1 NS ± .4 NS	7 NS	PDU-108-20	20 NS ± 1.5 NS	140 NS
PDU-108-2	2 NS ± .4 NS	14 NS	PDU-108-40	40 NS ± 2.0 NS	280 NS
PDU-108-3	3 NS ± .5 NS	21 NS	PDU-108-50	50 NS ± 2.5 NS	350 NS
PDU-108-5	5 NS ± .6 NS	35 NS			

*This delay value does not include the T_0 delay.
**Other delay increments available on request.

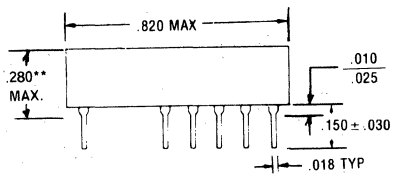
SERIES PDU-138 (TTL Interfaced) 3 BIT

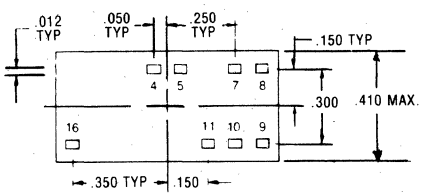


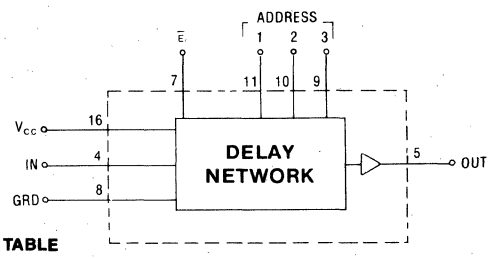
Specifications:

- **Supply voltage V_{CC}:** 4.75 to 5.25 V_{DC}
- **Operating temperature:** 0-70°C. (−55°C to +125°C on request)*
- **Inherent delay:** 7 NS ±1 NS.
- **Temperature coefficient:** 100 PPM/°C.
- **Delay variation:** Monotonic in one direction.
- **Total delay tolerance:** ±5% or 1 NS whichever is greater.

***Add "M" after PART NO. Example PDU-138-2M**
****.320 Max. for "M" Units**







TRUTH TABLE

Enable	Address (Bit No.) 3	2	1	Delay Out
0	0	0	0	T_0
0	0	0	1	T_1
0	0	1	0	T_2
0	0	1	1	T_3
0	1	0	0	T_4
0	1	0	1	T_5
0	1	1	0	T_6
0	1	1	1	T_7
1	0	0	0	0

1 = High
0 = Low
0 = Don't care
T_0 = Reference or inherent delay of circuit.
T_1 to T_7 = Multiplier of incremental delay.

Part ** Number	Incremental Delay Per Step	Total Delay* Change	Part ** Number	Incremental Delay Per Step	Total Delay* Change
PDU-138-.5	.5 NS ± .3 NS	3.5 NS	PDU-138-10	10 NS ± 1.0 NS	70 NS
PDU-138-1	1 NS ± .4 NS	7 NS	PDU-138-15	15 NS ± 1.3 NS	105 NS
PDU-138-2	2 NS ± .4 NS	14 NS	PDU-138-20	20 NS ± 1.5 NS	140 NS
PDU-138-3	3 NS ± .5 NS	21 NS	PDU-138-40	40 NS ± 2.0 NS	280 NS
PDU-138-5	5 NS ± .6 NS	35 NS	PDU-138-50	50 NS ± 2.5 NS	350 NS

*This delay value does not include the T_0 delay.
** Other delay increments available on request.

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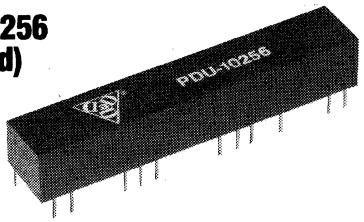
DIGITALLY PROGRAMMABLE DELAY LINES

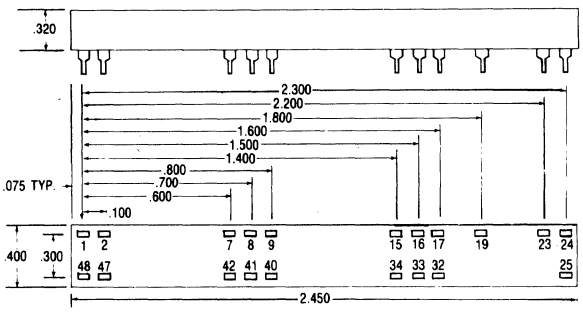
SERIES PDU-10256 (ECL Interfaced) 8-BIT

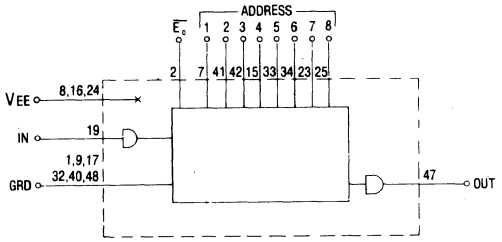


Specifications

Same as PDU-1016 except:

- **Inherent delay:** 16 NS typ.
- **Power dissipation:** 925 MW typ.





TRUTH TABLE

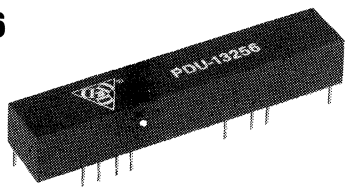
Address (Bit No.) 8	7	6	5	4	3	2	1	Enable ($\overline{E_0}$)	Delay Out
0	0	0	0	0	0	0	0	0	T_0
0	0	0	0	0	0	0	1	0	T_1
0	0	0	0	0	0	1	0	0	T_2
0	0	0	0	0	0	1	1	0	T_3
0	0	0	0	0	1	0	0	0	T_4
0	0	0	0	0	1	0	1	0	T_7
0	0	0	0	1	0	0	0	0	T_8
0	0	0	0	1	1	1	1	0	T_{15}
0	0	0	1	0	0	0	0	0	T_{16}
0	0	0	1	0	1	0	1	0	T_{31}
0	0	1	0	0	0	0	0	0	T_{32}
0	0	1	1	0	1	0	1	0	T_{63}
0	1	0	0	0	0	0	0	0	T_{64}
0	1	0	1	0	1	0	1	0	T_{127}
1	0	0	0	0	0	0	0	0	T_{128}
1	1	0	1	0	1	0	1	0	T_{255}
Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	0

0 = Logic 0 1 = Logic 1 Ø = Don't care
T_0 = Reference or inherent delay of circuit.
T_1 to T_{255} = Multiplier of incremental delay.

Part No.	Incremental Delay Per Step NS	Total Programmed Delay NS	Part No.	Incremental Delay Per Step NS	Total Programmed Delay NS
PDU-10256-1	1	255	PDU-10256-6	6	1,530
PDU-10256-2	2	510	PDU-10256-7	7	1,785
PDU-10256-3	3	765	PDU-10256-8	8	2,040
PDU-10256-4	4	1,020	PDU-10256-9	9	2,295
PDU-10256-5	5	1,275	PDU-10256-10	10	2,550

NOTE: For the sake of simplicity all 256 programmable steps are not shown in this truth table.

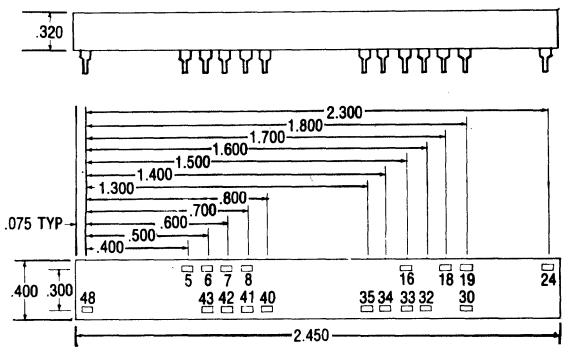
SERIES PDU-13256 (TTL Interfaced) 8-BIT

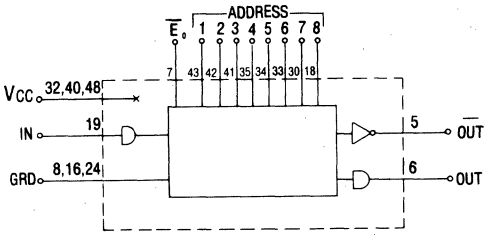


Specifications

Same as PDU-1316 except:

- **Inherent delay:** 44 NS on pin 6 } typ
  45 NS on pin 5 }
- **Power dissipation:** 1.1 W Max.





TRUTH TABLE

Address (Bit No.) 8	7	6	5	4	3	2	1	Enable ($\overline{E_0}$)	Delay Out
0	0	0	0	0	0	0	0	0	T_0
0	0	0	0	0	0	0	1	0	T_1
0	0	0	0	0	0	1	0	0	T_2
0	0	0	0	0	0	1	1	0	T_3
0	0	0	0	0	1	0	0	0	T_4
0	0	0	0	0	1	0	1	0	T_7
0	0	0	0	1	0	0	0	0	T_8
0	0	0	0	1	1	1	1	0	T_{15}
0	0	0	1	0	0	0	0	0	T_{16}
0	0	0	1	0	1	0	1	0	T_{31}
0	0	1	0	0	0	0	0	0	T_{32}
0	0	1	1	0	1	0	1	0	T_{63}
0	1	0	0	0	0	0	0	0	T_{64}
0	1	0	1	0	1	0	1	0	T_{127}
1	0	0	0	0	0	0	0	0	T_{128}
1	1	0	1	0	1	0	1	0	T_{255}
Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	0

0 = Logic 0 1 = Logic 1 Ø = Don't care
T_0 = Reference or inherent delay of circuit.
T_1 to T_{255} = Multiplier of incremental delay.

Part No.	Incremental Delay Per Step NS	Total Programmed Delay NS	Part No.	Incremental Delay Per Step NS	Total Programmed Delay NS
PDU-13256-1	1	255	PDU-13256-6	6	1,530
PDU-13256-2	2	510	PDU-13256-7	7	1,785
PDU-13256-3	3	765	PDU-13256-8	8	2,040
PDU-13256-4	4	1,020	PDU-13256-9	9	2,295
PDU-13256-5	5	1,275	PDU-13256-10	10	2,550

NOTE: For the sake of simplicity all 256 programmable steps are not shown in this truth table.

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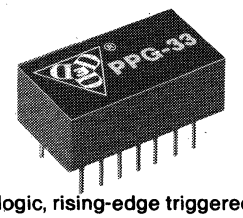
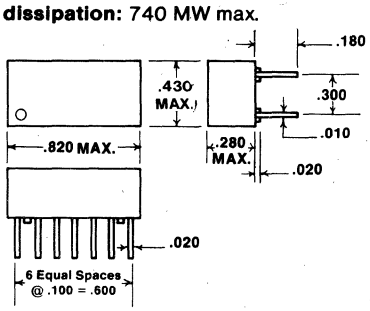
DIGITALLY PROGRAMMABLE PULSER

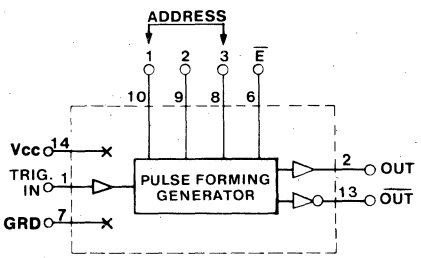
SERIES PPG-33 (TTL Interfaced) 3 BIT



Specifications

- **Input requirements:** TTL logic, rising-edge triggered.
- **Input pulse width:** 6 NS min.
- **Output fan-out:** TTL Schottky load.
- **Programmed pulse-width tolerance:** ±5% or 1 NS.
- **Supply voltage (Vcc):** 5 Vdc ±5%.
- **Operating temperature:** 0°C to 70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Power dissipation:** 740 MW max.





TRUTH TABLE

Address (Bit No.)				Pulse Width
Enable	3	2	1	Out
0	0	0	0	T_0
0	0	0	1	T_1
0	0	1	0	T_2
0	0	1	1	T_3
0	1	0	0	T_4
0	1	0	1	T_5
0	1	1	0	T_6
0	1	1	1	T_7
1	ϕ	ϕ	ϕ	0

1 = High
0 = Low
ϕ = Don't care
T_0 = Reference or inherent pulse width.
T_1 to T_7 = Multiplier of pulse width.

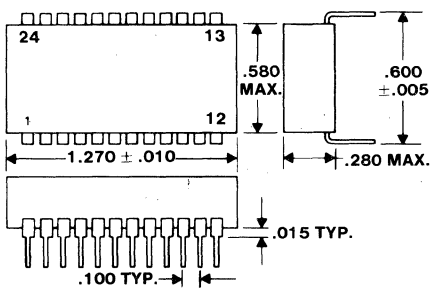
Part Number	Incremental Pulse Width Per Step	Total Pulse Width Change
PPG-33-1	1 NS ±.4 NS	7 NS
PPG-33-2	2 NS ±.4 NS	14 NS
PPG-33-3	3 NS ±.5 NS	21 NS
PPG-33-5	5 NS ±.6 NS	35 NS
PPG-33-10	10 NS ±1.0 NS	70 NS
PPG-33-15	15 NS ±1.3 NS	105 NS
PPG-33-20	20 NS ±1.5 NS	140 NS
PPG-33-40	40 NS ±2.0 NS	280 NS
PPG-33-50	50 NS ±2.5 NS	350 NS

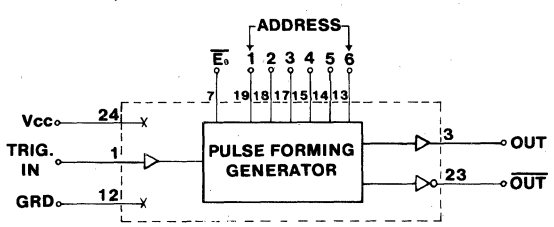
Contact us for specific requirements. We customize.

SERIES: PPG-36 (TTL Interfaced) 6 BIT

Specifications:

- **Input signal requirement:** TTL rising-edge.
- **Output fan-out:** TTL Schottky load.
- **Trigger inherent delay:** 6 NS Typ.
- **Inherent pulse-width:** 11 NS Typ.
- **Pulse-width variation:** monotonic in one direction.
- **Programmed pulse-width tolerance:** ±5% or 1 NS whichever is greater.
- **Supply voltage:** 5 Vdc.
- **Operating temperature:** 0° C to 70° C.
- **Temperature coefficient:** 100 PPM/° C.
- **Power dissipation:** 900 MW Typ.





TRUTH TABLE

Address (Bit No.)							
6	5	4	3	2	1	Enable ($\overline{E_0}$)	Pulse-Width Out
0	0	0	0	0	0	0	T_0
0	0	0	0	0	1	0	T_1
0	0	0	0	1	0	0	T_2
0	0	0	0	1	1	0	T_3
0	0	0	1	0	0	0	T_4
0	0	0	1	1	1	0	T_7
0	0	1	0	0	0	0	T_8
0	0	1	1	1	1	0	T_{15}
0	1	0	0	0	0	0	T_{16}
0	1	1	1	1	1	0	T_{31}
1	0	0	0	0	0	0	T_{32}
1	1	1	1	1	1	0	T_{63}
ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	1	0

0 = Logic 0 1 = Logic 1 ϕ = Don't care.
T_0 = Reference or inherent pulse-width of unit.
T_1 — T_{63} = Multiplier of incremental pulse-width.

Part No.	Incremental Pulse-Width	Total Programmed Pulse-Width	Part No.	Incremental Pulse-Width	Total Programmed Pulse-Width
PPG-36-1	1 NS ± .5 NS	63 NS	PPG-36-6	6 NS ±1.5 NS	378 NS
PPG-36-2	2 NS ± .5 NS	126 NS	PPG-36-7	7 NS ±1.5 NS	441 NS
PPG-36-3	3 NS ±1.0 NS	189 NS	PPG-36-8	8 NS ±2.0 NS	504 NS
PPG-36-4	4 NS ±1.0 NS	252 NS	PPG-36-9	9 NS ±2.0 NS	567 NS
PPG-36-5	5 NS ±1.5 NS	315 NS	PPG-36-10	10 NS ±2.0 NS	630 NS

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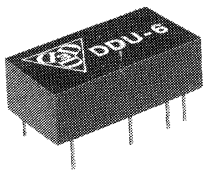
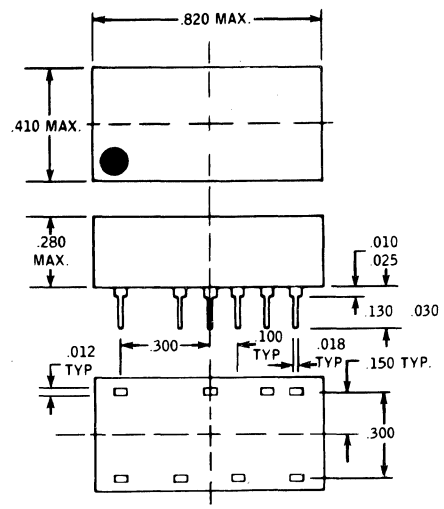
DIGITAL DELAY LINES

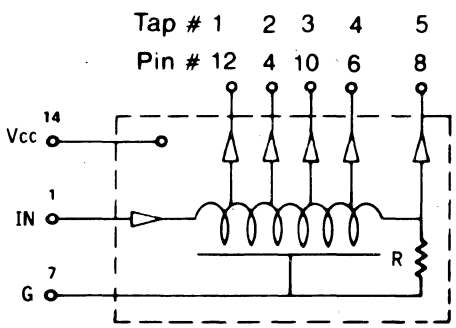
SERIES DDU-6 (TTL Interfaced) 14 pins DIP



Specifications

- **Outputs:** 5, equally spaced.
- **Delay tolerance:** see table.
- **Rise-time:** 4 NS typ.
- **Minimum pulse width:** 40% of total delay.
- **Temperature range:** 0 to 70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Supply voltage:** 4.75 to 5.25 Vdc.
- **Input signal:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Power dissipation:** 375 mw max.

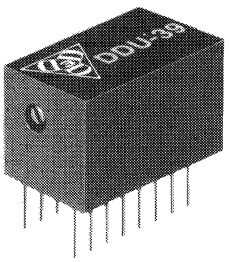




Part No.	Total Delay (NS)	Tap Delay (NS)	Part No.	Total Delay (NS)	Tap Delay (NS)
*DDU-6-4	4 ± 1	1 ± 0.5	DDU-6-45	45 ± 3	9 ± 3
*DDU-6-6	6 ± 1	1.5 ± 0.5	DDU-6-50	50 ± 3	10 ± 3
*DDU-6-8	8 ± 2	2 ± 1	DDU-6-60	60 ± 3	12 ± 3
*DDU-6-10	10 ± 2	2.5 ± 1	DDU-6-75	75 ± 4	15 ± 3
*DDU-6-12	12 ± 2	3 ± 1	DDU-6-100	100 ± 5	20 ± 3
*DDU-6-16	16 ± 2	4 ± 1.5	DDU-6-125	125 ± 6.5	25 ± 3
*DDU-6-20	20 ± 3	5 ± 2	DDU-6-150	150 ± 7.5	30 ± 3
DDU-6-30	30 ± 3	6 ± 2	DDU-6-175	175 ± 8	35 ± 4
DDU-6-35	35 ± 3	7 ± 2	DDU-6-200	200 ± 10	40 ± 4
DDU-6-40	40 ± 3	8 ± 2	DDU-6-250	250 ± 12.5	50 ± 5

*Time delay measured with respect to 1st tap.

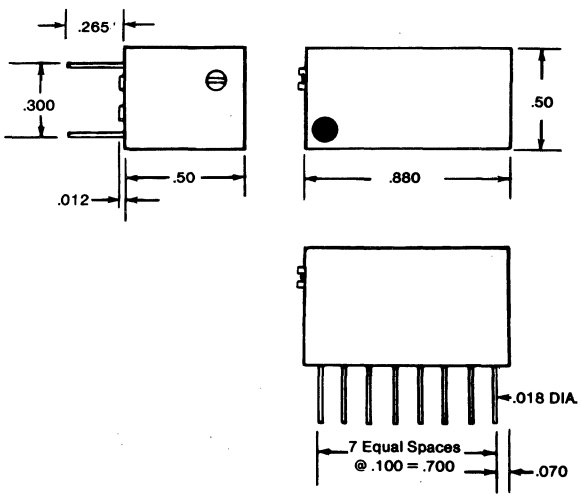
SERIES DDU-39 (TTL Interfaced) Continuously Variable

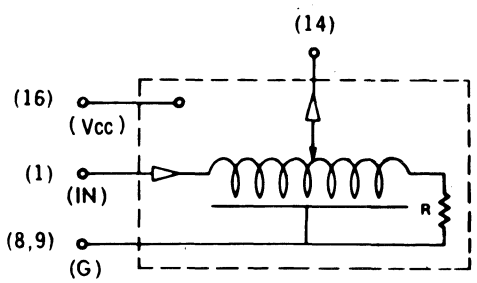


Specifications

- **Temperature coefficient:** 220 PPM/°C.
- **Rise-time:** 4 NS typically.
- **Delay:** Adjustable from 10 NS to 30 NS.
- **Temperature range:** 0°C to 70°C standard. (-55°C to +125°C on request)*
- **Supply voltage:** 4.5 to 5.5 Vdc.
- **Power dissipation:** 375 MW Max.

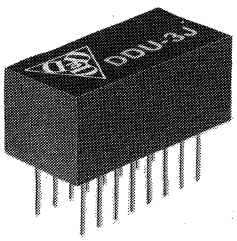
*Add "M" after PART NO. Example DDU-39M





DIGITAL DELAY LINES

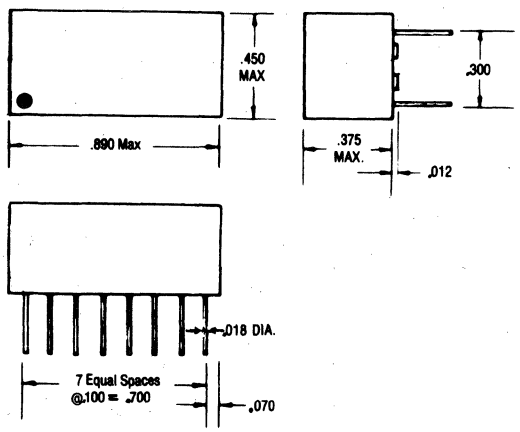
SERIES: DDU-3J (TTL Interfaced) 1 to 5 Taps, 16 pins DIP

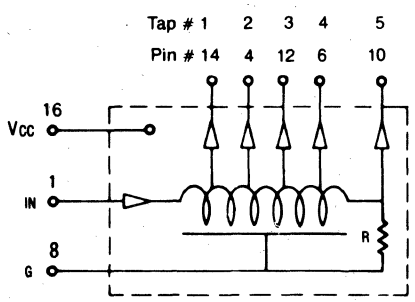


Specifications

- **Delay tolerance:** ±5% or better; or 2 NS whichever is greater.
- **Rise-time:** 4 NS typically.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** -0°C to 70°C standard (-55°C to + 125°C on request.)*

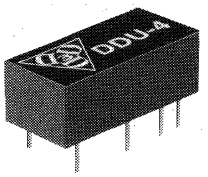
***Add "M" to PART NO. Example DDU-3J-5100M**





SCHEMATIC DIAGRAM FOR 5 DELAYS OUTPUT

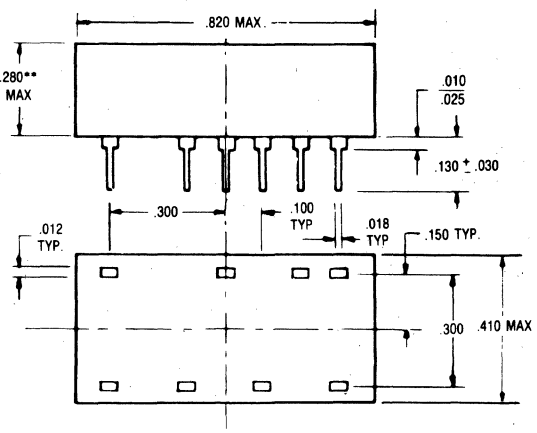
SERIES DDU-4 (TTL Interfaced) 1 to 5 Taps, 14 pins DIP

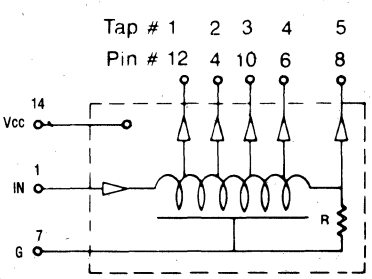


Specifications

- **Delay tolerance:** ±5% or better; or 2 NS whichever is greater.
- **Rise-time:** 4 NS typically.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** -0°C to 70°C standard (-55°C to + 125°C on request.)*
- **Minimum pulse width:** 20% of total delay.

***Add "M" after PART NO. Example DDU-4-5100M**
****.320 Max. for "M" units.**





SCHEMATIC DIAGRAM FOR 5 DELAYS OUTPUT

Part No.	5 Delays Output (NS)				
	Delay @ Pin #14	Delay @ Pin #4	Delay @ Pin #12	Delay @ Pin #6	Delay @ Pin #10
DDU-3J-5025	5	10	15	20	25
DDU-3J-5050	10	20	30	40	50
DDU-3J-5075	15	30	45	60	75
DDU-3J-5100	20	40	60	80	100
DDU-3J-5125	25	50	75	100	125
DDU-3J-5150	30	60	90	120	150
DDU-3J-5200	40	80	120	160	200
DDU-3J-5250	50	100	150	200	250
DDU-3J-5300	60	120	180	240	300
DDU-3J-5400	80	160	240	320	400
DDU-3J-5500	100	200	300	400	500

Part No.	5 Delays Output (NS)				
	Delay @ Pin #12	Delay @ Pin #4	Delay @ Pin #10	Delay @ Pin #6	Delay @ Pin #8
DDU-4-5025	5	10	15	20	25
DDU-4-5050	10	20	30	40	50
DDU-4-5075	15	30	45	60	75
DDU-4-5100	20	40	60	80	100
DDU-4-5125	25	50	75	100	125
DDU-4-5150	30	60	90	120	150
DDU-4-5200	40	80	120	160	200
DDU-4-5250	50	100	150	200	250
DDU-4-5300	60	120	180	240	300
DDU-4-5400	80	160	240	320	400
DDU-4-5500	100	200	300	400	500

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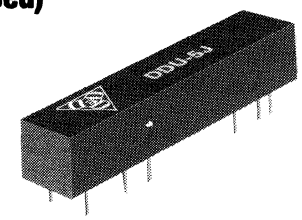
DIGITAL DELAY LINES

SERIES DDU-5J (TTL Interfaced) 10 Taps, 32 pins DIP

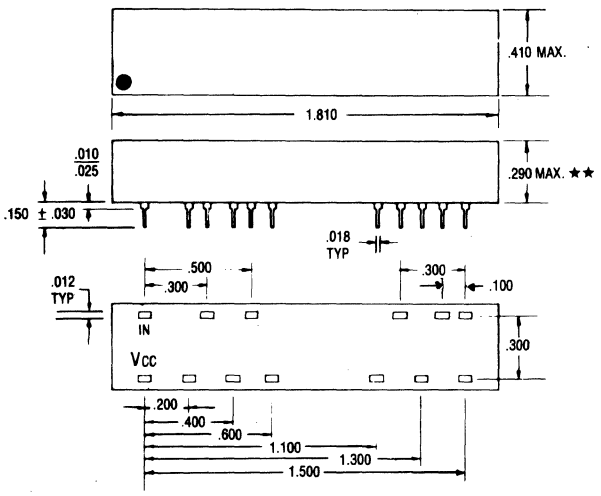


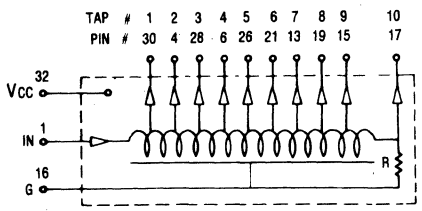
Specifications

- **Delay tolerance:** ±5% or better or 2 NS whichever is greater.
- **Rise-time:** 4 NS typically.
- **Minimum pulse width:** 20% of total delay.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** -0°C to 70°C standard. (-55°C to +125°C on request)*

***Add "M" after PART NO. Example DDU-5J-10100M**

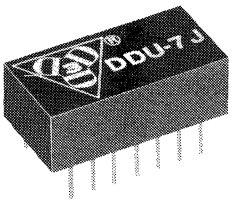
****.320 Max. for "M" units.**





Part No.	Total Delay (NS)	Delay Per Tap (NS)	Part No.	Total Delay (NS)	Delay Per Tap (NS)
DDU-5J-10050	50	5	DDU-5J-10400	400	40
DDU-5J-10100	100	10	DDU-5J-10500	500	50
DDU-5J-10150	150	15	DDU-5J-101000	1000	100
DDU-5J-10200	200	20	DDU-5J-101500	1500	150
DDU-5J-10250	250	25	DDU-5J-102000	2000	200
DDU-5J-10300	300	30			

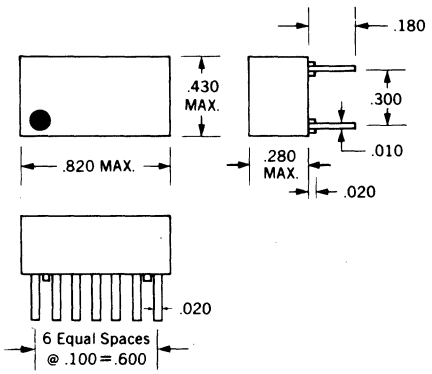
SERIES DDU-7J (TTL Interfaced) 10 Taps, 14 pins DIP

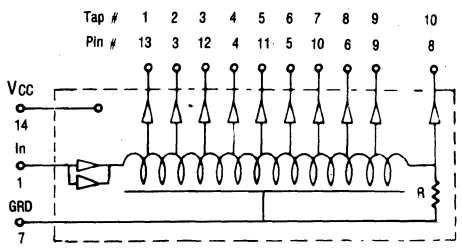


(Commercial Type)

Specifications:

- **No. Taps:** 10 equally spaced taps
- **Total delay tolerance:** ±5% or better or 2 NS whichever is greater.
- **Rise-time:** 4 NS typically.
- **Temperature coefficient:** 100 PPM°C.
- **Temperature range:** 0° to +70°C.
- **Supply voltage:** 4.5 to 5.5 Vdc.
- **Power dissipation:** 740 MW max.





Part No.	Total Delay NS	Delay Per Tap NS	Part No.	Total Delay NS	Delay Per Tap NS
*DDU-7J-10	9	1 ± 4	DDU-7J-200	200	20.0 ± 2
*DDU-7J-20	18	2 ± 5	DDU-7J-250	250	25.0 ± 2
*DDU-7J-25	22.5	2.5 ± 7	DDU-7J-300	300	30.0 ± 3
*DDU-7J-50	45	5.0 ± 1.5	DDU-7J-400	400	40.0 ± 4
DDU-7J-100	100	10.0 ± 2	DDU-7J-500	500	50.0 ± 5
DDU-7J-150	150	15.0 ± 2			

*Time delay referenced to 1st tap. Two (2) gates in parallel for input buffer.

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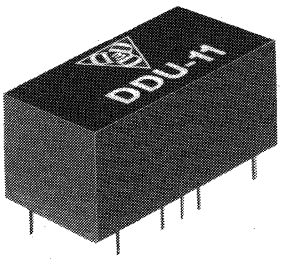
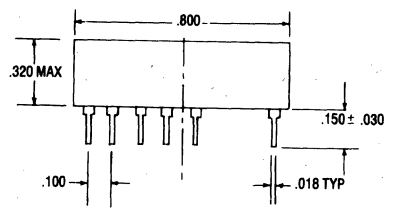
DIGITAL DELAY LINES

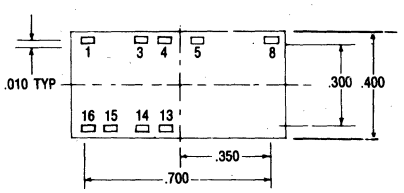
SERIES DDU-11 (ECL Interfaced) 5 Taps, 16 pins DIP

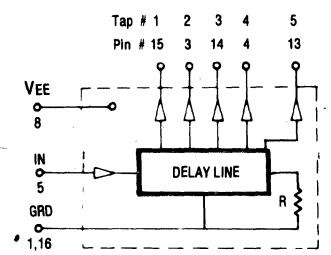


Specifications

- **Input & output completely buffered.**
- **Delay tolerance:** ± 5% or 2 NS whichever is greater.
- **Rise-time:** 2 NS typ.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** -30°C to 85°C.
- **Supply voltage:** -5.2 Vdc.
- **Power dissipation:** 200 MW typ. (no load).





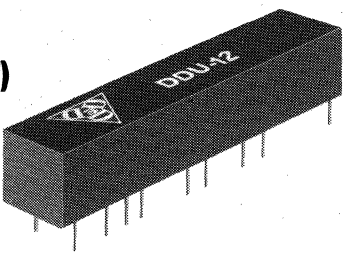


Pull-down resistor on output taps not provided inside unit.

Part No.	Total Delay (NS)	Delay Per Tap (NS)	Part No.	Total Delay (NS)	Delay Per Tap (NS)
*DDU-11-5	4	1	DDU-11-150	150	30
*DDU-11-10	8	2	DDU-11-200	200	40
*DDU-11-20	16	4	DDU-11-250	250	50
*DDU-11-25	20	5	DDU-11-300	300	60
DDU-11-50	50	10	DDU-11-400	400	80
DDU-11-75	75	15	DDU-11-500	500	100
DDU-11-100	100	20			

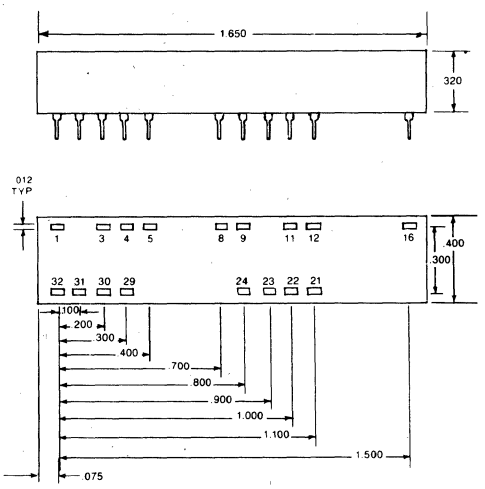
*Time delay measurements referenced to 1st tap

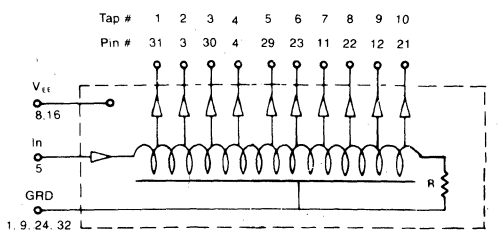
SERIES DDU-12 (ECL Interfaced) 10 Taps, 32 pins DIP



Specifications:

- **Total Delay Tolerance:** ±5% or better, or 2 NS whichever is greater.
- **No. Taps:** 10 equally spaced
- **Rise-Time:** 2 ns typical
- **Supply Voltage:** −5.2V
- **Operating Temperature:** −30°C to 85°C
- **Power Dissipation:** 400 MW typ. (no load)
- **Temperature Coefficient:** 100 PPM/°C





Pull-down resistor on output taps not provided inside the unit.

Part No.	Total Delay (NS)	Delay Per Tap (NS)	Part No.	Total Delay (NS)	Delay Per Tap (NS)
*DDU-12-10	9	1	DDU-12-200	200	20
*DDU-12-20	18	2	DDU-12-250	250	25
*DDU-12-25	22.5	2.5	DDU-12-300	300	30
*DDU-12-40	36	4	DDU-12-400	400	40
*DDU-12-50	45	5	DDU-12-500	500	50
DDU-12-75	75	7.5	DDU-12-750	750	75
DDU-*2-100	100	10	DDU-12-1000	1000	100
DDU-12-150	150	15	DDU-12-1500	1500	150

*Time delay measurements referenced to 1st tap.

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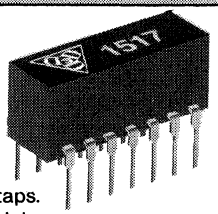
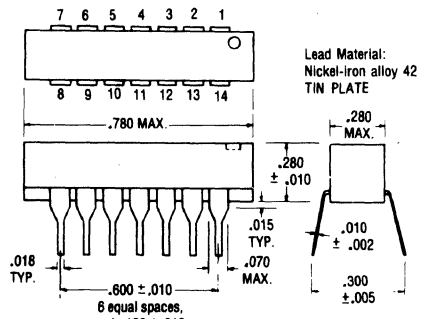
DIP-TAPPED DELAY LINES

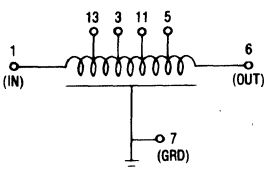
SERIES 1517
5 Taps



Specifications

- **Delay accuracy:** ± 5% (others on request).
- **No. taps:** 5 Equally spaced taps.
- **Taps accuracy:** ± 5% of tap delay.
- **Impedance tolerance:** ± 10%.(others on request).
- **Rise-Time:** 30% of time delay.
- **Withstanding voltage:** 50 Vdc. Min.
- **Temperature coefficient:** 100 PPM/°C.
- **Environment:** Meets or exceeds MIL-D-23859C.

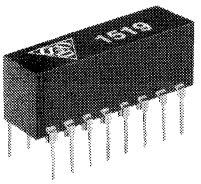




TAPS - CONNECTION

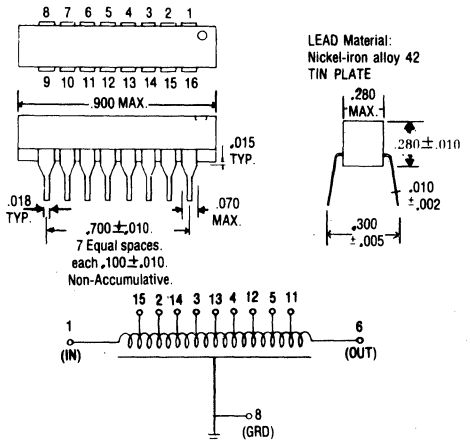
Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)	Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)
1517-10A	10	50	0.6	1517-150D	150	250	8.5
1517-15A	15	50	0.6	1517-15E	15	300	2.5
1517-20A	20	50	0.7	1517-30E	30	300	3.0
1517-30A	30	50	0.7	1517-50E	50	300	4.0
1517-40A	40	50	0.9	1517-60E	60	300	4.0
1517-5B	5	100	0.5	1517-75E	75	300	4.5
1517-10B	10	100	0.7	1517-90E	90	300	5.5
1517-15B	15	100	0.7	1517-120E	120	300	8.0
1517-20B	20	100	0.9	1517-130E	130	300	9.0
1517-25B	25	100	1.0	1517-180E	180	300	11.0
1517-30B	30	100	1.5	1517-220E	220	300	13.0
1517-40B	40	100	1.8	1517-20F	20	400	4.5
1517-50B	50	100	2.0	1517-40F	40	400	5.0
1517-60B	60	100	2.0	1517-60F	60	400	5.0
1517-75B	75	100	2.5	1517-80F	80	400	8.0
1517-10C	10	200	1.5	1517-100F	100	400	9.0
1517-20C	20	200	2.0	1517-120F	120	400	10.0
1517-30C	30	200	2.5	1517-160F	160	400	13.0
1517-40C	40	200	3.0	1517-180F	180	400	14.0
1517-50C	50	200	3.0	1517-240F	240	400	19.0
1517-60C	60	200	3.5	1517-300F	300	400	23.0
1517-80C	80	200	3.5	1517-25G	25	500	3.0
1517-90C	90	200	5.0	1517-50G	50	500	5.0
1517-120C	120	200	5.0	1517-75G	75	500	8.0
1517-150C	150	200	8.0	1517-100G	100	500	15.0
1517-25D	25	250	2.5	1517-125G	125	500	9.0
1517-37D	37	250	3.0	1517-150G	150	500	13.0
1517-50D	50	250	3.5	1517-200G	200	500	21.0
1517-60D	60	250	4.0	1517-225G	225	500	23.0
1517-75D	75	250	4.0	1517-300G	300	500	29.0
1517-100D	100	250	5.0				

SERIES 1519
10 Taps



Specifications

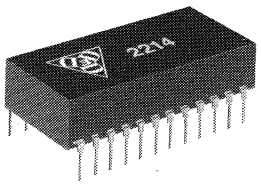
- **Delay Accuracy:** ± 5% (others on request)
- **No. taps:** 10 Equally spaced taps.
- **Taps accuracy:** ± 5% of tap delay.
- **Impedance tolerance:** ± 10% (others on request).
- **Rise-Time:** 20% of time delay.
- **Withstanding voltage:** 50 Vdc. Min.
- **Temperature coefficient:** 100 PPM/°C.
- **Environment:** Meets or exceeds MIL-D-23859C.



Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)	Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)
1519-20A	20	50	1.0	1519-200D	200	250	10.0
1519-25A	25	50	1.0	1519-225D	225	250	11.0
1519-30A	30	50	1.2	1519-300D	300	250	17.0
1519-40A	40	50	1.5	1519-375D	375	250	20.0
1519-45A	45	50	1.5	1519-500D	500	250	24.0
1519-50A	50	50	1.5	1519-30E	30	300	5.0
1519-60A	60	50	1.5	1519-60E	60	300	6.0
1519-75A	75	50	1.8	1519-90E	90	300	7.0
1519-100A	100	50	2.0	1519-120E	120	300	8.0
1519-10B	10	100	1.0	1519-150E	150	300	9.0
1519-20B	20	100	1.5	1519-180E	180	300	11.0
1519-30B	30	100	1.5	1519-240E	240	300	16.0
1519-40B	40	100	1.8	1519-270E	270	300	18.0
1519-50B	50	100	2.0	1519-360E	360	300	21.0
1519-60B	60	100	3.0	1519-450E	450	300	25.0
1519-80B	80	100	3.5	1519-600E	600	300	40.0
1519-90B	90	100	3.5	1519-40F	40	400	8.5
1519-100B	100	100	4.0	1519-80F	80	400	9.0
1519-120B	120	100	4.0	1519-120F	120	400	9.0
1519-150B	150	100	5.0	1519-160F	160	400	16.0
1519-200B	200	100	6.0	1519-200F	200	400	18.0
1519-250B	250	100	7.0	1519-240F	240	400	20.0
1519-20C	20	200	3.0	1519-320F	320	400	26.0
1519-40C	40	200	4.0	1519-360F	360	400	28.0
1519-60C	60	200	4.5	1519-480F	480	400	38.0
1519-80C	80	200	5.5	1519-600F	600	400	45.0
1519-100C	100	200	6.0	1519-800F	800	400	40.0
1519-120C	120	200	6.5	1519-50G	50	500	6.0
1519-160C	160	200	7.0	1519-100G	100	500	10.0
1519-180C	180	200	8.5	1519-150G	150	500	16.0
1519-200C	200	200	9.0	1519-200G	200	500	30.0
1519-240C	240	200	9.5	1519-250G	250	500	18.0
1519-300C	300	200	16.0	1519-300G	300	500	26.0
1519-400C	400	200	16.0	1519-400G	400	500	42.0
1519-50D	50	250	5.5	1519-450G	450	500	45.0
1519-75D	75	250	6.0	1519-500G	500	500	55.0
1519-100D	100	250	7.0	1519-600G	600	500	58.0
1519-125D	125	250	8.0	1519-750G	750	500	50.0
1519-150D	150	250	8.5	1519-1000G	1000	500	65.0

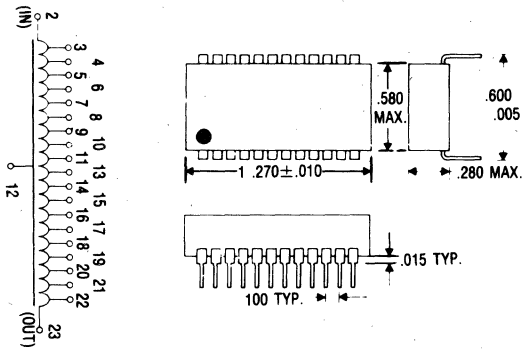
DIP-TAPPED DELAY LINES

SERIES 2214
20 Taps



Specifications

- **20 Equally spaced taps.**
- **Td/Tr = 10/1.**
- **Delay tolerance:** ± 5% or 1 NS whichever is greater.
- **Tap tolerance:** ± 5% or 1 NS whichever is greater.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** -55°C to +125°C.
- **Dielectric breakdown:** 50 Vdc.
- **Meets or exceeds MIL-D-23859C.**
- **Epoxy encapsulated.**



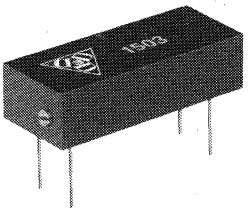
Part No.	Imp. (Ω)	Total Delay (NS)	Tap Increment (NS)	Rdc (Ω)
2214-50A	50	50	2.5	3.2
2214-60A	50	60	3.0	3.6
2214-80A	50	80	4.0	5.0
2214-100A	50	100	5.0	6.0
2214-150A	50	150	7.5	6.0
2214-200A	50	200	10.0	7.0
2214-50B	100	50	2.5	6.0
2214-60B	100	60	3.0	6.0
2214-80B	100	80	4.0	6.5
2214-100B	100	100	5.0	7.0
2214-150B	100	150	7.5	8.0
2214-200B	100	200	10.0	8.5
2214-300B	100	300	15.0	11.0
2214-400B	100	400	20.0	12.0
2214-40C	200	40	2.0	7.0
2214-80C	200	80	4.0	8.0
2214-120C	200	120	6.0	10.0
2214-200C	200	200	10.0	13.0
2214-300C	200	300	15.0	12.0
2214-400C	200	400	20.0	15.0
2214-500C	200	500	25.0	17.0
2214-600C	200	600	30.0	23.0
2214-800C	200	800	40.0	38.0
2214-50D	250	50	2.5	7.0
2214-100D	250	100	5.0	10.0
2214-150D	250	150	7.5	12.0
2214-200D	250	200	10.0	22.0
2214-250D	250	250	12.5	21.0
2214-300D	250	300	15.0	23.0
2214-400D	250	400	20.0	26.0
2214-500D	250	500	25.0	30.0
2214-600D	250	600	30.0	37.0
2214-800D	250	800	40.0	41.0
2214-1000D	250	1000	50.0	47.0
2214-200G	500	200	10.0	20.0
2214-300G	500	300	15.0	37.0
2214-400G	500	400	20.0	40.0
2214-500G	500	500	25.0	45.0
2214-600G	500	600	30.0	52.0
2214-800G	500	800	40.0	80.0
2214-1000G	500	1000	50.0	100.0
2214-1200G	500	1200	60.0	110.0
2214-1500G	500	1500	75.0	130.0
2214-2000G	500	2000	100.0	156.0

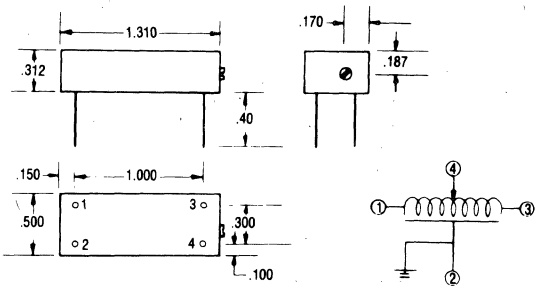
CONTINUOUSLY VARIABLE DELAY LINES

SERIES 1503

Specifications

- **Continuously variable delay.**
- **Multi-turn adjusting screw** (40 turns approx.).
- **Temperature coefficient:** 100 PPM/°C.
- **Rise-time:** 20% of time delay.
- **Flat leads** (.020 x .010).
- **Withstanding voltage:** 50 Vdc.
- **Resolution:** .12 NS approx.

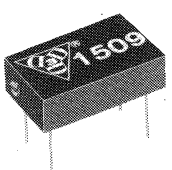




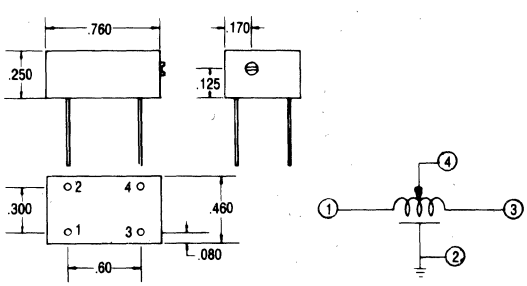
Part No.	Td (NS)	Imp. (Ω)	Rdc (Ω)	Part No.	Td (NS)	Imp. (Ω)	Rdc (Ω)
1503-15A	15	50	7	1503-100B	100	100	6.0
1503-25A	25	50	8	1503-120B	120	100	8.0
1503-30A	30	50	10	1503-160B	160	100	10.0
1503-40A	40	50	15	1503-200B	200	100	14.0
1503-50A	50	50	17	1503-30C	30	200	4.0
1503-60A	60	50	20	1503-60C	60	200	8.0
1503-80A	80	50	30	1503-100C	100	200	14.0
1503-100A	100	50	35	1503-20D	20	250	5.0
1503-15B	15	100	10	1503-20E	20	300	5.0
1503-30B	30	100	20	1503-30F	30	350	8.0
1503-50B	50	100	30	1503-25G	25	400	8.0
1503-60B	60	100	40	1503-40H	40	500	12.0
1503-80B	80	100	50				

SERIES 1509

Specifications



- **Low cost unit.**
- **Fits standard DIP sockets.**
- **Continuously variable.**
- **20 Turns approx.**
- **Resolution — .15 NS.**
- **Withstanding voltage — 100 Vdc.**
- **Temperature coefficient — 200 PPM/°C.**
- **Flat leads (.020 x .010).**



Part No.	Td (NS)	Impedance (Ω)	TR (NS)	Rdc (Ω)
1509-05B	5	100	3	4
1509-20C	20	200	8	1.0
1509-30F	30	400	10	7.0
1509-40H	40	500	15	13.0

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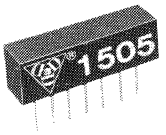
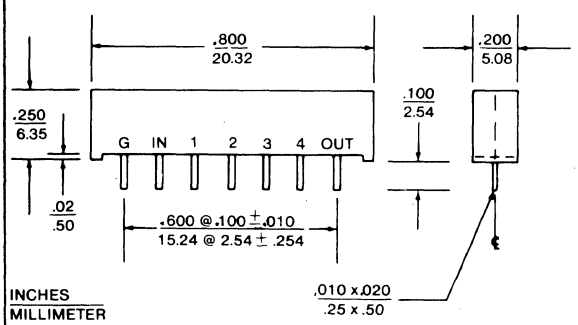
SIP-TAPPED DELAY LINES

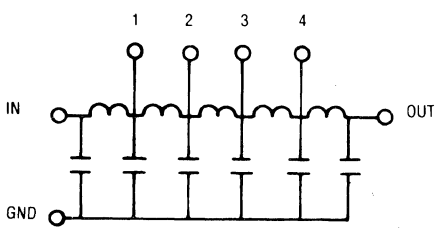
SERIES 1505
5 Taps,
7 Pins SIP



Specifications

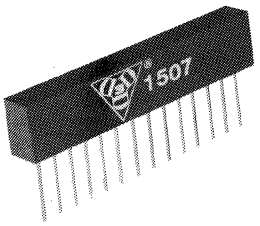
- **Low profile**
- **Meets or exceeds:** MIL-D-23859C
- **Operating temperature range:** -55°C to +125°C.
- **Storage temperature range:** -55°C to +125°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Dielectric breakdown:** 50 Vdc.
- **Epoxy encapsulated**
- **Maximum distortion @ output:** 10%





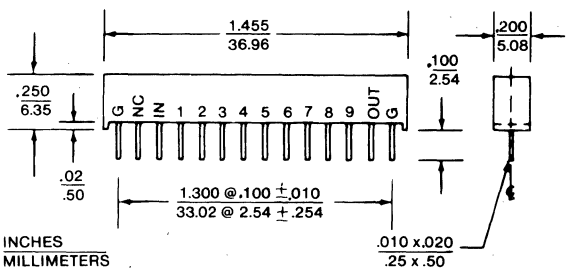
Part No.	Total Delay (NS)	Inp. (Ω)	Rdc (Ω)	Delay Per. Tap (NS)	Rise Time (NS)
1505-5A	5 ± 1.0	50	.6	1 ± .3	2.0
1505-10A	10 ± 1.0	50	.6	2 ± .4	3.0
1505-20A	20 ± 1.5	50	.7	4 ± .6	6.0
1505-30A	30 ± 2.0	50	.7	6 ± 1.0	9.0
1505-40A	40 ± 2.5	50	.9	8 ± 1.5	12.0
1505-50A	50 ± 3.0	50	1.0	10 ± 1.8	15.0
1505-60A	60 ± 3.0	50	1.2	12 ± 2.0	18.0
1505-70A	70 ± 3.5	50	1.4	14 ± 2.0	21.0
1505-80A	80 ± 4.0	50	1.6	16 ± 2.0	24.0
1505-90A	90 ± 5.0	50	1.8	18 ± 3.0	27.0
1505-100A	100 ± 5.0	50	2.0	20 ± 3.0	30.0
1505-5B	5 ± 1.0	100	.7	1 ± .3	2.0
1505-10B	10 ± 1.0	100	.7	2 ± .4	3.0
1505-20B	20 ± 1.5	100	1.0	4 ± .6	6.0
1505-30B	30 ± 2.0	100	1.5	6 ± 1.0	9.0
1505-40B	40 ± 2.5	100	1.8	8 ± 1.5	12.0
1505-50B	50 ± 3.0	100	2.0	10 ± 1.8	15.0
1505-60B	60 ± 3.0	100	2.0	12 ± 2.0	18.0
1505-75B	75 ± 3.5	100	2.5	15 ± 2.0	24.0
1505-100B	100 ± 5.0	100	3.5	20 ± 3.0	30.0
1505-30C	30 ± 2.0	200	2.5	6 ± 1.0	9.0
1505-50C	50 ± 3.0	200	3.0	10 ± 1.8	15.0
1505-60C	60 ± 3.0	200	3.5	12 ± 2.0	18.0
1505-100C	100 ± 5.0	200	6.0	20 ± 3.0	30.0
1505-50G	50 ± 3.0	500	5.0	10 ± 1.8	15.0
1505-100G	100 ± 5.0	500	15.0	20 ± 3.0	30.0
1505-200G	200 ± 10.0	500	21.0	40 ± 6.0	60.0
1505-300G	300 ± 15.0	500	29.0	60 ± 8.0	90.0

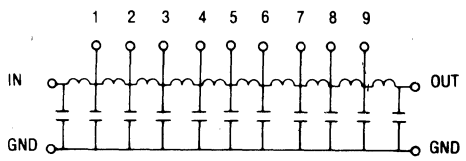
SERIES 1507
10 Taps,
14 pins SIP



Specifications:

- **Low profile.**
- **Meets or exceeds:** MIL-D-23859C
- **Operating temperature range:** -55°C to +125°C.
- **Storage temperature range:** -55°C to +125°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Dielectric breakdown:** 50 Vdc.
- **Epoxy encapsulated**
- **Maximum distortion @ output:** 10%.





Part No.	Total Delay (NS)	Inp. (Ω)	Rdc (Ω)	Delay Per. Tap (NS)	Rise Time (NS)
1507-20A	20 ± 2.0	50	1.0	2 ± .4	4.0
1507-40A	40 ± 2.0	50	1.5	4 ± 1.0	8.0
1507-50A	50 ± 2.5	50	1.5	5 ± 1.5	9.0
1507-100A	100 ± 5.0	50	2.0	10 ± 2.0	18.0
1507-150A	150 ± 7.5	50	3.0	15 ± 2.0	28.0
1507-200A	200 ± 10.0	50	4.0	20 ± 3.0	38.0
1507-20B	20 ± 2.0	100	1.5	2 ± .4	4.0
1507-50B	50 ± 2.5	100	2.0	5 ± 1.5	9.0
1507-100B	100 ± 5.0	100	4.0	10 ± 2.0	18.0
1507-200B	200 ± 10.0	100	6.0	20 ± 3.0	38.0
1507-250B	250 ± 13.0	100	7.0	25 ± 4.0	48.0
1507-20C	20 ± 2.0	200	3.0	2 ± .4	4.0
1507-50C	50 ± 2.5	200	4.5	5 ± 1.5	9.0
1507-100C	100 ± 5.0	200	6.0	10 ± 2.0	18.0
1507-200C	200 ± 13.0	200	9.0	20 ± 3.0	38.0
1507-50G	50 ± 2.5	500	6.0	5 ± 1.5	9.0
1507-100G	100 ± 5.0	500	10.0	10 ± 2.0	18.0
1507-200G	200 ± 10.0	500	30.0	20 ± 3.0	38.0
1507-300G	300 ± 15.0	500	30.0	30 ± 4.0	58.0
1507-500G	500 ± 25.0	500	55.0	50 ± 5.0	98.0

DATA DELAY DEVICES Inc. ■ 385 Lakeview Avenue, Clifton, New Jersey 07011 ■ (201) 772-1106 ■ TWX 710-989-7008

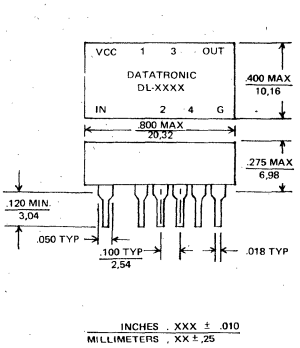
DIGITAL DELAY MODULES

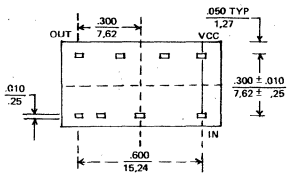
Series 6300

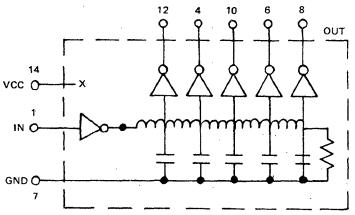
Part Number	Total Delay NS ±5%	Tap to Tap Delay NS (1)	Rise Time NS Max (2)
DL6305	25	5	3
DL6523	30	6	3
DL6943	35	7	3
DL6944	40	8	3
DL6945	45	9	3
DL6306	50	10	3
DL6526	75	15	3
DL8626	90	18	3
DL6307	100	20	3
DL6313	125	25	3
DL6308	150	30	3
DL8545	175	35	3
DL6309	200	40	3
DL8588	225	45	4
DL6310	250	50	4
DL6311	300	60	5
DL6582	350	70	7
DL6312	400	80	5
DL6521	450	90	5
DL6513	500	100	5
DL8589	600	120	5
DL8590	700	140	5
DL8621	735	147	5
DL8599	750	150	5
DL8591	800	160	5
DL8513	825	165	5
DL8592	900	180	5
DL8561	1000	200	5

• 14 Pin Package • TTL and DTL Compatible • 5 Equally spaced Taps Electrical Specifications at 25°C

Note: (1) Measured at 1.5V level leading edge,
Tol. ±5% or ±2NS, whichever is greater.
(2) Measured from 0.75V to 2.4V.
(3) Measured with no loads on taps.
(This note applies to all digital delay modules unless otherwise specified.)







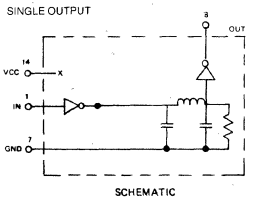
SINGLE OUTPUT

DIGITAL DELAY MODULES

Series 6330

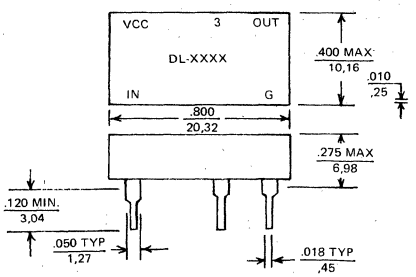
Part Number	Total Delay NS ±5%	Part Number	Delay NS ±5%
DL6335	10	DL6342	100
DL8614	15	DL8617	125
DL6336	20	DL6343	150
DL6337	30	DL8618	175
DL6338	40	DL6344	200
DL6339	50	DL8579	250
DL6340	60	DL6345	300
DL8615	70	DL6346	400
DL8616	75	DL6347	500
DL6341	80	DL6348	1000

SINGLE OUTPUT



SCHEMATIC

SINGLE OUTPUT AND ONE TAP



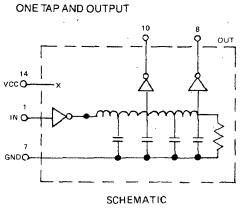
ONE TAP

DIGITAL DELAY MODULES

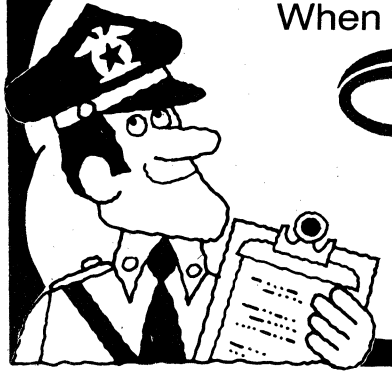
Series 6350

Part Number	Total Delay NS ±5%	Tap Delay NS(1)	Part Number	Total NS ±5%	Tap Delay NS(1)
DL6352	20	10	DL6358	150	75
DL6353	40	20	DL6359	200	100
DL6354	50	25	DL6360	300	150
DL8620	50	20	DL6361	400	200
DL6355	60	30	DL6362	500	250
DL6356	80	40	DL6363	1000	500
DL6357	100	50			

ONE TAP AND OUTPUT



SCHEMATIC



When Quality Counts, Count On

DATAMAX

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P.O. Box 2839, Blue Jay, CA 92317

PROGRAMMABLE DIGITAL DELAY LINES

Series 6550

TRUTH TABLE

Part Number	Incremental Delay per step (ns)	Total Delay (ns)
DL6551	1 ± 0.3	14 ± 1
DL6552	2 ± 0.4	21 ± 1
DL6553	3 ± 0.5	28 ± 1
DL6554	5 ± 0.6	42 ± 1
DL6555	10 ± 1.0	77 ± 2
DL6556	15 ± 1.3	112 ± 4

When Eo is H, no output
1D = Inherent dealy = 7NS ± 1NS
T_2 to T_8 = Multiplier of incremental delay

Eo	C	B	A	Tap#	Delay
L	L	L	L	1	1D
L	L	L	H	¢	1D+T
L	L	H	L	3	1D+2T
L	L	H	H	4	1D+3T
L	H	L	L	5	1D+4T
L	H	L	H	6	1D+5T
L	H	H	L	7	1D+6T
L	H	H	H	8	1D+7T

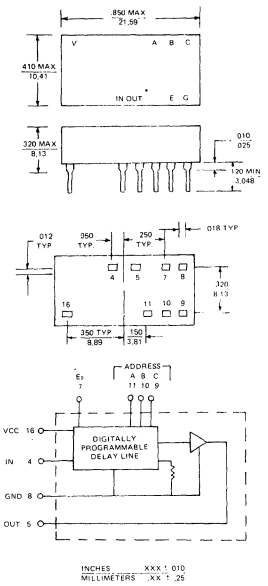
• TTL Compatible • Digitally Programmable in 8 delay 5 taps

SPECIFICATIONS:

Logic 1 Input Voltage	: 2.0 V Min.
Logic 1 Input Current	: 50 ua Max.
Logic O Input Voltage	: 0.7 V Max.
Logic 0 Input Current	: –0.4 ma Max.
Logic 1 Output Voltage	: 2.5 V Min.
Logic 0 Output Voltage	: 0.5 V Max.
Supply Voltage Vcc	: 4.75 to 5.25 VDC
Inherent delay	: 7 NS ± 1 NS
Operating Temperature	: 0–70°C
Temperature coefficient	: 100 PPM/°C

TEST CONDITIONS

Input Pulse–Width ≥ 50% of delay
Input Pulse Voltage 3V
Vcc: 5.0 VDC Typ.; Icc: 40 ma Typ.
Ambient Temperature: 25°C



7-PIN SINGLE-IN-LINE DIGITAL DELAY MODULE

Series DL 6250

Part Number	Total Delay Nanosecond (1)	Tap to Tap Delay NS (1)	Rise Time NS Max (2)
DL6251*	5 ± 1	1.2 ± 0.5	2
DL6252*	6 ± 1	1.5 ± 0.5	2
DL6253*	8 ± 2	2.0 ± 0.5	2
DL6254*	10 ± 2	2.5 ± 1.0	2
DL6255*	12 ± 2	3.0 ± 1.0	2
DL6256*	16 ± 2	4.0 ± 1.0	2
DL6257*	20 ± 3	5.0 ± 2.0	3
DL6258	30 ± 3	7.5 ± 2.0	3
DL6259	40 ± 3	8.0 ± 2.0	3
DL6260	40 ± 3	10.0 ± 2.0	3
DL6261	48 ± 3	12.0 ± 2.0	3
DL6262	50 ± 3	12.5 ± 2.0	4
DL6263	60 ± 3	15.0 ± 2.0	4
DL6264	80 ± 3	20.0 ± 2.0	4
DL6265	100 ± 3	25.0 ± 2.0	5
DL6266	120 ± 3	30.0 ± 2.0	5
DL6267	160 ± 3	40.0 ± 2.0	5
DL6268	200 ± 3	50.0 ± 2.5	5

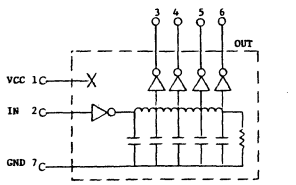
Note: (1) Measured at 1.5v level leading edge, tol. ± 5% or ± 2NS whichever is greater
(2) Measured from 0.75 to 2.4v
* Time Delay measurements referenced to 1st Tap

• Minimum Board Space Required • Low Profile Encapsulation Construction • 4 Equally Spaced Taps • TTL and DTL Compatible

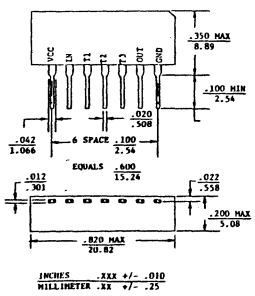
Specifications
- Supply Voltage: 4.5 to 5.5 VDC
- Logic 1 Input Current: 50μA Max
- Logic 0 Input Current: –2mA Max
- Logic 1 Volt Out: 2.4v Min
- Logic 0 Volt Out: 0.4v Max
- Logic 1 Fan-Out: 20/Tap Max
- Logic 0 Fan-Out: 10/Tap Max
- Power Dissipation: 240mW Total
- Operating Temp Range: 0–70°C
- Temp Coefficient: 100 PPM/°C

Input Test Conditions
- Input Pulse Voltage: 3.2v
- Input Rise Time: ≥3NS
- Input Current: 60mA Typ.
- Pulse Width: Min 40% of Total Delay

Electrical Specifications at 25°C (measured with no loads on Taps)



SCHEMATIC



When Dependability Counts, Count On

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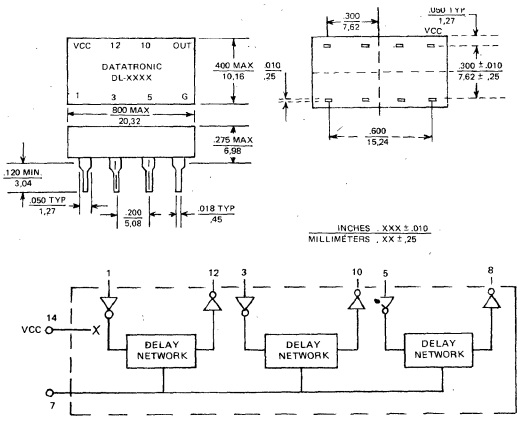
TRIPLE DELAY DIGITAL DELAY MODULE

Series DL 6130

Part Number	Delay Time NS (1)	Tolerance NS	Rise Time NS Max(2)
DL6130	5	±1.5	3.0
DL6131	10	±1.5	3.0
DL6132	15	±1.5	3.0
DL6163	18	±1.5	3.0
DL6133	20	±1.5	3.0
DL6134	25	±1.5	3.0
DL6135	30	±2.0	3.0
DL6136	40	±2.5	3.0
DL6137	50	±2.5	3.0
DL6138	60	±3.0	4.0
DL8546	65	±2.5	4.0
DL6139	70	±3.0	4.0
DL6140	75	±4.0	4.0
DL6141	80	±4.0	4.0
DL6142	90	±4.0	4.0
DL6143	100	±5.0	4.0
DL6144	125	±6.25	4.0
DL6164	134	±6.70	4.0
DL6145	150	±7.50	4.0
DL6146	154	±7.50	4.0
DL6147	175	±8.75	4.0
DL6148	200	±10.0	4.0
DL6149	225	±11.0	5.0
DL6150	250	±12.5	5.0

- 14 Pin Package • Three Independent Equal Delays • TTL and DTL compatible
- Electrical Specifications at 25°C



Note: (1) Measured at 1.5V level leading edge,
(2) Measured from 0.75V to 2.4V.
(3) Measured with no loads on taps.

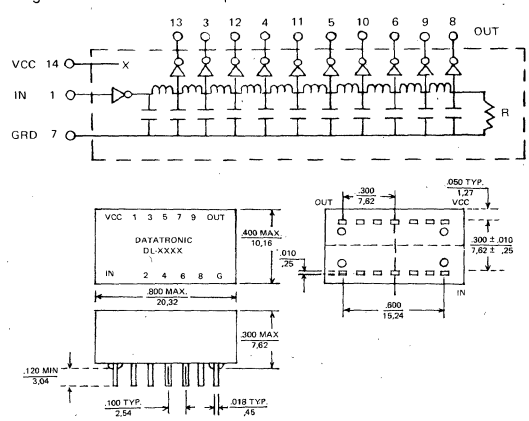
10 TAPS REDUCED SIZE

Series DL 6700

Part Number	Total Delay NSEC ±5%	Tap to Tap Delay NSEC(1)	Rise Time NSEC Max(2)
DL8611	25	2.5	3
DL8706	50	5.0	3
DL6936	60	6.0	3
DL6707	100	10	3
DL6708	150	15	4
DL6709	200	20	4
DL6710	250	25	4
DL6931	300	30	5
DL6332	350	35	5
DL6933	400	40	5
DL6934	450	45	5
DL6711	500	50	5

Note: (1) Measured at 1.5V level leading edge,
Tol. ±5% or ±2NS, whichever is greater.
(2) Measured from 0.75V to 2.4V.
(3) Measured with no loads on taps.

- 14 Pin Package • TTL and DTL Compatible • 10 Equally spaced Taps
- Tight Tolerances • Electrical Specifications at 25°C



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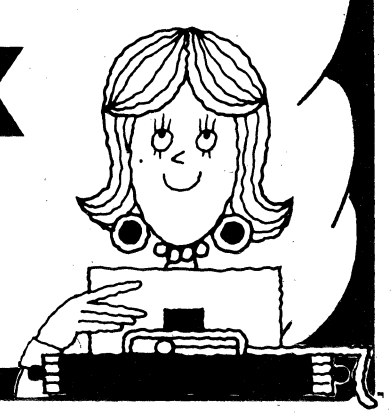


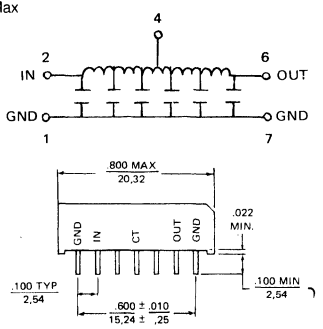
7-PIN SINGLE-IN-LINE DELAY LINES

Series DL 4320

• Minimum Board Space Required • Low Profile Encapsulated Construction • One Tap and Output • T.C. of Delay 100PPM/°C Max

Part Number	Impedance (ohm ±10%)	Total Delay (ns)	CT ±5% (ns)	Rise Time (ns max)	Part Number	Impedance (ohm ±10%)	Total Delay (ns)	CT ±5% (ns)	Rise Time (ns max)
DL4321	100	2±0.3	1	2.8	DL4334	100	28±1.5	14	8.4
DL4322	100	4±0.3	2	3.1	DL4335	100	30±1.5	15	9.0
DL4323	100	6±0.3	3	3.4	DL4336	100	32±1.5	16	9.6
DL4324	100	8±0.5	4	3.8	DL4337	100	34±1.7	17	10.2
DL4325	100	10±0.5	5	4.0	DL4338	100	36±1.7	18	10.8
DL4326	100	12±0.5	6	4.3	DL4339	100	38±2.0	19	11.4
DL4327	100	14±0.7	7	5.0	DL4340	100	40±2.0	20	12.0
DL4328	100	16±0.7	8	5.7	DL4341	100	42±2.0	21	12.6
DL4329	100	18±1.0	9	5.9	DL4342	100	44±2.5	22	13.2
DL4330	100	20±1.0	10	6.1	DL4343	100	45±2.5	22.5	13.5
DL4331	100	22±1.0	11	6.6	DL4344	100	46±2.5	23	13.8
DL4332	100	24±1.2	12	7.2	DL4345	100	48±2.5	24	14.4
DL4333	100	26±1.2	13	7.8	DL4346	100	50±2.5	25	15.0

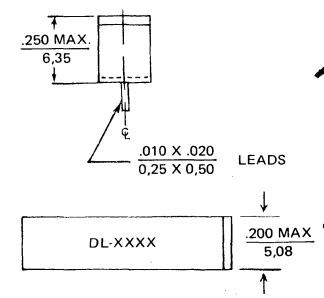
SCHEMATICS



Series DL 4300

• Minimum Board Space Required • Low Profile Encapsulation Construction • Single Output • T.C. of Delay 100PPM/°C Max

Part Number	Impedance Ohms ± 10%	Total Delay (ns)	Rise Time (ns max)	Attentuation % max	Distortion At Output % max
DL4301	100	1±0.3	2.6	3	10
DL4302	100	2±0.3	2.8	3	10
DL4303	100	3±0.3	2.9	3	10
DL4304	100	4±0.3	3.1	3	10
DL4305	100	5±0.3	2.2	5	10
DL4306	100	10±0.5	4.0	5	10
DL4307	100	15±0.7	5.3	5	10
DL4308	100	20±1.0	6.1	5	10
DL4309	100	24±1.2	7.2	5	10
DL4300	100	25±1.2	7.5	5	10
DL4311	100	26±1.2	7.8	6	10
DL4312	100	28±1.5	8.4	6	10
DL4313	100	30±1.5	9.0	6	10
DL4314	100	32±1.5	9.6	6	10
DL4315	100	34±1.7	10.2	6	10
DL4316	100	35±1.7	10.5	6	10
DL4317	100	40±2.0	12.0	6	10
DL4318	100	45±2.5	13.5	6	10
DL4319	100	50±2.5	15.0	6	10



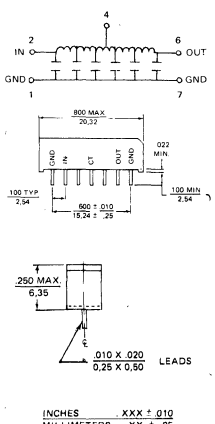
PLEASE NOTE: These schematics apply to both the 4320 and 4300 series except the 4 Tap on the 4300 series.

INCHES . XXX ± .010
MILLIMETERS , XX ± ,25

Series DL 4050

• Minimum Board Space Required • Low Profile Encapsulation Construction • 5 Equally Spaced Taps • • T.C. of Delay 100PPM/°C Max • Units Designed to meet Environmental Requirements of MIL-D-23859

Part Number	Impedance Ohms ± 10%	Total Delay (ns)	Delay Per Tap (ns)	Rise Time (ns max)	DC Resistence (Ohms max)	Distortion At Output % max
DL4051	50	5±0.5	1±0.3	2.0	0.3	10
DL4052	50	10±1.0	2±0.4	3.2	0.5	10
DL4053	50	20±1.0	4±0.6	6.0	0.8	10
DL4054	50	30±1.5	6±1.0	9.0	1.2	10
DL4055	50	40±2.0	8±1.5	12.0	1.8	10
DL4056	50	50±2.5	10±1.8	15.0	2.3	10
DL4057	50	60±3.0	12±2.0	18.0	2.5	10
DL4058	50	70±3.5	14±2.0	22.0	3.5	10
DL4059	50	80±4.0	16±2.0	24.0	4.2	10
DL4060	50	90±4.5	18±3.0	27.0	4.5	10
DL4061	50	100±5.0	20±3.0	28.0	5.2	10
DL4062	100	5±0.5	1±0.3	2.0	0.5	10
DL4063	100	10±1.0	2±0.4	3.3	1.0	10
DL4064	100	20±1.0	4±0.6	6.0	1.5	10
DL4065	100	30±1.5	6±1.0	9.0	2.5	10
DL4066	100	40±2.0	8±1.5	11.0	4.0	10
DL4067	100	50±2.5	10±1.8	14.0	5.0	10
DL4707	100					



INCHES .XXX ± .010
MILLIMETERS , XX ± ,25

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DATAMAX

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P.O. Box 2839, Blue Jay, CA 92317

Series DL 1000/2000 DIP delay lines are designed to provide maximum electrical performance and high quality. They exhibit excellent stability, high reliability and a small size package.

They are suited for timing applications in data processing systems, computers, peripheral equipments and digital instrumentation. The temperature coefficient is approximately 100 PPM/°C. Peak pulse voltage is 50 volts. Voltage Rating 50VDC. Dielectmic withstanding voltage iocone.

- High Performance
- Low Attenuation
- Compatible with all logical systems • Low DCR • Fast Rise time

(To complete part number, please see termination letter IE DL 2112A on next page.)

DIP DELAY LINES

Series DL 1000/2000

Part Number Surface Mount	Part Number Dip	Impedance (ohms ±10%)	Total Delay (ns ±5%)	Delay Per Tap (ns)	Rise Time (ns max)	Taps	Distortion % max	DC Resistance (ohms max)	Attenuation % max)
SM1105	DL1105	50	50	5±1	8.5	10	10	1	2.0
SM1106	DL1106	50	100	10±2	17	10	10	2	3.8
SM1107	DL1107	50	125	12.5±3	21	10	10	3	6.5
SM1111	DL1111	100	50	5±1	8.5	10	10	2.3	2.0
SM1112	DL1112	100	100	10±2	17	10	10	5	5.0
SM1113	DL1113	100	125	12.5±3	21	10	10	7	7.0
SM1114	DL1114	100	150	15±3	25	10	10	8	8
SM1115	DL1115	100	200	20±3	34	10	10	12	10.0
SM1116	DL1116	100	250	25±3	42	10	10	13	12.0

• Compatible With All Logic Systems • Fast Rise Time • Low Price• 10 Equally Spaced Taps • TTL and DTL Compatible • Small Attenuation • Temperature Stable

DIP DELAY LINES

Series DL2100/2200

Part Number Surface Mount	*Part Number Dip	Impedance (ohms ±10%)	Total Delay (ns ±5%	Delay Per Tap (ns)	Rise Time (ns max)	Taps	Distortion % max	DC Resistance (ohms max)	Attenuation % max
SM2105	DL2105	50	50	5±1	8.5	10	10	1	1.6
SM2106	DL2106	50	100	10±2	16.5	10	10	2	3.0
SM2107	DL2107	50	125	12.5±3	21	10	10	2	3.0
SM2111	DL2111	100	50	5±1	8.5	10	10	2	2.0
SM2112	DL2112	100	100	10±2	16.5	10	10	3	3.0
SM2113	DL2113	100	125	12.5±3	21	10	10	3	3.0
SM2114	DL2114	100	150	15±3	23	10	10	3.5	3.0
SM2115	DL2115	100	200	20±3	33	10	10	4.0	5.0
SM21116	DL2116	100	250	25±3	40	10	10	4.0	5.0
SM2203	DL2203	50	10	1.0±.25	3.5	10	10	1	1
SM2204	DL2204	50	20	2.0±.5	5.0	10	10	1	1.6
SM2205	DL2205	50	50	5±.5	8.5	10	10	1	1.6
SM2206	DL2206	50	100	10±1	16.5	10	10	2	3.0
SM2207	DL2207	50	125	12.5±2	21	10	10	2	3.0
SM2208	DL2208	100	10	1.0±.25	3.5	10	10	1	1
SM2209	DL2209	100	20	2.0±.5	5.0	10	10	1	1.6
SM2210	DL2210	100	25	2.5±.5	6.0	10	10	1	2
SM2211	DL2211	100	50	5±.5	8.5	10	10	2	2.0
SM2212	DL2212	100	100	10±1	16.5	10	10	3	3.0
SM2213	DL2213	100	125	12.5±2	21	10	10	3	3.0
SM2214	DL2214	100	150	15±2	22	10	10	3.5	3.0
SM2215	DL2215	100	200	20±2	33	10	10	4.0	5.0
SM2216	DL2216	100	250	25±2	40	10	10	4.0	5.0

SPECIFICATIONS:
Voltage Rating: 50VDC @ −55°C to 125°C

Dielectric Withstanding: 100VDC @ 25°C

Insulation Resistance: 10,000MΩ, 100VDC @ 25°C

Temperature Coefficient of Delay ≤ 100PPM/ −55°C to 125°C

Distortion: Less than ±10% on all outputs

Custom pin layout and other delays are available upon request

Delay Lines are available in 16 pin packages

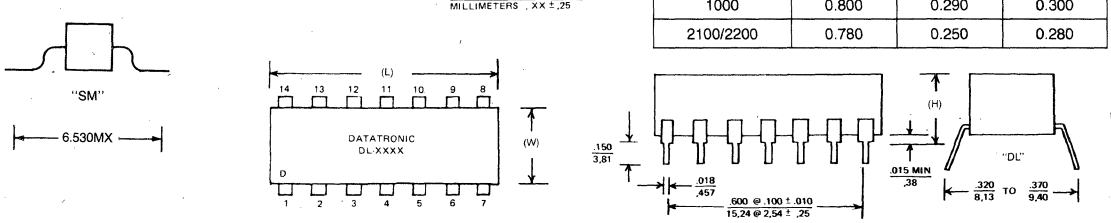
Materials: —

Case–Glass filled epoxy, flame resistant

Leads–Tintillate tin plated Kovar

PIN	L	H	W
1000	0.800	0.290	0.300
2100/2200	0.780	0.250	0.280

INCHES .XXX ± .010
MILLIMETERS .XX ± .25



When Service Counts, Count On

DATAMAX

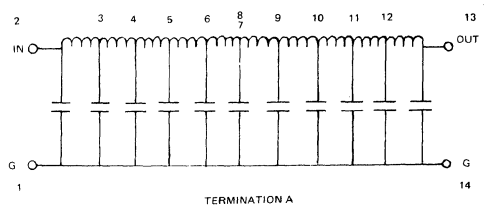
ELECTRONICS INC. (formerly Datatronics Ltd. US)

PHONE 714-336-3561 • TWX: 910-595-1578 DATAN US LKARW
P.O. Box 2839, Blue Jay, CA 92317

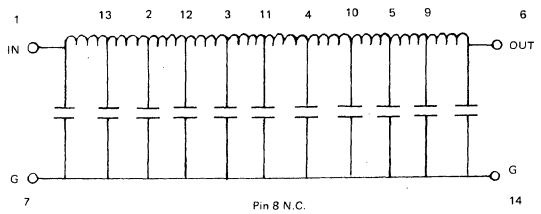
DIP DELAY LINES

TERMINAL CONFIGURATIONS

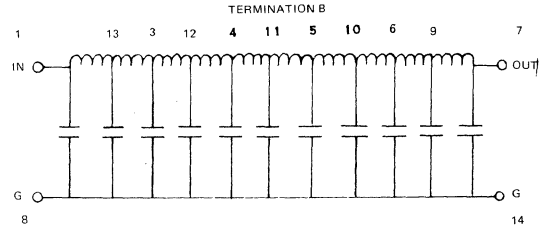
Series 1000/2000



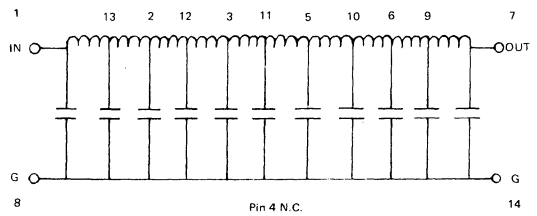
TERMINATION A



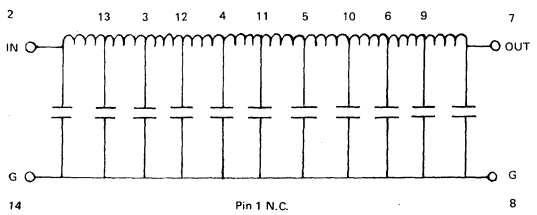
TERMINATION B



TERMINATION C



TERMINATION D



TERMINATION E

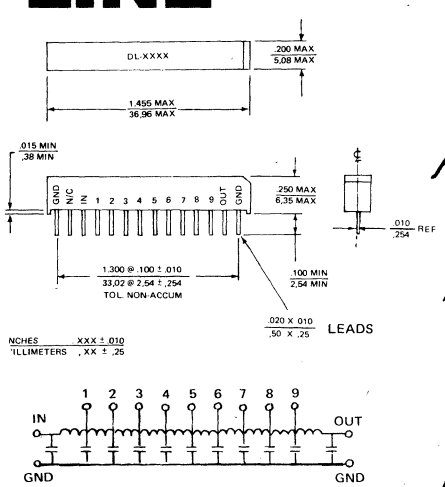
16 Pin Package is also available

NOTE: Please specify the required termination when ordering

14 PIN SINGLE-IN-LINE DELAY LINES

SERIES DL 4020

Part Number	Impedance (ohms × 10%)	Total Delay (ns × 5%)	Delay Per Tap (ns)	Rise Time (ns max)	Distortion % max	DC Resistance (ohms max)	Attentuation % max
DL4021	50	10	1 × .2	2.0	10	1.0	2
DL4022	50	20	2 × .4	4.0	10	1.0	2
DL4023	50	30	3 × .6	6.0	10	1.5	3
DL4025	50	50	5 × 1.0	9.0	10	2.0	4
DL4026	50	75	7.5 × 1.6	16.0	10	3.0	5
DL4027	50	100	10 × 2	18.0	10	3.0	6
DL4028	100	20	2 × .4	4.0	10	2.0	2
DL4029	100	25	2.5 × .4	4.0	10	2.5	3
DL4030	100	50	5 × 1.0	9.0	10	4.0	4
DL4031	100	60	6 × 1.2	12.0	10	4.0	6
DL4032	100	75	7.5 × 1.6	16.0	10	3.0	5
DL4033	100	100	10 × 2	19.0	10	6.0	6
DL4034	100	125	12.5 × 2.5	25.0	10	6.0	7
DL4036	100	150	15 × 2.5	30.0	10	7.0	8
DL4039	100	200	20 × 3	40.0	10	9.0	10



• Minimum Board Space Required • Low Profile Encapsulated Construction • 10 Equally Spaced Taps • T.C. of Delay 100PPM/°C Max • Units designed to meet Environmental Requirements of MIL-D-23859

When Experience Counts, Count On

DATAMAX

ELECTRONICS INC. (formerly Datatronics Ltd. US)

PHONE 714-336-3561 • TWX: 910-595-1578 DATAN US LKARW
P.O. Box 2839, Blue Jay, CA 92317

OVER 30 YEARS OF SUPERIOR QUALITY AND RELIABILITY!

ESC DELAY LINES

THE FOLLOWING PAGES REPRESENT A MINIMUM VARIETY OF ESC'S CURRENTLY AVAILABLE DELAY LINES

TABLE OF CONTENTS

PAGE NO.	DELAY RANGE	TYPE	SERIES	FEATURES
A•1511	1-5 nsec	Analog	ST	Miniature-Trimming
A•1510	1-50 nsec	Analog	SIL-7	7 Pin Single-in-Line-5 taps
A•1510	10-200 nsec	Analog	SIL-14	14 Pin Single-in-Line-10 taps
A•1510	10-200 nsec	Analog	DIP14	14 Pin DIP-10 tap
A•1511	10-200 nsec	Analog	MIL-23	14 Pin DIP-10 tap to MIL-D-23859/23
A•1510	250-1000 nsec	Analog	DIP16	16 Pin DIP-10 tap
A•1511	500-2000 nsec	Analog	DIP24	24 Pin DIP-20 tap
A•1515	Conversion Table Dual-in-Line to Auto-Insertable Package			
A•1512	25-500 nsec	Digital	14T (C)	5 tap-TTL-14 Pin DIL Case
A•1513	25-200 nsec	"	9T	5 tap-TTL-Very Low Profile
A•1514	25-100 nsec	"	8T(C)	5 tap-TTL-8 Pin DIL Case
A•1514	25-400 nsec	"	5T	5 tap-TTL-8Pin-Side Mounting
A•1517	25-100 nsec	"	SMT	5 tap-TTL-14Pin-Surface Mounting
A•1516	25-500 nsec	"	14TD	5 tap-TTL-14 Pin-Low Profile DIP
A•1512	50-500 nsec	"	14LT (C)	5 tap-L.P. Schottky-14 Pin DIL
A•1513	50-200 nsec	"	9LT	5 tap-L.P. Schottky-Very Low Profile
A•1518	10-100 nsec	"	16EC	5 tap-ECL "10,000" 16 Pin DIL
A•1517	8-200 nsec	"	24ECL	8 tap-ECL "100K"-24 Pin DIL
A•1512	5-100 nsec	"	14P (C)	Triplet-TTL-14 Pin DIL
A•1513	5-50 nsec	"	9P	Triplet-TTL-Very Low Profile
A•1512	10-100 nsec	"	14LP (C)	Triplet-L.P. Schottky-14 Pin DIL
A•1513	10-50 nsec	"	9LP	Triplet-L.P. Schottky-Very Low Profile
A•1518	5-50 nsec	"	16EP	Triplet-ECL "10,000" 16 Pin DIL
A•1512	5-500 nsec	"	14G (C)	Single Output-TTL-14 Pin DIL
A•1513	5-200 nsec	"	9G	Single Out-TTL-Very Low Profile
A•1513	10-200 nsec	"	9LG	Single Out L.P. Schottky-Very Low Profile
A•1514	25-100 nsec	"	8G (C)	Single Out-TTL-8 Pin DIL Case
A•1512	10-300 nsec	"	14LG (C)	Single Out L.P. Schottky-14 Pin DIL
A•1518	5-100 nsec	"	16EG	Single Out ECL "10,000" 16 Pin DIL
A•1514	50-500 nsec	"	10T	10 tap-TTL-14 Pin DIL Case
A•1516	50-500 nsec	"	10TD	10 tap-TTL-14 Pin-Low Profile DIP
A•1519	10-70 nsec	"	PTT3	TTL-3 Bit Programmable
A•1519	15-150 nsec	"	PTT4	TTL-4 Bit Programmable
A•1519	63-315 nsec	"	PTT6	TTL-6 Bit Programmable
A•1521	255-1275 nsec	"	PTT8	TTL-8 Bit Programmable
A•1520	7-35 nsec	"	PEC3	ECL "10,000"-3 Bit Programmable
A•1520	15-75 nsec	"	PEC4	ECL "10,000"-4 Bit Programmable
A•1520	63-315 nsec	"	PEC6	ECL "10,000"-6 Bit Programmable
A•1521	255-1275 nsec	"	PEC8	ECL "10,000"-8 Bit Programmable

(C) Indicates Series is available with Ceramic IC's.

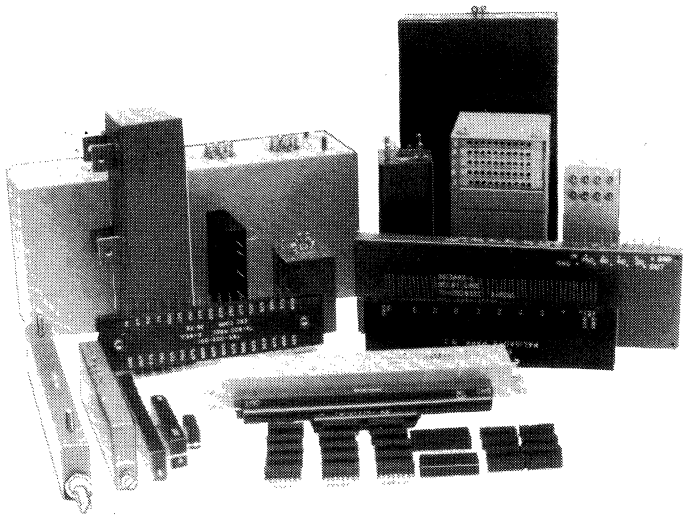
ESC ELECTRONICS CORPORATION

ESC ELECTRONICS CORPORATION
534 BERGEN BOULEVARD ● PALISADES PARK, N.J. 07650
PHONE: (201) 947-0400 ● TWX 710-991-9780
TOLL FREE 800-631-0853 (EXCEPT N.J.)

DELAY LINES

OVER 30 YEARS OF SUPERIOR QUALITY AND RELIABILITY!

30 years of experience and expertise in delay line design and manufacture. The following pages list a large sampling of the industry's current demand for short delay lines both analog and digital types, but ESC is still the most chosen source for delay lines ranging up to several hundred milliseconds and with delay-to-rise time ratios up to 250:1. In addition to lumped constant types, also manufactured are distributed constant, voltage variables and mechanically variable devices.



ESC ALSO DESIGNS AND MANUFACTURES TYPICALLY:

Equalized, Precision tapped, low distortion, beam forming delay lines for sonars, scanners, transponders, sorters, Tacan and DME, etc.

Programmable and mechanically variable Delay lines for the TV Broadcast industry, including video cable simulators and voltage variable Delay Lines.

Proven design, manufacturing capabilities, and facilities encompassing all quality levels dictated by MIL-I-45208 and MIL-Q-9858A.

HIGH RELIABILITY:

The proven design and manufacturing techniques are employed by ESC for all levels of reliability required for the military, satellite or space probes and encompass quality levels dictated by MIL-I-45208 & MIL-Q-9858A as applicable.

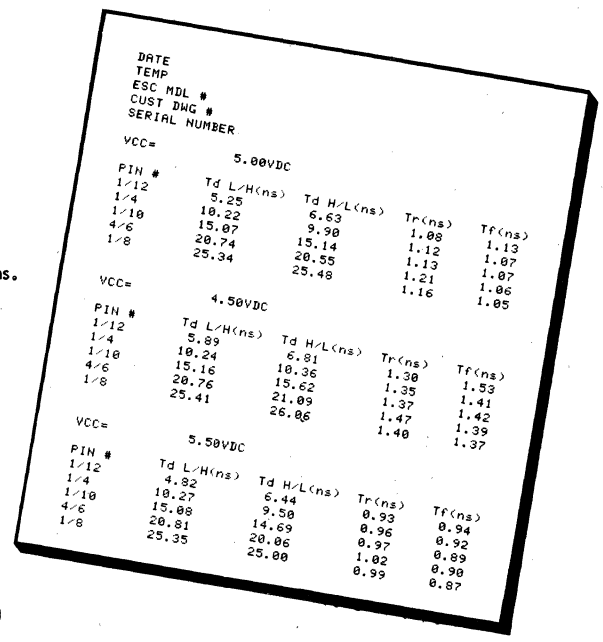
ESC has participated in many hi-rel programs over the years starting with Apollo, Minuteman and the Viking Probe and currently in such programs as Trident, F15, F16, B-1, Space Shuttle and Peacekeeper.

ESC maintains an extensive continuous program of life testing on the new generation of military TTL compatible hybrid delay lines. This program has accumulated data indicating exceptionally high reliability for both commercial and military applications.

ESC has expanded its testing capabilities for the new generation of TTL,DTL & ECL Compatible hybrid delay lines. Testing is accomplished by computer controlled, state-of-the-art equipment, which is capable of recording leading and trailing edge delay time, rise and fall time, all within seconds. In addition and at comparable speeds, the hybrid delay line DC parameters such as Icc,Vi,Vol,Voh,Ii,Iil and Iin are swiftly measured and recorded if necessary.

The highly accurate and high speed testing system allows all parameters to be tested on a 100% basis guaranteeing the highest quality product to our customers.

At the side is a sample computer read-out exhibiting the leading and trailing edge delay and rise and fall times at three operating levels for a TTL hybrid delay line.



DATE
TEMP
ESC MDL #
CUST DWG #
SERIAL NUMBER

VCC= 5.00VDC

PIN #	Td L/H(ns)	Td H/L(ns)	Tr(ns)	Tf(ns)
1/12	5.25	6.63	1.08	1.13
1/4	10.22	9.90	1.12	1.07
1/10	15.07	15.14	1.13	1.07
4/6	20.74	20.55	1.21	1.06
1/8	25.34	25.48	1.16	1.05

VCC= 4.50VDC

PIN #	Td L/H(ns)	Td H/L(ns)	Tr(ns)	Tf(ns)
1/12	5.89	6.81	1.30	1.53
1/4	10.24	10.36	1.35	1.41
1/10	15.16	15.62	1.37	1.42
4/6	20.76	21.09	1.47	1.39
1/8	25.41	26.06	1.40	1.37

VCC= 5.50VDC

PIN #	Td L/H(ns)	Td H/L(ns)	Tr(ns)	Tf(ns)
1/12	4.82	6.44	0.93	0.94
1/4	10.27	9.58	0.96	0.92
1/10	15.08	14.69	0.97	0.89
4/6	20.81	20.06	1.02	0.90
1/8	25.35	25.00	0.99	0.87

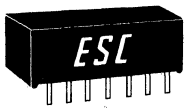
Write or call for catalog!

DELAY LINES

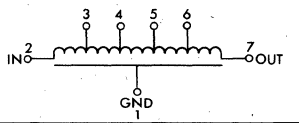
DELAY LINES

SERIES SIL-7
SINGLE-IN-LINE 5 TAPS

SPECIFICATIONS:
- Output Time Delay Tolerance: ± 5% for 20ns and above ± 10% or .25ns whichever is greater, for 10ns and less
- Distortion: ± 10% at output
- Attenuation: 0.5db max
- Temperature Coefficient: 100 ppm/°C
- Operating Temperature Range: -55°C to + 125°C
- Dielectric Strength: 50 VDC
- Conforms to applicable portions of MIL-D-23859
- Size: SIL-7: .80L X .20W X .25H SIL-14: 1.50L X .20W X .25H



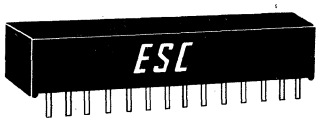
7 PIN



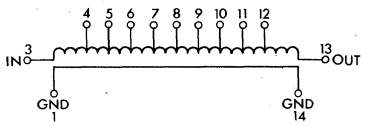
TD (ns)	Rise Time max (ns)	No. of Taps	TD/Tap (ns)	Atten. max %	MODEL NO. 50 Ω ± 10%	MODEL NO. 100 Ω ± 10%
1	1.5	none	—	2.0	SLA-1	SLB-1
2	1.5	none	—	2.0	SLA-2	SLB-2
3	1.5	none	—	2.0	SLA-3	SLB-3
4	2.0	none	—	2.0	SLA-4	SLB-4
5	2.0	5	1.0 ± 0.3	2.0	SLA-5	SLB-5
10	3.0	5	2.0 ± 0.4	2.0	SLA-10	SLB-10
20	6.0	5	4.0 ± 0.5	2.0	SLA-20	SLB-20
30	9.0	5	6.0 ± 1.0	2.0	SLA-30	SLB-30
40	12.0	5	8.0 ± 1.0	2.0	SLA-40	SLB-40
50	15.0	5	10.0 ± 1.0	2.5	SLA-50	SLB-50
60	18.0	5	12.0 ± 1.5	3.0	—	SLB-60
70	22.0	5	14.0 ± 1.5	4.0	—	SLB-70
80	25.0	5	16.0 ± 1.5	4.5	—	SLB-80
90	28.0	5	18.0 ± 2.0	4.5	—	SLB-90
100	30.0	5	20.0 ± 2.0	5.0	—	SLB-100

Consult Factory for Longer Delay Times

SERIES SIL-14
SINGLE-IN-LINE 10 TAPS

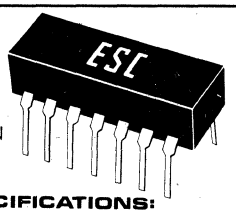


14 PIN



TD (ns)	Rise Time max (ns)	TD/Tap (ns)	Atten. max %	MODEL NO. 50 Ω ± 10%	MODEL NO. 100 Ω ± 10%
10	2.0	1.0 ± 0.5	2.5	SLA14-10	—
20	4.0	2.0 ± 0.5	2.5	SLA14-20	SLB14-20
25	5.0	2.5 ± 1.0	2.5	SLA14-25	SLB14-25
30	6.0	3.0 ± 1.0	2.5	SLA14-30	SLB14-30
40	8.0	4.0 ± 1.0	2.5	SLA14-40	SLB14-40
50	10.0	5.0 ± 1.0	3.0	SLA14-50	SLB14-50
60	12.0	6.0 ± 1.0	3.5	SLA14-60	SLB14-60
70	14.0	7.0 ± 1.0	3.5	SLA14-70	SLB14-70
75	15.0	7.5 ± 1.0	4.0	SLA14-75	SLB14-75
80	16.0	8.0 ± 1.0	4.5	SLA14-80	SLB14-80
90	18.0	9.0 ± 1.0	4.5	SLA14-90	SLB14-90
100	20.0	10.0 ± 1.0	4.5	SLA14-100	SLB14-100
150	30.0	15.0 ± 2.0	8.0	—	SLB14-150
200	40.0	20.0 ± 2.0	10.0	—	SLB14-200

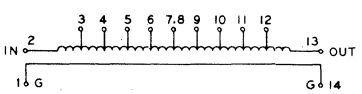
SERIES DIP-14
10 TAPS



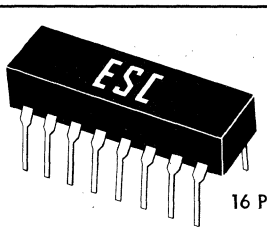
14 PIN DIP

SPECIFICATIONS:
- Operating Temperature: - 55°C to + 125°C
- Temperature Coefficient: 100ppm/°C max
- Attenuation: 1 db max
- Distortion: 10% max
- Dielectric Strength: 50 VDC
- Conforms to applicable portions of MIL-D-23859
- Size: .785 lg X .320 w X .300 h.

Time Delay (nsec) ± 5%	Rise Time (nsec)	No. of Taps	Delay per Tap (nsec) non-cumulative	IMPEDANCE ± 10% → 50 MODEL NO.	75 MODEL NO.	100 MODEL NO.	200 MODEL NO.
10 ± 1 ns	1.7	10	1.0 ± .5	5P10	7P10	1P10	—
20	3.3	10	2.0 ± .5	5P20	7P20	1P20	2P20
30	5.0	10	3.0 ± 1	5P30	7P30	1P30	2P30
40	6.5	10	4.0 ± 1	5P40	7P40	1P40	2P40
50	8.0	10	5.0 ± 1	5P50	7P50	1P50	2P50
100	16.0	10	10.0 ± 1.5	5P100	7P100	1P100	2P100
150	25.0	10	15.0 ± 1.5	5P150	7P150	1P150	2P150
200	35.0	10	20.0 ± 2	5P200	7P200	1P200	2P200
250	42.0	10	25.0 ± 2.5	5P250	7P250	1P250	2P250
300	50.0	10	30.0 ± 3.0	5P300	7P300	1P300	2P300



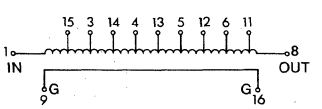
SERIES DIP-16
EXTENDED DELAY 10 TAPS



16 PIN DIP

SPECIFICATIONS:
- Operating Temperature Range: -55°C to + 125°C
- Temperature Coefficient: 100 ppm/°C
- Attenuation: 1 db max
- Distortion (at max. delay): ± 10% max
- Dielectric Strength: 25 VDC
- Size: .89 lg X .320 w X .280 h.
- Conforms to applicable portions of MIL-D-23859

Time Delay (ns) ± 5%	Rise Time (ns) max	No. of Taps	Delay per Tap (ns) ± 2 ns or 5% (whichever is greater)	Impedance ± 10% (ohms) → 100 MODEL NO.	200 MODEL NO.	300 MODEL NO.	500 MODEL NO.
250	45	10	25	1N25	2N25	3N25	5N25
300	55	10	30	1N30	2N30	3N30	5N30
350	65	10	35	1N35	2N35	3N35	5N35
400	70	10	40	1N40	2N40	3N40	5N40
450	80	10	45	1N45	2N45	3N45	5N45
500	90	10	50	1N50	2N50	3N50	5N50
600	110	10	60	1N60	2N60	3N60	—
800	145	10	80	1N80	2N80	—	—
1000	180	10	100	1N100	2N100	—	—



ELECTRONICS CORPORATION
534 BERGEN BOULEVARD ● PALISADES PARK, N.J. 07650
PHONE: (201) 947-0400 ● TWX 710-991-9780
TOLL FREE 800-631-0853 (EXCEPT N.J.)

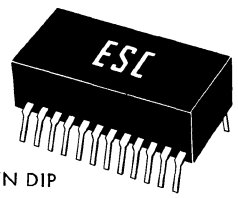
SERIES DIP-24

TO 2000 NSEC
20 TAPS

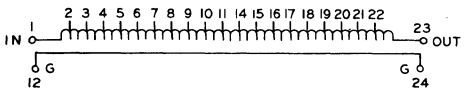
SPECIFICATIONS:

- Operating Temperature: -55°C to + 125°C
- Temperature Coefficient: 100ppm/°C
- Attenuation: 1 db max
- Distortion: 10% max
- Dielectric Strength: 50 VDC
- Conforms to applicable portions of MIL-D-23859
- Size: 1.3 lg X .580 w X .300 h.

IMPEDANCE 10% (OHMS) →				100	200
Time Delay ±5%(ns)	Rise Time (ns)Max	No. of Taps	Delay per Tap	MODEL NO.	
500	42	20	25	124-5	224-5
600	50	20	30	124-6	224-6
800	67	20	40	124-8	224-8
1000	84	20	50	124-10	224-10
1200	110	20	60	124-12	224-12
1500	125	20	75	124-15	224-15
2000	170	20	100	—	224-20



24 PIN DIP

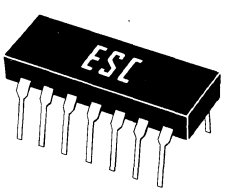


SERIES MIL-23

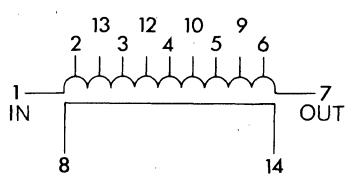
LOW PROFILE
TO
MIL-D-23859/23

SPECIFICATIONS:

- Total Time Delay Tolerance: ± 2 ns Below 40 ns Delay; ± 5% Above 40 ns Delay
- No. of Taps: 10
- Temperature Coefficient: 100 ppm/°C max.
- Operating Temp. Range: - 55°C to + 125°C
- Distortion at max delay: ± 10% max.
- Attenuation: 10% max.
- Dielectric Strength: 50 VDC
- Environmental Conditions: per MIL-D-23859/23
- Size: 14 Pin, .750L X .300W X .187H



14 PIN DIP



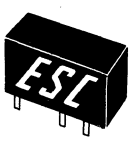
Total Td ns	Rise Time max(ns)	IMPEDANCE ± 10% 50Ω	100Ω	200Ω
10	3	A002	B102	-
15	4	A003	B103	-
20	5.5	A004	B104	-
25	6	A005	B105	-
30	6.5	A006	B106	-
35	7	A007	B107	-
40	8	A008	B108	C208
45	9	A009	B109	C209
50	10	A010	B110	C210
60	12	A012	B112	C212
80	16	A016	B116	C216
100	20	A020	B120	C220
120	24	A022	B122	C222
140	28	A024	B124	C224
150	30	A025	B125	C225
160	32	A026	B126	-
180	36	A028	B128	-
200	40	A030	B130	-
220	45	-	B132	-
240	50	-	B134	-
250	50	-	B135	-
260	55	-	B136	-
280	60	-	B138	-
300	60	-	B140	-
330	70	-	B143	-

SERIES ST

MINIATURE
SINGLES

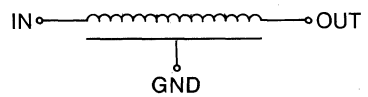
Miniature trimming delay lines in increments of 0.5 ns for your fine "tweeking."

Td (ns)	Impedance ± 10% 50 Ω	100 Ω
1.0	SAT-10	SBT-10
1.5	SAT-15	SBT-15
2.0	SAT-20	SBT-20
2.5	SAT-25	SBT-25
3.0	SAT-30	SBT-30
3.5	SAT-35	SBT-35
4.0	SAT-40	SBT-40
4.5	SAT-45	SBT-45
5.0	SAT-50	SBT-50



SPECIFICATIONS:

- Delay Tolerance: ± .25 ns
- Operating Temperature: -55°C to + 125°C
- Attenuation: 0.25 db max
- Dielectric Strength: 50VDC
- Temp. Coefficient: 100 ppm/°C
- Conforms to applicable portions of MIL-D-23859
- Band Width: 200 Mhz (-3db)
- Size: .56 L X .25 W X .20 H



DELAY LINES

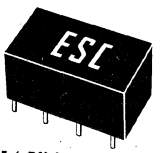
DELAY LINES

DIGITAL DELAY LINES

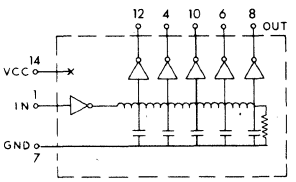
SERIES 14T
DIGITAL TTL/DTL 5 TAPS

TTL, DTL

Model No.	Delay (ns)	Delay/ Tap (ns)
14T25	25	5
14T30	30	6
14T35	35	7
14T40	40	8
14T45	45	9
14T50	50	10
14T75	75	15
14T100	100	20
14T150	150	30
14T200	200	40
14T250	250	50
14T300	300	60
14T500	500	100
14T750	750	150
14T1000	1000	200



14 PIN



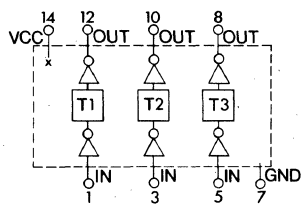
LOW POWER SCHOTTKY

Model No.	Delay (ns)	Delay Tap (ns)
14LT50	50	10
14LT75	75	15
14LT100	100	20
14LT150	150	30
14LT200	200	40
14LT250	250	50
14LT300	300	60
14LT500	500	100

SERIES 14LT
LOW POWER SCHOTTKY 5 TAPS

SERIES 14P
DIGITAL TTL/DTL TRIPLETS

Model No.	Delay per line (ns)
14P5	5
14P10	10
14P15	15
14P20	20
14P25	25
14P50	50
14P75	75
14P100	100

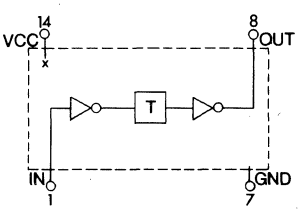


Model No.	Delay (ns)
14LP10	10
14LP15	15
14LP20	20
14LP25	25
14LP50	50
14LP75	75
14LP100	100

SERIES 14LP
LOW POWER SCHOTTKY TRIPLETS

SERIES 14G
DIGITAL TTL/DTL SINGLE OUTPUT

Model No.	Delay (ns)
14G5	5
14G10	10
14G20	20
14G25	25
14G50	50
14G75	75
14G100	100
14G150	150
14G200	200
14G500	500
14G750	750
14G1000	1000



Model No.	Delay (ns)
14LG10	10
14LG20	20
14LG25	25
14LG50	50
14LG75	75
14LG100	100
14LG150	150
14LG200	200
14LG300	300
14LG500	500

SERIES 14LG
LOW POWER SCHOTTKY SINGLE OUTPUT

SPECIFICATIONS:		
	14 Series	14L Series
Supply Voltage	5V ± 5%	5V ± 5%
Supply Current	70 Ma Max	25 Ma Max
Rise & Fall Time	4 ns Max	6 ns Max
Operating Temp.	0 to 70°C	0 to 70°C
Size	.8 X .4 X .3	.8 X .4 X .3
Delay tolerance: ± 5% or 2 ns whichever is greater		

ESC can also supply these devices with ceramic IC's that have been screened to MIL-STD-883 for -55°C to + 125°C operation. Case size will be .8L X .4W X .36H. When ordering add Letter "C" after fourth digit in part number.
Example: 14LP10 convert to 14LPC10.
14T100 convert to 14TC100

ESC ELECTRONICS CORPORATION

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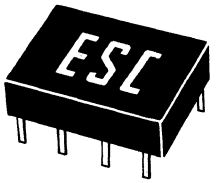
TOLL FREE 800-631-0853 (EXCEPT N.J.)

LOW PROFILE DIGITAL DELAY LINES

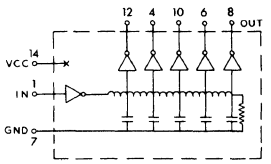


14 PIN

SERIES 9T
TTL/DTL COMPATIBLE 5 TAPS

TTL

Model No.	Delay (ns)	Delay/ Tap (ns)
9T25	25	5
9T30	30	6
9T35	35	7
9T40	40	8
9T45	45	9
9T50	50	10
9T75	75	15
9T100	100	20
9T150	150	30
9T200	200	40



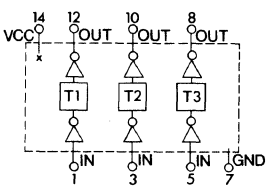
SERIES 9LT
LOW POWER SCHOTTKY 5 TAPS

LOW POWER SCHOTTKY

Model No.	Delay (ns)	Delay/ Tap (ns)
9LT50	50	10
9LT75	75	15
9LT100	100	20
9LT150	150	30
9LT200	200	40

SERIES 9P
TTL/DTL COMPATIBLE TRIPLETS

Model No.	Delay per line (ns)
9P5	5
9P10	10
9P15	15
9P20	20
9P25	25
9P50	50

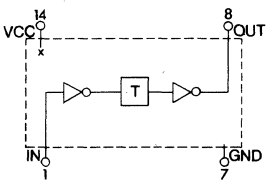


SERIES 9LP
LOW POWER SCHOTTKY TRIPLETS

Model No.	Delay per line (ns)
9LP10	10
9LP15	15
9LP20	20
9LP25	25
9LP50	50

SERIES 9G
TTL/DTL COMPATIBLE SINGLE OUTPUT

Model No.	Delay (ns)
9G5	5
9G10	10
9G20	20
9G25	25
9G50	50
9G100	100
9G200	200



SERIES 9LG
LOW POWER SCHOTTKY SINGLE OUTPUT

Model No.	Delay (ns)
9LG10	10
9LG20	20
9LG25	25
9LG50	50
9LG100	100
9LG200	200

SPECIFICATIONS:		
	9 Series	9L Series
Supply Voltage	5.0 VDC ± 5%	5.0 VDC ± 5%
Supply Current	70 Ma Max	25 Ma Max
Rise & Fall Time	4.0 ns Max	6.0 ns Max
Operating Temp.	-55°C to + 125°C	-55°C to + 125°C
Size *	.80L X .50W X .165H	
Delay Tolerance	± 5% or 2 ns whichever is greater	

These devices are supplied with ceramic IC's that have been screened to MIL-STD-883 for -55°C to + 125°C operation.

*Also available with stand-offs, maximum height becomes .180.
Specify above series with suffix "S". Example: 9T25 becomes 9T25S.

DELAY LINES

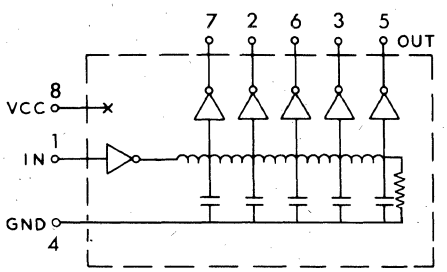
DELAY LINES

DIGITAL TTL, DTL - 8 AND 14 PIN

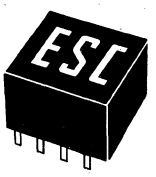
SERIES 8T

DIGITAL TTL/DTL COMPATIBLE 5 TAPS 8 PIN PACKAGE

Model No.	Delay (ns)	Delay/ Tap (ns)
8T25	25	5
8T30	30	6
8T40	40	8
8T50	50	10
8T75	75	15
8T100	100	20
8T200	200	40
8T250	250	50
8T300	300	60
8T400	400	80
8T500	500	100



Size: 8 Pin .50L X .40W X .25H



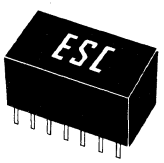
8 PIN

8G SERIES: Untapped version of above. Order as 8G25, 8G30..etc.

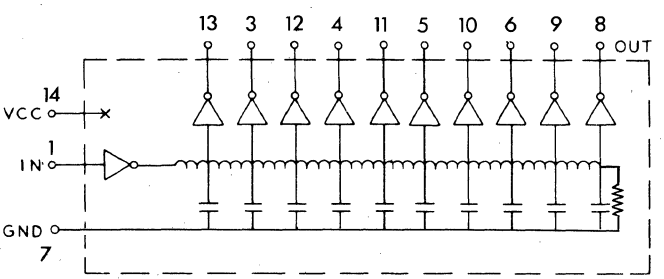
SERIES 10T

DIGITAL TTL/DTL COMPATIBLE 10 TAPS 14 PIN PACKAGE

Model No.	Delay (ns)	Delay/ Tap (ns)
10T50	50	5
10T60	60	6
10T70	70	7
10T80	80	8
10T90	90	9
10T100	100	10
10T150	150	15
10T200	200	20
10T250	250	25
10T500	500	50
10T750	750	75
10T1000	1000	100



14 PIN

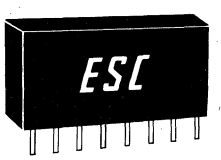


Size: 14 Pin .80L X .40W X .32H

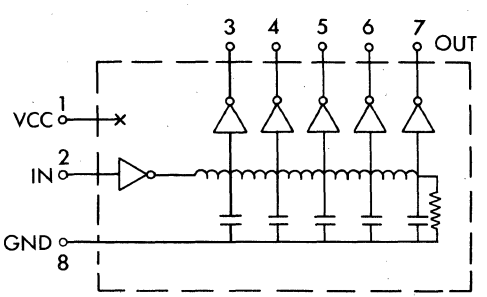
SERIES 5T

DIGITAL TTL/DTL COMPATIBLE 5 TAPS

Model No.	TD (ns)	TD/Tap (ns)
5T25	25	5
5T30	30	6
5T35	35	7
5T40	40	8
5T45	45	9
5T50	50	10
5T75	75	15
5T100	100	20
5T150	150	30
5T200	200	40
5T250	250	50
5T300	300	60
5T350	350	70
5T400	400	80



8 PIN SIL



Size: 8 PIN .81L X .18W X .40H

Looking for LC Filters? See our pages in Section 2700

SPECIFICATIONS:

- Supply voltage: 5V ± 5%
- Logic 1 input current: 50 µA max.
- Logic 0 input current: 2 MA max.
- Logic 1 voltage out: 2.4V min.
- Logic 0 voltage out: 0.5V max.
- Operating temperature: 0 to + 70°C
- Fan-out capabilities (max): 10 TTL loads/tap, 20 TTL loads/unit
- Delay tolerances: ± 2 ns or ± 5% whichever is greater
- Rise Time: 4 ns max

- Series 8T is available for -55°C to + 125°C operation. Add Letter "C" after "T" when specifying.

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PHONE: (201) 947-0400 ● TWX 710-991-9780
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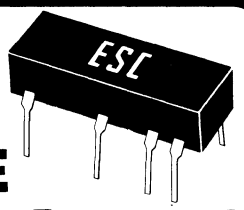
(EXCEPT N.J.)



The following SERIES of

MACHINE INSERTABLE DIP LOW PROFILE PACKAGE

(ONLY.250 INCH HEIGHT ABOVE SEATING PLANE)

DIGITAL DELAY LINES

Are available from ESC

Specifications for DIL & DIP Packages are the same		
DIL (Dual-In-Line)	**Description**	**NEW DIP SERIES**
14T	DIGITAL TTL/DTL 5 TAPS	14TD
14HT	DIGITAL TTL/DTL 5 TAPS-HIGH PERFORMANCE	14HTD
14P	DIGITAL TTL/DTL TRIPLETS	14PD
14G	DIGITAL TTL/DTL SINGLE OUTPUT	14GD
14LT	LOW POWER SCHOTTKY 5 TAPS	14LTD
14HLT	LOW POWER SCHOTTKY 5 TAPS-HIGH PERFORMANCE	14HLTD
14LP	LOW POWER SCHOTTKY TRIPLETS	14LPD
14LG	LOW POWER SCHOTTKY SINGLE OUTPUT	14LGD
10T	DIGITAL TTL/DTL 10 TAPS 14 PIN PACKAGE	10TD
16EC	DIGITAL ECL "10,000" 5 TAPS	16ECD
16EP	DIGITAL ECL "10,000" TRIPLETS	16EPD
16EG	DIGITAL ECL "10,000" SINGLE OUTPUT	16EGD

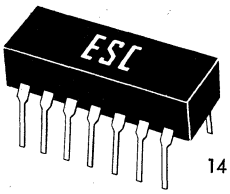
CONTACT PLANT FOR COMPLETE SPECIFICATIONS.

DELAY LINES

DELAY LINES

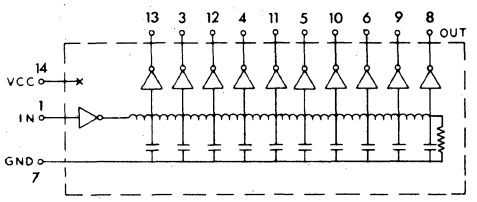
MACHINE INSERTABLE LOW PROFILE DIP DIGITAL DELAY LINES

SERIES 10TD
TTL/DTL COMPATIBLE
10 TAPS
14 PIN PACKAGE



14 PIN

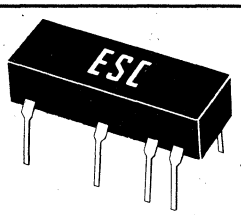
Model No.	*Delay (ns)	*Delay/ Tap (ns)
10TD50	50	5
10TD100	100	10
10TD150	150	15
10TD200	200	20
10TD250	250	25
10TD300	300	30
10TD350	350	35
10TD400	400	40
10TD450	450	45
10TD500	500	50
10TD750	750	75
10TD1000	1000	100



Size: .785 X .285 X .250

DC PARAMETERS		LIMITS Min.	LIMITS Max.
V_{oh}	Vcc = min, I_{oh} = 1.0 mA	2.5V	—
V_{ol}	Vcc = min, I_{ol} = 20 mA	—	0.5V
I_{ih}	Vcc = max, V_{ih} = 2.7V	—	50 µA
I_{il}	Vcc = max, V_{il} = 0.5V	-2.0 mA	—
I_i	Vcc = max, V_i = 5.5V	—	1.0 mA
V_i	Vcc = min, I_{in} = -18 madc	-1.2vdc	—
I_{cc}	Vcc = max, outputs low	Series 10TD 140mA Series 14TD 70mA	

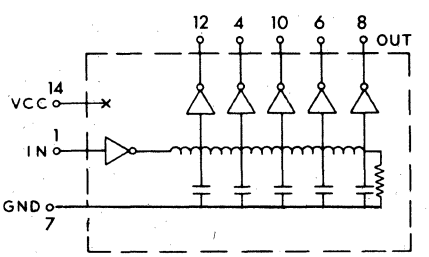
SERIES 14TD
TTL/DTL COMPATIBLE
5 TAPS
14 PIN PACKAGE



14 PIN

Model No.	*Delay (ns)	*Delay/ Tap (ns)
14TD25	25	5
14TD30	30	6
14TD35	35	7
14TD40	40	8
14TD45	45	9
14TD50	50	10
14TD75	75	15
14TD100	100	20
14TD150	150	30
14TD200	200	40
14TD250	250	50
14TD300	300	60
14TD500	500	100
14TD750	750	150
14TD1000	1000	200

High Performance Series 14HTD available with controlled delay at leading as well as trailing edges. Example: 14TD100 converts to 14HT100.



Size: .785 X .285 X .250

Series 10TD and 14TD are interchangeable with series 10T and 14T

SPECIFICATIONS:

- * Delay Tolerances: ± 2ns or ± 5% whichever is greater
- Rise Time: 4ns max
- Five equally spaced taps
- Operating Temp. Range: 0°C to + 70°C
- Terminal Leads: Electro tin plated Alloy 42 .020 W X .010

TEST CONDITIONS:

- Vcc = 5.0VDC, Temp. 25° ± 5°C
- Time delay measured at the 1.5V level
- Rise time measured from .75V to 2.4V
- Input Test Pulse:
  - Pulse voltage: 3.0V
  - Pulse rise time: 2ns
  - Pulse width: 1.2 X max Td

14 Pin Auto Insertable Versions of ESC'S 14G and 14P Series are also available upon request.

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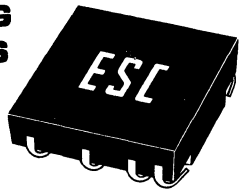
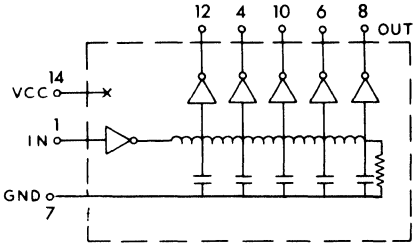
SURFACE MOUNTING DIGITAL DELAY LINES



SERIES SMT
SURFACE MOUNTING
TTL/DTL
COMPATIBLE
5 TAPS

Model No.	Time Delay (nsec)	Delay/Tap (nsec)
SMT25	25	5
SMT30	30	6
SMT35	35	7
SMT40	40	8
SMT45	45	9
SMT50	50	10
SMT75	75	15
SMT100	100	20

Consult factory for variations of above models.



Size: .510 X .510 X .175 O/A

SPECIFICATIONS:

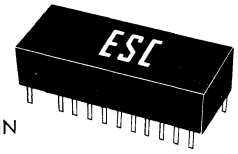
- Supply voltage (Vcc): 5.0VDC ± 10%
- Delay tolerances: ± 2ns or ± 5% whichever is greater
- Rise time: 4ns max
- Operating temp. range: 0 to 70°C
- Temp. coeff. of delay: 1.0ns + 500 ppm/°C
- Lead Dimensions: .017W x .007th

TEST CONDITIONS:

- Temperature: 25° ± 5°C; Vcc = 5.0VDC
- Input pulse width: 1.2 times the total delay time
- Pulse spacing: 5 times the total delay time
- Input rise time: 2ns; input pulse amplitude 3.0VDC
- All outputs loaded with 15pf
- Time delays measured at the 1.5 volts level on the leading edges
- Rise time measured from .75 to 2.4V

ECL "100,000" DIGITAL DELAY LINES

These 100K ECL Hybrid Delay Lines are contained in a 24 Pin DIP package using ECL "100,000" Series Circuits

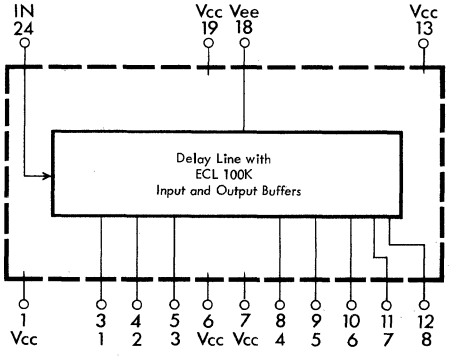


24 PIN

SERIES 24ECL
ECL "100K"
COMPATIBLE
8 TAPS

Model No.	Total Delay (ns)	Delay/ Tap (ns)	Delay Tolerances *
24ECL8	8	1	± .5ns or ± 5%
24ECL16	16	2	± .5ns or ± 5%
24ECL24	24	3	± 1.0ns or ± 5%
24ECL32	32	4	± 1.5ns or ± 5%
24ECL40	40	5	
24ECL48	48	6	
24ECL56	56	7	
24ECL64	64	8	
24ECL72	72	9	
24ECL80	80	10	
24ECL160	160	20	
24ECL200	200	25	

*Whichever is greater



Size: 1.3L X .50W X .375H

SPECIFICATIONS:

- 100K ECL Input and Output
- Operating Temp: 0°C to + 85°C
- Storage Temp: -55°C to + 125°C
- Vee: -4.5VDC ± 5%
- Logic 1 Output: -1.025 min
- Logic 0 Output: -1.620 max

TEST CONDITIONS:

- Pulse Width: 2 X total Td
- Pulse Spacing: 5 X total Td
- Pulse Amplitude: (-1.475 max to -1.165 min)
- Vee: -4.5VDC
- Vcc: 0VDC
- Temperature: + 25°C

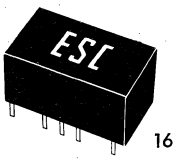
Outputs connected to external 50 ohms pulldown resistor to -2.0V

DELAY LINES

DELAY LINES

ECL "10,000" DIGITAL DELAY LINES

These ECL Hybrid Delay Lines are contained in a 16 Pin DIP Package using ECL "10,000" Series Circuits



16 PIN

SERIES 16EC
ECL COMPATIBLE 5 TAPS

SPECIFICATIONS:

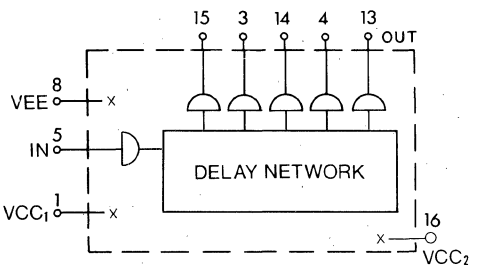
- Logic 1 (output): -.96 V min.
- Logic 0 (output): -1.65 V max.
- Delay tolerances: ± 1 ns below 20 ns delay ± 1 ns or ± 5% whichever is greater above 20 ns delay.
- Operating temp: -0°C to + 70°C
- Storage temp. range: -55°C to + 125°C
- Size: .8L X .4W X .36H

TEST CONDITIONS:

- Temp. = 25°C Vee = -5.2 VDC Vcc = Grd
- ** Input Amplitude: 1.0 V (-.75 V to -1.75 V)
- Pulse Width: 3 X max Td
- Pulse Spacing: 5 X max Td
- Time delays measured at the -1.3 V level
- Output terminals connected through an external pulldown resistor of 100 Ω to -2 VDC

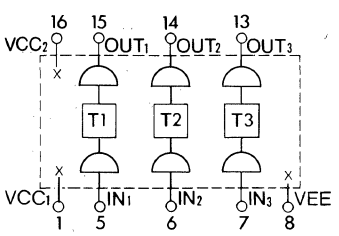
**Input pulse is provided by standard open emitter ECL 10,000 gate.

Model No.	Delay (ns)	Delay/ Tap (ns)
16EC10	10	2
16EC15	15	3
16EC20	20	4
16EC25	25	5
16EC30	30	6
16EC40	40	8
16EC50	50	10
16EC60	60	12
16EC80	80	16
16EC100	100	20



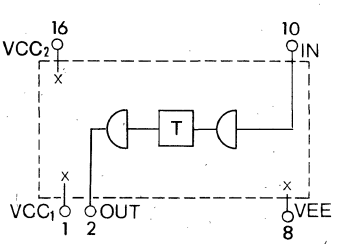
SERIES 16EP
ECL COMPATIBLE TRIPLETS

Model No.	Delay per line (ns)
16EP5	5
16EP10	10
16EP15	15
16EP20	20
16EP25	25
16EP50	50



SERIES 16EG
ECL COMPATIBLE SINGLE OUTPUT

Model No.	Delay (ns)
16EG5	5
16EG10	10
16EG15	15
16EG20	20
16EG25	25
16EG50	50
16EG75	75
16EG100	100



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TTL DIGITAL PROGRAMMABLE DELAY LINES

This series of programmable hybrid delay lines utilize TTL Schottky circuits.

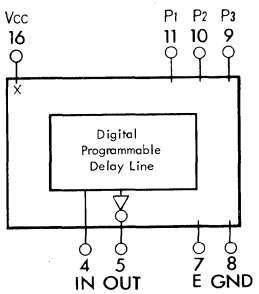
The PTT's are offered in 3, 4, 6 & 8 Bit Series.

SERIES PTT3 3 BIT

TTL COMPATIBLE PROGRAMMABLE DELAY LINE

Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PTT3-1	7 ± 2	14	1 ± .5
PTT3-2		21	2 ± .5
PTT3-3		28	3 ± .6
PTT3-4		35	4 ± .8
PTT3-5		42	5 ± 1
PTT3-6		49	6 ± 1
PTT3-7		56	7 ± 1
PTT3-8		63	8 ± 1
PTT3-9		70	9 ± 1
PTT3-10		77	10 ± 1

16 Pin DIL



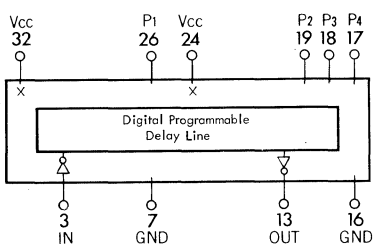
Size: .80L X .40W X .28 H

SERIES PTT4 4 BIT

TTL COMPATIBLE PROGRAMMABLE DELAY LINE

Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PTT4-1	15 ± 2	30	1 ± .5
PTT4-2		45	2 ± .5
PTT4-3		60	3 ± .6
PTT4-4		75	4 ± .8
PTT4-5		90	5 ± 1
PTT4-6		105	6 ± 1
PTT4-7		120	7 ± 1
PTT4-8		135	8 ± 1
PTT4-9		150	9 ± 1
PTT4-10		165	10 ± 1

32 Pin DIL



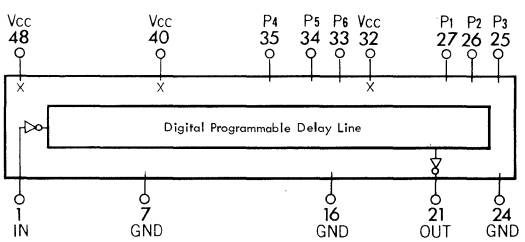
Size: 1.75L X .40W X .28 H

SERIES PTT6 6 BIT

TTL COMPATIBLE PROGRAMMABLE DELAY LINE

Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PTT6-1	20 ± 2	83	1 ± .5
PTT6-2		146	2 ± .5
PTT6-3		209	3 ± .6
PTT6-4		272	4 ± .8
PTT6-5		335	5 ± 1

48 Pin DIL



Size: 2.55L X .40W X .28 H

SPECIFICATIONS:

- Logic 1 (output): 2.4 min
- Logic 0 (output): .50 VDC max
- Operating Temp. Range: 0°C to + 70°C *
- Storage Temp. Range: -55°C to + 125°C

*For -55°C to + 125°C operation - Contact Plant

TEST CONDITIONS:

- Vcc = 5 VDC Temp. = 25°C
- Input Pulse Width: 3 X max Td
- Input Rise Time: 2ns max
- Input Pulse Spacing: 5 X max Td
- Td measured at 1.5 V level
- Output loaded with 15pf

DELAY LINES

DELAY LINES

ECL DIGITAL PROGRAMMABLE DELAY LINES

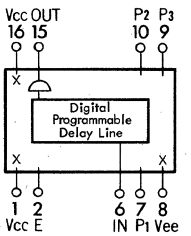
This series of programmable hybrid delay lines utilize ECL 10,000 Series IC's.

The PEC's are offered in 3, 4, 6 & 8 Bit Series.

SERIES PEC3 3 BIT ECL COMPATIBLE PROGRAMMABLE DELAY LINES

Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PEC3-1	3 ± 2	10	1 ± .5
PEC3-2		17	2 ± .5
PEC3-3		24	3 ± .6
PEC3-4		31	4 ± .8
PEC3-5		38	5 ± 1

16 Pin DIL

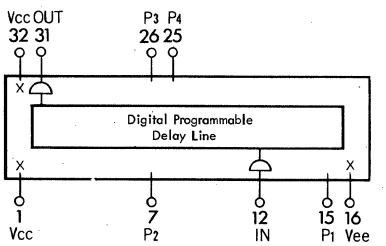


Size: .825L X .40W X .36H

SERIES PEC4 4 BIT ECL COMPATIBLE PROGRAMMABLE DELAY LINES

Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PEC4-1	10 ± 2	25	1 ± .5
PEC4-2		40	2 ± .5
PEC4-3		55	3 ± .6
PEC4-4		70	4 ± .8
PEC4-5		85	5 ± 1

32 Pin DIL

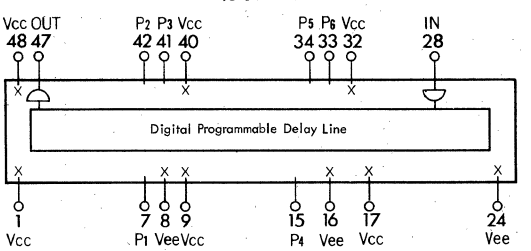


Size: 1.75L X .40W X .36H

SERIES PEC6 6 BIT ECL COMPATIBLE PROGRAMMABLE DELAY LINES

Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PEC6-1	8 ± 2	71	1 ± .5
PEC6-2		134	2 ± .5
PEC6-3		197	3 ± .6
PEC6-4		260	4 ± .8
PEC6-5		323	5 ± 1

48 Pin DIL



Size: 2.50L X .40W X .36H

SPECIFICATIONS:

- Logic 1 (output): -.96V min
- Logic 0 (output): -1.65V max
- Operating Temp. Range: -0°C to + 70°C
- Storage Temp. Range: -55°C to + 125°C

TEST CONDITIONS:

- Input Pulse Width: 3 X max delay time
- Input Pulse Spacing: 5 X max delay time
- Input Rise Time: 2 ns max
- Input Pulse Voltage: 1.0V (-.75V to -1.75V)
- Vee: -5.2VDC
- Output connected to -2VDC through 100 ohms.
- Time delays measured at -1.3 Volt Level.

OVER 30 YEARS OF SUPERIOR QUALITY AND RELIABILITY!

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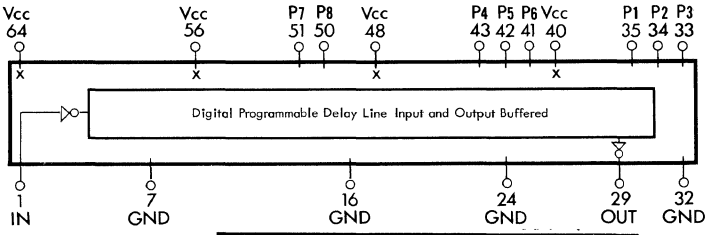
TTL DIGITAL PROGRAMMABLE DELAY LINES

This series of 8 Bit programmable hybrid delay lines utilize TTL Schottky circuits.

SERIES PTT 8 8 BIT
TTL COMPATIBLE PROGRAMMABLE DELAY LINES



Size: 3.30 L X .40 W X .28 H

Model No.	Zero step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PTT8-1	20 ± 2	275	1 ± .5
PTT8-2		530	2 ± .5
PTT8-3		785	3 ± .6
PTT8-4		1040	4 ± .8
PTT8-5		1295	5 ± 1

SPECIFICATIONS:

- Zero step delay is measured from the input pin #1
- All programmable delays after step zero are referenced to step zero
- Programmable delay tolerance: ± 2ns or 5% whichever is greater
- Rise time: 4ns max
- Operating temp. range: 0°C to + 70°C
- Vol: .4V max
- Voh: 2.4V min
- Vcc: 5VDC ± 0.25V
- Terminals: Electro tin plated alloy 42, .020 w x .010 th.

TEST CONDITIONS:

- Vcc = 5.0VDC, Temp. 25°C
- Time delay measured at the 1.5 volt level of the leading edge
- Rise time measured from .75V to 2.4 volts
- Output loaded with 15pf
- Input pulse width: 3 x max time delay
- Input rise time: 2ns
- Pulse amplitude: 3.0 volts
- Pulse spacing: 1000ns

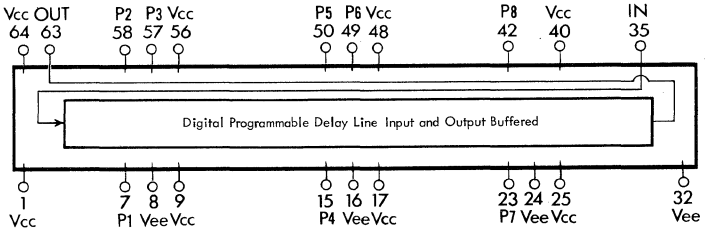
This Series is supplied in two versions: PTT8 and PTTC8

PTT8: Employs a plastic packaged IC for an operating temperature range of 0°C to + 70°C

PTTC8: Manufactured with a ceramic packaged IC which has been screened per MIL-STD-883 for a -55°C to + 125°C operating temperature range. The height of this series is .360. When specifying add letter "C" after "T"

ECL DIGITAL PROGRAMMABLE DELAY LINES

SERIES PEC8 8 BIT
ECL COMPATIBLE PROGRAMMABLE DELAY LINES



Size: 3.3 L X .40 W X .36 H

Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PEC8-1	12 ± 2	267	1 ± .5
PEC8-2		522	2 ± .5
PEC8-3		777	3 ± .6
PEC8-4		1032	4 ± .8
PEC8-5		1287	5 ± 1.0

SPECIFICATIONS:

- Zero step delay is measured from the input pin #35
- All programmable delays after step zero are referenced to step zero
- Programmable delay tolerances are ± 2ns or 5% whichever is greater
- Rise time (20% to 80% points) = 5ns max
- Operating temperature range: 0°C to + 70°C *
- Logic 1 (output): -.96V min
- Logic 0 (output): -1.65V max
- Logic 1 (input): -.98V min
- Logic 0 (input): -1.63V max
- Terminals: Electro tin plated alloy 42 .020 w x .010 th.

*Also available for -55°C to + 125°C operation as PECC8 Series

TEST CONDITIONS:

- Temp. 25°C Vee = 5.2 VDC Vcc = Grd
- ** Input pulse amplitude: 1.0V (-.75V H to -1.75 L)
- Pulse width: 3 X max Td
- Pulse spacing: 10 X max Td
- Time delay measured at the -1.3 V level
- Output connected through an external pulldown resistor of 100 ohms to -2 VDC

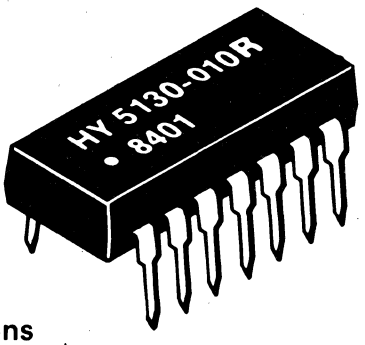
**Input pulse provided by a standard open emitter ECL 10,000 gate.

HY5130

3 INPUT/3 OUTPUT DIGITAL DELAY LINE
(Molded Package)

FEATURES

- **TTL Schottky buffered inputs and outputs**
- **Low profile (.220″ with .015″ standoff)**
- **Also available: HY-5100-XXX Series**
  Hi-Rel hermetically sealed metal package



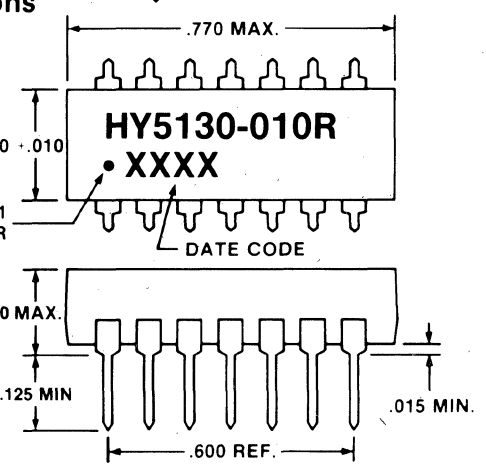
SPECIFICATIONS

INPUT TEST CONDITIONS:	
SUPPLY VOLTAGE (VCC)	5.0 VDC
PULSE VOLTAGE	Logic 1 = 3.2 volts Logic 0 = 0.0 volts
RISE TIME	3.0 nsec.
PULSE WIDTH	2 x total delay
DUTY CYCLE	20%
DRIVE CAPABILITIES:	
LOGIC O	10 TTL loads/output max. 20 TTL loads/unit max. (20 mA max.)
LOGIC 1	20 TTL loads/output max. (-1 mA max.)
OPERATING CHARACTERISTICS:	
OUTPUT RISE TIME	4 nsec. max. (measured from 0.75V to 2.4V)
DELAY TOLERANCES	±1 nsec or ±5% whichever is greater
SUPPLY CURRENT	65 mA max., 45 mA typical
SUPPLY VOLTAGE (VCC)	4.75 to 5.25 VDC
LOGIC 1 INPUT CURRENT	50μA @ VCC = 5.25V and VIH = 2.70V
LOGIC 0 INPUT CURRENT	-2 mA max. @ VCC = 5.25V and VIL = 0.50V
LOGIC 1 OUTPUT VOLTAGE	2.7V min., 3.4V typical
LOGIC 0 OUTPUT VOLTAGE	0.5V max.
LOGIC 1 INPUT VOLTAGE	2V min. to 5.25V max.
LOGIC 0 INPUT VOLTAGE	0.8V max.
SHORT CIRCUIT OUTPUT CURRENT	-40 mA min. to -100 mA max. VCC = 5.25V, one output shorted for max. 1 sec. duration
OPERATING TEMPERATURE	0°C to 70°C (optional -55°C to +125°C)
STORAGE TEMPERATURE	-55°C to +125°C

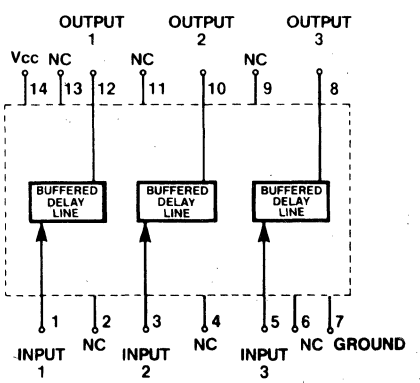
DELAY AT EA. OUTPUT	
Part No.*	**Delay Output (nsec.)**
HY5130-010R	10
HY5130-012R	12
HY5130-014R	14
HY5130-016R	16
HY5130-018R	18
HY5130-020R	20
HY5130-025R	25
HY5130-030R	30
HY5130-035R	35
HY5130-040R	40
HY5130-045R	45
HY5130-050R	50

* Suffix designates:
R = Standard 0°C to 70°C operation
M = Standard -55°C to +125°C operation

Dimensions
(Inches)



Top View



Specifications Subject to Change Without Notice

hytek microsystems incorporated

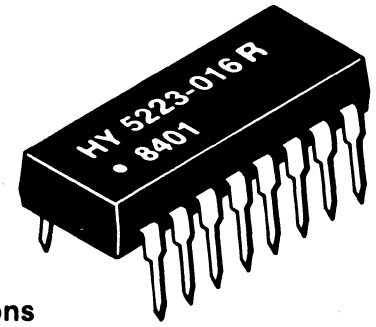
400 Hot Springs Road, Carson City, NV 89701
Phone (702) 883-0820 TWX 910-395-6030

3 BIT PROGRAMMABLE TTL DELAY LINE
(Molded Package)

HY5223

FEATURES

- **Digitally programmable in 8 delay steps**
- **Delay increments of 1, 2, 3, 5 nsec.**
- **Low profile (.220″ with .015″ standoff) 16-pin DIP**
- **Stable and precise delays**
- **Also available: HY-5203-XXX Series**
  Hi-Rel hermetically sealed metal package



SPECIFICATIONS

INPUT TEST CONDITIONS:

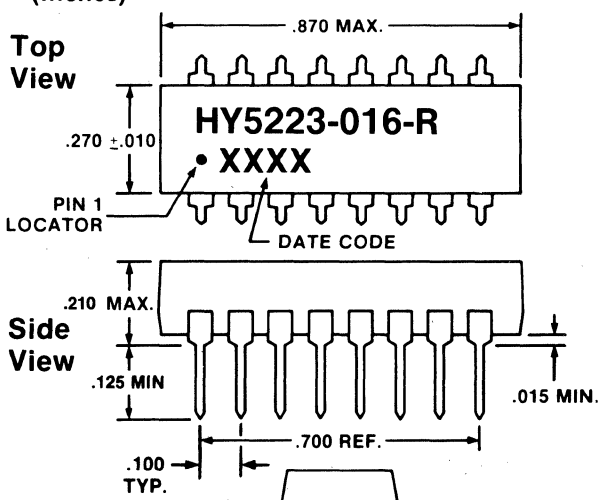
SUPPLY VOLTAGE (Vcc)	5.0 VDC
PULSE VOLTAGE	Logic 1 = 3.2 volts Logic 0 = 0.0 volts
RISE TIME	3.0 nsec.
PULSE WIDTH	2 x max. delay
DUTY CYCLE	20%
DRIVE CAPABILITIES:	
LOGIC O	10 TTL loads/tap max. 20 TTL loads/unit max. (20 mA max.)
LOGIC 1	20 TTL loads/tap and unit max. (-1 mA max.)
OPERATING CHARACTERISTICS:	
OUTPUT RISE TIME	4 nsec. max. (measured from 0.75V to 2.4V)
MAX. DELAY TOLERANCES	±5% or 2 nsec., whichever is greater
SUPPLY CURRENT	100 mA max.
SUPPLY VOLTAGE (Vcc)	4.75 to 5.25 VDC
OPERATING TEMPERATURE	0°C to 70°C (optional -55°C to +125°C)
STORAGE TEMPERATURE	-55°C to +125°C

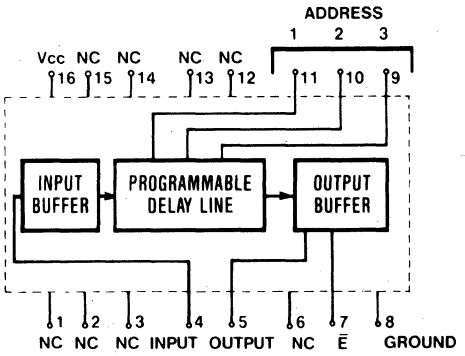
Part No. †	Min. Delay	Max. Delay (nom.)	Delay Change Per Step
HY5223-016R	9 ns ± 1	16 ns	1 ns ± .3
HY5223-023R	9 ns ± 1	23 ns	2 ns ± .4
HY5223-030R	9 ns ± 1	30 ns	3 ns ± .5
HY5223-044R	9 ns ± 1	44 ns	5 ns ± .5

† Suffix designates:
R = standard 0°C to 70°C operation
M = standard -55°C to +125°C operation

Enable	Address			Delay out in nsec. (nom.)			
(Ē)	3	2	1	HY5213-016	HY5213-023	HY5213-030	HY5213-044
0	0	0	0	9	9	9	9
0	0	0	1	10	11	12	14
0	0	1	0	11	13	15	19
0	0	1	1	12	15	18	24
0	1	0	0	13	17	21	29
0	1	0	1	14	19	24	34
0	1	1	0	15	21	27	39
0	1	1	1	16	23	30	44
1	X	X	X	N.A.	N.A.	N.A.	N.A.

Dimensions (Inches)





Specifications Subject to Change Without Notice

hytek microsystems incorporated

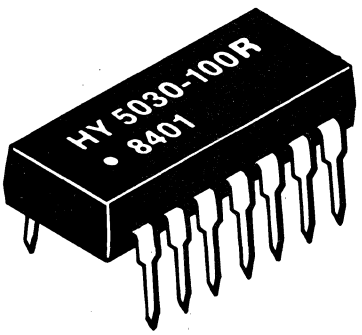
400 Hot Springs Road, Carson City, NV 89701
Phone (702) 883-0820 TWX 910-395-6030

HY5030

10-TAP DIGITAL DELAY LINE
(Molded Package)

FEATURES

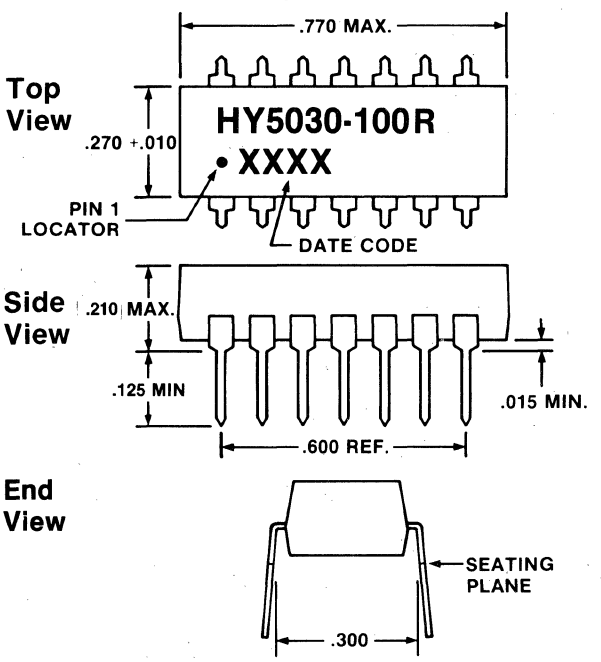
- **TTL Schottky buffered inputs and outputs**
- **Low profile (.220" with .015" standoff)**
- **Customs also available**
- **AUTO INSERTABLE**



SPECIFICATIONS

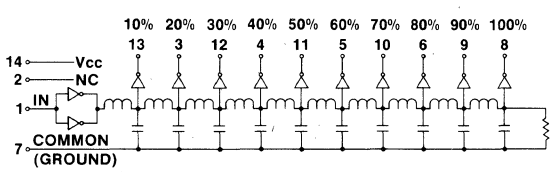
INPUT TEST CONDITIONS:	
SUPPLY VOLTAGE (Vcc)	5.0 VDC
PULSE VOLTAGE	Logic 1 = 3.2 volts Logic 0 = 0.0 volts
RISE TIME	3.0 nsec.
PULSE WIDTH	2 x total delay
DUTY CYCLE	20%
DRIVE CAPABILITIES:	
LOGIC 0	10 TTL loads/tap max. 20 TTL loads/unit max. (20 mA max.)
LOGIC 1	20 TTL loads/tap and unit max. (-1 mA max.)
OPERATING CHARACTERISTICS:	
OUTPUT RISE TIME	4 nsec. max. (measured from 0.75V to 2.4V)
DELAY TOLERANCES	±2 nsec. or ±5% whichever is greater
SUPPLY CURRENT	120 mA max.,
SUPPLY VOLTAGE (Vcc)	4.75 to 5.25 VDC
LOGIC 1 INPUT CURRENT	100μA @ Vcc = 5.25V and VIH = 2.70V
LOGIC 0 INPUT CURRENT	-4 mA max. @ Vcc = 5.25V and VIL = 0.50V
LOGIC 1 OUTPUT VOLTAGE	2.7V min., 3.4V typical
LOGIC 0 OUTPUT VOLTAGE	0.5V max.
LOGIC 1 INPUT VOLTAGE	2V min. to 5.25V max.
LOGIC 0 INPUT VOLTAGE	0.8V max.
SHORT CIRCUIT OUTPUT CURRENT	-40 mA min. to -100 mA max. Vcc = 5.25V, one output shorted for max. 1 sec. duration
OPERATING TEMPERATURE	0°C to 70°C (optional -55°C to +125°C)
STORAGE TEMPERATURE	-55°C to +125°C

Dimensions
(Inches)



DELAY AT EA. TAP IN NSEC.		
Part No.†	**Total Delay (nsec.)**	**Tap-To-Tap Delay (nsec.)**
HY5030-050R	50 ± 2.5	5 ± 1.0
HY5030-100R	100 ± 5.0	10 ± 1.0
HY5030-150R	150 ± 7.5	15 ± 1.5
HY5030-200R	200 ± 10.0	20 ± 2.0
HY5030-250R	250 ± 13.5	25 ± 2.5

† Suffix designates:
R = standard 0°C to 70°C operation
M = standard -55°C to +125°C operation



Specifications Subject to Change Without Notice

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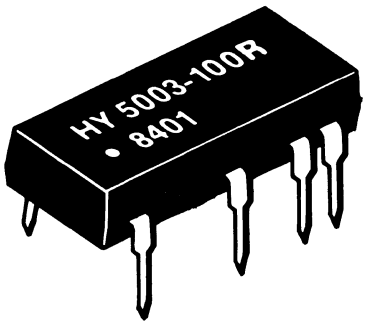
400 Hot Springs Road, Carson City, NV 89701
Phone (702) 883-0820 TWX 910-395-6030

5-TAP DIGITAL DELAY LINE
(Molded Package)

HY5003

FEATURES

- **TTL Schottky buffered inputs and outputs**
- **Low profile (.220" with .015" standoff)**
- **Customs also available**
- **AUTO INSERTABLE**



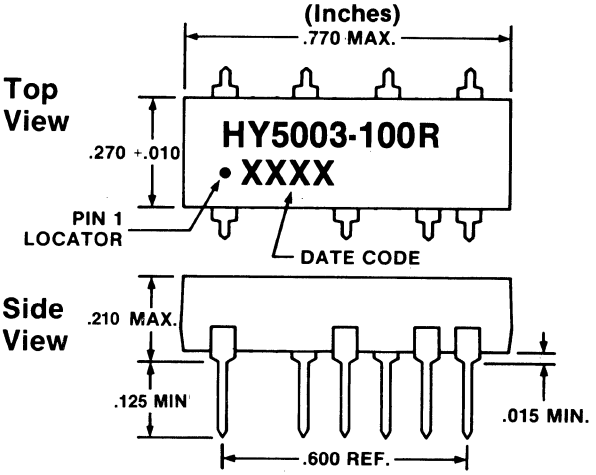
SPECIFICATIONS

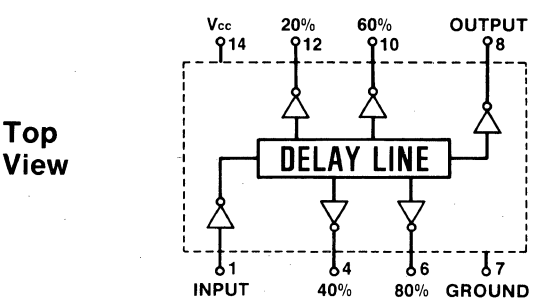
INPUT TEST CONDITIONS:	
SUPPLY VOLTAGE (VCC)	5.0 VDC
PULSE VOLTAGE	Logic 1 = 3.2 volts Logic 0 = 0.0 volts
RISE TIME	3.0 nsec.
PULSE WIDTH	2 x total delay
DUTY CYCLE	20%
DRIVE CAPABILITIES:	
LOGIC O	10 TTL loads/tap max. 20 TTL loads/unit max. (20 mA max.)
LOGIC 1	20 TTL loads/tap and unit max. (-1 mA max.)
OPERATING CHARACTERISTICS:	
OUTPUT RISE TIME	4 nsec. max. (measured from 0.75V to 2.4V)
DELAY TOLERANCES	±2 nsec. or ±5% whichever is greater
SUPPLY CURRENT	65 mA max., 45 mA typical
SUPPLY VOLTAGE (VCC)	4.75 to 5.25 VDC
LOGIC 1 INPUT CURRENT	50μA @ VCC = 5.25V and VIH = 2.70V
LOGIC 0 INPUT CURRENT	-2 mA max. @ VCC = 5.25V and VIL = 0.50V
LOGIC 1 OUTPUT VOLTAGE	2.7V min., 3.4V typical
LOGIC 0 OUTPUT VOLTAGE	0.5V max.
LOGIC 1 INPUT VOLTAGE	2V min. to 5.25V max.
LOGIC 0 INPUT VOLTAGE	0.8V max.
SHORT CIRCUIT OUTPUT CURRENT	-40 mA min. to -100 mA max. VCC = 5.25V, one output shorted for max. 1 sec. duration
OPERATING TEMPERATURE	0°C to 70°C (optional -55°C to +125°C)
STORAGE TEMPERATURE	-55°C to +125°C

DELAY AT EA. TAP IN NSEC.					
Part No. †	**Tap 1**	**Tap 2**	**Tap 3**	**Tap 4**	**Output**
HY5003-025R	5±2	10±2	15±2	20±2	25±2
HY5003-030R	6±2	12±2	18±2	24±2	30±2
HY5003-035R	7±2	14±2	21±2	28±2	35±2
HY5003-040R	8±2	16±2	24±2	32±2	40±2
HY5003-045R	9±2	18±2	27±2	36±2	45±2.3
HY5003-050R	10±2	20±2	30±2	40±2	50±2.5
HY5003-075R	15±2	30±2	45±2.3	60±3	75±3.8
HY5003-100R	20±2	40±2	60±3	80±4	100±5
HY5003-150R	30±2	60±3	90±5.4	120±6	150±7.5
HY5003-200R	40±2	80±4	120±6	160±8	200±10
HY5003-250R	50±2.5	100±5	150±7.5	200±10	250±12.5

† Suffix designates:
R = standard 0°C to 70°C operation
M = standard -55°C to +125°C operation

Dimensions
(Inches)





Specifications Subject to Change Without Notice

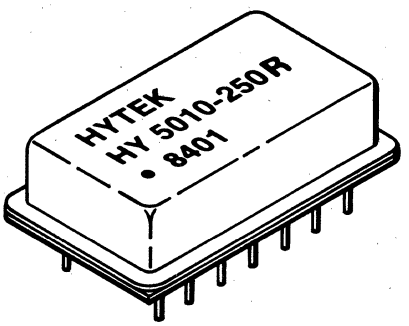
hytek microsystems incorporated
400 Hot Springs Road, Carson City, NV 89701
Phone (702) 883-0820 TWX 910-395-6030

HY5010

10-TAP DIGITAL DELAY LINE
(Hi-Rel Package)

FEATURES

- **TTL Schottky buffered inputs and outputs**
- **Hermetically sealed metal package**
- **Low profile 14-pin DIP**
- **High MTBF**
- **Customs also available**



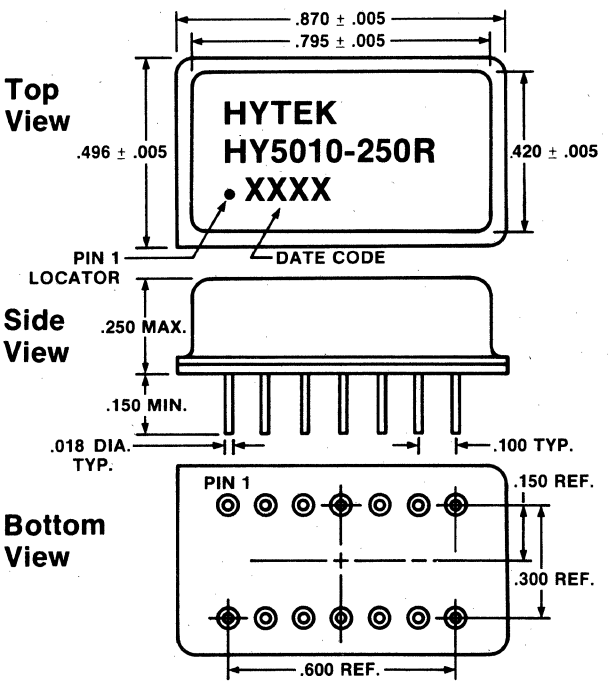
SPECIFICATIONS

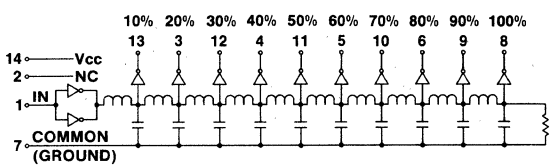
INPUT TEST CONDITIONS:	
SUPPLY VOLTAGE (Vcc)	5.0 VDC
PULSE VOLTAGE	Logic 1 = 3.2 volts Logic 0 = 0.0 volts
RISE TIME	3.0 nsec.
PULSE WIDTH	2 x total delay
DUTY CYCLE	20%
DRIVE CAPABILITIES:	
LOGIC O	10 TTL loads/tap max. 20 TTL loads/unit max. (20 mA max.)
LOGIC 1	20 TTL loads/tap and unit max. (-1 mA max.)
OPERATING CHARACTERISTICS:	
OUTPUT RISE TIME	4 nsec. max. (measured from 0.75V to 2.4V)
DELAY TOLERANCES	±2 nsec. or ±5% whichever is greater
SUPPLY CURRENT	120 mA max.,
SUPPLY VOLTAGE (Vcc)	4.75 to 5.25 VDC
LOGIC 1 INPUT CURRENT	100μA @ Vcc = 5.25V and VIH = 2.70V
LOGIC 0 INPUT CURRENT	-4 mA max. @ Vcc = 5.25V and VIL = 0.50V
LOGIC 1 OUTPUT VOLTAGE	2.7V min., 3.4V typical
LOGIC 0 OUTPUT VOLTAGE	0.5V max.
LOGIC 1 INPUT VOLTAGE	2V min. to 5.25V max.
LOGIC 0 INPUT VOLTAGE	0.8V max.
SHORT CIRCUIT OUTPUT CURRENT	-40 mA min. to -100 mA max. Vcc = 5.25V, one output shorted for max. 1 sec. duration
OPERATING TEMPERATURE	0°C to 70°C (optional -55°C to +125°C)
STORAGE TEMPERATURE	-55°C to +125°C
HERMETICITY	leak rate < 1 X 10^{-6} ATM. CC/S

DELAY AT EA. TAP IN NSEC.		
Part No.†	**Total Delay (nsec.)**	**Tap-To-Tap Delay (nsec.)**
HY5010-050R	50 ± 2.5	5 ± 1.0
HY5010-100R	100 ± 5.0	10 ± 1.0
HY5010-150R	150 ± 7.5	15 ± 1.5
HY5010-200R	200 ± 10.0	20 ± 2.0
HY5010-250R	250 ± 13.5	25 ± 2.5
HY5010-500R	500 ± 25	50 ± 5.0

† Suffix designates:
R = standard 0°C to 70°C operation
M = standard -55°C to +125°C operation
Z = 883 screening (method 5008)

Dimensions
(Inches)





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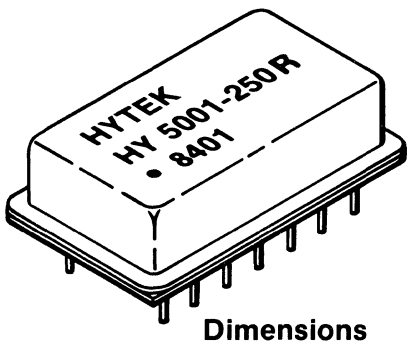
400 Hot Springs Road, Carson City, NV 89701
Phone (702) 883-0820 TWX 910-395-6030

5-TAP DIGITAL DELAY LINE
(Hi-Rel Package)

HY5001

FEATURES

- **TTL Schottky buffered inputs and outputs**
- **Hermetically sealed metal package**
- **Low profile 14-pin DIP**
- **High MTBF**
- **Customs also available**



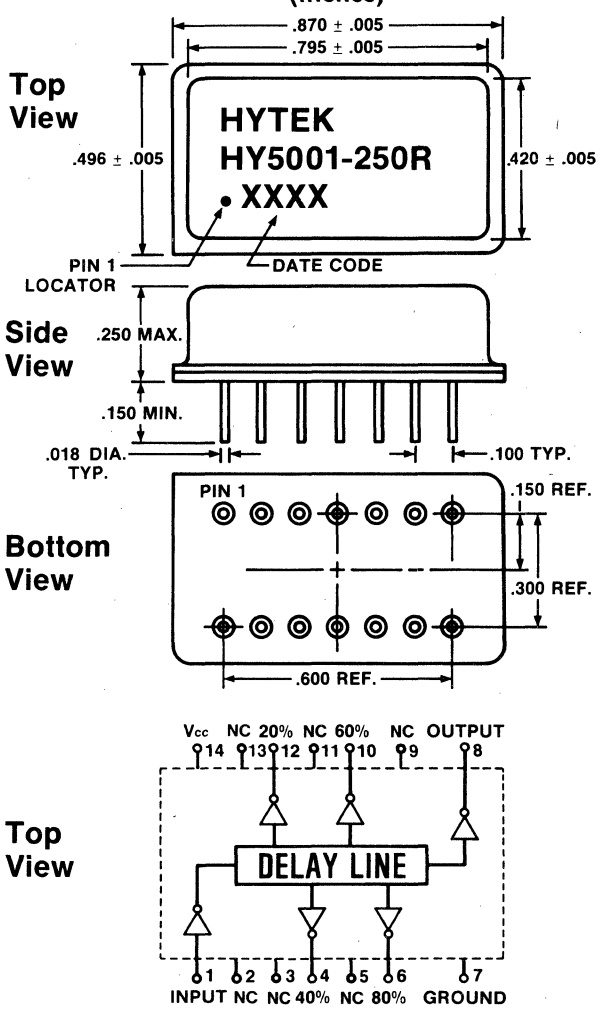
SPECIFICATIONS

INPUT TEST CONDITIONS:	
SUPPLY VOLTAGE (Vcc)	5.0 VDC
PULSE VOLTAGE	Logic 1 = 3.2 volts Logic 0 = 0.0 volts
RISE TIME	3.0 nsec.
PULSE WIDTH	2 x total delay
DUTY CYCLE	20%
DRIVE CAPABILITIES:	
LOGIC O	10 TTL loads/tap max. 20 TTL loads/unit max. (20 mA max.)
LOGIC 1	20 TTL loads/tap and unit max. (-1 mA max.)
OPERATING CHARACTERISTICS:	
OUTPUT RISE TIME	4 nsec. max. (measured from 0.75V to 2.4V)
DELAY TOLERANCES	±2 nsec. or ±5% whichever is greater
SUPPLY CURRENT	65 mA max., 45 mA typical
SUPPLY VOLTAGE (Vcc)	4.75 to 5.25 VDC
LOGIC 1 INPUT CURRENT	50μA @ Vcc = 5.25V and VIH = 2.70V
LOGIC 0 INPUT CURRENT	-2 mA max. @ Vcc = 5.25V and VIL = 0.50V
LOGIC 1 OUTPUT VOLTAGE	2.7V min., 3.4V typical
LOGIC 0 OUTPUT VOLTAGE	0.5V max.
LOGIC 1 INPUT VOLTAGE	2V min. to 5.25V max.
LOGIC 0 INPUT VOLTAGE	0.8V max.
SHORT CIRCUIT OUTPUT CURRENT	-40 mA min. to -100 mA max. Vcc = 5.25V, one output shorted for max. 1 sec. duration
OPERATING TEMPERATURE	0°C to 70°C (optional -55°C to +125°C)
STORAGE TEMPERATURE	-55°C to +125°C
HERMETICITY	leak rate < 1 X 10^{-6} ATM. CC/S

DELAY AT EA. TAP IN NSEC.					
Part No. †	**Tap 1**	**Tap 2**	**Tap 3**	**Tap 4**	**Output**
HY5001-025R	5±2	10±2	15±2	20±2	25±2
HY5001-030R	6±2	12±2	18±2	24±2	30±2
HY5001-035R	7±2	14±2	21±2	28±2	35±2
HY5001-040R	8±2	16±2	24±2	32±2	40±2
HY5001-045R	9±2	18±2	27±2	36±2	45±2.3
HY5001-050R	10±2	20±2	30±2	40±2	50±2.5
HY5001-075R	15±2	30±2	45±2.3	60±3	75±3.8
HY5001-100R	20±2	40±2	60±3	80±4	100±5
HY5001-150R	30±2	60±3	90±4.5	120±6	150±7.5
HY5001-200R	40±2	80±4	120±6	160±8	200±10
HY5001-250R	50±2.5	100±5	150±7.5	200±10	250±12.5
HY5001-500R	100±5	200±10	300±15	400±20	500±25

† Suffix designates:
R = standard 0°C to 70°C operation
M = standard -55°C to +125°C operation
Z = 883 screening (method 5008)

Dimensions
(Inches)



Specifications Subject to Change Without Notice

hytek microsystems incorporated

400 Hot Springs Road, Carson City, NV 89701
Phone (702) 883-0820 TWX 910-395-6030

jbm Active & Passive Delay Lines

JBM DELAY LINE HEADQUARTERS

JBM produces one of the industry's broadest lines of active (digital) and passive magnetic delay lines for use in computers, communications equipment, military instrumentation, etc.

In addition to hundreds of standard models, we offer extensive capabilities for the design and production of custom units for special applications.

STYLE L-21
(14-pin DIP)
10 equally-spaced taps
Td/Tr = 5:1 (typ.)

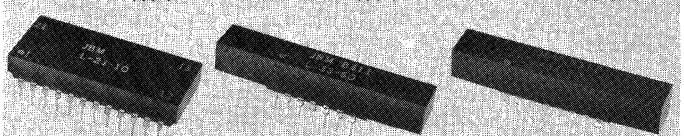
STYLE L-22
(16-pin DIP)
10 equally-spaced taps
Td/Tr = 5:1 (typ.)

TOTAL DELAY (nsec)	TAP INTERVALS (nsec)	RISE TIME @ OUT (nsec) MAX	JBM PART NUMBER L-21/22—XXX NOMINAL TERMINATING IMPEDANCE (±10%) 50Ω	75Ω	100Ω	200Ω	500Ω
5.0 ± 1ns	0.50 ± .35ns	2.5	250	260	270	—	—
7.5	0.75	3.0	251	261	271	—	—
10.0	1.00	3.5	252	262	272	282	—
12.5	1.25	4.0	253	263	273	283	—
15.0	1.50	4.5	254	264	274	284	—
17.5	1.75 ± .35ns	5.0	255	265	275	285	—
20.0 ± 1ns	2.0 ± 20%	5.5	256	266	276	286	—
25.0 ± 5%	2.5	6.0	257	267	277	287	—
30.0	3.0	6.5	258	268	278	288	—
35.0	3.5	7.0	259	269	279	289	—
40.0	4.0	8.0	10	—	280	290	—
45.0	4.5 ± 20%	9.0	—	—	281	281	—
50.0	5.0 ± 1ns	10.0	11	—	21	31	41
60.0	6.0	12.0	12	—	22	32	42
70.0	7.0	14.0	13	—	23	33	43
80.0	8.0	16.0	14	—	24	34	44
90.0	9.0	18.0	15	—	25	35	45
100.0	10.0 ± 1ns	20.0	16	—	26	36	46
125.0	12.5 ± 10%	25.0	17	—	27	37	47
150.0	15.0	30.0	18	—	28	38	48
175.0	17.5	35.0	19	—	—	—	—
200.0	20.0	40.0	20	—	29	39	49
300.0	30.0	60.0	—	—	30	40	50
350.0	35.0	70.0	650	654	661	671	—
400.0	40.0	80.0	651	655	662	672	—
450.0	45.0	90.0	652	656	663	673	—
500.0	50.0	100.0	653	657	664	674	—
600.0	60.0	120.0	—	658	665	675	—
700.0	70.0	140.0	—	659	666	676	—
750.0	75.0	150.0	—	660	667	677	—
800.0	80.0	160.0	—	—	668	—	—
900.0	90.0	180.0	—	—	669	—	—
1000 ± 5%	100.0 ± 10%	200.0	—	—	670	—	—

STYLE L-23
(24-pin DIP)
20 equally-spaced taps
Td/Tr = 10:1 (typ.)

STYLE L-33
(14-pin DIP)
10 equally-spaced taps
Td/Tr = 10:1 (typ.)

STYLE L-34
(16-pin DIP)
10 equally-spaced taps
Td/Tr = 10:1 (typ.)

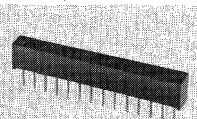


Compatible with Various Logic Systems Including TTL and Video Circuits.

TOTAL DELAY	TAP INTERVALS* (nsec)		RISE TIME @ OUT	JBM PART NUMBER L-23-XX L-33/34-XX									
				50Ω		75Ω		100Ω		200Ω		350Ω	
nsec ± 5%	L-23	L-33/34	(nsec) MAX	L-23	L-33/34	L-23	L-33/34	L-23	L-33/34	L-23	L-33/34	L-23	L-33/34
50	—	5.0	5.0	—	L-33/34-00	—	L-33/34-15	—	L-33/34-32	—	—	—	—
75	—	7.5	7.5	—	L-33/34-01	—	L-33/34-16	—	L-33/34-33	—	—	—	—
100	5.0	10.0	10.0	—	L-33/34-02	L-23-10	L-33/34-17	L-23-14	L-33/34-34	—	L-33/34-51	—	—
125	—	12.5	12.5	—	L-33/34-03	—	L-33/34-18	—	L-33/34-35	—	L-33/34-52	—	—
150	7.5	15.0	15.0	—	L-33/34-04	L-23-11	L-33/34-19	L-23-15	L-33/34-36	—	L-33/34-53	—	—
175	—	17.5	17.5	—	L-33/34-05	—	L-33/34-20	—	L-33/34-37	—	L-33/34-54	—	—
200	10.0	20.0	20.0	—	L-33/34-06	L-23-12	L-33/34-21	L-23-16	L-33/34-38	L-23-20	L-33/34-55	—	—
225	—	22.5	22.5	—	L-33/34-07	—	L-33/34-22	—	L-33/34-39	—	L-33/34-56	—	—
250	12.5	25.0	25.0	—	L-33/34-08	L-23-13	L-33/34-23	L-23-17	L-33/34-40	L-23-21	L-33/34-57	—	—
300	15.0	30.0	30.0	—	L-33/34-09	—	L-33/34-24	L-23-18	L-33/34-41	L-23-22	L-33/34-58	—	—
350	17.5	35.0	35.0	—	L-33/34-10	—	L-33/34-25	L-23-19	L-33/34-42	L-23-23	L-33/34-59	L-23-28	—
400	20.0	40.0	40.0	—	L-33/34-11	—	L-33/34-26	—	L-33/34-43	L-23-24	L-33/34-60	L-23-29	—
450	22.5	45.0	45.0	—	—	—	—	—	—	—	—	L-23-30	—
500	25.0	50.0	50.0	—	L-33/34-12	—	L-33/34-27	—	L-33/34-44	L-23-25	L-33/34-61	L-23-31	—
600	30.0	—	60.0	—	—	—	—	—	—	L-23-26	—	L-23-32	—
700	35.0	—	70.0	—	—	—	—	—	—	L-23-27	—	L-23-33	—
750	—	75.0	75.0	—	L-33/34-13	—	L-33/34-28	—	L-33/34-45	—	L-33/34-62	—	—
800	40.0	—	80.0	—	—	—	—	—	—	—	—	L-23-34	—
900	45.0	—	90.0	—	—	—	—	—	—	—	—	L-23-35	—
1000	50.0	100.0	100.0	—	L-33/34-14	—	L-33/34-29	—	L-33/34-46	—	L-33/34-63	L-23-36	—
1100	55.0	—	110.0	—	—	—	—	—	—	—	—	L-23-37	—
1200	60.0	—	120.0	—	—	—	—	—	—	—	—	L-23-38	—
1250	—	—	125.0	—	—	—	L-33/34-30	—	L-33/34-47	—	L-33/34-64	—	—
1500	—	—	150.0	—	—	—	L-33/34-31	—	L-33/34-48	—	L-33/34-65	—	—
1750	—	—	175.0	—	—	—	—	—	L-33/34-49	—	—	—	—
2000	—	—	200.0	—	—	—	—	—	L-33/34-50	—	—	—	—

* ± 10% or ± 1 ns, whichever is greater.
Consult factory for other parameters, tolerances and pin outs.

STYLE L-26 (14-pin SIP)
10 equally-spaced taps
Td/Tr = 5:1 (typ.)



TOTAL DELAY (nsec)	TAP INTERVALS (nsec)	RISE TIME @ OUT (nsec) MAX	JBM PART NUMBER L-26-XX NOMINAL TERMINATING IMPEDANCE (±10%) 50Ω	75Ω	100Ω	200Ω
5.0 ± 1ns	0.50 ± .35ns	2.5	L-26-50	L-26-80	L-26-110	L-26-150
7.5	0.75	3.0	L-26-51	L-26-81	L-26-111	L-26-151
10.0	1.00	2.5	L-26-52	L-26-82	L-26-112	L-26-152
12.5	1.25	4.0	L-26-53	L-26-83	L-26-113	L-26-153
15.0	1.50	4.5	L-26-54	L-26-84	L-26-114	L-26-154
17.5	1.75 ± .35ns	5.0	L-26-55	L-26-85	L-26-115	L-26-155
20.0 ± 1ns	2.0 ± 20%	5.5	L-26-56	L-26-86	L-26-116	L-26-156
25.0 ± 5%	2.5	6.0	L-26-57	L-26-87	L-26-117	L-26-157
30.0	3.0	6.5	L-26-58	L-26-88	L-26-118	L-26-158
35.0	3.5	7.0	L-26-59	L-26-89	L-26-119	L-26-159
40.0	4.0	8.0	L-26-60	L-26-90	L-26-120	L-26-160
45.0	4.5	9.0	L-26-61	L-26-91	L-26-121	L-26-161
50.0	5.0 ± 20%	10.0	L-26-62	L-26-92	L-26-122	L-26-162
60.0	6.0 ± 1ns	12.0	L-26-63	L-26-93	L-26-123	L-26-163
70.0	7.0	14.0	L-26-64	L-26-94	L-26-124	L-26-164
80.0	8.0	16.0	L-26-65	L-26-95	L-26-125	L-26-165
90.0	9.0	18.0	L-26-66	L-26-96	L-26-126	L-26-166
100.0	10.0 ± 1ns	20.0	L-26-67	L-26-97	L-26-127	L-26-167
125.0	12.5 ± 10%	25.0	L-26-68	L-26-98	L-26-128	L-26-168
150.0	15.0	30.0	L-26-69	L-26-99	L-26-129	L-26-169
175.0	17.5	35.0	L-26-70	L-26-100	L-26-130	L-26-170
200.0	20.0	40.0	L-26-71	L-26-101	L-26-131	L-26-171
300.0	30.0	60.0	L-26-72	L-26-102	L-26-132	L-26-172
350.0	35.0	70.0	L-26-73	L-26-103	L-26-133	L-26-173
400.0	40.0	80.0	L-26-74	L-26-104	L-26-134	L-26-174
450.0 ± 5%	45.0 ± 10%	90.0	L-26-75	L-26-105	L-26-135	L-26-175

Consult factory for other parameters, tolerances and pin outs.

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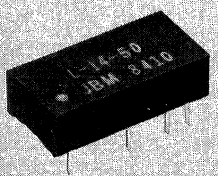
Telex No. 953134 TWX No. 710-220-8978

Active & Passive Delay Lines

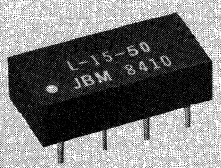
STYLE L-14
5-Tap, Fast Rise Time



DELAY SPECIFICATIONS (all times in nanoseconds)

JBM part #		Tap 1 Pin 12	Tap 2 Pin 4	Tap 3 Pin 10	Tap 4 Pin 6	Output Pin 8
L-14-050	lead	5 ± 3	10 ± 3	15 ± 3	20 ± 3	25 ± 2
	trail	5 ± 3	10 ± 3	15 ± 3	20 ± 3	25 ± 3
L-14-051	lead	6 ± 3	12 ± 3	18 ± 3	24 ± 3	30 ± 2
	trail	6 ± 3	12 ± 3	18 ± 3	24 ± 3	30 ± 3
L-14-052	lead	7 ± 3	14 ± 3	21 ± 3	28 ± 3	35 ± 2
	trail	7 ± 3	14 ± 3	21 ± 3	28 ± 3	35 ± 3
L-14-053	lead	8 ± 3	16 ± 3	24 ± 3	32 ± 3	40 ± 2
	trail	8 ± 3	16 ± 3	24 ± 3	32 ± 3	40 ± 4
L-14-054	lead	9 ± 3	18 ± 3	27 ± 3	36 ± 3	45 ± 2.5
	trail	9 ± 3	18 ± 3	27 ± 3	36 ± 3	45 ± 4
L-14-055	lead	10 ± 3	20 ± 3	30 ± 3	40 ± 3	50 ± 2.5
	trail	10 ± 3	20 ± 3	30 ± 3	40 ± 4	50 ± 4
L-14-056	lead	15 ± 3	30 ± 3	45 ± 3	60 ± 4	75 ± 4
	trail	15 ± 3	30 ± 3	45 ± 4	60 ± 5	75 ± 5
L-14-057	lead	20 ± 3	40 ± 3	60 ± 4	80 ± 4	100 ± 5
	trail	20 ± 3	40 ± 4	60 ± 5	80 ± 5	100 ± 6
L-14-058	lead	30 ± 3	60 ± 4	90 ± 5	120 ± 6	150 ± 7.5
	trail	30 ± 3	60 ± 5	90 ± 6	120 ± 9	150 ± 10
L-14-059	lead	40 ± 3	80 ± 4	120 ± 6	160 ± 8	200 ± 10
	trail	40 ± 4	80 ± 5	120 ± 8	160 ± 10	200 ± 12
L-14-060	lead	50 ± 4	100 ± 5	150 ± 8	200 ± 10	250 ± 12.5
	trail	50 ± 5	100 ± 6	150 ± 10	200 ± 12	250 ± 15
L-14-061	lead	60 ± 4	120 ± 6	180 ± 9	240 ± 12	300 ± 15
	trail	60 ± 5	120 ± 8	180 ± 11	240 ± 15	300 ± 18

STYLE L-15
Multi-Buffered

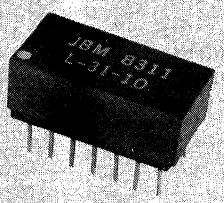


DELAY SPECIFICATIONS (all times in nanoseconds):

JBM Part #	Line 1 in 1—out 12	Line 2 in 3—out 10	Line 3 in 5—out 8
L-15-050	5 ± 2	5 ± 2	5 ± 2
L-15-051	6 ± 2	6 ± 2	6 ± 2
L-15-052	7 ± 2	7 ± 2	7 ± 2
L-15-053	8 ± 2	8 ± 2	8 ± 2
L-15-054	9 ± 2	9 ± 2	9 ± 2
L-15-055	10 ± 2	10 ± 2	10 ± 2
L-15-056	15 ± 2	15 ± 2	15 ± 2
L-15-057	20 ± 2	20 ± 2	20 ± 2
L-15-058	30 ± 2	30 ± 2	30 ± 2
L-15-059	40 ± 3	40 ± 3	40 ± 3
L-15-060	50 ± 3	50 ± 3	50 ± 3
L-15-061	60 ± 3	60 ± 3	60 ± 3
L-15-062	70 ± 3.5	70 ± 3.5	70 ± 3.5
L-15-063	75 ± 4	75 ± 4	75 ± 4
L-15-064	80 ± 4	80 ± 4	80 ± 4
L-15-065	90 ± 4.5	90 ± 4.5	90 ± 4.5
L-15-066	100 ± 5	100 ± 5	100 ± 5
L-15-067	125 ± 6.5	125 ± 6.5	125 ± 6.5
L-15-068	150 ± 7.5	150 ± 7.5	150 ± 7.5
L-15-069	175 ± 9	175 ± 9	175 ± 9
L-15-070	200 ± 10	200 ± 10	200 ± 10

Consult factory for other parameters and tolerances and low power (LS) version (L-57-XX).

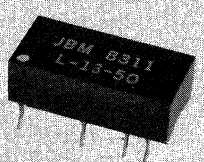
STYLE L-31
(14-pin DIP)
Delay Range 50 thru 1000 nsec
10 equally-spaced taps
TTL and DTL Compatible



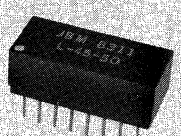
TOTAL DELAY (nsec ± 5%)	TAP INTERVALS (nsec ± 3 ns*)	RISE TIME (ns MAX) (0.8 to 2.0V)	JBM P/N L-31-XX
50	5.0	2.0	L-31-50
75	7.5	2.0	L-31-51
100	10.0	2.0	L-31-52
125	12.5	2.5	L-31-53
150	15.0	2.5	L-31-54
175	17.5	3.0	L-31-55
200	20.0	3.0	L-31-56
250	25.0	3.0	L-31-57
300	30.0	3.5	L-31-58
350	35.0	3.5	L-31-59
400	40.0	4.0	L-31-60
450	45.0	4.0	L-31-61
500	50.0	4.0	L-31-62
600	60.0	4.5	L-31-63
700	70.0	4.5	L-31-64
750	75.0	4.5	L-31-65
800	80.0	5.0	L-31-66
900	90.0	5.0	L-31-67
1000	100.0	5.0	L-31-68

*or ± 5%, whichever is greater.
Consult factory for other parameters, tolerances.

STYLE L-13
(14-pin outline)
Delay Range 25 thru 1000 nsec
5 equally-spaced taps



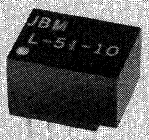
STYLE L-45
(16 pins)
Delay Range 25 thru 1000 nsec
5 equally-spaced taps



TOTAL DELAY (nsec ± 5%)	TAP INTERVALS (nsec ± 3 ns*)	RISE TIME (ns MAX) (0.8 to 2.0V)	JBM PART NUMBER L- L-13 (14) PIN	L-45 (16) PIN
25	5	2.0	L-13-50	L-45-50
30	6	2.0	L-13-51	L-45-51
35	7	2.0	L-13-52	L-45-52
40	8	2.0	L-13-53	L-45-53
45	9	2.0	L-13-54	L-45-54
50	10	2.0	L-13-55	L-45-55
75	15	2.0	L-13-56	L-45-56
100	20	2.0	L-13-57	L-45-57
150	30	2.5	L-13-58	L-45-58
200	40	3.0	L-13-59	L-45-59
250	50	3.0	L-13-60	L-45-60
300	60	3.5	L-13-250	L-45-250
350	70	3.5	L-13-251	L-45-251
400	80	4.0	L-13-252	L-45-252
450	90	4.0	L-13-253	L-45-253
500	100	4.0	L-13-254	L-45-254
600	120	4.5	L-13-255	L-45-255
700	140	4.5	L-13-256	L-45-256
750	150	4.5	L-13-257	L-45-257
800	160	5.0	L-13-258	L-45-258
900	180	5.0	L-13-259	L-45-259
1000	200	5.0	L-13-260	L-45-260

*or ± 5%, whichever is greater.
Consult factory for other parameters and tolerances and low power (LS) versions.

STYLE L-51
(8 pins)
Delay Range 25 thru 500 nsec
5 equally-spaced taps



TOTAL DELAY (nsec ± 5%)	TAP INTERVALS (nsec ± 3 ns*)	RISE TIME (ns MAX) (0.8 to 2.0V)	JBM P/N L-51-XX
25	5.0	2.0	L-51-50
30	6.0	↑	L-51-51
35	7.0	|	L-51-52
40	8.0	|	L-51-53
45	9.0	|	L-51-54
50	10.0	|	L-51-55
75	15.0	↓	L-51-56
100	20.0	2.0	L-51-57
150	30.0	2.5	L-51-58
200	40.0	3.0	L-51-59
250	50.0	3.0	L-51-60
300	60.0	3.5	L-51-61
350	70.0	3.5	L-51-62
400	80.0	4.0	L-51-63
450	90.0	4.0	L-51-64
500	100.0	4.0	L-51-65

*or ± 5%, whichever is greater.
Consult factory for other parameters, tolerances.

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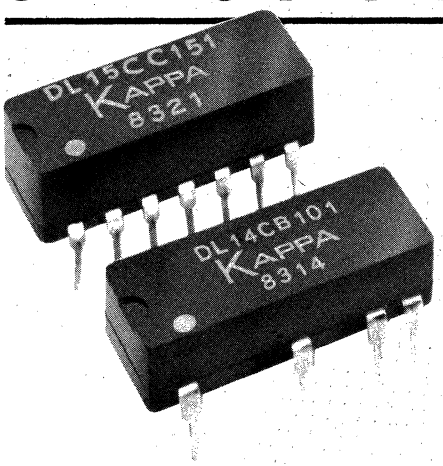
Telex No. 953134 TWX No. 710-220-8978

SERIES DL14C/DL15C TTL SCHOTTKY (14-PIN)

5- & 10-TAP DIGITAL DELAY LINES



FEATURES

- New Auto-Insertable 14-pin Package
- TTL Schottky Interfaced
- 5 or 10 equally spaced Taps
- Risetime: 4 ns max.(2)(3)

SPECIFICATIONS

Total Delay Times (ns)(1)(3):

25*, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600*, 700*, 800*, 900*, 1000*.

*Available in Series DL14 only.

Tap Delay:
(DL14) 20% of nominal Total Delay Time.
(DL15) 10% of nominal Total Delay Time.

Delay Tolerance: ±5% or ±2 ns, whichever is greater; referenced from input.

PART NUMBER EXAMPLE

Typical part number is a combination of the Basic Series Number and Delay Time.

DL14CB — **250**

BASIC SERIES #

DELAY TIME: Expressed in nanoseconds (ns)
First two digits are significant figures.
Last digit specifies number of zeros to follow.

Notes for Specifications above.

(1) Delays measured at 1.5V level on leading edge only, V_{CC} = 5.0, T_A = +25°C.
(2) Risetime measured from 0.75V to 2.4V, V_{CC} = 5.0, T_A = +25°C.
(3) Measured with no loads on Taps.

PARAMETER		TEST CONDITIONS	MIN	MAX	UNIT
RECOMMENDED OPERATING CONDITIONS					
V_{CC}	Supply Voltage		4.75	5.25	V
V_{IH}	High-Level Input Voltage		2.0		V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature		0	+70	°C
DC ELECTRICAL CHARACTERISTICS		TEST CONDITIONS			
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IH} = min, I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}		−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V		50	µA
		V_{CC} = max, V_{IN} = 5.25V		1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V		−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40	−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		75	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		75	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V		20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V		10	TTL load
INPUT PULSE TEST CONDITIONS					
E_{IN}	Pulse Voltage		3.1	3.3	V
T_{RI}	Pulse Rise-Time			2.0	NS
T_W	Pulse Width, of Total Delay		40		%
d	Duty Cycle			50	%

FIGURE 1 — SCHEMATIC

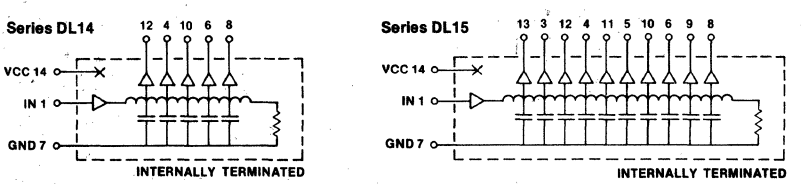
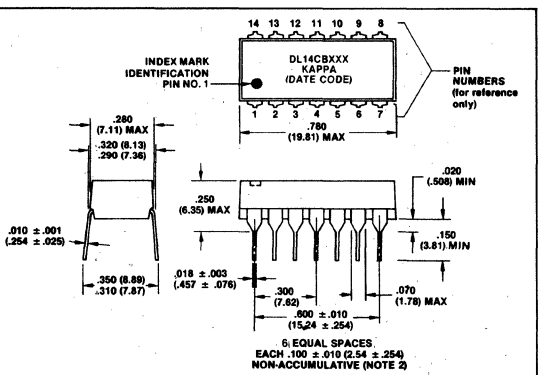


FIGURE 2 — MARKING & DIMENSIONS in inches and (mm)



Notes for Figure 2:
(1) A notch may be substituted for PIN #1 Dot Index.
(2) Each terminal is located within ±.010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 7 and 8.
(3) Series DL14 units may exclude terminals not shown in Figure 1 Schematic.

KAPPA® NETWORKS, INC.

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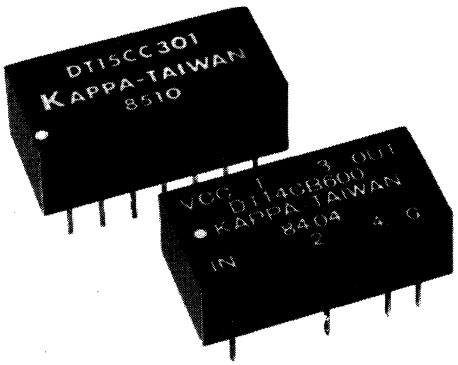
West Coast Office: 300 Cypress Ave., Alhambra, CA 91801, Phone (213) 283-2048. West Coast Distributor: Phone (213) 283-2058.

SERIES DT14/DT15 TTL SCHOTTKY (14-PIN)

5-& 10-TAP DIGITAL DELAY MODULES



FEATURES

- TTL Schottky Interfaced
- 5 or 10 equally spaced Taps
- Risetime: 4 ns max.(2) (3)

SPECIFICATIONS

Total Delay Times (ns)(1)(3):

25*, 50, 100, 150, 200, 250, 300 , 350 , 400 , 450 , 500 , 600*, 700*, 800*, 900*, 1000*.

*Available in Series DT14 only.

Tap Delay:
(DT14) 20% of nominal Total Delay Time.
(DT15) 10% of nominal Total Delay Time.

Delay Tolerance: ±5% or ±2 ns, whichever is greater; referenced from input.

PART NUMBER EXAMPLE

Typical part number is a combination of the Basic Series Number and Delay Time.

DT14CB — **250**

BASIC SERIES #

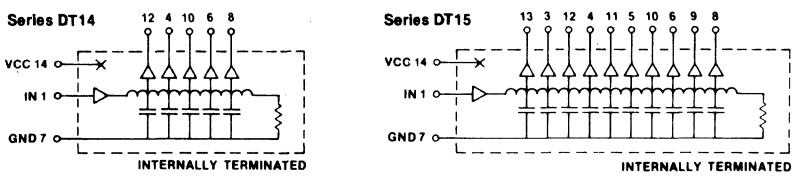
DELAY TIME: Expressed in nanoseconds (ns)
First two digits are significant figures.
Last digit specifies number of zeros to follow.

Notes for Specifications above.

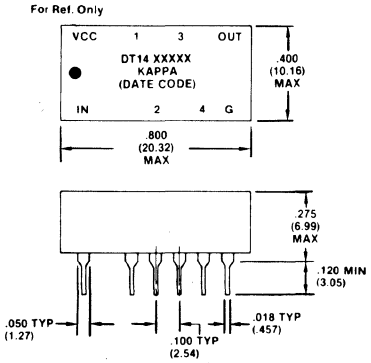
(1) Delays measured at 1.5V level on leading edge only, V_{CC} = 5.0, T_A = +25°C.
(2) Risetime measured from 0.75V to 2.4V, V_{CC} = 5.0, T_A = +25°C.
(3) Measured with no loads on Taps.

PARAMETER			MIN	MAX	UNIT
RECOMMENDED OPERATING CONDITIONS					
V_{CC}	Supply Voltage		4.75	5.25	V
V_{IH}	High-Level Input Voltage		2.0		V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature		0	+70	°C
DC ELECTRICAL CHARACTERISTICS		TEST CONDITIONS			
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IH} = min, I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}		−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V		50	µA
		V_{CC} = max, V_{IN} = 5.25V		1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V		−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40	−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		75/150	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		75/150	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V		20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V		10	TTL load
INPUT PULSE TEST CONDITIONS					
E_{IN}	Pulse Voltage		3.1	3.3	V
T_{RI}	Pulse Rise-Time			2.0	NS
T_W	Pulse Width, of Total Delay		40		%
d	Duty Cycle			50	%

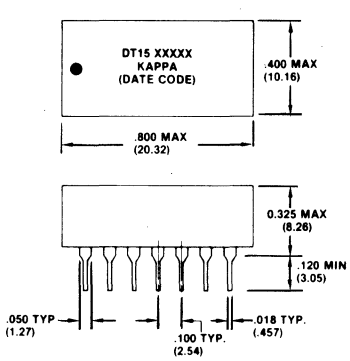
FIGURE 1 — SCHEMATIC



MARKING & DIMENSIONS in inches and (mm)



MARKING & DIMENSIONS in inches and (mm)



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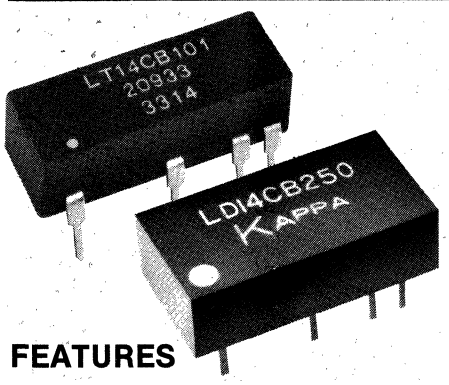
SERIES LT14/LD14 TTL SCHOTTKY (14-PIN)

5-TAP DIGITAL DELAY MODULES



FEATURES

- T_{PLH} and T_{PHL} controlled
- 14-pin package
- Available in Auto-Insertable (LT14) and Standard Package (LD14)
- 5 equally spaced Delay Taps

SPECIFICATIONS

Total Delay Times(ns)[1] [3]: 25, 30, 50, 60, 75, 100, 125,150, 175, 200, 225, 250, 300, 350, 400, and 500.

Tap Delay[1] [3]: 5 equally-spaced delay taps at 20%, 40%, 60%, 80%, and 100% of nominal Total Delay.

Delay Tolerance: ±5% or ±2 ns, whichever is greater; referenced from input.

Output Risetime[2] [3]: 4nS maximum.

PARAMETER		TEST CONDITIONS	MIN	MAX	UNIT
RECOMMENDED OPERATING CONDITIONS					
V_{CC}	Supply Voltage		4.75	5.25	V
V_{IH}	High-Level Input Voltage		2.0		V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature		0	+70	°C
DC ELECTRICAL CHARACTERISTICS		TEST CONDITIONS			
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IH} = min, I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}		−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V		50	µA
		V_{CC} = max, V_{IN} = 5.25V		1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V		−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40	−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		75	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		75	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V		20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V		10	TTL load
INPUT PULSE TEST CONDITIONS					
E_{IN}	Pulse Voltage		3.1	3.3	V
T_{RI}	Pulse Rise-Time			2.0	NS
T_W	Pulse Width, of Total Delay		40		%
d	Duty Cycle			50	%

Notes:

(1) Delays measured at 1.5V level on leading and trailing edges, V_{CC} = 5.0V, T_A = +25°C.

(2) Risetime measured from 0.75V to 2.4V, V_{CC} = 5.0V, T_A = +25°C.

(3) Measured with no loads on taps.

PART NUMBER EXAMPLE

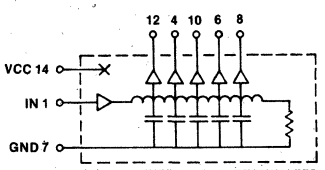
Typical Part Number is a combination of the Basic Series Number and Delay Time.

LT14CB 250

BASIC SERIES #

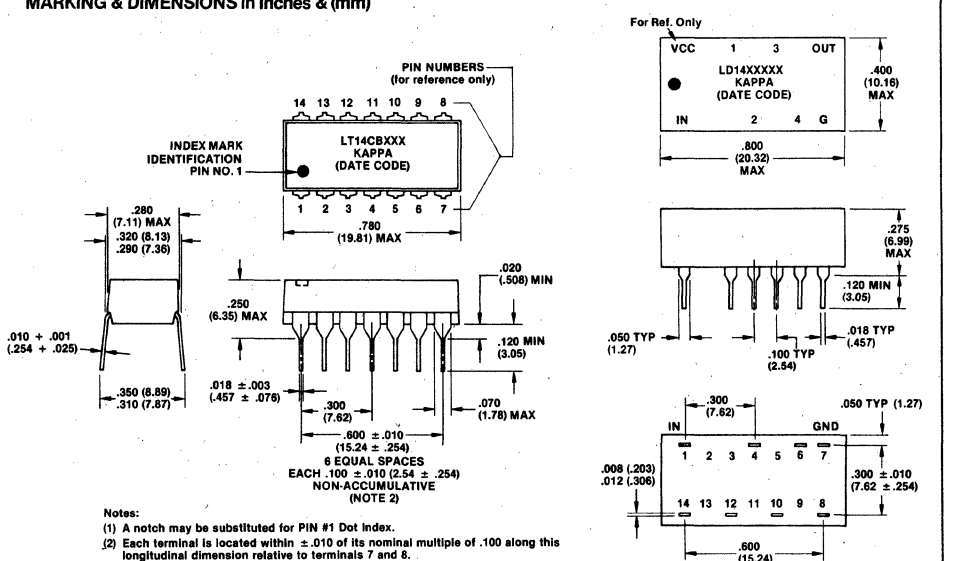
DELAY TIME

First two digits are significant figures. Last digit specifies number of zeros to follow (ns).



INTERNALLY TERMINATED

MARKING & DIMENSIONS in inches & (mm)



Notes:

(1) A notch may be substituted for PIN #1 Dot Index.

(2) Each terminal is located within ±.010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 7 and 8.

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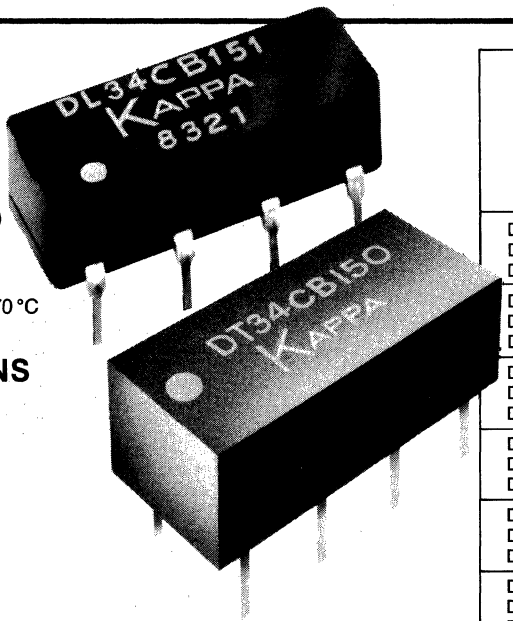
SERIES DL34/DT34 TTL SCHOTTKY (14-PIN)

TRIPLE-IN-LINE DIGITAL DELAY MODULE



FEATURES

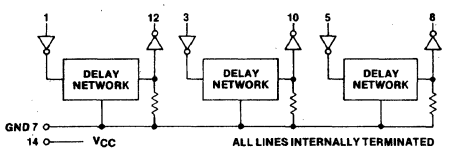
- 14-Pin DIL Package
- Available in Auto-Insertable (DL34) and Standard Package (DT34)
- Risetime 4ns Maximum(2)(3)
- Three Independent Equal Delays
- Operating Temperature 0°C to +70°C
- TTL Schottky Interfaced

INPUT TEST CONDITIONS

V_{CC}: 5.00V ±0.25V
Supply Current: I_{CCH} = 90mA max.
I_{CCL} = 115mA max.
Pulse Voltage: 3.2V ±0.1V
Risetime: 2.0 ns max.
Pulse Width: 100% min. of Delay
Duty Cycle: 25% or less

DRIVE CAPABILITIES

10 TTL loads per line



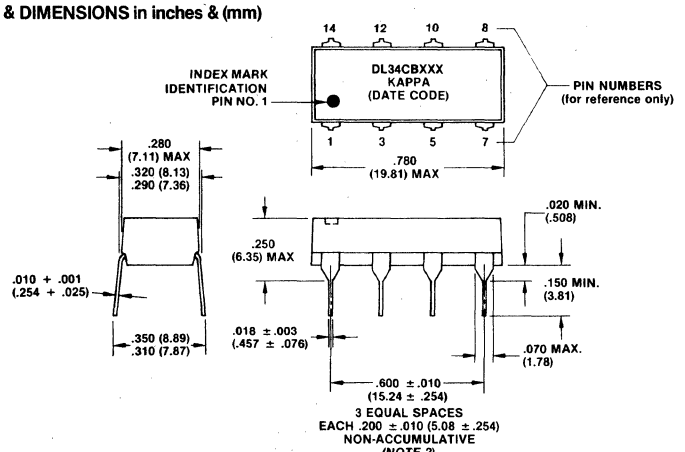
ELECTRICAL SPECIFICATIONS

Logic 1: 50µA max., 2.0V min.
Logic 0: −2.0mA max., 0.8V max.
Logic 1 Voltage Output: 2.4V min.
Logic 0 Voltage Output: 0.4V max.

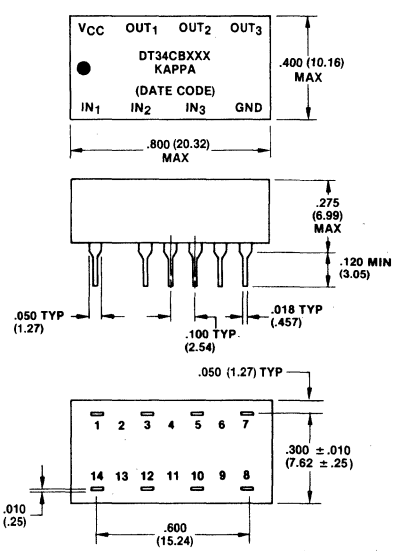
KAPPA PART # XXXXXXXXX		DELAY TIME (ns)(1)(3) ±5% or ±2 ns, whichever is greater (unless otherwise specified)
DL34CB050	DT34CB050	5 ±1.5
DL34CB100	DT34CB100	10 ±1.5
DL34CB150	DT34CB150	15
DL34CB200	DT34CB200	20
DL34CB250	DT34CB250	25
DL34CB300	DT34CB300	30
DL34CB350	DT34CB350	35
DL34CB400	DT34CB400	40
DL34CB450	DT34CB450	45
DL34CB500	DT34CB500	50
DL34CB600	DT34CB600	60
DL34CB700	DT34CB700	70
DL34CB800	DT34CB800	80
DL34CB900	DT34CB900	90
DL34CB101	DT34CB101	100
DL34CB125	DT34CB125	125
DL34CB151	DT34CB151	150
DL34CB175	DT34CB175	175
DL34CB201	DT34CB201	200
DL34CB225	DT34CB225	225
DL34CB251	DT34CB251	250

(1) Delays measured at 1.5V level on leading edge only.
(2) Risetime measured from 0.75V to 2.4V.
(3) Measured with no loads.

MARKING & DIMENSIONS in inches & (mm)



Notes:
(1) A notch may be substituted for PIN #1 Dot Index.
(2) Each terminal is located within ±.010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 7 and 8.



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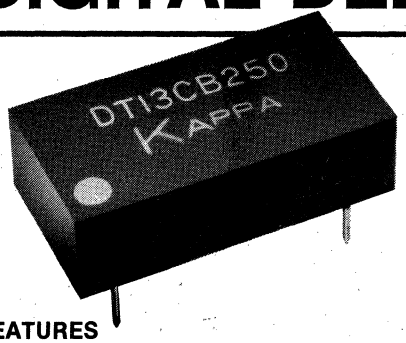
SERIES DT13 TTL SCHOTTKY (14-PIN)

DIGITAL DELAY MODULE



FEATURES

- TTL Schottky Interfaced
- STANDARD 14-pin Package
- 3 ns typ. Risetime (4 ns max.)
- Operating Temperature Range: 0°C to +70°C

SERIES DT13 SPECIFICATIONS

Delay Times (ns): 25, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1000 (other values available upon request).

Delay Tolerance: ±5% or ±2 ns, whichever is greater (tighter tolerances upon request).

INPUT TEST CONDITIONS

Pulse Voltage: 3.2V
Risetime: ⩽ 2.0 ns
Supply Current: 75 mA max.
Pulse Width: 40% minimum of total delay
Duty Cycle: 50% max.

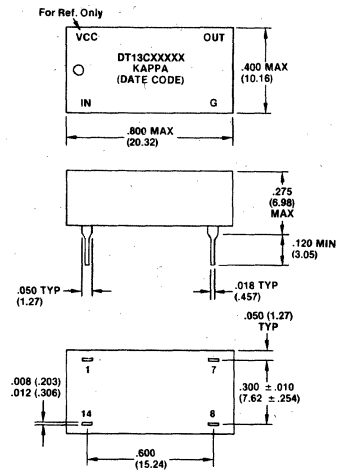
ELECTRICAL CHARACTERISTICS

Computer-Grade
Supply Voltage: 5.0V ±0.25V
Logic 1:
Input Voltage: 2.0V min.
Input Current: 50μA max.
Output Voltage: 2.7V min.
Logic 0:
Input Voltage: 0.8V max.
Input Current: −2.0 mA max.
Output Voltage: 0.5V max.

DRIVE CAPABILITIES

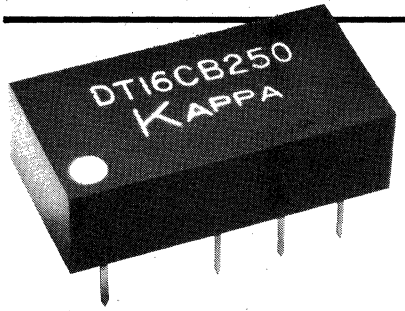
Logic 1 Output: 10 TTL Loads/Unit max.
Logic 0 Output: 10 TTL Loads/Unit max.

MARKING & DIMENSIONS in inches and (mm)



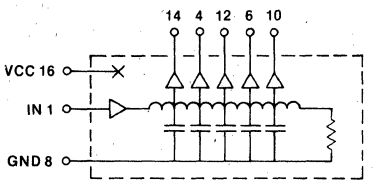
SERIES DT16 TTL SCHOTTKY (16-PIN)

5-TAP DIGITAL DELAY MODULE



FEATURES

- TTL Schottky Interfaced
- STANDARD 16-pin Package
- 3 ns typ. Risetime (4 ns max.)
- Operating Temperature Range: 0°C to +70°C
- 5 equally spaced Taps



INTERNALLY TERMINATED

SERIES DT16 SPECIFICATIONS

Total Delay Times (ns): 25, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1000 (other values available upon request).

Tap Delay: 20% of nominal Total Delay Time.

Delay Tolerance: ±5% or ±2 ns, whichever is greater; Referenced from input.

INPUT TEST CONDITIONS

Pulse Voltage: 3.2V
Risetime: ⩽ 2.0 ns
Supply Current: 75 mA max.
Pulse Width: 40% minimum of total delay
Duty Cycle: 50% max.

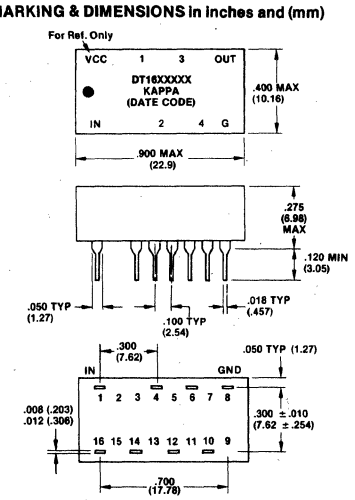
ELECTRICAL CHARACTERISTICS

Computer-Grade
Supply Voltage: 5.0V ±0.25V
Logic 1:
Input Voltage: 2.0V min.
Input Current: 50μA max.
Output Voltage: 2.7V min.
Logic 0:
Input Voltage: 0.8V max.
Input Current: −2.0 mA max.
Output Voltage: 0.5V max.

DRIVE CAPABILITIES

Logic 0 Output: 10 TTL Loads/Tap max.
20 TTL Loads/Unit max.
Logic 1 Output: 20 TTL Loads/Unit max.

MARKING & DIMENSIONS in inches and (mm)



PART NUMBER EXAMPLE

DT13 (16) 250

BASIC SERIES #

DELAY TIME: Expressed in nanoseconds (ns). First two digits are significant figures. Last digit specifies number of zeroes to follow.

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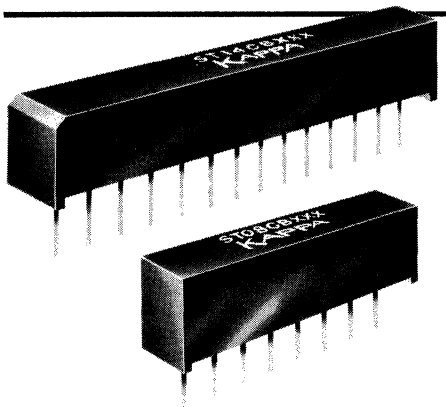
SERIES ST08C/ST14C TTL SCHOTTKY (8-PIN/14-PIN)

5- & 10-TAP DIGITAL DELAY LINES



FEATURES

- 8-Pin (ST08C) and 14-Pin (ST14C) SIP Package
- TTL Schottky interfaced
- 5 or 10 equally spaced Taps
- Risetime: 4 nS Max (See Notes 2 & 3)

SPECIFICATIONS

Total Delay Times(ns)(1) (3): 25*, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1000.

*Available in Series ST08 only.

Tap Delay:
(ST08) 20% of nom. Total Delay Time.
(ST14) 10% of nom. Total Delay Time.

Delay Tolerance: ±5% or ±2 ns, whichever is greater; referenced from input.

Notes for Specifications above.

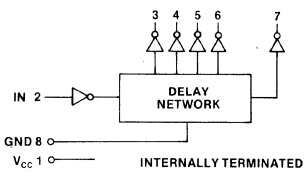
(1) Delays measured at 1.5V level on leading edge only, V_{CC} = 5.0V, T_A = +25°C.

(2) Risetime measured from 0.75V to 2.4V, V_{CC} = 5.0V, T_A = +25°C.

(3) Measured with no loads on Taps.

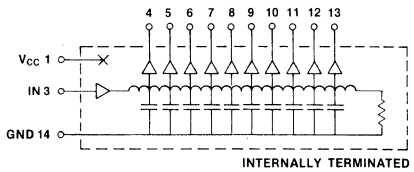
PARAMETER		TEST CONDITIONS	MIN	MAX	UNIT
RECOMMENDED OPERATING CONDITIONS					
V_{CC}	Supply Voltage		4.75	5.25	V
V_{IH}	High-Level Input Voltage		2.0		V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature		0	+70	°C
DC ELECTRICAL CHARACTERISTICS					
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IH} = min, I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}		−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V		50	µA
		V_{CC} = max, V_{IN} = 5.25V		1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V		−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40	−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		75/150	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		75/150	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V		20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V		10	TTL load
INPUT PULSE TEST CONDITIONS					
E_{IN}	Pulse Voltage		3.1	3.3	V
T_{RI}	Pulse Rise-Time			2.0	NS
T_W	Pulse Width, of Total Delay		40		%
d	Duty Cycle			50	%

SERIES ST08 SCHEMATIC



INTERNALLY TERMINATED

SERIES ST14 SCHEMATIC



INTERNALLY TERMINATED

PART NUMBER EXAMPLE

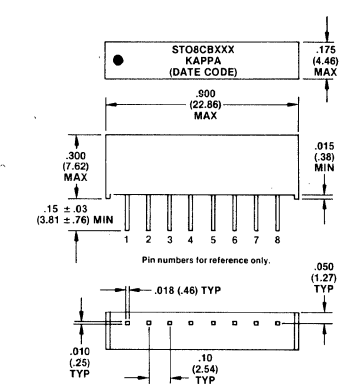
Typical Part Number is a combination of the Basic Series Number and Delay Time.

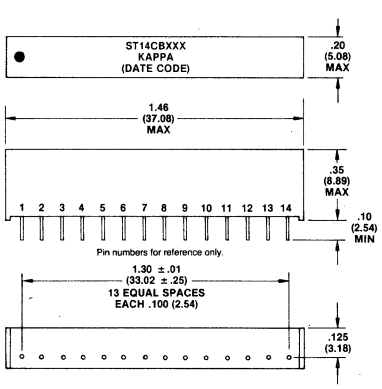
ST08CB — **250**

BASIC SERIES #

DELAY TIME
First two digits are significant figures. Last digit specifies number of zeros to follow (ns).

MARKING & DIMENSIONS in inches & (mm)





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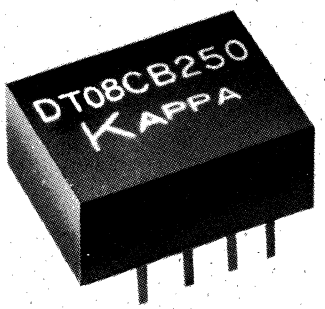
West Coast Office: 300 Cypress Ave., Alhambra, CA 01801, Phone (213) 283-2048, West Coast Distributor: Phone (213) 283-2058.

SERIES DT08 TTL SCHOTTKY (8-PIN)

5-TAP DIGITAL DELAY MODULE



PART NUMBER	Total Delay (ns)[1][3] ±5%	Tap Delay (ns)[1][3] ±5% or ±2ns, WIG[4]
DT08CB250	25	5
DT08CB500	50	10
DT08CB101	100	20
DT08CB151	150	30
DT08CB201	200	40
DT08CB251	250	50
DT08CB301	300	60
DT08CB351	350	70
DT08CB401	400	80
DT08CB451	450	90
DT08CB501	500	100
DT08CB601	600	120
DT08CB701	700	140
DT08CB801	800	160
DT08CB901	900	180
DT08CB102	1000	200

Notes:
(1) Delays measured at 1.5V level on leading edge only.
(2) Risetime measured from 0.75V to 2.4V.
(3) Measured with no loads on taps.
(4) Tap tolerances referenced from input.

FEATURES

- TTL Schottky Interfaced
- 8-pin package
- 5 equally spaced taps
- Operating Temperature Range: 0°C to +70°C
- Risetime: 4ns max.[2][3]

INPUT TEST CONDITIONS

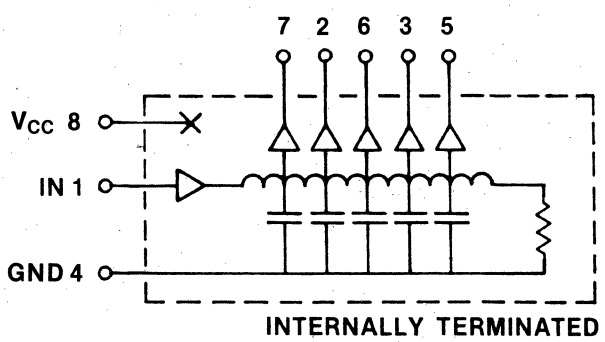
Pulse Voltage: 3.2V
Risetime: 2ns
Supply Current: 75 mA max
Pulse Width: 40% min. of total delay
Duty Cycle: 50% max.

ELECTRICAL SPECIFICATIONS

Supply Voltage (V_{CC}): 5.0V (±0.25V)
Logic 1 Input Current: 50μA max.
Logic 0 Input Current: −2mA max.
Logic 1 Voltage Output: 2.4V min.
Logic 0 Voltage Output: 0.4V max.

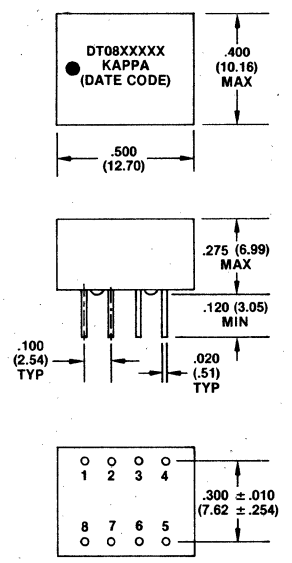
DRIVE CAPABILITIES

Logic 0 Output: 10 TTL Loads/Tap max.
20 TTL Loads/Unit max.
Logic 1 Output: 20 TTL Loads/Unit max.



INTERNALLY TERMINATED

MARKING & DIMENSIONS
in inches and (mm)



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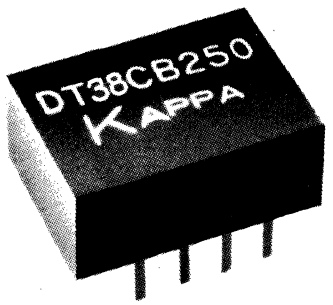
SERIES DT38 TTL SCHOTTKY (8-PIN)

TRIPLE-IN-LINE DIGITAL DELAY MODULE



KAPPA PART # XXXXXXXXX	DELAY TIME (ns)(1)(3) ±5% or ±2 ns, whichever is greater (unless otherwise specified)
DT38CB050	5 ±1.5
DT38CB100	10 ±1.5
DT38CB150	15 ±2.0
DT38CB200	20
DT38CB250	25
DT38CB300	30
DT38CB350	35
DT38CB400	40
DT38CB450	45
DT38CB500	50
DT38CB600	60
DT38CB700	70
DT38CB800	80
DT38CB900	90
DT38CB101	100
DT38CB125	125
DT38CB151	150
DT38CB175	175
DT38CB201	200
DT38CB225	225
DT38CB251	250

(1) Delays measured at 1.5V level on leading edge only.

(2) Risetime measured from 0.75V to 2.4V.

(3) Measured with no loads.

FEATURES

- 8-Pin DIL Package
- Risetime 4ns Maximum(2)(3)
- Three Independent Equal Delays
- Operating Temperature Range: 0°C to +70°C
- TTL Schottky Interfaced

INPUT TEST CONDITIONS

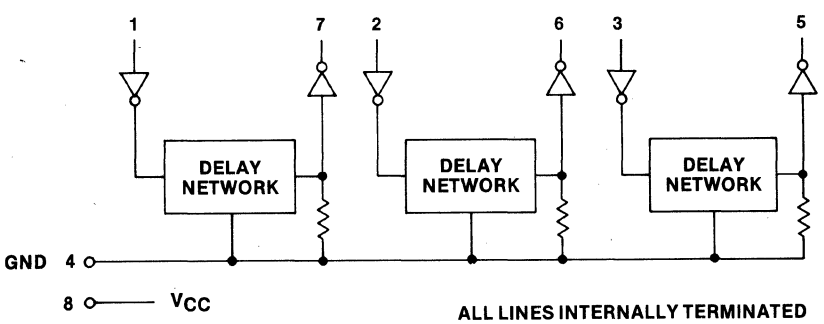
V_C: 5.0 ±0.25V
Supply Current: I_{CCH} = 90mA max.
I_{CCL} = 115mA max.
Pulse Voltage: 3.2V
Risetime: 2.0 ns
Pulse Width: 100% min. of Delay
Duty Cycle: 25% or less

ELECTRICAL SPECIFICATIONS

Logic 1: 50μA max., 2.0V min.
Logic 0: −2.0mA max., 0.8V max.
Logic 1 Voltage Output: 2.4V min.
Logic 0 Voltage Output: 0.4V max.

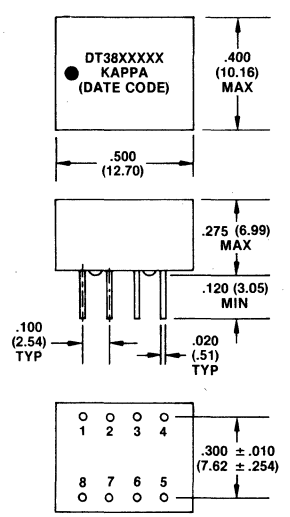
DRIVE CAPABILITIES

10 TTL loads per line



ALL LINES INTERNALLY TERMINATED

MARKING & DIMENSIONS in inches and (mm)



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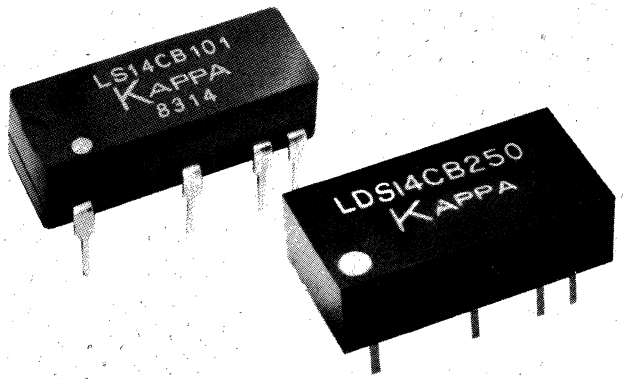
SERIES LS14/LDS14 TTL LOW POWER SCHOTTKY (14-PIN)

5-TAP DIGITAL DELAY LINES



FEATURES

- 14-Pin Auto-Insertable (LS14) and Standard Package (LDS14)
- TTL Low Power Schottky Interfaced
- 5 Equally Spaced Taps
- Risetime: 8 nS Max(2)(3)
- Operating Temperature Range: 0°C to +70°C
- Drives up to 20 Low Power TTL Loads

SPECIFICATIONS

Total Delay Times(ns)(1) (3): 50, 60, 75, 100, 125,150, 200, 250, 300, 400, and 500.

Tap Delay: 20% of nominal Total Delay Time

Delay Tolerance: ±5% or ±2 ns, whichever is greater; referenced from input.

INPUT TEST CONDITIONS

V_{CC}: 5.0 ±0.25VDC
Pulse Voltage: 3.2 ±0.1V
Risetime: 2 nS Max.
Current: 6 mA Typical
Pulse Width: 40% min. of Total Delay Time
Duty Cycle: 50% max.

PART NUMBER EXAMPLE

Typical Part Number is a combination of the Basic Series Number and Delay Time.

LS14CB — **250**

BASIC SERIES #

DELAY TIME

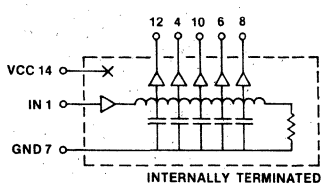
First two digits are significant figures. Last digit specifies number of zeros to follow (ns).

Notes for Specifications above.

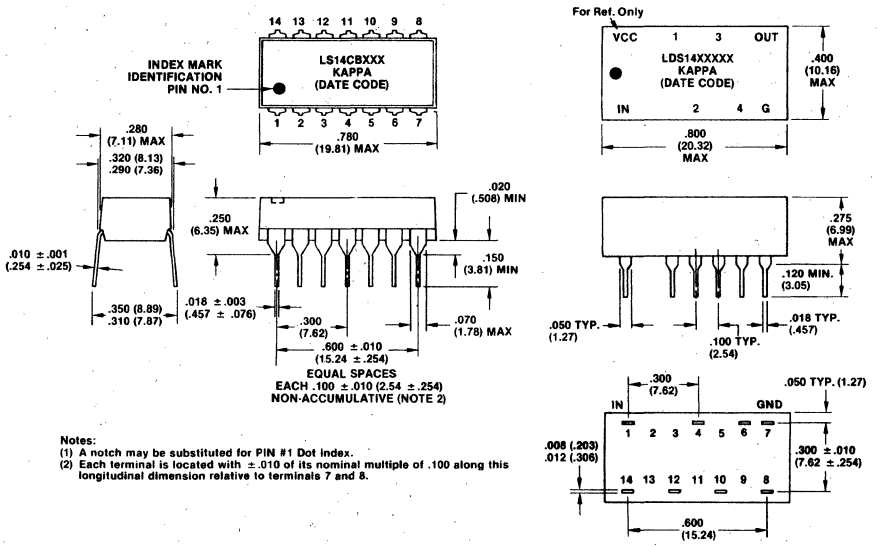
(1) Delays measured at 1.5V level on leading edge only
V_{CC} = 5.0V, T_A = +25°C.

(2) Risetime measured from 0.75V to 2.4V, V_{CC} = 5.0V, T_A = +25°C.

(3) Measured with no loads on Taps.



MARKING & DIMENSIONS in inches & (mm)



Notes:
(1) A notch may be substituted for PIN #1 Dot Index.
(2) Each terminal is located with ±.010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 7 and 8.

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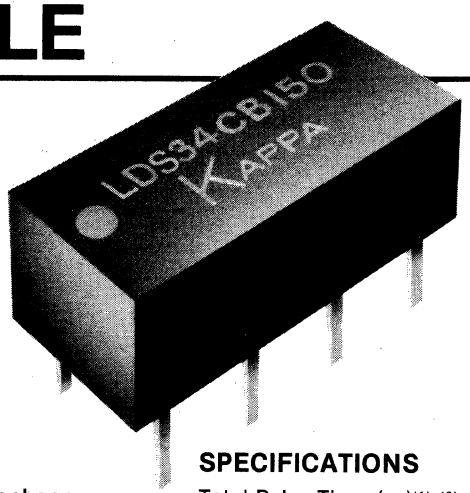
SERIES LDS34 TTL LOW POWER SCHOTTKY (14-PIN)

TRIPLE-IN-LINE DIGITAL DELAY MODULE



FEATURES

- 14-Pin Standard Package
- TTL Low Power Schottky Interfaced
- 3 Independent Equal Delays
- Risetime: 8 nS Max(2)(3)
- Operating Temperature Range: 0°C to +70°C
- Drives up to 20 Low Power TTL Loads

PART NUMBER EXAMPLE

Typical Part Number is a combination of the Basic Series Number and Delay Time.

LD34CB — BASIC SERIES #

250 — DELAY TIME

First two digits are significant figures. Last digit specifies number of zeros to follow (ns).

SPECIFICATIONS

Total Delay Times(ns)(1) (3): 50, 60, 75, 100, 125,150, 200, 250.

Delay Tolerance: ±5% or ±2 ns, whichever is greater; referenced from input.

INPUT TEST CONDITIONS

V_{CC}: 5.0 ±0.25VDC
Pulse Voltage: 3.2 ±0.1V
Risetime: 2 nS Max.
Current: 6 mA Typical
Pulse Width: 100% of Total Delay Time
Duty Cycle: 25% max.

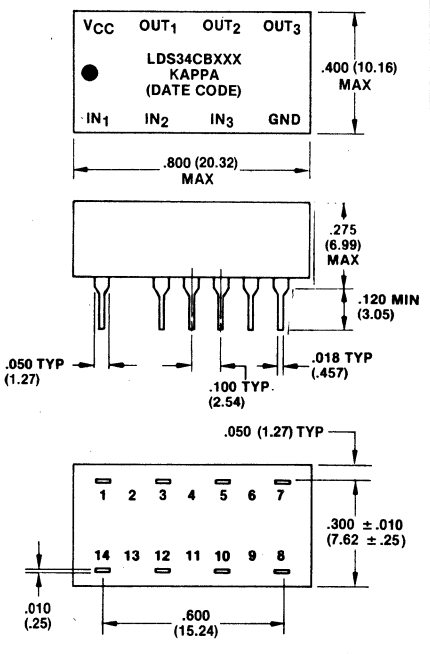
Notes for Specifications above.

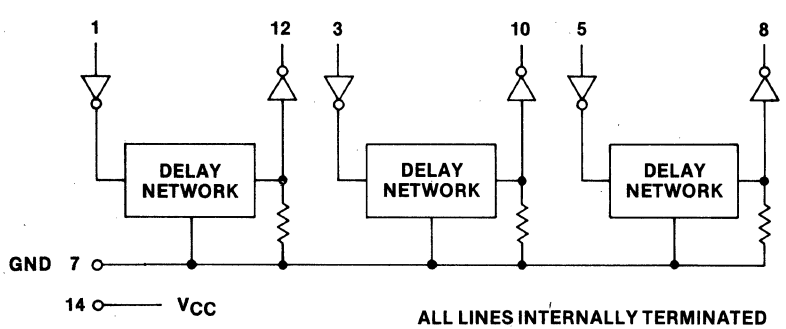
(1) Delays measured at 1.5V level on leading edge only, V_{CC} = 5.0V, T_A = +25°C.

(2) Risetime measured from 0.75V to 2.4V, V_{CC} = 5.0V, T_A = +25°C.

(3) Measured with no loads on Taps.

MARKING & DIMENSIONS in inches & (mm)





ALL LINES INTERNALLY TERMINATED

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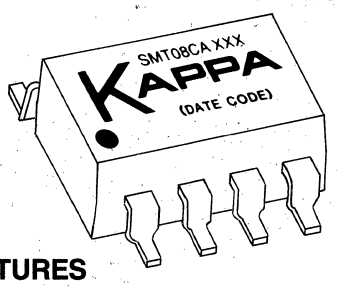
SERIES SMT08 TTL SCHOTTKY (8 PIN)

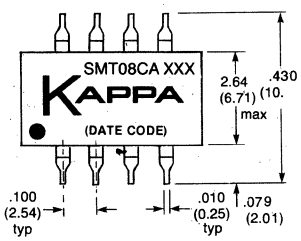
SURFACE MOUNTED DELAY MODULE

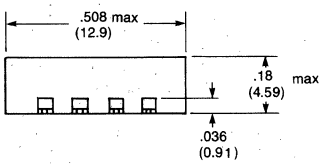


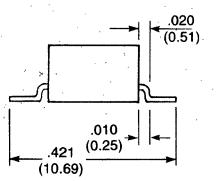
FEATURES

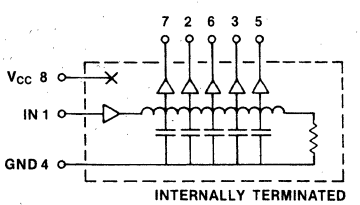
- Surface Mounted Device (SMD)
- TTL Schottky interfaced
- 8 Pin Package
- 5 equally spaced taps

Marking and Dimensions, in (mm)









PARAMETER			MIN	TYP	MAX	UNIT
RECOMMENDED OPERATING CONDITIONS						
V_{CC}	Supply Voltage		4.75	5.00	5.25	V
V_{IH}	High-Level Input Voltage		2.0			V
V_{IL}	Low-Level Input Voltage				0.8	V
I_{IK}	Input Clamp Current				−18	mA
I_{OH}	High-Level Output Current				−1.0	mA
I_{OL}	Low-Level Output Current				20	mA
T_A	Operating Free-Air Temperature		0	+25	+70	°C
DC ELECTRICAL CHARACTERISTICS		TEST CONDITIONS				
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OH} = max	2.7	3.4		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IH} = min, I_{OL} = max			0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}			−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V			50	µA
		V_{CC} = max, V_{IN} = 5.25V			1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V			−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40		−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		30	75	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		65	75	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V			20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V			10	TTL load
INPUT PULSE TEST CONDITIONS						
E_{IN}	Pulse Voltage		3.1	3.2	3.3	V
T_{RI}	Pulse Rise-Time				2.0	NS
T_W	Pulse Width, of Total Delay		40	100		%
d	Duty Cycle			25	50	%
AC ELECTRICAL CHARACTERISTICS						
T_{PLH}	Low-to-High Level Delay Time	V_{CC} = typ, T_A = typ, E_{IN} = typ T_W = typ, d = typ(1)(2)(6)	-5		+5	%
T_{PTA}	Temperature Coefficient of Delay	V_{CC} = typ, T_A = min-to-max E_{IN} = typ, T_W = typ, d = typ(1)(2)(3)(6)	115		700	ppm/°C
T_{PCC}	V_{CC} Coefficient of Delay	V_{CC} = min-to-max, T_A = typ E_{IN} = typ, T_W = typ, d = typ(1)(2)(4)(6)		0.2		%/mV
T_{RO}	Output Risetime	V_{CC} = typ, T_A = typ, E_{IN} = typ T_W = typ, d = typ(5)(6)		3	4	nS

PART NUMBER	Total Delay (ns)(1)(3)	Tap Delay (ns)(1)(3)
SMT08CA250	25	5
SMT08CA300	30	6
SMT08CA400	40	8
SMT08CA500	50	10
SMT08CA600	60	12
SMT08CA750	75	15
SMT08CA101	100	20

Notes
1. Delays measured at 1.5V level on leading edge only.
2. Delay tolerances: ±5% or ±2nS, whichever is greater, referenced from input.
3. Temperature coefficient of delay will vary, depending upon total delay, according to the formula: $T_{PTA} = [100 + (15{,}000/T_{PLH})]$
4. Delay will vary approximately 1% for every 1% change in supply voltage
5. Risetime measured from 0.75V to 2.4V level.
6. Measured with no loads on taps.

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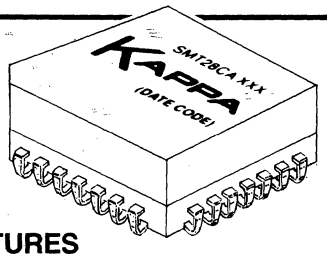
SERIES SMT28/29 TTL SCHOTTKY (28 PIN) 5-TAP/10-TAP

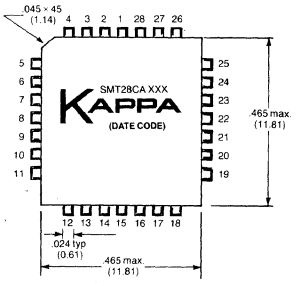
SURFACE MOUNTED DELAY MODULE

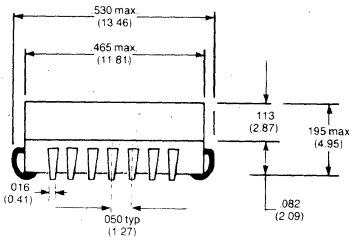


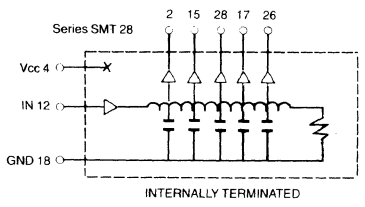
FEATURES

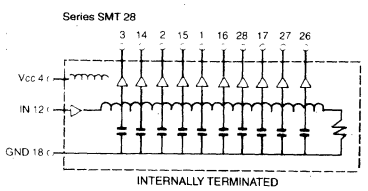
- Surface Mounted Device (SMD)
- TTL Schottky interfaced
- 28 Pin Package
- 5 equally spaced taps

Marking and Dimensions, in (mm)









PARAMETER			MIN	TYP	MAX	UNIT
RECOMMENDED OPERATING CONDITIONS						
V_{CC}	Supply Voltage		4.75	5.00	5.25	V
V_{IH}	High-Level Input Voltage		2.0			V
V_{IL}	Low-Level Input Voltage				0.8	V
I_{IK}	Input Clamp Current				−18	mA
I_{OH}	High-Level Output Current				−1.0	mA
I_{OL}	Low-Level Output Current				20	mA
T_A	Operating Free-Air Temperature		0	+25	+70	°C
DC ELECTRICAL CHARACTERISTICS		TEST CONDITIONS				
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OH} = max	2.7	3.4		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IH} = min, I_{OL} = max			0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}			−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V			50	µA
		V_{CC} = max, V_{IN} = 5.25V			1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V			−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40		−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		30/60	75/150	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		65/120	75/150	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V			20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V			10	TTL load
INPUT PULSE TEST CONDITIONS						
E_{IN}	Pulse Voltage		3.1	3.2	3.3	V
T_{RI}	Pulse Rise-Time				2.0	NS
T_W	Pulse Width, of Total Delay		40	100		%
d	Duty Cycle			25	50	%
AC ELECTRICAL CHARACTERISTICS						
T_{PLH}	Low-to-High Level Delay Time	V_{CC} = typ, T_A = typ, E_{IN} = typ, T_W = typ, d = typ(1)(2)(6)	-5		+5	%
T_{PTA}	Temperature Coefficient of Delay	V_{CC} = typ, T_A = min-to-max, E_{IN} = typ, T_W = typ, d = typ(1)(2)(3)(6)	250		700	ppm/°C
T_{PCC}	V_{CC} Coefficient of Delay	V_{CC} = min-to-max, T_A = typ, E_{IN} = typ, T_W = typ, d = typ(1)(2)(4)(6)		0.2		%/mV
T_{RO}	Output Risetime	V_{CC} = typ, T_A = typ, E_{IN} = typ, T_W = typ, d = typ(5)(6)		3	4	nS

PART NUMBER(7)	Total Delay (ns)(1) (3)	Tap Delay (ns)(1) (3)
SMT28CA250	25	5
SMT28CA300	30	6
SMT28CA400	40	8
SMT28CA500	50	10
SMT28CA600	60	12
SMT28CA750	75	15
SMT28CA101	100	20
SMT29CA500	50	5
SMT29CA600	60	6
SMT29CA750	75	7.5
SMT29CA101	100	10

Notes
1. Delays measured at 1.5V level on leading edge only.
2. Delay tolerances: ±5% or ±2nS, whichever is greater, referenced from input.
3. Temperature coefficient of delay will vary, depending upon total delay, according to the formula: $T_{PTA} = [100 + (15{,}000/T_{PLH})]$
4. Delay will vary approximately 1% for every 1% change in supply voltage.
5. Risetime measured from 0.75V to 2.4V level.
6. Measured with no loads on taps.
7. Other delays also available upon request.

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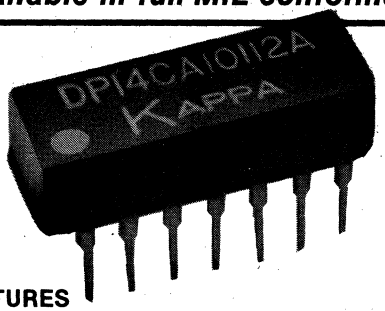
SERIES DP14C/DP16C ANALOG
14-PIN & 16-PIN DIP DELAY LINES
(available in full-MIL conformance as Series DP14M/DP16M)



FEATURES
- TTL and DTL compatible
- Meets applicable requirements of MIL-D-23859
- 5/1 Delay-to-Risetime Ratio
- 10 Equally Spaced Taps
- Wide Operating Temperature Range
- Low cost

ELECTRICAL SPECIFICATIONS
Total Delay: 10 to 1000 ns
Tap Delays: 10% increments standard (other increments available upon request)
Risetime: 20% maximum of total delay (see Table 1)
Characteristic Impedance: 50 to 500 ohms (±10%)
Attenuation: 2dB maximum (see Table 1)
Distortion: ±10% maximum
Temperature Coefficient of Delay: 100ppm/°C max.
Operating Temperature Range: −55°C to +125°C
Storage Temperature Range: −65°C to +130°C
Insulation Resistance: 1000 megohms min. @ 50VDC @ 25°C
Dielectric Strength: 50VDC

MECHANICAL SPECIFICATIONS
Case Configuration: See FIGURE 2
Case Material: Molded Epoxy
Terminals: Flat, DIP-type (See FIGURE 2)
Terminal Material: Kovar or equivalent, tin-plated
Pin Connections: See TABLE II and III
Potting: 100% filled with a two-component epoxy
Marking: Includes manufacturer's name, part number, and date code (See FIGURE 2)

PART NUMBER EXAMPLE
Typical part number is a combination of the Basic Series Number, Mounting Height Code, Delay Time, Impedance, and Pin Sequence Code.

EXAMPLE: DP14CA10112A

(100ns, 100 ohm, 0.200" (5.08mm) Max. Height, using the code "A" Pin Sequence).

DP14(16)C A 101 12 A

DP14C is 14-Pin DIP
DP16C is 16-Pin DIP

MOUNTING HEIGHT CODE (See TABLE IV)

DELAY TIME: Expressed in nanoseconds (ns). First two digits are significant figures. Last digit specifies number of zeros to follow.

IMPEDANCE: Expressed in ohms (Ω). First digit is significant. Last digit specifies number of zeros to follow.

PIN SEQUENCE CODE (See TABLE II and III). "STANDARD" Pin Sequence if omitted.

TABLE I

Td (ns)(1) (±5%)	Td/tap (ns)(2) (3) (±10%)	Tr (ns) MAX.	ATTENUATION (%) TYPICAL per IMPEDANCE (Ω)				
			50	100	200	300	500
10	1	3		5			
20	2	5.5	3	5	5		
30	3	6.5	3	5	5		
40	4	8	3	5	5	5	
50	5	10	3	5	5	5	7
60	6	12	3	5	5	5	7
75	7½	15	3	5	5	5	7
100	10	20	3	5	5	7	7
120	12	24	3	5	6	7	8
150	15	30	3	5	6	7	8
180	18	36	4	5	6	7	8
200	20	40	4	5	6	7	8
220	22	44	4	5	6	7	8
250	25	50	4	5	6	7	8
300	30	60		5	8	10	10
375	37½	75		7	8	10	10
500	50	100		8	10	12	12
600	60	120				15	15
750	75	150				15	20
1000	100	200					20

(1) Or ±2ns, whichever is greater. (2) Or ±1ns, whichever is greater. (3) For 10-tap lines only.

TABLE II. PIN-NUMBER SEQUENCE (FOR DP14C ONLY)*

CODE	IN	10%	20%	30%	40%	50%	60%	70%	80%	90%	OUT	GND
Standard	14	2	12	3	11	4	5	10	6	9	7	1, 8
A	1	2	13	3	12	4	10	5	9	6	7	14
B	2	3	4	5	6	7	9	10	11	12	13	1, 14
C	7	9	6	10	5	11	12	3	13	2	14	1, 8
D	1	13	2	12	3	11	4	10	5	9	6	7, 8, 14
E	2	3	4	5	6	7,8	9	10	11	12	13	1, 14
F	1	13	2	12	3	11	4	10	5	9	6	7
G	2	13	3	12	4	11	5	10	6	9	7	8, 14
H	2	3	4	5	6	7	9	10	11	12	13	1
I	1	13	2	12	3	11	5	10	6	9	7	8, 14
J	1	2	13	3	12	4	10	5	9	6	7	8, 14
U	2	3	4	5	6	8	9	10	11	12	13	1, 7
V	2	3	4	5	6	8	9	10	11	12	13	1
W	1	13	2	12	3	11	4	10	5	9	6	7, 14

*Other pin sequences available upon request.

TABLE III. PIN-NUMBER SEQUENCE (FOR DP16C ONLY)*

CODE	IN	10%	20%	30%	40%	50%	60%	70%	80%	90%	OUT	GND
A	15	2	14	3	13	4	5	11	6	10	7	1, 9
B	1	15	2	14	3	13	4	12	5	11	6	8
C	1	15	3	14	4	13	5	12	6	11	8	9, 16

*Other pin sequences available upon request.

FIGURE 1 — SCHEMATIC

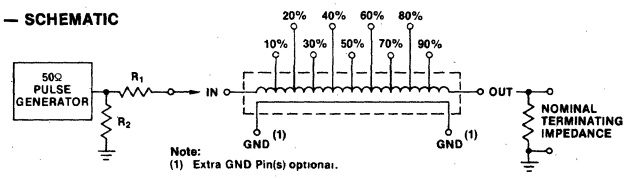
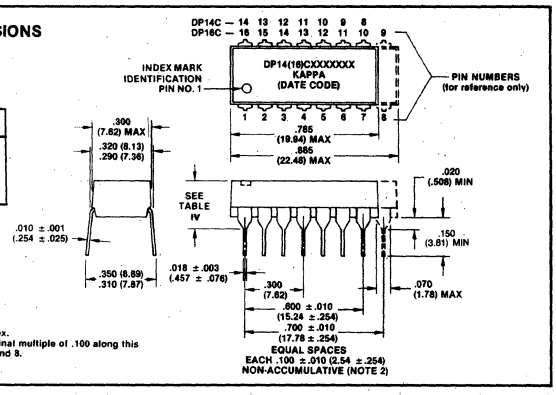


FIGURE 2 — MARKING & DIMENSIONS
In Inches and (mm)

TABLE IV
MOUNTING HEIGHT

CODE	DIMENSION (MAX)
A	.200 (5.08)
B	.250 (6.35)
C	.300 (7.62)



Notes:
(1) A notch may be substituted for PIN #1 Dot Index.
(2) Each terminal is located with ±.010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 7 and 8.

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SERIES DP24C ANALOG

24-PIN DIP DELAY LINE

(available in full-MIL conformance as Series DP24M)

ELECTRICAL SPECIFICATIONS

Total Delay: 20 to 2000 ns
Tap Delays: 5% increments standard (other increments available upon request)
Risetime: 10% maximum of total delay (see Table 1)
Characteristic Impedance: 50 to 200 ohms (±10%)
Attenuation: 2dB maximum (see Table 1)
Distortion: ±10% maximum
Temperature Coefficient of Delay: 100ppm/°C max.
Operating Temperature Range: −55°C to +125°C
Storage Temperature Range: −65°C to +130°C
Insulation Resistance: 1000 megohms min. @ 50VDC @ 25°C
Dielectric Strength: 50VDC

MECHANICAL SPECIFICATIONS

Case Configuration: See FIGURE 2
Case Material: Molded Epoxy
Terminals: Flat, DIP-type (See FIGURE 2)
Terminal Material: Kovar or equivalent, tin-plated
Pin Connections: See TABLE II
Potting: 100% filled with a two-component epoxy
Marking: Includes manufacturer's name, part number, and date code (See FIGURE 2)

TABLE I

PART NUMBER	Td (ns)(1) (±5%)	Td/tap (ns)(2) (±10%)	Tr (ns) (Max.)	Zo (ohms) (±10%)
20051	20	1	3	
40051	40	2	4	
60051	60	3	6	
80051	80	4	8	
10151	100	5	10	50
20151	200	10	20	
20012	20	1	3	
40012	40	2	4	
60012	60	3	6	
80012	80	4	8	
10112	100	5	10	
20112	200	10	20	
30112	300	15	30	100
40112	400	20	40	
50112	500	25	50	
60112	600	30	60	
80112	800	40	80	
10212	1000	50	100	
12212	1200	60	120	
15212	1500	75	150	
40022	40	2	4	
60022	60	3	6	
80022	80	4	8	
10122	100	5	10	
20122	200	10	20	
30122	300	15	30	200
40122	400	20	40	
50122	500	25	50	
60122	600	30	60	
80122	800	40	80	
10222	1000	50	100	
12222	1200	60	120	
15222	1500	75	150	
20222	2000	100	200	

Notes: (1) Or ±2ns, whichever is greater. (2). Or ±1ns, whichever is greater.

TABLE II. PIN-NUMBER SEQUENCE*

CODE	TAP #	IN	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	OUT	GND
A		2	3	4	5	6	7	8	9	10	11	12	14	15	16	17	18	19	20	21	22	23	1, 24
B		2	3	4	5	6	7	8	9	10	11	13	14	15	16	17	18	19	20	21	22	23	12
C		1	2	3	4	5	6	7	8	9	10	11	14	15	16	17	18	19	20	21	22	23	12, 24

*Other pin sequences available upon request.

FIGURE 1 — SCHEMATIC

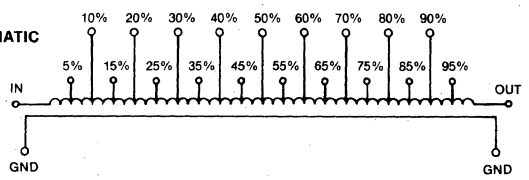

FIGURE 2 — MARKING & DIMENSIONS in inches and (mm)

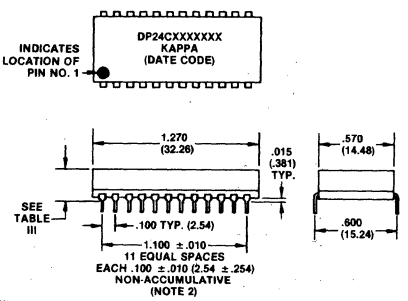

TABLE III. MOUNTING HEIGHT

CODE	DIMENSION (MAX.)
B	.250 (6.35)
C	.300 (7.62)

Notes:
(1) A notch may be substituted for PIN #1 Dot Index.
(2) Each terminal is located with ±.010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 12 and 13.

HOW TO ORDER

1. Select MOUNTING HEIGHT CODE from Table III.
2. Select PART NUMBER CODE from Table I.
3. Select PIN-NUMBER SEQUENCE CODE from Table II.
4. Construct the MODEL NUMBER. (See example below.)

This example, Model DP24CB-40112B, identifies a 400ns, 100-ohm line with 0.300" mounting height and the "B" pin-number sequence.

DP24C	C	40112	B
BASIC SERIES NUMBER	MOUNTING HEIGHT CODE (Table III)	PART NUMBER (Table I)	PIN-NUMBER SEQUENCE (Table II)

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SERIES SP07 ANALOG
7-PIN SIP DELAY LINE

FEATURES
- 7-Pin SIP Package
- Five (5) Equally-Spaced Delay Taps
- Operating Temperature Range: 0°C to +70°C
- Low Output Distortion — ±10% Max.
- 5 ns to 100 ns Delay Range (other values available upon request)

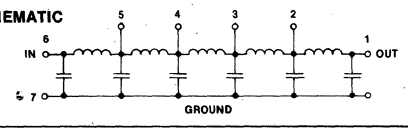
ELECTRICAL SPECIFICATIONS
Total Delay: 5 to 100 ns
Tap Delays: 20% increments
Risetime: See Table 1
Characteristic Impedance: 50 to 100 ohms (±10%)
Attenuation: 5% maximum
Distortion: ± 10% maximum
Temperature Coefficient of Delay: 100ppm/°C max.

MECHANICAL SPECIFICATIONS
Case Configuration: See Dimension Drawing
Case Material: Molded Epoxy
Terminals: Flat, DIP-type or 24 AWG round leads
Terminal Material: Kovar or equivalent, tin-plated
Potting: 100% filled with a two-component epoxy
Marking: Includes manufacturer's name, part number, and date code (See Dimension Drawing)

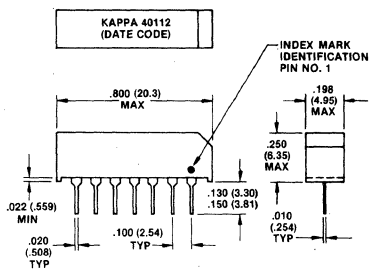
TABLE I

TOTAL DELAY (ns)	TAP DELAY (ns)	RISETIME (ns) MAX	DC RESISTANCE (Ω) MAX. PER IMPEDANCE (Ω)	
			50	100
5 ±0.5	1 ±0.3	2.0	0.3	0.5
10 ±1.0	2 ±0.4	3.3	0.5	1.0
20 ±1.5	4 ±0.6	6.0	0.8	1.5
30 ±2.0	6 ±1.0	9.0	1.2	2.5
40 ±2.5	8 ±1.5	12.0	1.8	4.0
50 ±3.0	10 ±1.8	15.0	2.3	5.0
60 ±3.5	12 ±2.0	18.0	2.5	
70 ±4.0	14 ±2.0	22.0	3.5	
80 ±4.5	16 ±2.0	24.0	4.2	
90 ±5.0	18 ±3.0	27.0	4.5	
100 ±5.0	20 ±3.0	28.0	5.2	

SCHEMATIC



MARKING & DIMENSIONS
In Inches and (mm)



PART NUMBER EXAMPLE

Typical part number is a combination of the Basic Series Number, Mounting Height Code, Delay Time, and Impedance

EXAMPLE: SP07CB10051

SP07C B 100 51

- **BASIC SERIES NUMBER**
- **MOUNTING HEIGHT CODE**
- **DELAY TIME:** Expressed in nanoseconds (ns). First two digits are significant figures. Last digit specifies number of zeros to follow.
- **IMPEDANCE:** Expressed in ohms (Ω). First digit is significant. Last digit specifies number of zeros to follow.

SERIES SP14 ANALOG
14-PIN SIP DELAY LINE

FEATURES
- 14-Pin SIP Package
- Ten (10) Equally-Spaced Delay Taps
- Low Attenuation — 5% Maximum
- Optional Internal Termination

ELECTRICAL SPECIFICATIONS
Total Delay: 10 to 200 ns
Tap Delays: 10% increments
Risetime: 20% maximum of total delay (see Table II)
Characteristic Impedance: 50 to 100 ohms (±10%)
Distortion: 10% maximum
Temperature Coefficient of Delay: 100ppm/°C max.
Operating Temperature Range: 0°C to +70°C
Storage Temperature Range: −55°C to +125°C

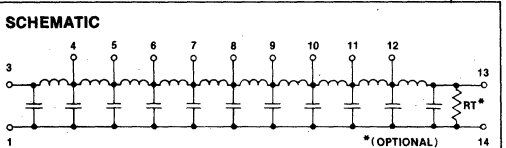
MECHANICAL SPECIFICATIONS
Same as Series SP07 above.

TABLE II

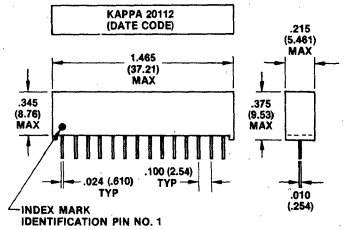
TOTAL DELAY (ns) ±5% *	TAPE DELAY (ns) ±10% *	RISETIME (ns) MAX	DC RESISTANCE (Ω) MAX. PER IMPEDANCE (Ω)	
			50	100
10	1.0 ±0.3	2.0	1.0	
20	2.0 ±0.4	4.0	1.0	4.0
30	3.0 ±0.5	6.0	1.0	
40	4.0 ±0.6	8.0	1.0	4.0
50	5.0 ±0.8	10.0	1.0	
60	6.0	12.0	2.0	4.0
70	7.0	14.0	2.0	
80	8.0	16.0	2.0	4.0
90	9.0	18.0	2.0	
100	10.0	20.0	2.0	4.0
120	12.0	24.0		6.0
140	14.0	28.0		6.0
160	16.0	32.0		6.0
180	18.0	36.0		6.0
200	20.0	40.0		6.0

*Or ±1 ns, whichever is greater, referenced from input.

SCHEMATIC



MARKING & DIMENSIONS In Inches and (mm)



PART NUMBER EXAMPLE

Typical part number is a combination of the Basic Series Number, Mounting Height Code, Delay Time, and Impedance

EXAMPLE: SP14CD10051T

SP14C D 100 51 T

- **BASIC SERIES NUMBER**
- **MOUNTING HEIGHT CODE**
- **DELAY TIME:** Expressed in nanoseconds (ns). First two digits are significant figures. Last digit specifies number of zeros to follow
- **IMPEDANCE:** Expressed in ohms (Ω). First digit is significant. Last digit specifies number of zeros to follow.
- **INTERNAL TERMINATION:** (OPTIONAL)

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CUSTOM MINIATURE & PRECISION DELAY LINES...

Optimization of Most Critical Parameters as Required.

Over the past two decades, **Kappa** has optimized, packaged, and critically tested literally thousands of specific variations of several hundred different passive and hybrid delay lines: fixed tapped, continuously adjustable, and electrically trimmable (varactor-tuned) lines; over virtually the complete signal spectrum from control (subaudio), through audio, sonar, RF, HF, and a wide variety of pulse rates widths and duty cycles.

Typical design families include:

- PRECISION SONAR DELAY LINES (Series A) 500 μsec to 10^6 μsec ±1%; linear to ±0.05%
- LOW-DISTORTION LINES (Series D) Delay-to-Rise-time Ratio: 50 max.; Bandwidth: 50 MHz max.
- MINIATURE CONTINUOUSLY VARIABLE DELAY TRIMMERS (Series TT) Size: ¼ Cubic Inch; up to 120 ns; resolution ≤0.25 ns.
- SUPER-η^{TM} DELAY LINES (Series H) Embody New Design Principle Providing the Highest Efficiency Yet Obtainable in Lumped-Constant Delay lines.
- MINITRIM DELAY LINE (Series MT) Resolution Less Than .5 ns and Delay Ranges Up to 300 ns.
- VIDEO BROADCASTING DELAY LINES (Series BC) Widely Used in the Most Demanding Color TV Applications in American and European Systems
- TRANSPONDER/TACAN/DME (Series C) Designed to Meet the Requirements of MIL-D-23859 and to Withstand the Most Rigorous Military Environments.

ELECTRICAL SPECIFICATIONS

DESCRIPTION	PRECISION AUDIO/SONAR	VIDEO BROADCAST	LOW DISTORTION	STD. ØIST. CONSTANT	SUPER η	CONTINUOUS VARIABLE	STD. LUMPED CONSTANT	MINI ® TRIM	TINY ® TRIM
SERIES NUMBER	A	BC	D	DC	H	K	LC	MT	TT
DELAY RANGE (in microseconds)	500 to 10^6	.05 to 10	up to 100	up to 3	.5 to 500	up to .5	.05 to 10^6	up to .25	up to .12
STANDARD DELAY TOLERANCES (±%)	1	2	1	5	5	+10 −0	5	+10 −0	+10 −0
IMPEDANCE RANGE (in ohms)	500 to 10K	75	100 to 1K	300 to 2K	50 to 2K	100 to 1K	100 to 20K	50 to 1K	300 to 500
STANDARD IMPEDANCE TOLERANCES (±%)	5	2	5	10	5	10	5	10	10
DELAY RESOLUTION	N/A	N/A	N/A	N/A	N/A	> of .1% or 1 ns	N/A	.25ns	.25ns
DELAY-to-RISETIME RATIO (max.)	N/A	N/A	50	11	150	8	200	7	4
DELAY LINEARITY (±%)	.05 to .25	.025 to 1	.25	N/A	1	N/A	.5	N/A	N/A
BANDWIDTH (max.)	70 KHz	20 MHz	50 MHz	30 MHz	10 MHz	25 MHz	250 MHz	100 MHz	70 MHz
ATTENUATION (in dB)	A.S.	A.S.	A.S.	*	A.S.	*	A.S.	<.5 dB	<25 dB
DISTORTION (±%)	N/A	A.S.	.1 to 2	*	10	15	10	15	15
DIELECTRIC STRENGTH (VDC)	100	100	100	100 or A.S.	100 or A.S.	100 or A.S.	A.S.	100	100
OPERATING TEMP. RANGE (°C)	−55/+85 A.S.	−55/+125	−55/+125	−55/+125	−55/+125	−55/+125	−55/+125	−55/+125	−55/+125
DELAY STABILITY vs. TEMPERATURE (ppm/°C)	50	50	50	200	50	50 or 200	50	200	200

Abbreviations: A.S. = As Specified; N/A = Not Applicable; * = See Data Sheet.

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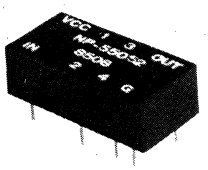
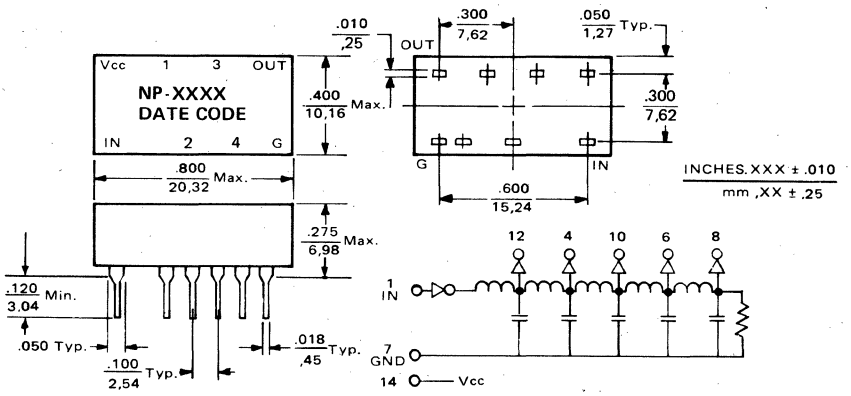
DIGITAL DELAY MODULES

- 14 PIN PACKAGE
- TTL AND DTL COMPATIBLE
- 5 EQUALLY SPACED TAPS





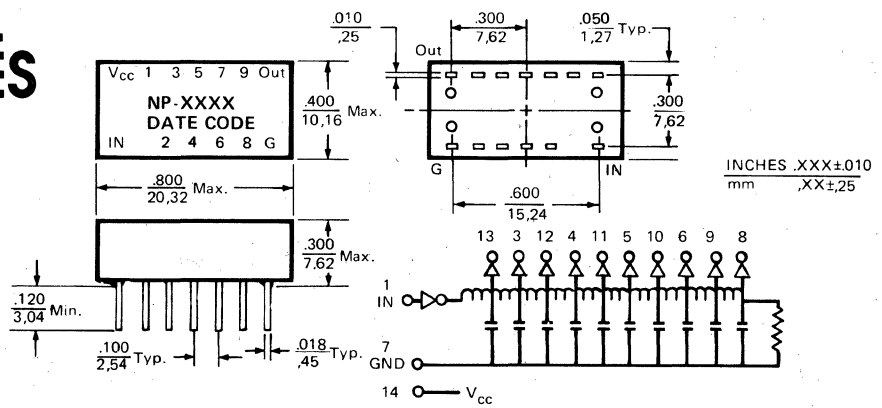
Part Number	Total Delay nS ± 5%	Tap to Tap Delay nS (2)	Rise Time nS Max. (3)
NP-55002	25	5	3
NP-55012	30	6	3
NP-55022	50	10	3
NP-55032	60	12	3
NP-55042	75	15	3
NP-55052	100	20	3
NP-55062	125	25	3

Part Number	Total Delay nS ± 5%	Tap to Tap Delay nS (2)	Rise Time nS Max. (3)
NP-55072	150	30	3
NP-55082	200	40	3
NP-55092	250	50	4
NP-55102	300	60	5
NP-55112	350	70	5
NP-55122	400	80	5
NP-55132	450	90	5
NP-55142	500	100	5

NOTES: 1) T_A = 25°C, V_{CC} = 5.0V
2) Measured at 1.5V level leading edge, tol. ± 5% or ± 2nS, whichever is greater
3) Measured from 0.75V to 2.4V
4) Measured with no load on taps

10 TAP DIGITAL DELAY MODULES REDUCED SIZE

- 14 PIN PACKAGE
- TTL AND DTL COMPATIBLE
- 10 EQUALLY SPACED TAPS
- TIGHT TOLERANCES
- 16 PIN PACKAGE IS ALSO AVAILABLE



Part Number	Total Delay nS ± 5%	Tap to Tap Delay nS (2)	Rise Time nS Max. (3)
NP-65802	50	5	3
NP-65812	100	10	3
NP-65822	150	15	4
NP-65832	200	20	4
NP-65842	250	25	4

Part Number	Total Delay nS ± 5%	Tap to Tap Delay nS (2)	Rise Time nS Max. (3)
NP-65852	300	30	5
NP-65862	350	35	5
NP-65872	400	40	5
NP-65882	450	45	5
NP-65892	500	50	5

NOTES: 1) T_A = 25°C, V_{CC} = 5.0V
2) Measured at 1.5V level leading edge, tol. ± 5% or ± 2nS, whichever is greater
3) Measured from 0.75V to 2.4V
4) Measured with no load on taps

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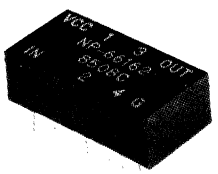
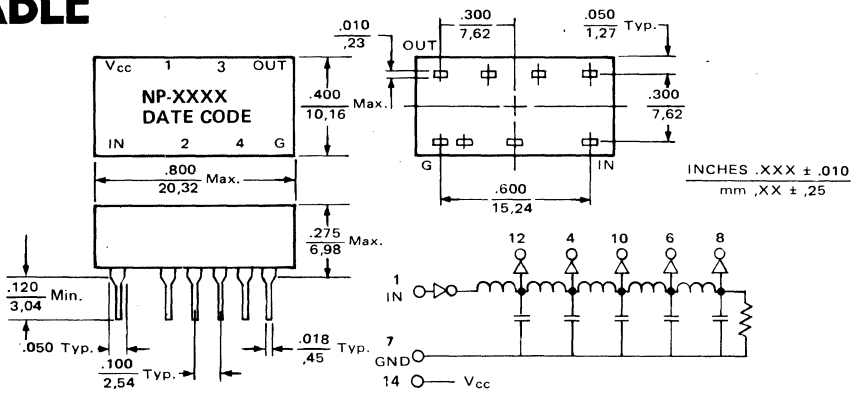
DUAL TRIGGERABLE DIGITAL DELAY MODULES

- 14 PIN PACKAGE
- TTL AND DTL COMPATIBLE
- 5 EQUALLY SPACED TAPS
- HIGH PERFORMANCE
- EACH UNIT PROVIDES 10 TIMING EDGES





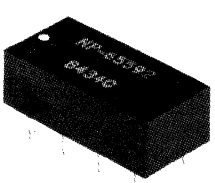
Part Number	Total Delay nS ± 5%	Tap to Tap Delay nS (2)	Rise Time nS Max. (3)
NP-66102	25	5 ± 2	3
NP-66112	50	10 ± 2	3
NP-66122	75	15 ± 2	3
NP-66132	100	20 ± 2	3
NP-66142	125	25 ± 2	4

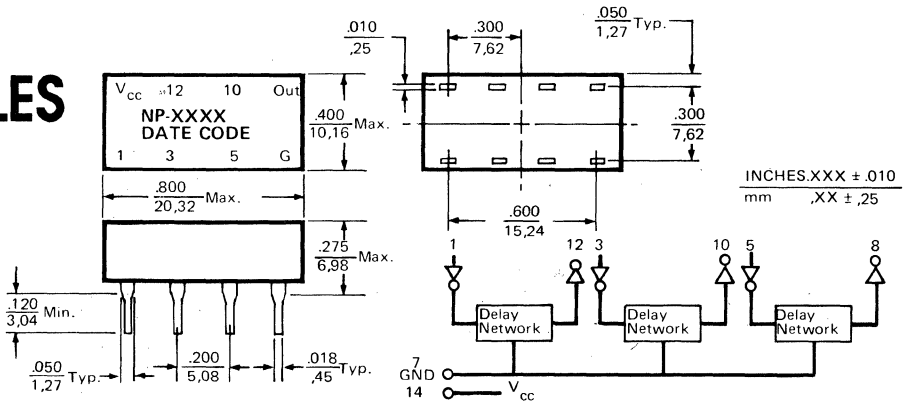
Part Number	Total Delay nS ± 5%	Tap to Tap Delay nS (2)	Rise Time nS Max. (3)
NP-66152	150	30 ± 3	4
NP-66162	200	40 ± 4	4
NP-66172	250	50 ± 5	4
NP-66182	300	60 ± 3	5
NP-66192	400	80 ± 4	5
NP-66202	500	100 ± 5	5 Typ.

NOTES: 1) T_A = 25°C, V_{CC} = 5.0V
2) Measured at 1.5V level, either leading or trailing edge.
3) Measured from 0.75V to 2.4V
4) Measured with no load on taps

TRIPLE DIGITAL DELAY MODULES

- 14 PIN PACKAGE
- TTL AND DTL COMPATIBLE
- THREE INDEPENDENT EQUAL DELAYS





Part Number	Delay Time nS (2)		Rise Time nS Max. (3)
NP-65502	5	± 1.5	3.0
NP-65512	10	± 1.5	3.0
NP-65522	15	± 1.5	3.0
NP-65532	20	± 1.5	3.0
NP-65542	25	± 1.5	3.0
NP-65552	30	± 2.0	3.0
NP-65562	40	± 2.5	3.0

Part Number	Delay Time nS (2)	Tolerance nS	Rise Time nS Max. (3)
NP-65572	50	± 2.5	3.0
NP-65582	60	± 3.0	4.0
NP-65592	70	± 3.0	4.0
NP-65602	75	± 4.0	4.0
NP-65612	80	± 4.0	4.0
NP-65622	90	± 4.0	4.0
NP-65632	100	± 5.0	4.0

NOTES: 1) T_A = 25°C, V_{CC} = 5.0V
2) Measured at 1.5V level leading edge,
3) Measured from 0.75V to 2.4V
4) Measured with no load on taps

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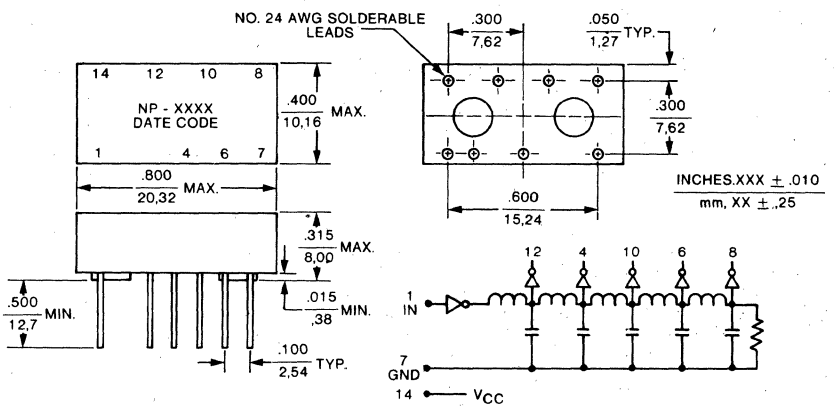
DIGITAL DELAY MODULES

- 14 PIN PACKAGE
- TTL AND DTL COMPATIBLE
- 5 EQUALLY SPACED TAPS



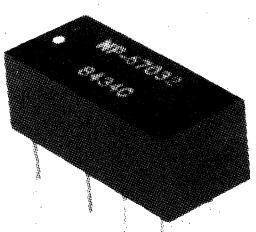
Part Number	Total Delay nS ± 5%	Tap to Tap Delay nS (2)	Rise Time nS Max. (3)
NP-66002	25	5	3
NP-66012	50	10	3
NP-66022	100	20	3
NP-66032	150	30	3

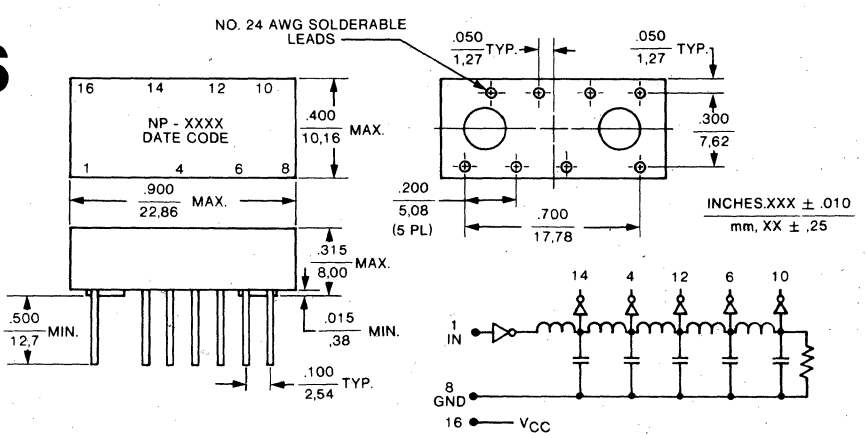
Part Number	Total Delay nS ± 5%	Tap to Tap Delay nS (2)	Rise Time nS Max. (3)
NP-66042	200	40	3
NP-66052	250	50	4
NP-66062	300	60	4
NP-66072	400	80	4
NP-66082	500	100	4

NOTES: 1) T_A = 25°C, V_{CC} = 5.0V
2) Measured at 1.5V level leading edge, tol. ± 5% or ± 2nS, whichever is greater
3) Measured from 0.75V to 2.4V
4) Measured with no load on taps

DIGITAL DELAY MODULES

- 14 PIN PACKAGE
- TTL AND DTL COMPATIBLE
- 5 EQUALLY SPACED TAPS





Part Number	Total Delay nS ± 5%	Tap to Tap Delay nS (2)	Rise Time nS Max. (3)
NP-67002	25	5	3
NP-67012	50	10	3
NP-67022	75	15	3
NP-67032	100	20	3
NP-67042	150	30	3

Part Number	Total Delay nS ± 5%	Tap to Tap Delay nS (2)	Rise Time nS Max. (3)
NP-67052	200	40	3
NP-67062	250	50	4
NP-67072	300	60	4
NP-67082	400	80	4
NP-67092	500	100	4

NOTES: 1) T_A = 25°C, V_{CC} = 5.0V
2) Measured at 1.5V level leading edge, tol. ± 5% or ± 2nS, whichever is greater
3) Measured from 0.75V to 2.4V
4) Measured with no load on taps

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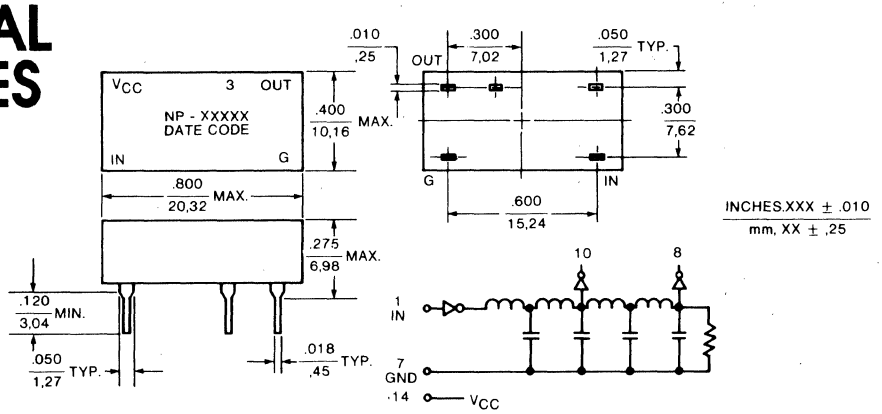
ONE TAP DIGITAL DELAY MODULES

- 14 PIN PACKAGE
- TTL AND DTL COMPATIBLE
- RISE TIME IS 4 nS TYPICAL



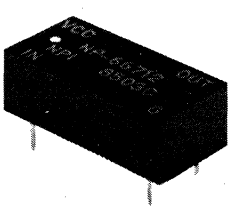
Part Number	Total Delay nS ± 5%	Tap Delay nS (2)
NP-55202	20	10
NP-55212	40	20
NP-55222	50	25
NP-55232	60	30
NP-55242	80	40
NP-55252	100	50

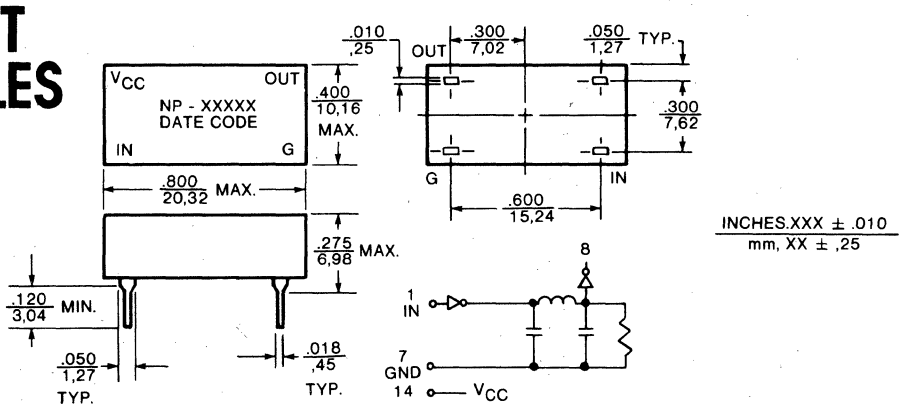
Part Number	Total Delay nS ± 5%	Tap Delay nS (2)
NP-55262	150	75
NP-55272	200	100
NP-55282	300	150
NP-55292	400	200
NP-55302	500	250
NP-55312	1000	500

NOTES: 1) T_A = 25°C, V_{CC} = 5.0V
2) Measured at 1.5V level leading edge, tol. ± 5% or ± 2nS, whichever is greater
3) Measured from 0.75V to 2.4V
4) Measured with no load on taps

SINGLE OUTPUT DELAY MODULES

- 14 PIN PACKAGE
- TTL AND DTL COMPATIBLE
- RISE TIME IS 4 nS TYPICAL





Part Number	Total Delay nS ± 5%
NP-66702	10
NP-66712	20
NP-66722	30
NP-66732	40
NP-66742	50
NP-66752	60
NP-66762	80

Part Number	Total Delay nS ± 5%
NP-66772	100
NP-66782	150
NP-66792	200
NP-66802	300
NP-66812	400
NP-66822	500
NP-66832	1000

NOTES: 1) T_A = 25°C, V_{CC} = 5.0V
2) Measured at 1.5V level leading edge, tol. ± 5% or ± 2nS, whichever is greater
3) Measured from 0.75V to 2.4V
4) Measured with no load on taps

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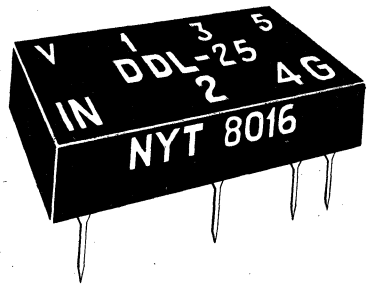
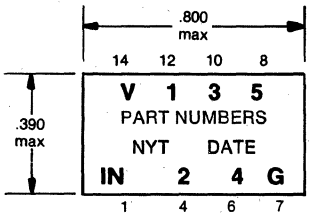
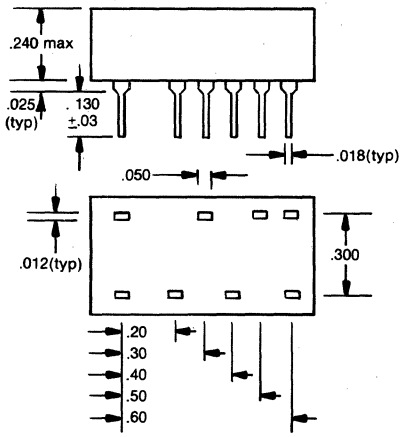
Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

DDL-XXX SCHOTTKY DELAY LINES



Nytronics Components Group, Inc. Digital Delay Lines provide a solution to terminating, driving and loading problems traditionally associated with delay line applications.





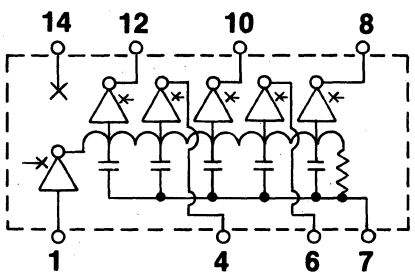
Eighteen (18) standard delay lines are offered ranging from 25ns to 500ns. Other combinations available include:

- Intermediate total delay values
- Non-symmetrical tapping points
- Closer tap and total delay tolerances
- Specified fall times and trailing edge delay times

Nytronics Components Group, Inc. Delay Line Engineering stands ready to help solve your delay line applications problems.

DIGITAL DELAY LINES FEATURE:

1) TTL Driven Inputs
2) TTL Buffered Outputs
3) Internal Terminations
4) Low Profile Packages (.240")
5) 14-Pin, DIP-IC Compatible
6) Output Rise Time 4.0ns max. (0.75v to 2.40v)



PART NUMBER	TOTAL DELAY (NS) (1) (2)	TAP DELAY (NS) (1) (2)	INPUT PULSE WIDTH (NS MINIMUM)
DDL-25	25	5	10
DDL-30	30	6	12
DDL-35	35	7	14
DDL-40	40	8	16
DDL-45	45	9	18
DDL-50	50	10	20
DDL-75	75	15	30
DDL-100	100	20	40
DDL-125	125	25	50
DDL-150	150	30	60
DDL-175	175	35	70
DDL-200	200	40	80
DDL-250	250	50	100
DDL-300	300	60	120
DDL-350	350	70	140
DDL-400	400	80	160
DDL-450	450	90	180
DDL-500	500	100	200

(1) Measured at 1.5V level leading edge; Vcc = 5.00VDC; No loads; at +25°C.
(2) Nominal delay, ±2NS or ±5%, whichever is greater; reference to input.

ELECTRICAL CHARACTERISTICS

(VIH) High-Level Input Voltage	2.0 to 5.0V
(IIH) High-Level Input Current	50ua Max.
(VIL) Low-Level Input Voltage	0.8V Max.
(IIL) Low-Level Input Current	−2ma Max.
(VOH) High-Level Output Voltage	2.4V Min.
(VOL) Low-Level Output Voltage	0.4V Max.
High-Level Output Drives	20 TTL Loads/Unit Max.
Low-Level Output Drives	10 TTL Loads/Tap Max. 20 TTL Loads/Unit Max.

RECOMMENDED OPERATING CONDITIONS

(Vcc) Supply Voltage	5.00 ±0.25VDC
(Icc) Supply Current	60ma (typ.)
(TRin) Input Rise Time	3ns.
(TWin) Input Pulse Width	40% of Delay
(Ein) Input Pulse Voltage	3.20VDC
Operating Temperature	0°C to 70°C
Storage Temperature	−55°C to +125°C

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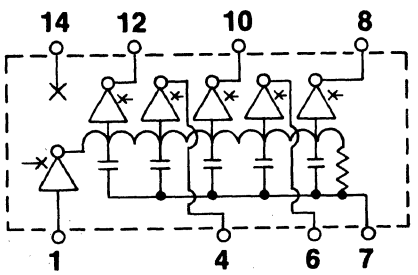
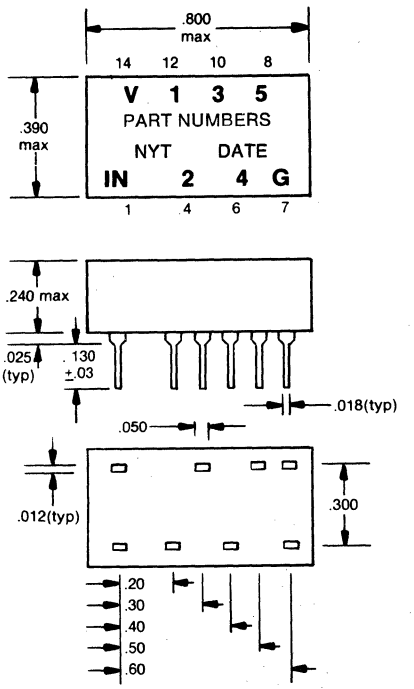
DDL-XXXF & LPS-XXX ADVANCED SCHOTTKY DELAY LINES





ADVANCED SCHOTTKY (DDL-XXXF)

RECOMMENDED OPERATING CONDITIONS

(Vcc) Supply Voltage ..... 5.00 ±0.25 VDC
(Icc) Supply Current ..... 35 ma (typ.)
(TRin) Input Rise Time ..... 3 ns.
(TWin) Input Pulse Width ..... 40% of Delay
(Ein) Input Pulse Voltage ..... 3.20 VDC
Operating Temperature ..... 0°C to 70°C
Storage Temperature ..... −55°C to 125°C

ELECTRICAL CHARACTERISTICS

(VIH) High-Level Input Voltage ..... 2.0 to 5.0V
(IIH) High-Level Input Current ..... 20 μa Max.
(VIL) Low-Level Input Voltage ..... 0.8V Max.
(IIL) Low-Level Input Current ..... −0.6 ma Max.
(VOH) High-Level Output Voltage ..... 2.4V Min.
(VOL) Low-Level Output Voltage ..... 0.4V Max.
High-Level Output Drives ..... 25 TTL Loads/Unit Max.
Low-Level Output Drives ..... 12.5 TTL Loads/Tap Max.
25 TTL Loads/Unit Max.

ADVANCED LOW-POWER SCHOTTKY (LPS-XXX)

RECOMMENDED OPERATING CONDITIONS

(Vcc) Supply Voltage ..... 5.00 ±0.25 VDC
(Icc) Supply Current ..... 25 ma (typ.)
(TRin) Input Rise Time ..... 3 ns.
(TWin) Input Pulse Width ..... 40% of Delay
(Ein) Input Pulse Voltage ..... 3.20 VDC
Operating Temperature ..... 0°C to 70°C
Storage Temperature ..... −55°C to +125°C

ELECTRICAL CHARACTERISTICS

(VIH) High-Level Input Voltage ..... 2.0 to 5.0V
(IIH) High-Level Input Current ..... 20 μa Max.
(VIL) Low-Level Input Voltage ..... 0.8V Max.
(IIL) Low-Level Input Current ..... −0.2 ma Max.
(VOH) High-Level Output Voltage ..... 2.4V Min.
(VOL) Low-Level Output Voltage ..... 0.4V Max.
High-Level Output Drives ..... 10 TTL Loads/Unit Max.
Low-Level Output Drives ..... 5 TTL Loads/Tap Max.
10 TTL Loads/Unit Max.

OUTPUT RISE TIME (0.75v to 2.40v)
DDL-XXXF SERIES = 4.0 ns Max.
LPS-XXX SERIES = 6.0 ns Max.

PART NUMBER	PART NUMBER	TOTAL DELAY (NS) (1) (2)	TAP DELAY (NS) (1) (2)	INPUT PULSE WIDTH (NS MINIMUM)
DDL-25F	LPS-25	25	5	10
DDL-30F	LPS-30	30	6	12
DDL-35F	LPS-35	35	7	14
DDL-40F	LPS-40	40	8	16
DDL-45F	LPS-45	45	9	18
DDL-50F	LPS-50	50	10	20
DDL-55F	LPS-55	55	11	22
DDL-60F	LPS-60	60	12	24
DDL-65F	LPS-65	65	13	26
DDL-70F	LPS-70	70	14	28
DDL-75F	LPS-75	75	15	30
DDL-100F	LPS-100	100	20	40
DDL-125F	LPS-125	125	25	50
DDL-150F	LPS-150	150	30	60
DDL-175F	LPS-175	175	35	70
DDL-200F	LPS-200	200	40	80
DDL-250F	LPS-250	250	50	100
DDL-300F	LPS-300	300	60	120
DDL-350F	LPS-350	350	70	140
DDL-400F	LPS-400	400	80	160
DDL-450F	LPS-450	450	90	180
DDL-500F	LPS-500	500	100	200

(1) Measured at 1.5v level leading edge; Vcc = 5.00 VDC; No loads; at +25°C.
(2) Nominal delay ±2 NS or ±5%; whichever is greater; reference to input.

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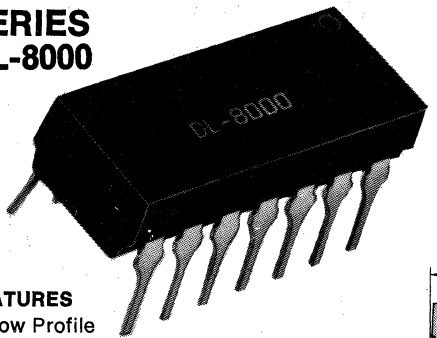
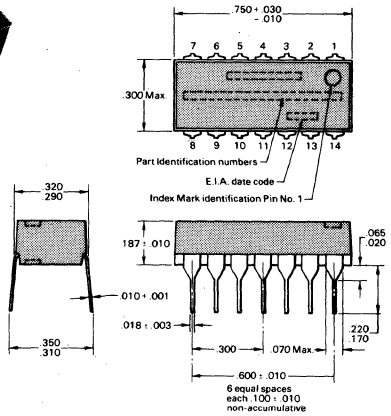
DL-8000- 14 PIN PASSIVE DELAY LINES

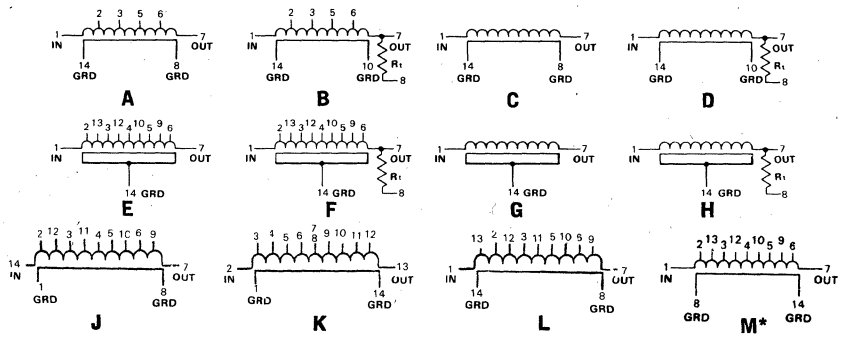
SERIES DL-8000





FEATURES

- Low Profile
- 14-Lead, DIP-IC Compatible Packages
- Standard Delay Times from 5 nsec to 500 nsec
- Standard Impedances of 50, 100, 200, 360 and 500 ohms
- Standard and Special Attenuations
- Easy to Order Special Models
- Drift Elimination by Lumped Constant Design
- Meets or Exceeds Applicable Requirements of MIL-STD-202
- Epoxy Transfer Molding for Cost/Delivery Time Savings
- Economy and Prompt Delivery on Standard Models
- High Reliability, Precision Performance, Broad Temperature Range Stability, Long Storage and Operational Life



R_T = Terminating Resistor (value of Z_o) ±5%, ⅛ watt.

*** BUILT TO MEET MILITARY SPECIFICATION MIL-D-23859/23C**

HOW TO ORDER

To allow the greatest possible range of parameters, the following ordering system should be followed on both standard and special orders.

Example: DL-8000-045-09-100-05 A
14-Pin Lumped Constant Dual In-Line Delay Line, 45 nsec T_d, 9 nsec T_r, 100 ohm impedance, 5% (Max.) attenuation, internal configuration "A."

DL-8000 045 09 100 05 A

PLACE 1
Base No. DL-8000 = 14-pin, Lumped Constant Dual In-Line Delay Lines (6 characters and dash)

PLACE 2
Delay Time (T_d)
Standard Models:
005 = 5 nsec, 050 = 50 nsec.
150 = 150 nsec, etc., from above table (3 digits)
Special Orders:
Enter full 3-digit nsec value (e.g., 075)

PLACE 3
Rise Time (T_r)
Standard Models:
Enter nsec digit
Value from table
(e.g., 2.0, 6.5, 40)
Special Orders:
Enter desired rise time in nsec (2 or more digits)

PLACE 4
Impedance (Z_o)
Standard Models:
050 = 50 ohms, 200 = 200 ohms
100 = 100 ohms, 360 = 360 ohms
(3 digits)
Special Orders:
Enter full 3-digit Ohm value (e.g., 075)

PLACE 5
Attenuation
Standard Models:
Enter 2-digit percent value from table (e.g., 05, 10)
Special Orders:
Enter Max. allowable percent attenuation (2 digits)

PLACE 6
Internal Configuration
Enter Schematic reference Letters
(1 letter)

Formerly Manufactured By McGraw-Edison Comp.: Edison Electronics Division
DAVEN DESIGN

Insulation Resistance: 100,000 megohms at 25°C.

Temperature Coefficient (Typ.): 100ppm/°C.

STANDARD DL-8000 MODELS

Delay Time (T_d), nsec*	Rise Time (T_r), Max nsec	% Attenuation Max Per Impedance†				
		50 ohms	100 ohms	200 ohms	360 ohms	500 ohms
5	02	3	5	5	5	7
10	03	3	5	5	5	7
15	04	3	5	5	5	7
20	05.5	3	5	5	5	7
25	05	3	5	5	5	7
30	06.5	3	5	5	5	7
35	07	3	5	5	5	7
40	08	3	5	5	5	7
45	09	3	5	5	5	7
50	10	3	5	5	5	7
55	11	3	5	5	5	7
60	12	3	5	5	5	7
65	13	3	5	5	5	7
70	14	3	5	5	5	7
75	15	3	5	5	5	7
80	16	3	5	5	5	7
85	17	3	5	5	5	7
90	18	3	5	5	5	7
95	19	3	5	5	5	7
100	20	3	5	5	5	7
110	22	3	5	6	7	8
120	24	3	5	6	7	8
130	26	3	5	6	7	8
140	28	3	5	6	7	8
150	30	3	5	6	7	8
160	32	3	5	6	7	8
170	34	3	5	6	7	8
180	36	3	5	6	7	8
190	38	3	5	6	7	8
200	40	3	5	6	7	8
210	45	5	5	6	7	8
220	45	5	5	6	7	8
230	50	5	5	6	7	8
240	50	5	5	6	7	8
250	50	5	5	6	7	8
260	55	5	5	6	7	8
270	55	5	5	6	7	8
280	60	5	5	6	7	8
290	60	5	5	6	7	8
300	60	5	5	6	7	8
310	65	5	7	8	10	10
320	65	5	7	8	10	10
330	70	5	7	8	10	10
340	70	5	7	8	10	10
350	70	5	7	8	10	10
360	75	5	7	8	10	10
370	75	5	7	8	10	10
380	80	5	7	8	10	10
390	80	5	7	8	10	10
400	80	5	7	8	10	10
410	85	5	8	10	10	10
420	85	5	8	10	10	10
430	90	5	8	10	10	10
440	90	5	8	10	10	10
450	90	5	8	10	10	10
460	95	5	8	10	10	10
470	95	5	8	10	10	10
480	100	5	8	10	10	10
490	100	5	8	10	10	10
500	100	5	8	10	10	10

Taps in equal increments of total delay.

* ±5% Tolerance for 40 through 500 nsec T_d.
2 nsec for 5 through 40 nsec T_d.

† ±10% Impedance Tolerance.

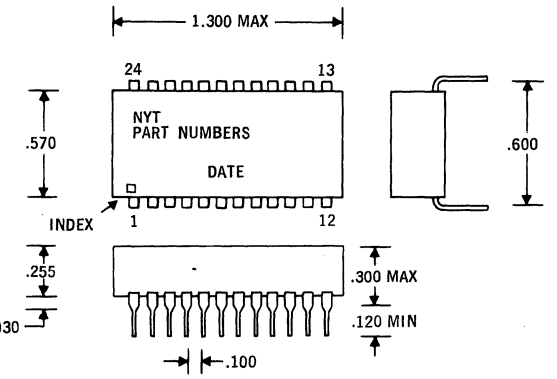
Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

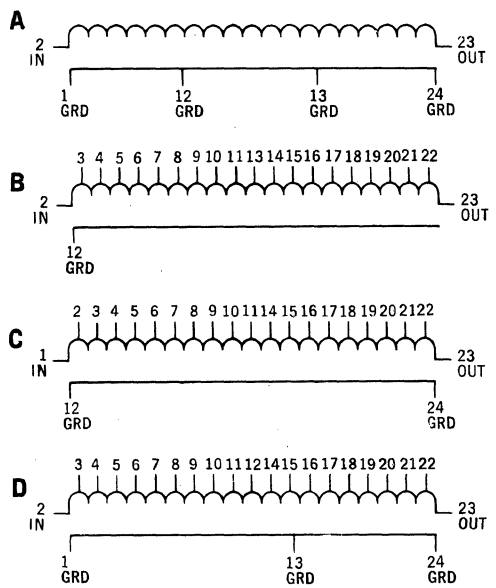
**DL-2400-
24 PIN PASSIVE
DELAY LINES**

DL-2400 SERIES

FEATURES

- Standard 24 Pin Dip
- Epoxy Encapsulated
- Operating Temp. −55°C to +125°C
- Hi-Pot = 100VDC
- Up to 20 Outputs
- Temp. Coeff. of Delay
  Up to 1000ns = 100ppm/°C
  Above 1000ns = 200ppm/°C
- Easy to Order Specials
- 1%, 2%, and Other Tolerances Available
- Many Other Delays, Impedances, and Rise Times Available
- Many Other Schematics Available
- **Lead Material: Alloy 42**





Delay Time (Td), nsec*	Rise Time (Tr), Max nsec	% Attenuation Max. per Impedance†				
		50 ohms	100 ohms	200 ohms	360 ohms	500 ohms
50	5	6	6	8	—	—
100	10	6	8	8	8	8
150	15	8	8	8	8	8
200	20	8	8	8	8	10
250	25	8	8	8	10	10
300	30	8	8	8	10	10
400	40	8	8	10	10	10
500	50	8	8	10	10	10
600	60	8	8	10	10	10
700	70	8	8	10	10	10
800	80	8	10	10	10	15
900	90	8	10	10	10	15
1000	100	8	10	10	10	15
1500	150	—	10	10	15	15
2000	200	—	10	15	15	15
3000	300	—	—	15	15	15
4000	400	—	—	15	15	15
5000	500	—	—	—	15	15
6000	600	—	—	—	15	—
7000	700	—	—	—	15	—

* ±5% Tolerance
† ±10% Impedance Tolerance.
Taps in equal increments of total delay.

HOW TO ORDER

To allow the greatest possible range of parameters, the following ordering system should be followed on both standard and special orders.

EXAMPLE: DL-2400-1000-100-100-10A

24-Pin Lumped Constant Dual In-Line Delay Line, 1000 nsec Td, 100 nsec Tr, 100 ohm impedance, 10% (Max.) attenuation, internal configuration "A".

DL-2400 — 1000 — 100 — 100 — 10 — A

PLACE 1
Base No. DL-2400 24-Pin, Lumped Constant Dual In-Line Delay Lines (6 Characters and dash)

PLACE 2
Delay Time (Td)
Standard Models:
050 = 50 nsec,
150 = 150 nsec, 1500 = 1500 nsec, etc., from above table (3 digits or more)

PLACE 3
Rise Time (Tr)
Standard Models:
Enter nsec digit Value from table (e.g. 05, 50, 500, etc.)
Special Orders:
Enter desired rise time in nsec (2 or more digits)

PLACE 4
Impedance (Z_o)
Standard Models:
050 = 50 ohms, 200 = 200 ohms,
100 = 100 ohms, 360 = 360 ohms
(3 digits)
Special Orders:
Enter full 3-digit Ohm value (e.g. 075)

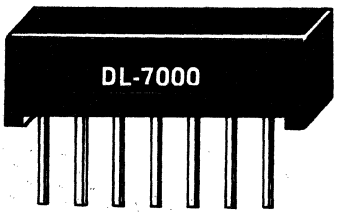
PLACE 5
Attenuation
Standard Models:
Enter 2-digit percent value from table (e.g., 06, 10)
Special Orders:
Enter Max. allowable percent attenuation (2 digits)

PLACE 6
Internal Configuration
Enter Schematic reference Letters
A, B, C or D (1 letter)

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

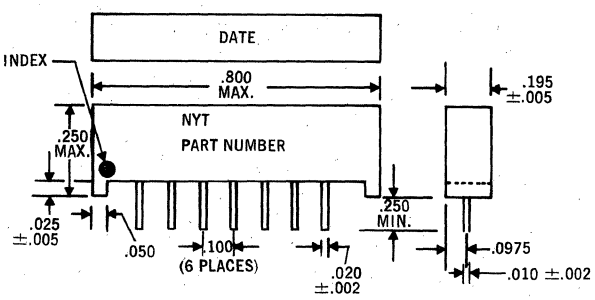
DL-7000- 7 PIN PASSIVE DELAY LINE

SERIES DL-7000



FEATURES

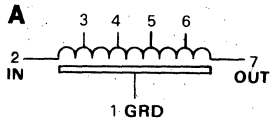
- Standard 7 Pin SIP
- Epoxy Encapsulated
- Terminal Material — Kovar, Flat
- Tap Delays ("A" Configuration) = 20% Increments (±5% or ±1 ns, whichever is greater)
- T_d/T_R Ratio ≥5/1 or ≥ 3/1
- Temperature Coefficient of Delay = 100 ppm/°C
- Hi-Pot = 100 VDC
- Operating Temperature = −55°C to +125°C
- Storage Temperature = −65°C to +130°C
- Meets or Exceeds Applicable Requirements of MIL-STD-202
- Easy to Order Specials
- Many Other Delays, and Impedances Available



DELAY TIME (T_d), nsec†	RISE TIME (T_R), MAX nsec		% ATTENUATION MAX. PER IMPEDANCE*			
	$T_d/T_R \geq 3/1$	$T_d/T_R \geq 5/1$	50 Ohms	100 Ohms	200 Ohms	500 Ohms
20	6.0	4.0	3	5	5	—
30	9.0	6.0	3	5	5	—
40	12.0	8.0	3	5	5	—
50	15.0	10.0	3	5	5	—
60	18.0	12.0	3	5	5	—
70	22.0	14.0	3	5	5	—
80	24.0	16.0	3	5	5	—
90	27.0	18.0	3	5	5	—
100	30.0	20.0	3	5	5	7
200	60.0	40.0	3	5	6	8
300	90.0	60.0	5	5	6	8
400	120.0	80.0	—	7	8	10
500	150.0	100.0	—	8	10	10

† ±5% Tolerance.
* ±10% Impedance Tolerance.

A



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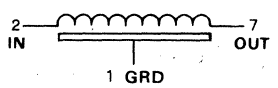

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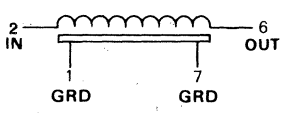


HOW TO ORDER

To allow the greatest possible range of parameters, the following ordering system should be followed on both standard and special orders.

EXAMPLE: **DL-7000 — 100 — 020 — 100 — 05 — A**

PLACE 1
Base No. DL-7000 7-Pin, Lumped Constant single in-line package (6 characters and dash)

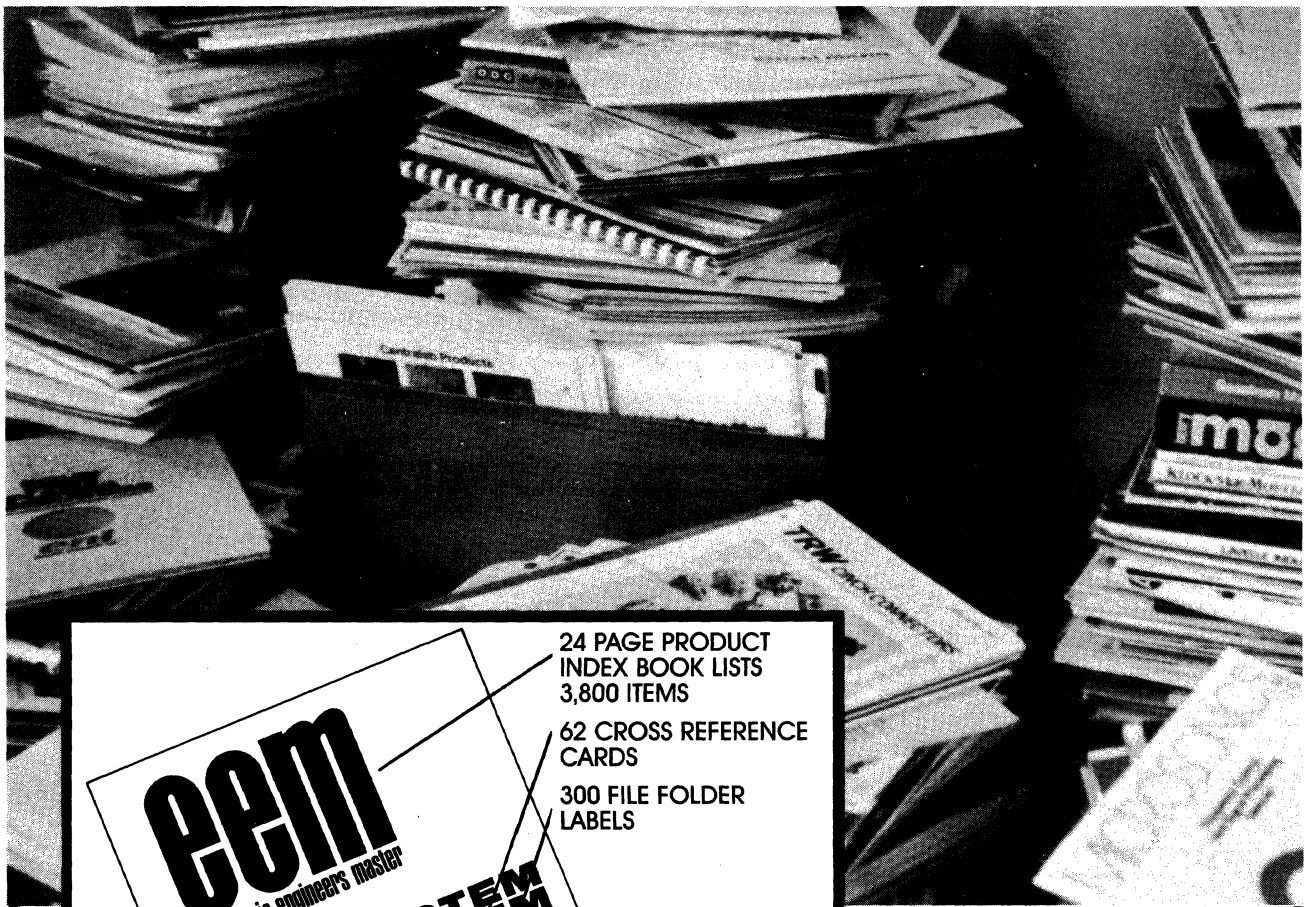
PLACE 2
Delay Time (T_d)
Standard Models:
050 = 50 nsec,
150 = 150 nsec, etc., from above table (3 digits or more)

PLACE 3
Rise Time (T_R)
Standard Models:
Enter nsec digit Value from table (e.g. 6.0, 40, 100, etc.)
Special Orders:
Enter desired rise time in nsec (2 or more digits)

PLACE 4
Impedance (Z_o)
Standard Models:
050 = 50 ohms, 200 = 200 ohms,
100 = 100 ohms, (3 digits)
Special Orders:
Enter full 3-digit Ohm value (e.g. 075)

PLACE 5
Attenuation
Standard Models:
Enter 2-digit percent value from table (e.g., 06, 10)
Special Orders:
Enter Max. allowable percent attenuation (2 digits)

PLACE 6
Internal Configuration
Enter Schematic reference Letters
A, B, C (1 letter)



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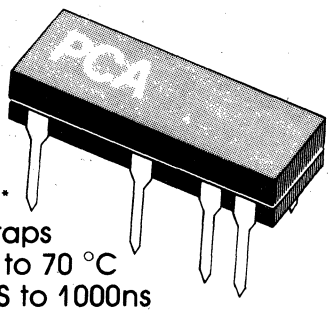
Low Profile 5 Tap TTL Compatible Active Delay Lines

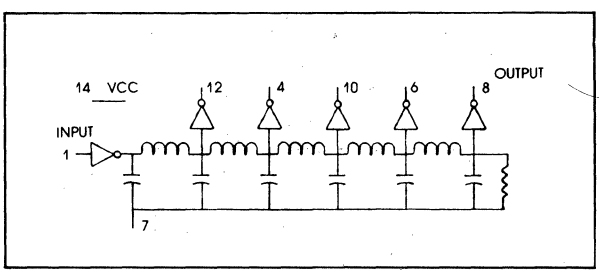


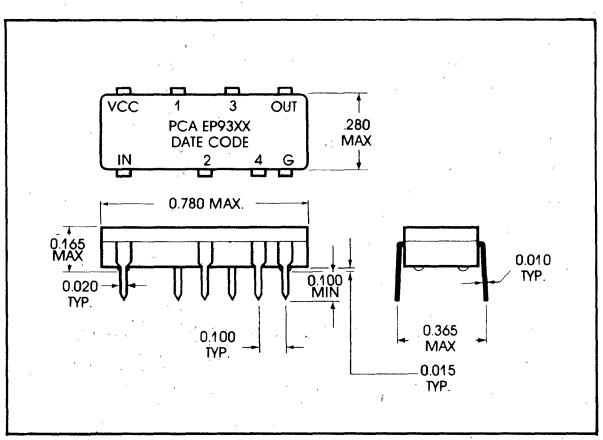
Features

- Schottky TTL
- Rise time 4nS max.*
- 5 equally spaced taps
- Operating temp. 0 to 70 °C
- Available from 25nS to 1000ns
- Low profile 14 pin DIP for auto-insertion

Input Test Conditions

- VCC: 5.0 VDC
- Pulse Voltage: 3.2V
- Rise Time: 2nS
- Input Current: 60mA TYP.
- Pulse Width: 1.1 x Total Delay
- Rep. Rate: 1 MHz (TD $\leq$ 500ns)
  500 KHz (TD $>$ 500ns)





TAP DELAYS ±5% OR 2 NS	TOTAL DELAYS ±5% OR 2 NS	PART NUMBER
5, 10, 15, 20	25	EP9300
6, 12, 18, 24	30	EP9313
7, 14, 21, 28	35	EP9314
8, 16, 24, 32	40	EP9315
9, 18, 27, 36	45	EP9316
10, 20, 30, 40	50	EP9301
12, 24, 36, 48	60	EP9311
15, 30, 45, 60	75	EP9317
20, 40, 60, 80	100	EP9302
25, 50, 75, 100	125	EP9319
30, 60, 90, 120	150	EP9303
35, 70, 105, 140	175	EP9320
40, 80, 120, 160	200	EP9304
45, 90, 135, 180	225	EP9321
50, 100, 150, 200	250	EP9305
60, 120, 180, 240	300	EP9306
70, 140, 210, 280	350	EP9307
80, 160, 240, 320	400	EP9308
84, 168, 252, 336	420	EP9318
88, 176, 264, 352	440	EP9322
90, 180, 270, 360	450	EP9309
94, 188, 282, 376	470	EP9323
100, 200, 300, 400	500	EP9310
110, 220, 330, 440	550	EP9330
120, 240, 360, 480	600	EP9324
130, 260, 390, 520	650	EP9331
140, 280, 420, 560	700	EP9325
150, 300, 450, 600	750	EP9329
160, 320, 480, 640	800	EP9326
170, 340, 510, 680	850	EP9332
180, 360, 540, 720	900	EP9327
190, 380, 570, 760	950	EP9333
200, 400, 600, 800	1000	EP9328

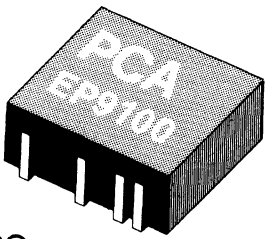
DELAY TIMES REFERENCED FROM INPUT TO LEADING EDGES
TAP DELAY TOLERANCE ±5% OR 2 NS WHICHEVER GREATER
TOTAL DELAY TOLERANCE ±5% OR 2 NS WHICHEVER GREATER
*5 NS FOR 550-1000 NS TOTAL DELAYS

PCA ELECTRONICS INC.
5 TTL LPADL 385

16799 SCHOENBORN STREET
SEPULVEDA, CA 91343

PHONE: (818) 892-0761
TELEX: 67-4681
TWX: 910-496-1525

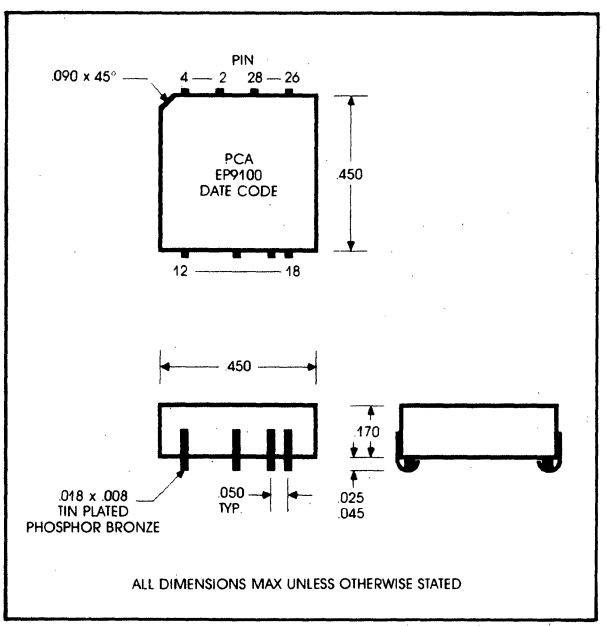
5 Tap TTL Compatible SMD Active Delay Lines

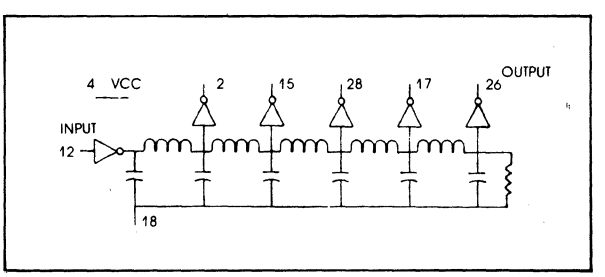


Features
- Surface Mountable
- Schottky TTL
- Transfer Molded Epoxy
- Rise time 4nS max.
- 5 equally spaced taps
- Operating temp. 0 to 70 °C

Input Test Conditions
- VCC: 5.0 VDC
- Pulse Voltage: 3.2V
- Rise Time: 2nS
- Input Current: 25mA TYP.
- Pulse Width: 1.2 x Total Delay
- Rep. Rate: 1MHz

TAP DELAYS ±5% OR 2 NS	TOTAL DELAYS ±5% OR 2 NS	PART NUMBER
5, 10, 15, 20	25	EP9100
6, 12, 18, 24	30	EP9101
7, 14, 21, 28	35	EP9102
8, 16, 24, 32	40	EP9103
9, 18, 27, 36	45	EP9104
10, 20, 30, 40	50	EP9105
12, 24, 36, 48	60	EP9106
15, 30, 45, 60	75	EP9107
20, 40, 60, 80	100	EP9108
25, 50, 75, 100	125	EP9109
30, 60, 90, 120	150	EP9110
35, 70, 105, 140	175	EP9111
40, 80, 120, 160	200	EP9112
45, 90, 135, 180	225	EP9113
50, 100, 150, 200	250	EP9114





PCA ELECTRONICS INC.
EP9100 385

16799 SCHOENBORN STREET
SEPULVEDA, CA 91343

PHONE: (818) 892-0761
TELEX: 67-4681
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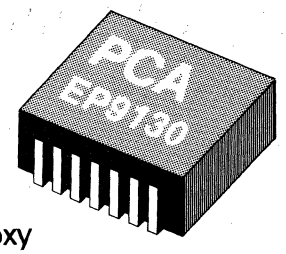
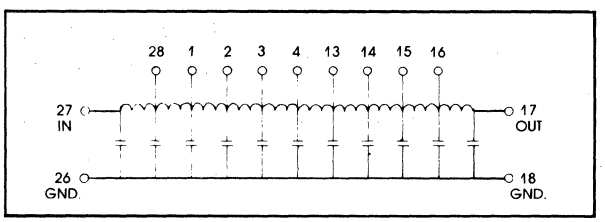
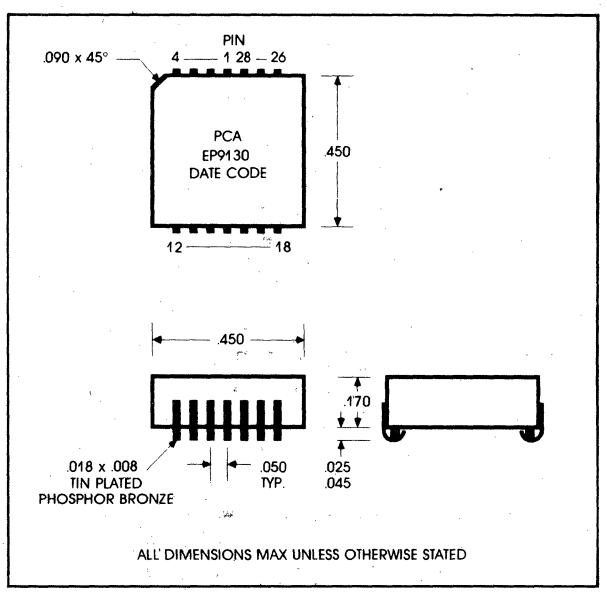
28 Pin SMD Delay Lines



Features

- Surface Mountable
- Transfer Molded Epoxy
- 10 equally spaced taps
- Operating temp. 0 to 70 °C
- Temperature Coefficient <100PPM/°C





Input Test Conditions

- Pulse Voltage: 10V
- Pulse Width: 3 x Total Delay
- Rep. Rate: 300 KHz - 1 MHz

Zo OHMS ±5%	ΔT NS ±5% OR 2 NS	TOTAL DELAYS ±5% OR 2 NS	PART NUMBER
100	2.5	25	EP9130
100	3.0	30	EP9131
100	3.5	35	EP9132
100	4.0	40	EP9133
100	4.5	45	EP9134
100	5.0	50	EP9135
100	6.0	60	EP9136
100	7.5	75	EP9137
100	10	100	EP9138
100	12.5	125	EP9139
100	15	150	EP9140
100	17.5	175	EP9141
100	20	200	EP9142
100	22.5	225	EP9143
100	25	250	EP9144
200	2.5	25	EP9145
200	3.0	30	EP9146
200	3.5	35	EP9147
200	4.0	40	EP9148
200	4.5	45	EP9149
200	5.0	50	EP9150
200	6.0	60	EP9151
200	7.5	75	EP9152
200	10	100	EP9153
200	12.5	125	EP9154
200	15	150	EP9155
200	17.5	175	EP9156
200	20	200	EP9157
200	22.5	225	EP9158
200	25	250	EP9159

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28 SMD 3/85

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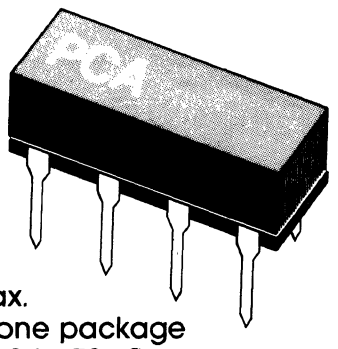
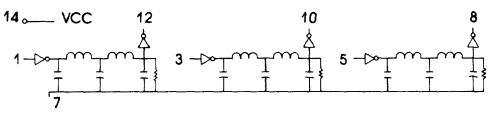
TWX: 910-496-1525

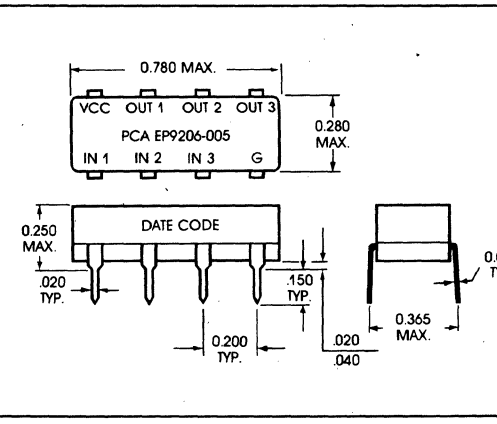
Triple TTL Compatible Active Delay Lines



Features
- Schottky TTL
- Rise time 4nS max.
- 3 Delay Lines in one package
- Operating temp. 0 to 70 °C
- Available from 5nS to 250nS
- Low profile 14 pin DIP for auto-insertion

Input Test Conditions
- VCC: 5.0 VDC
- Pulse Voltage: 3.2V
- Rise Time: 2nS
- Input Current: 115mA max.
- Pulse Width: 1.1 x Total Delay
- Rep. Rate: 1MHz





PART NUMBER	DELAY TIME ±5% OR 2 NS
EP9206-005	5
EP9206-006	6
EP9206-007	7
EP9206-008	8
EP9206-009	9
EP9206-010	10
EP9206-011	11
EP9206-012	12
EP9206-013	13
EP9206-014	14
EP9206-015	15
EP9206-016	16
EP9206-017	17
EP9206-018	18
EP9206-019	19
EP9206-020	20
EP9206-021	21
EP9206-022	22
EP9206-023	23
EP9206-024	24
EP9206-025	25
EP9206-030	30
EP9206-035	35
EP9206-040	40
EP9206-045	45
EP9206-050	50
EP9206-055	55
EP9206-060	60
EP9206-065	65
EP9206-070	70
EP9206-075	75
EP9206-080	80
EP9206-085	85
EP9206-090	90
EP9206-095	95
EP9206-100	100
EP9206-125	125
EP9206-150	150
EP9206-175	175
EP9206-200	200
EP9206-225	225
EP9206-250	250

DELAY TIMES REFERENCED FROM INPUT TO LEADING EDGES
TOLERANCE ±5% OR 2 NS WHICHEVER IS GREATER

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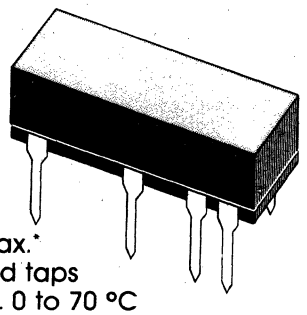
3TTL ADL 485

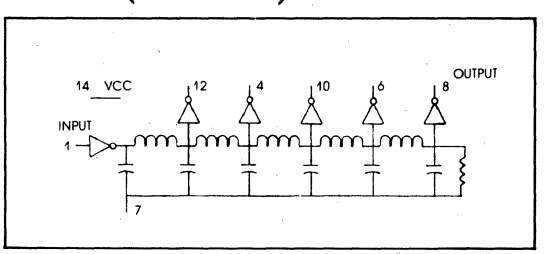
5 Tap TTL Compatible Active Delay Lines

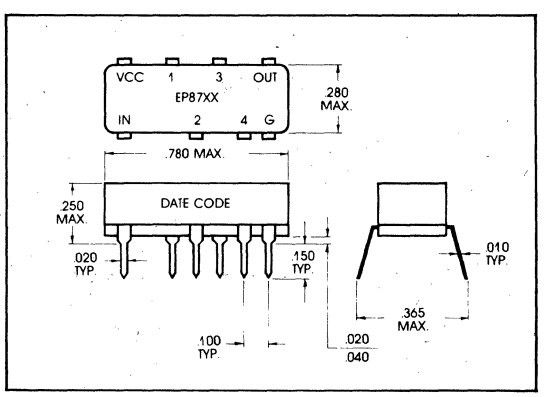
HI REP RATE



Features
- Schottky TTL
- Rise time 4nS max.*
- 5 equally spaced taps
- Operating temp. 0 to 70 °C
- Available from 25nS to 1000ns
- Low profile 14 pin DIP for auto-insertion

Input Test Conditions
- VCC: 5.0 VDC
- Pulse Voltage: 3.2V
- Rise Time: 2nS
- Input Current: 60mA TYP.
- Pulse Width: 50% of Total Delay
- Rep. Rate: 3 MHz (TD ≤ 500ns)
  2 MHz (TD > 500ns)





TAP DELAYS ±5% OR 2 NS	TOTAL DELAYS ±5% OR 2 NS	PART NUMBER
5, 10, 15, 20	25	EP8700
6, 12, 18, 24	30	EP8713
7, 14, 21, 28	35	EP8714
8, 16, 24, 32	40	EP8715
9, 18, 27, 36	45	EP8716
10, 20, 30, 40	50	EP8701
12, 24, 36, 48	60	EP8711
15, 30, 45, 60	75	EP8717
20, 40, 60, 80	100	EP8702
25, 50, 75, 100	125	EP8719
30, 60, 90, 120	150	EP8703
35, 70, 105, 140	175	EP8720
40, 80, 120, 160	200	EP8704
45, 90, 135, 180	225	EP8721
50, 100, 150, 200	250	EP8705
60, 120, 180, 240	300	EP8706
70, 140, 210, 280	350	EP8707
80, 160, 240, 320	400	EP8708
84, 168, 252, 336	420	EP8718
88, 176, 264, 352	440	EP8722
90, 180, 270, 360	450	EP8709
94, 188, 282, 376	470	EP8723
100, 200, 300, 400	500	EP8710
110, 220, 330, 440	550	EP8730
120, 240, 360, 480	600	EP8724
130, 260, 390, 520	650	EP8731
140, 280, 420, 560	700	EP8725
150, 300, 450, 600	750	EP8729
160, 320, 480, 640	800	EP8726
170, 340, 510, 680	850	EP8732
180, 360, 540, 720	900	EP8727
190, 380, 570, 760	950	EP8733
200, 400, 600, 800	1000	EP8728

DELAY TIMES REFERENCED FROM INPUT TO LEADING AND TRAILING EDGES
TAP DELAY TOLERANCE ±5% OR 2 NS WHICHEVER GREATER
TOTAL DELAY TOLERANCE ±5% OR 2 NS WHICHEVER GREATER
*5 NS FOR 550-1000 NS TOTAL DELAYS

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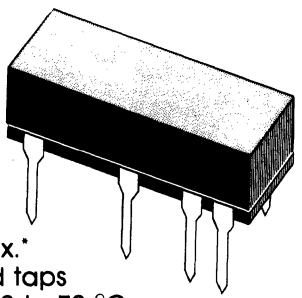
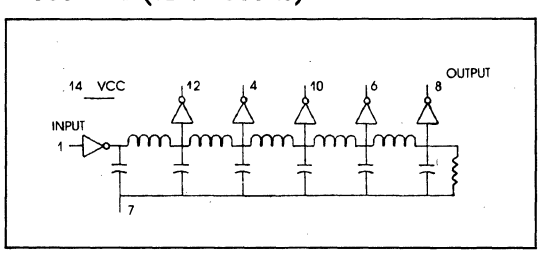
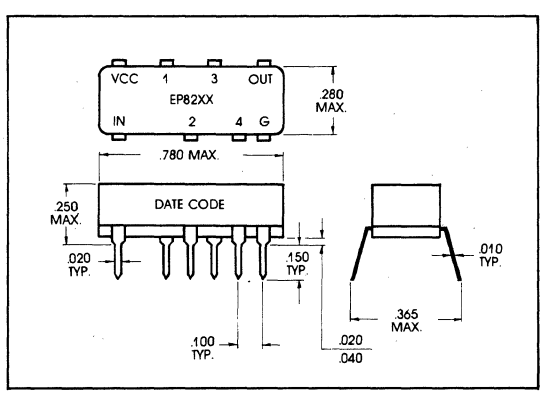
5 Tap TTL Compatible Active Delay Lines



Features
- Schottky TTL
- Rise time 4nS max.*
- 5 equally spaced taps
- Operating temp. 0 to 70 °C
- Available from 25nS to 1000ns
- Low profile 14 pin DIP for auto-insertion

Input Test Conditions
- VCC: 5.0 VDC
- Pulse Voltage: 3.2V
- Rise Time: 2nS
- Input Current: 60mA TYP.
- Pulse Width: 1.1 x Total Delay
- Rep. Rate: 1 MHz (TD ≤ 500ns)
  500 KHz (TD > 500ns)





TAP DELAYS ±5% OR 2 NS	TOTAL DELAYS ±5% OR 2 NS	PART NUMBER
5, 10, 15, 20	25	EP8200
6, 12, 18, 24	30	EP8213
7, 14, 21, 28	35	EP8214
8, 16, 24, 32	40	EP8215
9, 18, 27, 36	45	EP8216
10, 20, 30, 40	50	EP8201
12, 24, 36, 48	60	EP8211
15, 30, 45, 60	75	EP8217
20, 40, 60, 80	100	EP8202
25, 50, 75, 100	125	EP8219
30, 60, 90, 120	150	EP8203
35, 70, 105, 140	175	EP8220
40, 80, 120, 160	200	EP8204
45, 90, 135, 180	225	EP8221
50, 100, 150, 200	250	EP8205
60, 120, 180, 240	300	EP8206
70, 140, 210, 280	350	EP8207
80, 160, 240, 320	400	EP8208
84, 168, 252, 336	420	EP8218
88, 176, 264, 352	440	EP8222
90, 180, 270, 360	450	EP8209
94, 188, 282, 376	470	EP8223
100, 200, 300, 400	500	EP8210
110, 220, 330, 440	550	EP8230
120, 240, 360, 480	600	EP8224
130, 260, 390, 520	650	EP8231
140, 280, 420, 560	700	EP8225
150, 300, 450, 600	750	EP8229
160, 320, 480, 640	800	EP8226
170, 340, 510, 680	850	EP8232
180, 360, 540, 720	900	EP8227
190, 380, 570, 760	950	EP8233
200, 400, 600, 800	1000	EP8228

DELAY TIMES REFERENCED FROM INPUT TO LEADING EDGES
TAP DELAY TOLERANCE ±5% OR 2 NS WHICHEVER GREATER
TOTAL DELAY TOLERANCE ±5% OR 2 NS WHICHEVER GREATER
*5 NS FOR 550-1000 NS TOTAL DELAYS

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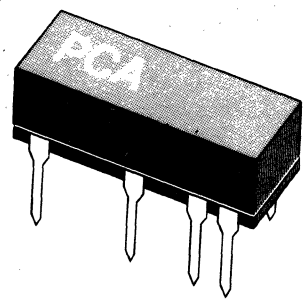
5 Tap Low Power TTL Compatible Active Delay Lines

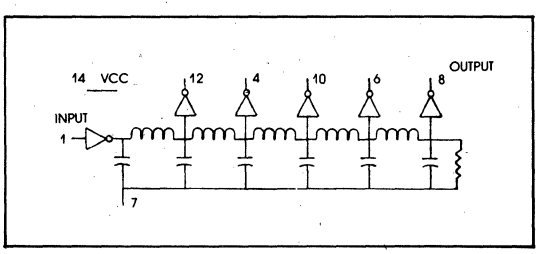


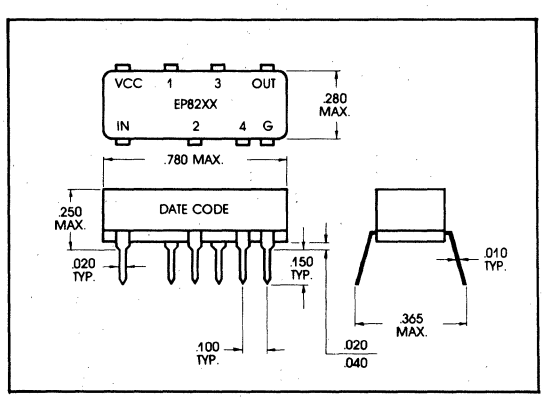
Features

- Low power Schottky TTL
- Rise time 8nS max.*
- 5 equally spaced taps
- Operating temp. 0 to 70 °C
- Drives up to 20 low power TTL loads
- Low profile DIP for auto-insertion

Input Test Conditions

- VCC: 5.0 VDC
- Pulse Voltage: 3.2V
- Rise Time: 2nS
- Input Current: 25mA TYP.
- Pulse Width: 1.1 x Total Delay
- Rep. Rate: 1 MHz (TD $\leq$ 500ns)
  500 KHz (TD $>$ 500ns)





TAP DELAYS ±5% OR 2 NS	TOTAL DELAYS ±5% OR 2 NS	PART NUMBER
10, 20, 30, 40	50	EP8270
11, 22, 33, 44	55	EP8271
12, 24, 36, 48	60	EP8272
13, 26, 39, 52	65	EP8273
14, 28, 42, 56	70	EP8274
15, 30, 45, 60	75	EP8275
16, 32, 48, 64	80	EP8276
17, 34, 51, 68	85	EP8277
18, 36, 54, 72	90	EP8278
19, 38, 57, 76	95	EP8279
20, 40, 60, 80	100	EP8280
25, 50, 75, 100	125	EP8281
30, 60, 90, 120	150	EP8282
35, 70, 105, 140	175	EP8283
40, 80, 120, 160	200	EP8284
45, 90, 135, 180	225	EP8285
50, 100, 150, 200	250	EP8286
55, 110, 165, 220	275	EP8287
60, 120, 180, 240	300	EP8288
70, 140, 210, 280	350	EP8289
80, 160, 240, 320	400	EP8290
90, 180, 270, 360	450	EP8291
100, 200, 300, 400	500	EP8292

DELAY TIMES REFERENCED FROM INPUT TO LEADING EDGES
TAP DELAY TOLERANCE ±5% OR 2 NS WHICHEVER GREATER
TOTAL DELAY TOLERANCE ±5% OR 2 NS WHICHEVER GREATER

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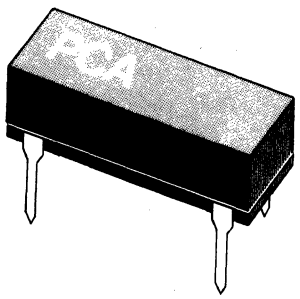
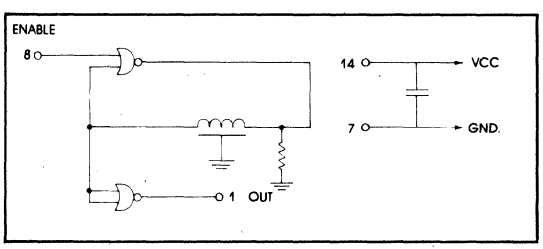
TTL Square-Wave Generator

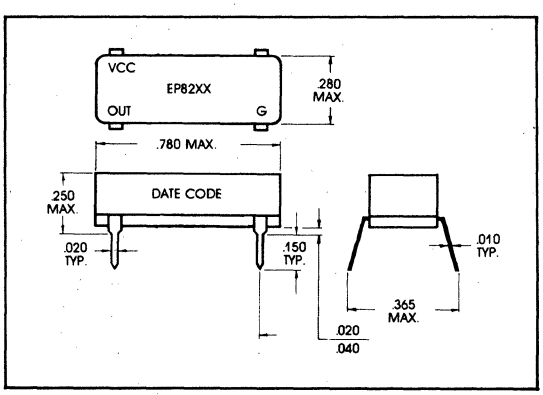


Features

- Output frequencies from 2 to 100 MHz ±5%
- Low profile 14 pin dual-inline package
- Operating temperature range 0 to 70 °C
- Output synchronized using enable line
- 50% duty cycle
- Schottky TTL

P/N	MHz	P/N	MHz
EP8250	2	EP8259	35
EP8251	3	EP8260	40
EP8252	4	EP8261	45
EP8253	5	EP8262	50
EP8254	10	EP8263	60
EP8255	15	EP8264	70
EP8256	20	EP8265	80
EP8257	25	EP8266	90
EP8258	30	EP8267	100





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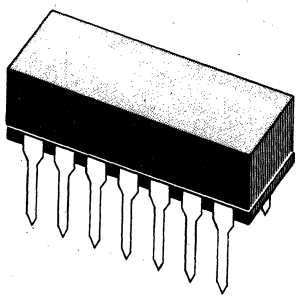
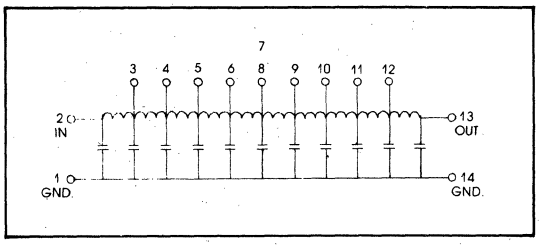
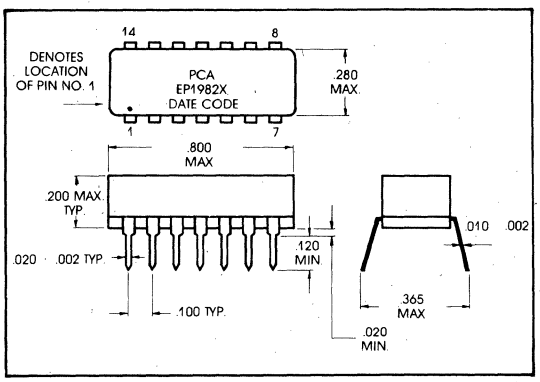
14 Pin Dip Delay Lines







Features
- 10 equally spaced taps
- Operating temp. 0 to 70 °C
- Available from 25nS to 1000ns
- Low profile 14 pin DIP for auto-insertion
- Temperature Coefficient <100 PPM/° C

Input Test Conditions
- Pulse Voltage: 10V
- Pulse Width: 3 x Total Delay
- Rep. Rate: 300 KHz - 1 MHz

IMPEDANCE OHMS ±10%	DELAY TIME NS ±5%	ΔT NS PER TAP (±3 NS)	DIST. % MAX.	RISE TIME NS MAX.	ATTENUATION % MAX.	PCA PART NUMBER
50	50	5 (± 2NS)	10	8.5	1.6	EP19821
50	100	10	10	17	3.8	EP19822
50	125	12.5	10	21	6.5	EP19823
100	50	5 (± 2NS)	10	8.5	2.0	EP19824
100	100	10	10	17	4.0	EP19825
100	125	12.5	10	21	7.0	EP19826
100	150	15	10	25	8.0	EP19827
100	200	20	10	34	10.0	EP19828
100	250	25	10	42	12.0	EP19829

TRANSFER MOLDED TO MEET MIL-D-23859 and MIL-STD-202C.
COMPATIBLE WITH AUTOMATIC INSERTION EQUIPMENT.
PEAK PULSE VOLTAGE, 50 VOLTS.

DELAY TIMES MEASURED FROM TAP TO TAP
TOTAL DELAY REFERENCED FROM INPUT
OTHER DELAYS AVAILABLE UPON REQUEST

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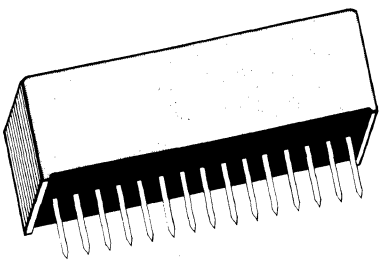
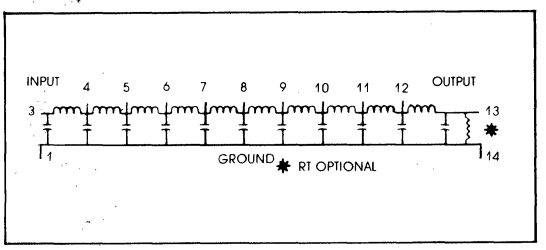
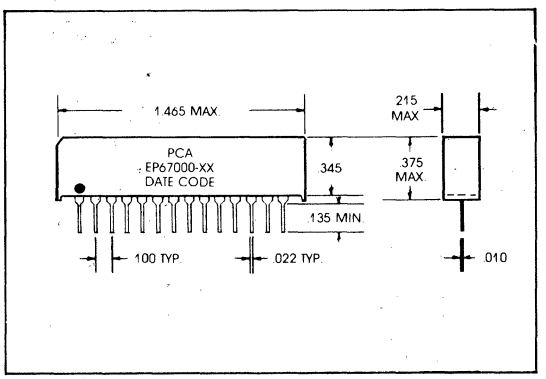
14 Pin Single-in-Line Package Delay Lines







Features

- 10 equally spaced taps
- Internal termination optional
- Available from 10nS to 200ns
- Operating temp. 0 to 70 °C
- Temperature Coefficient <100 PPM/° C

Input Test Conditions

- Pulse Voltage: 10V
- Pulse Width: 3 x Total Delay
- Rep. Rate: 300 KHz - 1 MHz

IMPEDANCE OHMS ±10%	TOTAL DELAY TIME NS ±5% OR 2NS	ΔT NS PER TAP (±5% OR 2NS)	RISE TIME NS MAX	DCR OHMS MAX.	DISTORTION AT OUTPUT % MAX.	PCA PART NUMBER*
50	10 NS	1 NS	2 NS	1 OHM	10	EP6700-1
50	20 NS	2 NS	4 NS	1 OHM	10	EP6700-2
50	30 NS	3 NS	6 NS	1 OHM	10	EP6700-3
50	40 NS	4 NS	8 NS	1 OHM	10	EP6700-4
50	50 NS	5 NS	10 NS	1 OHM	10	EP6700-5
50	60 NS	6 NS	12 NS	2 OHM	10	EP6700-6
50	70 NS	7 NS	14 NS	2 OHM	10	EP6700-7
50	80 NS	8 NS	16 NS	2 OHM	10	EP6700-8
50	90 NS	9 NS	18 NS	2 OHM	10	EP6700-9
50	100 NS	10 NS	20 NS	2 OHM	10	EP6700-10
100	20 NS	2 NS	4 NS	4 OHM	10	EP6700-11
100	40 NS	4 NS	8 NS	4 OHM	10	EP6700-12
100	60 NS	6 NS	12 NS	4 OHM	10	EP6700-13
100	80 NS	8 NS	16 NS	4 OHM	10	EP6700-14
100	100 NS	10 NS	20 NS	4 OHM	10	EP6700-15
100	120 NS	12 NS	24 NS	6 OHM	10	EP6700-16
100	140 NS	14 NS	28 NS	6 OHM	10	EP6700-17
100	160 NS	16 NS	32 NS	6 OHM	10	EP6700-18
100	180 NS	18 NS	36 NS	6 OHM	10	EP6700-19
100	200 NS	20 NS	40 NS	6 OHM	10	EP6700-20

DELAY TIMES MEASURED FROM TAP TO TAP TOTAL DELAY REFERENCED FROM INPUT OTHER DELAYS AVAILABLE UPON REQUEST

*ADD -T TO PART NUMBER FOR OPTIONAL INTERNAL TERMINATING RESISTOR

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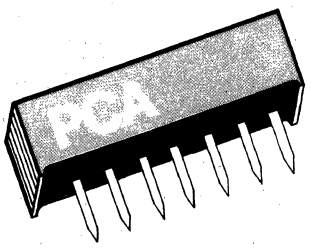
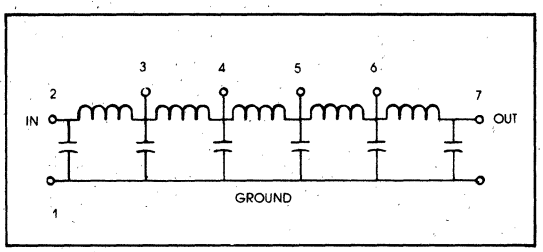
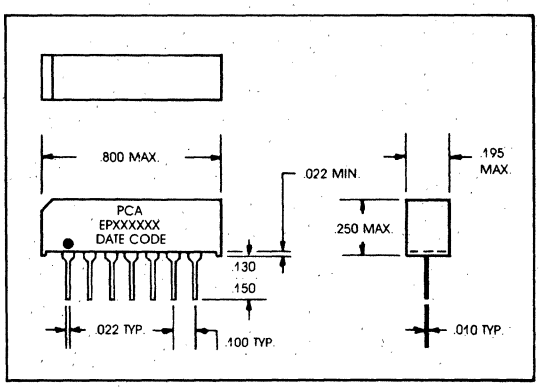
7 Pin Single-in-Line Package Delay Lines







Features
- 5 equally spaced taps
- Available from 5nS to 1000ns
- Operating temp. 0 to 70 °C
- Temperature Coefficient <100 PPM/°C

Input Test Conditions
- Pulse Voltage: 10V
- Pulse Width: 3 x Total Delay
- Rep. Rate: 300 KHz - 1 MHz

IMPEDANCE OHMS ±10%	TOTAL DELAY TIME NS ±5% OR 2NS	ΔT NS PER TAP (±5% OR 2NS)	RISE TIME NS MAX	DCR OHMS MAX.	DISTORTION AT OUTPUT % MAX.	PCA PART NUMBER
50	5 NS	1 NS	2.0 NS	0.3	10	120650
50	10 NS	2 NS	3.2 NS	0.5	10	120651
50	20 NS	4 NS	6.0 NS	0.8	10	120652
50	30 NS	6 NS	9.0 NS	1.2	10	120653
50	40 NS	8 NS	12.0 NS	1.8	10	120654
50	50 NS	10 NS	15.0 NS	2.3	10	120655
50	60 NS	12 NS	18.0 NS	2.5	10	120656
50	70 NS	14 NS	22.0 NS	3.5	10	120657
50	80 NS	16 NS	24.0 NS	4.2	10	120658
50	90 NS	18 NS	27.0 NS	4.5	10	120659
50	100 NS	20 NS	28.0 NS	5.2	10	120660
100	5 NS	1 NS	2.0 NS	0.5	10	120661
100	10 NS	2 NS	3.3 NS	1.0	10	120662
100	20 NS	4 NS	6.0 NS	1.5	10	120663
100	30 NS	6 NS	9.0 NS	2.5	10	120664
100	40 NS	8 NS	11.0 NS	4.0	10	120665
100	50 NS	10 NS	14.0 NS	5.0	10	120666

DELAY TIMES MEASURED FROM TAP TO TAP
TOTAL DELAY REFERENCED FROM INPUT
OTHER DELAYS AVAILABLE UPON REQUEST

PCA ELECTRONICS INC.

16799 SCHOENBORN STREET
SEPULVEDA, CA 91343

PHONE: (818) 892-0761
TELEX: 67-4681
TWX: 910-496-1525

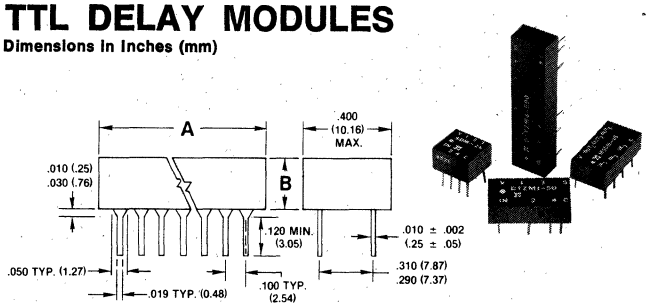
EEM PRODUCT SELECTION GUIDES

Use the EEM Product Selection Guides. There are 34 Guides in this edition of EEM. See page 2 (A•2, B•2, C•2, D•2) of each volume to locate the Product Selection Guides that pertain to your needs.

ECL & TTL BUFFERED DELAY LINES

TTL DELAY MODULES

Dimensions in inches (mm)



Dimensions in inches (mm)

Part Number	Configuration	"A" Dimension (Max.) Inches (mm)	"B" Dimension (Max.) Inches (mm)
FDM-XXX	8 Pin, Single Output	0.500 (12.70)	0.250 (6.35)
FSDM-XXX	14 Pin, Single Output	0.800 (20.32)	0.230 (5.84)
MDM-XXX	8 Pin, 3 Independent Lines	0.500 (12.70)	0.250 (6.35)
MSDM-XXX	14 Pin, 3 Independent Lines	0.800 (20.32)	0.230 (5.84)
SDM-XXX	8 Pin, 5 Taps	0.500 (12.70)	0.250 (6.35)
DTZM1-XXX	14 Pin, 5 Taps	0.800 (20.32)	0.230 (5.84)
D2TZM1-XXX	14 Pin, 10 Taps	0.800 (20.32)	0.250 (6.35)
D2TZM2-XXX	16 Pin, 10 Taps	0.800 (20.32)	0.250 (6.35)
D2TZM4-XXX	30 Pin, 10 Taps	1.600 (40.64)	0.230 (5.84)

OPERATING SPECIFICATIONS

Vcc Supply Voltage: ..... 4.75 to 5.25 VDC
Logic "1" Input:
  Voltage ..... 2V min.; 5.5V max.
  Current ..... 2.4V; 50 μA max.
Logic "0" Input:
  Voltage ..... .8V max.
  Current ..... −2 mA max.
Logic "1" Voltage Out: ..... 2.4V min.
Logic "0" Voltage Out: ..... .5V max.
Rise Time Out (all modules): ..... 4 ns max.[1]

ELECTRICAL SPECIFICATIONS AT 25°C

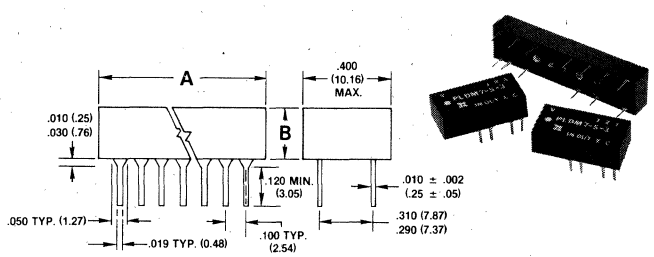
Total Delay Time[2]	8 Pin, Single Output Part Number	14 Pin, Single Output Part Number	8 Pin, 3 Independent Lines Part Number	14 Pin, 3 Independent Lines Part Number
5 ±1 ns	FDM-5	FSDM-5	MDM-5	MSDM-5
10 ±2 ns	FDM-10	FSDM-10	MDM-10	MSDM-10
25 ±2 ns	FDM-25	FSDM-25	MDM-25	MSDM-25
50 ±3 ns	FDM-50	FSDM-50	MDM-50	MSDM-50
100 ±5 ns	FDM-100	FSDM-100	MDM-100	MSDM-100
150 ±7.5 ns	FDM-150	FSDM-150		MSDM-150
200 ±10 ns	FDM-200	FSDM-200		MSDM-200
250 ±12.5 ns	FDM-250	FSDM-250		
300 ±15 ns	FDM-300	FSDM-300		
350 ±17.5 ns	FDM-350	FSDM-350		
400 ±20 ns	FDM-400	FSDM-400		
450 ±22.5 ns	FDM-450	FSDM-450		
500 ±25 ns	FDM-500	FSDM-500		
1000 ±50 ns		FSDM-1000		

ELECTRICAL SPECIFICATIONS AT 25°C

Total Delay Time[2]	5 Taps[2] @	5 Tap, 8 Pin Part Number	5 Tap, 14 Pin Part Number	10 Taps[2] @	10 Tap Part Number
25 ±2 ns	5 ±2 ns	SDM-25	DTZM1-25	5 ns ±2	
50 ±3 ns	10 ±2 ns	SDM-50	DTZM1-50	5 ns ±2	D2TZM(†)-50
100 ±5 ns	20 ±3 ns	SDM-100	DTZM1-100	10 ns ±2	D2TZM(†)-100
150 ±7.5 ns	30 ±3 ns	SDM-150	DTZM1-150	15 ns ±3	D2TZM(†)-150
200 ±10 ns	40 ±4 ns	SDM-200	DTZM1-200	20 ns ±3	D2TZM(†)-200
250 ±12.5 ns	50 ±5 ns	SDM-250	DTZM1-250	25 ns ±3	D2TZM(†)-250
300 ±15 ns	60 ±6 ns	SDM-300	DTZM1-300	30 ns ±3	D2TZM(†)-300
350 ±17.5 ns	70 ±7 ns	SDM-350	DTZM1-350	35 ns ±4	D2TZM(†)-350
400 ±20 ns	80 ±8 ns	SDM-400	DTZM1-400	40 ns ±4	D2TZM(†)-400
450 ±22.5 ns	90 ±9 ns	SDM-450	DTZM1-450	45 ns ±5	D2TZM(†)-450
500 ±25 ns	100 ±10 ns	SDM-500	DTZM1-500	50 ns ±5	D2TZM(†)-500
1000 ±50 ns	200 ±20 ns		[3]DTZM1-1000	100 ns ±10	[3]D2TZM(†)-1000

[1] Measured from .75V to 2.4V.
[2] Measured at 1.5V level on the leading edge.
[3] Package height dimension "B" will be .300" max.
Other delays readily available. Please consult factory.
†Denotes number of leads. Refer to Physical Dimensions table.

TTL PROGRAMMABLE LOGIC DELAY MODULES



Dimensions in inches (mm)

Part Number	Configuration	"A" Dimension (Max.) Inches (mm)	"B" Dimension (Max.) Inches (mm)
PLDM7-XX	16 Pin, 3 Bit	0.800 (20.32)	0.250 (6.35)
PLDMXX-XX	32 Pin, 4 Bit	1.600 (40.64)	0.230 (5.84)

OPERATING SPECIFICATIONS:

Vcc Supply Voltage: ..... 4.75 to 5.25 VDC
Logic "1" Input:
  Voltage ..... 2V Min.; 5.5V max.
  Current ..... 100 μA @ 2.4V, 2 mA @ 5.5V
Logic "0" Input:
  Voltage ..... .8V max.
  Logic "1" Voltage Out: ..... 2.4V min.
  Logic "0" Voltage Out: ..... .4V max.
Rise Time Out: ..... 4 ns max.
Storage Temp. Range: ..... −55° to +125°C
Operating Temp. Range: ..... 0° to 70°C

TABLE I — 4 BIT

Part Number	Min. Delay Time	Max. Delay Time (Nom.)	Max. Dev. from Programming Delay	Delay Change Per Step
PLDM 15-1	15 ns ±1 ns	30 ns	±1 ns	1 ns ±.5 ns
PLDM 15-2	15 ns ±1 ns	45 ns	±1 ns	2 ns ±.8 ns
PLDM 15-3	15 ns ±1 ns	60 ns	±2 ns	3 ns ±1 ns
PLDM 15-5	15 ns ±1 ns	90 ns	±2 ns	5 ns ±1 ns
PLDM 15-10	15 ns ±1 ns	165 ns	±4 ns	10 ns ±1 ns
PLDM 15-16	15 ns ±1 ns	255 ns	±4 ns	16 ns ±2 ns
PLDM 30-1	30 ns ±2 ns	45 ns	±2 ns	1 ns ±.5 ns
PLDM 45-1	45 ns ±2 ns	60 ns	±2.5 ns	1 ns ±.5 ns
PLDM 60-1	60 ns ±2 ns	75 ns	±2.5 ns	1 ns ±.5 ns
PLDM 75-1	75 ns ±3 ns	90 ns	±3.0 ns	1 ns ±.5 ns
PLDM 90-1	90 ns ±3 ns	105 ns	±3.5 ns	1 ns ±.5 ns

TABLE II — 3 BIT

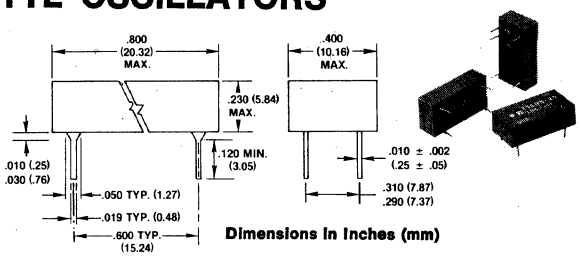
Part Number	Min. Delay Time	Max. Delay Time (Nom.)	Max. Dev. from Programming Delay	Delay Change Per Step
PLDM 7-1	7 ns ±1 ns	14 ns	±.4 ns	1 ns ±.3 ns
PLDM 7-2	7 ns ±1 ns	21 ns	±.6 ns	2 ns ±.4 ns
PLDM 7-3	7 ns ±1 ns	28 ns	±.8 ns	3 ns ±.5 ns
PLDM 7-4	7 ns ±1 ns	35 ns	±.9 ns	4 ns ±.5 ns
PLDM 7-5	7 ns ±1 ns	42 ns	±1.0 ns	5 ns ±.5 ns
PLDM 7-10	7 ns ±1 ns	77 ns	±2.0 ns	10 ns ±1.0 ns

Specifications subject to change without notice.

RHOMBUS INDUSTRIES INC.
15801 Chemical Lane • Huntington Beach, CA 92649 • (714) 898-0960 / (213) 594-8918 • TWX: 910-596-1826

ECL & TTL BUFFERED DELAY LINES

TTL OSCILLATORS



Dimensions in Inches (mm)

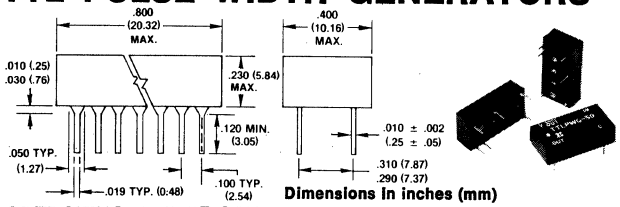
OPERATING SPECIFICATIONS

Vcc Supply Voltage: ..... 4.75 to 5.25 VDC
Logic "1" Input:
  Voltage ..... 2V min.; 5.5V max.
  Current ..... 2.4V; 50 μA max.
Logic "0" Input:
  Voltage ..... 0.8V max.
  Current ..... −2 mA max.
Logic "1" Voltage Out: ..... 2.4V min.
Logic "0" Voltage Out: ..... 0.4V max.
Operating Temp. Range: ..... 0° to 70°C
Storage Temp. Range: ..... −55° to +125°C
Dimensions: ..... 0.800" Long x 0.400" Wide x 0.230" High

ELECTRICAL SPECIFICATIONS AT 25°C

Part Number	Output Frequency	Part Number	Output Frequency
TTLOS-2	2 MHz	TTLOS-35	35 MHz
TTLOS-3	3 MHz	TTLOS-40	40 MHz
TTLOS-4	4 MHz	TTL0S-45	45 MHz
TTLOS-5	5 MHz	TTLOS-50	50 MHz
TTL0S-10	10 MHz	TTLOS-60	60 MHz
TTLOS-15	15 MHz	TTLOS-70	70 MHz
TTLOS-20	20 MHz	TTLOS-80	80 MHz
TTLOS-25	25 MHz	TTLOS-90	90 MHz
TTLOS-30	30 MHz	TTLOS-100	100 MHz

TTL PULSE WIDTH GENERATORS



Dimensions in inches (mm)

OPERATING SPECIFICATIONS

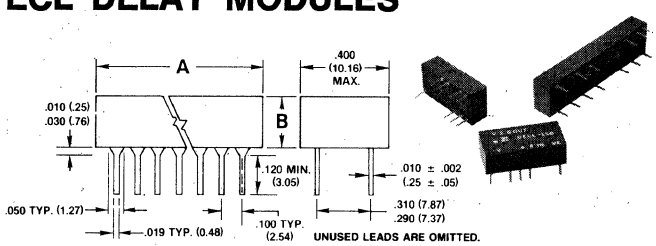
Vcc Supply Voltage: ..... 4.75 to 5.25 VDC
Logic "1" Input:
  Voltage ..... 2V min.; 5.5V max.
  Current ..... 2.4V; 50 μA max.
Logic "0" Input:
  Voltage ..... .8V max.
  Current ..... −2 mA max.
Logic "1" Voltage Out: ..... 2.4V min.
Logic "0" Voltage Out: ..... .4V max.
Operating Temp. Range: ..... 0° to 70°C
Storage Temp. Range: ..... −55° to +125°C
Rise and Fall Time[2] ..... 4 ns max.

ELECTRICAL SPECIFICATIONS AT 25°C

Part Number	Pulse Width[1]	Max. Pulse Rate
TTLPWG-5	5 ns	100 MHz
TTLPWG-10	10 ns	50 MHz
TTLPWG-15	15 ns	33 MHz
TTLPWG-20	20 ns	25 MHz
TTLPWG-25	25 ns	20 MHz
TTLPWG-30	30 ns	16 MHz
TTLPWG-35	35 ns	14 MHz
TTLPWG-40	40 ns	12 MHz
TTLPWG-45	45 ns	11 MHz
TTLPWG-50	50 ns	10 MHz
TTLPWG-60	60 ns	8.4 MHz
TTLPWG-70	70 ns	7.1 MHz
TTLPWG-80	80 ns	6.3 MHz
TTLPWG-90	90 ns	5.5 MHz
TTLPWG-100	100 ns	5.0 MHz

[1] Measured @ 1.5 volt levels. [2] Measured from .75V to 2.4V.

ECL DELAY MODULES



Dimensions in Inches (mm)

Part Number	Configuration Availability	"A" Dimension (Max.) Inches (mm)	"B" Dimension (Max.) Inches (mm)
DECL-XXX	16 Pin, 5 Taps	0.800 (20.32)	0.230 (5.84)
D2ECL-XXX	32 Pin, 10 Taps	1.600 (40.64)	0.230 (5.84)
FECL-XXX	16 Pin, Single Output	0.800 (20.32)	0.230 (5.84)
MECL-XXX	16 Pin, Multi-Output	0.800 (20.32)	0.230 (5.84)

OPERATING SPECIFICATIONS

Supply Voltage: ..... −5.2 VDC to Vee
Logic "1" Input:
  Voltage ..... −.98 min.
  Current ..... 265 μA max.
Logic "0" Input:
  Voltage ..... −1.63V max.
  Current ..... .5 μA max.
[1]Logic "1" Voltage Out: ..... −.96 min.
[1]Logic "0" Voltage Out: ..... −1.650 max.
[2]Rise Time Out: ..... < 5 ns typ.
Storage Temp. Range: ..... −55° to +125°C
Operating Temp. Range ..... 0° to 70°C

ELECTRICAL SPECIFICATIONS AT 25°C

Total Delay Time[3]	16 Pin, Single Output Part Number	16 Pin, 3 Independent Lines Part Number
5 ±1 ns	FECL-5	MECL-5
10 ±2 ns	FECL-10	MECL-10
15± 2 ns	FECL-15	MECL-15
20 ±3 ns	FECL-20	MECL-20
25 ±3 ns	FECL-25	MECL-25
30 ±3 ns	FECL-30	MECL-30
35 ±3 ns	FECL-35	MECL-35
40 ±3 ns	FECL-40	MECL-40
45 ±3 ns	FECL-45	MECL-45
50 ±3 ns	FECL-50	MECL-50
75 ±4 ns	FECL-75	MECL-75
100 ±5 ns	FECL-100	MECL-100
150 ±7.5 ns	FECL-150	MECL-150
200 ±10 ns	FECL-200	MECL-200

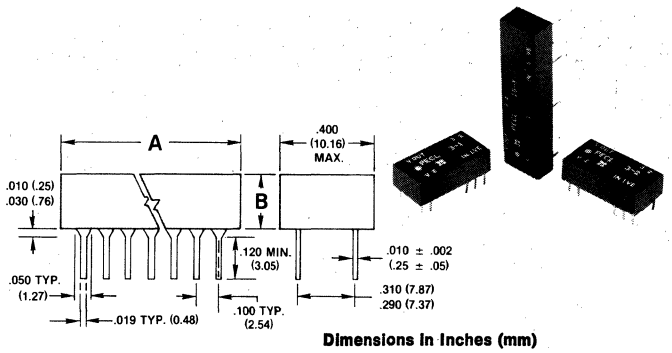
Total Delay Time[3]	5 Taps @	5 Tap Part Number	10 Taps @	10 Tap Part Number
10 ±2 ns	2 ±1 ns	DECL-10		
15 ±2 ns	3 ±2 ns	DECL-15		
20 ±2 ns	4 ±2 ns	DECL-20		
25 ±2 ns	5 ±2 ns	DECL-25		
30 ±3 ns	6 ±2 ns	DECL-30	3.0 ±1 ns	D2ECL-30
35 ±3 ns	7 ±2 ns	DECL-35	3.5 ±1 ns	D2ECL-35
40 ± 3ns	8 ±2 ns	DECL-40	4.0 ±1 ns	D2ECL-40
45 ±3 ns	9 ±2 ns	DECL-45	4.5 ±1 ns	D2ECL-45
50 ±3 ns	10 ±2 ns	DECL-50	5.0 ±2 ns	D2ECL-50
75 ±4 ns	15 ±3 ns	DECL-75	7.5 ±2 ns	D2ECL-75
100 ±5 ns	20 ±3 ns	DECL-100	10 ±2 ns	D2ECL-100
150 ±7.5 ns	30 ±3 ns	DECL-150	15 ±3 ns	D2ECL-150
200 ±10 ns	40 ±4 ns	DECL-200	20 ±3 ns	D2ECL-200
250 ±12.5 ns	50 ±5 ns	DECL-250	25 ±3 ns	D2ECL-250

[1] Outputs terminated through 100 ohms to −2.0 VDC.
[2] Measured from 20% to 80% pulse amplitude.
[3] Measured at −1.3V level on leading edge.
Specifications subject to change without notice.

RHOMBUS INDUSTRIES INC.
15801 Chemical Lane • Huntington Beach, CA 92649 • (714) 898-0960 / (213) 594-8918 • TWX: 910-596-1826

ECL & TTL BUFFERED DELAY LINES

ECL PROGRAMMABLE DELAY MODULES



Dimensions in Inches (mm)

Part Number	Configuration	"A" Dimension (Max.) Inches (mm)	"B" Dimension (Max.) Inches (mm)
PECL 3-XXX	16 Pins, 3 Bits	0.800 (20.32)	0.250 (6.35)
PECL XX-XXX	32 Pins, 4 Bits	1.600 (40.64)	0.250 (6.35)

OPERATING SPECIFICATIONS

Supply Voltage: ..... −5.2 VDC to Vee
Logic "1" Input:
  Voltage ..... −.98V min.
  Current ..... 265 μA max.
Logic "0" Input:
  Voltage ..... −1.63V max.
  Current ..... .5 μA max.
Logic "1" Output: ..... −.96V min.
Logic "0" Output: ..... −1.65V max.
Storage Temp. Range: ..... −55° to +125°C
Operating Temp. Range: ..... 0° to 70°C

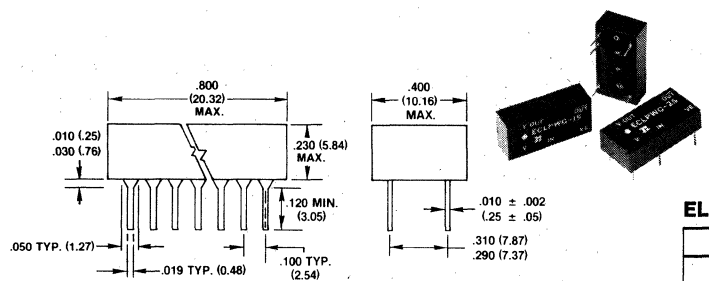
TABLE I — 4 BIT

Part Number	Min. Delay Time	Max. Delay Time (Nom.)	Max. Dev. from Programming Delay	Delay Change Per Step
PECL 6-1	6 ns±1 ns	21 ns	±1 ns	1 ns ±.5 ns
PECL 15-1	15 ns ±1 ns	30 ns	±1 ns	1 ns ±.5 ns
PECL 30-1	30 ns ±2 ns	45 ns	±2 ns	1 ns ±.5 ns
PECL 45-1	45 ns ±2 ns	60 ns	±2.5 ns	1 ns ±.5 ns
PECL 60-1	60 ns ±2 ns	75 ns	±2.5 ns	1 ns ±.5 ns
PECL 75-1	75 ns ±3 ns	90 ns	±3.0 ns	1 ns ±.5 ns
PECL 90-1	90 ns ±3 ns	105 ns	±3.5 ns	1 ns ±.5 ns
PECL 15-2	15 ns ±1 ns	45 ns	±1 ns	2 ns ±.8 ns
PECL 15-3	15 ns ±1 ns	60 ns	±2 ns	3 ns ±1 ns
PECL 15-5	15 ns ±1 ns	90 ns	±2 ns	5 ns ±1 ns
PECL 15-10	15 ns ±1 ns	165 ns	±2 ns	10 ns ±1 ns
PECL 15-16	15 ns ±1 ns	255 ns	±4 ns	16 ns ±2 ns

TABLE II — 3 BIT

Part Number	Min. Delay Time	Max. Delay Time (Nom.)	Max. Dev. from Programming Delay	Delay Change Per Step
PECL 3-1	3 ns ±1 ns	10 ns	±.4ns	1 ns ±.3 ns
PECL 3-2	3 ns ±1 ns	17 ns	±.6 ns	2 ns ±.4 ns
PECL 3-3	3 ns ±1 ns	24 ns	±.8 ns	3 ns ±.5 ns
PECL 3-4	3 ns ±1 ns	31 ns	±.9 ns	4 ns ±.5 ns
PECL 3-5	3 ns ±1 ns	38 ns	±1.0 ns	5 ns ±.5 ns
PECL 3-10	3 ns ±1 ns	73 ns	±2.0 ns	10 ns ±1 ns

ECL PULSE WIDTH GENERATORS



Dimensions in Inches (mm)

OPERATING SPECIFICATIONS

Supply Voltage: ..... −5.2 VDC to Vee
Logic "1" Input:
  Voltage ..... −.98V min.
  Current ..... 265 μA max.
Logic "0" Input:
  Voltage ..... −1.63V max.
  Current ..... .5 μA min.
Logic "1" Output:
  Voltage ..... −.96V min.
Logic "0" Output:
  Voltage ..... −1.650V max.
Operating Temp Range: ..... 0° to 70°C
Storage Temp. Range: ..... −55° to +125°C
Rise and Fall Time[2]: ..... 3 ns typ.

ELECTRICAL SPECIFICATIONS AT 25°C

Part Number	Pulse Width[1] [3]	Max. Pulse Rate
ECLPWG-5	5 ns	100 MHz
ECLPWG-10	10 ns	50 MHz
ECLPWG-15	15 ns	33 MHz
ECLPWG-20	20 ns	25 MHz
ECLPWG-25	25 ns	20 MHz
ECLPWG-30	30 ns	16 MHz
ECLPWG-35	35 ns	14 MHz
ECLPWG-40	40 ns	12 MHz
ECLPWG-45	45 ns	11 MHz
ECLPWG-50	50 ns	10 MHz
ECLPWG-60	60 ns	8.4 MHz
ECLPWG-70	70 ns	7.1 MHz
ECLPWG-80	80 ns	6.3 MHz
ECLPWG-90	90 ns	5.5 MHz
ECLPWG-100	100 ns	5.0 MHz

[1] Measured @ −1.3V levels. [2] Measured from 20% to 80% points.
[3] Output terminated through 100 ohms to −2.0 VDC.
Specifications subject to change without notice.

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ELECTROMAGNETIC DELAY LINES

ELECTRICAL SPECIFICATIONS AT 25°C*

Overshoot: ..... 5% to 10%, typical
Line Distortion: ..... 3% max.
Working Volts: ..... 25 VDC max.
Dielectric Strength: ..... 100 VDC
Insulation Resistance: ..... 1000 Megohms @ 100 VDC, min.
Temperature Coefficient: ..... 70 PPM/°C, max.
Input-to-Tap Tolerance: ..... ±5% or 1 ns, whichever is greater
Tap-to-Tap Tolerance:
1 ns ..... ±0.35 ns
1-3 ns ..... ±0.5 ns

ELECTRICAL SPECIFICATIONS AT 25°C* (Cont.)

4-5 ns ..... ±1 ns
6-10 ns ..... ±2 ns
11-50 ns ..... ±3 ns

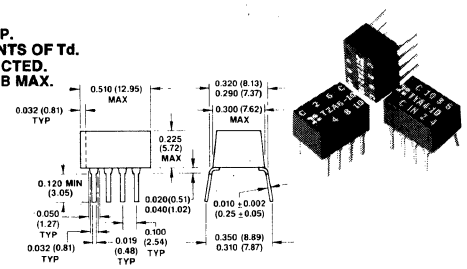
* All units tested 100% electrically.

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: ..... −55°C to +125°C
Military Specifications: ..... Meets or exceeds applicable portions of MIL-D-23859. Capable of meeting all environmental requirements of MIL-STD-202

DIP PACKAGE "A," 5 TAP, 8 PIN

8 LEAD "DIP"
Td to Tr RATIO — 4:1 TYP.
TAPS @ 20% INCREMENTS OF Td.
CAN BE SERIES CONNECTED.
ATTENUATION — 0.25 dB MAX.



Dimensions in Inches (mm)

50Ω IMPEDANCE

Part Number	Delay Time (NS) (±5%)**	Rise Time (NS) (Maximum)	Taps (NS) (Typical)	DCR Ω (Maximum)
TZA1-5	5 ± 0.5 ns	2.9	1	.5
TZA2-5	10 ±1 ns	3.8	2	.5
TZA3-5	15 ±1 ns	5.0	3	.5
TZA4-5	20	5.8	4	.7
TZA5-5	25	6.8	5	.9
TZA6-5	30	7.8	6	1.0
TZA7-5	35	8.8	7	1.25
TZA8-5	40	9.9	8	1.4
TZA9-5	45	11.6	9	1.5
TZA10-5	50	13.0	10	1.7
TZA11-5	75	19.0	15	1.9
TZA12-5	100	28.0	20	2.0

50 IMPEDANCE (cont.)

Part Number	Delay Time (NS) (±5%)**	Rise Time (NS) (Maximum)	Taps (NS) (Typical)	DCR Ω (Maximum)
TZA13-5	125	34.0	25	2.0
TZA14-5	150	41.0	30	2.0
TZA15-5	175	47.0	35	2.2
TZA16-5	200	54.0	40	2.2
TZA17-5	225	59.0	45	2.5
TZA18-5	250	73.0	50	2.5

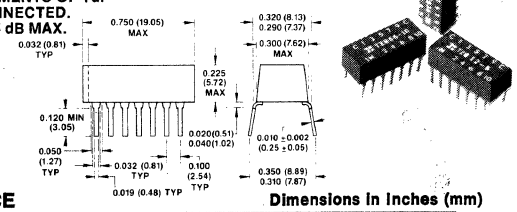
100Ω IMPEDANCE

TZA1-10	5 ±0.5 ns	3.6	1	.6
TZA2-10	10 ±1 ns	4.4	2	.7
TZA3-10	15 ±1 ns	5.6	3	.9
TZA4-10	20	7.3	4	1.2
TZA5-10	25	7.8	5	1.3
TZA6-10	30	8.3	6	1.4
TZA7-10	35	12.5	7	1.5
TZA8-10	40	15.2	8	1.6
TZA9-10	45	16.0	9	1.7
TZA10-10	50	17.6	10	1.8
TZA11-10	75	25.0	15	2.0
TZA12-10	100	38.0	20	2.0
TZA13-10	125	45.0	25	2.0
TZA14-10	150	52.0	30	2.0
TZA15-10	175	59.0	35	2.2
TZA16-10	200	65.0	40	2.2
TZA17-10	225	75.0	45	2.5
TZA18-10	250	84.0	50	2.5

** Unless otherwise specified.

DIP PACKAGE "B," 10 TAP, 14 PIN

14 LEAD "DIP"
Td to Tr RATIO — 8:1 TYP.
TAPS @ 10% INCREMENTS OF Td.
CAN BE SERIES CONNECTED.
ATTENUATION — 0.5 dB MAX.



Dimensions in Inches (mm)

50Ω IMPEDANCE

Part Number	Delay Time (NS) (±5%)**	Rise Time (NS) (Maximum)	Taps (NS) (Typical)	DCR Ω (Maximum)
TZB6-5	10 ±1 ns	3.0	1	.7
TZB12-5	20	4.0	2	.7
TZB18-5	25	4.5	2.5	.9
TZB24-5	30	5.5	3	1.0
TZB30-5	40	6.0	4	1.2
TZB36-5	50	7.0	5	1.3
TZB42-5	60	8.0	6	1.6
TZB48-5	70	9.0	7	1.7
TZB54-5	80	10.0	8	1.9
TZB60-5	90	12.0	9	2.0
TZB66-5	100	14.0	10	2.1
TZB72-5	150	20.0	15	2.2
TZB78-5	200	30.0	20	2.4
TZB84-5	250	35.0	25	2.4
TZB90-5	300	43.0	30	2.5
TZB92-5	350	50.0	35	2.7
TZB94-5	400	55.0	40	2.8
TZB96-5	450	60.0	45	3.0
TZB98-5	500	75.0	50	3.3

100Ω IMPEDANCE

Part Number	Delay Time (NS) (±5%)**	Rise Time (NS) (Maximum)	Taps (NS) (Typical)	DCR Ω (Maximum)
TZB6-10	10 ±1 ns	3.8	1	.75
TZB12-10	20	4.6	2	1.5
TZB18-10	25	5.5	2.5	1.7
TZB24-10	30	5.8	3	2.0
TZB30-10	40	7.5	4	2.2
TZB36-10	50	8.0	5	2.3
TZB42-10	60	8.5	6	2.5
TZB48-10	70	12.7	7	2.75
TZB54-10	80	15.5	8	3.0
TZB60-10	90	16.5	9	3.1
TZB66-10	100	18.0	10	3.2
TZB72-10	150	26.0	15	3.5
TZB78-10	200	39.0	20	3.5
TZB84-10	250	46.0	25	4.0
TZB90-10	300	54.0	30	4.2
TZB92-10	350	61.0	35	4.2
TZB94-10	400	67.0	40	4.5
TZB96-10	450	77.0	45	4.7
TZB98-10	500	86.0	50	5.0

200Ω IMPEDANCE

TZB6-20	10±1 ns	5.5	1	1.0
TZB12-20	20	8.5	2	1.5
TZB18-20	25	9.0	2.5	1.8
TZB24-20	30	10.0	3	2.0
TZB30-20	40	13.0	4	2.2
TZB36-20	50	15.5	5	2.4
TZB54-20	80	19.0	8	2.5
TZB66-20	100	20.0	10	2.6
TZB72-20	150	30.0	15	3.6
TZB78-20	200	40.0	20	4.8
TZB84-20	250	51.0	25	5.2

** Unless otherwise specified.
Specifications subject to change without notice.

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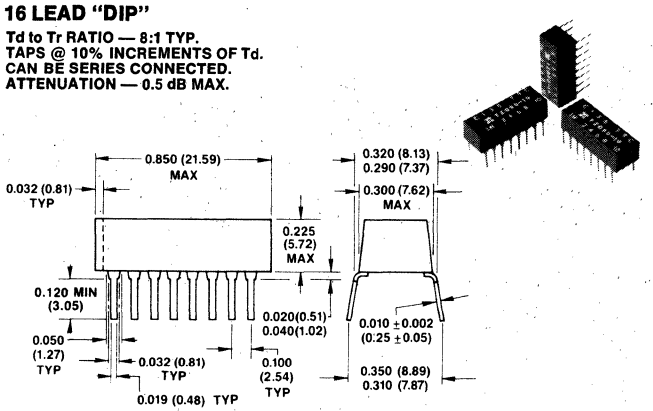
ELECTROMAGNETIC DELAY LINES

DIP PACKAGE "D," 10 TAP, 16 PIN

16 LEAD "DIP"

Td to Tr RATIO — 8:1 TYP.
TAPS @ 10% INCREMENTS OF Td.
CAN BE SERIES CONNECTED.
ATTENUATION — 0.5 dB MAX.



Dimensions in Inches (mm)

50Ω IMPEDANCE

Part Number	Delay Time (NS) (±5%)**	Rise Time (NS) (Maximum)	Taps (NS) (Typical)	DCR Ω (Maximum)
TZD6-5	10 ±1 ns	3.0	1	.7
TZD12-5	20	4.0	2	.7
TZD18-5	25	4.5	2.5	.9
TZD24-5	30	5.5	3	1.0
TZD30-5	40	6.0	4	1.2
TZD36-5	50	7.0	5	1.3
TZD42-5	60	8.0	6	1.6
TZD48-5	70	9.0	7	1.7
TZD54-5	80	10.0	8	1.9
TZD60-5	90	12.0	9	2.0
TZD66-5	100	14.0	10	2.1
TZD72-5	150	20.0	15	2.2
TZD78-5	200	30.0	20	2.4
TZD84-5	250	35.0	25	2.4
TZD90-5	300	43.0	30	2.5
TZD92-5	350	50.0	35	2.7
TZD94-5	400	55.0	40	2.8
TZD96-5	450	60.0	45	3.0
TZD98-5	500	75.0	50	3.3

100Ω IMPEDANCE

Part Number	Delay Time (NS) (±5%)**	Rise Time (NS) (Maximum)	Taps (NS) (Typical)	DCR Ω (Maximum)
TZD6-10	10 ±1 ns	3.8	1	.75
TZD12-10	20	4.6	2	1.5
TZD18-10	25	5.5	2.5	1.7
TZD24-10	30	5.8	3	2.0
TZD30-10	40	7.5	4	2.2
TZD36-10	50	8.0	5	2.3
TZD42-10	60	8.5	6	2.5
TZD48-10	70	12.7	7	2.75
TZD54-10	80	15.5	8	3.0
TZD60-10	90	16.5	9	3.1
TZD66-10	100	18.0	10	3.2
TZD72-10	150	26.0	15	3.5
TZD78-10	200	39.0	20	3.5
TZD84-10	250	46.0	25	4.0
TZD90-10	300	54.0	30	4.2
TZD92-10	350	61.0	35	4.2
TZD94-10	400	67.0	40	4.5
TZD96-10	450	77.0	45	4.7
TZD98-10	500	86.0	50	5.0

200Ω IMPEDANCE

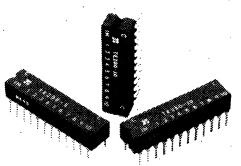
TZD6-20	10 ±1 ns	5.5	1	1.0
TZD12-20	20	8.5	2	1.5
TZD18-20	25	9.0	2.5	1.8
TZD24-20	30	10.0	3	2.0
TZD30-20	40	13.0	4	2.2
TZD36-20	50	15.5	5	2.4
TZD54-20	80	19.0	8	2.5
TZD66-20	100	20.0	10	2.6
TZD72-20	150	30.0	15	3.6
TZD78-20	200	40.0	20	4.8
TZD84-20	250	51.0	25	5.2

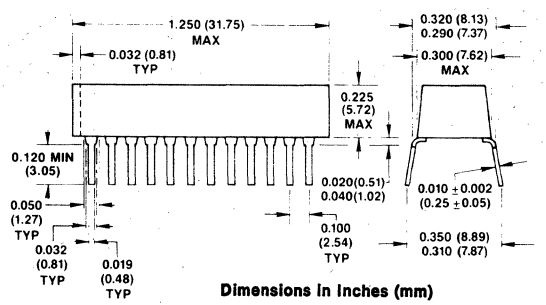
** Unless otherwise specified.

DIP PACKAGE "E," 10 TAP, 24 PIN

24 LEAD "DIP"

Td to Tr RATIO — 8:1 TYP.
TAPS @ 10% INCREMENTS OF Td.
CAN BE SERIES CONNECTED.
ATTENUATION — 0.5 dB MAX.





Dimensions in Inches (mm)

50Ω IMPEDANCE

Part Number	Delay Time (NS) (±5%)**	Rise Time (NS) (Maximum)	Taps (NS) (Typical)	DCR Ω (Maximum)
TE150-5	150	20.0	15	1.2
TE200-5	200	30.0	20	2.0
TE250-5	250	35.0	25	2.2
TE300-5	300	43.0	30	2.3
TE350-5	350	50.0	35	2.4
TE400-5	400	55.0	40	2.5
TE450-5	450	60.0	45	2.7
TE500-5	500	75.0	50	3.0

100Ω IMPEDANCE

TE150-10	150	26.0	15	2.5
TE200-10	200	39.0	20	2.7
TE250-10	250	46.0	25	3.0
TE300-10	300	54.0	30	3.5
TE350-10	350	61.0	35	3.8
TE400-10	400	67.0	40	4.0
TE450-10	450	77.0	45	4.3
TE500-10	500	86.0	50	4.5

** Unless otherwise specified.

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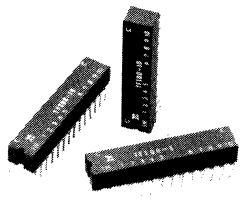
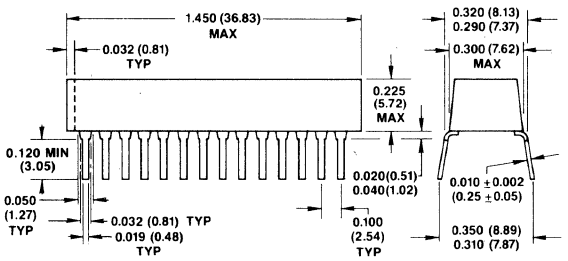
ELECTROMAGNETIC DELAY LINES

DIP PACKAGE "F," 10 TAP, 28 PIN

28 LEAD "DIP"

Td to Tr RATIO — 12:1 TYP.
TAPS @ 10% INCREMENTS OF Td.
CAN BE SERIES CONNECTED.
ATTENUATION — 0.6 dB MAX.





Dimensions In Inches (mm)

50Ω IMPEDANCE

Part Number	Delay Time (NS) (±5%)**	Rise Time (NS) (Maximum)	Taps (NS) (Typical)	DCR Ω (Maximum)
TF100-5	100	8.2	10 ns	3.4
TF120-5	120	9.3	12 ns	3.6
TF140-5	140	11.2	14 ns	3.8
TF160-5	160	12.5	16 ns	4.0
TF180-5	180	14.0	18 ns	4.4
TF200-5	200	15.0	20 ns	4.6

100Ω IMPEDANCE

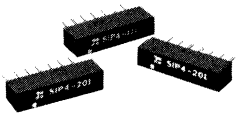
TF100-10	100	8.5	10 ns	4.5
TF120-10	120	9.5	12 ns	5.0
TF140-10	140	11.5	14 ns	5.5
TF160-10	160	12.5	16 ns	6.0
TF180-10	180	14.0	18 ns	6.4
TF200-10	200	15.0	20 ns	6.5

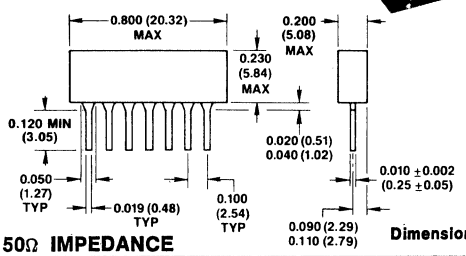
** Unless otherwise specified.

SIP PACKAGE 4, 5 TAP, 7 PIN

7 PIN "SIP"

Td to Tr RATIO — 4:1 TYP.
TAPS @ 20% INCREMENTS OF Td.
CAN BE SERIES CONNECTED.
ATTENUATION — .25 dB MAX.





Dimensions In Inches (mm)

50Ω IMPEDANCE

Part Number	Delay Time (NS) (±5%)**	Rise Time (NS) (Maximum)	Taps (NS) (Typical)	DCR Ω (Maximum)
SIP4-55	5 ±.5 ns	2.9	1	.5
SIP4-105	10 ±1 ns	3.8	2	.5
SIP4-155	15 ±1 ns	5.0	3	.5
SIP4-205	20	5.8	4	.7
SIP4-255	25	6.8	5	.9
SIP4-305	30	7.8	6	1.0
SIP4-355	35	8.8	7	1.25
SIP4-405	40	9.9	8	1.4
SIP4-455	45	11.6	9	1.5
SIP4-505	50	13.0	10	1.7
SIP4-755	75	19.0	15	1.9
SIP4-1005	100	28.0	20	2.0

100Ω IMPEDANCE

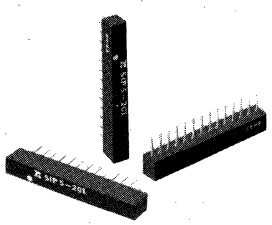
SIP4-51	5 ±.5 ns	3.6	1	.6
SIP4-101	10 ±1 ns	4.4	2	.7
SIP4-151	15 ±1 ns	5.6	3	.9
SIP4-201	20	7.3	4	1.2
SIP4-251	25	7.8	5	1.3
SIP4-301	30	8.3	6	1.4
SIP4-351	35	12.5	7	1.5
SIP4-401	40	15.2	8	1.6
SIP4-451	45	16.0	9	1.7
SIP4-501	50	17.0	10	1.8
SIP4-751	75	25.0	15	2.0
SIP4-1001	100	38.0	20	2.0

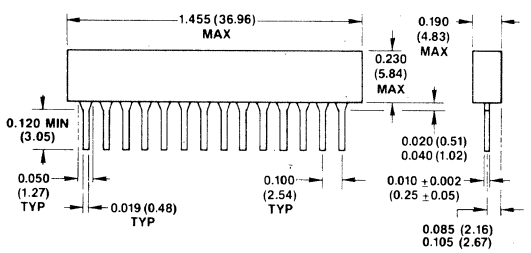
** Unless otherwise specified.

SIP PACKAGE 5, 10 TAP, 14 PIN

14 PIN "SIP"

Td to Tr RATIO — 8:1 TYP.
TAPS @ 10% INCREMENTS OF Td.
CAN BE SERIES CONNECTED.
ATTENUATION — 0.5 dB MAX.





Dimensions In inches (mm)

50Ω IMPEDANCE, 10 TAPS

Part Number	Delay Time (NS) (±5%)**	Rise Time (NS) (Maximum)	Taps (NS) (Typical)	DCR Ω (Maximum)
SIP5-105	10 ±1 ns	3.0	1.0	.7
SIP5-205	20	4.0	2.0	.7
SIP5-255	25	4.5	2.5	.9
SIP5-305	30	5.5	3.0	1.0
SIP5-405	40	6.0	4.0	1.2
SIP5-505	50	7.0	5.0	1.3
SIP5-605	60	8.0	6.0	1.6
SIP5-755	75	10.0	7.5	1.8
SIP5-1005	100	14.0	10.0	2.1

100Ω IMPEDANCE, 10 TAPS

SIP5-101	10 ±1 ns	3.8	1.0	.75
SIP5-201	20	4.6	2.0	1.5
SIP5-251	25	5.5	2.5	1.7
SIP5-301	30	5.8	3.0	2.0
SIP5-401	40	7.5	4.0	2.2
SIP5-501	50	8.0	5.0	2.3
SIP5-601	60	8.5	6.0	2.5
SIP5-751	75	14.0	7.5	3.0
SIP5-1001	100	18.0	10.0	3.2

** Unless otherwise specified.

Specifications subject to change without notice.

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15801 Chemical Lane • Huntington Beach, CA 92649 • (714) 898-0960 / (213) 594-8918 • TWX: 910-596-1826

Technitrol, Inc.

1952 East Allegheny Avenue
Philadelphia, PA 19134
Telephone (215) 426-9105 • Telex 834245

Technitrol delay-module performance is widely known and highly regarded by both military and commercial users. Many models, such as the ultrastable STTLDL shown below, are unmatched in performance and reliability. Designed primarily for high-performance applications, the STTLDL has very high output stability over a wide range of temperature and input-voltage variations. Increasingly, the STTLDL is selected as a commercial prototype for brand-new designs — and then written in because of the superior performance it offers.

We invite you to consider the STTLDL as an example of Technitrol capability. Its technology is an integral part of all our delay modules — including low-cost products — shown on this and the following pages.

ULTRA-STABLE TTL DELAY MODULES

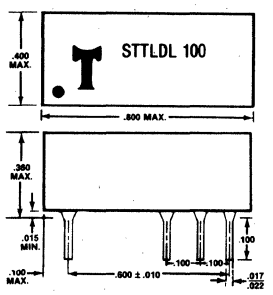
- Ultra stable. ±1 ns or ±1% delay tolerance over −55 to +125°C at 5V supply ±10%. 0 to 70°C available.
- 5 to 2000 ns delays available.
- Meets Mil-M-D-23859.
- Three-tap, lumped constant, active.
- For Schottky TTL, FAST, TTL, and low-power Schottky TTL circuits.
- Transfer-molded — reliable.
- Pin-compatible to 74/54 Series 14-pin DIP package.
- Trailing-edge timing available.

Recommended Operating Conditions	Min.	Typ.	Max.	Unit
Supply voltage V_{cc}	4.5	5.0	5.5	Volts
Operating ambient temp. range	−55	25	+125	°C

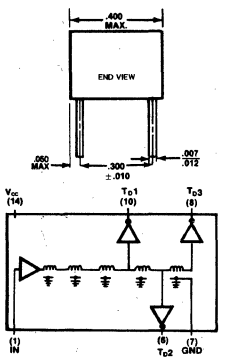
Minimum % input-pulse width to total delay	20%
Temperature coefficient at maximum delay	100 ppm/°C
Operable input-supply-voltage variance from 5V rated	±10%

Part No.	NANOSECONDS T_{D1}	T_{D2}	T_{D3}	All Taps (Max.) T_R+	T_R-
STTLDL025	15.0	20.0	25.0	2.0	2.0
STTLDL050	30.0	40.0	50.0	2.0	2.0
STTLDL075	45.0	60.0	75.0	2.0	2.0
STTLDL100	60.0	80.0	100.0	2.0	2.0
STTLDL125	75.0	100.0	125.0	2.0	2.0
STTLDL150	90.0	120.0	150.0	2.0	5.0
STTLDL200	120.0	160.0	200.0	2.0	5.0
STTLDL250	150.0	200.0	250.0	2.0	5.0
STTLDL500	300.0	400.0	500.0	2.0	9.0

Delay characteristics measured at V_{cc} = 4.5V to 5.5V; temperature range 0-70°C.



3-TAP



HIGH-PERFORMANCE TTL DELAY MODULES

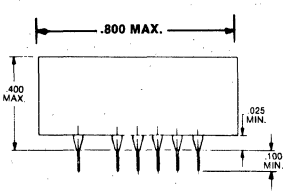
- ±1.5 ns or ±5% delay tolerance (whichever is greater) over 0 to 70°C. −55 to +125°C available.
- 5 to 500 ns delays.
- Meets MIL SPEC M-D-23859.
- Five-tap, lumped constant, active; available in ten-tap.
- For Schottky TTL, FAST, TTL, and low-power Schottky TTL circuits.
- Supply-voltage tolerance ±10%.
- Transfer-molded — reliable.
- Pin-compatible to 74/54 series 14-pin.
- DIP package.
- Trailing-edge timing available.

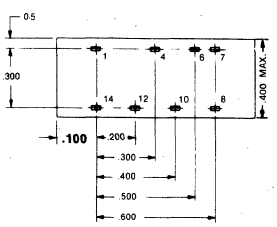
Recommended Operating Conditions	Min.	Typ.	Max.	Unit
Supply voltage V_{cc}	4.5	5.0	5.5	Volts
Operating ambient temp range	0	25	75	°C

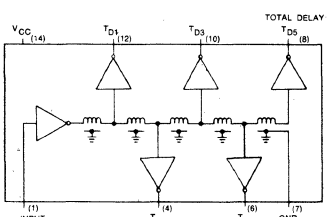
Minimum % input-pulse width to total delay	20%
Temperature coefficient at maximum delay	±2%
Operable input-supply-voltage variance from 5V rated	±10%

Part No.	NANOSECONDS T_{D1}	T_{D2}	T_{D3}	T_{D4}	T_{D5}	All Taps TR+ & TR−
TTLDL020	10.0 ±1.5	12.5 ± 1.5	15.0 ± 1.5	17.5 ± 1.5	20.0 ± 1.5	≤2.0 ≤2.0 nsec.
TTLDL025	5.0 ±1.5	10.0 ± 1.5	15.0 ± 1.5	20.0 ± 1.5	25.0 ± 1.5	≤2.0 ≤2.0 nsec.
TTLDL050	10.0 ±1.5	20.0 ± 1.5	30.0 ± 1.5	40.0 ± 2.0	50.0 ± 2.5	≤2.0 ≤2.0 nsec.
TTLDL075	15.0 ±1.5	30.0 ± 1.5	45.0 ± 2.25	60.0 ± 3.0	75.0 ± 3.75	≤2.0 ≤2.0 nsec.
TTLDL100	20.0 ±1.5	40.0 ± 2.0	60.0 ± 3.0	80.0 ± 4.0	100.0 ± 5.0	≤2.0 ≤2.0 nsec.
TTLDL125	25.0 ±1.5	50.0 ± 2.5	75.0 ± 3.75	100.0 ± 5.0	125.0 ± 6.25	≤2.0 ≤2.0 nsec.
TTLDL150	30.0 ±1.5	60.0 ± 3.0	90.0 ± 4.5	120.0 ± 6.0	150.0 ± 9.0	≤2.0 ≤5.0 nsec.
TTLDL200	40.0 ±2.0	80.0 ± 4.0	120.0 ± 6.0	160.0 ± 8.0	200.0 ±10.0	≤2.0 ≤5.0 nsec.
TTLDL250	50.0 ±2.5	100.0 ± 5.0	150.0 ± 7.5	200.0 ±10.0	250.0 ±12.5	≤2.0 ≤5.0 nsec.
TTLDL500	100.0 ±5.0	200.0 ±10.0	300.0 ±15.0	400.0 ±20.0	500.0 ±25.0	≤2.0 ≤9.0 nsec.

Delay characteristics measured at V_{cc} = 5.0V, 25°C no load.







CONNECTION DIAGRAM 5 TAP VERSION

Technitrol products: Manchester encoder/decoders • pulse transformers • data bus couplers • pulse-width regulators • delay lines including digital, fixed-constant-distributed, fixed-lumped-constant, programmable, and trimmer types • transformers including audio, autotransformer, chopper, constant-voltage, dc-to-dc-conversion, decade, differential, discriminator, driver, ferroresonant, filament, 400 Hz, high-voltage, input, instrument, interstage, inverter, isolation, magnetic-amplifier, matching, microminiature, microphone, mixing, modulation, output, plate, power, pc-mounting, pulse, rf, rectifier, reference, Scott T, servo, synchro-control, telephone-coupling, toroidal, transistor, voltage-dividing, voltage-regulating, voltage-stabilizing, wideband, MIL-audio, MIL-power, MIL-rf, and MIL-pulse, and MIL-variable types • saturable reactors • filter reactors • square-wave oscillators • magnetic amplifiers • coils including foil-wound, high-Q/low frequency, toroidal, and transformer types.

Technitrol, Inc.

1952 East Allegheny Avenue
Philadelphia, PA 19134
Telephone (215) 426-9105 • Telex 834245

STANDARD TTL DELAY MODULE

Low-profile delay modules with good performance **not** commensurate with their low cost. Half-size package available.

- Low cost.
- 0 to 70°C temperature range.
- 5X to 500 ns delay times available.
- Five-equal-tap line gives X ns, 2X ns, 3X ns, 4X ns, and 5X ns delay times.
- Available in ten-tap.
- For Schottky TTL, TTL, and low-power Schottky TTL circuits.
- Supply-voltage tolerance ±10%.
- Transfer-molded — reliable.
- Pin compatible to 74/54 series 14-pin DIP package.
- Trailing-edge timing available.
- HALF-DIP PACKAGE AVAILABLE.

Minimum % input-pulse width to total delay	40%
Temperature coefficient at maximum delay	±4%

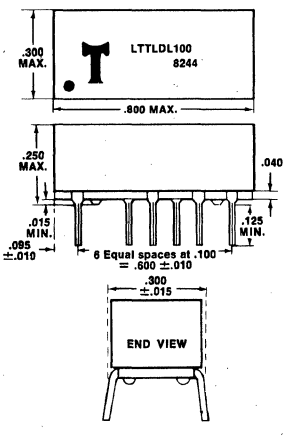
Higher performance modules available.

Part No.	NANOSECONDS TD1	TD2	TD3	TD4	TD5	All Taps (Max.) TR+	TR−
LTTLDL025	5.0	10.0	15.0	20.0	25.0	2.0	2.0
LTTLDL050	10.0	20.0	30.0	40.0	50.0	2.0	2.0
LTTLDL075	15.0	30.0	45.0	60.0	75.0	2.0	2.0
LTTLDL100	20.0	40.0	60.0	80.0	100.0	2.0	2.0
LTTLDL125	25.0	50.0	75.0	100.0	125.0	2.0	2.0
LTTLDL150	30.0	60.0	90.0	120.0	150.0	2.0	5.0
LTTLDL200	40.0	80.0	120.0	160.0	200.0	2.0	5.0
LTTLDL250	50.0	100.0	150.0	200.0	250.0	2.0	5.0
LTTLDL500	100.0	200.0	300.0	400.0	500.0	2.0	9.0

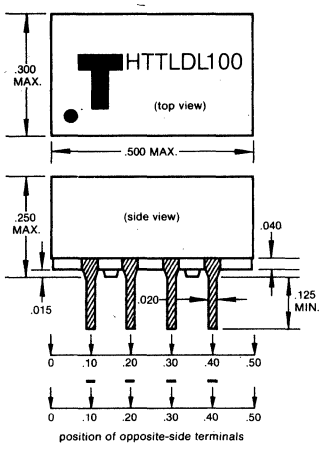
Delay characteristics measured at V_{cc} = 5.0V, 25°C no load.
Delay tolerance ±2 ns or 5% whichever is greater.

Recommended Operating Conditions	Min.	Typ.	Max.	Unit
Supply voltage V_{cc}	4.5	5.0	5.5	Volts
Operating ambient temp. range	0	25	70	°C

STANDARD LTTL PACKAGE



HALF-DIP HTTL PACKAGE

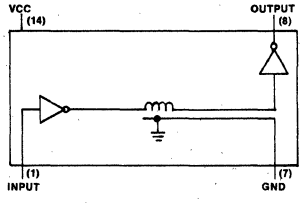


TECHNITROL TTL DELAY MODULES

Technitrol TTL delay modules are designed to be used directly with super-high-speed TTL, standard TTL, and DTL logic circuits. They interface with little or no additional requirements. They can be cascaded in various combinations to get any delay without degrading output rise time (T_R+ or T_R−). The delay rise-time ratio (T_D/T_R) of individual modules is very high (approximately 50:1) and improves with cascading modules. Output rise times of each module are independent of input rise times up to 50 ns. All Technitrol delay modules are transfer molded, not potted, assuring maximum reliable operating lives.

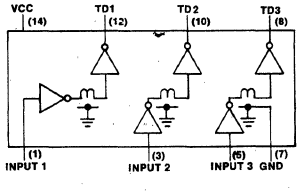
SINGLE-OUTPUT DELAY MODULES

Single-output modules are available with 5 to 500 ns delays. Buffered. Only the pins to be used are brought out.



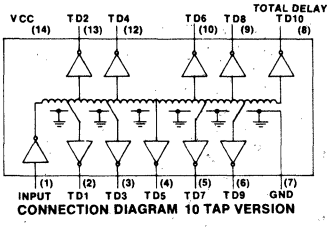
TRIPLE-OUTPUT DELAY MODULES

Technitrol TTL buffered delay modules are available with three individual inputs and outputs in delays from 5 to 250 ns per delay.



10-TAP DELAY MODULES

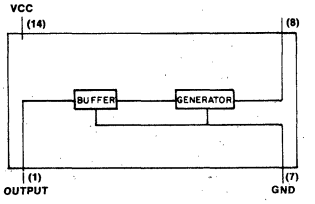
10-tap delay modules are available with 50 to 500 ns total delays. Dimensions same as standard 5-tap, with the exception of 5 additional pins. See connection diagram.



CONNECTION DIAGRAM 10 TAP VERSION

TTL SQUARE-WAVE OSCILLATORS

Available in 2 to 100 MHz frequency range. Frequency tolerance ±2%. Dimensions same as Technitrol standard 5-tap delay module.



Technitrol products: Manchester encoder/decoders • pulse transformers • data bus couplers • pulse-width regulators • delay lines including digital, fixed-constant-distributed, fixed-lumped-constant, programmable, and trimmer types • transformers including audio, autotransformer, chopper, constant-voltage, dc-to-dc-conversion, decade, differential, discriminator, driver, ferroresonant, filament, 400 Hz, high-voltage, input, instrument, interstage, inverter, isolation, magnetic-amplifier, matching, microminiature, microphone, mixing, modulation, output, plate, power, pc-mounting, pulse, rf, rectifier, reference, Scott T, servo, synchro-control, telephone-coupling, toroidal, transistor, voltage-dividing, voltage-regulating, voltage-stabilizing, wideband, MIL-audio, MIL-power, MIL-rf, and MIL-pulse, and MIL-variable types • saturable reactors • filter reactors • square-wave oscillators • magnetic amplifiers • coils including foil-wound, high-Q/low frequency, toroidal, and transformer types.

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Telephone (215) 426-9105 • Telex 834245

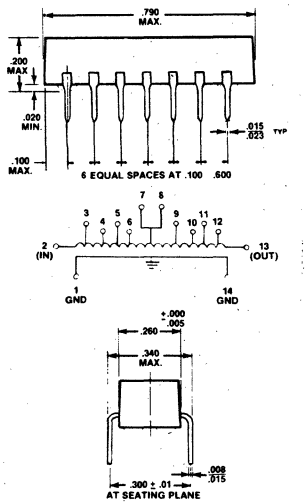
MINIATURE AND LUMPED-CONSTANT PASSIVE DELAY LINES
SIP AND DIP PACKAGES

- 5- and 10-tap.
- Impedances of 50, 75, 100, and 200 ohms.
- Temperature range −55 to +125°C.
- Temperature coefficient 100 ppm/°C.
- Maximum distortion ±10%.

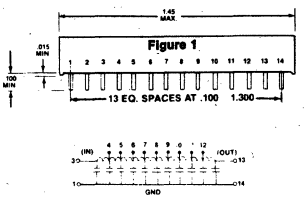
	Part No.*	Delay** (NS)	Rise Time (NS-Max.)	Impedance (Ohms) +10%	DCR (Ohms Max.)	Tap Delay (NS)
10 TAP	LF10D1	10.0	2.2	100	1.0	1.0
	LF10E1	12.5	2.5	100	1.0	1.2
	LF10F1	20.0	4.0	100	1.5	2.0
	LF10G1	25.0	5.0	100	1.5	2.5
	LF10K1	50.0	10.0	100	2.5	5.0
	LF10M1	100.0	20.0	100	5.0	10.0
	LF10P1	200.0	40.0	100	11.5	20.0
5 TAP	LF05C1	5.0	2.0	100	1.0	1.0
	LF05D1	10.0	3.5	100	1.0	2.0
	LF05E1	12.5	5.0	100	1.0	2.5
	LF05F1	20.0	7.0	100	1.0	4.0
	LF05G1	25.0	8.5	100	1.5	5.0
	LF05K1	50.0	17.0	100	2.5	10.0
	LF05M1	100.0	35.0	100	5.0	20.0

* Sample listing.
For DIP delay lines, use prefix LF in part number (as shown).
For SIP delay lines, use prefix SF. Otherwise, specify interchangeably.
** Delay tolerance ±1.5 ns or 5%, whichever is greater.

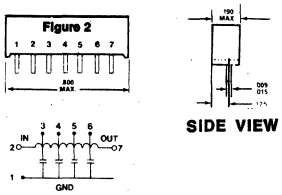
10-TAP DIP



10-TAP SIP

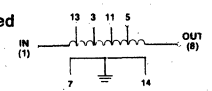


5-TAP SIP



5-TAP DIP

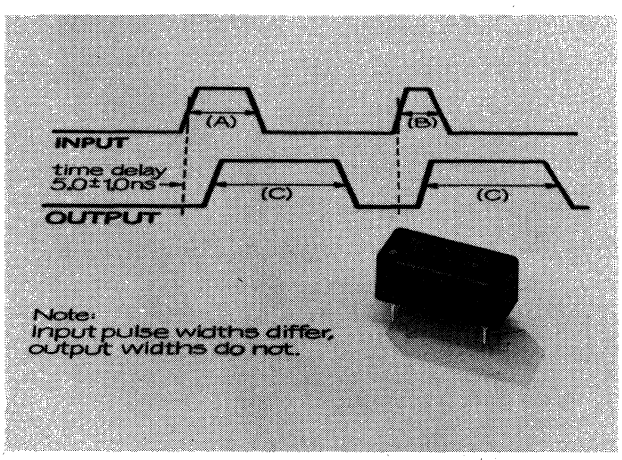
(Terminals used as marked, dimensions same as ten-tap.)



NEW TTL PULSE-WIDTH REGULATORS

A new concept. Takes TTL-level input signals of unequal duration and transforms these into TTL-level output signals of precisely timed and equal duration. Can replace a monostable multivibrator, and provide improved output stability.

5 ns minimum input-pulse width. 5 to 500 ns output-pulse width, as selected. Input-pulse width can vary; output-pulse width remains the same. Precisely timed output-pulse trailing edge permits trailing-edge timing or gating functions.



- 5 ns propagation delay from input to output.
- −55 to +125°C temperature range available.
- For Schottky TTL, TTL, and low-power Schottky TTL circuits.
- ±10% supply voltage tolerance.
- Minimum input-pulse width only 5 ns.
- Pin compatible with 74/54 series TTL/SSI 14-pin DIP.

Part No.	Pulse Width (PW) ns	Max. Input Freq. (MHz)	Part No.	Pulse Width (PW) ns	Max. Input Freq. (MHz)
TTLPW005	5.0	98.0	TTLPW060	60.0	8.0
TTLPW010	10.0	49.0	TTLPW070	70.0	6.5
TTLPW015	15.0	30.0	TTLPW075	75.0	6.0
TTLPW020	20.0	23.0	TTLPW100	100.0	4.0
TTLPW025	25.0	18.0	TTLPW150	150.0	3.0
TTLPW030	30.0	15.0	TTLPW200	200.0	2.0
TTLPW035	35.0	13.0	TTLPW250	250.0	1.9
TTLPW040	40.0	11.0	TTLPW300	300.0	1.5
TTLPW045	45.0	10.0	TTLPW400	400.0	1.0
TTLPW050	50.0	9.0	TTLPW500	500.0	0.9

- Delay Characteristics @ V_{CC} = 5.0V., 25°C no load.
- Pulse width tolerance ±1.5 ns or 5% whichever is greater.
- Maximum frequency with input pulse ≤ Pw.
- Input to output propagation delay (T_d) = 5 ±1.5 ns.
- Rise and fall time 2 ns max.

Technitrol products: Manchester encoder/decoders • pulse transformers • data bus couplers • pulse-width regulators • delay lines including digital, fixed-constant-distributed, fixed-lumped-constant, programmable, and trimmer types • transformers including audio, autotransformer, chopper, constant-voltage, dc-to-dc-conversion, decade, differential, discriminator, driver, ferroresonant, filament, 400 Hz, high-voltage, input, instrument, interstage, inverter, isolation, magnetic-amplifier, matching, microminiature, microphone, mixing, modulation, output, plate, power, pc-mounting, pulse, rf, rectifier, reference, Scott T, servo, synchro-control, telephone-coupling, toroidal, transistor, voltage-dividing, voltage-regulating, voltage-stabilizing, wideband, MIL-audio, MIL-power, MIL-rf, and MIL-pulse, and MIL-variable types • saturable reactors • filter reactors • square-wave oscillators • magnetic amplifiers • coils including foil-wound, high-Q/low frequency, toroidal, and transformer types.

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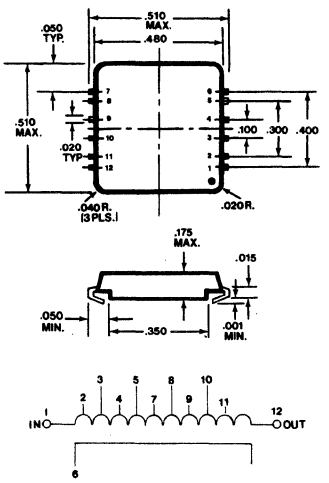
PASSIVE CHIP-CARRIER DELAY LINES, ½" AND ¾"

- Compact.
- Standard chip-carrier socket mounting.
- Designed for surface mounting via vapor-phase reflow soldering.
- Designed for TTL circuits.
- 10-tap.
- 10 to 200 ns delays.
- −55 to +125°C temperature range available.

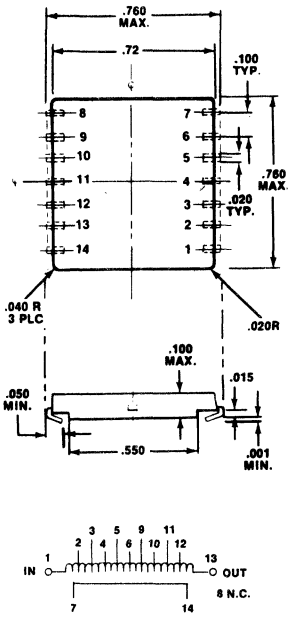
Part No.*	Total Delay T_D (ns)	Rise Time T_R (ns)	RDC (ohms)
BF10D1	10.0	2.2	1.0
BF10F1	20.0	4.0	2.0
BF10G1	25.0	5.0	3.0
BF10K1	50.0	10.0	5.0
BF10L1	75.0	15.0	6.5
BF10M1	100.0	20.0	8.0
CF10D1	10.0	2.2	1.0
CF10F1	20.0	4.0	2.0
CF10G1	25.0	5.0	3.0
CF10K1	50.0	10.0	5.0
CF10M1	100.0	20.0	8.0
CF10N1	125.0	25.0	9.0
CF10P1	150.0	30.0	10.0
CF-10Q1	200.0	40.0	12.0

* Sample listing. "BF" designates ½" models. "CF" designates ¾" models.

½" MODELS



¾" MODELS



ELECTRICAL CHARACTERISTICS

- Impedance (Z_O): 100 ohms ±10%
- Tap Delay: Every 10% of total delay
- Distortion: ±10%
- Temperature Coefficient (T_D): 100 PPM/°C
- Delay Tolerance: ±1.0 ns or 5% W.I.G.
- Input Pulse Width: Minimum 3 times output rise time
- Input Rise Time: 2 ns maximum
- Also available: 50 ohm and 200 impedance.

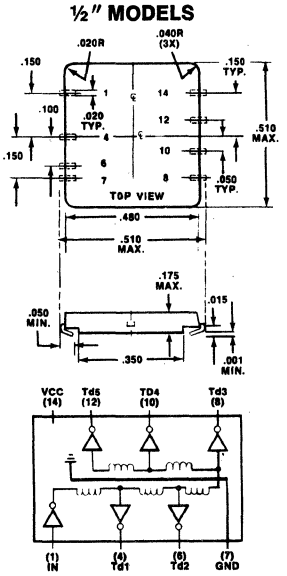
ACTIVE CHIP-CARRIER DELAY MODULES, ½" AND ¾"

- Compact.
- For Schottky TTL, TTL, and low-power Schottky TTL circuits.
- Standard chip-carrier socket mounting.
- Designed for surface mounting via reflow soldering.
- 5-tap.
- 5 to 200 ns delays.
- ±10% supply voltage tolerance.
- −55 to 125°C temperature range available.

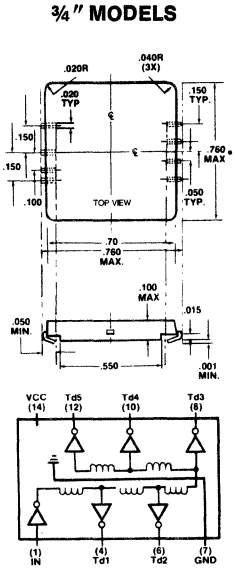
Part No.*	NANOSECONDS					All Taps (Max.)	
	T_{D1}	T_{D2}	T_{D3}	T_{D4}	T_{D5}	T_R+	T_R−
BTTLDL020	10.0	12.5	15.0	17.5	20.0	2.0	2.0
BTTLDL025	5.0	10.0	15.0	20.0	25.0	2.0	2.0
BTTLDL050	10.0	20.0	30.0	40.0	50.0	2.0	2.0
BTTLDL075	15.0	30.0	45.0	60.0	75.0	2.0	2.0
BTTLDL100	20.0	40.0	60.0	80.0	100.0	2.0	2.0
BTTLDL125	25.0	50.0	75.0	100.0	125.0	2.0	2.0
BTTLDL150	30.0	60.0	90.0	120.0	150.0	2.0	5.0
BTTLDL200	40.0	80.0	120.0	160.0	200.0	2.0	5.0

* Sample listing. For ½" delay modules, use prefix BT in part number (as shown). For ¾" delay modules, use prefix CT. Otherwise specify interchangeably.

½" MODELS



¾" MODELS



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ECL DELAY MODULES

DELAY CHARACTERISTICS

Part No.	NANOSECONDS T_{D1}	T_{D2}	T_{D3}	T_{D4}	T_{D5}	All Taps (Max.) T_R+*	T_R−*
ECLDL025	5 ±1.0	10 ± 1.0	15 ± 1.0	20 ± 1	25 ± 1.0	4	4
ECLDL050	10 ±1.0	20 ± 1.0	30 ± 1.5	40 ± 2	50 ± 2.5	4	4
ECLDL075	15 ±1.0	30 ± 1.5	45 ± 2.0	60 ± 3	75 ± 3.75	5	5
ECLDL100	20 ±1.0	40 ± 2.0	60 ± 3.0	80 ± 4	100 ± 5.0	6	6
ECLDL125	25 ±1.0	50 ± 2.5	75 ± 3.75	100 ± 5	125 ± 6.0	7	7
ECLDL150	30 ±1.5	60 ± 3.0	90 ± 4.5	120 ± 6	150 ± 7.5	7	7
ECLDL200	40 ±2.0	80 ± 4.0	120 ± 6.0	160 ± 8	200 ±10.0	8	8
ECLDL250	50 ±2.5	100 ± 5.0	150 ± 7.5	200 ±10	250 ±12.5	10	10
ECLDL300	60 ±3.0	120 ± 6.0	180 ± 9.0	240 ±12	300 ±15.0	15	15
ECLDL350	70 ±3.5	140 ± 7.0	210 ±10.5	280 ±14	350 ±17.5	15	15
ECLDL400	80 ±4.0	160 ± 8.0	240 ±12.0	320 ±16	400 ±20.0	15	15
ECLDL450	90 ±4.5	180 ± 9.0	270 ±13.5	350 ±18	450 ±22.5	20	20
ECLDL500	100 ±5.0	200 ±10.0	300 ±15.0	400 ±20	500 ±25.0	20	20

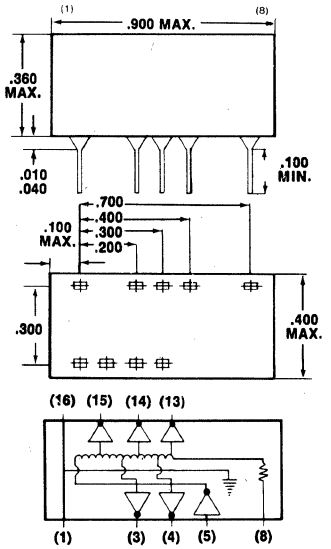
* T_R = Measured from 20% to 80%.

ELECTRICAL CHARACTERITICS

Over operating temperature range and Vee = −5.2 ±0.01V with 500 liner FPM air flow and all output terminals with 50Ω to −2.0 VDC.

Symbol	Parameter	Min.	Max.	Unit	Test Conditions
I_{EE}	Supply Current		75	MA	
I_{IH}	Input Current HIGH		425	MA	V_{IH} = −0.810V
I_{IL}	Input Current LOW	.5		MA	V_{IL} = —1.850V
V_{OH}	Logic "1" Output Voltage	−1.060	−0.700	VDC	V_{IH} = −0.810
V_{OL}	Logic "0" Output Voltage	−1.890	−1.615	VDC	V_{IL} = —1.850

All specifications are subject to change without notice.



Recommended Operating Conditions	Min.	Typ.	Max.
Vee	−5.72	−5.2	−4.68
Operating temp. range With Airflow 500 LFPM	−30°C	25°C	80°C
Fan Out			85 ECL Loads

10K ECL PROGRAMMABLE DELAY LINE MODULES

DELAY CHARACTERISTICS Ta = 25°C

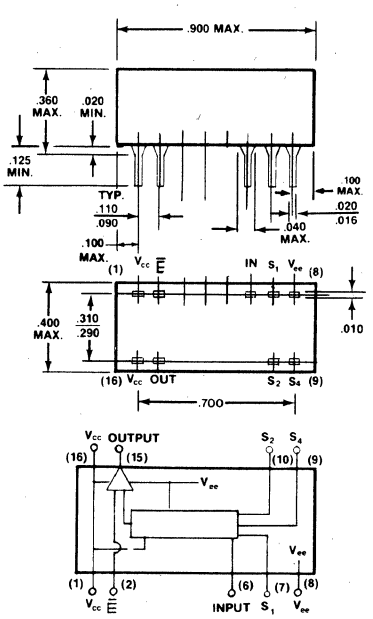
Technitrol Part No.	Step Delay ns ±ns	Max. Delay ns ±ns
ECLPG301	1.0 ±0.4	11.0 ± 1.5
ECLPG302	2.0 ±0.6	17.0 ± 1.5
ECLPG303	3.0 ±1.0	24.0 ± 1.5
ECLPG304	4.0 ±1.0	31.0 ± 2.0
ECLPG305	5.0 ±1.5	38.0 ± 2.0
ECLPG306	6.0 ±1.5	45.0 ± 2.5
ECLPG307	7.0 ±1.5	52.0 ± 2.5
ECLPG308	8.0 ±1.5	59.0 ± 3.0
ECLPG309	9.0 ±1.5	66.0 ± 3.5
ECLPG310	10.0 ±1.5	73.0 ± 4.0
ECLPG315	15.0 ±1.5	108.0 ± 5.0
ECLPG320	20.0 ±1.5	143.0 ± 7.0
ECLPG325	25.0 ±1.5	178.0 ± 9.0
ECLPG330	30.0 ±2.0	213.0 ±11.0
ECLPG335	35.0 ±2.0	248.0 ±12.0
ECLPG340	40.0 ±2.5	283.0 ±14.0
ECLPG345	45.0 ±2.5	318.0 ±16.0
ECLPG350	50.0 ±2.5	353.0 ±17.0

ELECTRICAL CHARACTERISTICS

Over operating temperature range and Vee = −5.2 ±0.01V with 500 liner FPM air flow and all output terminals with 50Ω to −2.0 VDC.

Symbol	Parameter	Min.	Max.	Unit	Test Conditions
I_{EE}	Supply Current		100	MA	
I_{IH}	Input Current HIGH		13.0	MA	V_{IH} = −0.810V
I_{IL}	Input Current LOW	.5	600	MA	V_{IL} = −1.850V
V_{OH}	Logic "1" Output Voltage	−1.060	−0.700	VDC	V_{IH} = −0.810
V_{OL}	Logic "0" Output Voltage	−1.890	−1.615	VDC	V_{IL} = —1.850

All specifications subject to change without notice.



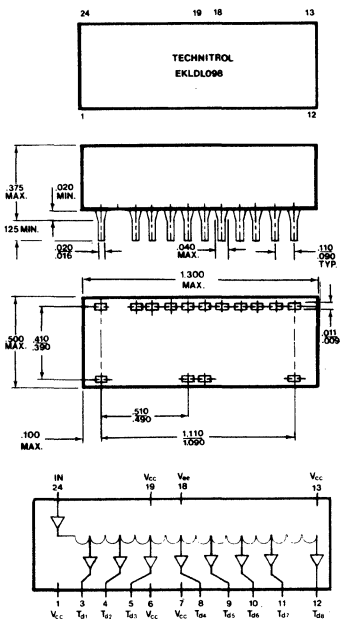
Technitrol products: Manchester encoder/decoders • pulse transformers • data bus couplers • pulse-width regulators • delay lines including digital, fixed-constant-distributed, fixed-lumped-constant, programmable, and trimmer types • transformers including audio, autotransformer, chopper, constant-voltage, dc-to-dc-conversion, decade, differential, discriminator, driver, ferroresonant, filament, 400 Hz, high-voltage, input, instrument, interstage, inverter, isolation, magnetic-amplifier, matching, microminiature, microphone, mixing, modulation, output, plate, power, pc-mounting, pulse, rf, rectifier, reference, Scott T, servo, synchro-control, telephone-coupling, toroidal, transistor, voltage-dividing, voltage-regulating, voltage-stabilizing, wideband, MIL-audio, MIL-power, MIL-rf, and MIL-pulse, and MIL-variable types • saturable reactors • filter reactors • square-wave oscillators • magnetic amplifiers • coils including foil-wound, high-Q/low frequency, toroidal, and transformer types.

Technitrol, Inc.

1952 East Allegheny Avenue
Philadelphia, PA 19134
Telephone (215) 426-9105 • Telex 834245

100K ECL DELAY MODULES

- 100K ECL input and output.
- 24 pin transfer molded dip package on .400 lead center.
- Available in delays from 5 ns to 200 ns.
- Eight (8) equal taps each buffered with 70 ECL fanout capacity.
- Operating temperature range 0°C to 85°C.
- Other delays available.



DELAY CHARACTERISTICS : TA, +25°C, Vee −4.5V ±.1V

Technitrol Part No.	T_{D1} ns	T_{D2} ns	T_{D3} ns	T_{D4} ns	T_{D5} ns	T_{D6} ns	T_{D7} ns	T_{D8} ns	Tol. T_{D1} (ns or %, WIG)
EKLDL005	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	± .25 or 10%
EKLDL008	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	± .40 ns
EKLDL016	2.0	4.0	6.0	8.0	10.0	12.0	14.0	16.0	± .50 or 5%
EKLDL025	4.0	7.0	10.0	13.0	16.0	19.0	22.0	25.0	±1.0 or 5%
EKLDL032	4.0	8.0	12.0	16.0	20.0	24.0	28.0	32.0	±1.5 or 5%
EKLDL040	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	±1.5 or 5%
EKLDL048	6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0	±1.5 or 5%
EKLDL056	7.0	14.0	21.0	28.0	35.0	42.0	49.0	56.0	±1.5 or 5%
EKLDL064	8.0	16.0	24.0	32.0	40.0	48.0	56.0	64.0	±1.5 or 5%
EKLDL072	9.0	18.0	27.0	36.0	45.0	54.0	63.0	72.0	±1.5 or 5%
EKLDL080	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	±1.5 or 5%
EKLDL100	12.5	25.0	37.5	50.0	62.5	75.0	87.5	100.0	±1.5 or 5%
EKLDL120	15.0	30.0	45.0	60.0	75.0	90.0	105.0	120.0	±1.5 or 5%
EKLDL160	20.0	40.0	60.0	80.0	100.0	120.0	140.0	160.0	±1.5 or 5%
EKLDL200	25.0	50.0	75.0	100.0	125.0	150.0	175.0	200.0	±1.5 or 5%

Specifications subject to change without notice.

100K ECL PROGRAMMABLE DELAY LINE MODULES

DELAY CHARACTERISTICS Ta = 25°C

Technitrol Part No.	Step Delay ns ±ns	Max. Delay ns ±ns
EKLPGR10	0.10 ±0.05	3.50 ±1.0
EKLPGR25	0.25 ±0.13	5.75 ±1.0
EKLPGR50	0.50 ±0.20	9.50 ±1.0
EKLPGR75	0.75 ±0.25	13.25 ±1.5
EKLPG010	1.00 ±0.40	17.00 ±1.5
EKLPG015	1.50 ±0.50	24.50 ±1.5
EKLPG020	2.00 ±0.50	32.00 ±1.5
EKLPG025	2.50 ±0.50	39.50 ±2.0
EKLPG030	3.00 ±0.50	47.00 ±2.5
EKLPG035	3.50 ±0.50	54.50 ±2.5
EKLPG040	4.00 ±0.50	62.00 ±3.0
EKLPG045	4.50 ±0.50	69.50 ±3.0
EKLPG050	5.00 ±1.00	77.00 ±4.0
EKLPG060	6.00 ±1.00	92.00 ±5.0
EKLPG070	7.00 ±1.00	107.00 ±5.0
EKLPG080	8.00 ±1.00	122.00 ±6.0
EKLPG090	9.00 ±1.00	137.00 ±7.0
EKLPG100	10.00 ±1.00	152.00 ±8.0

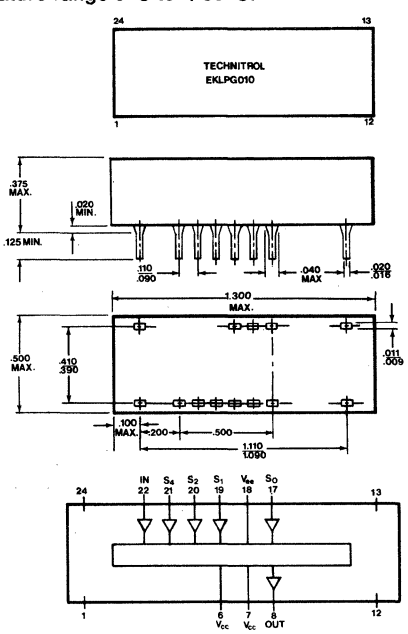
ELECTRICAL CHARACTERISTICS

- For 100K ECL Programmable Delay Line Module
- V_{ee} = 4.5V ±5%
- 500 linear FPM air flow and output terminated with 50 ohm to − 2.0 VDC

Symbol	Parameter	Min.	Max.	Unit	Test Conditions
I_{EE}	Supply Current		115	MA	
I_{IH}	Input Current HIGH		13.0	MA	V_{IH} = −0.880V
I_{IL}	Input Current LOW	.5	.600	MA	V_{IL} = −1.810V
V_{OH}	Logic "1" Output Voltage	−1.025	−0.880	VDC	V_{IH} = −0.880
V_{OL}	Logic "0" Output Voltage	−1.810	−1.620	VDC	V_{IL} = −1.810

Specifications subject to change without notice.

- 100K ECL input and output.
- Four (4) bit binary (1, 2, 4, 8) programming gives 15 equal step delays.
- Available in 18 step delays from .1 ns to 10 ns; other step delays available.
- Low inherent delay (T_O) T_O = 2.0 ±1.0 ns.
- Seventy (70) ECL fanouts.
- Temperature range 0°C to +85°C.



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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K
kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L
LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microforad
MHz megahertz
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOSIGT metal-oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM nuclear instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLL phased lock loop
PPI plan position indicator
PROM programmable read only memory
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

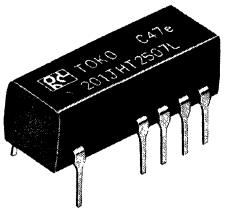
Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

TOKO AMERICA DELAY LINES/ PULSE TRANSFORMERS

DELAY LINES

- 20 Years of experience in manufacturing delay lines.
- Standard DIP packaging suitable for automated insertion lowering your installation costs.
- Highest quality design and manufacturing techniques render superior utilization of electromagnetic coupling, providing exceptionally low distortion and unusually fast rise time.
- A measure of reliability that can be counted on to perform in the most critical applications.



GENERAL SPECIFICATIONS

	R5ET	JAT	PICODELAY	RET	RHT	JBT
Temp. Range Operating	0 to +70°c	0 to +70°c	—	0 to +70°C	0 to +70°c	0 to +70°c
Storage	−55 to +125°c	−45 to +125°c	—	−50 to +125°c	−40 to +120°C	−45 to +125°c
Insulation Resistance	>100 mΩ @ 50 vdc	100 mΩ @ 50 vdc	Over 100 mΩ (50 vdc)	50 vdc 100 mΩ min	—	>100 mΩ @ 50v
Waveform Distortion	Within ±10%	Within ±15%	Within ±10%	Within ±10%	—	—
Temperature Coefficient	<±100 ppm/°c	150 ppm/°c	Below ±100 ppm/°c	Within ±100 ppm/°c	—	150 ppm/°c
Peak Pulse	50v	—	50v	50v	—	—
Packaging			Epoxy Transfer Molded			

ELECTRICAL SPECIFICATIONS

JAT TYPE — 14 PIN DIP/10 TAP PASSIVE

Type No.	Impedance Zo (Ω) ±10%	Delay Time Td (ns) ±5%	Type No.	Impedance Zo (Ω) ±10%	Delay Time Td (ns) ±5%
101JAT/IMPEDANCE Zo(Ω) ±10% −100			**201JAT/IMPEDANCE Zo(Ω) ±10% −200**		
1007L	100	10 ±2	5007L	200	50
2007L	100	20 ±2	1006L	200	100
3007L	100	30 ±2	1506L	200	150
4007L	100	40	2006L	200	200
5007L	100	50	2506L	200	250
6007L	100	60	3006L	200	300
7007L	100	70	**301JAT/IMPEDANCE Zo(Ω) ±10% −300**		
8007L	100	80			
9007L	100	90	5007L	300	50
1006L	100	100	1006L	300	100
1256L	100	125	1506L	300	150
1506L	100	150	2006L	300	200
2006L	100	200	2506L	300	250
2506L	100	250	**501JAT/IMPEDANCE Zo(Ω) ±10% −500**		
3006L	100	300			
201JAT/IMPEDANCE Zo(Ω) ±10% −200			5007L	500	50
3007L	200	30 ±2	1006L	500	100
4007L	200	40	1506L	500	150

RHT/JHT TYPE — 14 PIN DIP/5 TAP BUFFERED

201RHT/Vcc = 5.0 ±0.1V, Ta = +25°C ±2°C

Type No.	Total Delay Time ±5% (ns)	Delay Time per Tap (ns)	Rise Time Tro Max (ns)	No. of Taps
2007	20 ±2	4 ±2	3	5
2507	25 ±2	5 ±2	3	5
5007	50	10 ±2	3	5
7507	75	15 ±2	3	5
1006	100	20 ±2	3	5
1506	150	30 ±3	3	5
2006	200	40 ±4	4	5
2506	250	50 ±5	4	5

PICODELAY™ — 10 TAP PASSIVE

Type No.	Delay Time Td(PS) ±10%	Delay Time per Tap Td(PS)	Rise Time Tr(PS) Max
101RET/CHAR. IMPEDANCE Zo(Ω) ±10% −100			
2008L—2	2000	200	1800
5008L—2	5000	500	2200
1007L—2	10000	1000	3000
101R20ET/CHAR. IMPEDANCE Zo(Ω) ±10% −100			
2008F—1	2000	200	1800
5008F—1	5000	500	2200
1007F—1	10000	1000	3000

R5ET TYPE — 14 PIN DIP/5 TAP PASSIVE

Type No.	Total Delay Time Td(ns) ±5%	Delay Time per Tap (ns)	Rise Time Tr (ns) Max
101R5ET/IMPEDANCE Zo(Ω) ±10% −100			
1007	10 ±2	2 ±0.7	4.0
2007	20 ±2	4 ±1.0	7.0
2507	25 ±2	5 ±1.0	8.5
5007	50	10 ±2.0	14.5
1006	100	20 ±3.0	35.0
1506	150	30 ±4.0	43.0
2006	200	40 ±4.0	59.0
2506	250	50 ±5.0	70.0
201R5ET/IMPEDANCE Zo(Ω) ±10% −200			
1007	10 ±2	2 ±0.7	4.0
2007	20 ±2	4 ±1.0	6.5
5007	50	10 ±2.0	15.0
1006	100	20 ±3.0	32.0
2006	200	40 ±4.0	61.0
3006	300	60 ±5.0	86.0
301R5ET/IMPEDANCE Zo(Ω) ±10% −300			
2007	20 ±2	4 ±1.0	8.0
5007	50	10 ±2.0	15.0
1006	100	20 ±3.0	32.0
1506	150	30 ±4.0	45.0
2006	200	40 ±4.0	57.0
501R5ET/IMPEDANCE Zo(Ω) ±10% −500			
5007	50	10 ±2.0	15.0
1006	100	20 ±3.0	29.0

RET TYPE — 14 PIN DIP/10 TAP PASSIVE

Type No.	Total Delay Time Td(ns) ±5%	Delay Time per Tap (ns)	Rise Time Tr (ns) Max
L-CONNECTIONS 101RET/IMPEDANCE Zo(Ω) ±10% −100			
1007L	10 ±1	1 ±0.4	3.0
2007L	20 ±2	2 ±0.7	4.5
3007L	30 ±2	3 ±1.0	6.5
4007L	40	4 ±1.2	7.0
5007L	50	5 ±1.5	9.0
6007L	60	6 ±1.6	10.5
7007L	70	7 ±1.7	12.5
8007L	80	8 ±1.8	14.0
9007L	90	9 ±1.9	16 0
1006L	100	10 ±2.0	17.5
1256L	125	12.5 ±2.5	22.0
1506L	150	15 ±2.5	26.5
2006L	200	20 ±3.0	35.0
2506L	250	25 ±3.0	44.0
3006L	300	30 ±3.5	52.5
201RET/IMPEDANCE Zo(Ω) ±10% −200			
3007L	30 ±2	3 ±1.0	6.0
4007L	40	4 ±1.2	7.0
5007L	50	5 ±1.5	9.0
1006L	100	10 ±2.0	17.5
1506L	150	15 ±2.5	26.5
2006L	200	20 ±3.0	35.0
2506L	250	25 ±3.0	45.0
3006L	300	30 3.5	54.0
301RET/IMPEDANCE Zo(Ω) ±10% −300			
5007L	50	5 ±1.5	9.0
1006L	100	10 ±2.0	17.5
1506L	150	15 2.5	26.5
2006L	200	20 ±3.0	35.0
2506L	250	25 ±3.0	48.0
501RET/IMPEDANCE Zo(Ω) ±10% −500			
5007L	50	5 ±1.5	11.5
1006L	100	10 ±2.0	18.0
1506L	150	15 ±2.5	32.0
L-5 CONNECTIONS 101RET/IMPEDANCE Zo(Ω) ±10% −500			
1007L-5	10 ±1	1 ±0.4	3.0
2007L-5	20 ±2	2 ±0.7	4.5
5007L-5	50	5 ±1.5	9.0
1006L-5	100	10 ±2.0	17.5
2006L-5	200	20 ±3.0	35.0

JBT — 7 PIN SIP/5 TAP PASSIVE

Part No.	Impedance, Zo, Ω, ±10%	Delay Time, Td ns, ±5%	Delay Time Between Taps, ns	Rise & Fall Time, Tri ns, Max 10-90% (for ref.)	Rise & Fall Time, Tri ns, Max TTL Level
101JBT2007	100	20 ±2 ns	4 ±1.5	7.0	5.0
101JBT4007	100	40	8 ±2	13.0	9.0
101JBT5007	100	50	10 ±2	14.0	11.0
101JBT1006	100	100	20 ±3	35.0	22.0
101JBT1506	100	150	30 ±3	43.0	27.0
101JBT2006	100	200	40 ±3	59.0	37.0
301JBT2007	300	20 ±2 ns	4 ±1.5	8.0	6.0
301JBT4007	300	40	8 ±2	13.0	9.0
301JBT5007	300	50	10 ±2	15.0	12.0
301JBT1006	300	100	20 ±3	35.0	22.0
301JBT1506	300	150	30 ±3	45.0	28.0
301JBT2006	300	200	40 ±3	57.0	36.0
351JBT5007	350	50	10 ±2	13.0	9.0
351JBT1006	350	100	20 ±3	35.0	22.0

Q30 TYPE — 16 PIN DIP/ 4 TRANSFORMERS PER PKG.

Part No.	Turns Ratio N1: N2:N3 ±5%	Mag. Ind. Lm (μH) ±20%	ET Constant (μSV) Min.	Leakage Ind. Lli (μH) Max	Interwind. Cap. Cw (pF) Max	DC Resist. R dc (Ω) Max
Q30AJN3-1AA4	1:1	4	0.6	0.15	7	0.25
Q30AJN5-1AA4	1:1	11	0.9	0.15	11	0.30
Q30AJN7-1AA4	1:1	22	1.2	0.15	15	0.30
Q30AJN9-1AA4	1:1	36	1.7	0.20	20	0.35
Q30ASQ10-1AA4	1:1	100	2.8	0.15	12	0.30
Q30ASQ13-1AA4	1:1	170	3.5	0.16	16	0.35
Q30ASQ17-1AA4	1:1	300	4.6	0.18	19	0.40
Q30AXQ16-1AA4	1:1	550	6.2	0.20	18	0.35
Q30AXQ22-1AA4	1:1	1050	8.0	0.25	27	0.35
Q30AWQ6-R2LA4	2:1	4	0.6	0.30	7	0.25
Q30AJN6-R2LA4	2:1	15	0.9	0.30	11	0.30
Q30AHQ8-R2LA4	2:1	25	1.4	0.40	18	0.35
Q30AJN12-R2LA4	2:1	55	2.0	0.40	14	0.30
Q30ASQ10-R2LA4	2:1	100	2.8	0.40	12	0.30
Q30AXQ16-R2LA4	2:1	550	6.2	0.40	18	0.35
Q30AXQ22-R2LA4	2:1	1050	8.0	0.40	25	0.40
Q30AJN3-1BB2	1:1:1	4	0.6	0.30	14	0.25
Q30AJN4-1BB2	1:1:1	7	0.7	0.30	18	0.30
Q30AJN5-1BB2	1:1:1	11	0.9	0.30	22	0.30
Q30AJN6-1BB2	1:1:1	16	1.1	0.30	26	0.30
Q30AJN7-1BB2	1:1:1	22	1.2	0.30	30	0.30
Q30ASQ7-1BB2	1:1:1	55	2.0	0.40	28	0.30
Q30ASQ10-1BB2	1:1:1	100	2.8	0.30	24	0.30

PULSE TRANSFORMERS

GENERAL SPECIFICATIONS

Operating Temperature:	0 ~ +70°C	**Peak Pulse Voltage:**	50V
Storage Temperature:	−50 ~ +125°C	**Packaging:**	Epoxy Transfer-mold
Insulation Resistance:	250V DC10³MΩ	**Pin Material:**	Phosphor Bronze Solder Plated (P10H) Phosphor Bronze SN Plated (930)
Maximum Current:	800 mA (at Duty Cycle 0.1)		

P10H TYPE

Part Number	Turns Ratio ±5%	Lm (μH)	ET Constant (μSV) Min.	Cw (pF) Max	Lli (μH) Max	Rdc (Ω) Max
P10HHS12-1AA	1:1	75	9.0	18.5	0.22	0.40
P10HSS9-1AA	1:1	100	9.0	14.0	0.18	0.35
P10HSS11-1AA	1:1	170	10.0	17.0	0.20	0.38
P10HSS15-1AA	1:1	300	15.0	22.0	0.23	0.48
P10HSS17-1AA	1:1	400	17.0	26.0	0.25	0.53
P10HSS20-1AA	1:1	550	21.0	29.0	0.27	0.60
P10HSS24-1AA	1:1	750	25.0	34.0	0.30	0.68
P10HTS19-1AA	1:1	1000	21.0	27.5	0.27	0.55
P10HTS23-1AA	1:1	1500	23.0	33.0	0.30	0.65
P10HTS26-1AA	1:1	2000	26.0	38.5	0.35	0.75
P10HTS32-1AA	1:1	3000	28.0	46.5	0.37	0.90

Toko America, Inc. Corporate Offices / 1250 Feehanville Drive / Mount Prospect, IL 60056 / Tel. 312-297-0070 / Telex 72-4372 / FAX 312-297-8063
California Office / 10050 N. Wolfe Rd. / SW3-361 / Cupertino, CA 95014 / Tel. 408-996-7575 / FAX 408-996-7280
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FROM CERAMIC POWDER TO MIL-APPROVED TEST LABS . . . MURATA ERIE HAS IT ALL – 100% IN-HOUSE

Only one company can deliver your total EMI Ceramic Filter needs . . .Murata Erie.

We've been applying sophisticated ceramic and related technologies to developing superior filters for more than 40 years. Today, Murata Erie has, by far, the broadest line of subminiature EMI Filters in the world.

The scope of our product line extends from tiny high frequency filters through AC power line filters specifically designed to meet FCC requirements – filtered connectors and custom filter assemblies . . . all offering the ultimate in quality. With this experience, you receive a unique responsibility, for only Murata Erie builds the complete filter in a plant devoted exclusively to the design and manufacture of EMI Filters.

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For technical assistance, call 613-392-2581.

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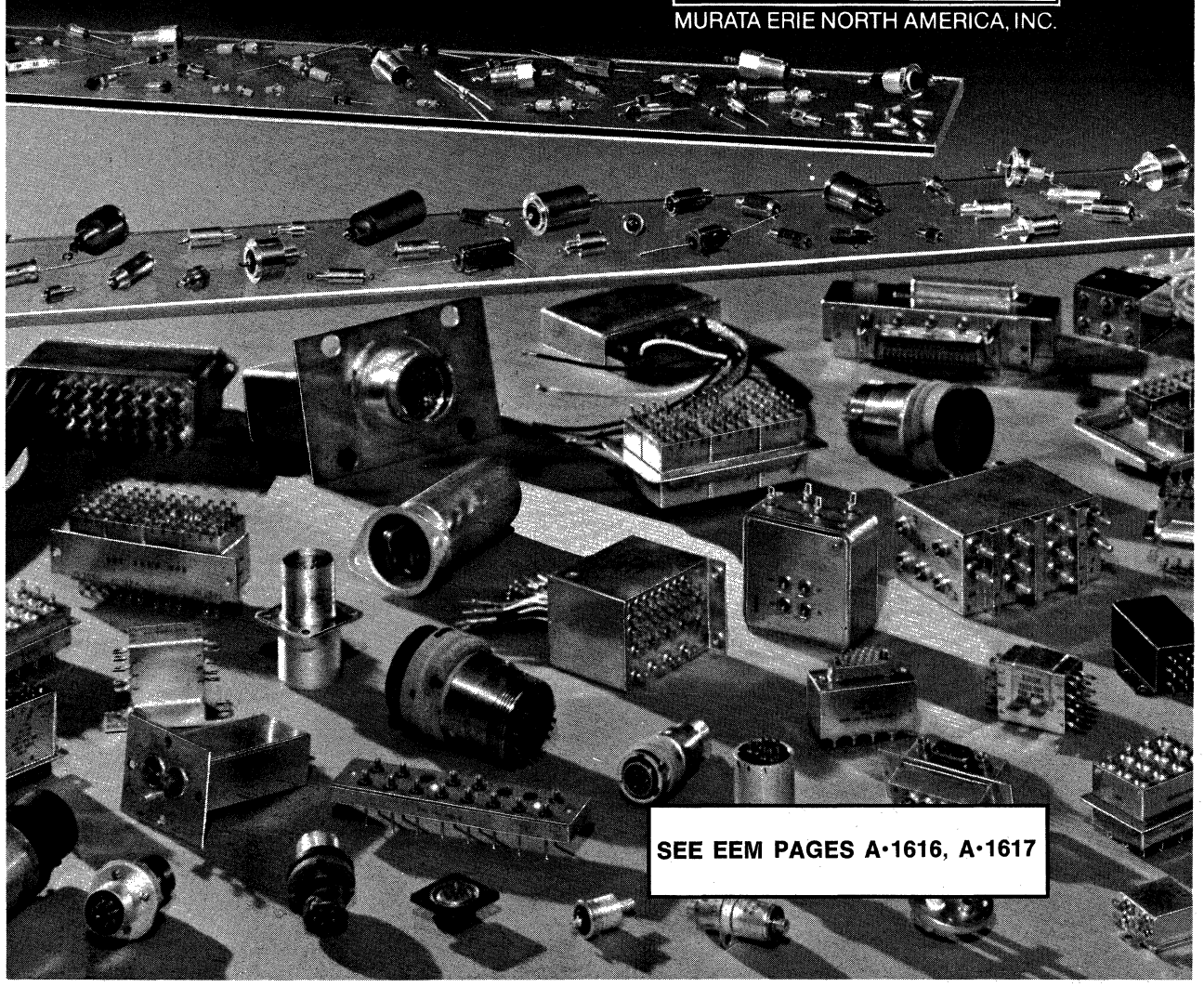

SEE EEM PAGES A•1616, A•1617

FILTERS

Manufacturer	EEM Page No.	Low Pass	High Pass	Band-pass (Incl. SAW)	Band Reject	AF	IF	RF/ Micro-wave	VHF/ UHF	Active	Digital	Variable (Incl. Prgrmbl.)	LC	EMI/RFI	Video	Equal-izer	Other
Allen Avionics	A•1584 A•1589	●	●	●	●			●	●				●			●	Monitors, Micro-wave; Equalizers, Delay; Linear Phase
AMP Incorporated	A•1590													●			
Andersen Labs	A•1591			●													
A. P. Circuit	A•1592	●	●	●	●	●				●		●					Hybrid
Chesterfield Products	A•1593	●	●	●													
Compac	A•1594	●						●						●			
Comstron Corp.	A•1595	●		●	●	●	●	●	●	●			●				MIL; Hybrid; Telemetering; Vestigial Sideband; Single Sideband
Corcom	A•1596													●			
Cornell Dubilier	A•1597													●			
Curtis Industries	A•1599		●	●				●			●			●			Linear Phase
Delta Electronic	A•1600 A•1601													●			
Electronic Precision Comps.	A•1603	●	●	●	●	●	●			●			●			●	Telemetering; MIL; Tone
ESC Electronics	A•1604 A•1605	●	●	●	●	●	●	●	●				●				Linear Phase; MIL
Filter Concepts	A•1606 A•1607													●			Chokes
Filtron/Aeroflex	A•1608		●	●				●						●			Telephone, Signal Line
Frequency Devices	A•1609	●	●	●	●						●	●					
Hisonic	A•1610							●									MIL
JMK Inc.	A•1611													●			
KR Electronics	A•1613	●	●	●	●		●	●					●		●	●	Linear Phase
Metuchen Capacitors	A•1614 A•1615													●			
Microsonics	A•1386												●				
Murata Erie	A•1616 A•1617													●			MIL; Filtered Connectors
Opt	A•1401												●				
Piconics	A•1618	●	●	●	●	●		●	●				●				Linear Phase; Vestigial Sideband; MIL; Coaxial
Polyphase Instrument	A•1619-A•1622	●	●	●	●	●				●							MIL
Potter	A•1623													●			
Power Dynamics	A•1628													●			Some Models for Export
Precision Filters	A•1624-A•1627	●	●	●	●					●		●					Linear Phase; Synchronous Tracking
RFI Corp.	A•1629													●			MIL
Sawtek	A•1433			●													
SFE Technologies	A•1630 A•1631	●												●			MIL; International Connector
Signal Transformer	A•1632 A•1633													●			
Sokol	A•1435												●				
Spectrum Control	A•1635-A•1637													●			Filtered Connectors
Standex Electronics	A•1638 A•1639													●			
TDK Corp.	A•1640 A•1641													●			
Toko America	A•1643					●		●		●	●		●		●		Mechanical; Ceramic
TTE, Inc.	A•1644-A•1655	●	●	●	●	●	●	●	●	●							Telemetering; Linear Phase
Tusonix	A•1656 A•1657			●					●					●			

ALLEN AVIONICS, INC.

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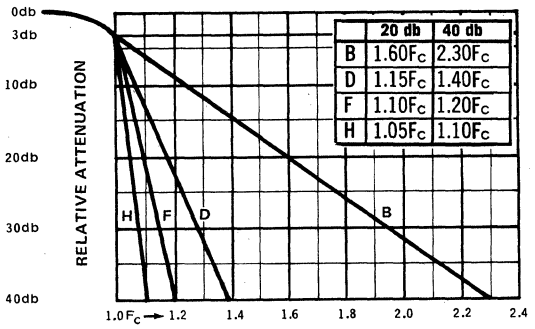
DELAY LINES
SECTION 2350
WRITE FOR CATALOG

CUSTOM-BUILT LOWPASS & HIGHPASS L-C FILTERS

FAST DELIVERY ON PROTOTYPES

Types: Butterworth, Tchebycheff, Gaussian, Bessel and Elliptic Function.
Frequency Range: 200 Hz to 200 MHz.
Construction: Epoxy encapsulated or sealed in metal can.
The Lowpass and Highpass Filters listed below are typical units that we build. We do manufacture units with shape factors and cut-off frequencies in-between those listed.

LOW PASS FILTERS



	20 db	40 db
B	1.60Fc	2.30Fc
D	1.15Fc	1.40Fc
F	1.10Fc	1.20Fc
H	1.05Fc	1.10Fc

SIZE (INCHES)

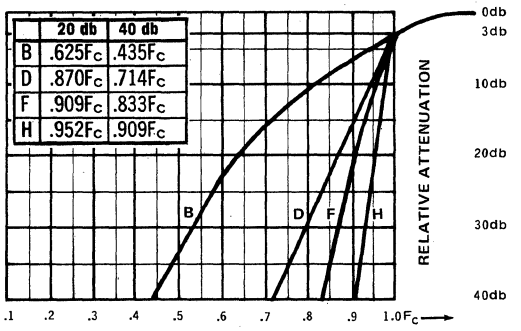
Sealed in Metal Can with B.N.C. Connectors:

L — 2.00 x 1.625 x 1.125
M — 3.00 x 1.625 x 1.125
N — 4.00 x 1.500 x 1.250
O — 5.00 x 1.500 x 1.250

Encapsulated in Epoxy Container:

S — 1.25 x .875 x .625
U — 2.00 x 1.125 x .750
W — 2.50 x 1.125 x .750
X — 3.00 x 1.500 x 1.000
Y — 4.00 x 1.500 x 1.125
Z — 4.50 x 2.500 x 1.375

HIGH PASS FILTERS



	20 db	40 db
B	.625Fc	.435Fc
D	.870Fc	.714Fc
F	.909Fc	.833Fc
H	.952Fc	.909Fc

1 db MAXIMUM RIPPLE — 2 db MAXIMUM INSERTION LOSS

Cut-Off (Fc) Frequency 3 db Max.	Impedance Range (Ohms)	Shape Factor (See Graph)	Size
200 Hz	500-1500	B	Z
		D	Z
400 Hz	500-3K	B	Y
		D	Z
1 kHz	500-10K	B	Y
		D	Z
		F	Z
2.5 kHz	500-20K	B	Y
		D	Z
		F	Z
5 kHz	50-20K	B	Y
		D	Z
	150-20K	F	Z
7.5 kHz	50-20K	B	Y
		D	Z
	150-20K	F	Z
10 kHz	50-10K	B	X
		D	Z
	150-10K	F	Z
25 kHz	50-10K	B	X
		D	Z
	150-10K	F	Z
50 kHz	50-10K	B	X
		D	Z
	150-10K	F	Y
		H	Z
75 kHz	50-10K	B	W
		D	Y
	150-10K	F	Y
		H	Z
100 kHz	50-10K	B	W
		D	Y
		F	Y
		H	Z
200 kHz	50-10K	B	U
		D	W
	50-5K	F	Y
		H	Z
300 kHz	50-5K	B	U
		D	W
	50-5K	F	Y
		H	Z

Cut-Off (Fc) Frequency 3 db Max.	Impedance Range (Ohms)	Shape Factor (See Graph)	Size
400 kHz	50-5K	B	U
		D	W
		F	Y
		H	Z
500 kHz	50-5K	B	U
		D	W
		F	Y
		H	Z
600 kHz	50-2.5K	B	U
		D	W
	50-2K	F	Y
		H	Z
700 kHz	50-2.5K	B	U
		D	W
	50-2.0K	F	Y
		H	Z
800 kHz	50-1.5K	B	U
		D	W
	50-1.0K	F	X
		H	Z
900 kHz	50-1.5K	B	U
		D	W
	50-1.0K	F	X
		H	Y
1 MHz	50-1.5K	B	U
		D	W
	50-1.0K	F	X
		H	O
2 MHz	50-250	B	U
		D	W
	50-200	F	X
		H	O
3 MHz	50-250	B	U
		D	W
	50-200	F	X
		H	O
4 MHz	50-250	B	U
		D	W
	50-200	F	X
		H	O
5 MHz	50-250	B	S
		D	W
	50-100	F	X
		H	O
6 MHz	50-100	B	S
		D	U
		F	X
		H	O

Cut-Off (Fc) Frequency 3 db Max.	Impedance Range (Ohms)	Shape Factor (See Graph)	Size
7 MHz	50-100	B	S
		D	U
		F	M
		H	O
8 MHz	50-100	B	S
		D	U
		F	M
		H	O
9 MHz	50-100	B	S
		D	U
		F	M
		H	N
10 MHz	50-100	B	S
		D	S
		F	M
		H	N
15 MHz	50-100	B	S
		D	S
		F	M
		H	N
20 MHz	50-100	B	S
		D	S
	50	F	M
		H	N
25 MHz	50	B	S
		D	S
		F	M
		H	N
30 MHz	50	B	S
		D	S
		F	M
35 MHz	50	B	L
		D	M
		F	M
40 MHz	50	B	L
		D	M
		F	M
50 MHz	50	B	L
		D	M
		F	N
75 MHz	50	B	M
		D	N
* 100 MHz to 400 MHz	50	B	M

* Lowpass only.

REQUEST THE MOST COMPREHENSIVE L-C FILTERS CATALOG

ALLEN AVIONICS, INC.

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Call/Write for Most Comprehensive L-C Filters Catalog in Industry

Allen Avionics is staffed and organized to provide precision L-C Filters and Delay Lines with fast delivery. Your most difficult engineering problems are solved by our high level engineering staff in conjunction with sophisticated computer programs, enabling rapid filter design determination.

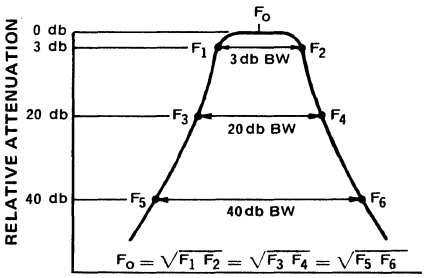
Allen Avionics computer designs are generated for the four basic filter types: Lowpass, Highpass, Bandpass, and Bandstop. These are built-in Butterworth, Tchebycheff, Elliptical, Gaussian, and Bessel functions. All Allen Avionics products are manufactured in the U.S.A.

BANDPASS

FAST DELIVERY ON PROTOTYPES

Types: Butterworth, Tchebycheff, and Elliptic Function.
Frequency Range: 400 Hz to 30 MHz.
Impedance Range: 50 ohms to 10K ohms.
Construction: Epoxy encapsulated or sealed in metal can.
Order any center frequency required. Interpolation between frequencies listed below is valid.

Shape Factor	20 db BW / 3 db BW	40 db BW / 3 db BW
Ao	3.65	7.85
B	1.60	2.50
C	1.45	1.85
E	1.20	1.45



1 db MAXIMUM RIPPLE

SIZE (INCHES)

Sealed in Metal Can. Printed Circuit Terminals, End Terminals or Connectors available where applicable:

M — 3.00 x 1.625 x 1.125
N — 4.00 x 1.500 x 1.250
O — 5.00 x 1.500 x 1.250
P — 6.00 x 1.500 x 1.250
Q — 7.00 x 1.500 x 1.250
NN — 4.00 x 4.000 x 1.250
OO — 5.00 x 4.000 x 1.250

Encapsulated in Epoxy Container:

V — 1.75 x 1.750 x .875
W — 2.50 x 1.125 x .750
X — 3.00 x 1.500 x 1.000
Y — 4.00 x 1.500 x 1.125
Y_1 — 4.00 x 2.000 x 1.250
Z — 4.50 x 2.500 x 1.375

Center Frequency (Fo)	Q Range Fo / 3 db BW	Impedance Range (Ohms)	Shape Factor	Insertion Loss	Size
400 Hz	1-10	1K-10K	Ao	2-8 db	Y_1
1 kHz	1-20	1K-10K	Ao	2-8 db	Y, Y_1
	1-8	1K-10K	B	4-8 db	Z
5 kHz	1-25	500-10K	Ao	1-8 db	X, Y, Y_1
	1-10	500-10K	B	2-8 db	Y_1, Z
	1-5	1K	C	3-8 db	Z
10 kHz	1-50	100-1K	Ao	1-8 db	X, Y, Y_1
	1-25	100-10K	B	2-8 db	Y, Y_1, Z
	1-20	100-500	C	3-8 db	Y_1, Z
	1-5	500	E	4-8 db	Z
25 kHz	1-50	100-10K	Ao	1-8 db	W, X, Y
	1-40	100-5K	B	2-8 db	X, Y, Y_1
	1-25	100-500	C	3-8 db	Y_1, Z
	1-5	100-500	E	4-8 db	Z
50 kHz	1-50	100-5K	Ao	1-8 db	W, X, Y
	1-40	100-500	B	2-8 db	X, Y, Y_1
	1-25	100-250	C	3-8 db	Y_1, Z
	1-5	100-500	E	4-8 db	Z
75 kHz	1-50	100-5K	Ao	1-8 db	W, X, Y
	1-30	100-500	B	2-8 db	X, Y, Y_1
	1-25	100-250	C	3-8 db	Y_1, Z
	1-6	50-200	E	4-8 db	Z
100 kHz	1-50	100-5K	Ao	1-8 db	W, X, Y
	1-35	50-150	B	2-8 db	X, Y, Y_1
	1-25	50-100	C	3-8 db	Y_1, Z
	1-8	50-100	E	4-8 db	Z
200 kHz	1-50	50-5K	Ao	1-7 db	V, W, X
	1-25	50-50K	B	2-7 db	W, X, Y
	1-25	50-100	C	3-7 db	X, Y, Y_1
	1-8	50-100	E	4-7 db	Y_1, Z
300 kHz	1-50	50-5K	Ao	1-7 db	V, W, X
	1-25	50-5K	B	2-7 db	W, X, Y
	1-15	50-100	C	3-7 db	Y, Y_1
	1-6	50-100	E	4-7 db	Z
400 kHz	1-50	50-5K	Ao	1-8 db	V, W, X
	1-25	50-5K	B	2-8 db	W, X, Y
	1-12	50-100	C	3-8 db	Y_1, Z
	1-6	50-100	E	4-8 db	Z
500 kHz	1-50	50-5K	Ao	1-8 db	V, W, X
	10-25	50-5K	B	2-8 db	W, X, Y
	1-12	50-100	C	3-8 db	X, Y, Y_1
	1-5	50-100	E	4-8 db	Y, Z
750 kHz	1-50	50-2K	Ao	1-10 db	W, X, Y
	1-25	50-5K	B	2-8 db	X, Y, Y_1
	1-10	50-2K	C	3-8 db	Y, Y_1
	1-3	50-100	E	4-8 db	Y_1, Z

OUR COMPLETE CATALOG INCLUDES LINEAR PHASE LOWPASS & BANDPASS, BAND REJECT, SHARP CUT-OFF LOWPASS & HIGHPASS & VIDEO FILTERS.

REQUEST CATALOG

Center Frequency (Fo)	Q Range Fo / 3 db BW	Impedance Range (Ohms)	Shape Factor	Insertion Loss	Size
1 MHz	1-50	50-100	Ao	1-10 db	W, X, Y
	1-25	50-100	B	2-8 db	X, Y, N
	1-10	50-100	C	3-8 db	M, N. O
	1-5	50	E	3-8 db	NN
2 MHz	1-50	50-100	Ao	1-10 db	M, N, O
	1-25	50-100	B	2-8 db	N, O, P
	1-10	50-100	C	3-8 db	N, O, P
	1-5	50	E	3-8 db	P, NN
3 MHz	1-50	50-100	Ao	1-10 db	M, N, O
	1-20	50-100	B	2-8 db	N, O, P
	1-10	50-100	C	3-8 db	N, O, P
	1-5	50	E	3-8 db	P, NN
4 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-20	50	B	2-8 db	N, O, P
	1-10	50	C	3-8 db	N, O, P
	1-3	50	E	3-8 db	P, NN
5 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-20	50	B	2-8 db	N, O, P
	1-10	50	C	3-8 db	N, O, P
	1-3	50	E	3-8 db	P, NN
7.5 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-15	50	B	2-8 db	N, O, P
	1-10	50	C	3-8 db	N, O, P
	1-3	50	E	3-8 db	P, NN
10 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-20	50	B	2-8 db	N, O, P
	1-12	50	C	3-8 db	O, P, Q
	1-6	50	E	3-8 db	Q, NN, OO
15 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-15	50	B	2-8 db	N, O, P
	1-10	50	C	2-6 db	O, P, Q
	1-3	50	E	3-7 db	Q, NN, OO
20 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-15	50	B	2-6 db	N, O, P
	1-10	50	C	2-6 db	O, P, Q
	1-5	50	E	3-7 db	Q, NN, OO
25 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-15	50	B	2-6 db	N, O, P
	1-10	50	C	2-6 db	Q, NN
	1-3	50	E	3-7 db	Q, NN, OO
30 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-12	50	B	2-6 db	N, O, P
	1-6	50	C	3-7 db	P, Q, NN
	1-3	50	E	3-7 db	Q, NN, OO

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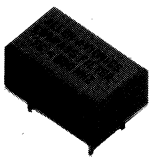
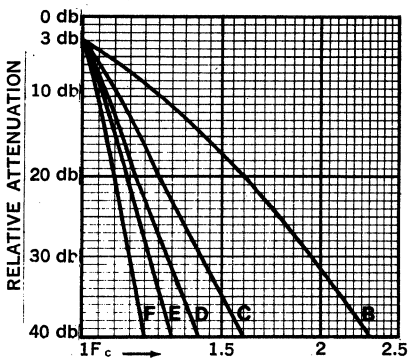
SUB-MINIATURE FILTERS

FROM 5 MHz TO 500 MHz • PASSIVE L-C FILTER DESIGN



LOW PASS FILTERS — 50 OHMS — ½db MAX. RIPPLE — ½db MAX. INSERTION LOSS



Shape Factor (See Graph)	20db	40db	Size
B	1.60	2.30	SA
C	1.25	1.60	SA
D	1.15	1.40	SB
E	1.14	1.30	SB
F	1.10	1.20	SC

FEATURING:
- Small size, lightweight.
- Low insertion loss — ½db Max.
- .5db Maximum Ripple.
- SMA Connectors standard.
- Order any cut-off frequency from 5 to 500 MHz.
- Good temperature stability.

ORDERING PROCEDURE:

Filter Type	Cut-Off Frequency	Shape Factor B, C, D, E, F (See Graph)	S (for SMA Connectors) *P (for Printed Circuit Mtg.)

EXAMPLES: ML — 500P — B — S
ML — 5P55 — D — P

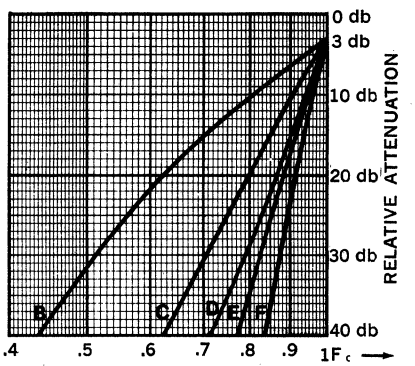
Cut-off frequency can be any 3 digit number from 5 to 500 MHz. "P" represents decimal point and must be used in 2nd, 3rd or 4th location.

Examples: 5P55 = 5.55 MHz
58P7 = 58.7 MHz
500P = 500 MHz

* PC Mounting optional for cut-off frequencies of 100 MHz or less.

SIZE (INCHES)
Units normally supplied in metal cans with SMA Connectors on each end (.5″ x .5″).
SA — .80 x .50 x .50
SB — 1.00 x .50 x .50
SC — 1.25 x .50 x .50

HIGH PASS FILTERS — 50 OHMS — 1db MAX. RIPPLE — 1db MAX. INSERTION LOSS



Shape Factor (See Graph)	20db	40db	Size
B	.625	.435	SA
C	.800	.625	SA
D	.870	.714	SB
E	.877	.769	SB
F	.909	.833	SC

FEATURING:
- Small size, lightweight.
- Low insertion loss — 1db Max.
- 1db Maximum Ripple.
- SMA Connectors standard.
- Order any cut-off frequency from 5 to 500 MHz.
- Good temperature stability.

ORDERING PROCEDURE:

Filter Type	Cut-Off Frequency	Shape Factor B, C, D, E, F (See Graph)	S (for SMA Connectors) *P (for Printed Circuit Mtg.)

EXAMPLES: MH — 500P — E — P
MH — 58P7 — F — S

Cut-off frequency can be any 3 digit number from 5 to 500 MHz. "P" represents decimal point and must be used in 2nd, 3rd or 4th location.

Examples: 5P55 = 5.55 MHz
58P7 = 58.7 MHz
500P = 500 MHz

* PC Mounting optional for cut-off frequencies of 50 MHz or less.

NETWORKS

RANDOM NOISE MEASUREMENT NETWORKS (EIA STANDARD RS-250B)

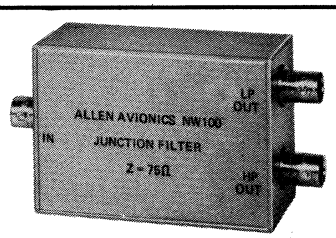
Most of the video industry has found a need for passive networks designed for use in making noise measurements in a 75 ohm system. Allen Avionics now manufactures three passive networks for noise measurement. They include:

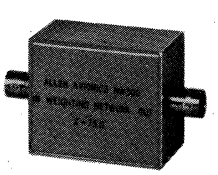
1) A Junction Filter to cut-off all frequencies below 10 KHz
2) A Lowpass Filter to cut-off all frequencies above 5 MHz
3) A Weighting Network to shape the passband

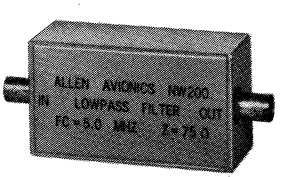
IMPEDANCE 75 OHMS

Part No.	Description	Size
NW100	Junction Filter	3″ x 2″ x 1¼″
NW200	5 MHz Lowpass Filter	3″ x 1⅝″ x 1⅛″
NW300	Weighting Network	2″ x 1⅝″ x 1⅛″

UNITS SUPPLIED IN METAL CANS WITH BNC CONNECTORS







PRE-EMPHASIS & DE-EMPHASIS WAVE SHAPING NETWORKS

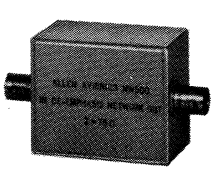
Pre-emphasis networks are used preceding the FM modulator in order to optimize the TV transmission.

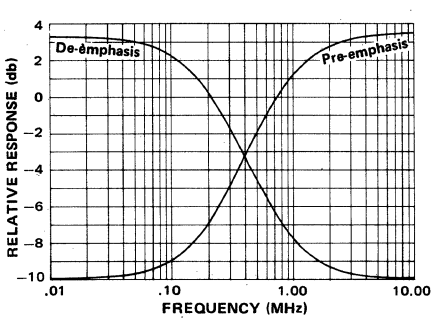
De-emphasis follows the demodulator and serves to restore the wave shape of the demodulated signal.

IMPEDANCE 75 OHMS

Part No.	Description	Size
NW400	Pre-emphasis	2″ x 1⅝″ x 1⅛″
NW500	De-emphasis	2″ x 1⅝″ x 1⅛″

UNITS SUPPLIED IN METAL CANS WITH BNC CONNECTORS

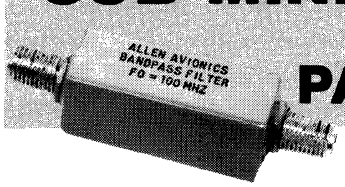




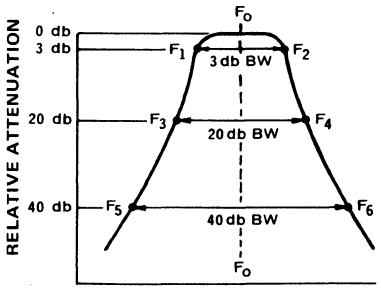
ALLEN AVIONICS, INC.

224 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • PHONES: 516-248-8080 OR 516-747-5450

SUB-MINIATURE BANDPASS FILTERS
FROM 10MHz to 500MHz
PASSIVE L-C FILTER DESIGN
50 Ohms — 1db Maximum Ripple



All of our filters are specified as having a minimum bandwidth at the −3db points and a maximum bandwidth at the −20 and −40db points. These filters are no exception. Most of the bandpass filters on this page do not exhibit arithmetic or geometric symmetry. However, to insure our customers of a simple method of determining their requirements, we are specifying the −3db, −20db and −40db bandwidths as if all had arithmetic symmetry. This will guarantee that at least ½ of the 3db passband will exist on each side of the center frequency. The −20db and −40db points will be no greater than ± ½ of their respective bandwidth away from the center frequency.



F_1 to F_o and F_o to $F_2 > ½$ 3db bandwidth
F_3 to F_o and F_o to $F_4 < ½$ 20db bandwidth
F_5 to F_o and F_o to $F_6 < ½$ 40db bandwidth

ORDERING PROCEDURE

Filter Type	Center Frequency (F_o)	3db Bandwidth (F_c)=$\frac{F_o}{Q}$	Shape Factor (See Table)	S (for SMA Connectors) *p (for Printed Circuit Mtg.)
	Can be any 3 digit number from 10 to 500MHz. "P" represents decimal point and must be used in 2nd, 3rd or 4th location.	Can be any 3 digit number up to 125MHz (a center frequency of 500MHz with a Q of 4). "P" represents decimal point & must be used in one of the 4 locations. The specified bandwidth must be within the limits of the tabulated Q. (See examples below.)		

EXAMPLE: MB − 99P5 − 4P50 − A − S

This Part No. describes a bandpass filter having its center frequency at 99.5MHz and having a 3db bandwidth of 4.50MHz with an "A" shape factor and SMA Connectors. Note in tabulation below that for a center frequency of 100MHz, and a shape factor of "A", a Q of up to 30 is realizable.

EXAMPLE: MB − 10P0 − P200 − A − S

This Part No. describes a bandpass filter having its center frequency at 10.0MHz and having a 3db bandwidth of .200MHz with an "A" shape factor and SMA Connectors. Note in tabulation below that for a center frequency of 10MHz, and a shape factor of "A", a Q of 50 is realizable.

*PC Mounting optional for center frequencies of 100MHz or less.

Shape Factor	20db / 3db	40db / 3db
A	3.6	8.0
B	2.6	4.8
C	2.3	3.4
D	2.0	2.6

SIZE (INCHES)
Units normally supplied in metal cans with SMA Connectors on each end (.5" x .5").
SA − .80 x .50 x .50
SB − 1.00 x .50 x .50
SC − 1.25 x .50 x .50

Center Frequency (Fo)	Q Range Fo / 3db BW	Shape Factor	Insertion Loss (db)	Size
10MHz	10-25	A	3-8	SA
	25-50	A	7-15	SA
	8-25	B	4-9	SB
	25-35	B	8-15	SB
	6-15	C	3-7	SB
	15-30	C	6-13	SB
	4-10	D	2-7	SC
	10-15	D	6-12	SC
25MHz	10-25	A	3-8	SA
	25-50	A	7-15	SA
	8-25	B	4-9	SB
	25-35	B	8-15	SB
	6-15	C	3-7	SB
	15-30	C	6-13	SB
	4-10	D	2-7	SC
	10-15	D	6-12	SC
50MHz	10-25	A	4-8	SA
	25-45	A	7-15	SA
	8-25	B	5-9	SB
	25-30	B	8-15	SB
	6-15	C	3-7	SB
	15-25	C	6-13	SB
	4-10	D	3-8	SC
	10-15	D	6-12	SC

Center Frequency (Fo)	Q Range Fo / 3db BW	Shape Factor	Insertion Loss (db)	Size
75MHz	10-25	A	4-8	SA
	25-40	A	7-15	SA
	8-15	B	5-9	SB
	15-25	B	8-13	SB
	6-15	C	4-7	SB
	15-20	C	6-12	SC
	4-10	D	3-8	SC
	10-15	D	6-12	SC
100MHz	10-25	A	4-8	SA
	25-30	A	7-13	SA
	8-15	B	5-9	SB
	15-22	B	8-13	SB
	6-10	C	4-6	SB
	10-15	C	5-10	SC
	4-10	D	4-8	SC
	10-15	D	6-12	SC
150MHz	10-15	A	4-8	SA
	15-25	A	7-13	SA
	8-15	B	5-9	SB
	15-20	B	8-13	SB
	6-10	C	4-6	SB
	10-15	C	5-10	SC
	4-10	D	4-8	SC
	10-15	D	6-12	SC

Center Frequency (Fo)	Q Range Fo / 3db BW	Shape Factor	Insertion Loss (db)	Size
200MHz	10-15	A	4-8	SA
	15-20	A	7-12	SA
	8-12	B	5-9	SB
	12-15	B	8-13	SB
	6-10	C	4-6	SB
	10-13	C	5-10	SB
	4-10	D	4-8	SC
	10-13	D	6-12	SC
250MHz	10-15	A	4-8	SA
	15-20	A	7-12	SA
	8-12	B	5-9	SB
	12-15	B	8-13	SB
	6-10	C	4-6	SB
	10-12	C	5-10	SB
	4-10	D	4-8	SC
	10-12	D	6-12	SC
300MHz to 500MHz	10-15	A	4-8	SA
	8-12	B	5-9	SB
	12-15	B	8-13	SB
	6-10	C	4-6	SB
	10-12	C	5-10	SB
	4-10	D	4-8	SC
	10-12	D	6-12	SC

ALLEN AVIONICS, INC.
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SEE OUR PAGES UNDER
DELAY LINES
SECTION 2350
WRITE FOR CATALOG

CUSTOM-BUILT L-C FILTERS LINEAR PHASE LOWPASS

LINEAR PHASE LOWPASS FILTERS

Types:
Bessel, Gaussian, Equal Phase Ripple and Transitional (Gaussian to 6 db).

Frequency Range:
400Hz to 50MHz.

Impedance Range:
50 ohms to 20K ohms.

Low Delay and Phase Distortion in Passband.

Very Low Pulse Distortion (Low Overshoot).

Construction:
Epoxy encapsulated or sealed in metal can.

DELIVERY: PROTOTYPES CAN OFTEN BE DELIVERED IN LESS THAN 7 DAYS

The lowpass filters listed below are typical units that we build. We do manufacture linear phase lowpass filters with any cut-off frequency between 1KHz and 50MHz.

SIZE (INCHES)

Sealed in Metal Can. Printed Circuit Terminals, End Terminals or Connectors available where applicable:

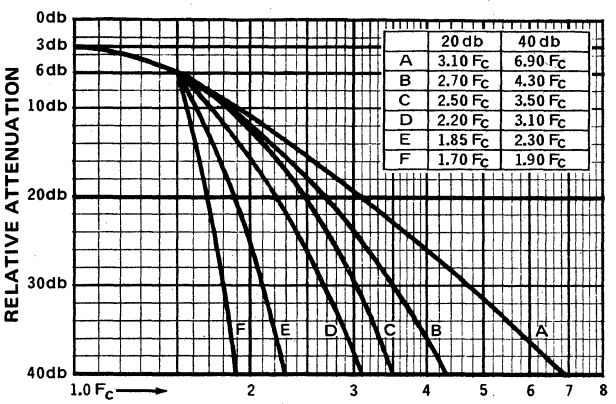
K — 1.50 x 1.000 x .800
L — 2.00 x 1.625 x 1.125
M — 3.00 x 1.625 x 1.125
N — 4.00 x 1.500 x 1.250

Encapsulated in Epoxy Container:

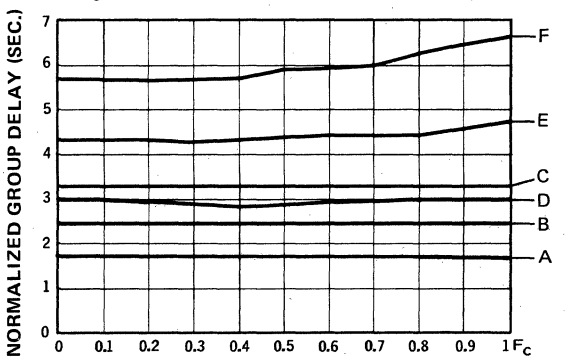
U — 2.00 x 1.125 x .750
W — 2.50 x 1.125 x .750
X — 3.00 x 1.500 x 1.000
Y — 4.00 x 1.500 x 1.125
Z — 4.50 x 2.500 x 1.375

The graph at right illustrates ideal delay characteristics.
Consult table below for typical realizable values.

Shape Factor	Max. Phase Distortion	Maximum Overshoot	Typical Delay Variation
A	±2°	1.5%	3%
B	±2°	1.5%	3%
C	±2°	1.5%	3%
D	±3°	3%	8%
E	±7°	6%	13%
F	±12°	9%	17%



	20 db	40 db
A	3.10 Fc	6.90 Fc
B	2.70 Fc	4.30 Fc
C	2.50 Fc	3.50 Fc
D	2.20 Fc	3.10 Fc
E	1.85 Fc	2.30 Fc
F	1.70 Fc	1.90 Fc



$$\text{GROUP DELAY} = \frac{\text{NORMALIZED (GROUP DELAY)}}{2\pi F_c \text{ (Hz)}}$$

½ db MAXIMUM RIPPLE — 1 db MAXIMUM INSERTION LOSS

Cut-Off (F_c) Frequency 3 db Max.	Impedance Range (Ohms)	Shape Factor (See Graph)	Size Range
1KHz	500-10K	A	X
	500-10K	B	Y, Z
	500-10K	C	Z
	500-10K	D	Y
	500-10K	E	Y, Z
	500-10K	F	Z
5KHz	50-20K	A	X
	50-20K	B	Y, Z
	50-15K	C	Y, Z
	50-20K	D	Y
	50-20K	E	Y, Z
	50-10K	F	Z
10KHz	50-10K	A	W, X
	50-10K	B	X, Y
	50-10K	C	X, Y
	50-10K	D	W, X
	50-10K	E	X, Y
	50-10K	F	Y, Z
50KHz	50-10K	A	W, X
	50-10K	B	X
	50-5K	C	X, Y
	50-10K	D	W, X
	50-10K	E	X, Y
	50-10K	F	X, Y
100KHz	50-10K	A	U, W
	50-5K	B	W, X
	50-5K	C	X, Y
	50-10K	D	W, X
	50-10K	E	X
	50-10K	F	X, Y

Cut-Off (F_c) Frequency 3 db Max.	Impedance Range (Ohms)	Shape Factor (See Graph)	Size Range
500KHz	50-3K	A	U, W
	50-3K	B	W
	50-1K	C	W, X
	50-5K	D	W
	50-5K	E	W, X
	50-5K	F	X, Y
750KHz	50-2.5K	A	U, W
	50-2.5K	B	W, X
	50-1K	C	X, Y
	50-5K	D	U, W
	50-5K	E	W, X
	50-5K	F	X
1MHz	50-500	A	L
	50-500	B	M
	50-500	C	M
	50-500	D	W
	50-500	E	W, X
	50-500	F	X
2MHz	50-500	A	L
	50-500	B	M
	50-500	C	M
	50-500	D	W
	50-500	E	W, X
	50-500	F	W, X
5MHz	50-500	A	L
	50-500	B	M
	50-200	C	M
	50-500	D	L
	50-500	E	M
	50-500	F	M

Cut-Off (F_c) Frequency 3 db Max.	Impedance Range (Ohms)	Shape Factor (See Graph)	Size Range
7.5MHz	50-500	A	K
	50-250	B	L
	50-100	C	M
	50-500	D	L
	50-500	E	M
	50-500	F	M
10MHz	50-100	A	K
	50-100	B	L
	50-100	C	M
	50-100	D	L
	50-100	E	M
	50-100	F	M
20MHz	50-100	A	K
	50-100	B	L
	50-100	D	L
	50-100	E	M
	50-100	F	N
30MHz	50-100	A	K
	50-100	B	L
	50-100	D	L
	50-100	E	M
	50-100	F	N
40MHz	50	A	K
	50	B	L
	50	D	L
	50	E	M
	50	F	M
50MHz	50	A	K
	50	D	L
	50	E	M
	50	F	M

SHARP DELAY EQUALIZED LOWPASS FILTERS

By the utilization of delay equalization techniques, Allen Avionics now designs and manufactures a complete line of sharper cut-off, flat delay lowpass filters than shown above. We offer these with 40db to 3db ratios as small as 1.22 and delay distortion of less than 10%.

ALLEN AVIONICS, INC.
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VIDEO FILTERS

DELAY EQUALIZED NTSC LOWPASS FILTERS — VFL, MVFL & VCL SERIES

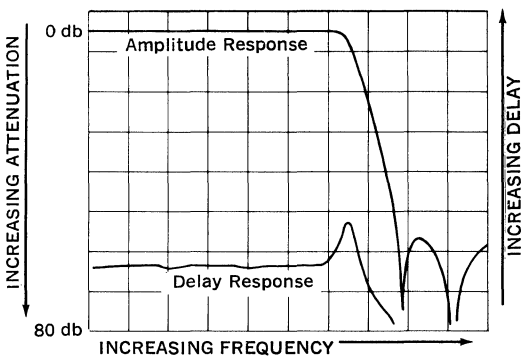
For the video field, we have built many lowpass filters having sharp roll-offs and good passband delay linearity with cut-off frequencies from .1 MHz to 10 MHz. The most popular of these are used to attenuate the harmonics of the NTSC color sub-carrier frequency 3.58 MHz. The most commonly used filters in this group are tabulated below:

VFL & MVFL SERIES — IMPEDANCE = 75 OHMS

Standard Size Max. Insertion Loss 1 db Part No.	Miniature Size Max. Insertion Loss 2db Part No.	Max. .25 db Attenuation @ Frequency (MHz)	Max. 3 db Attenuation @ Frequency (MHz)	Min. 45 db Attenuation @ Frequency (MHz)	Approximate Passband Delay (Nanoseconds)
VFL1P7	MVFL1P7	1.75	1.92	2.41	1691
VFL2P2	MVFL2P2	2.25	2.45	3.10	1325
VFL2P7	MVFL2P7	2.75	3.00	3.77	1082
VFL3P2	MVFL3P2	3.20	3.50	4.40	928
VFL3P5	MVFL3P5	3.50	3.84	4.82	846
VFL3P8	MVFL3P8	3.80	4.16	5.22	781
VFL4P0	MVFL4P0	4.00	4.38	5.51	741
VFL4P5	MVFL4P5	4.50	4.93	6.19	659
VFL5P2	MVFL5P2	5.20	5.70	7.16	570
VFL6P0	MVFL6P0	6.00	6.58	8.27	494
VFL6P5	MVFL6P5	6.50	7.12	8.95	457

Max. Delay Variation=±3% to −.25 db Freq. Max. Passband Ripple=±.25 db.
VFL Size: 4″ x 2″ x 1¼″ in metal can with BNC Connectors.
MVFL Size: 3″ x 1⅝″ x ½″ in metal can with terminals for PC mounting.

DELIVERY FROM STOCK

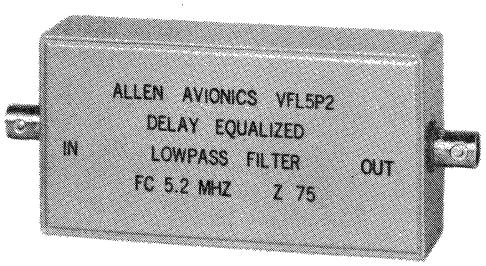


TYPICAL AMPLITUDE & DELAY RESPONSE OF VFL & MVFL SERIES

VCL SERIES — IMPEDANCE = 75 OHMS

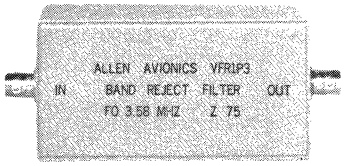
Part No.	Maximum ±3% Delay Distortion to Frequency (MHz)	Maximum .25 db Attenuation @ Frequency (MHz)	Minimum 45 db Attenuation @ Frequency (MHz)	Approximate Passband Delay (Nanoseconds)
VCL3P2	2.7	3.2	3.63	1100
VCL3P5	2.9	3.5	3.97	1010
VCL3P8	3.2	3.8	4.31	930
VCL4P2	3.5	4.2	4.76	840
VCL4P5	3.8	4.5	5.10	780
VCL4P9	4.1	4.9	5.56	720
VCL5P2	4.4	5.2	5.90	680
VCL5P7	4.8	5.7	6.46	620

Max. Insertion Loss @ 100 KHz=2.5 db. Max. Passband Ripple=±.25 db.
Size: 6″ x 2″ x 1¼″ in metal can with BNC Connectors.



NTSC REJECT FILTERS

Some of the most frequent specifications that we encounter in the video industry are based upon rejection of the color information in the video signal to provide isolation from the luminance signal. These specifications require very low phase distortion to the luminance signal. To satisfy this requirement, Allen Avionics has designed a group of band reject filters with phase equalization where necessary. One of the most often used applications for this band reject filter is in color systems for monochrome transmission to prevent color flashes from appearing on the screen. Since various segments of the television industry have different passband requirements, we are listing three filters with different reject bandwidths.



Impedance = 75 ohms.
Maximum Insertion Loss @ 100 KHz = 3 db.
Maximum Passband Ripple to 5.5 MHz = ±.25 db.

Part No.	Maximum 3 db Attenuation @ Frequency (MHz)	Minimum Attenuation @ 3.58 MHz
VFR4P6	1.95 — 6.55	40 db
VFR1P3	3.00 — 4.30	40 db
VFR0P5	3.37 — 3.88	30 db

Size: 4″ x 2″ x 1¼″ in metal can with BNC Connectors.

NTSC BANDWIDTH FILTER

Allen Avionics sub-carrier bandpass filter is a low distortion unit designed to attenuate the luminance information in color TV signals. This filter is useful in most applications where it is required to isolate the chrominance information.

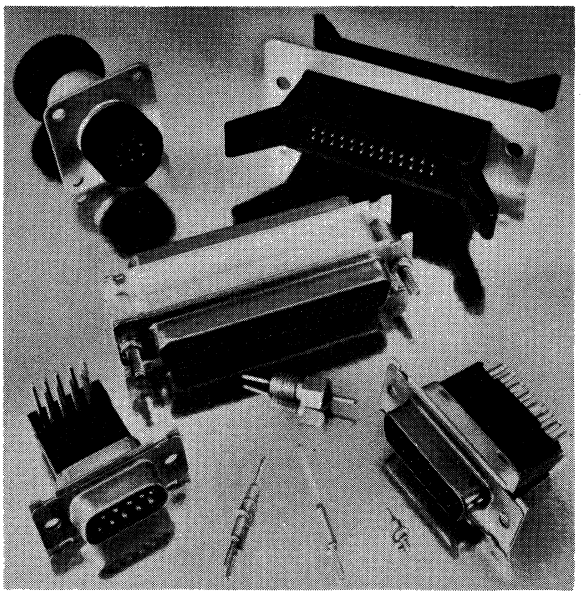
Impedance = 75 ohms.
Maximum Insertion Loss @ 3.58 MHz = 1.5 db.
Maximum Ripple = ±.25 db.

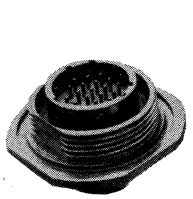
Part No.	Maximum 3 db Attenuation @ Frequency (MHz)	Minimum 30 db Attenuation @ Frequency (MHz)
VFB3P6	3.40 — 3.70	2.40 — 5.80

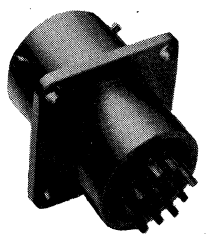
Size: 4″ x 2″ x 1¼″ in metal can with BNC Connectors.

COMPLETE LINE OF GAUSSIAN LOWPASS FILTERS AVAILABLE — REQUEST VIDEO CATALOG

AMP Makes the Difference in Filters







All the above connectors are available in filtered version.

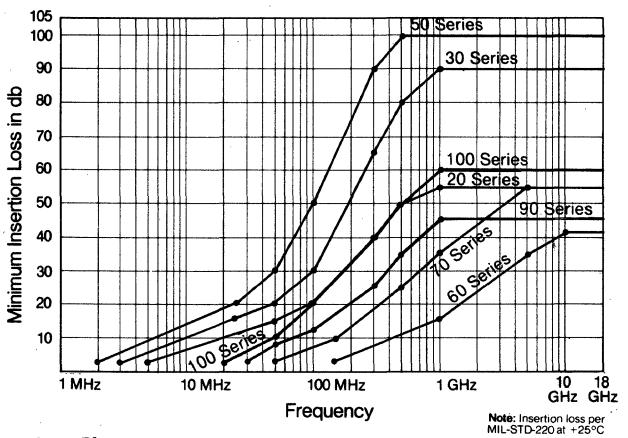
Proven, Inexpensive Filtering. AMP Quiet Line Filters provide proven, inexpensive filtering of conducted electro-magnetic interference (EMI) and general system noise. Available as loose pieces or as components of preassembled connectors, AMP Quiet Line Filters are divided into Standard and Premium groups. Standard series filters are appropriate for most commercial applications. Generally, Premium series filters offer higher operating voltage maximums, withstand higher operating temperatures and provide higher dielectric withstanding voltage and insulation resistance. Also, Premium series filters are subjected to environmental testing typical of components for military applications.

Standard and Premium filter groups are divided as follows: Within the Standard group there are three series having normal capacitance (20, 30 and 50 series having 1000, 2000 and 3000 picofarads min., respectively). Within the Premium group there are three series having normal capacitance (20P, 30P and 50P series having 1500, 3000 and 4000 picofarads min., respectively).

Standard mid-capacitance filters are divided into two series: The 90 series having 600 picofarads max. and the 100 series having 1000 picofarads max.

Standard low capacitance filters are divided into two series: The 60 series having 175 picofarads max., and 70 series having 400 picofarads max.

AMP Quiet Line Filters
Standard Series Specifications



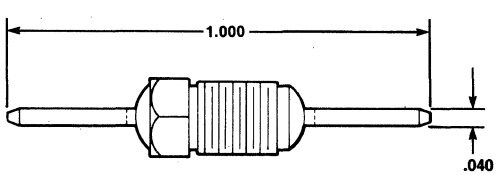
Note: Insertion loss per MIL-STD-220 at +25°C

Filter Pins

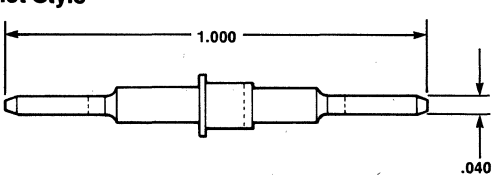
Style	"20" Series Part No.	"30" Series Part No.	"50" Series Part No.	"60" Series Part No.	"70" Series Part No.
Bolt (8-32)	859619-1	859618-1	859617-1	859659-1	859658-1
Bolt (12-32)	—	859645-1	859646-1	—	859681-1
Eyelet	859616-1	859615-1	859614-1	859656-1	859655-1
Pin/Sleeve	859613-1	859612-1	859611-1	859653-1	859652-1

"30" Series Filters
(Shown as typical)

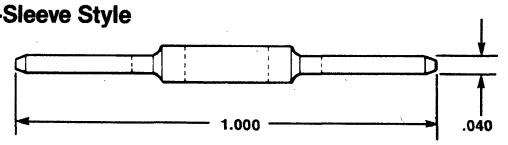
Bolt Style
(8-32 Thread Size)



Eyelet Style



Pin-Sleeve Style



Request Catalog No. 78-487 and 80-565 for complete listing

Need more details? Call AMP Customer Service at (717) 780-4400, or write AMP Incorporated, Harrisburg, PA 17105.

Specifications subject to change. Consult AMP Incorporated for latest design specifications.

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AMP INCORPORATED

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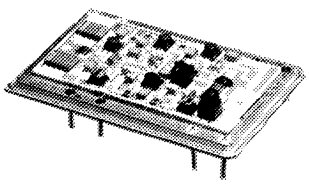
RF • MICROWAVE • OPTICAL

SAW Components
for radar & communications

SAW Bandpass Filters

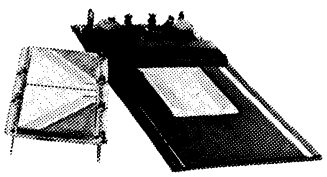
Optimum amplitude and phase characteristics for radar, ECM, ESM and communications filtering.

SAW Hybrid Oscillators



Compact, rugged, alignment-free frequency sources available in standard industry packages for PC mounting, VHF, UHF frequency range and voltage controlled tuning.

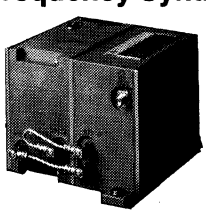
SAW and IMCON Dispersive Delay Lines



The powerful signal processing tool for radar, ELINT, ESM receivers.

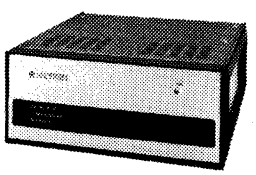
Super Components
for radar & communications

Frequency Synthesizers



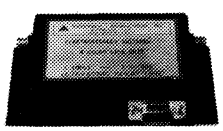
Unique design provides optimized programmable frequency source for today's most demanding applications including radar, radios, telecommunications, TACAN, telemetry, navigational equipment and satellite communications.

Compressive IF Receivers



100% probability of intercept and real time spectrum analysis for ESM and ELINT Receivers.

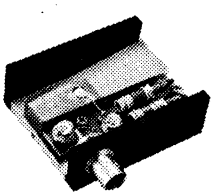
Bulk Acoustic Wave Delay Lines and Subsystems



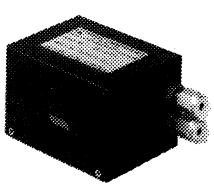
Practical and economical memory for radar, communications and TV signal processing.

Acousto-Optics

Modulators and Beam Deflectors



Q-Switches



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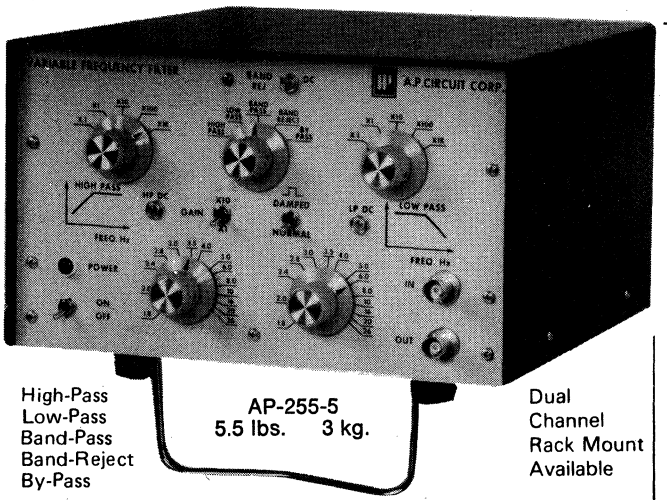
NEW! HYBRID CONSTRUCTION MINIATURE FILTERS



High-Pass
Low-Pass
Band-Pass
Band-Reject
By-Pass

AP-255-5
5.5 lbs. 3 kg.

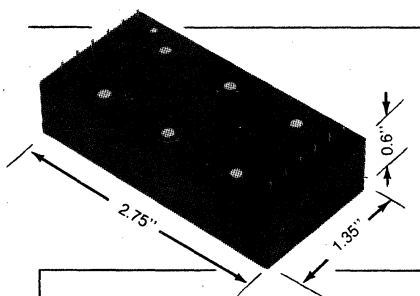
Dual
Channel
Rack Mount
Available

VARIABLE FREQUENCY INSTRUMENTS FEATURE:

- Low Noise (50 micro Volt RMS)
- High Input, Low Output impedance
- 0 dB insertion loss or +20 dB Preamplifier
- 24 dB / octave slope
- Frequency range 0.01 Hz to 5 MHz
- Portable battery operated option

Partial List of Models	FUNCTION Low Pass	High Pass	Band Pass	Band Reject	Tuning Range	
APVL-43-5	✓				0.02Hz–2KHz	A
APVL-44-5	✓				0.2Hz–20KHz	A
APVL-45-5	✓				2.0Hz–200KHz	A
APVH-43-5		✓			0.02Hz–2KHz	A
APVH-44-5		✓			0.2Hz–20KHz	A
AP255-5	✓	✓	✓	✓	0.2Hz–20KHz	B
AP260-5	✓	✓	✓	✓	0.1Hz–10KHz	B
AP265-5	✓	✓	✓	✓	0.02Hz–2KHz	B
AP280-5	✓	✓	✓	✓	2.0Hz–200KHz	B
AP220-5	✓	✓	✓	✓	20Hz–2MHz	B
AP 301			✓		0.1–10KHz	B
AP 401			✓	✓	0.1–10KHz	B

A: Rack mounted option - 4 channel std.
B: Rack mounted option - 2 channel std.



6 pole
Band Pass
Band Reject
with trimming
potentiometers
for fine tuning

FILTER MODULES

FIXED FREQUENCIES • EXTERNALLY TUNEABLE
DUAL IN LINE CONSTRUCTION

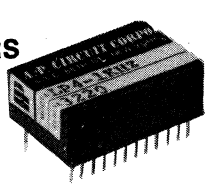
Feature Low Noise, High Input, Low Output Impedance. O insertion Loss.

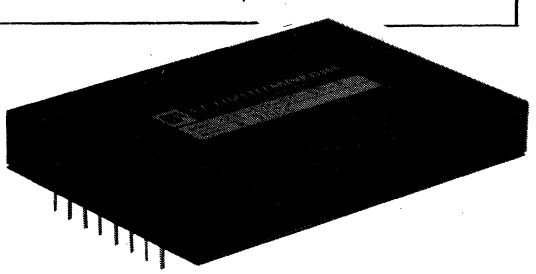
- Low-Pass
- High-Pass
- Band-Pass
- Band Reject

STD. FREQUENCIES:
0.01 Hz—500 KHz
4 pole 24 dB/Octave
6 pole 36 dB/Octave
8 pole 48 dB/Octave

NEW MINIATURE ACTIVE FILTERS

Model LP4 — Low-Pass
HP4 — High-Pass
4-5 poles, input buffered
0.795"W x 1.245"L x 0.425"H
Volume: 0.42 cu. inch





Programmable Filters

Model AP-DP-8S-5P

Cut off Frequency	Bit 3	Bit 2	Bit 1
f_o	0	0	0
$2f_o$	0	0	1
$4f_o$	0	1	0
$8f_o$	0	1	1
$16f_o$	1	0	0
$32f_o$	1	0	1
$64f_o$	1	1	0
$128f_o$	1	1	1

Voltage Tunable Filters*

MODEL AP-6VC

6 Pole Voltage-Controlled
- Low-Pass
- High-Pass
- Band-Pass
- Band-Reject

**Particularly useful as Antialiasing Filters*

A. P. CIRCUIT CORPORATION

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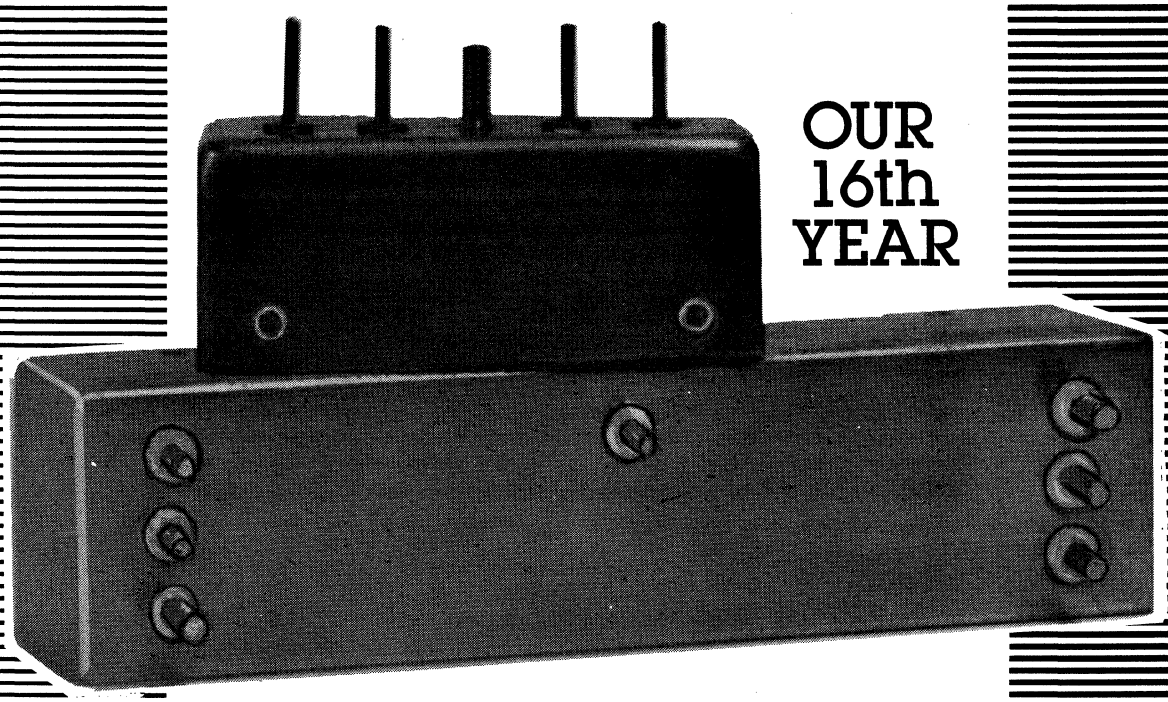
CUSTOMIZED LC FILTERS



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Chesterfield Products has a large inventory of customized LC filter designs for a wide variety of applications designed to commercial or military specs.

As a result, we can fulfill all of your technical requirements without adding unnecessary costs and delays. LC filters are available from 1.0 Hz to 1,000 MHz.

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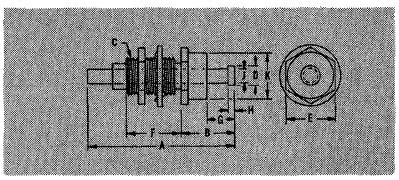
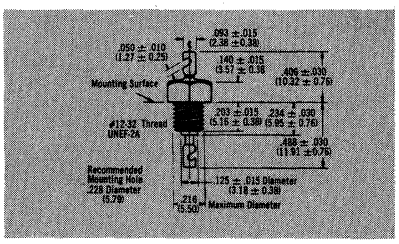
FILTERS & FEED-THRUS



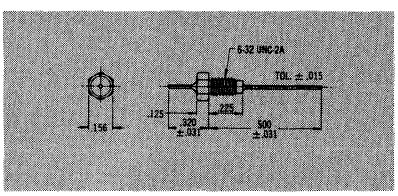
PLAIN TEFLON FEED-THRU

PART NO.	DIMENSIONS									
	A	B	C	D	E	F	G	H	J	K
100-1001	0.690	0.287	12-28 UNF-2A	0.082	0.250	0.225	0.163	0.031	0.062	0.188



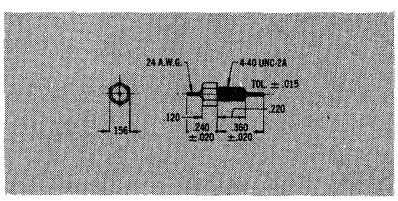
PART NO.	DIMENSIONS									
	A	B	C	D	E	F	G	H	J	K
100-1002	.874	0.406	12-32 UNF-2A	0.093	0.312	0.234	—	0.031	—	—

Capacitance 1000 pF

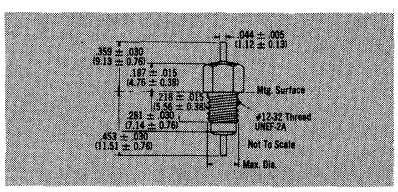


RFI/EMI SUPPRESSION FILTERS

PART NO.	RATED I_{DC}	WORKING VOLTS		DCR MAX.	REFER CAP - - - -	INSERTION LOSS					
		+85°C	+125°C			1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz
100-1003	3 Amps	200 VDC	100 VDC	.01	.001 MFD	—	3	40	50	70	70
100-1004	10 Amps	200 VDC	100 VDC	.01	.022 MFD	10	28	50	60	60	60



PART NO.	RATED I_{DC}	WORKING VOLTS		DCR MAX.	REFER CAP - - - -	INSERTION LOSS					
		+85°C	+125°C			1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz
100-1005	10 Amps	200 VDC	100 VDC	.01	.0015 MFD	—	5	42	60	65	65
100-1006	10 Amps	200 VDC	100 VDC	.01	.022 MFD	20	30	50	55	65	65



HIGH FREQUENCY LOWPASS FEED-THRU FILTERS

PART NO.	RATED I_{DC}	WORKING VOLTS		DCR MAX.	REFER CAP - - - -	INSERTION LOSS					
		+85°C	+125°C			1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz
100-1007	10 Amps	200 VDC	100 VDC	—	5500 pf	—	10	50	70	70	70

ADAPTERS

SIMPLIFIED ADAPTER PART NUMBERS
SELECT CONNECTOR TYPE

N = N	SMA = S	FEMALE = F
TNC = T	SMB = SMB	MALE = M
BNC = B	SMC = SMC	
BULKHEAD	= Prefix with B	
RIGHT ANGLE	= Prefix with R	
PANEL	= Prefix with P	

EXAMPLES:	PART NO.
N (male) to SMA (female)	NM-SF
TNC (female) to SMA (female)	TF-SM
BNC (male) to BNC (female)	BM-BF
SMB (male) to SMC (female)	SMBM-SMCF

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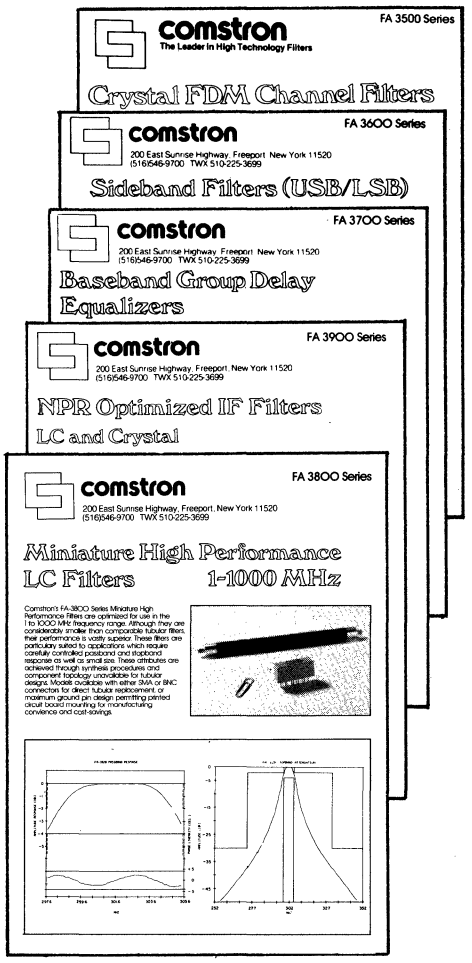
TECHNOLOGY " + " FILTERS

The Extra Edge in Systems Performance DC to 1 GHz

Comstron has developed optimum frequency or time domain filters to produce near theoretical system performance. These technology + filters are available as catalog items or custom tailored to your needs.



Design

Comstron has implemented modern network synthesis and physical realization techniques to the point where highly reliable, compact, LC and crystal filters are available – quickly and economically. Proprietary computer analysis, modeling, and optimization programs efficiently arrive at near-optium solutions to spectral, time domain, and stochastic problems. The Company's Enhanced Synthesis Program (ESP), Filter Optimization Program (FOP) and Parameter Optimization Program (POP) provide design parameters for systems oriented functions. Requirements for group delay equalization, wide band arithmetic symmetry, x/sin x amplitude correction, corrected Nyquist filters, phase compensation, and time domain response designs are routinely and efficiently handled.

Test

The Company's commitment to excellence is evident in its extensive test facilities. Automatic computer based network analyzers cover the frequency range from dc to 1.3 GHz with full plotting and printer output capability. Parameters which are automatically measured include amplitude response, phase response, group delay, and return loss. Time domain testing can also be performed to verify impulse response or response to complex waveforms.
Computer directed environmental testing allows unattended measurements of performance over temperature on a production basis. Comstron's proprietary Automatic Filter Test (AFT) programs permits rapid and accurate generation of acceptance test procedures as well as full documentation and data files when required.

Quality Control

Comstron maintains a Quality Control Department that ensures compliance with MIL-I-45208A and MIL-Q-9858A when applicable. Microscopic inspection, controlled environment, material control and traceability, solder training programs, and strict configuration management all contribute to producing an exceptionally reliable product.
The quality control program is continuously monitored. Over the years since its inception, Comstron has assembled a dedicated, conscientious staff whose pride of workmanship and customer loyalty is the keynote of the Company.

Send for our complete Data Sheets.

Standard Filter Catagories

- FDM Channel
- Quad Phase Matched
- Miniature LC.
- USB/LSB
- Fiber Optic Repeater
- Group Delay Equalizer
- NPR Optimized
- Pulse Response Optimized
- Nyquist
- Video
- Speech Plus
- Group/Super Group/Master Group/Pilot Notch
- 70/140 MHz Satellite IF Filters
- 70 MHz Switchable Equalizer (Delay or Amplitude)

Call Comstron for applications assistance for your LC and Crystal Filter requirements.

comstron corporation

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RFI Power Line Filters

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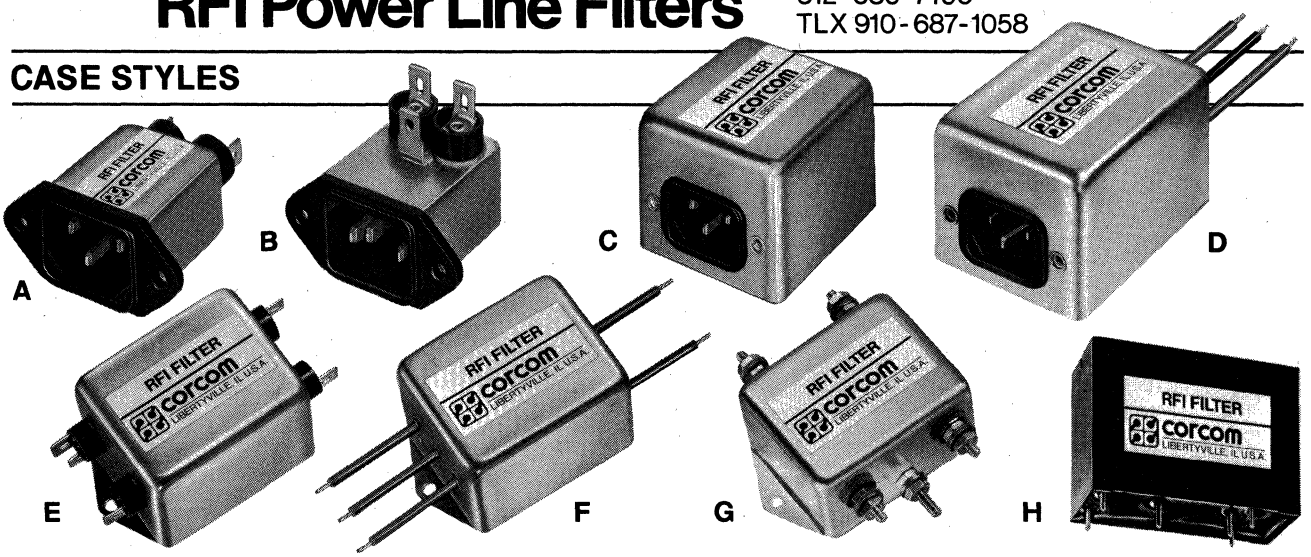
TLX 910-687-1058

CASE STYLES



CORCOM'S FAMILY OF PRODUCTS

B Series
General purpose common mode filters. Available in case styles E, F, and G. Current ratings: 1, 2, 3, 5, 10, 20, 30 amps.

EF Series
Attenuation performance similar to B series, small package with IEC connector. Available in case styles A and B. Current ratings: 1, 3, 6 amps.

ED & EC Series
Enhanced common mode plus differential mode performance in the EF package for the ED series. Enhanced common mode plus enhanced differential mode performance in a stretched EF package for the EC series. Available in case styles A and B. Current ratings: 1, 3, 6 amps.

H Series
Special purpose filters for medical equipment that must meet the extremely low leakage current requirements of UL544, Patient Care category. Available in case styles A, B, and E. Current rating: 6 amps.

K Series
General purpose common mode performance (similar to B and EF) plus differential mode performance. Available in case styles C, E, F, and G. Current ratings: 1, 2, 3, 5, 10, 20, 30 amps.

R Series
Dual section filter for high common and differential mode performance in low impedance equipment such as synchronous motors. Available in case styles C, E, F, and G. Current ratings: 1, 2, 3, 5, 10, 20 amps.

VS, VV, VW Series
Combines Corcom's successful line-to-ground interference rejection filters with additional circuitry designed to reduce line-to-line noise and transients. Available in case style E. Current ratings: 3, 6, 10, 20 amps.

X, Y, Z Series
Compact PCB mountable filters for emission control applications, such as switching power supplies, offering excellent common and differential mode performance from 10kHz to 30MHz, while meeting the very low leakage requirements of SEV and VDE portable equipment. Available in case style H.

X—Designed to bring most digital equipment (including switching power supplies) into compliance with FCC Class B emission limits. Current rating: 3 amps.

Y—Designed for equipment compliance to VDE 0871 A-level emission limits. Current ratings: 2, 3 amps.

Z—Designed for equipment compliance to VDE 0871 B-level emission limits. Current ratings: 1, 2, 3 amps.

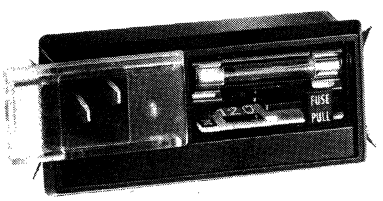
SK Series
Enhanced common mode and differential mode performance with high peak current capability; best suited for FCC emission control applications including switching power supplies. Available in case styles C, E, and F. Current ratings: 3, 6, 10 amps.

EP Series
Superior common and differential mode performance from 150kHz to 30MHz, with high peak current capability for switching power supplies, to meet VDE 0871 A-level and FCC Class B emission limits. Available in case styles C, E, and F. Current ratings: 3, 6, 10 amps.

T Series
Superior common and differential mode performance from 10kHz to 30MHz with high peak current capability for switching power supplies, to meet VDE 0871 A-level emission limits and guidelines down to 10kHz. Available in case styles D, E, and F. Current ratings: 3, 6, 10 amps.

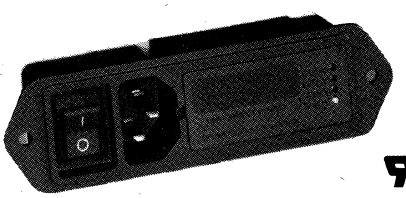
Q Series
Premium common and differential mode performance from 10kHz to 30MHz with high peak current capability for switching power supplies, to meet VDE 0871 B-level emission limits down to 10kHz. Available in case styles D, E, and F. Current ratings: 3, 6 amps.

J SERIES AND M SERIES/POWER ENTRY PRODUCTS



418 419 756

J Series/Voltage Selecting and Fused Connector
Developed for the manufacturer who markets products worldwide, the VS & F Connector eliminates the need for internal wiring changes, special power supplies or the need for stocking different line cords. Designed with an internationally approved line cord connector, a fuse holder and a unique voltage selector card. Available unfiltered or filtered.

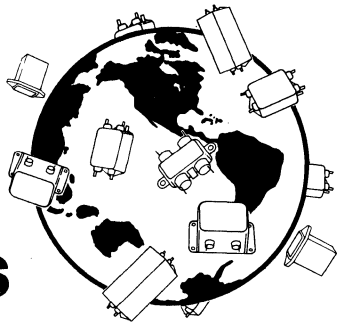


M Series/Power Entry Module Patent Pending
Corcom's Power Entry Module is the new generation of Corcom's VS & F Connector. Incorporated into one unit are the following:
- IEC Line Cord Connector, internationally accepted design
- Fuse Holder, capable of using one U.S. or two European fuses
- Optional DPST Power On/Off Rocker Switch
- Optional 2-Voltage or 4-Voltage Card Selection

©Corcom Inc.

CDE EMI FILTERS — EVERYWHERE!

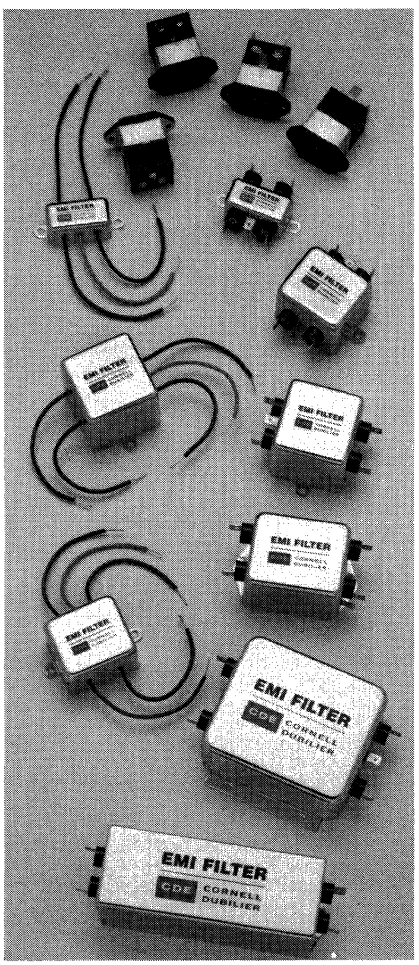
Cornell Dubilier's All Purpose International Series Filters



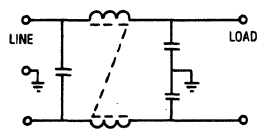
The CORNELL DUBILIER INTERNATIONAL SERIES OF EMI FILTERS feature a broad selection of case and termination styles in current ratings from 1 to 20 amps and a wide range of performance.

APPLICATIONS: Computers, Peripherals, Data Terminals, Printers, Power Supplies, Medical Instrumentation, Industrial Controls, Communications, Military, Consumer Products.

APPROVALS: UL Recognized under the Component Recognition Program of UL 1283; C.S.A. Certified; VDE Approval to VDE Specification 0565, part 3

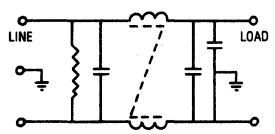


APFV-11 SERIES



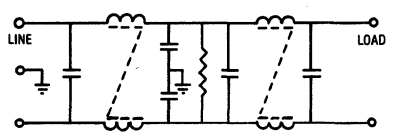
Designed to provide effective reduction of line-to-ground (common mode) interference at low cost. Ideally suited for application in a wide variety of electrical/electronic equipment intended for multnational markets.

APFV-21 SERIES



Provides effective reduction of line-to-ground (common mode) and line-to-line (differential mode) interference. Similar to the APFV-11 Series' line-to-ground performance, the APFV-21 Series provides greater line-to-line interference reduction by the addition of line-to-line capacitance.

APFV-31 SERIES



Offers optimum reduction in line-to-ground (common mode) and line-to-line (differential mode) interference while providing excellent susceptibility protection to equipment operated in "noisy" E.M.I. environments.

SPECIFICATIONS

Rated Voltage: 120-250 VAC
Power Line Frequency: 50-60 Hz
Rated Current: 1-20 Amperes*
Leakage Current — Line-to-Ground
@ 120 VAC, 60 Hz: 0.5 ma max.
@ 250 VAC, 50 Hz: 1.0 ma max.
Test Voltage: Line-to-Ground: 2250 VDC, One minute
Line-to-Line: 1450 VDC, One minute

Write for new line EMI filter Catalog or call for application assistance at (617) 996-8561

CDE CORNELL DUBILIER

Wayne Interchange Plaza 1 • Wayne, N.J. 07470

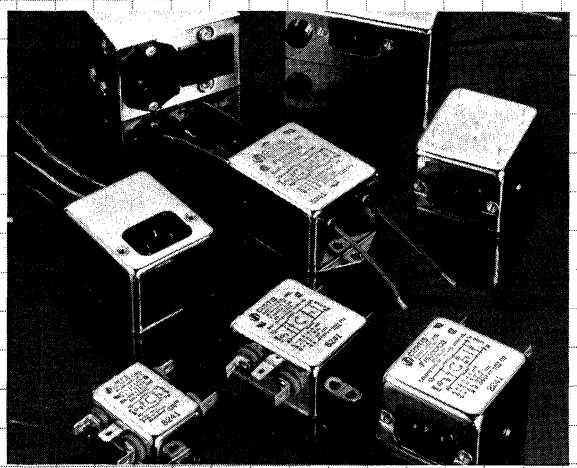
MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

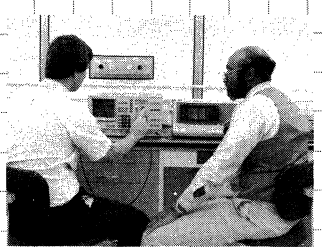
WHERE TO FIND THEM IN THE 85/86 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1166, **B**•1012, **C**•1028, **D**•1016
ASCII Code ..... **D**•1087
Batteries, Product Selection Guide ..... **D**•1413
Batteries & Fuel Cells, Characteristics ..... **D**•1430
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide ..... **A**•1003
Circuit Boards (Printed) Product Selection Guide ..... **C**•1099
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1205
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1863
Connectors, Miniglossary ..... **C**•1129
Connectors, Terminals, & Sockets, Product Selection Guide ..... **C**•1105
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Gude ..... **A**•1309
Delay Lines, Product Selection Guide ..... **A**•1459
Discrete Semiconductors, Product Selection Guide ..... **A**•2067
Displays, Readouts, Lamps, & Lights, Product Selection Guide ..... **B**•1015
EBCDIC Code ..... **D**•1092
Encapsulation, Miniglossary ..... **C**•1086
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide .. **C**•1623
Filters, Product Selection Guide ..... **A**•1583
Instruments, Graphic Recording Product Selection Guide ..... **D**•1401
Instruments, Panel Meters, Product Selection Guide ..... **D**•1329
Instruments, Test & Measuring Product Selection Guide ..... **D**•1175
Interconnection Systems, Product Selection Guide ..... **C**•1699
Keyboards & Keypads, Product Selection Guide ..... **B**•1705
Logofinder & Trademark Directories ..... **B**•901
Microwave Components, Product Selection Guide ..... **A**•1701
Military Qualified Products Lists ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1129
Opto Semiconductors, Miniglossary ..... **B**•1214
Oscilloscopes, Product Selection Guide ..... **D**•1385
Panel Hardware, Product Selection Guide ..... **C**•1589
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide ..... **A**•1991
Power Supplies, Miniglossary ..... **D**•1462
Power Supplies, AC, Product Selection Guide ..... **D**•1877
Power Supplies, DC, Product Selection Guide ..... **D**•1447
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide .... **B**•1225
Relay Contact Forms ..... **B**•1317
Relays, Electromechanical, Miniglossary ..... **B**•1308
Relays, Product Selection Guide ..... **B**•1261
Resistor Color Codes ..... **A**•1828
Resistors, Product Selection Guide ..... **A**•1785
Servo Components, Miniglossary ..... **D**•1985
Solenoids, Product Selection Guide ..... **B**•1463
Switches, Product Selection Guide ..... **B**•1477
Thermal Components, Product Selection Guide ..... **B**•1741
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1744
Thyristors/High Power Diodes, Miniglossary ..... **A**•2076
Transducers & Encoders, Product Selection Guide ..... **B**•1777
Transformers, Product Selection Guide ..... **A**•2099
Wire & Cable, Product Selection Guide ..... **C**•1743
Wire Gauges—Diameter, Area, Copper Weight ..... **C**•1844

CURTIS®
RFI POWER LINE FILTERS



FULL RFI-EMI CONDUCTED EMISSIONS TESTING OFFERED



CURTIS FILTER SELECTION GUIDE

CURTIS FILTER SERIES	APPLICATION	PERFORMANCE RELATIVE ATTENUATION		MAXIMUM LEAKAGE CURRENT		CURRENT RATING AMPS @115VAC						Safety Agency Approvals				PACKAGING/TERMINATIONS				
		Common Mode	Differential Mode	mA @115VAC	mA @ 250VAC	1	3	6	10	20	30	UL	CSA	VDE	TÜV	Wire	Quick Conn.	IEC	PC	Screw Term.
F1100	General Purpose/Linear	● ●		0.5	1.2	●	●	●	●	●		●	●		●	●	●			●
F1150	General Purpose/Linear	●		0.25	0.40	●	●	●	●	●		●	●	●	●	●	●			●
F1200	General Purpose/Linear	● ●	● ●	0.5	1.2	●	●	●	●	●	●	●	●		●	●	●			●
F1250	General Purpose/Linear	●	● ●	0.25	0.40	●	●	●	●	●		●	●	●	●	●	●			●
F1300	Motor, Capacitive, Low Impedance Loads	● ● ● ●	● ●	0.5	1.2	●	●	●	●			●	●		●	●	●	●	●	
F1350	Motor, Capacitive, Low Impedance Loads	● ● ●	● ●	0.25	0.40	●	●	●	●			●	●	●	●	●	●	●	●	
F1400	Switching Power Supplies	● ● ● ● ●	● ● ● ●	0.25	0.40		●	●	●			●	●	●	●	●	●			
F1500	Linear/Switching	● ● ● ●	● ● ●	0.25	0.40		●	●	●			●	●	●	●			●		
F1600	Switching Power Supplies	● ● ● ● ●	● ● ●	0.25	0.40		●	●	●			●	●	●	●			●	●	
F1700	General Purpose Off-Line Switching Power Supplies	● ●	● ● ● ●	0.5	1.2		●	●	●	●		●	●		●*	●	●			●
F1900	Consumer/Linear (UL1410)	●	●	0.25			●					●	●				●			
F2100	General Purpose	●		0.25	0.40	●	●	●				●	●	●*	●			●		
F2200	General Purpose	●		0.25	0.40	●	●	●				●	●	●*	●			●		
F2300	General Purpose	● ● ●	● ●	0.25	0.40			●				●	●	●*	●*			●		
F2400	General Purpose	●	●	0.25	0.40		●	●				●	●		●*			●		
F2500	General Purpose	●	●	0.25	0.40		●	●				●	●		●*			●		
F3000	Medical/Dental (UL544) Patient Care Equipment	●		0.002	0.005			●				●	●		●*		●			
F3100	Medical/Dental (UL544) Nonpatient Equipment	●		0.002	0.005			●				●	●		●*			●		
F3200	Medical/Dental (UL544) Nonpatient Equipment	●		0.002	0.005			●				●	●		●*			●		

*PENDING

CURTIS® INDUSTRIES, INC.
8000 W. Tower Avenue, Milwaukee, Wisconsin 53223
Phone (414) 354-1500, Twx 910-262-3035

"We Build Confidence!"

DELTA

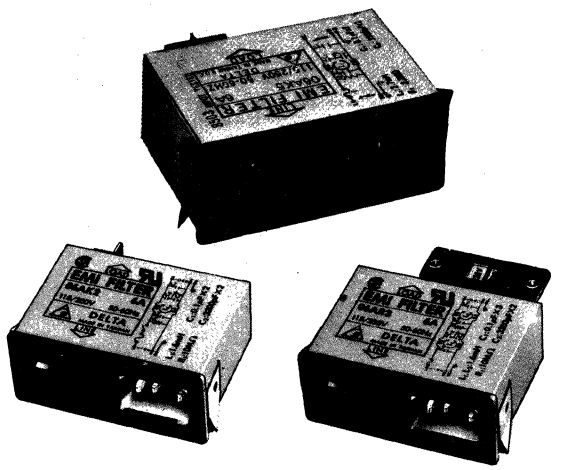
HPF 0565-3

AK/AR SERIES

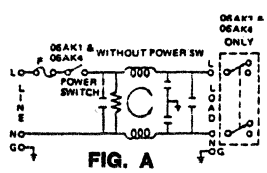
POWER ENTRY MODULE EMI FILTER

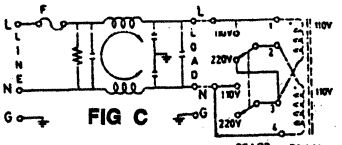
INTRODUCTION

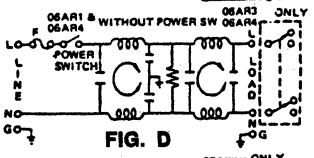
1. Both series incorporate an IEC connector, a fuse holder with optional power on/off switch and voltage selector switch plus an EMI filter all in one single, easy to install unit. **2.** AR series designed as high performance, two stage filter for low impedance load with better noise attenuation than AK series in low frequency application such as switching power supply. **3.** Presents at least a one-third cost saving over individual components, plus additional assembly cost savings and space savings due to compact design. **4.** Power switches are UL, CSA, VDE approved rated 6 amp both at 125V and 250V for single pole, and 6A/125V 4A/250V for double pole. **5.** Fuse holder designed for one IEC 5 20mm fuse and additional space for one spare fuse. **6.** Safety interlock prevents fuse removal with line plug inserted. **7.** All part numbers are UL recognized, CSA certified and VDE approved.

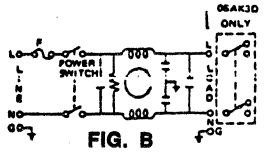


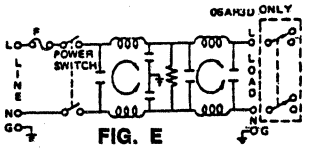
ELECTRICAL SCHEMATIC











SPECIFICATIONS

Maximum leakage current, each line-to-ground:
@ 115 VAC 60 Hz — 0.25 mA
@ 250 VAC 50 Hz — 0.45 mA
Hipot rating (one minute): line-to-ground 2250 VDC
line-to-line 1450 VDC
Operating frequency: 50-60 Hz
Rated voltage: 115/250 VAC
Minimum insertion loss in dB

Common mode (L-G) in 50 ohm system (Min)

Type	Frequency - MHz						
	.10	.15	.50	1.0	5.0	10	30
06AK	15	16	25	30	42	50	45
06AR	22	34	60	65	50	45	30
06AR2D, 3D	22	34	60	60	45	40	30

Differential mode (L-L) in 50 ohm system (Min)

06AK	6	6	30	48	40	40	40
06AR	5	8	30	65	55	50	45
06AR2D, 3D	5	10	10	50	50	45	40

Delta Part No.			06AK1	06AK2	06AK3	06AK4	06AK5	06AK2D	06AK3D	06AR1	06AR2	06AR3	06AR4	06AR2D	06AR3D
IEC Connector			△	△	△	△	△	△	△	△	△	△	△	△	△
Fuse Holder			△	△	△	△	△	△	△	△	△	△	△	△	△
Power Switch				△[1]	△[1]			△[2]	△[2]		△[1]	△[1]		△[2]	△[2]
Voltage Selector Switch					△[3]	△[3]	△[4]		△[3]			△[3]	△[3]		△[3]
Electrical Schematic			A	A	A	A	C	B	B	D	D	D	D	E	E
Dimension	L	Inch	2.38	2.38	2.59	2.59	2.38	2.38	2.59	2.38	2.38	2.59	2.59	2.38	2.59
		mm	60.5	60.5	65.8	65.8	60.5	60.5	65.8	60.5	60.5	65.8	65.8	60.5	65.8
Dimension	W	Inch	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64
		mm	67.0	67.0	67.0	67.0	67.0	67.0	67.0	67.0	67.0	67.0	67.0	67.0	67.0
Dimension	H	Inch	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
		mm	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0

1. Single Pole Power On/Off Switch approved by UL, CSA & VDE
Current Rating: 6A/250VAC
Electrical Life Time: 50,000 cycles
Maximum In-Rush Current: 24A
2. Double Pole Power On/Off Switch approved by UL, CSA & VDE
Current Rating: UL & CSA — 6A/125VAC, 4A/250VAC,
VDE — 4A/250VAC
Electrical Life Time: 10,000 cycles
Maximum In-Rush Current: 51A
3. Voltage Selector Switches — UL, CSA & VDE approved rated at 10A/125VAC 5A/250VAC, installed at the rear of Filters for 06AK3, 06AK3D & 06AK4, 06AR3, 06AR3D & 06AR4.
4. Voltage Selector Switch — UL, CSA & VDE approved rated 6A both at 125VAC & 250VAC, installed in the Front Panel of Filter for 06AK5.

DELTA ELECTRONIC INDUSTRIAL CO., LTD.
9th FL., ASIA ENTERPRISE CENTER, NO. 602, MIN CHUAN E. RD., TAIPEI, TAIWAN, R.O.C.
TEL: (02) 7169762, 7314822, 7517790 TELEX: "26524 DELTATRO" FAX: (02) 7169764
USA OFFICE: DELTA PRODUCTS CORP.
351 FAIRVIEW WAY, MILPITAS, CA 95035
TEL: (408) 262-2002 TELEX: "4992342 DELTAITTHY"

DELTA

EMI FILTERS

HPF 0565-3

INTRODUCTION

1. 300 standard part numbers UL recognized and CSA certified. **2.** Over 140 part numbers VDE approved to 0565-3 test specification and HPF temperature and humidity specification (−25°C to +85°C, 75% humidity) at full current ratings at both 115V and 250V. **3.** 100% tested for hi-pot, leakage current and insertion loss before and after potting. **4.** Less than 200 ppm defect rate. **5.** Superior mechanical construction, corrosion-proof case. **6.** Molded core cover to separate toroid windings, non-rotating terminal insulators, both crimped and soldered connections. **7.** Precision balance between choke windings, and use of low leakage current high voltage and temperature stable capacitors provide excellent performance under actual operating conditions.

SPECIFICATIONS

Maximum leakage current, each line-to-ground:
@ 115 VAC 60 Hz — 0.25 mA
@ 250 VAC 50 Hz — 0.45 mA
Hipot rating (one minute): line-to-ground 2250 VDC
line-to-line 1450 VDC
Operating frequency: 60-60 Hz
Rated voltage: 115/250 VAC

Minimum insertion loss in dB, in 50 ohm system:

Series No.	Frequency — MHz								
	.02	.05	.10	.15	.50	1.0	5.0	10	30
01, 03 DE	7	13	19	23	28	34	52	54	55
06 DE	2	5	10	12	21	26	42	50	55
01, 03 GE	9	15	21	26	36	44	54	55	55
06 GE	3	6	11	15	25	32	45	50	55
01, 03 SE	12	16	30	42	65	70	70	65	60
06 SE	6	11	15	25	50	60	70	65	55
02, 04, 06 BE	9	16	23	26	35	45	50	55	55
01—10 DB	8	15	20	25	30	38	50	50	50
20 DB	3	8	11	13	20	25	40	45	48
01—10 DK	8	15	20	22	30	38	50	55	55
20 DK	6	10	12	14	19	28	42	45	50
01—05 DR	8	10	30	45	65	70	70	65	55
10, 20 DR	7	10	15	20	44	60	70	60	50
03 DP	20	35	55	65	75	75	70	60	50
06 DP	16	25	44	58	70	70	70	60	50
10 DP	17	26	40	58	70	70	70	70	30

DIMENSIONS

Delta Part No.	Current Rating	Fig.	Inches Dimensions mm LxWxH—M*	LxWxH—M
*—DEEG3H	1, 3, 6A	1	2.08x1.97x0.82—1.58	52.8x 50.0x20.8— 40.1
*—DEEG3V	1, 3, 6A	2	1.53x1.97x0.82—1.58	38.9x 50.0x20.8— 40.1
*—GEEG3H	1, 3, 6A	1	1.95x1.97x0.82—1.58	49.5x 50.0x20.8— 40.1
*—SEEG3H	1, 3, 6A	3	3.47x1.97x0.82—1.58	88.2x 50.0x20.8— 40.1
*—SEEG3V	1, 3, 6A	4	3.04x1.97x0.82—1.58	77.2x 50.0x20.8— 40.1
04BEEG3S	4A	5	2.19x1.73x1.28—1.41	55.5x 43.9x32.5— 35.8
*—BEEG3H	2, 4, 6A	5	2.54x1.73x1.28—1.41	64.5x 43.9x32.5— 35.8
01DBAG5	1A	6	2.13x2.50x0.63—2.13	54.1x 63.5x16.0— 54.1
01DBAW5	1A	7	0.94x2.50x0.63—2.13	23.9x 63.5x16.0— 54.1
02DBAG5	2A	6	2.13x2.50x0.63—2.13	54.1x 63.5x16.0— 54.1
02DBAW5	2A	7	0.94x2.50x0.63—2.13	23.9x 63.5x16.0— 54.1
10DBAG5	10A	6	2.52x2.50x1.16—2.13	64.0x 63.5x29.5— 54.1
10DBAW5	10A	7	1.31x2.50x1.16—2.13	33.3x 63.5x29.5— 54.1
03DKAG5	3A	6	2.97x2.75x1.13—2.38	75.4x 69.9x28.7— 60.5
03DKAW5	3A	7	1.81x2.75x1.13—2.38	46.0x 69.9x28.7— 60.5
05DKAG5	5A	6	2.97x2.75x1.13—2.38	75.4x 69.9x28.7— 60.5
05DKAW5	5A	7	1.81x2.75x1.13—2.38	46.0x 69.9x28.7— 60.5
10DKAG5	10A	6	3.23x2.75x1.13—2.38	82.0x 69.9x28.7— 60.5
10DKAW5	10A	7	2.06x2.75x1.13—2.38	52.3x 69.9x28.7— 60.5
20DKBG5	20A	8	3.23x3.32x1.50—2.94	82.0x 84.3x38.1— 74.7
*—DKDG3	3, 5A	9	3.20x2.20x1.25—1.58	81.3x 55.9x31.8— 40.1
*—DKDW3	3, 5A	10	2.61x2.20x1.25—1.58	66.3x 55.9x31.8— 40.1
01DRCG5	1A	11	3.23x1.75x1.13—2.38	82.0x 44.5x28.7— 60.5
01DRCW5	1A	12	2.75x1.75x1.13—2.38	69.9x 44.5x28.7— 60.5
02DRCG5	2A	11	3.23x1.75x1.13—2.38	82.0x 44.5x28.7— 60.5
02DRCW5	2A	12	2.75x1.75x1.13—2.38	69.9x 44.5x28.7— 60.5
03DRCG5	3A	11	3.73x2.00x1.13—2.94	94.7x 50.8x28.7— 74.7
03DRCW5	3A	12	3.32x2.00x1.13—2.94	84.3x 50.8x28.7— 74.7
05DRCG5	5A	11	3.73x2.00x1.13—2.94	94.7x 50.8x28.7— 74.7
05DRCW5	5A	12	3.32x2.00x1.13—2.94	84.3x 50.8x28.7— 74.7
10DRCG5	10A	11	3.73x2.00x1.50—2.94	94.7x 50.8x38.1— 74.7
10DRCW5	10A	12	3.32x2.00x1.50—2.94	84.3x 50.8x38.1— 74.7
20DRGG5	20A	13	5.12x4.12x1.50—3.75	130.0x104.6x38.1— 95.3
*—DRDG3	3, 5, 10A	9	4.33x2.17x1.25—1.58	110.0x 55.1x31.8— 40.1
*—DRDW3	3, 5, 10A	10	3.75x2.17x1.25—1.68	95.3x 55.1x31.8— 40.1
03DPCW5	3A	12	3.73x2.20x1.53—4.15	94.7x 56.9x38.9—105.4
03DPCG5S	3A	11	3.73x2.00x1.76—2.94	94.7x 50.8x44.5— 74.7
03DPCW5S	3A	12	3.32x2.00x1.75—2.94	84.3x 50.8x44.5— 74.7
03DPDG3	3A	9	3.20x2.20x1.75—1.58	81.3x 55.9x44.5— 40.1
03DPDW3	3A	10	2.61x2.20x1.75—1.58	66.3x 55.9x44.5— 40.1

Available P/N: 01DEEG3H, 01DEEG3V, 03DEEG3H, 03DEEG3V, 06DEEG3H, 06DEEG3V, 01GEEG3H, 03GEEG3H, 06GEEG3H, 01SEEG3H, 01SEEG3V, 03SEEG3H, 03SEEG3V, 06SEEG3H, 06SEEG3V, 02BEEG3H, 04BEEG3H, 04BEEG3S, 06BEEG3H, 03DKDW3, 05DKDW3, 03DKDG3, 05DKDG3, 03DRDW3, 05DRDW3, 03DRDG3, 05DRDG3, 10DRDG3, 10DRDW3.

*M Pitch between mounting hole

FIG. 1

FIG. 2

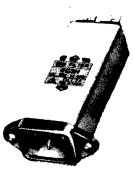


FIG. 3

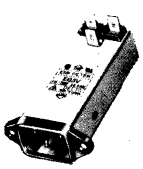


FIG. 4

FIG. 5

FIG. 6

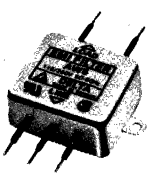


FIG. 7

FIG. 8

FIG. 9

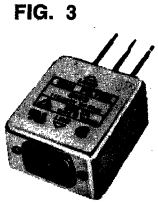


FIG. 10

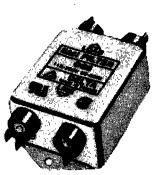


FIG. 11

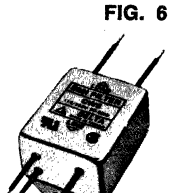


FIG. 12

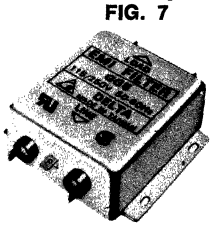


FIG. 13

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USA OFFICE: DELTA PRODUCTS CORP.
351 FAIRVIEW WAY, MILPITAS, CA 95035
TEL: (408) 262-2002 TELEX: "4992342 DELTAITTHY"

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K
kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L
LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microforad
MHz megahertz
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOSIGT metal-oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM nuclear instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLL phased lock loop
PPI plan position indicator
PROM programmable read only memory
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

epc CORPORATION

MANUFACTURERS OF ACTIVE AND PASSIVE FILTERS—DC TO 500MHz.

LOWPASS, HIGHPASS, BANDPASS, BANDREJECT CUSTOM OR STANDARD DESIGNS.

FILTER TYPES

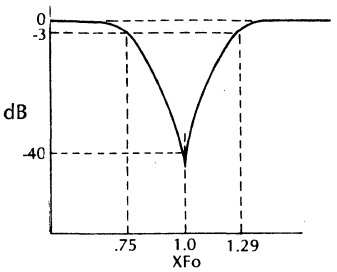
- Elliptic
- Tschebyscheff
- Butterworth
- Bessel
- Gaussian
- Legendre
- Inverted Chebychev
- Audio Frequency
- Equalizers
- Harmonic
- IF
- Video
- Telemetering
- Tone, Telegraph
- Constant group delay
- Wideband Band Pass
- Phase matched
- Attenuation matched

Components manufactured to rigid MIL-STD specifications with operating temperature range from −55°C to + 125°C.

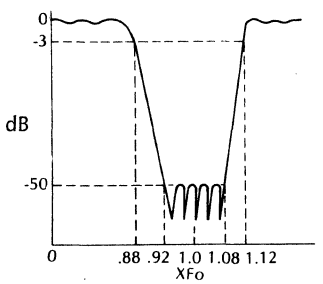
CUSTOM BUILT FILTERS PROMPT DELIVERY

The filters listed here are some of the typical units we build. We can design filters to your exact specifications. Call for more information.

ACTIVE NOTCH FILTER

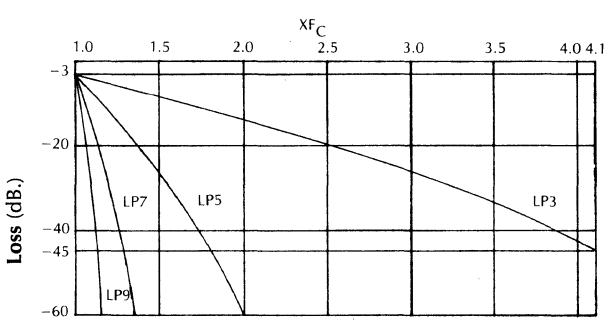


LC BAND REJECT FILTER



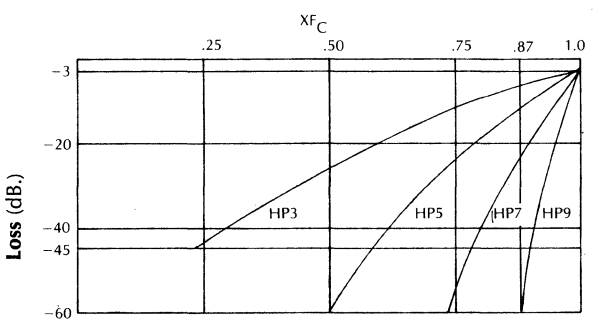
LC LOW PASS SERIES

SERIES TYPE	STOPBAND	MAX. CASE DIMENSIONS
LP3	>45dB @ 4.1 Fc & above	1x1x.6"
LP5	>60dB @ 2 Fc & above	1.25x1.25x.6"
LP7	>60dB @ 1.35 Fc & above	1.5x1.5x.6"
LP9	>60dB @ 1.15 Fc & above	2x1.75x.6"



LC HIGH PASS SERIES

SERIES TYPE	STOPBAND	MAX. CASE DIMENSIONS
HP3	>45dB @ .24 Fc & below	1x1x.6"
HP5	>60dB @ .5 FC & below	1.25x1.25x.6"
HP7	>60dB @ .74 Fc & below	1.5x1.5x.6"
HP9	>60dB @ .87 Fc & below	2x1.75x.6"



LC NARROW BANDPASS SERIES

SERIES TYPE	PERCENT BANDWIDTH (3dB)	PASSBAND 3dB. MAX @	STOPBAND >60dB. @
NB-2	±2	.98 Fo & 1.02 Fo	.85 Fo & below 1.17 Fo & above
NB-3	±3	.97 Fo & 1.03 Fo	.80 Fo & below 1.25 Fo & above
NB-4	±4	.96 Fo & 1.04 Fo	.74 Fo & below 1.35 Fo & above

LC WIDEBAND BANDPASS SERIES

SERIES TYPE	PERCENT BANDWIDTH (3dB)	PASSBAND 3dB. MAX @	STOPBAND >60dB. @
WB-25	25	.87 Fo & 1.14 Fo	.58 Fo & below 1.70 Fo & above
WB-50	50	.78 Fo & 1.28 Fo	.38 Fo & below 2.60 Fo & above
WB-100	100	.62Fo & 1.62 Fo	.21 Fo & below 4.65 Fo & above

CASE DIMENSIONS: 2"x1.75"x.6" MAX

ELECTRONIC PRECISION COMPONENTS CORPORATION

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ESC ELECTRONICS CORPORATION
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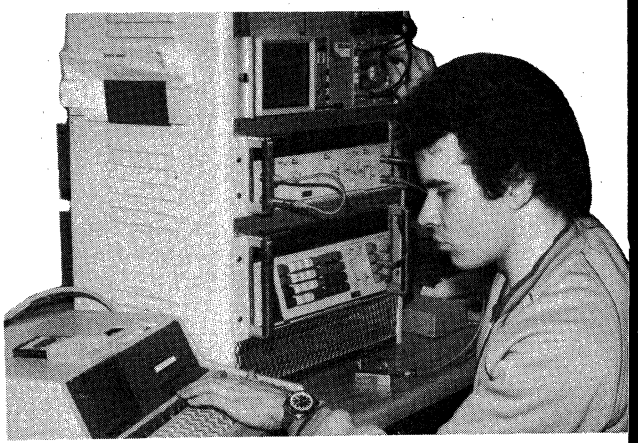
LC FILTERS
DC TO 500 MHZ

30 Year Leadership in Quality and Reliability!



Covering a range of DC to 500 Mhz, ESC designs and manufactures a wide variety of LC filters for commercial and military high reliability applications. Starting with computer aided design through final test on ESC's computer controlled Network Analyzer, ESC's long history of quality and experience assures maximum component efficiency and reliability. ESC has established controlled manufacturing facilities with certified operators to produce components to all levels of reliability from missile applications to space probe environments. Conformance to MIL-F-18327 is normal and to MIL-Q-9858A as required.

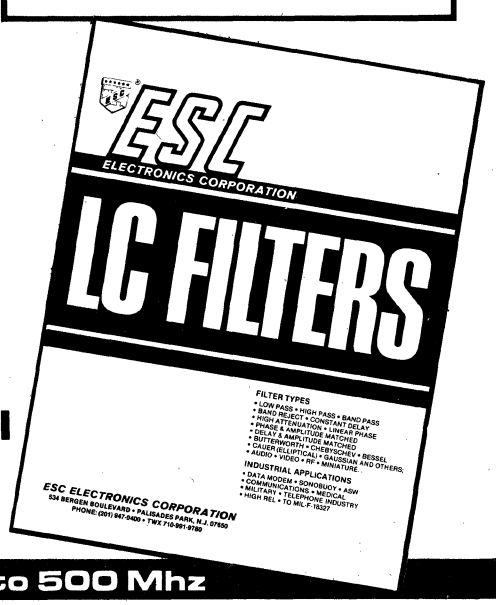
Dual-in-Line (14 Pin) LC Filters-Miniature
Size: .76L X .46W X .28H, From 1Khz to 10 Mhz.
Series DIFL20 - Low Pass, 20db Stopband at $1.4f_c$
Series DIFL39 - Low Pass, 39db Stopband at $2.5f_c$
Series DIFLP - Linear Phase, 30db at $5.0f_c$
Series DIFH20 - High Pass, 20db at $.715f_c$
Series DIFH39 - High Pass, 39db at $.4f_c$

Flatpack LC Filter Series-2Khz at 50 Khz
Epoxy molded for P.C. Board mounting, maximum height of .350 and volume of .35 to .55 cubic inches.
Series FL - Low Pass, 130db/octave roll-off
Series MFL - Low Pass, 100db/octave roll-off
Series MFH - High Pass, 100db/octave roll-off
Series CF - 15% Band Pass
Series DF - 20% Band Pass
Series LF - 60% Band Pass

Low Profile Hybrid RLC Filters
Let ESC repackage your RLC filters using advanced hybrid technology. Available for filters in the 1-50Mhz range both single-ended and balanced outputs.
Contact Plant with your requirement.

FILTER TYPES
• LOW PASS • HIGH PASS • BAND PASS
• BAND REJECT • CONSTANT DELAY
• HIGH ATTENUATION • LINEAR PHASE
• PHASE & AMPLITUDE MATCHED
• DELAY & AMPLITUDE MATCHED
• BUTTERWORTH • CHEBYSCHEV • BESSEL
• CAUER (ELLIPTICAL) • GAUSSIAN AND OTHERS;
• AUDIO • VIDEO • RF • MINIATURE...

INDUSTRIAL APPLICATIONS
• DATA MODEM • SONOBUOY • ASW
• COMMUNICATIONS • MEDICAL
• MILITARY • TELEPHONE INDUSTRY
• HIGH REL • TO MIL-F-18327



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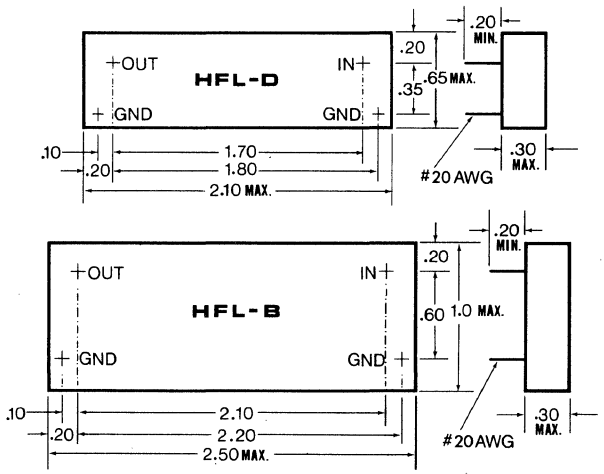
LC FILTERS DC to 500 Mhz

OVER 30 YEARS OF SUPERIOR QUALITY AND RELIABILITY!

ESC LC FILTERS

HFL HIGH FREQUENCY 50 MHZ TO 500 MHZ

Low Pass Series Filters



SPECIFICATIONS:

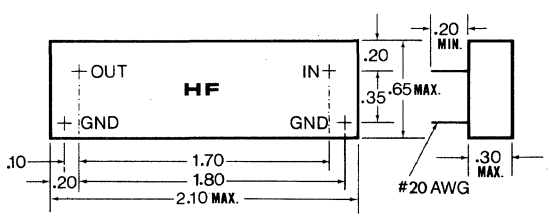
- Insertion Loss: 1 db max at reference frequency
- Reference Frequency: Min. loss in passband
- Source & Load Impedance: 50 Ω
- Cut-off Frequency (f_c): 3 db max at f_c
- Passband Ripple: 1 db max
- Operating Temperature Range: -55°C to + 125°C
- Construction: Metal encased-Hermetically sealed-PC board mounting.
- Built to conform to applicable portions of MIL-F-18327.

Series	Cut-off Frequency (f_c) Range (Mhz)	Stop Band 60 db min. at
HFL-D	50 - 500	1.4 f_c & above
HFL-B	50 - 500	1.2 f_c & above

To order specify by Series number and Passband cut-off frequency.

HF HIGH FREQUENCY 50 MHZ TO 500 MHZ

Band Pass Series Filters



SPECIFICATIONS:

- Insertion Loss: 8 db max
- Source & Load Impedance: 50 Ω
- Passband Ripple: ± .5 db max
- Operating Temperature Range: -55°C to + 125°C
- Construction: Metal encased-Hermetically sealed-PC board mounting.
- Built to conform to applicable portions of MIL-F-18327.

Series	Center Frequency (f_o) Range (Mhz)	3 db Bandwidth	Stopband Attenuation 60 db min. at
HFA	50 - 500	± 2% f_o	.62 f_o & 1.68 f_o
HFB	50 - 500	± 3.5% f_o	.58 f_o & 1.72 f_o
HFC	50 - 500	± 5% f_o	.55 f_o & 1.82 f_o
HFD	50 - 500	± 7.5% f_o	.45 f_o & 2.2 f_o

Order by specifying Series and f_o.

LC FILTERS DC to 500 Mhz

HIGH-PERFORMANCE APPLICATION ENGINEERED EMI FILTERS

- PERFORMANCE PROVEN & TESTED with OEM & custom design switching and linear power supplies
- INDUSTRY'S WIDEST SELECTION OF EMI filters for switchers requiring single or multiple phase AC power

SE SERIES
SWITCHING POWER SUPPLY FILTER

Our most compact and economical T section filter for applications using switching power supplies and required to meet FCC conducted EMI specifications.

SE Series EMI filters are designed to provide balanced differential and common mode insertion loss for reliable performance at 450KHz and above with the typical off line type switcher.

Part No.	Current	Case	Leakage*
SE3	3A	2.75x1.75x.87	0.8 mA
SE7	7.5A	2.75x2.0x1.25	0.8mA
SE15	15A	3.31x2.0x1.5	0.8mA
SE20	20A	3.67x2.12x1.78	0.8mA
SE30	30A	4.0x2.8x2.0	1.6mA
SE50	50A	5.5x3.0x2.75	1.6mA

Rated Voltage: 250VAC 47-63HZ
Test Voltage: Line To Line: 1.5 KVDC
Line To Gnd: 2.2 KVDC
Insertion Loss: (typical 50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	7db	15db	50db	65db	65db	55db
L/L	7db	15db	50db	60db	55db	50db

SF SERIES
HIGH PERFORMANCE SWITCHING SUPPLY FILTER

Designed for applications required to meet the VDE conducted EMI spectrum, SF Series T section filters are designed to effectively attenuate differential and common mode noise from switching supplies down to the 150KHz limit of VDE 0871 and 0875 spectrums.

The SF Series also provides the added performance often required to solve severe FCC conducted EMI problems.

Part No.	Current	Case	Leakage*
SF3	3A	2.75x2.0x1.25	0.8mA
SF5	5A	2.5x2.0x1.5	0.8mA
SF7	7.5A	3.31x2.0x1.5	0.8mA
SF10	10A	3.67x2.12x1.75	0.8mA
SF15	15A	4x2.87x2.0	0.8mA
SF20	20A	5.1x4.1x1.5	1.2mA
SF30	30A	5.5x3.0x2.75	1.6mA
SF45	45A	8.22x3.0x2.75	1.6mA

Rated Voltage: 250VAC, 47-63Hz
Test Voltages: Line To Line: 1.5KVDC
Line To Gnd: 2.2KVDC
Insertion Loss: (Typical 50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	8db	45db	65db	65db	65db	60db
L/L	15db	45db	60db	60db	65db	60db

SX SERIES
PREMIUM SWITCHING POWER SUPPLY FILTER

With an extra 15 db of performance at 150KHz our SX Series filters are designed to solve severe conducted EMI problems in equipment required to meet VDE 0871 and 0875 spectrums.

SX Series T section filters are designed to remain effective independent of wide variations in line and load impedance and noise characteristics.

Part No.	Current	Case	Leakage*
SX3	3A	3.3x2.0x1.5	0.8mA
SX7	7.5A	5.0x2.0x2.0	0.8mA
SX15	15A	5.5x3.0x2.75	1.6mA
SX30	30A	8.25x3.0x2.75	1.6mA
SX60	60A	12.0x6.5x4.75	1.8mA

Rated Voltage: 250VAC, 47-63HZ
Test Voltages: Line To Line: 1.5VDC
Line To Gnd: 2.2KVDC
Insertion Loss: (Typical 50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	20db	60db	65db	65db	60db	55db
L/L	30db	60db	65db	65db	60db	50db

SW SERIES
WIDE BAND HIGH PERFORMANCE FILTER

Extended high and low frequency insertion loss characteristics are featured with the SW Series filters.

Designed to provide the wide spectrum EMI performance often required for VDE 0871 level B and MIL STD-461B type requirements.

Part No.	Current	Case	Leakage*
SW3	3A	3.67x2.12x1.75	2.4mA
SW5	5A	5.0x2.0x2.0	2.4mA
SW10	10A	5.5x3.0x3.0	2.4mA
SW20	20A	8.25x3.0x3.0	2.4mA
SW30	30A	8.62x4.0x4.0	2.4mA

Rated Voltage: 250VAC, 47-63 Hz
Test Voltages: Line To Line: 1.5KVDC
Line To Gnd: 2.2KVDC
Insertion Loss: (Typical 50 ohms)

	.05MHz	0.5MHz	1.5MHz	5.0MHz	50MHz	0.1GHz
L/G	35db	70db	70db	70db	60db	50db
L/L	50db	70db	70db	70db	60db	50db

TF SERIES
HIGH PERFORMANCE LOW LEAKAGE SWITCHING SUPPLY FILTER

High performance low leakage T section filter provides extended low frequency attenuation for applications required to meet enforced VDE conducted EMI spectrums.

TF Series filters provide the balanced differential and common mode performance plus the low leakage current often required for products using off line switching power supplies.

Part No.	Current	Case	Leakage*
TF2	2a	2.75x1.75x1.12	.45mA
TF3	3A	2.75x2.0x1.25	.45mA
TF5	5A	3.31x2.0x1.5	.45mA
TF10	10A	6.0x2.0x1.5	.45mA

Rated Voltage: 250VAC, 47-63 Hz
Test Voltages: Line To Line: 1.5KVDC
Line To Gnd: 2.2KVDC
Insertion Loss: (Typical 50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	10db	48db	>65db	>65db	>65db	60db
L/L	12db	40db	55db	60db	60db	60db

DF SERIES
POWER SUPPLY OUTPUT FILTER

Multiple channel differential and common mode filter for regulated outputs of switchers to minimize their noise disturbances of low level analog circuitry.

DF Series filters also attenuate EMI from wall mount power supplies.

Part No.	Current	Case	Leakage*
DF104	4x10A	2.75x2.0x1.25	N/A
DF106	6x10A	3.31x2.0x1.50	N/A

Rated Voltage: 50VAC-DC
Test Voltage: Line to Gnd: 200VDC
Insertion Loss: (Typical 50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	15db	25db	35db	50db	50db	50db
L/L	3db	15db	35db	45db	50db	50db

Includes a minimum of 10mfds at the load.

FCI reserves the right to make specification changes without notice. Consult the factory for current information.

FCI FILTER CONCEPTS INC.
2624 S. Rousselle St., Santa Ana, CA 92707 • (714) 545-7003

HIGH-PERFORMANCE APPLICATION ENGINEERED EMI FILTERS

- PERFORMANCE PROVEN & TESTED with OEM & custom design switching and linear power supplies
- INDUSTRY'S WIDEST SELECTION OF EMI filters for switchers requiring single or multiple phase AC power

LE SERIES
LOW LEAKAGE π SECTION FILTER

Our most economical and compact π section filter features low leakage current with balanced differential and common mode performance.

LE Series filters are designed as system level filters to augment the existing filter included with off line switchers. An optional ground isolater is available.

Part No.	Current	Case	Leakage
LE5	5A	2.75x1.75x.87	.30mA
LE10	10A	2.75x1.75x1.12	.30mA
LE15	15A	3.31x2.0x1.50	.30mA
LE20	20A	3.67x2.12x1.75	.30mA
LE30	30A	4.0x2.87x2.0	.45mA

Rated Voltage: 250VAC 47-63Hz
Test Voltages: Line To Line: 1.5KVDC
Line To Gnd: 2.2KVDC
Insertion Loss: (Typical 50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	8db	20db	32db	40db	45db	50db
L/L	8db	12db	45db	65db	65db	60db

LF SERIES
PREMIUM LOW LEAKAGE π SECTION FILTER FOR SWITCHERS

High performance low leakage π section filter offers enhanced differential and common mode insertion loss in compact case sizes.

The LF Series is designed to work with the existing EMI filter in an off line switcher, or by itself, providing the extra differential and common mode performance often required to meet FCC and VDE specifications.

Part No.	Current	Case	Leakage*
LF2	2A	2.75x1.75x.87	.45mA
LF3	3A	2.75x2.0x1.25	.45mA
LF5	5A	2.5x2.0x1.5	.45mA
LF7	7A	3.31x2.0x1.5	.45mA
LF10	10A	3.67x2.12x1.75	.45mA
LF15	15A	4.0x2.87x2.0	.45mA

Rated Voltage: 250VAC, 47-63Hz
Test Voltages: Line To Line: 1.5KVDC
Line To Gnd: 2.2KVDC
Insertion Loss: (Typical 50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	18db	30db	42db	50db	50db	50db
L/L	6db	30db	60db	60db	60db	60db

LX SERIES
PREMIUM LOW LEAKAGE π SECTION FILTER FOR SWITCHERS

Providing significant performance from 10KHz to 30MHz, the LX Series filter is designed for applications required to meet the 10KHz to 150KHz extension of VDE 0871.

The LX Series EMI filter is designed to work with the existing filter in a switching supply or as a stand alone unit. It provides the extra differential and common mode low frequency insertion loss required while maintaining good high frequency characteristics.

Part No.	Current	Case	Leakage*
LX1	1.5A	2.75x2.0x1.25	0.45mA
LX3	3A	3.31x2.0x1.5	0.45mA
LX6	6A	6.24x2.0x1.5	.45mA
LX7	7.5A	4.0x2.87x2.0	0.8mA
LX10	10A	6.24x2.0x2.75	0.8mA
LX15	15A	6.0x3.0x3.0	1.2mA
LX20	20A	8.25x3.0x3.0	1.6mA

Rated Voltage: 250VAC 47-63Hz
Test Voltages: Line To Line: 1.5KVDC
Line To Gnd: 2.2KVDC
Insertion Loss: (Typical 50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	30db	40db	50db	50db	50db	50db
L/L	45db	65db	65db	65db	65db	60db

3E SERIES
3 PHASE T SECTION FILTER

High performance with switching power supplies in 3 phase Wye or Delta configurations is offered by this Series.

3E Series T section filters are proven performers with single or multiple switching supplies in balanced or unbalanced configurations required to meet FCC conducted EMI spectrums.

Part No.	Current	Case	Leakage*
3E15	15A	6.0x3.0x3.0	1.2mA
3E30	30A	6.62x4.0x4.0	1.6mA
3E40	40A	8.62x4.0x4.0	1.8mA
3E60	60A	9.96x5.0x4.75	1.8mA

Rated Voltage: 250VAC, 47-63Hz
Test Voltage: Line To Line: 2.2KVDC
Line to Grid: 2.2KVDC
Insertion Loss: (Typical 50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	3db	25db	55db	60db	50db	50db
L/L	12db	22db	50db	55db	50db	50db

3F SERIES
HIGH PERFORMANCE 3 PHASE FILTER

Extended low frequency performance for 3 phase applications required to meet VDE conducted EMI spectrums with switch mode power supplies.

3F Series T section filters effectively attenuate differential and common mode noise from switching power supplies in balanced or unbalanced configurations.

Part No.	Current	Case	Leakage
3F15	15A/PH	6.62x4.0x4.0	1.6mA
3F30	30A/PH	10x5.0x4.75	1.8mA
3F60	60A/PH	14x6.5x4.75	2.4mA

Rated Voltage: 250VAC, 47-63 Hz
Test Voltages: Line To Line: 2.2KVDC
Line To Gnd: 2.2KVDC
Insertion Loss: (Typical 50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	10db	50db	65db	65db	65db	60db
L/L	15db	50db	60db	60db	60db	55db

3X SERIES
PREMIUM 3 PHASE FILTER

The extra 15 db of insertion loss at 150KHz provided by the 3X Series is often required in 30 power systems with multiple high power switch mode supplies.

The 3X Series maintains its enhanced performance in balanced or unbalanced and in Wye or Delta configurations.

Part No.	Current	Case	Leakage*
3X7	7.5A/PH	6.62x4.0x4.0	1.6mA
3X15	15A/PH	10x5.0x4.75	1.6mA
3X30	30A/PH	14x6.5x4.75	1.8mA

Rated Voltage: 250VAC, 47-63 Hz
Test Voltages: Line To Line: 2.2KVDC
Line To Gnd: 2.2KVDC
Insertion Loss: (Typical 50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	20db	60db	65db	65db	60db	60db
L/L	30db	65db	65db	65db	60db	55db

*Each line to Gnd @250 VAC/50 Hz

FCI reserves the right to make specification changes without notice. Consult the factory for current information.

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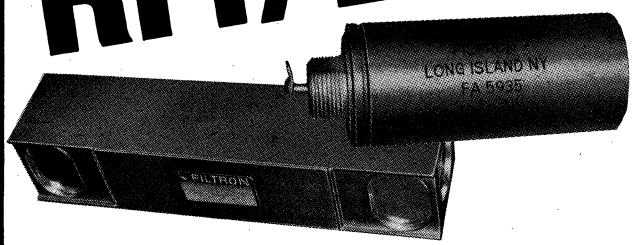
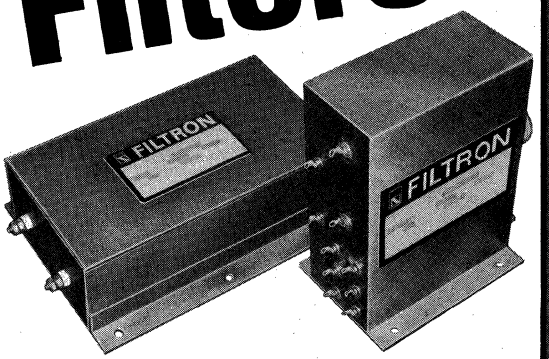
Standard to the Industry Since 1946
RFI/EMC Filters





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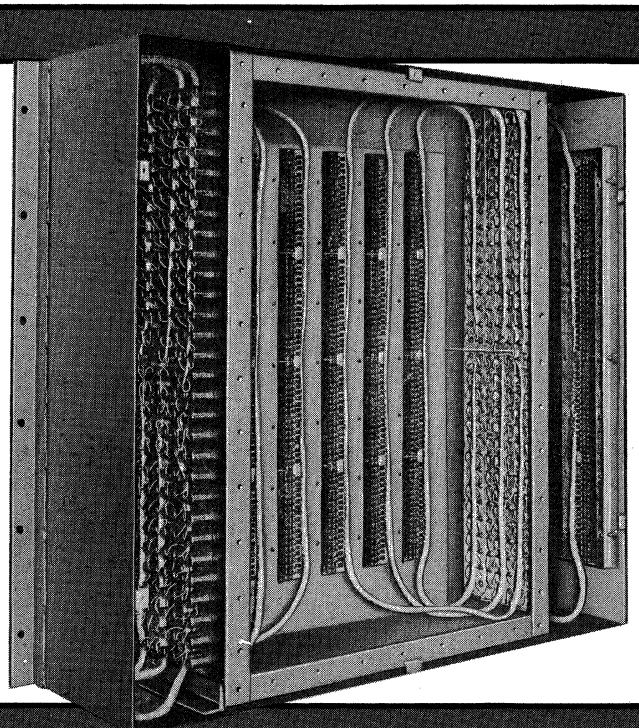

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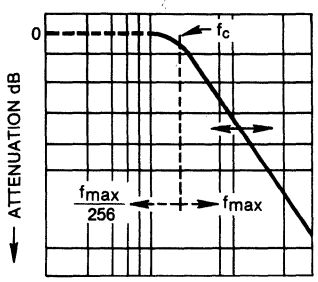
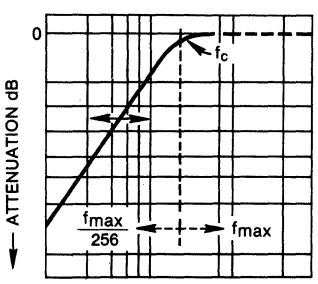
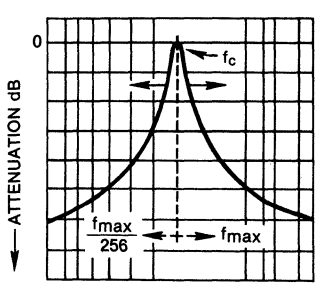


NORMALIZED FREQUENCY f/fc
844 SERIES LOWPASS



NORMALIZED FREQUENCY f/fc
874 SERIES HIGHPASS



NORMALIZED FREQUENCY f/fc
864 SERIES BANDPASS

844 SERIES 4-POLE LOWPASS FILTERS				
		CHEBYCHEFF RESPONSE		
BUTTERWORTH RESPONSE	BESSEL RESPONSE	Passband Ripple 0.2dB	Passband Ripple 0.5dB	PROGRAMMABLE TUNING RANGE (Hz)
844P8B-1	844P8L-1	844P8YA2W-1	844P8YA5W-1	0.1 to 25.6
844P8B-2	844P8BL-2	844P8YA2W-2	844P8YA5W-2	1.0 to 256
844P8B-3	844P8L-3	844P8YA2W-3	844P8YA5W-3	10 to 2560
844P8B-4	844P8L-4	844P8YA2W-4	844P8YA5W-4	100 to 25.6k
844P8B-5	844P8L-5	844P8YA2W-5	844P8YA5W-5	200 to 51.2k

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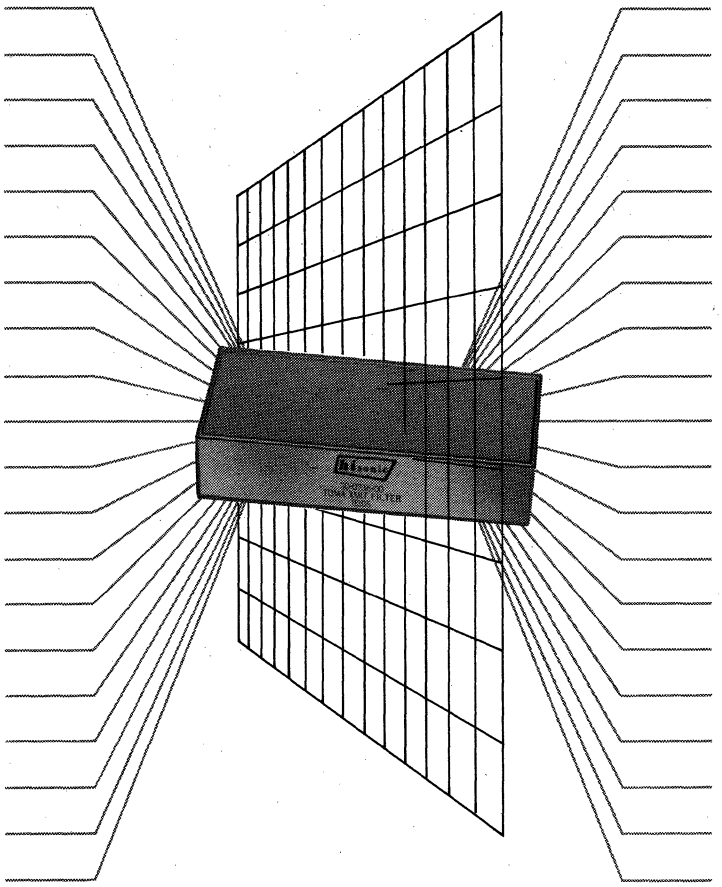

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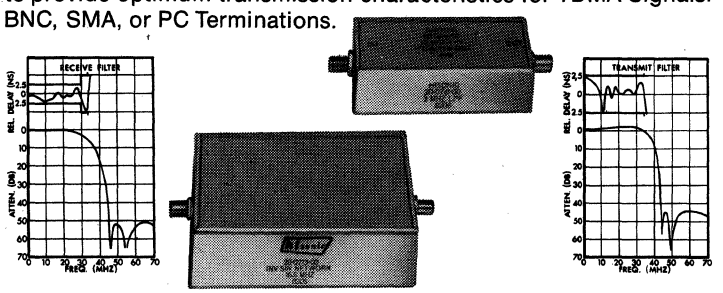
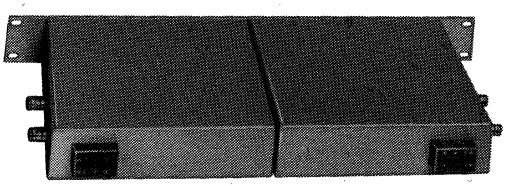


Telephone Interconnect Filters:

Base Group Interconnect 60-108 KHZ
P/N 20-0999-00

Super Group Interconnect 312-552 KHZ
P/N 20-0651-02



Base Band Separation Filters:

Supergroup 1-2	Supergroup 2-3
0-300 KHZ LP	0-552 KHZ LP
312-12000 KHZ HP	564-12000 KHZ HP
P/N 20-0998-00	P/N 20-0688-02

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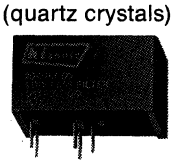

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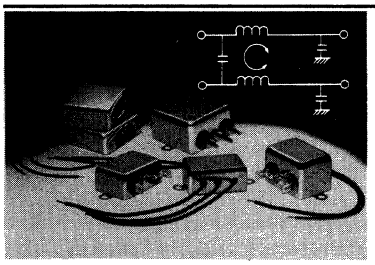
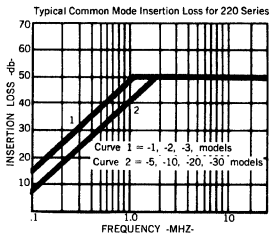
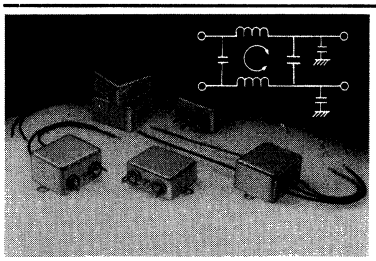


220 Series

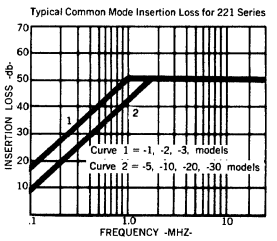
The 220 series is designed to give excellent filtering of "common mode," line-to-ground interference on computer-peripheral and other electronic hardware. Line-to-ground interference is the most common interference experienced and is generally the major source of "interference caused" malfunctions.

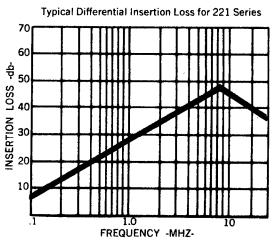


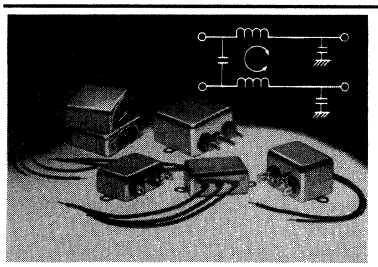


221 Series

The 221 series has the same "common mode" performance as the 220 series but the circuit has been modified to give substantial "differential mode" rejection of noise caused by switching transistors and power supply diodes.

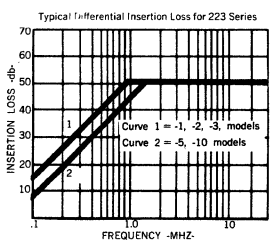


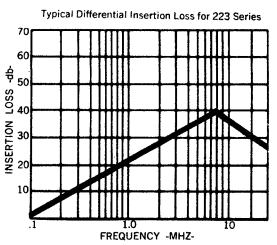


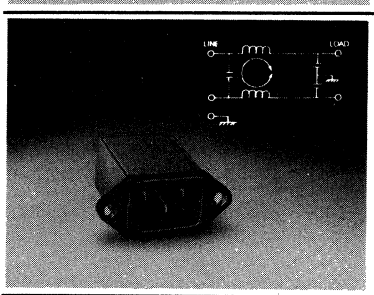


223 Series

The 223 series in intended as an economical compromise between the 220 and 221 series. This filter has the same "common mode" performance as the 220 model with approximately one-half the differential attenuation of the 221 series.

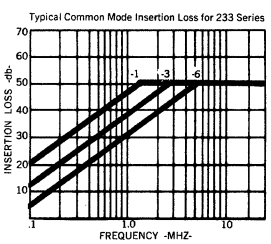


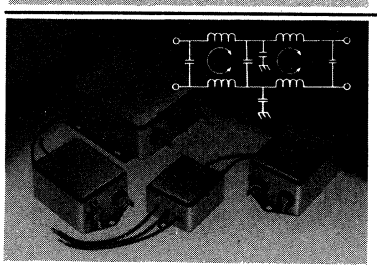




233 Series

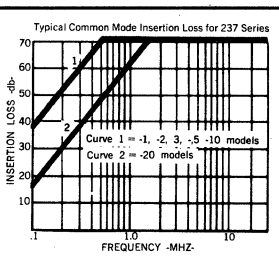
The 233 series filter is a compact filter with an integral IEC connector. This filter gives effective line-to-ground insertion loss and has low leakage current to meet VDE, SEV and other safety organization requirements. If you want an integral filter and connector ask your representative or contact the factory. Many of our other filters can be made available with the IEC connector.

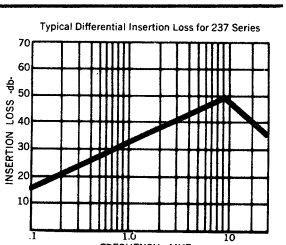


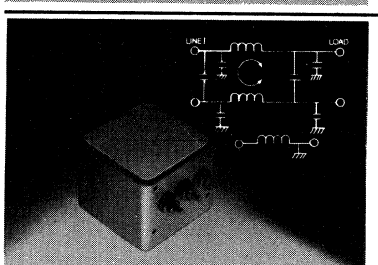


237 Series

This series is a high performance package where filtering requirements are more stringent than those associated with the 220 or 221 series. This package incorporates very high attenuation of both "common mode" and "differential mode" interference yet the cost for such attenuation is moderate.

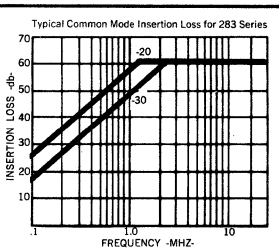


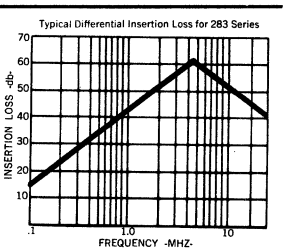




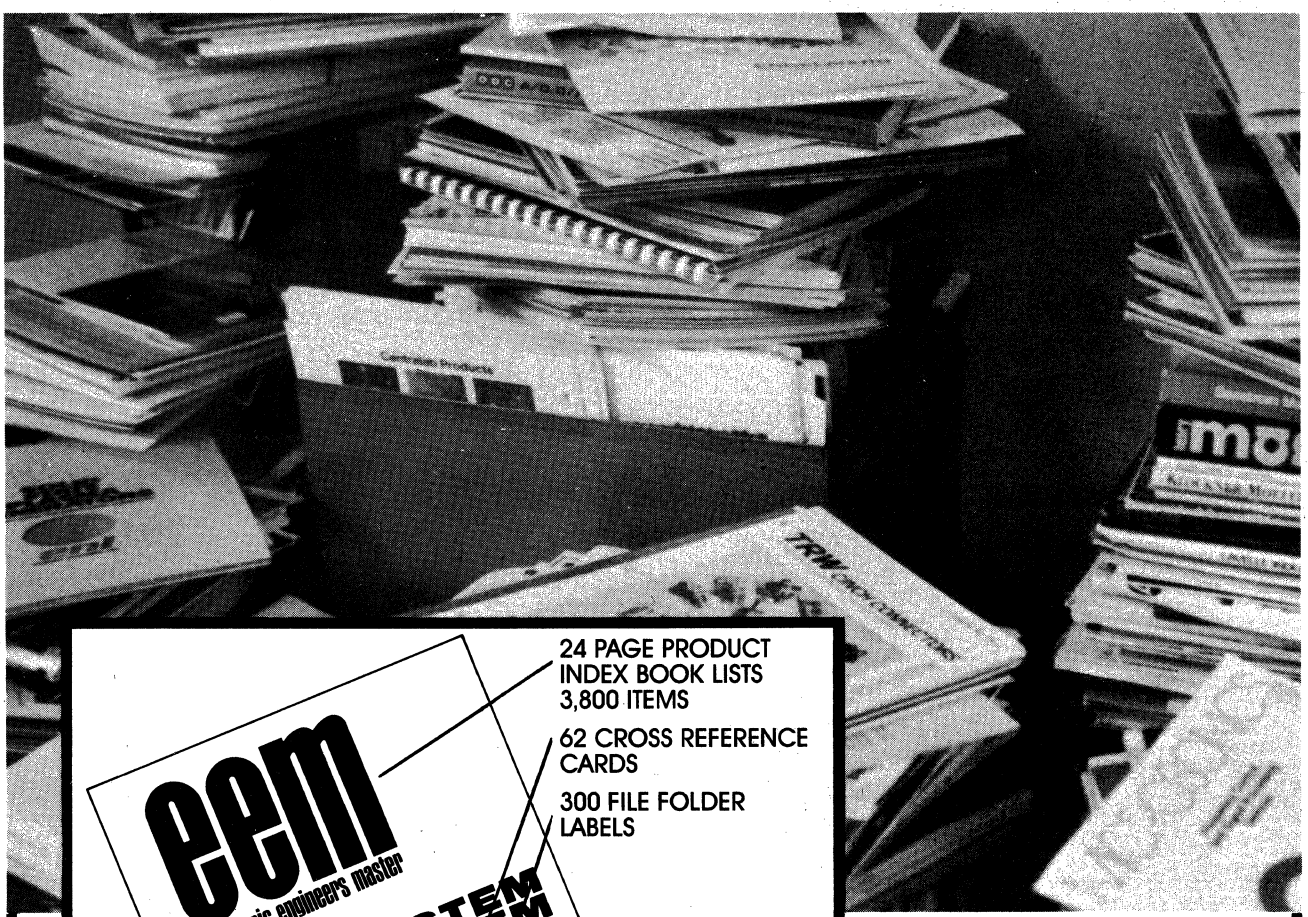
283 Series

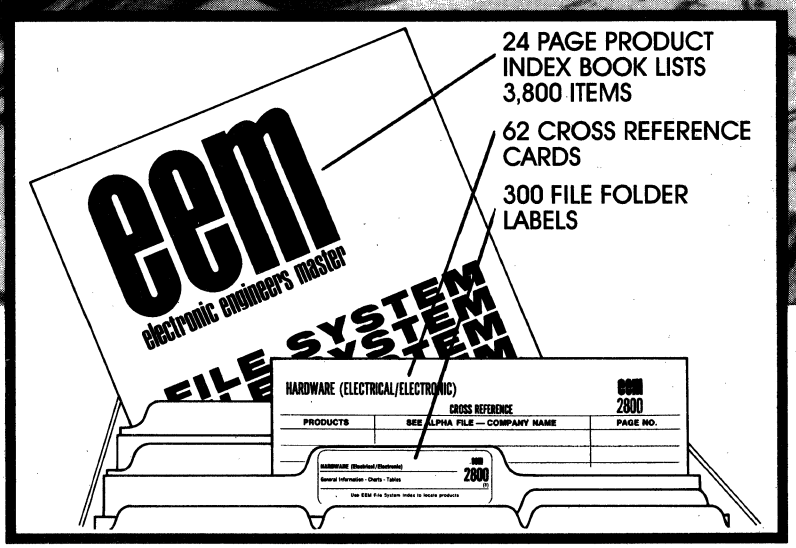
The 283 series is a compact single phase high current filter. This filter is rated for 20 and 30 amps and has good common mode and differential mode insertion loss. This filter has a ground coil for high frequency ground isolation which may be included or omitted as desired.





JMK INCORPORATED • 15 CALDWELL DRIVE • AMHERST, NH 03031 • (603) 886-4100





24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS

62 CROSS REFERENCE CARDS

300 FILE FOLDER LABELS

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GET ORGANIZED!

Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

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The EEM File System is shipped in one neat package. The package contains everything you need to set up your very own filing system. Best of all, it's easy to get and very affordable. Send a check or money order for $25.00 and EEM will pay the postage and sales tax. If you must use a purchase order, please add $5.00 for postage and handling. An invoice will accompany your System.

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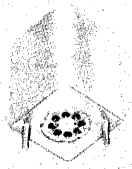
EEM FILE SYSTEM,
645 stewart ave., garden city, ny 11530

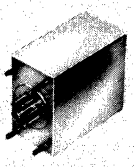
KR ELECTRONICS, INC. 91 Avenel Street, Avenel, New Jersey 07001 • (201) 636-1900

LOW PASS FILTERS



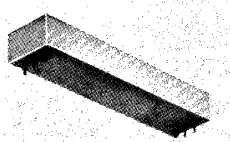
Frequency Range: DC to 50MHz
Impedance Range: 1 ohm to ∞
Stop Bands: 10 to 80db

BAND PASS FILTERS



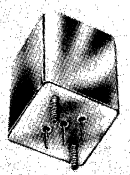
Frequency Range: DC to 50MHz
Band Width: 1% to >100%
Stopband: 10 to 80db
Impedance Range: 1 ohm to ∞

HIGH PASS FILTERS



Frequency Range: DC to 50MHz
Impedance Range: 1 ohm to ∞
Stop Bands: 10 to 80db

BAND REJECT FILTERS



Frequency Range: DC to 50MHz
Band Width: 1% to >100%
Stop Band: 10 to 80db
Impedance Range: 1 to ∞

Custom LC Filters

☐ Filters ☐ Attenuation Equalizers ☐ Group Delay Equalizers ☐ Cable Equalizers ☐ Phase Equalizers ☐ Phase and Attenuation Matched ☐ Delay Lines

Computer-Assisted Design

Shown here are some typical examples of our LC filter design capabilities. Through the use of in-house computers, plus computer time-sharing, we can quickly generate and evaluate such output data as frequency vs. impedance, attenuation, phase, group delay and phase delay in order to provide an immediate quotation.

KR Electronics has computer programs for:

1. Analysis of network behavior to determine attenuation, phase, group delay, transient response and response to a step function and a tone burst.
2. Predistortion of a network and synthesis of a network directly from the poles and zeros.
3. Designing equal ripple group delay networks from your error curve.
4. Determining a network's tolerance sensitivity and reliability.
5. Determining degree of success that can be achieved in production of matched networks.

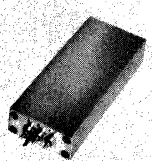
Some of the specialized test equipment used:

1. Computer controlled HP 3042A automatic test set can supply tabular or graphic data with each unit.
2. Programmable synthesizer, phase, gain test sets.
3. Swept low frequency group delay and attenuation test set.
4. Spectrum analyzer.
5. Swept high frequency test set.

DIP Filters

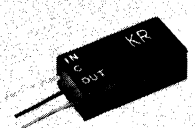
For information on our complete line of DIP filters, send for comprehensive catalog.

MATCHED PHASE & ATTENUATION



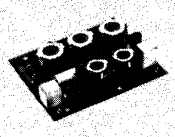
Typical Specifications:
Phase Matched ± 2½° in Pass Band
Attenuation Matched ±.25db in Pass Band for use in Sonar & other multi channel systems.

MAXIMUM FLAT DELAY (BESSEL) FILTER



Size (Typical): .75" x .75" x 1.5"
Frequency Range: 1.5KHz to 1MHz
Z Range: 50 to 10 K
Overshoot: <1%
Delay Flat: <2% to Fc

LINEAR GROUP DELAY VIDEO FILTER



Typical Specifications:
L.P. Cutoff: 4.5 MHz
I.L.: <1db
Passband Ripple: <±.1db
Pass Band Delay Distortion: <25 nsec.
Stopband: >25db

GROUP DELAY & ATTENUATION EQUALIZER NETWORK

To correct system introduced delay distortion & attenuation roll off.

Constant Group Delay Filters

Computer-designed and checked to give equal ripple delay over the pass band insuring exact delay and attenuation characteristics.

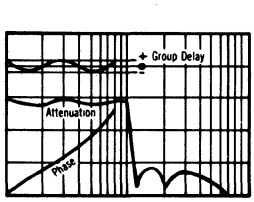
Frequency Range: DC to 50 MHz
Impedance Range: 1 ohm to ∞
Temperature Range: —55°C to +125°C.
Complete Encapsulation
Hermetic Seal
P.C. Board Construction
Case Configuration:
Stock or Custom Designed
P.C. Card
Dual In-Line
Standard Hardware Program
All filters conform to applicable mil specifications.

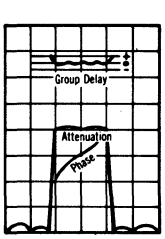
Phase & Attenuation Matching

Differential phase and attenuation matched to eliminate the need for adjustments in multi-channeled systems.

Linear Phase Filters

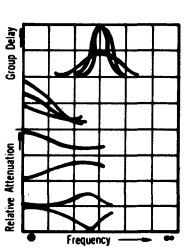
To reduce distortions and lower transient response in modulated systems.





Equalizers

Phase/Delay/Attenuation Computer-designed correction networks derived from system error curves.



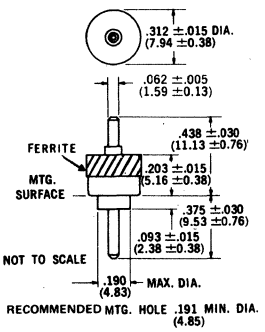
Printed in USA

METUCHEN CAPACITORS INC.

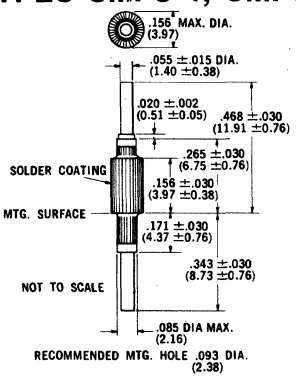
EMI/RFI Suppression Filters

Specifications	Type FCS-C	Type SMFB-A4	Type SMF0-1 / Type SMFB-A1	Type SMFB-A2 / Type SMF0-2
Attenuation 100 MHz - 10 GHz	25 dB @ 25°C 20 dB @ 85°C	50 dB @ 25°C 45 dB @ 125°C	35 dB @ 25°C 35 dB @ 125°C	60 dB @ 25C° 50 dB @ 85°C
Operating Temperature Range	−55°C to +85°C	−55°C to +125°C	−55°C to +125°C	−55°C to +85°C
DC Working Voltage	500 Volts	500 Volts	200 Volts	200 Volts
Feed-Thru Current	25 Amperes	10 Amperes	10 Amperes	10 Amperes
Capacitance (pF)	1000	2500	1300	5500
Feed-Thru Terminal Resistance	0.01 Ohm Maximum			

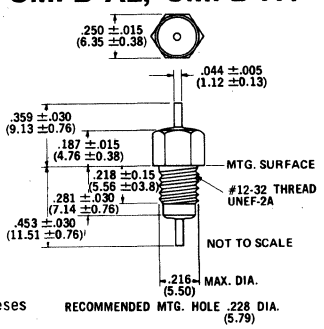
TYPE FCS-C



TYPES SMFO-1, SMFO-2



TYPES SMFB-A1, SMFB-A2, SMFB-A4



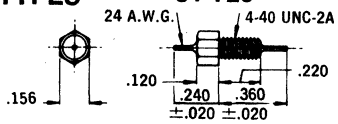
mm are in parentheses

ORDERING INFORMATION

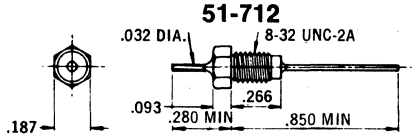
Previous Type Number	Ordering Number
FCS-C	51-722-001 51-722-002 with solder mounting washer
SMFB-A1	51-719-022 with nut and lockwasher
SMFB-A2	51-719-021 with nut and lockwasher
SMFB-A4	51-719-011 with nut and lockwasher

Previous Type Number	Ordering Number
SMF0-1	51-723-303 51-723-304 with solder mounting washer
SMF0-2	51-723-301 51-723-302 with solder mounting washer

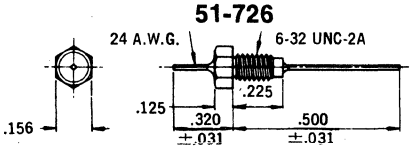
TYPES 51-729



51-712

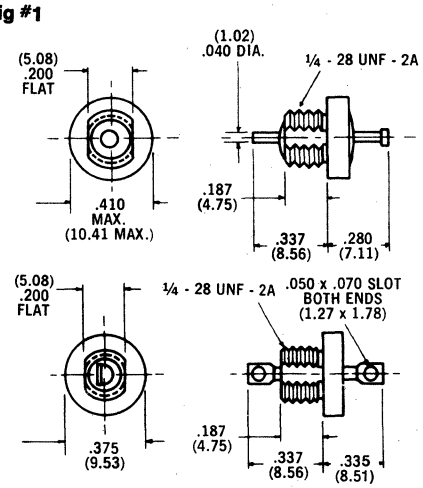


51-726



Part No.	Rated IDC in Amps	Working Volts, DC +85 °C	Working Volts, DC +125 °C	DCR Max.	Capacitance Reference Only μF	Insertion Loss dB 1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz
51-729-303	10	200	100	.01	.0015	—	5	42	60	65	65
51-729-304	10	200	100	.01	.022	7	27	43	50	60	60
51-726-001	3	200	100	.01	.0015	—	3	42	50	70	70
51-726-002	10	200	100	.01	.022	7	27	43	50	60	60
51-712-001	10	200	100	.01	.0015	—	5	43	50	70	70
51-712-003	10	200	100	.01	.022	10	28	45	50	70	70

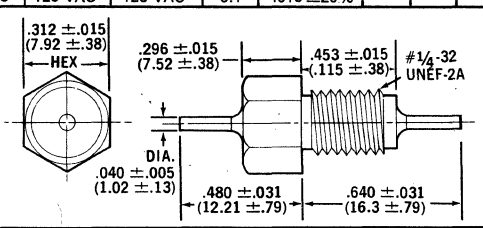
Fig #1



100 VDC +85°C L SECTIONS 125 VAC +125°C

Part No.	Rated IDC	Working Volts +85°C	Working Volts +125°C	DCR Max.	Capacitance Reference Only	Insertion Loss dB 30 KHz	150 KHz	300 KHz	1 MHz	10 MHz	1 GHz	FIG.
51-717-001	15 amps	100 VDC	50 VDC	0.1	1.4 MFD	15	28	33	44	60	70	1
51-717-007	15 amps	125 VAC	125 VAC	0.1	.015 ±20%	—	—	—	10	30	70	1
51-359-001	15 amps	100 VDC	50 VDC	0.1	1.4 MFD	15	28	33	44	60	70	2
51-359-007	15 amps	125 VAC	125 VAC	0.1	.015 ±20%	—	—	—	10	30	70	2

Fig #2



Part No.	Rated DC Current	WVDC @ 125°C	DCR	CKT	CAP.	Minimum Insertion Loss dB 1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz
51-732-002	10A	100	.01	L	.1 μF	18	65	70	70	70	70

All Feed-thru Capacitors and RFI Filters stocked by MCI are manufactured in the U.S.A. by **Spectrum Control Inc. . .**
The world's leading manufacturer of Electro-Magnetic Components. Distributed for Spectrum Control, Inc.

Metuchen Capacitors Inc. / Dept. EM, 420 Park Avenue, Perth Amboy, NJ 08861 / (201) 442-0500 / TWX 710-998-0892

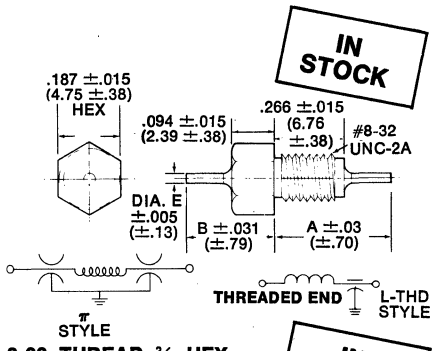
METUCHEN CAPACITORS INC.

Military Filters

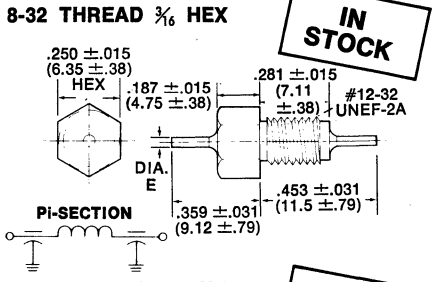
Shown below are a few of the most commonly used Military approved filters. These filters are approved to MIL-F-15733. Metuchen Capacitors stocks several hundred different MIL-F-15733 filters from MIL-F-15733/23 thru MIL-F-15733/70. Those shown below are IN STOCK continuously and offer a wide selection for your various applications. Both hermetic and non-hermetic (resin seal) are listed as well as different electrical configurations—L's and A's and Voltages from 50 VDC to 125 VAC.

EMI/RFI Suppression Filters
RESIN SEAL

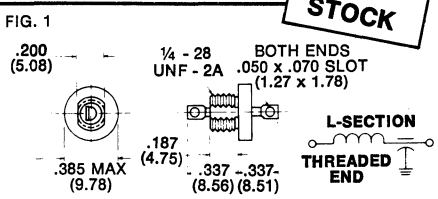
MIL P/N	Capacitance Ref-pF	Rtd. DC Voltage	Rtd. Current (A)	Electrical Circuit	Minimum Insertion Loss (dB) Per Mil-Std 220								A	B	C	E
					100 kHz	1 MHz	5 MHz	10 MHz	50 MHz	100 MHz	200 MHz	1 GHz				
MIL-F-15733/28-0001	1500	100	10	π	—	—	—	—	25	45	60	60	.890	.312	.266	.032
MIL-F-15733/28-0004	25,000	50	10	L-THD	—	10	—	28	—	41	44	60	.890	.312	.266	.040
MIL-F-15733/61-0008	5500	100	10	π	—	—	—	—	—	—	—	—	.500	.312	.266	.032
MIL-F-15733/61-0013	22,000	100	10	L-THD	—	10	22	30	—	50	—	70	.890	.280	.266	.032



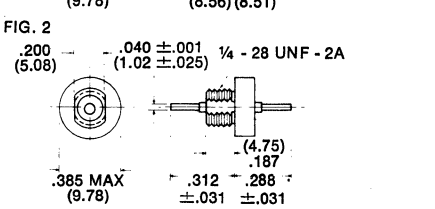
MIL P/N	Capacitance Ref-pF	Rated Voltage DC	Rated Current (A)	Electrical Circuit	Minimum Insertion Loss (dB) Per Mil-Std 220								E ±.005 (±.13)
					100 kHz	1 MHz	3 MHz	10 MHz	50 MHz	100 MHz	500 MHz	1-10 GHz	
MIL-F-15733/61-0002	1500	200	10	π	—	—	—	—	32	45	70	70	.032 (.81)



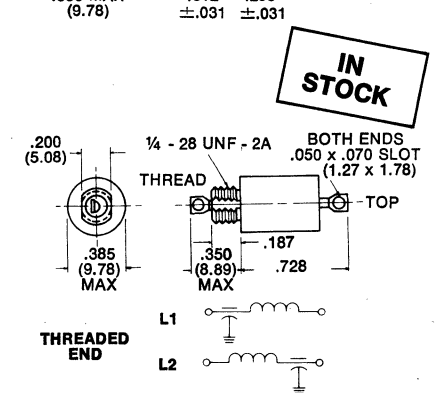
EMI/RFI Suppression Filters
HERMETIC SEAL



MIL P/N	Rated Current	Working Volts +125°C	DCR Max. Ω	Reference Capacitance	Insertion Loss (dB) Per Mil-Std-220						
					30 kHz	150 kHz	300 kHz	1 MHz	10 MHz	1 GHz	Fig.
MIL-F-15733/49-0001	15 amps	100 VDC	.01	.68 μf	8	20	28	38	55	70	2
MIL-F-15733/49-0006	15 amps	50 VDC	.01	1.4 μf	15	28	33	44	60	70	1



MIL P/N	Rated Current (Amps)	Filter Circuit	Working Volts 125°C		Voltage Drop	Insertion Loss (dB) Per Mil-Std-220					
			AC	DC		75 kHz	150 kHz	300 kHz	1 MHz	10 MHz	1 GHz
MIL-F-15733/26-0001	1	L-1	125	150	.25	—	13	24	45	80	70
MIL-F-15733/26-0003	1	L-2	125	150	.25	—	13	24	45	80	70
MIL-F-15733/26-0004	3	L-1	125	150	.15	—	8	15	30	68	70
MIL-F-15733/26-0006	3	L-2	125	150	.15	—	8	15	30	68	70
MIL-F-15733/26-0007	5	L-1	125	150	.075	—	8	14	25	58	70
MIL-F-15733/26-0010	5	L-2	125	150	.075	—	8	14	25	58	70



All Feed-thru Capacitors and RFI Filters stocked by MCI are manufactured in the U.S.A. by **Spectrum Control Inc. . . .**
The world's leading manufacturer of Electro-Magnetic Components. Distributed for Spectrum Control, Inc.

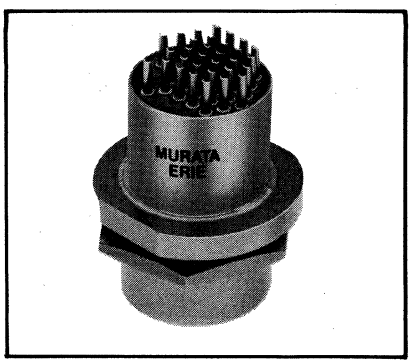
Metuchen Capacitors Inc. / Dept. EM, 420 Park Avenue, Perth Amboy, NJ 08861 / (201) 442-0500 / TWX 710-998-0892

EMI/RFI filter connectors

muRata ERIE
MURATA ERIE NORTH AMERICA, INC.

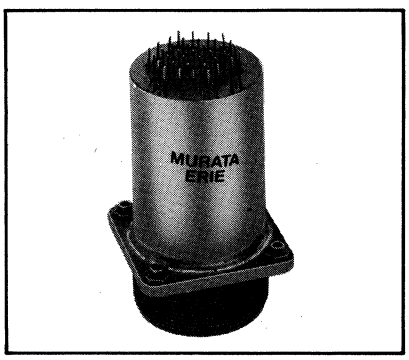
Cylindrical Connectors

Murata Erie cylindrical filter connectors can be found in numerous military, aerospace and commercial programs and have to be of the highest reliability. Because of the large variations in requirements for specific applications, Murata Erie has a competent staff of applications engineers available to aid in custom designs. Shown are some typical examples of Murata Erie cylindrical filter connectors and the appropriate MIL specifications which they meet.

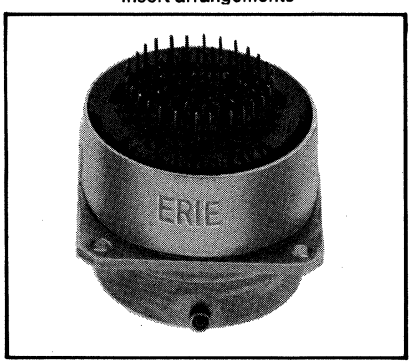


1255-080 Series to MIL-C-83723
Hermetically sealed, 2-61 line insert arrangements

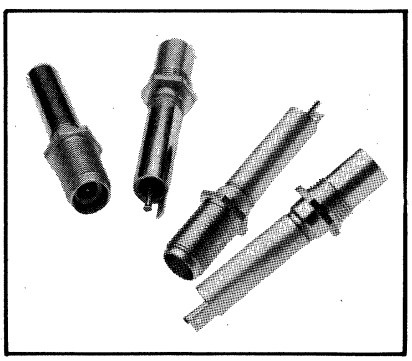
1255-100 Series to MIL-C-26482
Wide capacitance range. Directly replaces ITT "PVJ" and Bendix "FPT"



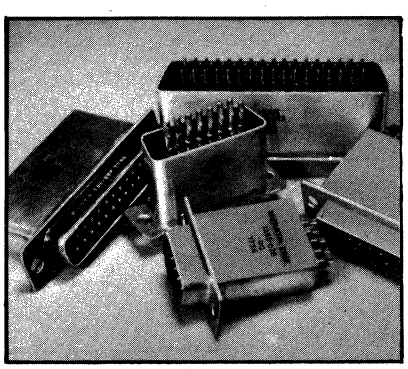
1255-070 Series to MIL-C-5015
Power connector with #12 or #16 contacts



1255-090 Series to MIL-C-38999
Low profile. 3-128 lines with from #12 to #22 contacts



1240-010 Series — UG/U Types
For audio lines. TNC/BNC compatible



"D" Connectors
1255-030 Series to MIL-C-24308

A complete line of high quality subminiature filtered connectors is available in 9, 15, 25, 37, and 50 contact arrangements, per MIL-C-24308. Capable of withstanding MIL-F-15733 testing including vibration and moisture resistance, these rugged assemblies are of a complete solder construction, thereby delivering the highest possible insertion loss at frequencies up to 10 GHz. The rear termination is available in solder-cup, .025" square wire wrap or .030" round PC board variations.

CUSTOM DESIGNS

Murata Erie specializes in developing sophisticated circuit designs and creating high component density packaged networks in-house. Our engineering design teams analyze individual customer problems, design specific components or networks to solve the problem, build prototypes and test the complete system. To support the high technological content of these custom networks, the engineering and test capabilities at our facility have become one of the most advanced in the industry today. The reliability of every component and network is assured by a comprehensive battery of tests performed under carefully controlled conditions. Then in-line prototype techniques further validate component performance prior to volume production. These technical support activities permit Murata Erie to respond to customer needs promptly and efficiently with positive performance engineered into the customer's system. If your requirements are unique, if you have a critical space, weight, or environmental problem, Murata Erie can help solve your specific requirements for you with a custom designed filter network.

muRata ERIE

MURATA ERIE NORTH AMERICA, INC. 1148 Franklin Rd., S.E. Marietta, Georgia 30067 Tel: (404) 952-9777 Telex: 54-2329 TWX: 810-766-1531

EMI/RFI filters

MURATA ERIE NORTH AMERICA, INC.

Murata Erie manufactures a complete line of EMI/RFI suppression, low pass filters in C, LT, LB, Pi and T configurations.

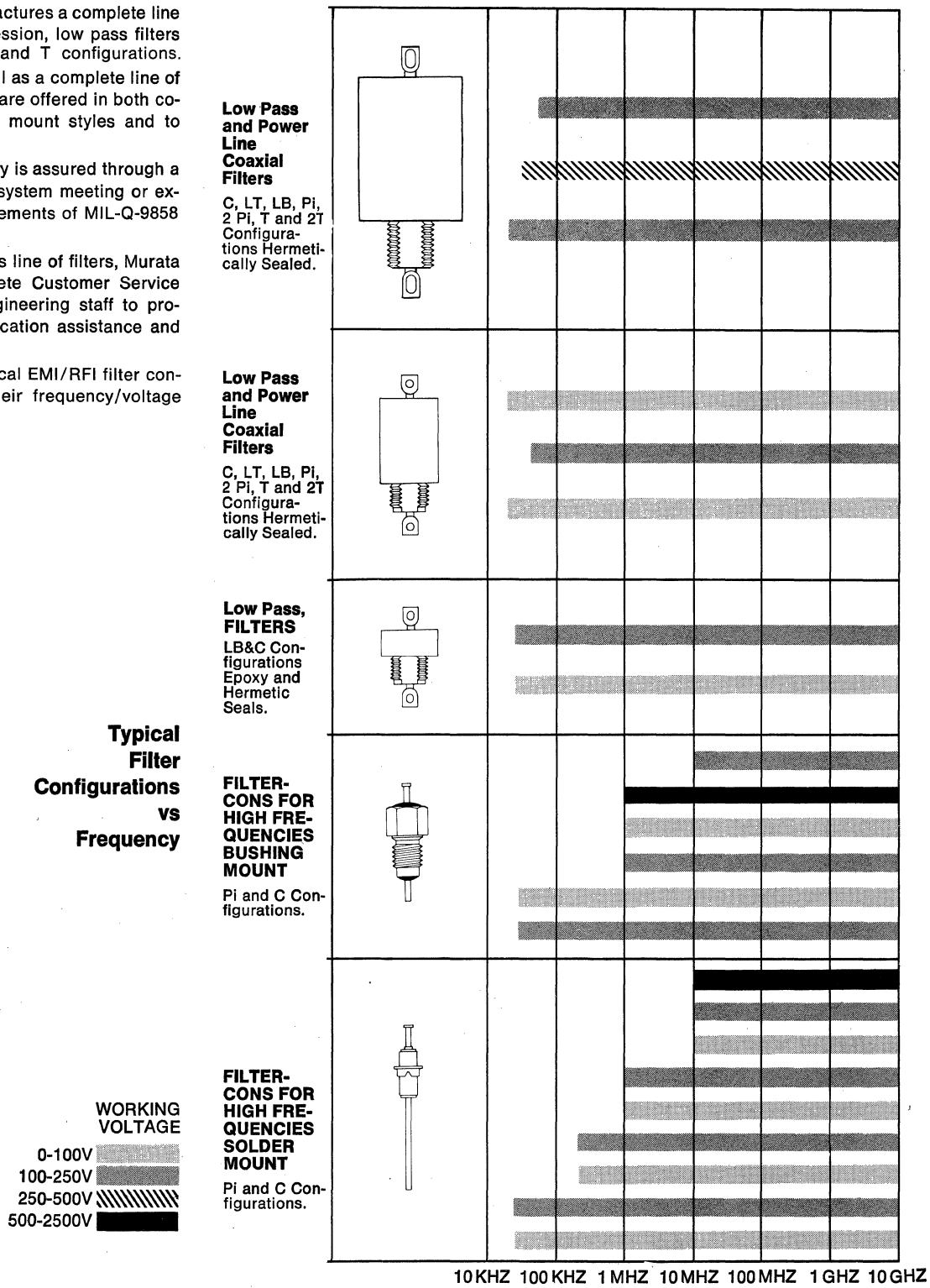
These units, as well as a complete line of Power Line filters, are offered in both coaxial and bushing mount styles and to MIL-F-15733.

Long term reliability is assured through a quality assurance system meeting or exceeding the requirements of MIL-Q-9858 and DND-1015.

To complement this line of filters, Murata Erie has a complete Customer Service and Customer Engineering staff to provide specific application assistance and custom designs.

Illustrated are typical EMI/RFI filter configurations and their frequency/voltage capabilities.

Typical Filter Configurations vs Frequency



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PICONICS

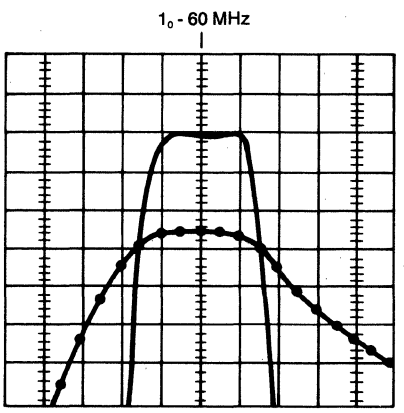
L/C FILTERS

PICONICS is a pioneer in the development of Magnetic Hybrid Components, circuits and Filters. Our 20,000 square foot facility features modern ultra clean production, inspection, and storage facilities. On site test and environmental laboratory, including x-ray, shock, vibration, hermeticity, etc. that satisfy all the necessary military and commercial testing requirements.
We will design and optimize your filter requirements using sophisticated computer programs. Our designs are computer analyzed and optimized prior to assembly. Tuning and testing are achieved with the latest precision equipment.

MINIATURE HYBRID BUTTERWORTH BANDPASS FILTER

FILTER TYPE	BANDPASS
Filter Characteristic	Butterworth
Number of Poles	4
Center Frequency	60 MHz
Bandwidth –3 dB	30 MHz
Insertion Loss	0.5 dB
Group Delay	25 nsec

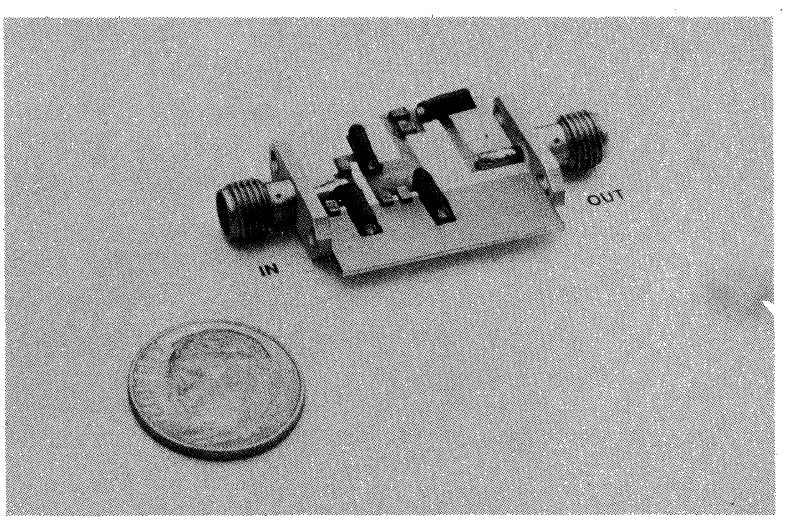
PHOTO SCALE	
TOP TRACE	BOTTOM TRACE
Freq Vs Ampl (dB)	Freq Vs Ampl (dB)
Vertical: 1 dB/Div	10 dB/Div
Horizontal: 10 MHz/Div	10 MHz/Div



MARKER SPACING 5 MHz

CONSTRUCTION

CHIP INDUCTORS
AND CAPACITORS
MOUNTED ON
AN ALUMINA SUBSTRATE



L/C filters are specified in either the Frequency or the Time Domain. Frequency Domain filters emphasize pass-band ripple and stop-band attenuation. Butterworth, Chebyshev, and Elliptic Function filters are included in this category. Time Domain filters emphasize the time-amplitude domain characterized by phase linearity and constant group delay. Bessel, Gaussian and other linear phase designs are included in this category.
Low-pass, Hi-pass, Band-pass, and Band-reject designs are available in the frequency range up to 800 MHz. Special Low-pass and Band-pass filters have been achieved featuring notches placed at desired frequencies in the stop-band to further attenuate undesired or spurious signals.
For those filter applications where size and weight are the prime consideration, PICONICS offers a line of chip inductor-capacitor designs. Low-pass, High-pass, and Band-pass types mounted on alumina substrates are available. Common substrate sizes are 1 x 1 inch and 2 x 1 inch. Overall package height is determined by orientation and size of the chip inductors.
To meet environmental military applications, filter networks are packaged in metal shielded cases with r.f. connectors. Printed circuit and end terminals are also available. Epoxy encapsulation is optional. For units assembled with chip inductors and capacitors on alumina/ceramic substrates, shield covers are optional. This is usually determined by the environment surrounding the device.

CALL OR WRITE
FOR COMPLETE
CATALOG AND FOR DESIGN/
APPLICATION ENGINEERING
SUPPORT.

See section 1800 pg. **A•1273** for your INDUCTOR requirements and section 3130 pg. **A•1696** for HYBRIDS.

PICONICS INC. P.O. BOX 387, TYNGSBORO, MA 01879 • TEL: (617) 649-7501 • TELEX: 754759

polyphase

CUSTOM ENGINEERED

FILTERS

for
MODERN CIRCUITS

82F

POLYPHASE Instrument Co.

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RELIABILITY / ENGINEERED ELECTRONICS / SINCE 1948

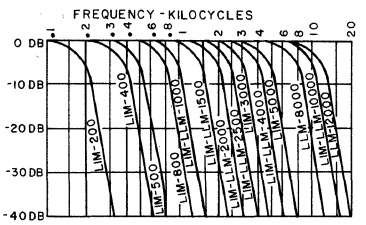
The information in this bulletin was organized to illustrate the wide range of our filter capability. As a "custom engineering house" our true capability lies in our unique ability to engineer solutions to specific filter problems.

Since 1948 Polyphase has built a reputation for high quality custom magnetic components and engineering excellence. We have solved many critical circuit problems. Engineering advice, custom designs and prototypes are available, to help you with *your* specific problem.

STANDARD INTERSTAGE AND LINE FILTERS

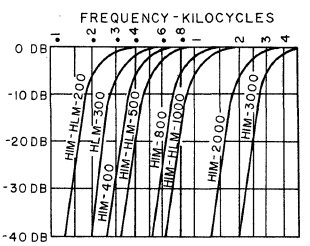
LOW PASS

STANDARD FREQUENCIES Hz		
LIM—100	LIM—2,000	LLM—1,500
LIM—200	LIM—2,500	LLM—2,000
LIM—400	LIM—3,000	LLM—2,500
LIM—500	LIM—4,000	LLM—4,000
LIM—800	LIM—5,000	LLM—8,000
LIM—1,000	LIM—10,000	LLM—10,000
LIM—1,500	LLM—1,000	LLM—12,000



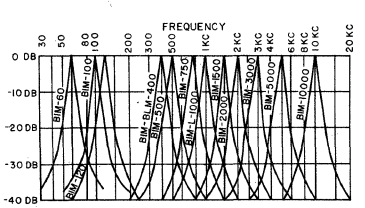
HIGH PASS

STANDARD FREQUENCIES Hz		
HIM, HIL–100	HIM, HIL–800	HLM–200
HIM, HIL–200	HIM, HIL–1,000	HLM–300
HIM, HIL–300	HIM, HIL–2,000	HLM–500
HIM, HIL–400	HIM, HIL–3,000	HLM–1,000
HIM, HIL–500		



BAND PASS

STANDARD FREQUENCIES Hz		
BIM—50	BIM—500	BIM—4,500
BIM—60	BIM—750	BIM—5,000
BIM—100	BIM—800	BIM—10,000
BIM—120	BIM—1,000	BLM—400
BIM—200	BIM—1,500	BLM—1,000
BIM—240	BIM—2,000	BIT—60
BIM—400	BIM—3,000	BIT—100
		BIT—120



SPECIFICATIONS

Standard Interstage and Line Filters

Polyphase standard filters cover common mid-range frequencies and impedances. Designed to MIL-F-18327. Special filters to your specifications can be supplied. Filters available for transistor or tube circuits.

LOW PASS

LIM — Impedance 10KΩ in/out. Cut off frequencies from 25Hz to 100KHz available.

LLM — Impedance 600Ω in/out. Cut off frequency from 500Hz to 100KHz.

HIGH PASS

HIM — 10KΩ impedance in/out. Insertion Loss less than 5db at cut off frequency. Attenuation is more than 35db @ 66% of cut off frequency.

HLM — Impedance 600Ω in/out.

HIL — Step up or step down from 600Ω nominal to 10KΩ with a 4:1 voltage ratio.

BAND PASS

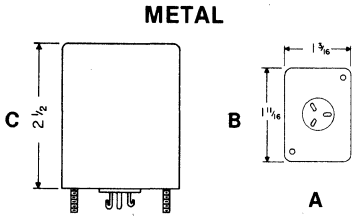
BIM — Impedance 10KΩ in/100KΩ or higher out. Gain is 1:2 at CF approx.; 3db bandwidth ±4% approx. of CF; slope 40db per octave.

BIT — As above except impedance is 10KΩ in/out.

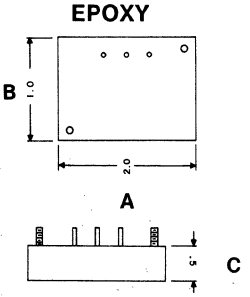
BLM — As above except impedance is 600Ω in, 100KΩ out-1:9 gain approx. at CF.

Center frequency is ±1%; or better if specified.

METAL



EPOXY



STANDARD CASES

POLYPHASE Instrument Co.

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RELIABILITY / ENGINEERED ELECTRONICS / SINCE 1948

CUSTOM ACTIVE FILTER NETWORKS — Some Examples

The design of these discrete networks is a combination of art and science. Polyphase has the special techniques and engineering experience to solve unique active filter circuit problems. Polyphase discrete filters are functionally complete, circuit-ready components.

LOW PASS FILTER AND GROUP DELAY EQUALIZER

The operating band 800 Hz to 3000 Hz is equalized for constant time delay.

Filter input and output circuits are capacitive coupled to be free from telephone line or other DC voltage interaction. A swept oscillator (OTO 5K Hz) drives the filter. Figure I shows the response curve at output terminal.

Application: For Vestigial Single Side Band Applications on Fax-simile transmitter unit.

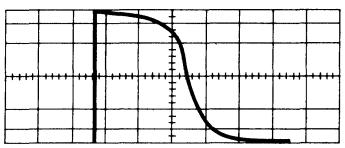


FIG I

NOTCH FILTER AND EQUALIZER

This active band pass unit has an amplitude response within ± 1 DB of the curve shown in Figure 2. The phase response is within ± 2°. The self-noise of the filter is −90 DB below 1 volt level (as measured on a wave analyzer with a 1 Hz band-width).

Application: Underwater Surveillance Network

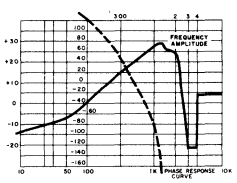


FIG 2

NARROW BAND FILTER

Typical specifications BPF104014

Center frequency 7500 Hertz

3 DB band width 180 Hertz (Q -41 66)

Center frequency stability ± 30 Hertz at room temperature.

Center frequency stability ± 60 Hertz over the temperature range of −30°C to +85°. Skirt band width at −90 DB (see response curve below) 5000 Hertz max. Filter gain 24 DB.

Input impedance 10 K OHM

Output impedance 1 OHM

Case Dimensions (1.2 × 1.4 × .68)

See Figure 3

Application: Military instrumentation.

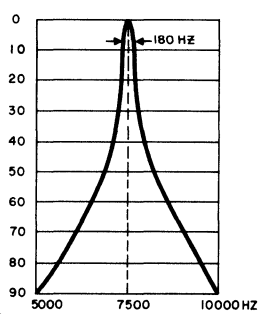
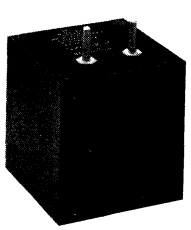


FIG 3

BYPASS POWER NOTCH-FILTER



These filters bypass the eleventh, the thirteenth, the twenty-third, and twenty-fifth harmonic currents, generated by a 12-phase rectification system using 400 Hz multiphase power source.

The impedance of this filter type is 0.1 OHM typical...linearity excellent. The bypass current exceeds 20 amperes. The resonance capacitance is 12 microfarad. Operation is continuous with good heat stability.

The filter operates in the "LOAD" — "NO LOAD" condition of the selected harmonic frequency.

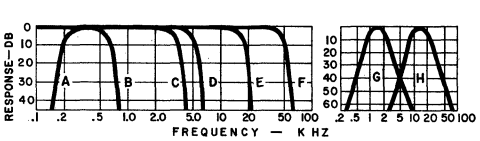
Application: Mobile computer power supply. MI03872

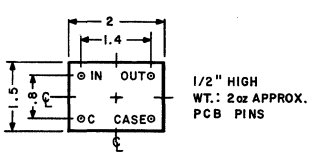
LO-PAK FILTERS

for TRANSISTOR CIRCUITS

Flat packages for printed circuit board minimum spacing. Designed to meet MIL-F-18327 Grade 6 Class Q Life X. Other frequencies available.

	Type No's	Source & Load Ω	Pass Band DB 1db	Pass Band DB 3db±1db	Stop Band	Curve #
LOW PASS	LPL 1	10K	DC to 450Hz	600Hz	40db above 800Hz	B
	LPL 2	600	DC to 3KHz	3.5KHz	40db above 4.5KHz	C
	LPL 3	10K	DC to 4.2KHz	5KHz	43db above 6.4KHz	D
	LPL 4	600	DC to 15KHz	18KHz	43db above 23KHz	E
	LPL 5	600	DC to 42KHz	50KHz	43db above 64KHz	F
BAND PASS	LPB 6	10K	1 KHz to 2KHz		40db above 4KHz 40db below .5KHz	G
	LPB 7	10K	10 KHz to 20KHz		40db above 40KHz 40db below 5KHz	H
HIGH PASS	LPH 8	10K	300Hz & above	200Hz	40db below 140Hz	A





polyphase... a closer view

engineering

Polyphase is that rare vendor who can help you with both effective engineering design and unique manufacturing techniques, involving magnetic components. A source a step beyond the commonplace in capability to serve you.

As all our products are custom designed to your specifications this Guide is formatted, as a discussion and illustration of some key magnetic components used in modern electronic circuits.

Our broad engineering capability has qualified us as a vendor on major space, defense. and industrial programs since 1948. The credibility Polyphase has earned with design engineers throughout the electronic industry, for effective answers to magnetic component circuit problems, insures your satisfaction. At Polyphase, authoritative, computer-aided engineering and prototype service is the heart of the company.

quality control

Polyphase manufactures MIL, NASA and U/L quality magnetic components—assured quality and reliability are a must. Our quality standards are governed by MIL-Q-9858, NHB 3400.4(1c). MIL-I-45208, MIL-T-27, MIL-T-21038 and MIL-F-18327. An approved Quality Control Manual blueprints procedures and standards to be followed. All products are monitored and controlled by this system from incoming materials through production tests, to the final Quality Assurance check at the time of shipment. The plant is completely equipped with the latest test instrumentation. Our calibration system conforms to MIL-C-45662. A DLA inspector is available.

production

Our concentration on quality-demanding programs dictates an efficient production department staffed by quality-minded people. Over 43,000 square feet of floor space is our plant area, with the balanced capability to handle large or small orders.

polyphase products

Chokes, AF
Chokes, Filter
Chokes, Power
Coils, Toroidal
Converter, Transformers DC-DC/AC-DC
Demodulators
Discriminators
Filters, Active
Filters, Band Elimination
Filters, Band Pass
Filters, Dual - ILS
Filters, High Pass
Filters, Line
Filters, Low Pass
Filters, Octave
Filters, Power 400 Hz
Inductors, Toroid
Modules, Encapsulated Circuit
Modules, SHP
Networks, Pulse-Custom
Reactors, Saturable
Transformers, Audio
Transformers, Converter DC-DC & AC-DC
Transformers, Current
Transformers, Current Limiting
Transformers, Discriminator
Transformers, Driver
Transformers, Filament
Transformers, High Voltage, Corona Free
Transformers, Input
Transformers, Instrument
Transformers, Interstage
Transformers, Isolation
Transformers, Line
Transformers, Linear
Transformers, Matching
Transformers, MIL Type
Transformers, Miniature & Subminiature
Transformers, Mixing
Transformers, Modulation
Transformers, Output
Transformers, Phase Conversion
Transformers, Saturable
Transformers, SCR Trigger
Transformers, Step-down and Step-up
Transformers, Toroidal
Transformers, Transistor Circuit
Transformers, Wide Band

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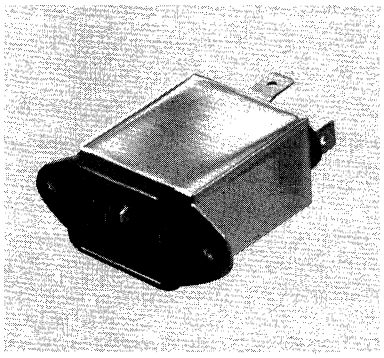
For your Delay Line requirements please see Kappa Networks in Section 2350

POTTER COMPANY EMI Power Line Filters

varian



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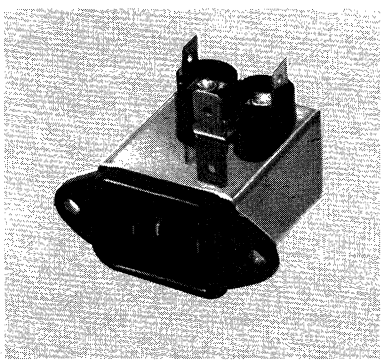

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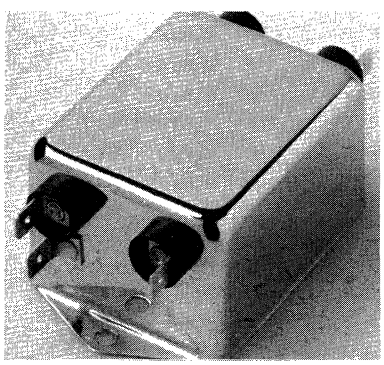

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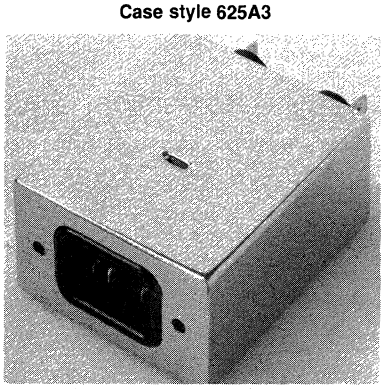


Case style 625G3

POTTER COMPANY
P.O. BOX 337,
WESSON, MISSISSIPPI 39191
(601) 643-2215

608 SERIES

HIGH PERFORMANCE INTERNATIONAL FILTERS

The 608 Series features the IEC international power line connector and is designed to provide superior insertion loss down to 10 KHz. This will help switching power supply manufacturers meet the new VDE low frequency conducted EMI requirements. Series 608 is designed to meet the requirements of IEC, CSA, BSI, VDE, SEV and UL. The series is UL recognized. CSA, VDE and SEV approvals are pending.

Ask for Bulletin 8101

Case style G

PERFORMANCE CHARACTERISTICS:

RATED VOLTAGE: 115-250VAC
OPERATING FREQUENCY RANGE: 50-60 Hz
MAXIMUM LEAKAGE CURRENT:
Applied Voltage — CURRENT
250 VAC @ 50 Hz — 0.5 mA
TEST VOLTAGE:
Line-to-ground — 2250 VDC
Line-to-line — 1500 VDC

TYPICAL INSERTION LOSS (dB):

	Frequency In MHz						
AMP	.01	.05	.1	.5	1	10	20
1	28	36	45	60	60	60	60
2	18	28	36	54	58	60	60
3	14	25	31	46	52	50	60
4	10	21	27	40	46	60	60
6	8	15	20	31	40	57	60

Tested in accordance with MIL-STD-220 with the unused circuit grounded on the load side.

609 SERIES

HIGH PERFORMANCE INTERNATIONAL FILTERS

The 609 Series was designed as a companion to our 610 Super Series. It also meets the requirements of VDE and features the IEC international power line connector. The compact construction complies with IEC, CSA, BSI, VDE and SEV. The series is UL recognized. CSA, VDE and SEV approvals are pending.

Ask for Bulletin 8102

Case styles G and H

PERFORMANCE CHARACTERISTICS:

RATED VOLTAGE: 115-250 VAC
OPERATING FREQUENCY RANGE: 50-60 Hz
MAXIMUM LEAKAGE CURRENT:
Applied Voltage — CURRENT
250 VAC @ 50 Hz — 0.5 mA
TEST VOLTAGE:
Line-to-ground — 2250 VDC
Line-to-line — 1500 VDC

TYPICAL INSERTION LOSS (dB):

	Frequency in MHz					
AMP	.15	.5	1	5	10	20
1	30	45	54	60	60	55
3	24	38	45	60	60	55
6	17	32	40	58	60	55

Tested in accordance with MIL-STD-220 with the unused circuit grounded on the load side.

610 SUPER SERIES

HIGH PERFORMANCE INTERNATIONAL FILTERS

The 610 Super Series was designed specifically to meet the low frequency requirements of the latest VDE EMI specifications and features the IEC international power line connector. Series 610 is designed to meet the requirements of IEC, BSI, VDE, and SEV. The series is UL recognized, and CSA approval is pending.

Ask for Bulletin 8103

Case styles G and H

PERFORMANCE CHARACTERISTICS:

RATED VOLTAGE: 115-250 VAC
OPERATING FREQUENCY RANGE: 50-60 Hz
MAXIMUM LEAKAGE CURRENT:
Applied Voltage — CURRENT
250 VAC @ 50 Hz — 0.5 mA
TEST VOLTAGE:
Line-to-ground — 2250 VDC
Line-to-line — 1500 VDC

TYPICAL INSERTION LOSS (dB):

	Frequency in MHz					
AMP	.15	.5	1	5	10	30
1	24	34	40	47	50	50
3	19	29	35	43	47	50
6	13	22	28	40	42	47

Tested in accordance with MIL-STD-220 with the unused circuit grounded on the load side.

625 SUPER SERIES

HIGH PERFORMANCE INTERNATIONAL FILTERS

The 625 Super Series provides additional insertion loss down to 10 KHz to meet the latest VDE EMI specifications. They are designed primarily for the effective reduction of line-to-ground (common mode) and line-to-line (differential mode) interference in equipment which must meet the requirements of FCC and VDE specifications. All models are UL recognized. Low leakage current models are available in all ratings. To order these, replace the "V" suffix with an "E."

Ask for Bulletin 8104

Case styles 625A3 and 625G3

PERFORMANCE CHARACTERISTICS:

RATED VOLTAGE: 115-250 VAC
OPERATING FREQUENCY RANGE: 50-60 Hz
MAXIMUM LEAKAGE CURRENT:

Applied Voltage	CURRENT "V"	CURRENT "E"
115 VAC @ 60 Hz	0.5 mA	0.25 mA
250 VAC @ 50 Hz	1.0 mA	0.5 mA

TEST VOLTAGE:
Line-to-ground — 2250 VDC
Line-to-line — 1500 VDC

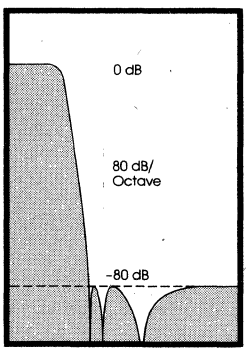
TYPICAL INSERTION LOSS (dB):
FILTER RATED AT 3.0A RMS ONLY

	Frequency In MHz								
	.01	.02	.05	.15	.5	1	5	10	20
625VS	22	27	37	50	55	55	55	55	55
625ES	22	27	36	47	47	45	45	45	45

Tested in accordance with MIL-STD-220 with the unused circuit grounded on the load side.

BEGONE CURSED ALIAS

FILTER SYSTEMS



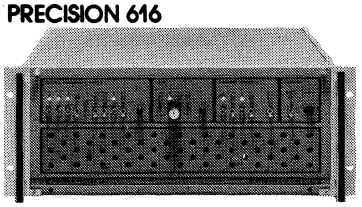
You want analog data to come clean before digital conversion.

We keep extending your choice of Precision systems for HP, LP, TD, BP, BR and anti-alias filters.

All are programmable. All offer time delay filters superior to Bessel. All offer elliptics with 80 dB/octave attenuation. All offer the option of fixed frequencies for economy. All have phase match of 1° or better. All can interface with mini or micro with serial, parallel or GPIB.

Individually, they provide different cost-performance parameters and options to provide the Precision Conditioners you need.

PRECISION 616



System offers our highest cutoff frequencies with exceptional phase match of 1°. Standard maximum frequency is 150 kHz; 300 kHz is available as a special. Four ranges with a resolution of 5 bits provide 124 programmable cutoff frequencies. Up to 16 programmable filter channels. Wide variety of options tailors this Precision Conditioner to your application.

PRECISION 616 AND 602 CUTOFF FREQUENCIES

FREQUENCY RANGE (Hz)	FREQUENCY STEP (Hz)	XX→	†MODEL 616-XX-LP1 01	02	03
10,000-150,000	10,000		H	—	—
1,000-15,000	1,000		MH	H	—
100-1,500	100		ML	MH	H
10-150	10		L	ML	MH
1-15	1		—	L	ML
0.1-1.5	0.1		—	—	L

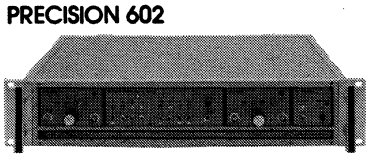
Four frequency ranges in each model: H, MH, ML, L.

CUTOFF FREQUENCIES FOR PRECISION 616 WITH OPTION 05

FREQUENCY RANGE (Hz)	FREQUENCY STEP (Hz)	XX→	†MODEL 616-XX-LP1-05 01	02	03
5,000-155,000	5,000		H	—	—
500-15,500	500		MH	H	—
50-1,550	50		ML	MH	H
5-155	5		L	ML	MH
0.5-15.5	0.5		—	L	ML
0.05-1.55	0.05		—	—	L

Four frequency ranges in each model: H, MH, ML, L.

PRECISION 602



System provides most of the performance characteristics of the Precision 616 in two programmable channels. Our most economical system where only one or two channels are needed.

† How to Build a Catalog Number

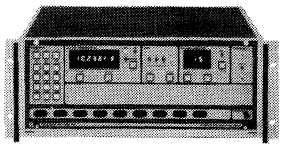
616-02-LP1-01-05-11

- 616 — System number
- 02 — Frequency range
- LP1 — Filter type
- 01-05-11 — Options 01, 05 and 11

THE PRECISION CONDITIONERS™

†See other products in Section 1100.

PRECISION 636



Our most resolute alias stopper. Standard resolution is 3 digit in four ranges for 4092 cutoff frequency selections. Optional 3½ digit instrument provides 6141 cutoff frequencies. Precision 636 with 3½ option offers our highest standard cutoff frequency of 204.7 kHz, with 1° phase match. Convenient keyboard entry and LED displays. Up to 16 channels. Many options.

PRECISION 636 CUTOFF FREQUENCIES

RANGE (Hz) REDUCED PERFORMANCE	RANGE (Hz) SPECIFIED PERFORMANCE	FREQUENCY STEPS (Hz)	†MODEL 636-XX-LP1 XX→ 01	02
100-3100	3200-102,300	100	H	—
10-310	320-10,230	10	MH	H
1-31	32-1,023	1	ML	MH
0.1-3.1	3.2-102.3	0.1	L	ML
0.01-0.31	0.32-10.23	0.01	—	L

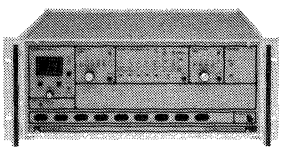
Four cutoff frequency ranges in each model: H, MH, ML, L

CUTOFF FREQUENCIES FOR PRECISION 636 WITH 3½ OPTION

RANGE (Hz) REDUCED PERFORMANCE	RANGE (Hz) SPECIFIED PERFORMANCE	FREQUENCY STEPS (Hz)	†MODEL 636-XX-LP1-3½ XX→ 01	02	03
100-3100	3200-204,700	100	H	—	—
10-310	320-20,470	10	M	H	—
1-31	32-2,047	1	L	M	H
0.1-3.1	3.2-204.7	0.1	—	L	M
0.01-0.31	0.32-20.47	0.01	—	—	L

Three cutoff frequency ranges in each model: H, M, L

PRECISION 416



Goodbye alias, hello gain. This combined filter-amplifier system lets you save 25% to 35% by buying one instrument instead of two. 62 programmable cutoff frequencies. DC differential input stage with 100 dB CMRR. Programmable prefilter and postfilter gain of 1-1000. Overload detectors built in. Up to 16 channels.

PRECISION 416 CUTOFF FREQUENCIES

FREQUENCY RANGE (Hz)	FREQUENCY STEPS (Hz)	†MODEL 416-XX-LP1 XX→ 01	02	03	04	05
10K-150K	10K	H	—	—	—	—
1K-15K	1K	L	H	—	—	—
100-1.5K	100	—	L	H	—	—
10-150	10	—	—	L	H	—
1-15	1	—	—	—	L	H
0.1-1.5	0.1	—	—	—	—	L

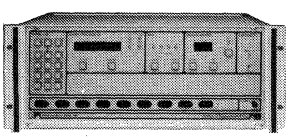
Two frequency ranges in each model: H, L.

CUTOFF FREQUENCIES FOR PRECISION 416 WITH OPTION 05

FREQUENCY RANGE (Hz)	FREQUENCY STEPS (Hz)	†MODEL 416-XX-LP1-05 XX→ 01	02	03	04	05
5K-155K	5K	H	—	—	—	—
500-15.5K	500	L	H	—	—	—
50-1.55K	50	—	L	H	—	—
5-155	5	—	—	L	H	—
0.5-15.5	0.5	—	—	—	L	H
0.05-1.55	0.05	—	—	—	—	L

Two frequency ranges in each model: H, L.

PRECISION 32



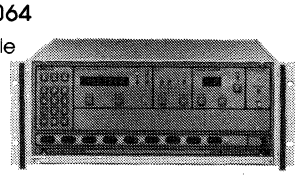
Double trouble for aliases. Precision System 32 saves 25% to 40% per channel by packing 32 programmable channels into the same 7 inches of rack previously needed for 16. Three digit resolution with 3069 programmable cutoff frequencies. 102.3 kHz maximum cutoff. An excellent price-performance value.

PRECISION 32 CUTOFF FREQUENCIES

RANGE (Hz) REDUCED PERFORMANCE	RANGE (Hz) SPECIFIED PERFORMANCE	FREQUENCY STEPS (Hz)	†MODEL 32-XX-LP1 XX→ 01	02	03
100-3100	3200-102,300	100	H	—	—
10-310	320-10,230	10	M	H	—
1-31	32-1,023	1	L	M	H
0.1-3.1	3.2-102.3	0.1	—	L	M
0.01-0.31	0.32-10.23	0.01	—	—	L

Three frequency ranges in each model: H, M, L.

PRECISION 6064



Double trouble doubled. Precision System 6064 packs 64 programmable filters into the same 7 inches of rack space previously needed for 16 or 32. Savings per channel can run more than 50% over 16-channel systems. 2-1/2 digit resolution with more than 400 programmable cutoff frequencies. Maximum cutoff is 12.75 kHz.

PRECISION 6064 CUTOFF FREQUENCIES

RANGE (Hz) REDUCED PERFORMANCE	RANGE (Hz) SPECIFIED PERFORMANCE	FREQUENCY STEPS (Hz)	RANGE & STEP MULTIPLIER †MODEL 6064-XX-LP1 XX→ 04	05	06	07	08	09
—	105-1275	5	10			1		
1-7	8-100	1	10			1		
—	128-510	2		10			1	
—	50.5-127.5	0.5		10			1	
—	12.8-50.0	0.2		10			1	
0.1-3.1	3.2-12.7	0.1		10			1	
—	64-255	1			10			1
—	20.5-63.5	0.5			10			1
0.1-1.5	1.6-20.0	0.1			10			1

Three cutoff frequency ranges in each model.

†See next page for Selection Guides.

† See other products in Section 1100.

PRECISION FILTERS, INC.
240 Cherry Street, Ithaca, New York 14850, Tel. 607-277-3550

SELECTION GUIDES

FILTER SYSTEM

	PRECISION 616	PRECISION 602	PRECISION 636	PRECISION 416	PRECISION 32	PRECISION 6064
Number of channels per system	16	2	16	16	32	64
Number of channels per card	1	1	1	1	2	4
Maximum cutoff frequency (kHz)	155*	150	204.7**	155*	102.3	12.75
Minimum cutoff frequency (Hz)	0.05	0.1	0.32	0.05	0.32	0.10
Number of frequency ranges	4	4	4/3**	2	3	4
Phase match (degrees max.)	1°	1°	1°	1°	1°	2°
Amplitude accuracy (dB)	0.05	0.05	0.05	0.05	0.1	0.1
Cutoff accuracy (%)	1/4	1/4	1/4	1/4	1/4	1
Steps in decade	10/20*	10	900/1800**	10/20*	900	200
Bits in a range	4/5*	4	10/11**	4/5*	10	8

**with option 05*
***with option 3½*

OPTION GUIDE

	PRECISION 616	PRECISION 602	PRECISION 636	PRECISION 416	PRECISION 32	PRECISION 6064
C Colibration	No	No	No	No	No	Yes
G Programmable gain	1,2,5,10	1,2,5,10	1,2,5,10	Std. A	B	E
1 AC coupled input	Yes	No	Yes	No	Yes	No
2 AC coupled output	Yes	No	Yes	No	No	No
3 Unbalanced differential input	Yes	No	Yes	No	Yes D	Yes
4 Output sense	Yes	No	Yes	No	No	No
5 Extra bit F_C	Yes	No	3½ C	Yes	No	No
6 Change F_C range	Yes	Yes	Yes	Yes	Yes	Yes
7 Fixed input gain	Yes	Yes	Yes	No	Yes	Yes
8 Fixed output gain	Yes	Yes	Yes	No	Yes	Yes
9 Change front panel	Yes	Yes	Yes	Yes	Yes	Yes
10 Change control format	Yes	Yes	Yes	Yes	Yes	Yes
11 Filter by-pass	Yes	Yes	Yes	No	Yes	Yes
12 Post warranty calibration	Yes	Yes	Yes	Yes	Yes	Yes
13 Output mux	Yes	No	Yes	No	No	Yes
14 Differential input	Yes	No	Yes	Std.	Yes D	Yes F
15 AC coupled differential input	Yes	No	Yes	No	No	No
16 Delete F_C range	Yes	Yes	Yes	Yes	Yes	Yes
17 Switched input gain	Yes	No	Yes	No	Yes D	No
18 Switched AC coupled input	Yes	No	Yes	No	Yes D	No
20 Programmable AC/DC coupling	No	No	No	No	Yes D	No
21 Programmable input gain	No	No	No	No	Yes D	No

A. Prefilter gain 1, 2, 5, 10, 20, 50.
Postfilter gain 1, 2, 5, 10, 20.
B. Gain from 0.50 to 12.75 in steps of 0.05.
C. 3-1/2 digit cutoff frequency resolution—lose lowest range.
D. Cannot have more than one of options 3, 14, 17, 18, 20 or 21.
E. 0 to 30 dB in 2 dB steps.
F. Max input reduced to 5 Vpk.

FILTER GUIDE

	MODEL HP1	MODEL LP1	MODEL LP2	MODEL LP3	MODEL TD1	MODEL TD2
Filter type	HP	LP	LP	LP	LP	LP
Function	Cauer	Cauer	Cauer	Cauer	E	Bessel F
Number of poles, zeros	6p,6z	6p,6z	6p,6z	6p,6z	6p,6z	6p or 6p,6z
Passband ripple (dB p-p)	0.1	0.1	0.1	0.1	0.35	—
Passband limit	1.081 F_C	0.925 F_C	F_C	F_C	0.78 F_C	—
Cutoff frequency Amplitude (dB)	-3.01	-3.01	-0.1	-0.1	-3.01	-3.01
Cutoff frequency Phase (degrees)	+358.5	-358.5	-296.7	-300	-305.8	-155
Stop band limit	0.5 F_C	2 F_C	1.744 F_C	2.13 F_C	3.24 F_C	—
Stop band attenuation (dB)	80	80	67.8	80	70	—
Attenuation slope (dB/octave)	80	80	96.9	80	42	36
Settling time (1%) $\left(\frac{SECS}{F_C}\right)$	5.4/F_C	5.4/F_C	5.25/F_C	5.0/F_C	3.1 F_C	—
Zero frequency time delay	—	.79/F_C	.71/F_C	.73/F_C	.85/F_C	.86/F_C
Cutoff frequency accuracy (%)	1/4	1/4	1/4	1/4	1/4	1/4
Amplitude accuracy (dB)	0.05	0.05	0.05	0.05	0.05	0.05
Phase accuracy (degrees) Max.	1/2	1/2	1/2	1/2	1/2	1/2
Phase accuracy (degrees) Typ.	1/4	1/4	1/4	1/4	1/4	1/4
Phase match (degrees) Max.	1	1	1	1	1	1
Phase match (degrees) Typ.	1/2	1/2	1/2	1/2	1/2	1/2

E. Equi-ripple delay (±2.5° phase ripple) with 6 zeros.
F. 6 pole Bessel or 6 pole, 6 zero with Bessel poles.

A Filter For Every Need

All Precision Filter systems use the same high-performance filters.

For the frequency domain, there is a Cauer (elliptic) high-pass or low-pass filter with 0.1 dB peak-to-peak passband ripple and 80 dB stop-band attenuation. Compare its attenuation slope of 80dB/octave with an 8 pole Butterworth's 48 dB/octave.

For the time domain, there is the TD1, a 6 pole, 6 zero equi-ripple delay (linear phase) filter, which has less attenuation in the passband and more attenuation in the stop-band than an 8 pole Bessel. Yet, it maintains a linear phase response within ± 2.5°. There is also the TD2 which offers both a 6 pole Bessel and a 6 pole, 6 zero time delay filter.

In any case, you get a tightly controlled elliptic or linear phase filter with phase match better than 1° and usually better than 1/2°.

For bandpass operation, cascade a high-pass and low-pass filter to form a bandpass filter with 80 dB attenuation an octave above and below the center frequency.

For band-reject operation, parallel the inputs of a high-pass and low-pass filter and add their outputs through 1 k resistors to form a band-reject filter.

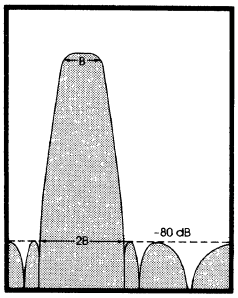
For tough anti-alias applications, cascade two LP2 filters to provide 90 dB of attenuation at 1.56 times the cutoff frequency.

For lowest cost solutions, we provide the option of fixed frequency filters.

THE PRECISION CONDITIONERS™

†See other products in Section 1100.

PRECISION 1776 FREQUENCY-BAND TRANSLATORS



Precision System 1776 is the industry's first multi-channel programmable frequency-band translator for signal conditioning.

It draws heavily on our advanced filter technology to provide usefulness not previously associated with frequency-band translators for applications like these:

- Super bandpass filter.
- Analog zoom for spectrum analysis, modal analysis and beam forming.

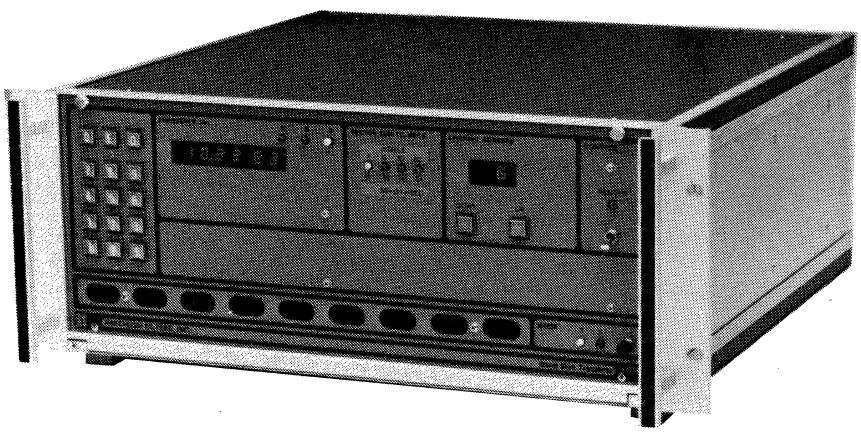
NEW SPECTRUM SLICER

The Precision 1776 cuts far more sharply than any conventional bandpass filter can.

In fact, it's nearly perfect. The system translates band center frequency to zero, passing the signal band through sharp low-pass filters to obtain 80 dB/*bandwidth-octave* skirts. Q's can go higher than 10,000.

From there, the instrument can translate back to the starting band, acting as a super bandpass filter. Or it can translate to any other part of the spectrum.

Configured as a super bandpass filter, the Precision 1776 can have up to eight channels.



NEW SUPER ZOOMER

The Precision 1776 translator also can zoom in to make existing equipment do more work.

Ahead of an FFT spectrum analyzer, the analog zoom extends frequency range while making possible much finer resolution.

For modal analysis and beam forming, the 1776 discards unwanted noise and lowers the sampling frequency. As a result, old limits for computer speed, memory and AD conversion rates are overcome. Sampling rates can be decreased. Dynamic range and signal-to-noise ratio are enhanced.

For analog zoom, a 16 channel configuration is available for this Precision Conditioner.

Precision 1776 Features:

- Programmable center frequency: 3.2 Hz—200 kHz.
- Programmable bandwidth: 1 Hz—25 kHz.
- Phase match: 2° maximum, 1° typical.
- Wide dynamic range.
- Low noise: 250 microvolts in 20 MHz BW.
- Interfaces: serial, parallel, GPIB.
- $\frac{\text{-80 dB bandwidth}}{\text{- 3 dB bandwidth}} < 2$
- Passband ripple: 0.15 dB pk-pk.
- Outband rejection: 80 dB minimum.
- Hum: < - 100 dB, re full-scale.
- Noise: < - 100 dB, re full-scale.
- Intermodulation: < - 80 dB, re full-scale.

†See other products in Section 1100.

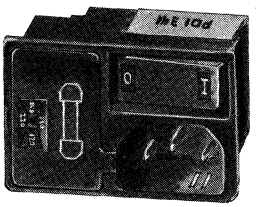
PRECISION FILTERS, INC.
240 Cherry Street, Ithaca, New York 14850, Tel. 607-277-3550

Power Dynamics, Inc.

P.O. Box 539, 59 Lakeside Avenue, West Orange, NJ 07052 • (201) 736-5722 • TWX: 136567 (PDI) • Intl. Telex: 666173 (PDI)

RFI/EMI Filtered Power Entry Modules

PDI-341

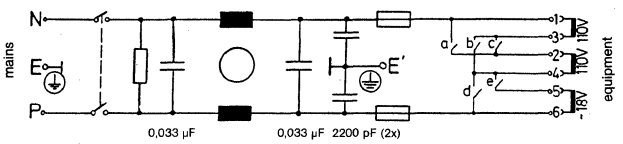


Line filters PDI 341 are especially designed for use in electronic devices to be exported to all countries. First time in the world PDI 341 offers a combination from IEC-plug, two-pole ON/OFF switch, fuse-holder that accepts two fuses 5 x 20 mm or 3AG and a voltage selector for **four different voltages**. This excellent power line filter saves costs and protects electronic equipment against malfunctions. Snap-in mounted.

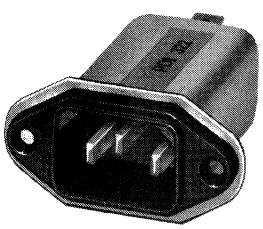
Technical data

Operating voltage	250 V / 50 Hz 110 V / 60 Hz
Rated current	1 A / 2 A / 3 A / 4 A / 6 A
Leakage current	<0,5 mA / 250 VAC
Temperature range	−25° C — +85° C
Test voltage (VDE 0565)	1,8 kV / 50 Hz — 2 s

Circuit



PDI-322

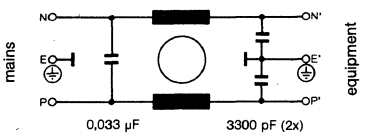


The filter series PDI 322 are designed for optimal results and have a short case-length. Common mode and differential mode noise is attenuated beginning at the low frequency range up to 30MHz. Among other uses these filters protect electronic devices with microprocessors against malfunction.

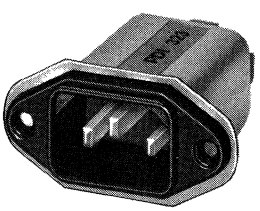
Technical data

Operating voltage	250 V / 50 Hz 110 V / 60 Hz
Rated current	1 A / 3 A / 6 A
Leakage current	<0,5 mA / 250 VAC
Temperature range	−25° C — +85° C
Test voltage (VDE 0565)	1,8 kV / 50 Hz — 2 s

Circuit



PDI-323

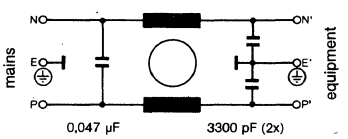


The line filters PDI 323 protect electronic devices such as computers, terminals and office equipment against line interference. 34.3 mm case-length and excellent attenuation identify this filter-series.

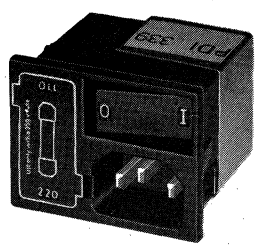
Technical data

Operating voltage	250 V / 50 Hz 110 V / 60 Hz
Rated current	1 A / 3 A / 6 A
Leakage current	<0,5 mA / 250 VAC
Temperature range	−25° C — +85° C
Test voltage (VDE 0565)	1,8 kV / 50 Hz — 2 s

Circuit



PDI-339

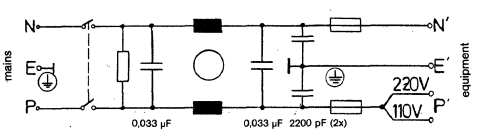


Line filters PDI 339 are especially designed for use in equipment intended for export. The additional voltage-selector enables the fast change to other mains-voltages. Snap-in mounted.

Technical data

Operating voltage	250 V / 50 Hz 110 V / 60 Hz
Rated current	1 A / 2 A / 3 A / 4 A / 6 A
Leakage current	<0,5 mA / 250 VAC
Temperature range	−25° C — +85° C
Test voltage (VDE0565)	1,8 kV / 50 Hz — 2 s

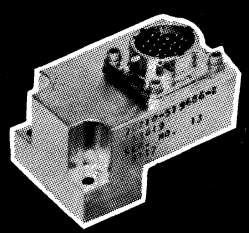
Circuit



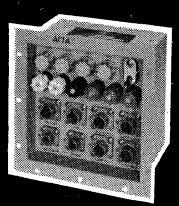
Refer to our page in the Connector section for additional Power Dynamics Filter Entry Modules.

RFI®

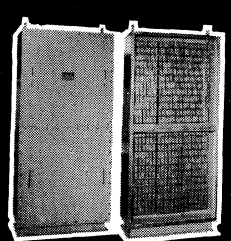
NO.



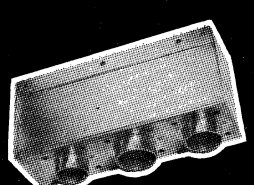
FILTER FOR INSTALLATION IN CRITICAL VOLUME CONFIGURATION



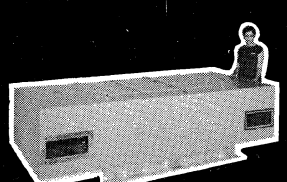
MULTI-CIRCUIT FILTER ASSEMBLY WITH INPUT POWER CONNECTORS



1100 CIRCUIT SIGNAL LINE FILTER CABINET



156 CIRCUIT, HIGH RELIABILITY FILTER PACKAGE FOR AEROSPACE APPLICATION



1300 AMP, 3 PHASE 380 VAC FILTER ASSEMBLY

MANUFACTURER OF RFI/EMC FILTERS.

We've got over 30,000 filter designs on file to meet your basic or most sophisticated needs ...

and more parts QPL listed to MIL-F-15733 than any other manufacturer.

The fact that we've got so many filter designs available is only one part of our success story.

Our 24 years of engineering experience and expertise in providing custom engineered filters is the other part.

Our technology has provided our customers with the golden edge in filter performance. We've helped plan and expedite efficient and economical filter systems ...from the simplest to the most intricate.

"Made by RFI" doesn't only tell you who made it, but how well it was made. After all, we sell more than just filters. We sell ideas.

Write for our complete FREE catalog.

RFI®

RFI Corporation

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100-E PINE AIRE DRIVE
BAY SHORE, LONG ISLAND
NEW YORK 11706
(516) 231-6400
TWX 510-227-6233

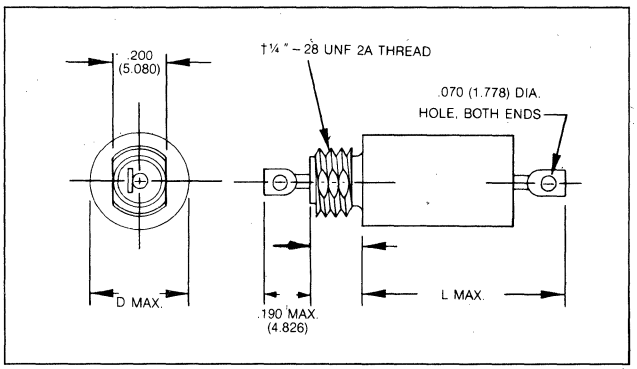
SFE TECHNOLOGIES

San Fernando Electric

1501 First Street, San Fernando, California 91340-2793 • 818/365-9411 TWX 910-946-1535

MINI FILTERS

ELECTROMAGNETIC INTERFERENCE FILTERS MIL-F-15733/24



PERFORMANCE SPECIFICATIONS

Operating Temperature: –55°C. to +125°C. • **Operating Voltage:** 28VDC. • **Dielectric Strength:** 2.5 times rated voltage, ↑ +25°C., 50 mA. maximum charging current. • **Insulation Resistance:** 100 megohms minimum with rated voltage, 50 mA. maximum charging current, ↑ +25°C. after two minutes. • **Insertion Loss:** Per MIL-STD 220 (full load). • **Military Specifications:** Meets or exceeds the applicable parameters of MIL-F-15733. • **Housing:** (Hermetic Seal): Tin plated. • **Marking:** West-Cap, MIL number, and Federal Code identification, voltage, current, date code, and circuit type.

MIL-F-15733/24 STYLE FL12 DASH NO.	L Dimension Inches	D Dimension Inches	A Dimension Inches	MIL-F-15733/24 STYLE FL12 DASH NO.	L Dimension Inches	D Dimension Inches	A Dimension Inches	MIL-F-15733/24 STYLE FL12 DASH NO.	L Dimension Inches	D Dimension Inches	A Dimension Inches
0001	.760	.385	.187	0009	.760	.350	.187	0017	.740	.350	.187
0002	.740	.385	.312	0010	.760	.385	.187	0018	.740	.350	.187
0003	.740	.350	.187	0011	.760	.385	.187	0019	.760	.350	.187
0004	.740	.350	.312	0012	.760	.385	.187	0020	.760	.350	.187
0005	.760	.385	.312	0013	.740	.385	.312	0021	.740	.350	.312
0006	.760	.385	.312	0014	.740	.385	.312	0022	.740	.350	.312
0007	.740	.350	.187	0015	.760	.385	.312	0023	.760	.350	.312
0008	.740	.350	.312	0016	.760	.385	.312	0024	.740	.350	.312

FEED THRU CAPACITOR FILTERS

EPOXY AND HERMETICALLY SEALED AC AND DC APPLICATIONS

PERFORMANCE SPECICATIONS

Operating Temperature: –55°C to +125°C. • **Operating Voltage:** 50VDC, 100VDC, 200 VDC. • **Rated Current:** 10 Amperes maximum. • **Insulation Resistance:** At +25°C: 1000 megohm-microfarad or 100,000 megohms minimum, whichever is less. AT +25°C: 100 megohm-microfarad or 10,000 megohms minimum, whichever is less. • **Insertion Loss:** At –55°C and +125°C, the insertion loss will decrease a maximum of 3dB from the +25°C value. • **Military Specifications:** Meets or exceeds the applicable parameters of MIL-F-28861. • **Voltage Drop:** 0.1 Volts maximum. • **Housing (non-hermetically sealed):** Tin plated. Can be supplied with silver or gold plating. • **D.C. Resistance:** 0.01 ohms maximum. • **Temperature Rise:** 25°C maximum. • **Solderability of Terminals:** In accordance with MIL-F-28861.

BUTTON FILTERS

GENERAL PURPOSE DC APPLICATIONS

PERFORMANCE SPECIFICATIONS

Operating Temperature: –55°C to +125°C. • **Operating Voltage:** 50VDC. • **Peak Transient Voltage:** 150VDC (10μsec.) ↑ 25°C. • **Dielectric Strength:** 100VDC ↑ +25°C., 50 mA. maximum charging current. • **Insulation Resistance:** 100 megohms minimum with 50VDC, 50 mA. maximum charging current ↑ +25°C. after two minutes. • **Insertion Loss;** At –55°C and +125°C, the insertion loss will decrease a maximum of 12dB from the +25°C value. • **Military Specifications:** Meets or exceeds the applicable parameters of MIL-F-15733 and MIL-F-28861. • **Housing (hermetic or epoxy seal):** Tin plated. Can be supplied with silver or gold plating. Screw mount. • **Torque:** 48 inch oz. maximum. • **Marking:** West-Cap, part number.

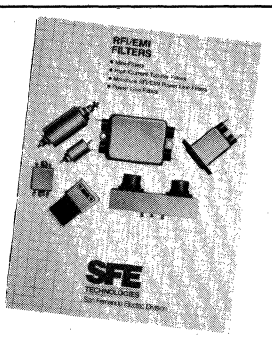
LOW PASS EMI FILTERS

HIGH PERFORMANCE, GENERAL PURPOSE EPOXY SEALED, NON AND HERMETICALLY SEALED, AC AND DC APPLICATIONS

PERFORMANCE SPECIFICATIONS

Operating Temperature: –55°C to +125°C. • **Operating Voltage:** 50VDC. • **Peak Transient Voltage:** 150VDC (10μsec.) ↑ +25°C. • **Dielectric Strength:** 100VDC ↑ +25°C., 50 mA. maximum charging current. • **Insulation Resistance:** 170 megohms minimum with 50VDC, 50 mA. maximum charging current, ↑ +25°C after two minutes. • **Insertion Loss:** At –55°C and +125°C, the insertion loss will decrease a maximum of 3dB from the +25°C value. • **Military Specifications:** Meets or exceeds the applicable parameters of MIL-F-15733. • **Housing (hermetically sealed):** Tin plated. Can be supplied with silver or gold plating. • **Torque:** 48 inch oz. maximum. • **Marking:** West-Cap, part number and Federal Code identification, voltage, current, circuitry, and date code.

Write or call for the complete 66 page catalog covering our full line of filters detailing performance specifications, mechanical dimensions, and options.



SFE TECHNOLOGIES

San Fernando Electric

1501 First Street, San Fernando, CA 91340-2793 • 818/365-9411 TWX 910-946-1535

MINIATURE POWER LINE FILTERS

For over thirty years, the San Fernando Electric Division of SFE Technologies has been a leader in the design and manufacture of a broad line of RFI/EMI filters. Innovative design approaches and close attention to quality have earned us this leadership position.

Our unique capabilities as a filter supplier stem from our vertically integrated manufacturing operations. Vertical integration offers benefits that other filter manufacturers cannot provide. As a leading manufacturer of both multi-layer ceramic (MLC) capacitors and a broad line of wound capacitor and inductor products (made at our West-Cap Arizona subsidiary), we incorporate many of these component parts into our filter products. This allows us to control the total quality process—from raw materials used to manufacture the electronic components to the assembled filter product. With 100% surveillance over total product quality, our customers are assured of the highest reliability levels.

EF SERIES

The EF international series is a low cost general purpose common mode filter supplied with an IEC powerline connector. These filters meet the very low leakage current requirements of SEV and VDE portable equipment as well as 120 volt UL544 nonpatient medical equipment.

EF series filters can be supplied with either solder lugs (1 and 2) or faston-type terminals (1F and 2F).

ED SERIES

ED series filters are unique in that they offer considerably higher performance than similarly sized filters. These filters are particularly more effective than general purpose filters in applications where it's desired to control line-to-line and low frequency line-to-ground noise.

EH SERIES

The EH series filters are designed for use in medical equipment and comply with UL544 Patient Health Care regulations.

B SERIES

The B series of RFI power line filters are low cost general purpose common mode filters for control of line-to-ground noise. These filters are supplied with current ratings from 1 to 30 amps with a variety of termination styles.

EB SERIES

The EB series of RFI power line filters are low cost general purpose common mode filters for control of line-to-ground noise. These filters are supplied with current ratings from 1 to 30 amps with a variety of termination styles.

EB series filters are very low leakage devices which meet the requirements of SEV and VDE portable equipment as well as 120 volt UL544 nonpatient medical equipment.

K SERIES

Line-to-line as well as line-to-ground RFI interference is effectively controlled by the K series RFI power line filters. These are general purpose common mode and differential mode filters. They are particularly suitable in applications where pulsed, continuous and/or intermittent RFI is present.

The EK series offers low leakage and conforms to the very low leakage requirements of SEV, VDE portable equipment and 120 volt UL544 nonpatient medical equipment.

R SERIES

These dual section RFI power line filters are suitable for low impedance loads in a noisy RFI environment. Pulsed, continuous and/or intermittent interference are controlled to protect your equipment from power line and equipment noise.

The ER models conform to the low leakage requirements of SEV, VDE portable equipment and 120 volt UL544 nonpatient medical equipment.

S SERIES

S series filters feature line-to-ground interference rejection capability with additional circuitry which reduces low frequency line-to-line noise and transients. These filters can provide needed noise suppresion to comply with FCC and VDE specifications for conducted emissions.

V SERIES

V series filters feature line-to-ground interference rejection capability with additional circuitry which reduces low frequency line-to-line noise and transients. These filters can provide needed noise suppression to comply with FCC and VDE specifications for conducted emissions.

W SERIES

W series filters feature line-to-ground interference rejection capability with additional circuitry which reduces low frequency line-to-line noise and transients. These filters can provide needed noise suppression to comply with FCC and VDE specifications for conducted emissions.

SK SERIES

These Super K (SK) series filters supply a higher insertion loss than the K series. SK series filters are suitable for use with equipment that has high line-to-line as well as line-to-ground conducted emissions.

The ESK models meet the very low leakage current requirements of SEV, VDE portable equipment and 120 volt UL544 nonpatient medical equipment.

These filters are designed to reduce conducted noise to acceptable limits for equipment that must comply with VDE 0871 in West Germany and with FCC regulations.

EP SERIES

EP series RFI filters reduce conducted noise for equipment that must comply with VDE 0871 in West Germany and applicable FCC specifications.

SP SERIES

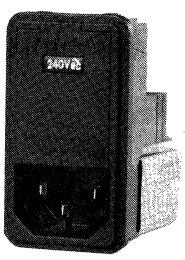
The SP series of RFI power line filters is effective in reducing the RFI noise generated by switching power supplies. This series is recommended for use with equipment that must comply with VDE 0875 and VDE 0871 in West Germany and Parts 15 and 18 of the FCC regulations in the United States.

Q SERIES

Q series RFI filters are designed to provide effective power line filtering for switching power supply applications. EQ type filters conform to the low leakage requirements of SEV, VDE portable equipment and UL544 nonpatient medical equipment.

Write or call for the complete 66 page catalog covering our full line of filters detailing performance specifications, mechanical dimensions, and options.

POWER LINE MODULE



F2-VSM SERIES

The F2-VSM series incorporates an international power line connector, line voltage selector/display, fuses, and EMI/RFI filter.

F2-PSM SERIES

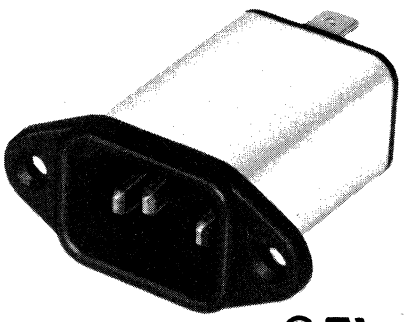
The F2-PSM series incorporates an international power line connector, line switch, fuse(s), and EMI/RFI filter. There are 72 standard configurations to select from to meet a broad range of electrical and mechanical requirements.

now available in U.S.A.

Made to Swiss Quality Standards (by Timonta)

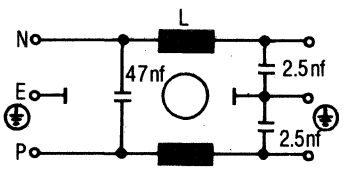
SERIES FGA

Compact design with I.E.C. Connector
Short depth: 1.58 in (40mm) long
Wide attenuation bandwidth (0.1 - 100 MHz)
Provides protection against malfunction caused by power line interference
Nominal voltage: 250V 50/60 Hz
Leakage current: <0.5mA
Test voltage: 2kV - 50 Hz

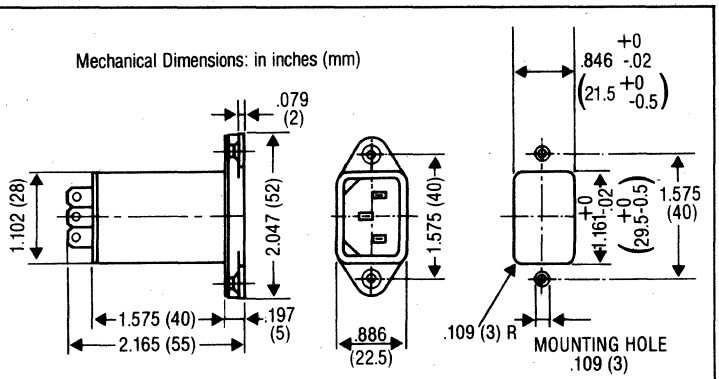


approved
pending (file E 76360)

SCHEMATIC
POWER LINE

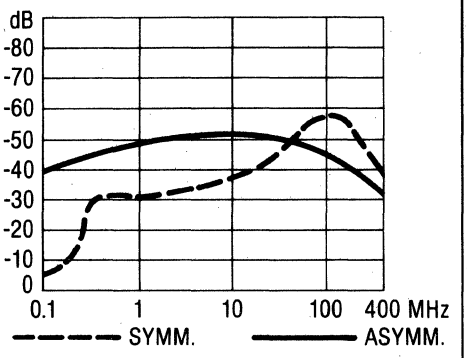


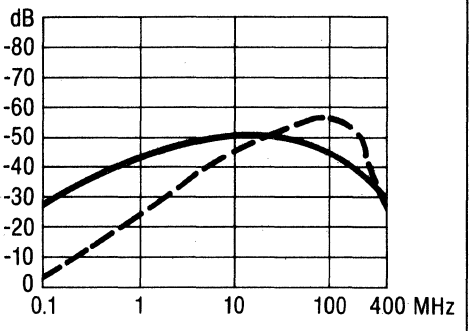
Mechanical Dimensions: in inches (mm)

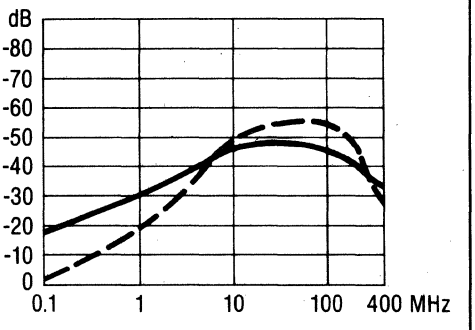


Part No.	Amps	L (mH)
FGA-2-40-1/1	1	10
FGA-2-40-3/1	3	2.5
FGA-2-40-6/1	6	1

ATTENUATION CURVES







Always in Stock — "THE PRONTO CHALLENGE": — We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep.

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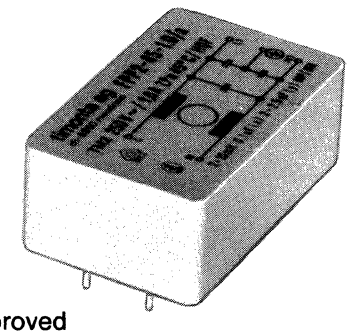
Telephone: (516) 239-5777
An Insilco Company

RFI suppression filters

Stocked & Distributed by Signal

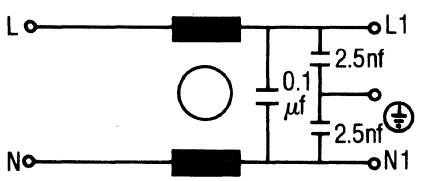


appproved
pending file (file E 76360)

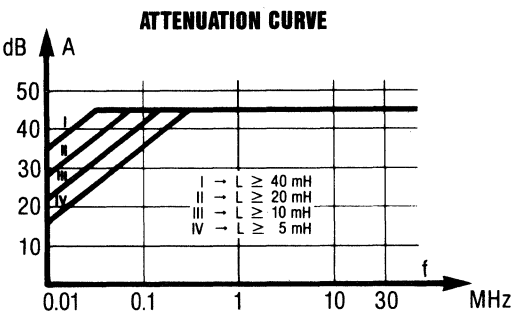
SERIES FPP

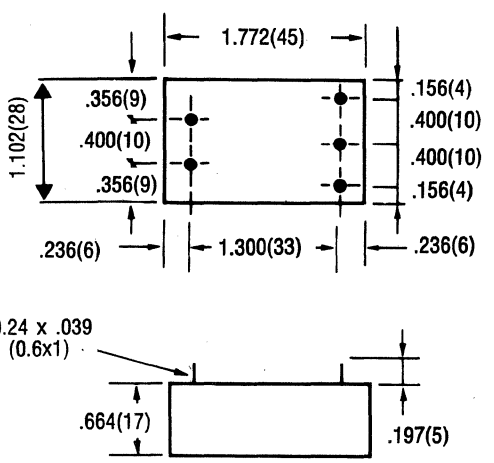
Flat for PC board applications
Only 0.67 in (17mm) high
Low price - large frequency range
Provides protection against malfunction caused by power line interference
Nominal voltage: 250V 50/60 Hz
Leakage current: <0.5mA
Test voltage: 2kV - 50 Hz

SCHEMATIC



ATTENUATION CURVE





Part No.	Amps	L (mH)
FPP-2-45-0.5a	0.5	40
FPP-2-45-1.0a	1.0	10
FPP-2-45-2.5a	2.5	2
FPP-2-45-6.5a	6.5	1

Always in Stock — "THE PRONTO CHALLENGE": — We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep.

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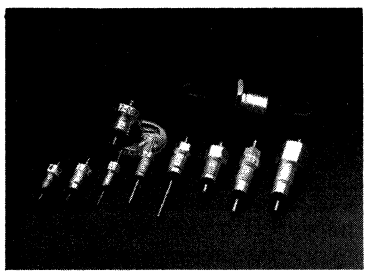
EEM PRODUCT SELECTION GUIDES

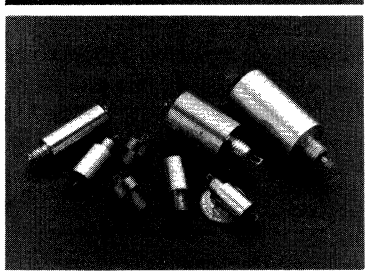
Use the EEM Product Selection Guides. There are 34 Guides in this edition of EEM. See page 2 (A•2, B•2, C•2, D•2) of each volume to locate the Product Selection Guides that pertain to your needs.

SPECTRUM CONTROL INC.

IN STOCK

EMI/RFI FILTERS AND CAPACITORS





RESIN SEALED EMI/RFI FEED THROUGH CAPACITORS AND FILTERS

These filters and capacitors depend on ceramic capacitors and ferrite beads to achieve their high degree of miniaturization and volume efficiency. All bushings are suitably plated and supplied with lockwasher and nut or solder preforms as required. The capacitor elements are protected from the environment with a proprietary resin formulation.

Distributor stocked items are shown on page 2 of this catalog.

For a full line listing of Spectrum's resin seal filters and capacitors, request bulletins 27-0027-46 and 27-0027-47.

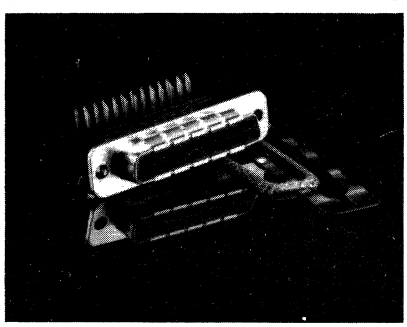
HERMETICALLY SEALED EMI/RFI FILTERS AND CAPACITORS

These hermetic seal styles of filters and feed-thru capacitors are intended for bulkhead mounting to prevent spurious signals from entering or leaving a chassis, compartment or equipment. The discoidal ceramic capacitors used in Spectrum's filters "self resonate" at much higher frequencies than other types of capacitors (mylar and foil, tantalum, electrolytic paper, etc.).

Distributor stocked items are shown on page 3 of this catalog.

For a full line listing of Spectrum's glass seal filters and feed-thru capacitors, request bulletins 27-0027-42 and 27-0027-43.

EMI FILTERED D SUBMINIATURE CONNECTORS



EMI FILTERED D SUBMINIATURE CONNECTORS

Spectrum D Subminiature filtered connectors feature a unique ground plane to effectively block bulkhead leakage of EMI. The design also provides line to line isolation to limit cross talk (line to line mutual coupling) to an absolute minimum. A most important feature is the coaxial spring contact* that provides proper electrical grounding when mating one connector to another connector. Spectrum connectors are designed to provide compatibility with EIA RS-232 and RS-449 and will mount in existing chassis hole patterns.

DISTRIBUTOR STOCKED FILTERED CONNECTORS ARE SHOWN ON PAGES **C**•1513 THROUGH **C**•1517 OF EEM SECTION 2100

For a full line listing of Spectrum's EMI D Subminiature Connectors, request bulletin 27-0027-53. *U.S. Patent 4516815

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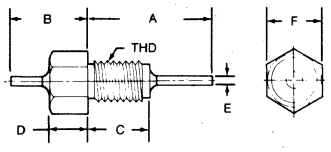
SPECTRUM CONTROL, INC. 2185 West Eighth St., Erie, PA 16505 Phone (814) 455-0966 TWX 510-699-6871

SPECTRUM CONTROL INC.

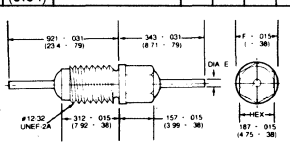
RESIN SEAL EMI/RFI SUPPRESSION FILTERS



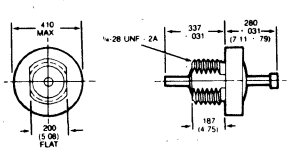
IN STOCK

PART NUMBER	WORKING VOLTAGE (Vdc)		CAP VALUE	RATED DC CURRENT	DCR	CKT	A +.031 (.79)	B +.031 (.79)	C +.015 (.38)	D +.015 (.38)	E +.005 (.13)	F +.015 (.38)	THREAD SIZE	INSERTION LOSS dB				
	+85°	+125°												1 Mhz	10 Mhz	100 Mhz	300 Mhz	1 Ghz
51-729-303	200	100	1500pf	10 amp	.01	pi	.360 (9.4)	.240 (6.10)	.220 (5.59)	.120 (3.06)	.018 (.46)	.156 (3.96)	4-40 UNC-2A	–	5	42	65	70
51-729-304	200	100	.022uf	10 amp	.01	L	.360 (9.4)	.240 (6.10)	.220 (5.59)	.120 (3.06)	.018 (.46)	.156 (3.96)	4-40 UNC-2A	7	27	43	47	55
SCI-3112-002	200	100	.027uf	10 amp	.01	L	.360 (9.4)	.240 (6.10)	.220 (5.59)	.120 (3.05)	.016 (.41)	.156 (3.96)	4-40 UNC-2A	10	30	50	54	60
51-726-002	200	100	.022uf	10 amp	.01	L	.500 (12.7)	.320 (8.13)	.225 (5.72)	.125 (3.18)	.032 (.81)	.156 (3.96)	6-32 UNC-2A	7	27	43	50	60
51-712-001	200	100	1500pf	10 amp	.01	pi	.890 (22.6)	.312 (7.92)	.266 (6.76)	.094 (2.39)	.032 (.81)	.187 (4.75)	8-32 UNC-2A	–	5	42	65	70
51-712-003	200	100	.022uf	10 amp	.01	L	.850 (21.6)	.280 (7.11)	.266 (6.76)	.094 (2.39)	.040 (1.02)	.187 (4.75)	8-32 UNC-2A	7	27	43	50	60
51-744-002	200	100	5500pf	10 amp	.01	pi	.413 (10.5)	.265 (6.73)	.242 (6.15)	.094 (2.39)	.040 (1.02)	.187 (4.75)	8-32 UNC-2A	–	14	55	70	70
51-719-011		500	2500pf	10 amp	.01	pi	.453 (11.5)	.359 (9.12)	.281 (7.11)	1.87 (4.75)	.040 (1.12)	.250 (6.35)	12-32 UNEF-2A	–	12	45	60	70
51-719-021		200	5500pf	10 amp	.01	pi	.453 (11.5)	.359 (9.12)	.281 (7.11)	.187 (4.75)	.040 (1.12)	.250 (6.35)	12-32 UNEF-2A	–	12	50	70	70
SCI-3313-000	200	100	.10uf	10 amp	.01	pi	.920 (23.4)	.343 (8.71)	.311 (7.9)	.157 (3.99)	.032 (.81)	.187 (4.75)	12-32 UNEF-2A	10	40	70	70	70
54779001X5U102P	200	100	1000pfGMV	3 amp	.01	FT	.500 (12.7)	.320 (8.13)	.225 (5.72)	.125 (3.18)	.032 (.81)	.156 (3.96)	6-32 UNC-2A					
54713001X5F101M	200	100	100pf ± 20%	10 amp	.01	FT	.631 (16.03)	.267 (6.77)	.256 (6.34)	.093 (2.38)	.051 (1.3)	.187 (4.75)	8-32 UNC-2A					
54713001X5U102P	200	100	1000pfGMV	10 amp	.01	FT	.631 (16.03)	.267 (6.77)	.256 (6.34)	.093 (2.38)	.051 (1.3)	.187 (4.75)	8-32 UNC-2A					
54743001X5U102Z	500	250	1000pf $^{+80\%}_{-20\%}$	10 amp		FT	.594 (15.08)	.406 (10.36)	.312 (7.93)	.156 (3.96)	.051 (1.3)	.250 (6.34)	12-28 UNF-2A					
54-785-005	100	100	.05ufGMV	10 amp		FT	.421 (10.7)	.328 (8.33)	.234 (5.94)	.140 (3.56)	.040 (1.02)	.187 (4.75)	8-32 UNC-2A					
54-786-014	50	50	1.0ufGMV	10 amp		FT	.500 (12.7)	.359 (9.12)	.328 (8.33)	.171 (4.34)	.040 (1.02)	.218 (5.54)	10-32 UNF-2A					

PART NUMBER	CAPACITANCE AND TOLERANCE	RATED DC VOLTAGE	RATED CURRENT	ELECTRICAL CIRCUIT	MINIMUM INSERTION LOSS (dB) PER MIL. STD. 220								E	F
					100 KHz	1 MHz	3 MHz	10 MHz	30 MHz	100 MHz	300 MHz	1-10 GHz		
51-714-002	5000pF REF	100V	10A	Pi	—	—	7	12	35	60	70	70	.032 (.81)	.250 ± .015 (6.35 ± .38)

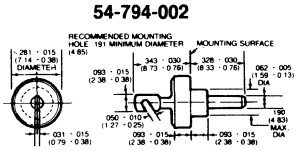


PART NUMBER.	RATED DC CURRENT	WORKING VOLTS		DCR MAX.	REFER CAP.	MINIMUM INSERTION LOSS dB					
		+85°C	+125°C			30KHz	150KHz	300KHz	1MHz	10MHz	1GHz
51-717-001	15A	100Vdc	50Vdc	.01	1.4 uF	15	28	33	44	60	70



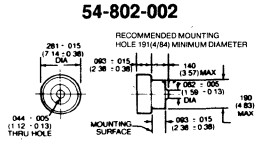
FEED-THRU CERAMIC CAPACITORS 500VDC −55° TO +85°C

54-794-002



PART NUMBER	HARDWARE SUPPLIED
54-794-002	Solder Preform
54-802-002	Solder Preform
54-803-004	Solder Preform
54-804-002	Nut & Washer

54-802-002

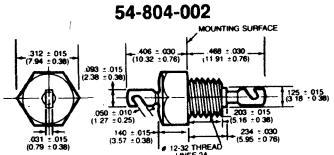


STANDARD CAPACITANCE & TOLERANCE

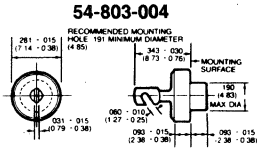
CAP.	TOL.	EIA CODE
470pf	±20%	471M
1000pf	GMV	102P

ORDERING EXAMPLE: 54-794-002-102P

54-804-002



54-803-004



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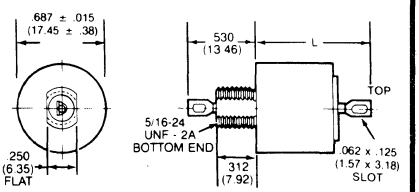
HERMETIC SEAL EMI/RFI SUPPRESSION FILTERS

IN STOCK

SPECTRUM CONTROL INC.

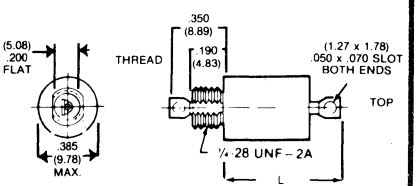
240VAC @ 125°C L, Pi, T 0-60Hz

PART NUMBER	RATED DC CURRENT	CKT	LENGTH "L" ± .030 (.76)	DCR. MAX.	MINIMUM INSERTION LOSS dB PER MIL - STD 220					
					75KHz	150KHz	300KHz	1MHz	10MHz	1GHz
51-320-024	1A	L Top	1.006 (25.55)	.3	15	30	38	60	70	70
51-320-026	3A	L Top	1.006 (25.55)	.03	6	19	25	45	70	70
51-320-028	5A	L Top	1.006 (25.55)	.1	6	19	24	37	70	70
51-321-318	3A	Pi	1.170 (29.72)	.03	6	31	55	80	80	80
51-321-610	1A	T	1.170 (29.72)	.6	25	49	60	70	70	70

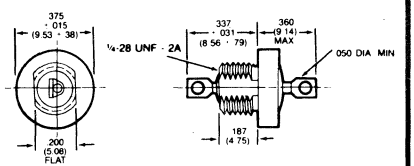


100VDC @ 125°C

PART NUMBER	RATED DC CURRENT	CKT	LENGTH "L" ± .030 (.76)	DCR. MAX.	MINIMUM INSERTION LOSS dB PER MIL - STD 220				
					75KHz	150KHz	300KHz	1MHz	1GHz
51-351-605	2 A	T	1.164 (29.57)	.1	6	25	34	57	80
51-353-123	3 A	L Top	.728 (18.49)	.06	6	22	29	44	70
51-311-322	5 A	Pi	.778 (19.76)	.015	—	—	28	65	80

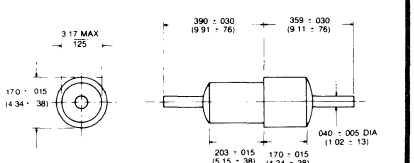


PART NUMBER	RATED DC CURRENT	WORKING VOLTS		DCR MAX.	REFER CAP.	MINIMUM INSERTION LOSS dB					
		+85°C	+125°C			30KHz	150KHz	300KHz	1MHz	10MHz	1GHz
51-359-001	15A	100Vdc	50Vdc	.01	1.4uF	15	28	33	44	50	70
SCI-1020-000	15A	50Vdc	25Vdc	.01	1.4uf	15	28	33	44	50	70



SOLDER-IN EMI/RFI CAPACITOR

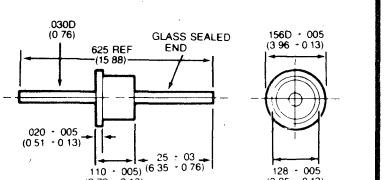
PART NUMBER	RATED DC CURRENT	WVDC @ 125°C	CAP.	MINIMUM INSERTION LOSS dB							
				30KHz	100KHz	1MHz	10MHz	30MHz	100MHz	300MHz	1-10GHz
54-785-002	10A	100	.05uFGMV	—	—	16	33	41	45	48	50



SERIES SCI 9900/9910/9920

All units are hermetically sealed (glass to metal) on one end, while the other end is epoxy sealed. Series 99XX units are designed to be soldered in place. Maximum soldering temperature is +200°C (400°F).

SERIES	SCI 9900	SCI 9910	SCI 9920
VOLTAGE	50 WVDC	100 WVDC	200 WVDC 115VAC 60Hz
DC AMPS. MAX.	5	5	5
CAPACITANCE (GMV)	100pF 1200pF 2700pF 5000pF	100pF 1200pF 2700pF 5000pF	100pF 1200pF



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Standex Electronics

EMI/RFI Power Line Filters

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Phone (513) 871-3777

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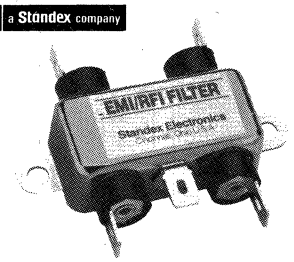
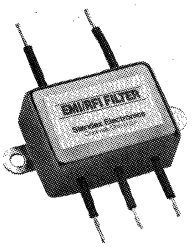
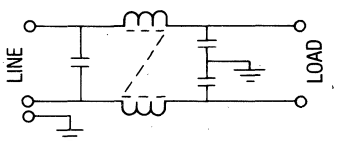




SERIES A GENERAL PURPOSE FILTERS

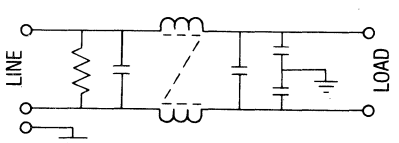
The A Series of EMI/RFI filters is a general purpose, common mode line. Available in a broad selection at lowest cost. **Rated Voltage:** 115/250 VAC, 50/60 Hz. **Max. Leakage Current (Line-to-case):** 0.5 mA at 115 VAC, 60 Hz. 1.0 mA at 250 VAC, 50 Hz. **Test Voltage:** Line-to-case 2250 VDC, line-to-line 1450 VDC.



Standex Number	Max. Line Current Amps	Size Inches L x W x H
F6000A101	1	2.50 x 2.11 x 0.63
F6000A102	2	2.50 x 2.11 x 0.63
F6000A103	3	2.50 x 2.50 x 0.75
F6000A105	5	2.50 x 2.50 x 0.75
F6000A110	10	2.50 x 2.50 x 1.13
F6000A120	20	3.23 x 2.78 x 1.13
F6000A301	1	2.50 x 0.94 x 0.63
F6000A302	2	2.50 x 0.94 x 0.63
F6000A303	3	2.50 x 1.31 x 0.75
F6000A305	5	2.50 x 1.31 x 0.75
F6000A310	10	2.50 x 1.31 x 1.13
F6000A610	10	2.50 x 2.60 x 1.13
F6000A620	20	3.35 x 2.78 x 1.13
F6000A630	30	5.22 x 4.12 x 1.50

SERIES B GENERAL PURPOSE FILTERS

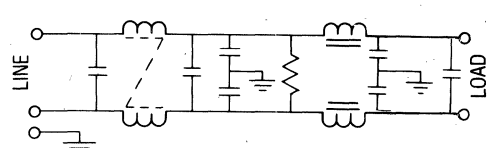
General purpose, common-mode and differential-mode filters. Effective where pulsed, continuous and/or intermittent interference is present. **Rated Voltage:** 115/250 VAC, 50/60 Hz. **Max. Leakage Current (Line-to-case)** 0.5 mA at 115 VAC, 60 Hz. 1.0 mA at 250 VAC, 50 Hz. **Test Voltage:** Line-to-case 2250 VDC, line-to-line 1450 VDC.



Standex Number	Max. Line Current Amps	Size Inches L x W x H
F6000B101	1	2.78 x 2.98 x 0.88
F6000B102	2	2.98 x 2.78 x 0.88
F6000B103	3	2.98 x 2.78 x 1.13
F6000B105	5	2.98 x 2.78 x 1.13
F6000B10	10	3.23 x 2.78 x 1.13
F6000B120	20	3.23 x 3.23 x 1.50
F6000B301	1	2.78 x 1.81 x 0.88
F6000B302	2	2.78 x 1.81 x 0.88
F6000B303	3	2.78 x 1.81 x 1.13
F6000B305	5	2.78 x 1.81 x 1.13
F6000B310	10	2.78 x 2.06 x 1.13
F6000B610	10	3.35 x 2.78 x 1.13
F6000B620	20	3.35 x 3.20 x 1.50
F6000B630	30	5.23 x 4.12 x 1.50
F6000B703	3	3.15 x 2.19 x 1.25
F6000B705	5	3.15 x 2.19 x 1.25
F6000B710	10	3.64 x 2.19 x 1.25

SERIES F SWITCHING TYPE POWER SUPPLY FILTERS

This series has been designed to protect equipment from malfunctions. Especially effective where switching type power supplies, SCR's and T^2L circuits are utilized. **Rated Voltage:** 115/250 VAC, 50/60 Hz. **Max. Leakage Current (Line-to-case):** 0.5 mA at 115 VAC, 60 Hz. 1.0 mA at 250 VAC, 50 Hz. **Test Voltage:** Line-to-case 2250 VDC, line-to-line 1450 VDC.



Standex Number	Max. Line Current Amps	Size Inches L x W x H
F6000F103	3	3.23 x 2.75 x 1.25
F6000F106	6	3.73 x 3.32 x 1.50
F6000F110	10	3.73 x 3.32 x 1.50
F6000F120	20	5.11 x 4.12 x 1.50

Standex Electronics manufactures a broad line of standard filters with direct cross reference to most major brands. Call or write for complete catalog.

Special filters are standard at Standex Electronics. Call (305) 863-7550 for engineering assistance.

Standex Electronics

EMI/RFI Power Line Filters

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Cincinnati, Ohio 45209
Phone (513) 871-3777

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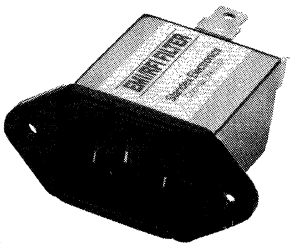
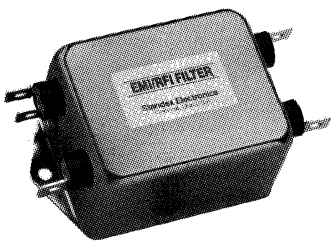
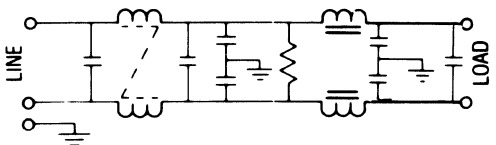




SERIES S HIGH PERFORMANCE POWER LINE FILTERS

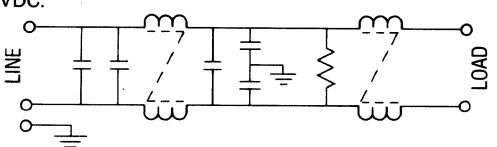
The Series S is particularly suited for equipment with high line-to-case as well as line-to-line emissions. **Rated Voltage:** 115/250 VAC, 50/60 Hz. **Max. Leakage Current (Line-to-case):** 0.25 mA at 115 VAC, 60 Hz. 0.40 mA at 250 VAC, 50 Hz. **Test Voltage:** Line-to-case 2250 VDC, line-to-line 1450 VDC.



Standex Number	Max. Line Current Amps	Size Inches L x W x H
F6000S103	3	3.68 x 3.32 x 1.13
F6000S106	6	4.16 x 3.80 x 1.25
F6000S110	10	4.80 x 4.44 x 1.25
F6000S303	3	3.32 x 2.51 x 1.13
F6000S306	6	3.80 x 2.99 x 1.25
F6000S310	10	4.44 x 3.63 x 1.75
F6000S203	3	3.09 x 2.19 x 1.50
F6000S706	6	3.09 x 2.19 x 1.75
F6000S710	10	4.21 x 2.19 x 1.75

SERIES J SWITCHING POWER SUPPLY NOISE SUPPRESSION FILTERS

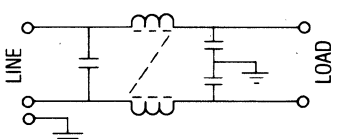
The Series J is well suited to meet VDE 0871, B level and FCC Part 15J, Class B. all models meet UL544 non-patient medical equipment requirements. **Rated Voltage:** 115/250 VAC, 50/60 Hz. **Max. Leakage Current (Line-to-case)**0.25 mA at 115 VAC, 0.40mA at 250 VAC, 50 Hz. **Test Voltage:** Line-to-case 2250 VDC, line-to-line 1450 VDC.



Standex Number	Max. Line Current Amps	Size Inches L x W x H
F6000J103	3	3.74 x 3.32 x 1.75
F6000J106	6	6.49 x 6.00 x 2.25
F6000J110	10	6.49 x 6.00 x 2.75
F6000J303	3	3.32 x 2.56 x 1.75
F6000J306	6	6.00 x 5.31 x 2.25
F6000J310	10	6.00 x 5.31 x 2.75
F6000J703	3	3.15 x 2.19 x 1.75

SERIES L HIGH PERFORMANCE FILTERS

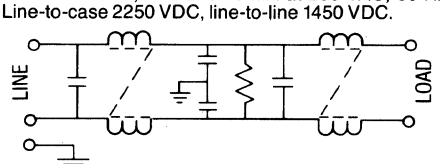
The Series L offers prime performance in controlling line-to-line and low-frequency line-to-line noise. It offers superior performance to comparable sized filters. All units incorporate an IEC power line connector. **Rated Voltage:** 115/250 VAC, 50/60 Hz. **Max. Leakage Current (Line-to-case):** 0.25 mA at 115 VAC, 60 Hz. 0.50 mA at 250 VAC, 50 Hz. **Test Voltage:** Line-to-case 2250 VDC, line-to-line 1450 VDC.



Standex Number	Max. Line Current Amps	Size Inches L x W x H
F6000L801	1	2.16 x 1.97 x 0.79
F6000L803	3	2.16 x 1.97 x 0.79
F6000L806	6	2.16 x 1.97 x 0.79
F6000L901	1	1.97 x 1.55 x 0.83
F6000L903	3	1.97 x 1.55 x 0.83
F6000L906	6	1.97 x 1.55 x 0.83

SERIES R LOW IMPEDENCE LOAD FILTERS

This series offers premium performance for low impedance loads. It protects equipment from power line noise as well as protecting the line from equipment noise. A further advantage is low leakage of current. All units meet VDE portable equipment requirements, as well UL544 nonpatient medical equipment requirements at 120V. **Rated Voltage:** 115/250 VAC, 50/60 Hz. **Max. Leakage Current (Line-to-case):** 0.25 mA at 115 VAC, 60 Hz. 0.40 mA at 250 VAC, 50 Hz. **Test Voltage:** Line-to-case 2250 VDC, line-to-line 1450 VDC.



Standex Number	Max. Line Current Amps	Size Inches L x W x H
F6000R101	1	3.23 x 2.75 x 1.13
F6000R102	2	3.23 x 2.75 x 1.13
F6000R103	3	3.73 x 3.32 x 1.13
F6000R105	5	3.73 x 3.32 x 1.13
F6000R10	10	3.73 x 3.32 x 1.50
F6000R120	20	5.11 x 4.12 x 1.50
F6000R301	1	2.75 x 2.06 x 1.13
F6000R302	2	2.75 x 2.06 x 1.13
F6000R303	3	3.32 x 2.56 x 1.13
F6000R305	5	3.32 x 2.56 x 1.13
F6000R310	10	3.32 x 2.56 x 1.50
F6000R203	3	4.28 x 2.19 x 1.25
F6000R205	5	4.28 x 2.19 x 1.25
F6000R210	10	4.28 x 2.19 x 1.50

All Standex EMI/RFI Filters are UL recognized and CSA Certified, with VDE approval in process.

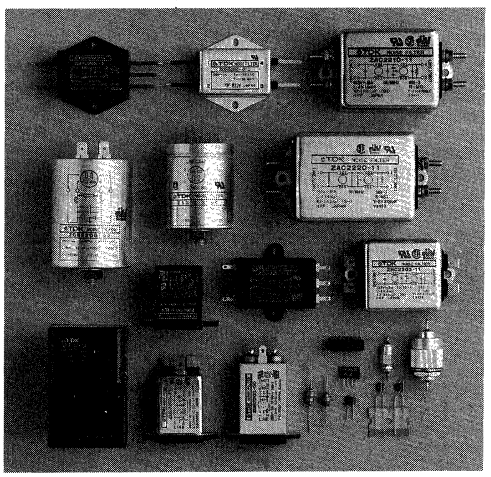
NOISE (EMI) FILTERS

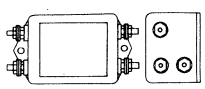
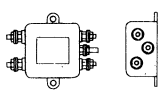
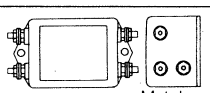
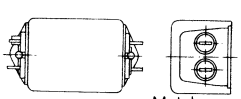
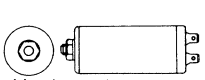
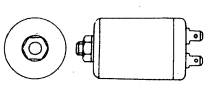
TDK CORPORATION OF AMERICA 4711 West Golf Road, Suite 300, Skokie, Illinois 60076, U.S.A. Phone: (312) 679-8200 **CHICAGO SALES OFFICE** (312) 679-8200 **LOS ANGELES SALES OFFICE** (213) 539-6631 **SAN FRANCISCO SALES OFFICE** (408) 943-9325 **NEW YORK SALES OFFICE** (516) 625-0100 **INDIANAPOLIS SALES OFFICE** (317) 872-0370 **DETROIT BRANCH** (313) 353-9393 **ALABAMA BRANCH** (205) 539-4551 **TDK CORPORATION** Tokyo, Japan

The latest developments in electronics have caused more attention to be focused on problems concerning noise (EMI) due to incorrect operation as well as generated noise (EMI). TDK's noise (EMI) filters are the result of many years of research in ferrite cores, SF cores and ceramic capacitors. These filters are designed to meet a wide variety of demanding applications.

Features

1) Highly permeable ferrite cores and high saturation flux density cores are used in the inductors, the critical component in any noise (EMI) filter.
2) A high dielectric ceramic capacitor with low loss is used in these filters to reduce their size and ground the small leakage current.
3) A full series is available to permit selection based on characteristics, structure, dimensions and price.
4) Preparations to obtain UL, CSA, VDE and TÜV recognition/approval have been made.



Series name	Exterior view	Function	Type	Rated current (A)	Rated voltage (V.a.c.)	Test voltage (V.a.c.)	Leadkage current (mA)	Weight (g)
ZAC	 Metal cased Terminal: studs	Normal mode and common mode noise is prevented within a 0.2 to 30 MHz range. UL recognized, CSA certified TÜV approved	ZAC2205-00U	5	250	1500	<1.0 ($^{250V}_{60Hz}$)	240
			ZAC2206-11	6	250	1500	<1.0 ($^{250V}_{60Hz}$)	280
			ZAC2210-00U	6	250	1500	<1.0 ($^{250V}_{60Hz}$)	250
			ZAC2210-11	10	250	1500	<1.0 ($^{250V}_{60Hz}$)	300
			ZAC2215-00U	15	250	1500	<1.0 ($^{250V}_{60Hz}$)	260
			ZAC2220-11	20	250	1500	<1.0 ($^{250V}_{60Hz}$)	440
			ZAC2220-00U	20	250	1500	<1.0 ($^{250V}_{60Hz}$)	260
ZAG	 Metal cased Terminal: studs	Common mode noise is prevented within a 0.15 to 100 MHz and normal mode noise prevented within 0.15 to 30 MHz range. UL recognized	ZAG2205-11	5	250	1500	<1.0 ($^{250V}_{60Hz}$)	150
			ZAG2210-11	10	250	1500	<1.0 ($^{250V}_{60Hz}$)	160
			ZAG2220-11	20	250	1500	<1.0 ($^{250V}_{60Hz}$)	170
ZAG-P	 Metal cased Terminal: studs	High voltage pulse noise is prevented. UL recognized	ZAG2205-11-P	5	250	1500	<1.0 ($^{250V}_{60Hz}$)	280
			ZAG2210-11-P	10	250	1500	<1.0 ($^{250V}_{60Hz}$)	280
			ZAG2220-11-P	20	250	1500	<1.0 ($^{250V}_{60Hz}$)	290
ZHC	 Metal cased Terminal: faston tabs	Normal mode and common mode noise is prevented within a 0.2 to 30 MHz range. UL recognized TÜV approved	ZHC2203-11	3	250	1500	<1.0 ($^{250V}_{60Hz}$)	130
			ZHC2206	6	250	1500	<1.0 ($^{250V}_{60Hz}$)	250
			ZHC2210-11	10	250	1500	<1.0 ($^{250V}_{60Hz}$)	280
ZSB	 Metal cased Terminal: faston tabs	Normal mode and common mode noise is prevented within a 0.15 to 30 MHz range. VDE approved	ZSB2210-05A	10	250	1500	<1.5 ($^{250V}_{60Hz}$)	120
ZSG	 Metal cased Terminal: faston tabs	Normal mode and common mode noise is prevented within a 0.15 to 30 MHz range. UL recognized CSA certified	ZSG1215-06A	15	125	1500	<0.5 ($^{125V}_{60Hz}$)	170

NOISE (EMI) FILTERS

TDK®

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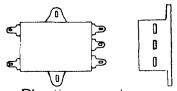
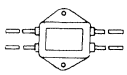
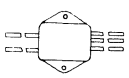
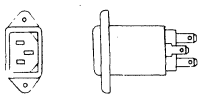
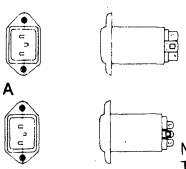
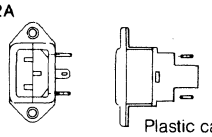
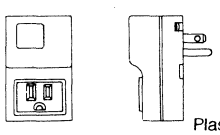
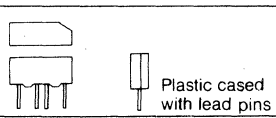
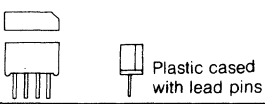
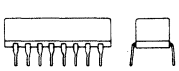
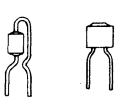
Series name	Exterior view	Function	Type	Rated current (A)	Rated voltage (V.a.c.)	Test voltage (V.a.c.)	Leakage current (mA)	Weight (g)
ZCB	 Plastic cased Terminal: faston tabs	Normal mode and common mode noise is prevented within a 0.15 to 30 MHz range. UL recognized CSA certified TÜV approved	ZCB2203-11	3	250	1500	<0.75 (250V, 60Hz)	45
			ZCB2206-11	6	250	1500	<0.75 (250V, 60Hz)	45
ZGB	 Metal cased Lead wires	Normal mode and common mode noise is prevented within a 0.15 to 30 MHz range. UL recognized	ZGB22R5-01U	0.5	250	1500	<0.1 (250V, 60Hz)	75
			ZGB2201-01U	1	250	1500	<0.4 (250V, 60Hz)	75
			ZGB2202-01U	2	250	1500	<0.4 (250V, 60Hz)	75
			ZGB2203-01U	3	250	1500	<0.4 (250V, 60Hz)	75
ZMB	 Plastic cased Lead wires	Normal mode noise is prevented within a 0.15 to 30 MHz range. UL recognized: –11 VDE approved: –13	ZMB22R5-11	0.5	250	1500	<1.0 (250V, 60Hz)	65
			ZMB2201-11, 13	1	250	1500	<1.0 (250V, 60Hz)	65, 45
			ZMB2202-11	2	250	1500	<1.0 (250V, 60Hz)	65
			ZMB2203-11, 13	3	250	1500	<1.0 (250V, 60Hz)	65, 45
ZUB	 Metal cased Terminal: faston tabs	Common mode noise is prevented within a 0.15 to 300 MHz range. With fuse: –00-F UL recognized: –00 CSA certified TÜV approved	ZUB2203-00	3	250	1500	<0.5 (250V, 60Hz)	50
			ZUB2203-00-F	3	250	1500	<0.5 (250V, 60Hz)	70
			ZUB2206-00	6	250	1500	<0.5 (250V, 60Hz)	50
			ZUB2206-00-F	6	250	1500	<0.5 (250V, 60Hz)	70
ZUG-11 ZUG-11A	 Metal cased Terminal: faston tabs	Normal mode and common mode noise is prevented within a 0.15 to 300 MHz range. UL recognized CSA certified TÜV approved	ZUG2203-11	3	250	1500	<0.5 (250V, 60Hz)	48
			ZUG2206-11	6	250	1500	<0.5 (250V, 60Hz)	48
			ZUG2203-11A	3	250	1500	<0.5 (250V, 60Hz)	48
			ZUG2206-11A	6	250	1500	<0.5 (250V, 60Hz)	48
ZUG-12A	 Plastic cased Terminal: solder lugs	Normal mode and common mode noise is prevented within a 0.15 to 300 MHz range. UL recognized CSA certified TÜV approved	ZUG2203-12A	3	250	1500	<0.75 (250V, 60Hz)	32
			ZUG2206-12A	6	250	1500	<0.75 (250V, 60Hz)	32
ANF-U	 Plastic cased	Normal mode and common mode noise is prevented within a 0.15 to 30 MHz range. –106U: 3P type UL recognized	ANF-106U	6	125	1500	<0.5 (125V, 60Hz)	160
ZJK-00	 Plastic cased with lead pins	Common mode noise is prevented within a 0.2 to 200 MHz range.	ZJK51R1-00	0.1	DC. 50	DC. 125		1.5
			ZJK51R5-00	0.5	DC. 50	DC. 125		1.5
			ZJK5103-00	3	DC. 50	DC. 125		1.5
ZJK-05	 Plastic cased with lead pins	Common mode noise is prevented within a 0.2 to 200 MHz range.	ZJK51R1-05	0.1	DC. 50	DC. 125		0.8
			ZJK51R5-05	0.5	DC. 50	DC. 125		0.8
			ZJK5103-05	3	DC. 50	DC. 125		0.8
ZJY			ZJY51R5-8P	0.5	DC. 50	DC. 250		1.4
ZBF		Impedance is over 30Ω for the 10 to 1000 MHz band.	ZBF253S-01	3	DC. 50			0.5
			ZBF503S-01	3	DC. 50			0.5
			ZBF253D-01	3	DC. 50			0.5
			ZBF503D-01	3	DC. 50			0.5
			ZBF503S-01 TA	3	DC. 50			0.5

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K
kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L
LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microforad
MHz megahertz
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOSIGT metal-oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM nuclear instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLL phased lock loop
PPI plan position indicator
PROM programmable read only memory
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

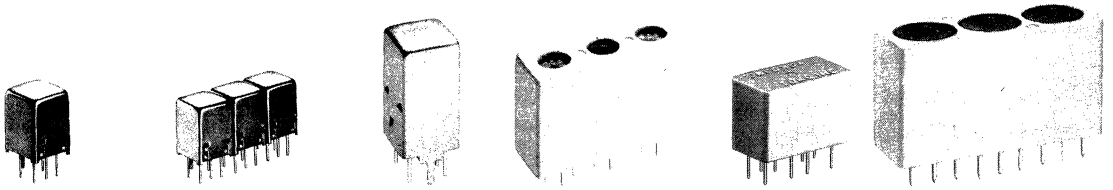
W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

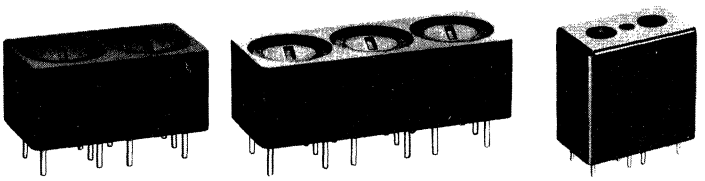
TOKO AMERICA FILTERS

LC FILTERS



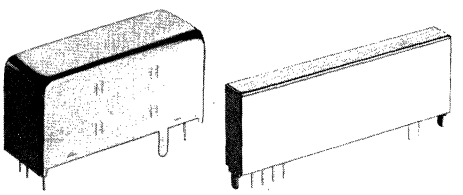
Type	5 VUS	5 VST	7 VUS	7 VST	5 VNW	ABT-07
Freq.	100 KHz ~ 10 MHz	100 KHz ~ 10 MHz	100 KHz ~ 10 MHz	100 KHz ~ 10 MHz	100 KHz ~ 10 MHz	10 KHz ~ 200 KHz
Impedance	100Ω ~ 10 KΩ	100Ω ~ 10 KΩ	100Ω ~ 10 KΩ	100Ω ~ 10 KΩ	100Ω ~ 10 KΩ	1 KΩ ~ 10 KΩ
Ht/Lth/Wd	8/6.1/6.1	8/18/6.1	15/8/8	16/26/10	8/12.5/6.5	13.5/25/9
Temp. Range	−10° ~ +60°C	−10° ~ +60°C	−10° ~ +60°C	−10° ~ +60°C	−10° ~ +60°C	−10° ~ +60°C

LC FILTERS



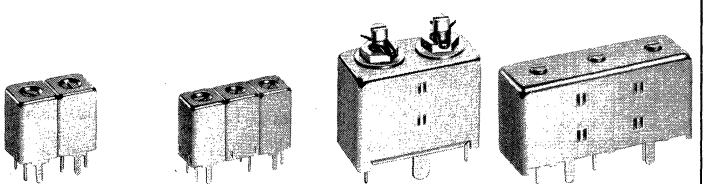
Type	ABW-10L	ABT-10L	LPFS-21
Freq.	10 KHz ~ 200 KHz	10 KHz ~ 200 KHz	10 KHz ~ 200 KHz
Impedance	1 KΩ ~ 10 KΩ	1 KΩ ~ 10 KΩ	1 KΩ ~ 10 KΩ
Ht/Lth/Wd	10/23/13.5	10/34/13.5	16.5/21/11.5
Temp. Range	−10° ~ +60°C	−10° ~ +60°C	−10° ~ +60°C

DIGITAL AUDIO FILTERS



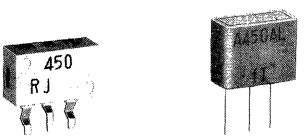
Type	PALI 0900	PALH 1100
Freq.	5 KHz ~ 20 KHz	5 KHz ~ 20 KHz
Impedance	10 KΩ	10 KΩ
Ht/Lth/Wd	20.5/38.5/13.5	20.5/38.5/13.5
Temp. Range	−10° ~ +60°C	−10° ~ +60°C

HELICAL FILTERS



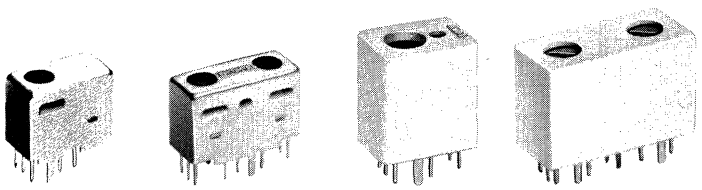
Type	7 HW	7 HT	HRW	CBT
Freq.	435 MHz - 904 MHz	904 MHz	427.5 MHz	145 MHz
Impedance	50Ω - 500Ω	50Ω - 500Ω	50Ω	50Ω - 500Ω
Ht/Lth/Wd	14.7/15.5/8	14.7/22.9/8	24/32/19	20.6/38.9/13
Temp. Range	−10° ~ +60°C	−10° ~ +60°C	−10° ~ +60°C	−10° ~ +60°C

AM MECHANICAL FILTERS



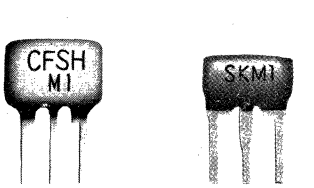
Type	CFL	CFMS
Freq.	455 KHz	455 KHz
Impedance	3 KΩ	1 KΩ ~ 2.5 KΩ
Ht/Lth/Wd	6.5/9.5/4	6.5/8.2/4
Temp. Range	−10° ~ +60°C	−10° ~ +60°C

AM CERAMIC FILTERS



Type	CFZ	CFT	CFMA	CFMQ
Freq.	455 KHz ±3.5 KHz	455 KHz ±3.5 KHz	455 ±5KHz	455 ±1.5 KHz
Impedance	200 KΩ	200 KΩ	200 KΩ	200 KΩ
Ht/Lth/Wd	12/14/7.5	12/18/7.5	14/13/10	14/21/9.5
Temp. Range	−10° ~ +60°C	−10° ~ +60°C	−10° ~ +60°C	−10° ~ +60°C

FM CERAMIC



Type	CFSK	CFSH
Freq.	10.7 MHz	10.7 MHz
Impedance	330Ω	330Ω
Ht/Lth/Wd	6/9/3.5	9/9/4
Temp. Range	−20° ~ +80°C	−20° ~ +80°C

~ Denotes: Numerous variations available between values listed.

Toko filters are available in a variety of types and sizes for use in a wide range of electronic equipment. Applications include: video cassette recorders, video disc players, radio and hi-fi equipment, cordless telephones and digital audio equipment.
We are interested in custom design for filters also. If you have trouble finding that right filter give Toko a call.

Toko America, Inc. Corporate Offices / 1250 Feehanville Drive / Mount Prospect, IL 60056 / Tel. 312-297-0070 / Telex 72-4372 / FAX 312-297-8063
California Office / 10050 N. Wolfe Rd. / SW3-361 / Cupertino, CA 95014 / Tel. 408-996-7575 / FAX 408-996-7280
New York Office / 6 Corporate Park Drive / Suite 307 / White Plains, NY 10604 / Tel. 914-694-5618 / FAX 914-694-6280

TTE® *miniature passive* FILTERS

Over 1,000,000 Standard Types

*Fast Prototype Service Available**

TTE, Inc. is a California Corporation, established in 1954 and incorporated in 1957. Housed in its facility in West Los Angeles, are the sales offices, R & D department and manufacturing operation. Since its' beginnings TTE® has designed and manufactured both Active and Passive Filters.

When using this catalog, please remember the graphs are intended as a visual aid, not as a specification. The guaranteed specification is the specification listed in the individual product tables.

TTE® has no minimum order. There are no set-up charges for standard filter types and no engineering costs are charged to TTE® customers.

The first eight pages of this listing are Passive Filters followed by the Active Filters, pages 9 through 12, the case and base dimensions for all types and the Passive Band Reject Filters are listed on page 12.

WIDE BAND FILTERS: A Bandwidth of ±20% or greater can be obtained by ordering TTE® standard Highpass and Lowpass filter sections as a composite network. Select the numbers from the Series H and J listing on pages 5-6 which give the desired attenuation slopes and combine these numbers. For example, to obtain a slope of 40dB at 0.65 of the lower frequency, Fc1, (Highpass section) and 40dB at 1.6 of the upper frequency, Fc2, (Lowpass section) use Highpass series H69 plus Lowpass series J59. The resulting Bandpass number is K6959. THE HIGHPASS SERIES NUMBER IS FIRST FOLLOWED BY THE LOWPASS SERIES NUMBER. Types with dissymmetrical attenuation can be combined.

Insertion losses for bandpass types between equal terminations are from 0.5dB to 12dB depending upon the bandwidth, frequency and size. K10 and K11 types typically have 12dB insertion loss and K12 types about 7dB flat loss. Specials are available for center frequencies from 10Hz upwards. Others are available with 60dB to 3dB bandwidth ratios of 2.0:1. Please contact us with your specification.

miniature — BANDPASS FILTERS

specify any frequency from *10Hz* to *100MHz*

Series No.	(Fc) Center Freq. Range		% Bandwidth @ −3dB	Stopband Attenuation	Source (ohms)		Load (ohms)		Case Type & Number	
	Minimum	Maximum			Minimum	Maximum	Minimum	Maximum	Chassis	PCB
K10B	500Hz	10KHz	±1%Fc		1K	500K	1K	500K	4	17
K10C	10KHz	100KHz	±1%Fc	30dB @ .92Fc & 1.1Fc &	500	10K	500	10K	3	11
K10F	100KHz	1MHz	±1%Fc	40dB @ .86Fc & 1.2Fc	500	1K	500	1K	613 (A or B)	11
K10G	1MHz	20MHz	±1%Fc		50	1K	50	1K	613 (A or B)	11
K10H	20MHz	100MHz	±1%Fc		50	75	50	75	613 (A or B)	
K11H	500Hz	10KHz	±1%Fc		1K	500K	1K	500K	4	17
K11J	10KHz	100KHz	±1%Fc	30dB @ .94Fc & 1.06Fc &	500	10K	500	10K	3	13
K11M	100KHz	1MHz	±1%Fc	40dB @ .93Fc & 1.1Fc	500	1K	500	1K	613 (A or B)	12
K11P	1MHz	20MHz	±1%Fc		50	1K	50	1K	613 (A or B)	12
K11R	20MHz	100MHz	±1%Fc		50	75	50	75	613 (A or B)	
K12D	500Hz	10KHz	±2%Fc	30dB @ .92Fc & 1.1Fc	1K	10K	1K	10K	4	17
K12H	10KHz	100KHz	±2%Fc	30dB @ .92Fc & 1.1Fc	500	10K	500	10K	3	12
K12J	100KHz	1MHz	±2%Fc	30dB @ .92Fc & 1.1Fc	500	1K	500	1K	613 (A or B)	12
K12L	1MHz	20MHz	±2%Fc	30dB @ .92Fc & 1.1Fc	50	1K	50	1K	613 (A or B)	12
K12M	20MHz	100MHz	±2%Fc		50	75	50	75	613 (A or B)	
K18A	30Hz	100Hz	±5%Fc	55dB @ .5Fc & 2Fc	1K	500K	1K	500K	5	
K18B	100Hz	300Hz	±5%Fc	60dB @ .5Fc & 2Fc	500	10K	500	10K	4	17
K18C	300Hz	3KHz	±5%Fc	40dB @ .5Fc & 2Fc	500	15K	500	15K	3	12
K18D	3KHz	10KHz	±5%Fc	50dB @ .5Fc & 2Fc	100	50K	100	50K	3	11
K18E	10KHz	100KHz	±5%Fc	60dB @ .5Fc & 2Fc	500	10K	500	10K		11
K18F	100KHz	1MHz	±5%Fc	60dB @ .5Fc & 2Fc	500	1K	500	1K	613 (A or B)	11
K18G	1MHz	20MHz	±5%Fc	50dB @ .5Fc & 2Fc	50	75	50	75	613 (A or B)	11
K18H	20MHz	100MHz	±5%Fc	50dB @ .5Fc & 2Fc	50	75	50	75	613 (A or B)	
K20E	100Hz	1KHz	±7.5%Fc	40dB @ .57Fc & 1.75Fc	500	10K	500	10K	4	17
K20F	1KHz	10KHz	±7.5%Fc	40dB @ .6Fc & 1.67Fc	500	10K	500	10K	3	13
K20G	10KHz	100KHz	±7.5%Fc	40dB @ .6Fc & 1.67Fc	500	10K	500	10K	3	11
K20L	100KHz	1 MHz	±7.5%Fc	40dB @ .6Fc & 1.67Fc	500	1K	500	1K	613 (A or B)	11
K20M	1MHz	20MHz	±7.5%Fc	40dB @ .6Fc & 1.67Fc	50	75	50	75	613 (A or B)	11
K20N	20MHz	100MHz	±7.5%Fc	40dB @ .6Fc & 1.67Fc	50	75	50	75	613 (A or B)	
Q20	1KHz	10KHz	±7.5%Fc	40dB @ .7Fc & 1.4Fc	1K	10K	1K	10K	5	14
Q22	1KHz	10KHz	±7.5%Fc	60dB @ .75Fc & 1.3Fc	1K	10K	1K	10K	6	17
Q23	10KHz	100KHz	±7.5%Fc	40dB @ .7Fc & 1.4Fc	600	10K	600	10K	4	13
Q24	10KHz	100KHz	±7.5%Fc	60dB @ .75Fc & 1.3Fc	600	10K	600	10K	5	16
Q25	100KHz	1MHz	±7.5%Fc	40dB @ .7Fc & 1.4Fc	500	1K	500	1K	613 (A or B)	12
Q26	100KHz	1MHz	±7.5%Fc	60dB @ .75Fc & 1.3Fc	500	1K	500	1K	720 (A or B)	15/22
Q27A	1MHz	20MHz	±7.5%Fc	40dB @ .7Fc & 1.4Fc	50	75	50	75	613 (A or B)	12
Q27B	20MHz	100MHz	±7.5%Fc	40dB @ .7Fc & 1.43Fc	50	75	50	75	613 (A or B)	
Q28A	1MHz	20MHz	±7.5%Fc	50dB @ .75Fc & 1.3Fc	50	75	50	75	720 (A or B)	15/22
K30E	100Hz	1KHz	±15%Fc	40dB @ .4Fc & 2.5Fc	500	10K	500	10K	4	17
K30F	1KHz	10KHz	±15%Fc	40dB @ .45Fc & 2.2Fc	500	10K	500	10K	3	13
K30G	10KHz	100KHz	±15%Fc	40dB @ .45Fc & 2.2Fc	500	10K	500	10K	3	11
K30H	100KHz	1MHz	±15%Fc	40dB @ .45Fc & 2.2Fc	500	1K	500	1K	613 (A or B)	11
K30L	1MHz	20MHz	±15%Fc	40dB @ .45Fc & 2.2Fc	50	75	50	75	613 (A or B)	11
K30B	20MHz	100MHz	±15%Fc	40dB @ .45Fc & 2.2Fc	50	75	50	75	613 (A or B)	
Q30	1KHz	10KHz	±15%Fc	30dB @ .67Fc & 1.37Fc	1K	10K	1K	10K	5	14
Q32	1KHz	10KHz	±15%Fc	50dB @ .73Fc & 1.31Fc	1K	10K	1K	10K	6	17
Q33	10KHz	100KHz	±15%Fc	30dB @ .67Fc & 1.37Fc	600	10K	600	10K	4	13
Q34	10KHz	100KHz	±15%Fc	50dB @ .73Fc & 1.31Fc	600	10K	600	10K	5	16
Q35A	100KHz	1MHz	±15%Fc	30dB @ .67Fc & 1.37Fc	500	1K	500	1K	613 (A or B)	12
Q36	100KHz	1MHz	±15%Fc	50dB @ .73Fc & 1.31Fc	500	1K	500	1K	720 (A or B)	15/22
Q37A	1MHz	20MHz	±15%Fc	30dB @ .67Fc & 1.37Fc	50	75	50	75	613 (A or B)	12
Q37B	20MHz	100MHz	±15%Fc	30dB @ .67Fc & 1.5Fc	50	75	50	75	613 (A or B)	
Q38A	1MHz	20MHz	±15%Fc	50dB @ .73Fc & 1.31Fc	50	75	50	75	720 (A or B)	15/22

Case and Mounting dimensions are listed on page 12.

*Additional charge for this service.

TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, (213) 478-8224

TTE® *subminiature passive* FILTERS

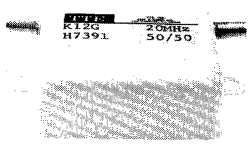
Over 1,000,000 Standard Types

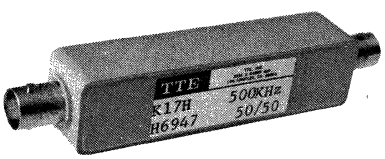
*Fast Prototype Service Available**

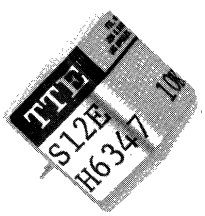
subminiature — BANDPASS FILTERS –specify any freq. from *300Hz* to *20MHz.*

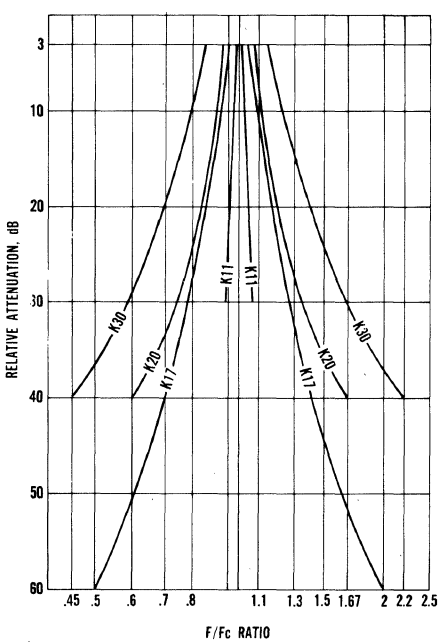
Series No.	(Fc) Center Freq. Range		% Bandwidth @ −3dB	Stopband Attenuating	Source (ohms)		Load (ohms)		Case Type & No. PCB
	Minimum	Maximum			Minimum	Maximum	Minimum	Maximum	
S10D	300Hz	1KHz	±7.5%Fc	35dB @ .55Fc & 1.8Fc	10K	10K	10K	10K	231
S11D	1KHz	5KHz	±7.5%Fc	40dB @ .55Fc & 1.8Fc	1K	10K	1K	10K	231
S12D	5KHz	50KHz	±7.5%Fc	40dB @ .58Fc & 1.75Fc	1K	10K	1K	10K	231
S12E	5KHz	50KHz	±7.5%Fc	40dB @ .58Fc & 1.75Fc	1K	1K	1K	1K	230
S13D	50KHz	1MHz	±7.5%Fc	40dB @ .58Fc & 1.75Fc	500	1K	500	1K	231
S13E	50KHz	1MHz	±7.5%Fc	40dB @ .58Fc & 1.75Fc	500	1K	500	1K	230
S14D	1MHz	20MHz	±7.5%Fc	40dB @ .58Fc & 1.75Fc	50	500	50	500	231
S20D	300Hz	1KHz	±15%Fc	40dB @ .4Fc & 2.5Fc	10K	10K	10K	10K	231
S21D	1KHz	5KHz	±15%Fc	40dB @ .4Fc & 2.5Fc	1K	10K	1K	10K	231
S21E	5KHz	50KHz	±15%Fc	40dB @ .4Fc & 2.5Fc	1K	10K	1K	10K	231
S22E	5KHz	50KHz	±15%Fc	40dB @ .4Fc & 2.5Fc	1K	10K	1K	10K	230
S23D	50KHz	1MHz	±15%Fc	40dB @ .4Fc & 2.5Fc	500	1K	500	1K	231
S23E	50KHz	1MHz	±15%Fc	40dB @ .4Fc & 2.5Fc	500	1K	500	1K	230
S24D	1MHz	20MHz	±15%Fc	40dB @ .4Fc & 2.5Fc	50	500	50	500	231

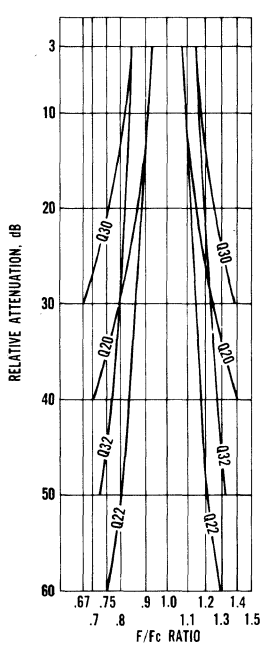
TO ORDER BANDPASS FILTERS — specify (1) TTE® series number, (2) the center frequency, (3) the source and load impedance; TO ORDER SPECIALS — also specify (4) the 3dB frequencies and (5) the stopband frequencies. The price range for the standard types listed is from $94 to $310 each in quantities of 1 to 4. PLEASE CONTACT US WITH YOUR SPECIFICATION.

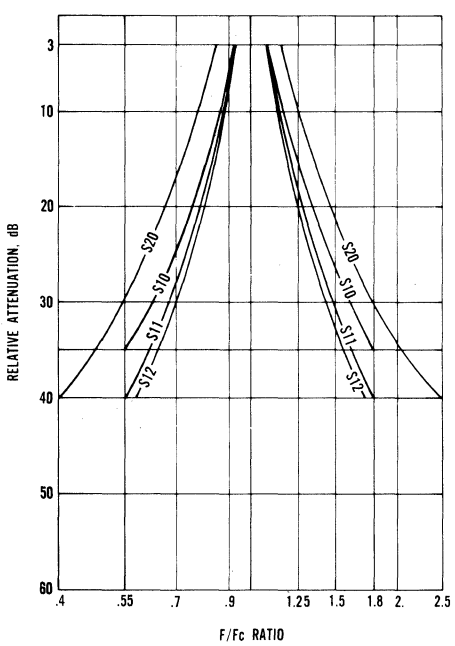












Case and Mounting dimensions are listed on page 12.

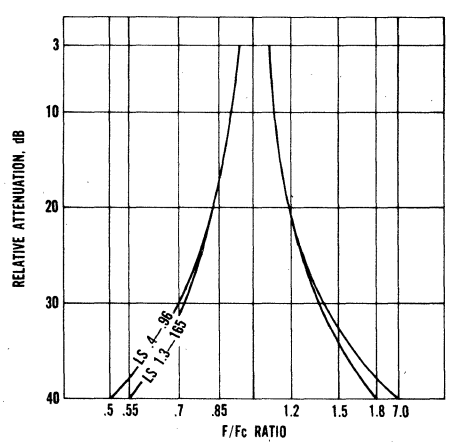
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, (213) 478-8224

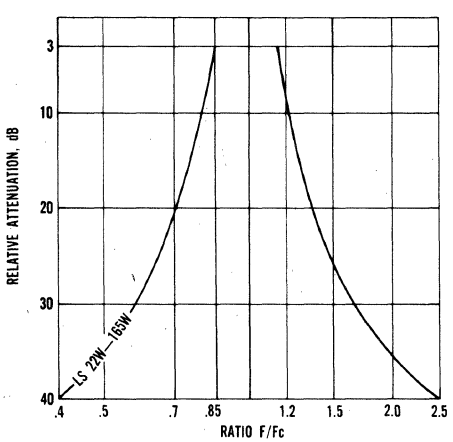
TTE® *subminiature passive* FILTERS

TELEMETERING BANDPASS FILTERS FROM * STOCK

Chan. No.	Model No.	Fc	−3dB BW	Stopband Attenuation	Source/Load (ohms)	Case No.
1	LS.4	400Hz	±7.5%	40dB @ .5Fc & 2Fc	10K/10K	231
2	LS.56	560Hz	±7.5%	40dB @ .5Fc & 2Fc	10K/10K	231
3	LS.73	730Hz	±7.5%	40dB @ .5Fc & 2Fc	10K/10K	231
4	LS.96	960Hz	±7.5%	40dB @ .5Fc & 2Fc	10K/10K	231
5	LS1.3	1300Hz	±7.5%	40dB @ .55Fc & 1.8Fc	10K/10K	231
6	LS1.7	1700Hz	±7.5%	40dB @ .55Fc & 1.8Fc	10K/10K	231
7	LS2.3	2300Hz	±7.5%	40dB @ .55Fc & 1.8Fc	10K/10K	231
8	LS3.0	3000Hz	±7.5%	40dB @ .55Fc & 1.8Fc	10K/10K	231
9	LS3.9	3900Hz	±7.5%	40dB @ .55Fc & 1.8Fc	10K/10K	231
10	LS5.4	5400Hz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
11	LS7.35	7350Hz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
12	LS10.5	10.5KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
13	LS14.5	14.5KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
14	LS22	22KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
15	LS30	30KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
16	LS40	40KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
17	LS52.5	52.5KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
18	LS70	70KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
19	LS93	93KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
20	LS124	124KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
21	LS165	165KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
A	LS22W	22KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231
B	LS30W	30KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231
C	LS40W	40KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231
D	LS52.5W	52.5KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231
E	LS70W	70KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231
F	LS93W	93KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231
G	LS124W	124KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231
H	LS165W	165KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231

TO ORDER — specify the model number and channel needed. This series is a **STOCK ITEM**, however, the stock is limited to two of each frequency and are offered on a first come first served basis. There is a limit of two of each line item per customer if stock delivery is required. If T T E® is out of stock when your order is placed, T T E® will manufacture these networks and ship them to you within 7 working days; this service is provided at no additional charge. If you require sharper slopes the series Q bandpass filter may be specified. Shipment will be in accordance with the standard delivery schedule for that series. The series Q is available for IRIG channels in PCB cases even though PCB cases are not listed in the literature for that series. Please contact T T E® for exact dimensions.





Case and Mounting dimensions are listed on page 12.

TTE® *miniature passive* FILTERS

Over 1,000,000 Standard Types

*Fast Prototype Service Available**

miniature — LOWPASS FILTERS — specify any freq. from *75Hz* to *100MHz.*

Series No.	Min. Attn. dB	Cut-Off Ratio F/Fc	Case Selection Guide: Freq. Range	Case Number: Chassis	Case Number: PCB
			10-74Hz	5	
			75-99Hz	4	
			100-199Hz	4	13
J57G	30	1.4	200-999Hz	4	12
J59G	40	1.6	1000-1999Hz	3	12
J61G	50	1.9	2000-4999Hz	3	11
J63G	60	2.2	5KHz-99.9KHz	2	11
			100KHz-20MHz	718 (A/B)	11
			20MHz-100MHz	718 (A/B)	
			10-99Hz	6	
			100-199Hz	5	17
J71G	30	1.2	200-499Hz	5	16
J73G	40	1.3	500-999Hz	5	13
J75G	50	1.4	1000-2499Hz	4	12
J77G	60	1.5	2500-4999Hz	4	11
			5KHz-99.9KHz	3	11
			100KHz-20MHz	613 (A/B)	11
			20MHz-100MHz	613 (A/B)	
			75-199Hz	6	
J81G	30	1.15	200-499Hz	5	17
J83G	40	1.20	500-999Hz	5	16
J85G	50	1.27	1000-2499Hz	4	15
J87G	60	1.35	2500-4999Hz	4	12
			5KHz-99.9KHz	3	12
			100KHz-20MHz	613 (A/B)	12
			20MHz-100MHz	613 (A/B)	
			200-999Hz	6	
J91G	30	1.10	1000-4999Hz	5	20
J93G	40	1.13	5000-9999Hz	4	20
J95G	50	1.17	10KHz-99.9KHz	4	22
J97G	60	1.20	100KHz-20MHz	720 (A/B)	22
			20MHz-100MHz	720 (A/B)	

The Lowpass Filters cataloged on this page may be specified for any frequency from 10Hz to 100MHz. Frequency range and the case selections are listed to the right of each group.

The passband ripple is 0.4dB peak to valley for most types. Exceptions include series J91 through J97. Typical passband ripple for this series is 0.6dB peak to valley. If the small PCB cases are specified for low frequency networks the passband ripple may increase to 1dB peak to valley.

Phase linearity is reasonable, phase matched sets of filters may be specified. If phase shift is critical in your application TTE® also manufactures Bessel, Gaussian and Butterworth designs. Specify from 2 to 10 poles. The frequency range offered is from 1000Hz to 100KHz.

The maximum power measured at the filter's output terminal is 20 milliwatts. Exceptions are, the Subminiature series and again the low frequency filters and particularly miniaturized low frequency types. Please remember that TTE® also offers Active Filters that are substantially smaller at low frequency and less expensive; please see pages 7 through 12.

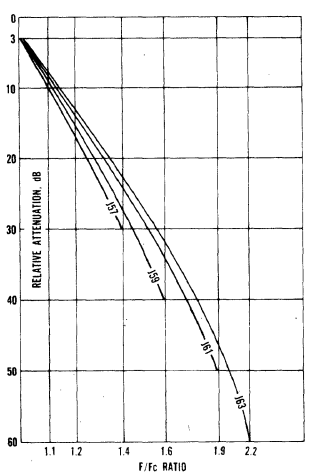
In the tables under the heading of chassis mounting cases are listed case 613, 718 and 720. These cases may be specified with either BNC or SMA connectors. Please note your choice when ordering by following the case number with B for BNC or A for SMA (i.e. 720A). The case dimensions and mounting information is listed on page 12. Please note that these networks should not be mounted near transformers or other strong magnetic fields.

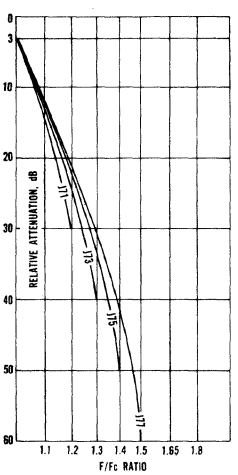
IMPEDANCE GUIDE FOR MINIATURE LOWPASS TYPES

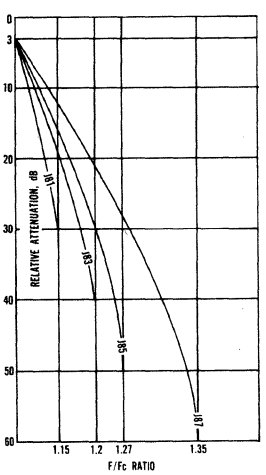
Fc −3dB		10Hz 50Hz	50Hz 100Hz	100Hz 500Hz	500Hz 5KHz	5KHz 10KHz	10KHz 100KHz	100KHz 500KHz	500KHz 1MHz	1MHz 5MHz	5MHz 20MHz
Z Min.	Ω	10K	10K	5K	1K	500	100	50	50	50	50
Z Max.	Ω	15K	39K	39K	39K	20K	3K	1K	500	300	75

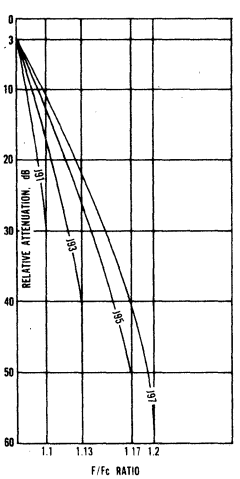
To Order: specify (1) the TTE® series number and; (2) the cut-off frequency and (3) the source and load inpedance (resistive), the impedance guide is below for your convenience. The approximate price range is $42 to $175 each in quantities of 1-4 units.

Individual response curves are plotted on the next page. These curves are intended to give the reader a fast comparison between groups. The 1dB location will move down to .7Fc at low frequency and/or low impedance levels. Again, these curves are "typical responses" not specifications.









Case and Mounting dimensions are listed on page 12.

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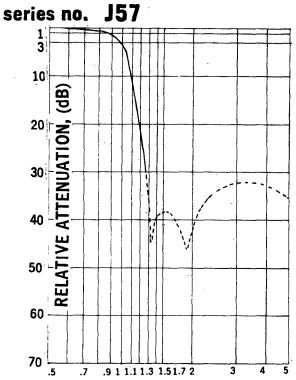
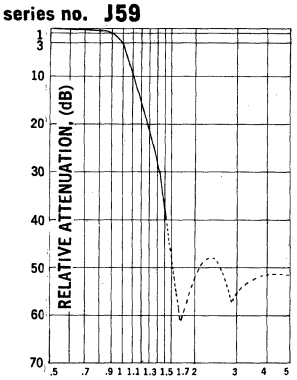
TYPICAL RESPONSE CURVES FOR "J" SERIES LOWPASS FILTERS

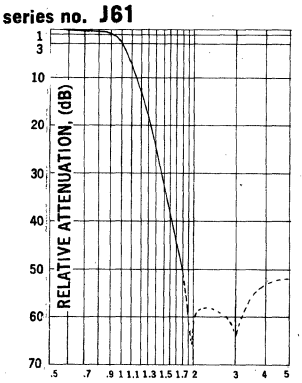
series no. **J57**



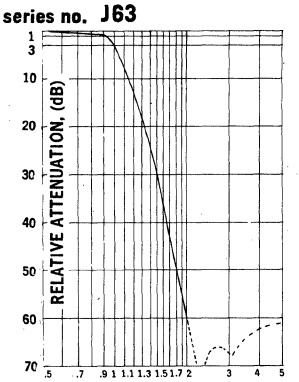
series no. **J59**



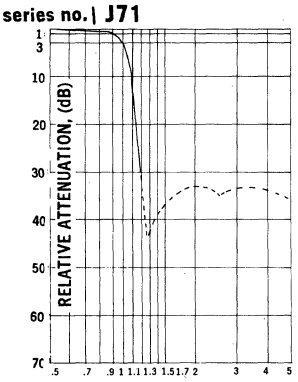
series no. **J61**



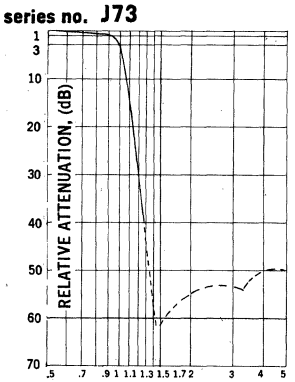
series no. **J63**



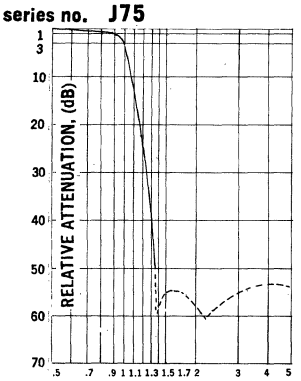
series no. **J71**



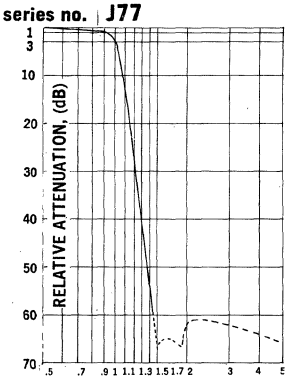
series no. **J73**



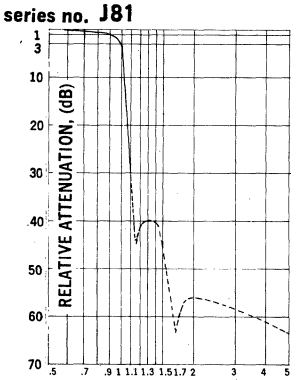
series no. **J75**



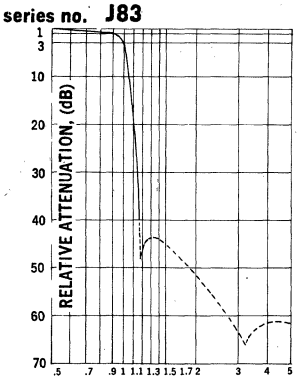
series no. **J77**



series no. **J81**



series no. **J83**



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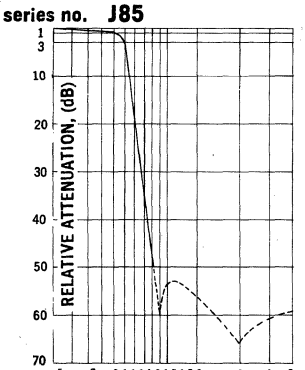
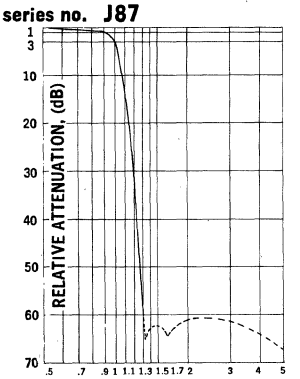
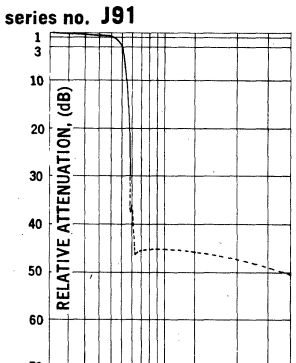


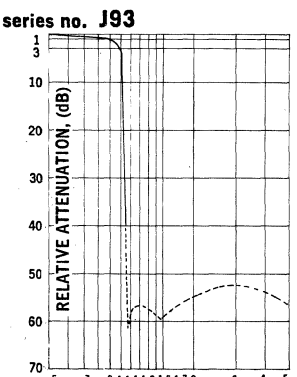
series no. **J87**



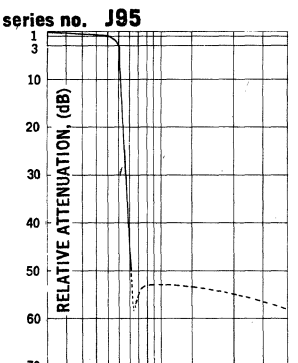
series no. **J91**



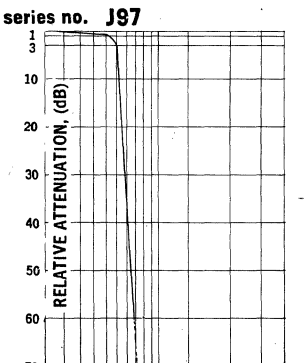
series no. **J93**



series no. **J95**



series no. **J97**



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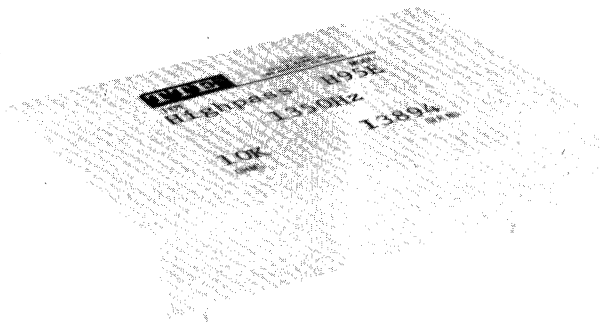
miniature – HIGHPASS FILTERS — specify any freq. from *75Hz* to *100MHz*.

Series No.	Min.Attn. dB	Cut-off Ratio F/Fc	Case Selection Guide: Frequency Range	Case Number: Chassis	Case Number: PCB
			75-99Hz	4	
H60G	30	.45	100-199Hz	3	
H62G	40	.35	200-499Hz	3	9
H64G	50	.25	500-999Hz	2	9
H66G	60	.15	1KHz-99.9KHz	2	9
			100-KHz-20MHz	718 (A/B)	
			20MHz-100MHz	718 (A/B)	
			75-99Hz	5	
H67G	30	.70	100-199Hz	4	13
H69G	40	.60	200-999Hz	4	12
H71G	50	.52	1000-1999Hz	3	12
H73G	60	.45	2000-4999Hz	3	11
			5KHz-99.9KHz	2	11
			100KHz-20MHz	718 (A/B)	11
			20Mhz-100MHz	718 (A/B)	
			75-99Hz	6	
			100-199Hz	5	17
H81G	30	.81	200-499Hz	5	16
H83G	40	.75	500-999Hz	5	13
H85G	50	.70	1000-2499Hz	4	12
H87G	60	.65	2500-4999Hz	4	11
			5KHz-99.9KHz	3	11
			100-KHz-20MHz	613 (A/B)	11
			20MHz-100MHz	613 (A/B)	
			75-99Hz	6	
			100-199Hz	5	
H91G	30	.85	200-499Hz	5	17
H93G	40	.80	500-999Hz	5	16
H95G	50	.75	1000-2499Hz	4	15
H97G	60	.70	2500-4999Hz	4	12
			5KHz-99.9KHz	3	12
			100KHz-20MHz	613 (A/B)	12
			20MHz-100MHz	613 (A/B)	

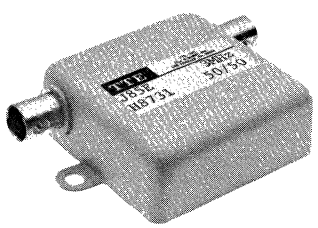


The Highpass Filters cataloged on this page may be specified for any frequency from 75Hz to 100MHz. The frequency range and the case selections are listed to the right of each group.

The passband ripple is 0.4dB peak to valley for most types. Phase linearity is reasonable, phase matched sets are available.

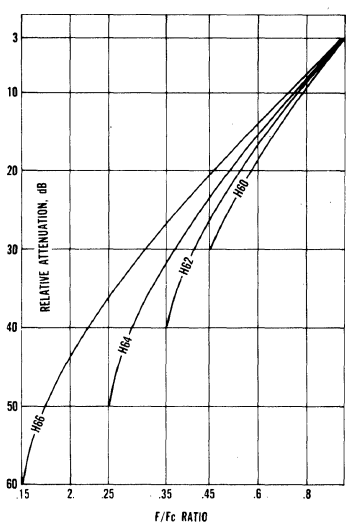
The maximum power measured at the filters output terminal is 20 milliwatts for the series H and 10 milliwatts for the series S listed on page 7.

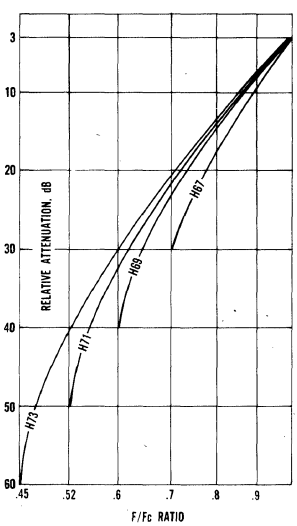
TO ORDER: specify (1) the T T E series number and; (2) the cut-off frequency and (3) the source and load impedance (resistive), the impedance guide is below for your convenience. The approximate price range is $42 to $125 each in quantities of 1-4 units.

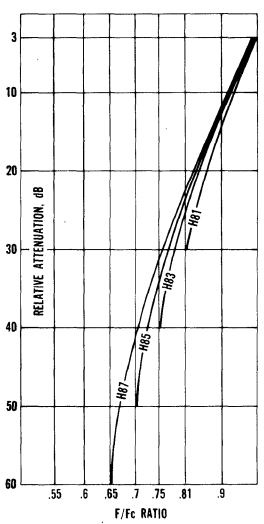


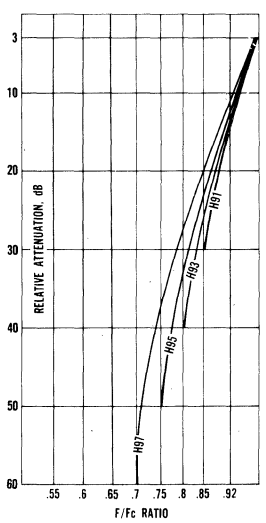
IMPEDANCE GUIDE FOR MINIATURE HIGHPASS TYPES

Fc −3dB	10Hz 50Hz	50Hz 100Hz	100Hz 500Hz	500Hz 5KHz	5KHz 10KHz	10KHz 100KHz	100KHz 500KHz	500KHz 1MHz	1MHz 5MHz	5MHz 20MHz
Z Min. Ω	10K	10K	5K	1K	500	100	50	50	50	50
Z Max. Ω	15K	39K	39K	39K	20K	3K	1K	500	300	75









Case and Mounting dimensions are listed on page 12.

*Additional charge for this service.

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subminiature — HIGHPASS

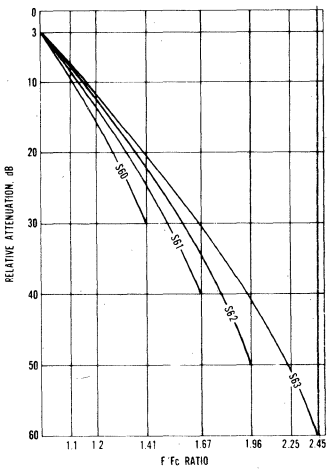
specify any frequency from *1KHz* to *20MHz*

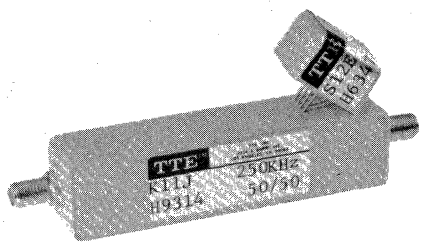
Series No.	Min. Attn. dB	Cut-Off Ratio F/Fc	Case Selection Guide: Frequency Range	Case Selection Guide: Case No. PCB
S40D	30	.70	1KHz-9.9KHz	231
S41C	40	.59	10KHz-999.9KHz	230
S42C	50	.51	1KHz-20MHz	231

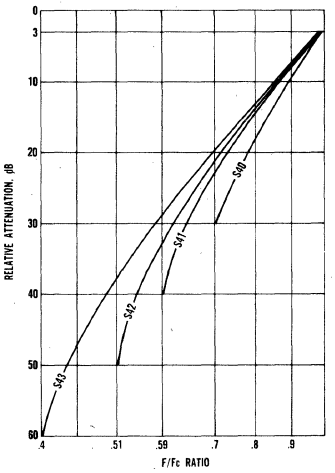
subminiature — LOWPASS

specify any frequency from *1KHz* to *20MHz*

Series No.	Min. Attn. dB	Cut-off Ratio F/Fc	Case Selection Guide: Frequency Range	Case Selection Guide: Case No. PCB
S60D	30	1.41		
S61C	40	1.67	1KHz-9.9KHz	231
S62C	50	1.96	10KHz-999KHz	230
S63C	60	2.45	1KHz-20MHz	231







IMPEDANCE GUIDE FOR SUBMINIATURE HIGHPASS AND LOWPASS TYPES

Fc −3dB		1KHz 5KHz	5KHz 20KHz	20KHz 100KHz	100KHz 500KHz	500KHz 1MHz	1MHz 10MHz	10MHz 20MHz
Z Min.	Ω	10K	1K	300	50	50	50	50
Z Max.	Ω	10K	10K	1K	1K	300	75	75

GAUSSIAN and BUTTERWORTH LOWPASS FILTERS

gaussian — LOWPASS

specify any frequency from *1KHz* to *100KHz*

Series No.	Min. Attn. (dB)	Cut-off Ratio F/Fc	Frequency Range	Case Number: Chassis	Case Number: PCB
LG 20	24	5	1KHz-9.9KHz 10KHz-100KHz	3	9 10
LG 40	34	5	1KHz-9.9KHz 10KHz-100KHz	3	*11T 11
LG 60	50	5	1KHz-9.9KHz 10KHz-100KHz	4	13 12
LG 80	58	5	1KHz-9.9KHz 10KHz-100KHz	5	16 15
LG 100	70	5	1KHz-9.9KHz 10KHz-100KHz	6	16 15

*Case 11T has the base & mounting dimensions as Case 11, however, the height is .75".

butterworth — LOWPASS

specify any frequency from *1KHz* to *100KHz*

Series No.	Min. Attn. (dB)	Cut-off Ratio F/Fc	Frequency Range	Case Number: Chassis	Case Number: PCB
LB 20	12	2	1KHz-9.9KHz 10KHz-100KHz	3	9 10
LB 40	24	2	1KHz-9.9KHz 10KHz-100KHz	3	*11T 11
LB 60	36	2	1KHz-9.9KHz 10KHz-100KHz	4	13 12
LB 80	48	2	1KHz-9.9KHz 10KHz-100KHz	5	16 15
LB 100	60	2	1KHz-9.9KHz 10KHz-100KHz	6	16 15

IMPEDANCE GUIDE FOR GUASSIAN and BUTTERWORTH LOWPASS FILTERS

Fc-3dB	1KHz to 9.9KHz	10KHz to 49KHz	50KHz to 100KHz
Z min Ω	1K	500	250
Z max Ω	10K	10K	1K

GAUSSIAN LOWPASS FILTERS are frequently specified by designers of pulse communication systems. This design features low ringing or overshoot. If the designer requires sharper cut-off ratios and can tolerate greater ringing or overshoot, the **BUTTERWORTH LOWPASS FILTER** should be considered. This design, like the Gaussian, features passbands and stopbands that contain no ripple.

TO ORDER: specify (1) the **T T E®** series number, (2) the cut-off frequency (Fc), (3) the source and load impedance (resistive) and (4) the case number. Prices range from $39.00 to $152.00 each in quantities 1-4; there is a set-up charge for these series of lowpass filters.

Case and mounting dimensions are listed on page 12.

T T E, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, (213) 478-8224

TTE® *digitally programmable* FILTERS

digitally CONTROLLED CUT-OFF FREQUENCIES USING 3 BINIARY CODED SIGNALS.

- 128:1 TUNING RANGE IN EACH FREQUENCY BAND.
- 4 FREQUENCY BANDS UP TO128KHz.
- TTL COMPATIBLE.
- PRINTED CIRCUIT BOARD MOUNTING.

LOWPASS FILTERS

Model No.	Min. Attn (dB)	Cut-Off Ratio (F/Fc)	Tuning Range (Hz)
PALF 51	40	3	1 to 128
PALF 53	40	3	10 to 1280
PALF 55	40	3	100 to 12.8K
PALF 57	40	3	1000 to 128K

HIGHPASS FILTERS

Model No.	Min. Attn (dB)	Cut-Off Ratio (F/Fc)	Tuning Range (Hz)
PAHF 52	40	.33	1 to 128
PAHF 54	40	.33	10 to 1280
PAHF 56	40	.33	100 to 12.8K
PAHF 58	40	.33	1000 to 128K

General Specifications		Options
Gain (non-inverting):	unity ±.2dB	(01) Phase Matching Network
Input offset voltage:	5mV	(02) Latching For Pulse Application
Input bias current:	200pA	(03) Brake Before Make Switching
Input Impedance:	$10^{12}\ \Omega$	
Input AC signal:	±7.5V max.	
Output impedance:	1 Ω	
Noise (DC to 128KHz):	25 UV RMS	
Supply current:	7.2 mA	
Supply voltage:	±5V min. ±7.5 max.	
Switch on time (V_s=±5V):	85nS typ. 200nS max.	
Switch off time (V_s=±5V):	170nS typ. 400nS max.	
Switch on time (V_s=±7.5V):	70nS typ. 130nS max.	
Switch off time (V_s=±7.5V):	140nS typ. 260nS max.	

To order specify (1) Model Number, (2) Frequency Range and (3) Any Options desired.

TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, (213) 478-8224

TTE® *miniature active* FILTERS

Over 1,000,000 Standard Types

*Fast Prototype Service Available**

miniature — ACTIVE BUTTERWORTH BANDPASS FILTERS

any freq. from *10Hz* to *200KHz* may be specified

Series No.	%BW @ −3dB	Stopband Attenuation	Supply Current Maximum	Case No.
ABB20	±0.5%	30dB @ .8 & 1.25Fc	5.6mA	810
ABB40	±0.5%	40dB @ .9 & 1.11Fc	8.4mA	812
ABB60	±0.5%	60dB @ .7 & 1.40Fc	11.2mA	815
ABB22	±1.0%	30dB @ .7 & 1.40Fc	5.6mA	810
ABB42	±1.0%	40dB @ .8 & 1.22Fc	8.4mA	812
ABB62	±1.0%	50dB @ .8 & 1.20Fc	11.2mA	815
ABB24	±2.0%	30dB @ .5 & 2.00Fc	5.6mA	810
ABB44	±2.0%	40dB @ .74 & 1.35Fc	8.4mA	812
ABB64	±2.0%	60dB @ .66 & 1.50Fc	11.2mA	815
ABB26	±5.0%	30dB @ .25 & 4.0Fc	5.6mA	810
ABB46	±5.0%	30dB @ .4 & 2.5Fc	8.4mA	812
ABB66	±5.0%	50dB @ .3 & 3.3Fc	11.2mA	815

Active Filters are desirable at low frequencies as they are lighter and smaller than Passive Filters; impedance matching is not required and gains at the ouput may be specified.

This section of the catalog contains specifications and descriptions of T T E's Active Filter line. Individual product data pages will be available soon, please contact us with your specification.

When using this section of the catalog, please remember the graphs are visual aids, not specifications. The guaranteed specifications are (1) the attenuation of the passband edge (Fc) is — 3dB ± 0.5dB and (2) that the stopband attenuation listed in the catalog is the minimum attenuation that each filer type will develop.

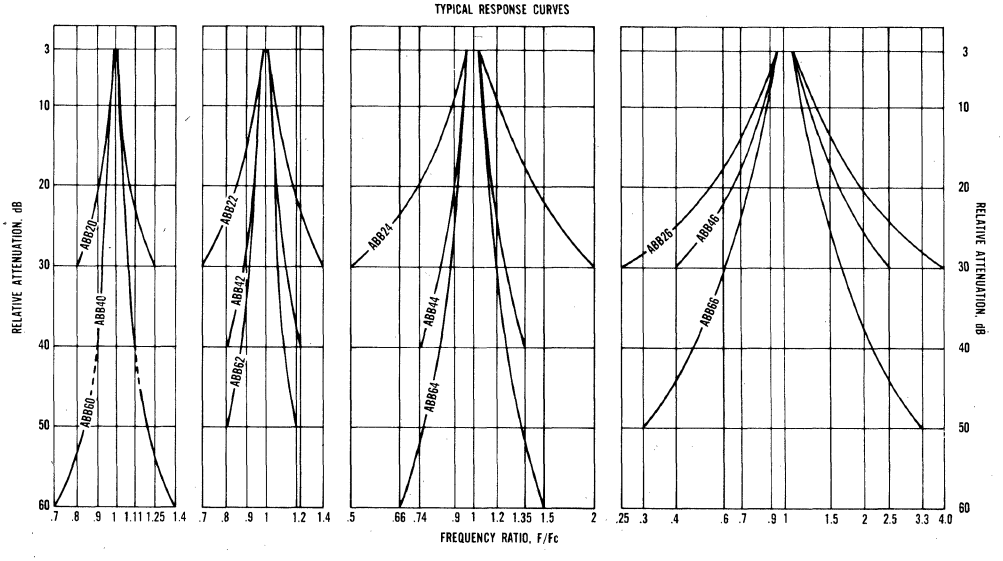
Now the designer is able to specify either Active or Passive Filters from one supplier, this saves time for both the designer and the purchasing agent. At T T E there is NO MINIMUM ORDER, and NO ENGINEERING CHARGE for any standard series filter.

GENERAL SPECIFICATIONS

Parameter	Voltage Supply		Units
	TYP	MAX	
Supply Voltage	±5	± 18	VDC
Input Offset Voltage (10Kr at 25 C)	2	5	mV
Input Offset Current (± 15V @ 25°C)	5	50	mA
Gain (Non-Inverting)	Unity ±0.2		dB
Operating Temperature	0 to + 70 C		
Storage Temperature	−30 to +120 C		

TO ORDER: (1) specify the T T E series number and (2) specify the center frequency and (3) specify option D or S. The prices range from $87 to $155 each in prototype quantities. Specials are available at standard prices. Please contact us with your specification.

TYPICAL RESPONSE CURVES



Case and Mounting dimensions are listed on page 12.

TTE® *miniature active* FILTERS

Over 1,000,000 Standard Types

*Fast Prototype Service Available**

miniature – ACTIVE BUTTERWORTH LOWPASS FILTERS

any frequency from *10Hz* to *200KHz* may be specified

Series No.	Minimum Attenuation (dB)	Cut-off Ratio F/Fc	Supply Current Maximum	Case No.
ALB20	12	2	5.6mA	810
ALB40	24	2	5.6mA	810
ALB60	36	2	8.4mA	811
ALB80	48	2	8.4mA	812
ALB100	60	2	11.2mA	815

miniature – ACTIVE BUTTERWORTH HIGHPASS FILTERS

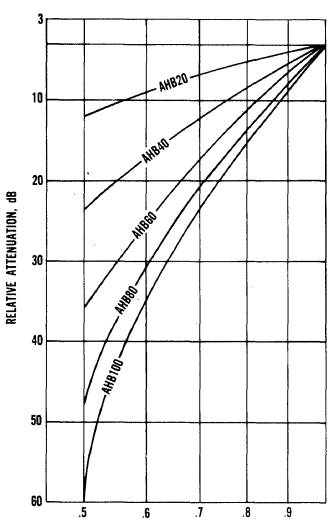
any frequency from *10Hz* to *200KHz* may be specified

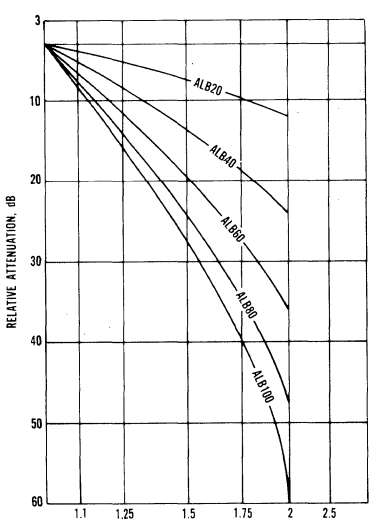
Series No.	Minimum Attenuation (dB)	Cut-off Ratio F/Fc	Supply Current Maximum	Case No.
AHB20	12	.50	5.6mA	810
AHB40	24	.50	5.6mA	810
AHB60	36	.50	8.4mA	811
AHB80	48	.50	8.4mA	812
AHB100	60	.50	11.2mA	815

TO ORDER: specify (1) the T T E series number and (2) the minus 3dB frequency. These filters range in price from $57 to $140 each in prototype quantities.
SPECIALS: other types of both Active and Passive Filters are available. Please contact us with your specification.

GENERAL SPECIFICATIONS

Parameter	Voltage Supply TYP	Voltage Supply MAX	Units
Supply Voltage	±5	± 18	VDC
Input Offset Voltage (10Kr at 25°C)	2	5	mV
Input Offset Current (± 15V @ 25°C)	5	50	mA
Gain (Non-Inverting)	Unity ±0.2		dB
Operating Temperature	0 to + 70°C		
Storage Temperature	−30 to +120°C		





Case and Mounting dimensions are listed on page 12.

TTE® *miniature active* FILTERS

Over 1,000,000 Standard Types

*Fast Prototype Service Available**

miniature – ACTIVE CHEBYSHEV LOWPASS FILTERS

any frequency from *10Hz* to *200KHz* may be specified

Series No.	Minimum Attenuation (dB)	Cut-off Ratio F/Fc	Supply Current Maximum	Case No.
ALC20	20	3.2	5.6mA	810
ALC40	40	2.4	5.6mA	810
ALC60	40	1.75	8.4mA	811
ALC80	50	1.65	8.4mA	812
ALC100	60	1.6	11.2mA	815

miniature – ACTIVE CHEBYSHEV HIGHPASS FILTERS

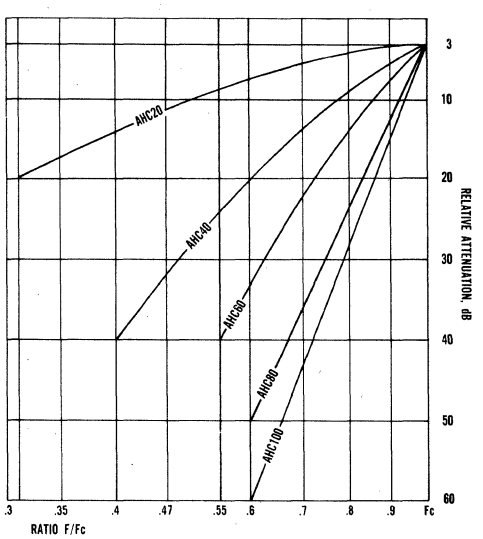
any frequency from *10Hz* to *200KHz* may be specified

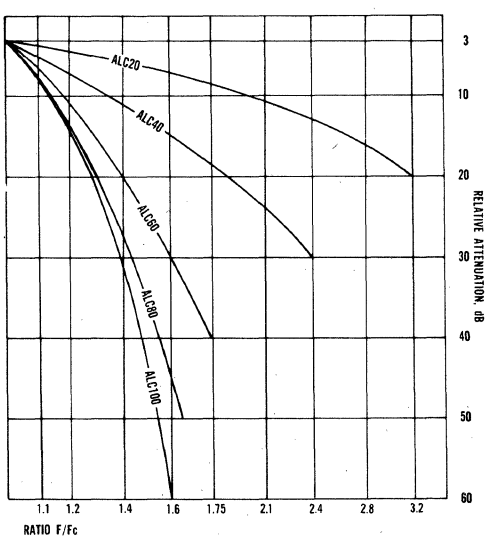
Series No.	Minimum Attenuation (dB)	Cut-off Ratio F/Fc	Supply Current Maximum	Case No.
AHC20	20	.31	5.6mA	810
AHC40	40	.41	5.6mA	810
AHC60	40	.55	8.4mA	811
AHC80	50	.60	8.4mA	812
AHC100	60	.60	11.2mA	815

TO ORDER: specify (1) the TTE series number and (2) the minus 3dB frequency. These filters range in price from $57 to $140 each prototype quantities of 1-4. **SPECIALS:** other types of both Active and Passive Filters are available. Please contact us with your specification.

GENERAL SPECIFICATIONS

Parameter	Dual Voltage Supply *Option D		Units
	TYP	MAX	
Supply Voltage	±5	± 18	VDC
Input Offset Voltage (10Kr at 25 C)	2	5	mV
Input Offset Current (± 15V @ 25°C)	5	50	mA
Gain (Non-Inverting)	Unity ±0.2		dB
Operating Temperature	0 to + 70 C		
Storage Temperature	−30 to +120 C		





Case and Mounting dimensions are listed on page 12.

*Additional charge for this service.

TTE® *miniature* FILTERS

Over 1,000,000 Standard Types

*Fast Prototype Service Available**

miniature – PASSIVE BAND REJECTION FILTERS

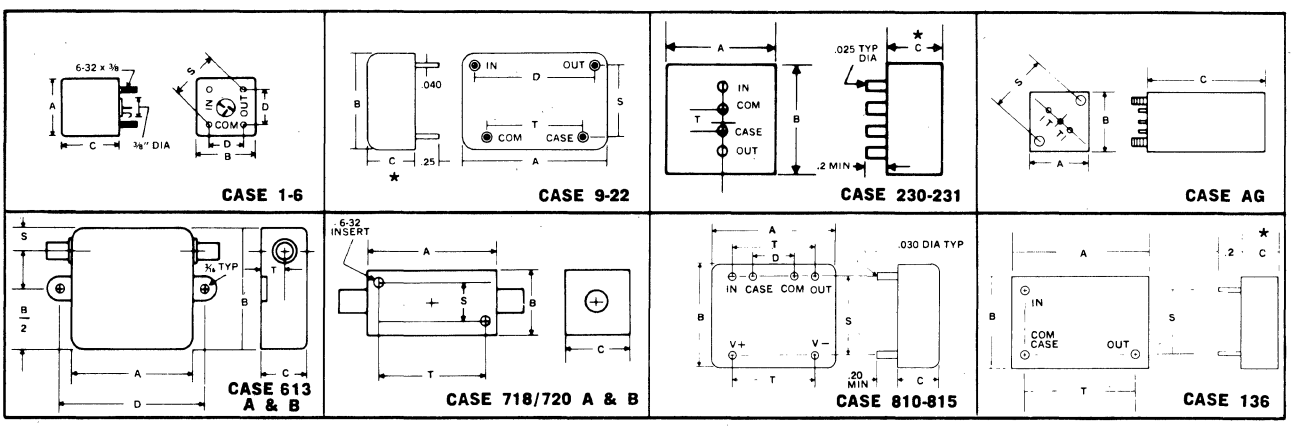
Series No.	(Fc) Center Frequency Range		Bandwidth @ −3dB	Attenuation @ Fc	Impedance (ohms)		Case Type/No.	
	Minimum	Maximum			Minimum	Maximum	Chassis	PCB
B83B	25Hz	100Hz	.6Fc & 1.4Fc	40dB	600	50K	4	
B83C	100Hz	1KHz	.77Fc & 1.3Fc	50dB	50	50K	4	
B83D	1KHz	100KHz	.77Fc & 1.3Fc	50dB	50	50K	3	14
B83E	100KHz	1MHz	.77Fc & 1.3Fc	50dB	50	50K		13/18
D	10Hz	100KHz	.25Fc & 4Fc	50dB	50	50K	2	11

miniature – ACTIVE BAND REJECTION FILTERS

Series No.	(Fc) Center Frequency Range		Bandwidth @ −3dB	Stopband Attenuation	Supply Current Maximum	Case No.	General Specifications
	Minimum	Maximum					
AN20	10Hz	10KHz	±2.5%Fc	−40dB min. @ Fc	5.6mA	811	Please see page 9 for these specifications
AN10	10Hz	10KHz	±5%Fc	−40dB min. @ Fc	5.6mA	811	
AN05	10Hz	10KHz	±10%Fc	−40dB min. @ Fc	5.6mA	811	

TO ORDER: specify (1) TTE series number, (2) the notch frequency; and for Passive Filters also specify (3) the source and load impedance and case selection if available. Prices range from $22 to $95 each in prototype quantities.

CASE DIMENSIONS AND MOUNTING INFORMATION



* The tolerance for dimension c is ±0.050

	Chassis Cases						PCB Cases									
Dim.	**AG**	**2**	**3**	**4**	**5**	**6**	**9**	**10**	**11**	**12**	**13**	**15**	**16**	**17**	**18**	**19**
A	1.0	1.19	1.31	1.63	1.81	2.06	1.27	1.27	1.88	2.0	2.0	2.96	2.96	2.96	3.0	3.0
B	1.0	1.19	1.31	1.63	1.94	2.31	1.27	1.27	1.44	2.0	2.0	1.93	1.93	1.93	.75	.75
C	1.38	1.25	1.75	2.38	2.44	3.13	1.0	.5	.5	.5	.75	.5	.75	1.25	.75	.5
D	—	.75	—	1.19	1.38/ 1.25	1.69/ 1.44	.9	.9	1.5	1.5	1.5	2.4	2.4	2.4	2.4	2.4
S	.75	—	1.25	—	—	—	.9	.9	1.0	1.5	1.5	1.4	1.4	1.4	.4	.4
T	.22	—	—	—	—	—	.6	.6	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0
Mtg.	2-4-40 X3/8	(4)	(2)	(4)	(4)	(4)	Printed Circuit Board Mounting									
		6-32 x 3/8 studs														

	PCB Cases										VHF-UHF Connectors					
Dim.	**20**	**22**	**136**	**229**	**230**	**231**	**810**	**811**	**812**	**815**	**613A**	**613B**	**718A**	**718B**	**720A**	**720B**
A	5.03	5.03	1.6	.75	.75	1.19	1.27	1.88	2.0	2.96	2.0	2.0	3.0	3.0	5.03	5.03
B	1.42	1.42	1.0	.75	.75	1.19	1.27	1.44	2.0	1.93	2.0	2.0	.75	.75	1.42	1.42
C	.75	.5	.5	.75	.5	.5	.5	.5	.5	.5	.75	.75	.75	.75	.75	.75
D	4.0	4.0	—	—	—	—	.6	.75	.8	1.0	2.38	2.38	—	—	—	—
S	1.0	1.0	.65	—	—	—	.9	1.0	1.5	1.4	.38	.38	.40	.40	1.0	1.0
T	3.0	3.0	1.3	.1	.1	.2	.9	1.5	1.5	2.4	.38 (SMA)	.38 (BNC)	2.0 (SMA)	2.0 (BNC)	4.0 (SMA)	4.0 (BNC)
Mtg.	Printed Circuit Board Mtg.										6-32 Inserts		2	2	4	4

TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, (213) 478-8224

TUSONIX SLC™*

Ceramic Capacitors—EMI Filters

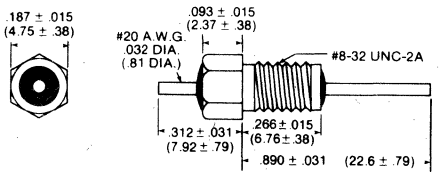
Dimension tolerance ±.015" unless otherwise specified. inches / mm | inches/mm

Bushing Mount

SPECIFICATIONS								
TUSONIX Part Number	Min. Cap. pF	Working Voltage (WVdc) 85°C	125°C	Current Idc	Minimum No Load Insertion Loss (dB) at 25° per Mil-Std-220 10 MHz	100 MHz	1 GHz	10 GHz
4201-000	1500	200	100	10	5	45	65	60
4201-050	5500	200	100	10	14	55	70	70
4201-001	1500	200	100	10	5	45	65	60
4201-051	5500	200	100	10	14	55	70	70
4202-000 **4202-020** (12-28 UNEF) **4202-001** **4202-021** (12-28 UNEF)	1500	350	200	10	5	45	70	70

SPECIFICATIONS								
TUSONIX Part Number	Min. Cap. pF	Working Voltage (WVdc) 85°C	125°C	Current Idc	Minimum No Load Insertion Loss (dB) at 25° per Mil-Std-220 10 MHz	100 MHz	1 GHz	10 GHz
4202-050 **4202-051**	5000	200	100	10	20	65	70	70
4203-000 **4203-001**	1500	350	200	10	5	45	70	70
4203-050 **4203-051**	5000	200	100	10	20	65	70	70

4201-000 4201-050



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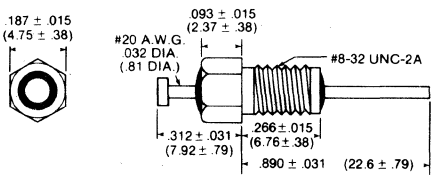

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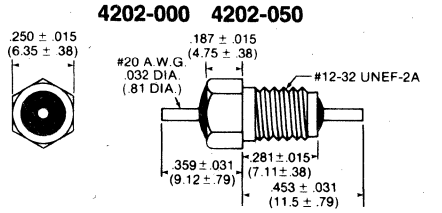

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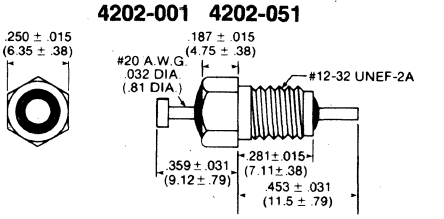

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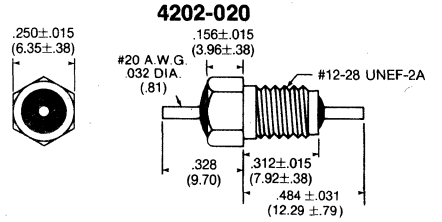

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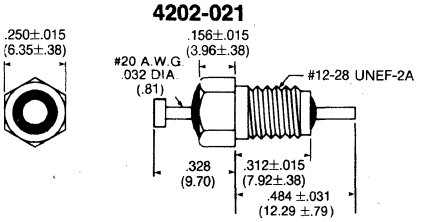

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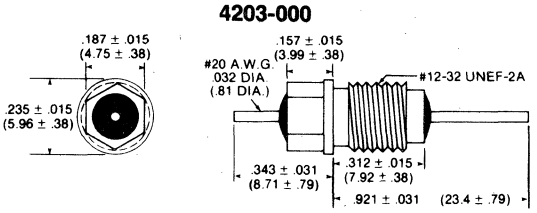

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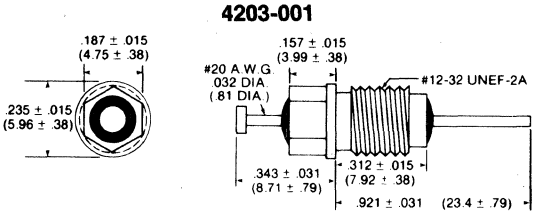

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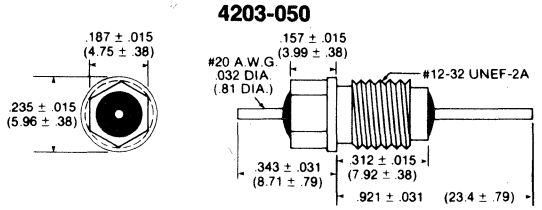

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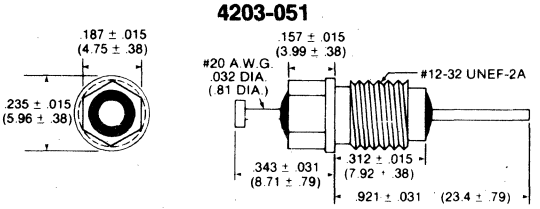


*SLC stands for Single-layer Ceramic Technology

NOTE: Bushing mount filters include nut and (internal tooth or split ring) washer.

TUSONIX SLC™*

Ceramic Capacitors—EMI Filters

TUSONIX ceramic filters are chosen to suppress undesired EMI in those applications where space is limited and small size is critical.

Popular applications include telecommunications, CATV, telemetry, radar, and other transmission equipment.

IMPORTANT:

Techniques for Solder connections to eyelet type filters

A. A 60/40 type solder preform is recommended.
B. Preheat filters and mounting assembly to 250°F.
C. Complete the solder joint by adding heat to the assembly, adjacent to the filter.
D. Allow assemblies to cool slowly.

Mounting torques for bushing type filters

12-32 UNEF - 6-8 lb. ins.
8-32 UNC - 3-5 lb. ins.

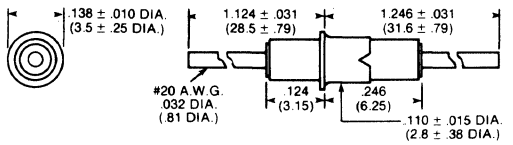
Techniques for solder connections to filter leads

A. Maximum solder temperatures should not exceed 450°F.
B. Whenever practical, employ a heat sink between soldering point and filter body.
C. Refrain from bending or twisting lead.

Solder Mount

SPECIFICATIONS									SPECIFICATIONS								
TUSONIX Part Number	Min. Cap. pF	Working Voltage (WVdc) 85°C	125°C	Current Idc	Minimum No Load Insertion Loss (dB) at 25° per Mil-Std-220 10 MHz	100 MHz	1 GHz	10 GHz	TUSONIX Part Number	Min. Cap. pF	Working Voltage (WVdc) 85°C	125°C	Current Idc	Minimum No Load Insertion Loss (dB) at 25° per Mil-Std-220 10 MHz	100 MHz	1 GHz	10 GHz
4100-000	1500	250	125	10	6	45	60	60	**4101-001**	1500	350	200	10	5	45	70	70
4100-002	1500	350	200	15	5	25	60	60	**4101-002**	1750	250	125	10	5	50	60	60
4101-000	1750	250	125	10	5	35	50	50	**4102-000**	3000	350	200	10	8	55	65	65

4100-000



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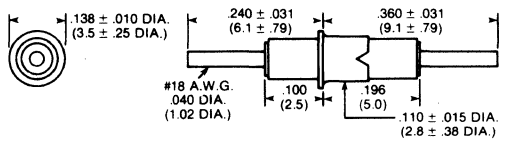

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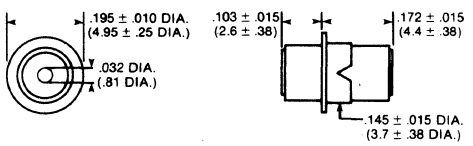

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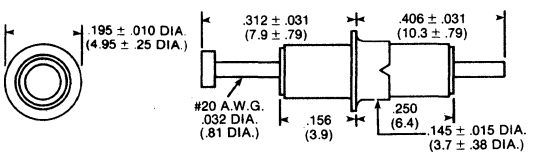

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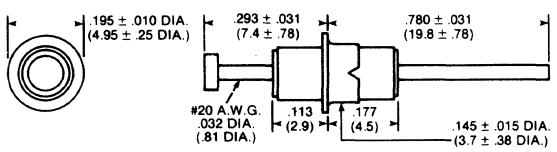

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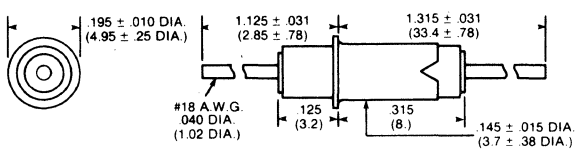


*SLC stands for Single-layer Ceramic Capacitors

*SLC stands for Single-layer Ceramic Technology

TUSONIX

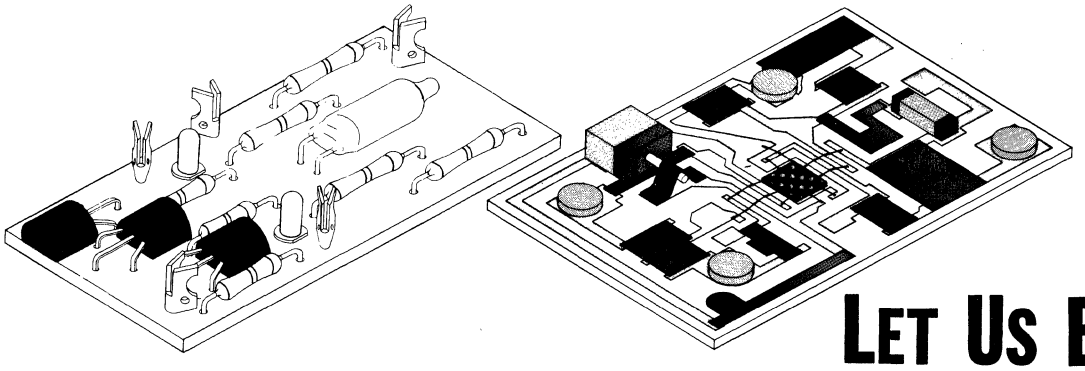
For complete ordering information, write or call
TUSONIX, Inc., P.O. Box 37144, Tucson,
Arizona 85740-7144, (602) 744-0400, TX 299-640 (RCA)

GLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 85/86 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1166, **B**•1012, **C**•1028, **D**•1016
ASCII Code ..... **D**•1087
Batteries, Product Selection Guide ..... **D**•1413
Batteries & Fuel Cells, Characteristics ..... **D**•1430
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide ..... **A**•1003
Circuit Boards (Printed) Product Selection Guide ..... **C**•1099
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1205
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1863
Connectors, Miniglossary ..... **C**•1129
Connectors, Terminals, & Sockets, Product Selection Guide ..... **C**•1105
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Gude ..... **A**•1309
Delay Lines, Product Selection Guide ..... **A**•1459
Discrete Semiconductors, Product Selection Guide ..... **A**•2067
Displays, Readouts, Lamps, & Lights, Product Selection Guide ..... **B**•1015
EBCDIC Code ..... **D**•1092
Encapsulation, Miniglossary ..... **C**•1086
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide .. **C**•1623
Filters, Product Selection Guide ..... **A**•1583
Instruments, Graphic Recording Product Selection Guide ..... **D**•1401
Instruments, Panel Meters, Product Selection Guide ..... **D**•1329
Instruments, Test & Measuring Product Selection Guide ..... **D**•1175
Interconnection Systems, Product Selection Guide ..... **C**•1699
Keyboards & Keypads, Product Selection Guide ..... **B**•1705
Logofinder & Trademark Directories ..... **B**•901
Microwave Components, Product Selection Guide ..... **A**•1701
Military Qualified Products Lists ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1129
Opto Semiconductors, Miniglossary ..... **B**•1214
Oscilloscopes, Product Selection Guide ..... **D**•1385
Panel Hardware, Product Selection Guide ..... **C**•1589
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide ..... **A**•1991
Power Supplies, Miniglossary ..... **D**•1462
Power Supplies, AC, Product Selection Guide ..... **D**•1877
Power Supplies, DC, Product Selection Guide ..... **D**•1447
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide .... **B**•1225
Relay Contact Forms ..... **B**•1317
Relays, Electromechanical, Miniglossary ..... **B**•1308
Relays, Product Selection Guide ..... **B**•1261
Resistor Color Codes ..... **A**•1828
Resistors, Product Selection Guide ..... **A**•1785
Servo Components, Miniglossary ..... **D**•1985
Solenoids, Product Selection Guide ..... **B**•1463
Switches, Product Selection Guide ..... **B**•1477
Thermal Components, Product Selection Guide ..... **B**•1741
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1744
Thyristors/High Power Diodes, Miniglossary ..... **A**•2076
Transducers & Encoders, Product Selection Guide ..... **B**•1777
Transformers, Product Selection Guide ..... **A**•2099
Wire & Cable, Product Selection Guide ..... **C**•1743
Wire Gauges—Diameter, Area, Copper Weight ..... **C**•1844



LET US BE YOUR MANUFACTURING FACILITY

Do You Need Help To Get The End Product You Want?

After you have your design to meet your circuit performance requirements, ACC's Engineering Staff can assist you to package your circuit. We have a complete staff of electrical, mechanical, industrial, and chemical engineers to develop the most cost-effective assembly to compliment your product.

Custom Thick Film Hybrid?

If space is a problem, thick film hybrids are the answer to reduced manufacturing cost and component inventories. ACC can design and deliver a custom thick film hybrid to meet your performance, space, and cost requirements. For less stringent space requirements, formed discrete components or SOT packages are quite adequate. If space is tight or you have your own custom chip, a chip and wire hybrid may be the best approach.

The results to you are smaller size, improved reliability, and in most cases, better circuit performance due to the fact that thick film allows you to choose the exact resistor values and tolerances you want.

We have the capability to build your product to any stage of completion you desire. From a thick film print, fire, and trim, only, to a finished encased product, or any stage in between, by using custom thick film hybrids or printed circuit assemblies.

We will work with you during your development stage. We possess the capability to deliver into the millions, if necessary.

Automotive Controls Corporation (ACC) has over 200,000 square feet of production space. This facility, located in Southeast Kansas is staffed with a quality-conscious, dependable, rural and small-town work force. Our employees, to whom we owe our success, will build your product.

Printed Circuit Assembly?

If space is not a problem, then an automatically inserted printed circuit assembly is the most cost effective approach. ACC's printed circuit assembly area is equipped to insert components and wave solder boards up to 16 inches wide. Water washing is standard. Chlorinated cleaning solvents are available. The ACC facility is equipped and the personnel are trained to handle electrostatic sensitive components at all stages of production.

Packaging Support

In support of the electronic assembly, ACC can offer single-sided printed circuit boards, coil winding, transfer and injection molding, potting, metal and lead frame stampings, metal plating, and painting, if required.

Total Design Capability through manufacture, test and delivery

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AN ECHLIN COMPANY

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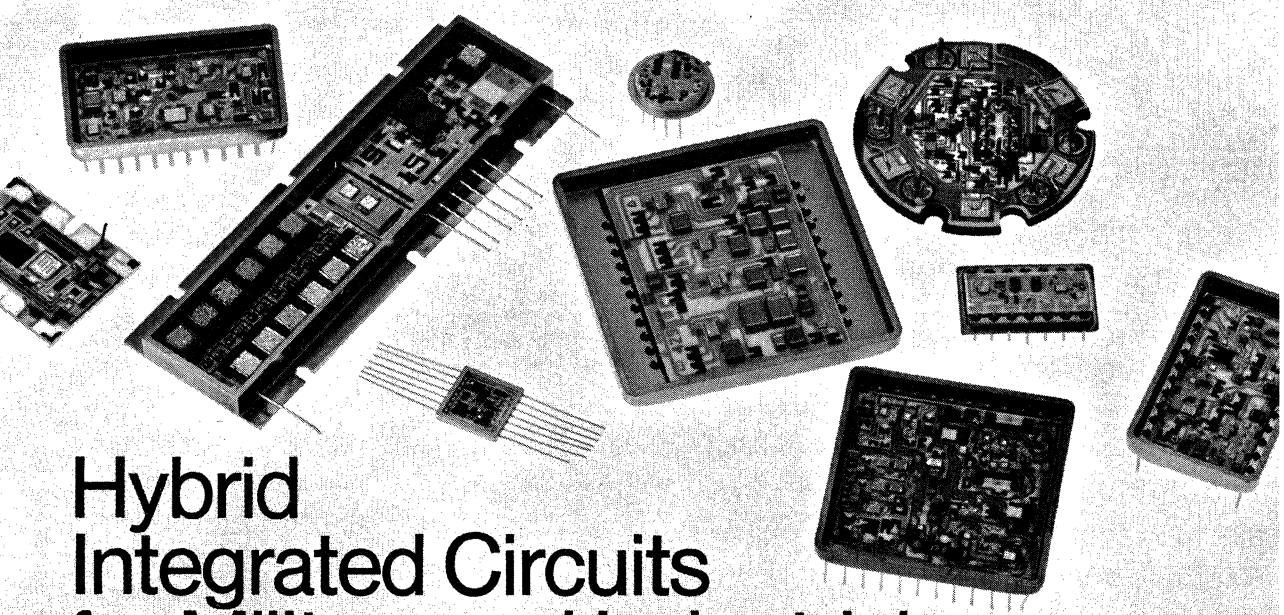

Hybrid Integrated Circuits for Military and Industrial Applications

Aeroflex designs, develops and manufactures custom hybrids for both military and industrial customers. We are qualified for use on B1, B52, F15, F16 and LAMPS MK III, plus numerous other ground and airborne systems and medical and communications equipment.

Will a custom hybrid do your job? Hybrid technology combines the quick-response design and manufacturing economies of the printed circuit assembly with the reliability and small size of the monolithic IC. To help you determine when the method will be cost effective, Aeroflex's experienced engineers will consider the circuit itself, manufacturing lead time, and the quantities involved.

Once the decision has been made, Aeroflex has the technical and manufacturing support to meet your most exacting requirements. Our circuit designers will put your parameters together into the smallest, lightest package consistent with effective performance.

We excel in designing active filters, sample and hold networks, low noise pre-amps, voltage regulators, drivers and receivers and digital interface circuits to meet MIL-STD-1553. Electrical performance is guaranteed by our automatic test systems.

In our complete manufacturing facility, Aeroflex has the skilled personnel and production equipment to meet every hybrid design and manufacturing requirement. For most designs, we use thick film deposition for its great flexibility. On occasion, however, we will utilize thin film chip components in conjunction with thick film resistors and conductors. Gold conductors and various silver alloys are often employed, as well as a variety of resistor inks to cover the full range of resistor values. We have and use both laser, for active trimming, and airbrasive trimming systems.

Packaging for all environments. Aeroflex commercial hybrids are often epoxy sealed in ceramic for industrial applications. Heavy duty packaging options include welded hermetically sealed all-metal cases including flat packs, dips, plug-ins and "TO" cans for military requirements.

Product Assurance, in and out. Our Product Assurance Department meets the requirements of MIL-Q-9858A. Quality Assurance, Quality Control, Qualification Testing and Equipment Calibration are its responsibilities. Incoming inspection is performed on semiconductors in accordance with MIL-STD-883, Method 2010.1 Level B. Similar criteria are applied to hybrid inspection. Screening and qualification testing to MIL-STD-883B, Method 5008 and MIL-M-38510 are also available.

Microelectronics Division

AEROFLEX LABORATORIES INC.

35 South Service Road
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Tel. 516-694-6700 TWX 510-224-6417

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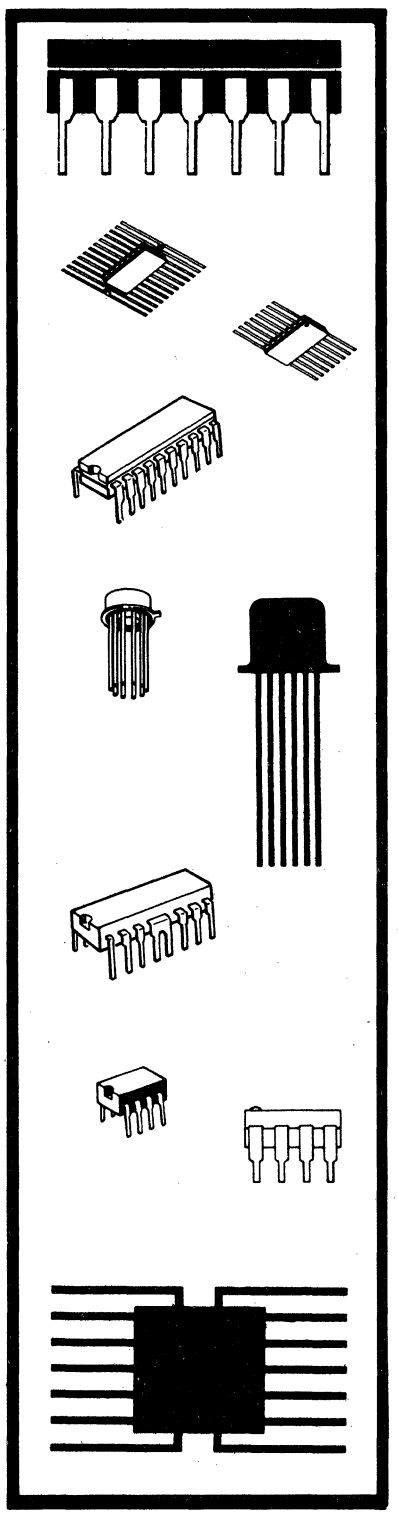

7400 SERIES TTL FAMILIES

7400	74C00	74HC00	74LS00
74ALS00	74H00	74L00	74S00

C/MOS

4000	4024	4051	4098	4538
4001	4025	4052	4502	4541
4002	4026	4053	4503	4543
4006	4027	4056	4506	4556
4007	4028	4059	4507	4562
4009	4029	4060	4508	4566
4010	4030	4066	4510	4583
4011	4034	4068	4511	4584
4012	4035	4069	4512	4585
4013	4040	4070	4514	4723
4014	4041	4071	4515	4724
4015	4042	4072	4516	4725
4016	4043	4073	4518	14409
4017	4044	4075	4519	14410
4018	4045	4076	4520	14411
4019	4046	4078	4526	14412
4020	4047	4081	4528	14419
4021	4048	4082	4529	14433
4022	4049	4093	4531	14490
4023	4050			

LINEARS

301	359	567	747	3081
307	531	709	748	3082
310	555	710	1458	3096
317	556	711	1488	3130
339	564	733	1489	3401
348	565	739	3010	3900
358	566	741	3035	

MEMORIES

RAMS	4116	5290	**ROMS**	2732
2101	48256	5298	2513	2764
2102	5101	6116	2708	87S180
2112	5261	7489	2516	87S181
2114	5262	74C920	2532	87S190
2148	5270	74S200	2564	87S191
4027	5280	82S10	2716	

DTL

830	838	846	853	861
832	840	848	855	862
833	841	849	856	863
836	844	852	857	951
837	845			

MISCELLANEOUS

6800	7905	8080	8212	8748
7805	7912	8085	8223	8749
7812	7915	8086	8224	9600
7815	7924	8088	8251	9601
7824	Z80	8136	8255	9602

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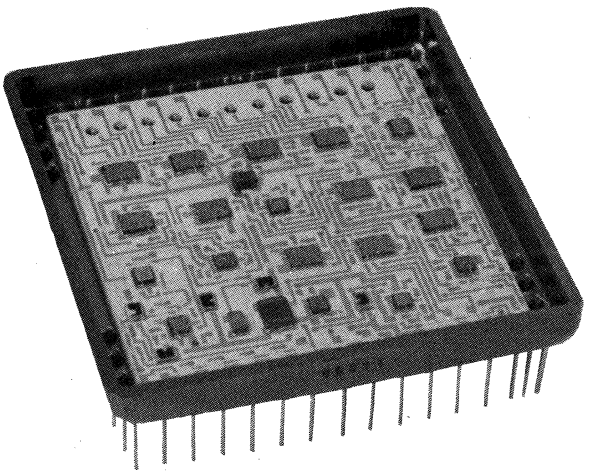

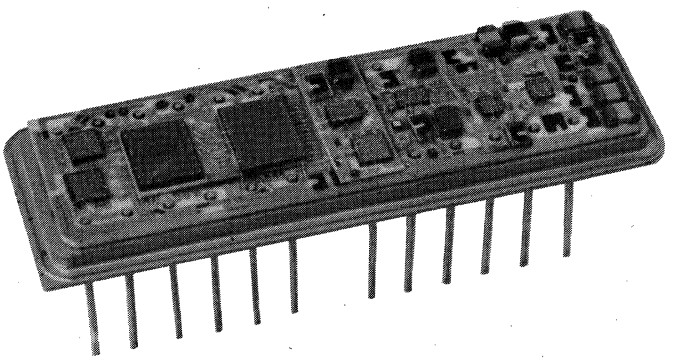

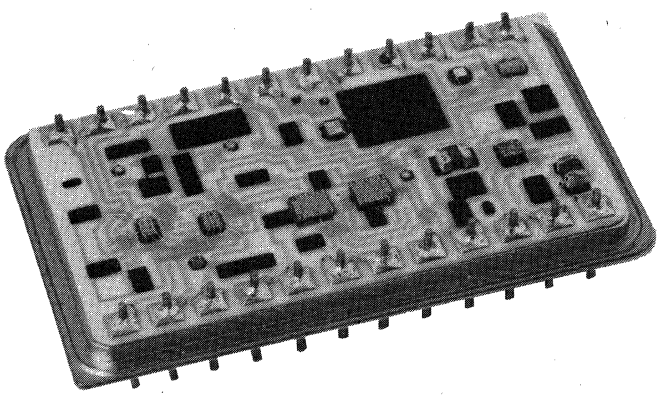

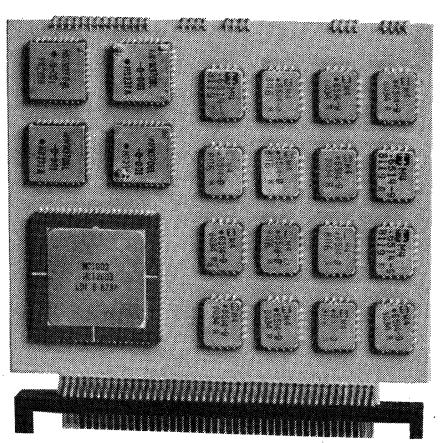

CTS®

HI-REL HYBRIDS

THICK & THIN FILM HYBRID TECHNOLOGY

CTS Microelectronics produces high quality thick film hybrid circuits. The modern 101,000 square foot manufacturing facility in West Lafayette, Indiana, specializes in volume production of "Hi-Rel" and commercial grade chip and wire hybrid circuits, quality discrete hybrids and custom resistor networks.

CUSTOM DESIGN/ QUALITY ASSURANCE.

CTS Microelectronics works directly with the customer to establish and maintain testing procedures that will insure the highest standards of quality and reliability. Specification reviews are a standard practice at CTS. Representatives from the quality assurance, sales and engineering departments met with the customer to establish the requirements of each designed circuit prior to any production run, following the general requirements of MIL-STD-883 and MIL-M-38510.

All incoming materials go through quality assurance. There, samples are taken, tested and quarantined until written approval is given to release them to stock.

The in-process inspection system checks circuits at all stages of manufacturing to insure highest quality workmanship and adherence to specifications. Finally, quality assurance inspectors thoroughly test the finished circuits. Records from each stage of design and manufacturing for all circuits assure complete traceability of a project.

CTS Microelectronics' in-house testing facilities include vibration, shock, centrifuge, thermal shock, temperature cycling, moisture resistance, leak testing, PIND, burn-in, life testing and moisture/gas analysis. These are applied as an effective check-and-balance system to assure consistent quality and reliability in circuit manufacturing.

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TELEX: 68-3448

MICROELECTRONICS DIVISION
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MICROELECTRONICS DIVISION
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WE'LL "SECOND SOURCE" STANDARD HYBRIDS **YOUR** WAY

STANDARD HI-REL HYBRIDS AVAILABLE TO YOUR SPECIFICATION FROM CTS MICROELECTRONICS, INC.

Now get standard pin-for-pin Hi-Rel Hybrid replacements with production extras like special screening, environmental testing, data logging and electrical testing.

For more than 20 years CTS Microelectronics has been a leading producer of Hi-Hel Hybrids that can withstand the harshest environments. These hybrids will meet test standards set out by MIL-STD 883. And now they are available for fast delivery in many pin-for-pin configurations.

When you need a reliable second source for Hi-Rel Hybrids, tested to your custom specifications, think first of CTS Microelectronics. For complete technical information, prices and delivery projection, get in touch with CTS Microelectronics, 1201 Cumberland Avenue, West Lafayette, IN 47906.

Or call (317) 463-2565.

CTS HYBRID STANDARD DESIGNS

PRODUCT NO.	DESCRIPTION	REPLACES PRODUCT NO.
Operational Amplifiers:		
CTS 0004	High Voltage Operational Amplifier	National LH 0004/883B
CTS 0021 H/B	Power Operational Amplifier	National LH 0021/883B
CTS 0024	High Slew Operational Amplifier	National LH 0024/883B
CTS 0032	Ultrafast FET Operational Amplifier	National LH 0032/883B
CTS 0041 H/B	Power Operational Amplifier	National LH 0041/883B
CTS 0042	Low Cost FET Operational Amplifier	National LH 0042/883B
CTS 101A H/B	High Performance Operational Amplifier	National LH 101/883B
CTS 2101	Dual High Performance Operational Amplifier	National LH 2101/883B
CTS 108A H/B	Super Beta Operational Amplifier	National LH 108/883B
CTS 2108	Dual Super Beta Operational Amplifier	National LH 2108/883B
CTS 111 H/B	Operational Amplifier	National LH 111/883B
CTS 2111	Dual Voltage Comparator	National LH 2111/883B
CTS 861	Log IF Amplifier	Plessy SL 521
Buffers:		
CTS 0002	Current Amplifier	National LH 0002/883B
CTS 0033	Fast Buffer Amplifier	National LH 0033/883B
Sample & Hold Amplifiers:		
CTS 0023	Sample & Hold Circuit	National LH 0023/883B
MOS Clock Drivers:		
CTS 0007	DC Coupled MOS Clock Driver	National MH 0007/883B
CTS 0009	Two Phase MOS Clock Driver	National MH 0009/883B
Digital Drivers:		
CTS 0006 H/B	Current Driver	National DH 0006/883B
CTS 0008 H/B	High Voltage Current Driver	National DH 0008/883B
CTS 0034	High Speed Dual Level Translator	National DH 0034/883B

AVAILABLE HOW YOU WANT THEM.

Others say — "Take-it-the-way-we-make-it." CTS will "second source" standard hybrids your way.

What a great alternate source for standard pin-for-pin Hi-Rel Hybrid replacements! When you are faced with the "take-it-or-leave-it" attitude that some major suppliers have adopted on Hi-Rel Hybrid standards — look to CTS Microelectronics. CTS will provide Hi-Rel Hybrids just as you want them. And, our prices are very competitive.

Don't settle for standard hybrids that don't meet your individual needs. Ask about the CTS-0002, 6, 8, 21, 32, 33, 34 and 41 as alternates for the LH and DH series. We'll make your standards to custom requirements.

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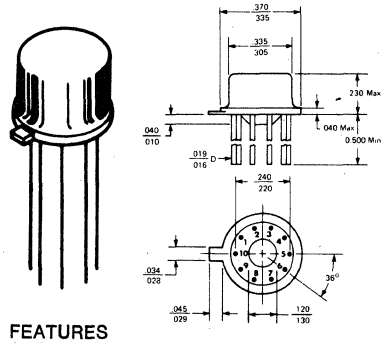
HIGH VOLTAGE HIGH CURRENT DRIVER/CTS 0008 IB



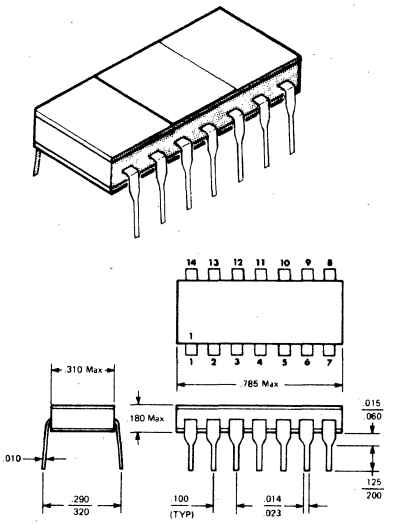
FEATURES
1. Operation from a single +10V to +45V power supply.
2. Low standby power dissipation of only 35MW for 28V power supply.
3. 3.0A, 50MS pulse current capability.

The CTS 0008 IB is a hybrid high voltage, high current driver, designed to accept standard DTL or TTL input levels and provide a pulsed load up to 3A from a continuous supply voltage up to 45V. AND inputs are provided with an EXPANDER connection, should additional gating be required.

Since one side of the load is grounded, there is less likelihood of false turn-on due to an inadvertant short in the drive line.

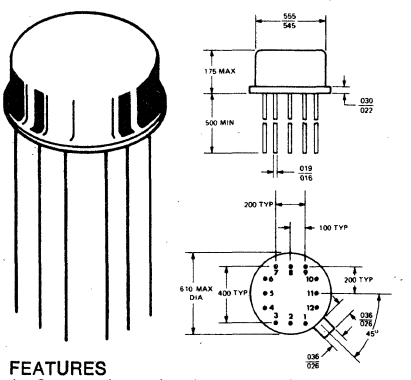
The high pulse current capability makes the CTS 0008 IB ideal for driving nonlinear resistive loads such as incandescent lamps. The circuit also requires only one power supply for functional operation.

DUAL HIGH SPEED LEVER SHIFTER/CTS 0034 CB



The Model CTS 0034 CB Dual High Speed Level Shifter is used to provide an interface between TTL/DTL, and MOS/JFET, voltages. The circuit features large output swings to 25 volts, output currents to 100 mA and high-speed operation.

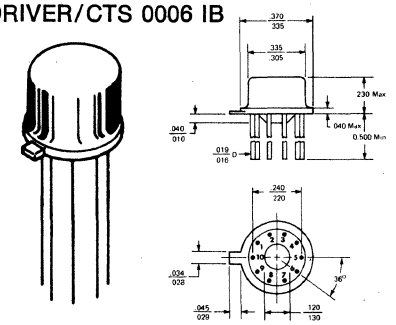
SAMPLE AND HOLD CIRCUIT/ CTS 0023 ZB



FEATURES
1. Output short circuit protected.
2. Extremely low drift rate: .5 mV/sec typ. with .01 μF teflon capacitor.
3. TTL or DTL compatible logic input.
4. Operates with just ±15V or with ±15V and a separate +5V logic supply for improved noise immunity.
5. Voltage offset adjustable to zero using a 10K pot with wiper at V−.
6. Military grade processing per MIL-STD-883.
7. Pin-for-pin replacement for LH 0023.

The CTS 0023 ZB is a high performance sample and hold circuit that exhibits an extremely low drift rate. Some typical applications include: Sampled Data Systems, D/A Deglitchers, Analog De-Multiplexers and A/D inputs.

HIGH VOLTAGE CURRENT DRIVER/CTS 0006 IB



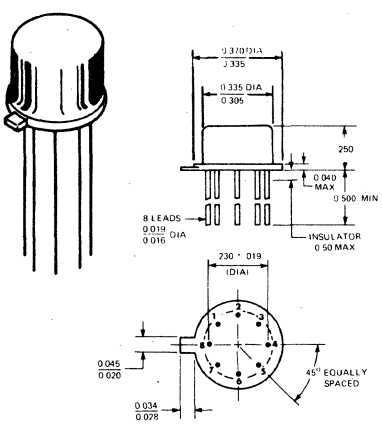
FEATURES
1. Operation from a single +10V to +45V power supply.
2. Low standby power dissipation of only 35MW for 28V power supply
3. 1.5A, 50MS pulse current capability.

The CTS 0006 IB is a hybrid high voltage, high current driver, designed to accept standard DTL or TTL input levels and provide a pulsed load up to 1.5A from a continuous supply voltage up to 45V. AND inputs are provided with an EXPANDER connection, should additional gating be required.

Since one side of the load is grounded, there is less likelihood of false turn-on due to an inadvertant short in the drive line.

The high pulse current capability makes the CTS 0006 IB ideal for driving nonlinear resistive loads such as incandescent lamps. The circuit also requires only one power supply for functional operation.

LOG INTERMEDIATE FREQUENCY AMPLIFIER/ CTS 861 GB



The CTS 861 GB is a cermet hybrid integrated circuit. This wideband amplifier is intended primarily for use as one stage of a log IF amplifier, with midband frequency of 10 MHz to 100 MHz. It has a voltage gain of typically 12 dB, which is flat to within .6 dB typically from 30 to 100 MHz. These units have RF output which is limited to .5V typical and can be directly coupled to the following stage. The detector has current output which makes possible the direct summing of several output stages.

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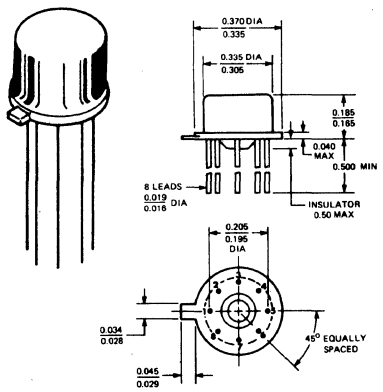
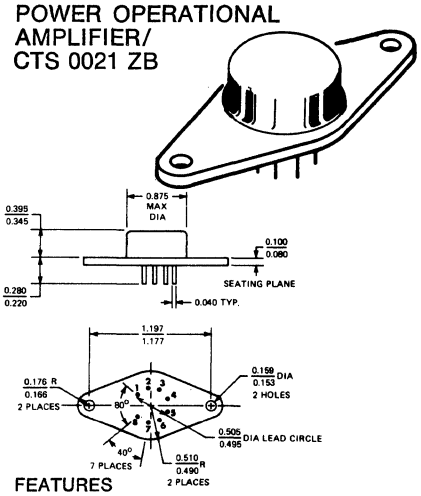
OPERATIONAL AMPLIFIERS

HIGH SLEW RATE OPERATIONAL AMPLIFIER/CTS 0024 GB



The CTS 0024 GB is a very wide bandwidth, high slew rate operational amplifier intended to fulfill a wide variety of high speed applications such as buffers to A to D and D to A converters and high speed comparators. The device exhibits useful gain in excess of 50 MHz making it possible to use in video applications requiring higher gain accuracy than is usually associated with such amplifiers. It is plug-in compatible with LH 0024.

POWER OPERATIONAL AMPLIFIER/ CTS 0021 ZB

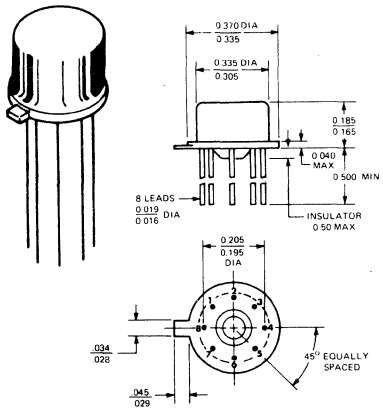


FEATURES

1. Output current 1.0 Amp.
2. Low input offset voltage and current.
3. Output voltage swing ±12V into 10 ohms.
4. Options on high reliability processing.
5. Moisture less than 1000 PPM.
6. Solderability shall conform to MIL-STD-883B, Method 2003.

The CTS 0021 ZB is a general purpose operational amplifier featuring an output current in excess of one ampere at voltage levels of ±12V and is compensated with a single external capacitor.

BUFFER AMPLIFIER/ CTS 0002 GB

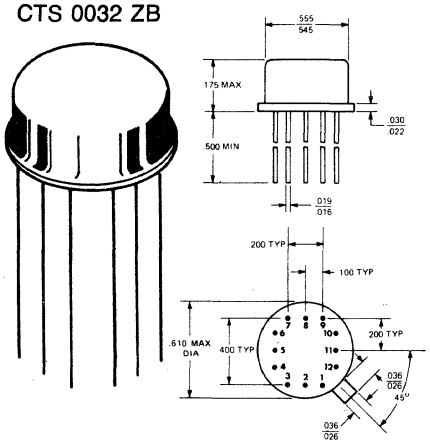


FEATURES

1. Slew rate 200 V/μsec.
2. Bandwidth 300 MHz.
3. Output current (pulsed) 400 mA.
4. Output voltage swing approaches supply voltages.
5. Input impedance 400 KΩ.
6. Output impedance 6Ω.
7. AC current gain 20 A/mA.

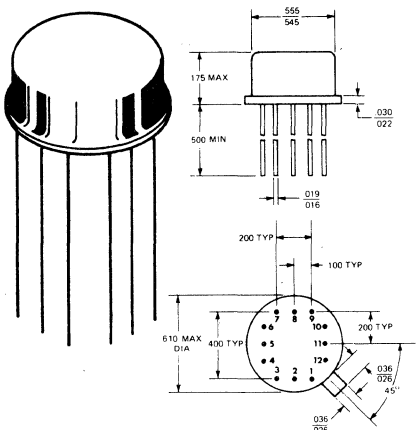
The CTS 0002 GB Buffer Amplifier is a high speed, high impedance follower used with operational amplifiers to increase the current output drive. Other applications include line driving, and high speed D/A conversion.

HIGH SLEW RATE FET OPERATIONAL AMPLIFIER/ CTS 0032 ZB



The Model CTS 0032 ZB FET Operation Amplifier is a high speed device capable of 500 V/μsec, slew rates and band widths of 70 MHz. The JFET input provides input impedances of 10^{12} ohms. The high speed, high impedance performance lends itself for use in D-A summing amplifiers, sample and hold circuits, integrators and video amplifiers.

BUFFER AMPLIFIER/ CTS 0033 ZB

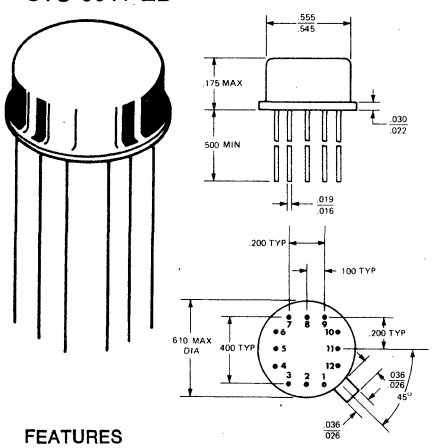


FEATURES

1. Slew rate 1500 V/μsec.
2. Propagation delay 1.2 nsec.
3. Input impedance 10^{11} ohm.
4. Input bias current 50 pa.
5. Output impedance 6 ohm.
6. Output voltage swings ±13V.
7. Bandwidth 100 MHz.

The Model CTS 0033 ZB Voltage Follower is a high-speed buffer used to provide high input impedance and low output impedance for interfacing and line driving requirements. Typical performance specifications permit wide-range usage in many applications.

0.2 AMP POWER OPERATIONAL AMPLIFIER/ CTS 0041 ZB



FEATURES

1. Output current 0.2 amp.
2. Offset null capability.
3. Low input offset voltage and current.
4. Output voltage swing ±14V into 100 ohms.
5. Options on high reliability processing.
6. Moisture less than 1000 PPM.
7. Solderability shall conform to MIL-STD-883B, Method 2003.

The CTS 0041 ZB is a general purpose operational amplifier featuring an output current in excess of 200 mA at voltage levels of ±12V and is compensated with a single external capacitor.

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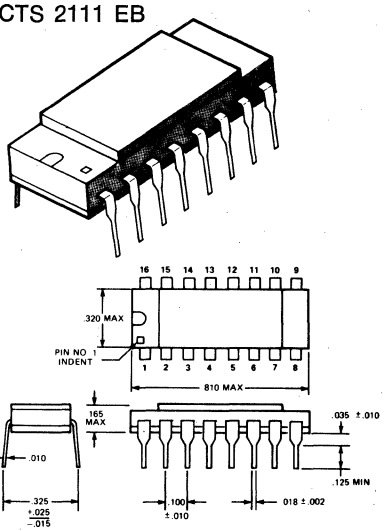
OPERATIONAL AMPLIFIERS

DUAL VOLTAGE COMPARATOR/ CTS 2111 EB



FEATURES

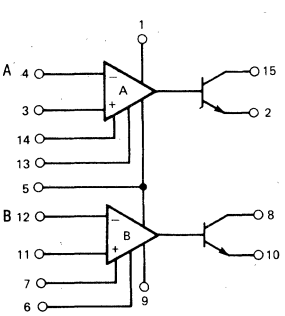
1. Short circuit protection.
2. Offset null capability.
3. Large common-mode and differential voltage range.
4. Low power consumption
5. Options on high reliability processing.
7. Moisture less than 1000 ppm.
8. Solderability shall conform to MIL-STD-883B, Method 2003.

The CTS 2111 EB Dual Voltage Comparator consists of two 111 type voltage comparators in a single hermetic package. The 111 voltage comparator has input currents approximately a hundred times lower than devices like the uA710. They are designed to operate over a wider range of supply voltages; from standard ±15V Op Amp supplies down to the single 5V supply used for IC logic. The output is compatible to RTL, DTL, and TTL as well as MOS circuits. Further, it can drive lamps or relays, switching voltages up to 50V at currents as high as 50 mA.

SCHEMATIC DIAGRAM

PIN CONFIGURATION

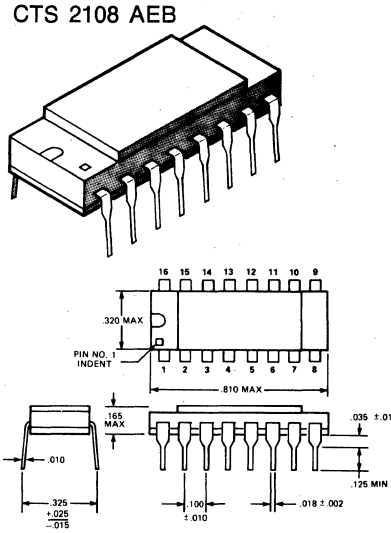
1. V+ A
2. GND (Emitter) A
3. Non-Inverting Input A
4. Inverting Input A
5. V− A and B
6. Balance B
7. Balance/Strobe B
8. Output B
9. V+ B
10. GND (Emitter) B
11. Non-Inverting Input B
12. Inverting Input B
13. Balance A
14. Balance/Strobe A
15. Output A
16. NC



NOTE 1: The Dual-In-Line package must be derated based on a thermal resistance of 100°C/W, junction to ambient.

NOTE 2: This rating applies for ±15V supplies. The positive input voltage limit is 30V above the negative supply. The negative input voltage limit is equal to the negative supply, whichever is less.

DUAL OPERATIONAL AMPLIFIER/ CTS 2108 AEB



FEATURES

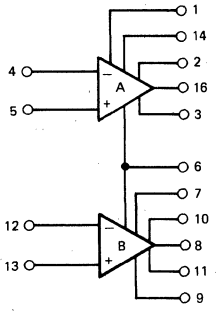
1. Maximum input bias current of 3.0 nA over temperature.
2. Offset voltage less than .5 mV.
3. Offset current less than 400 pA over temperature.
4. Low supply current.
5. Drift 5 μV/°C.
6. Options on high reliability processing.
7. Moisture less than 1000 ppm.
8. Solderability shall conform to MIL-STD-883B, Method 2003.

The CTS 2108 AEB Dual Operational Amplifier consists of two 108A type Op Amps in a single hermetic package. The 108A Op Amp is a precision operational amplifier featuring low input currents and extremely low offset voltage, making it possible in most cases, to eliminate offset adjustments.

SCHEMATIC DIAGRAM

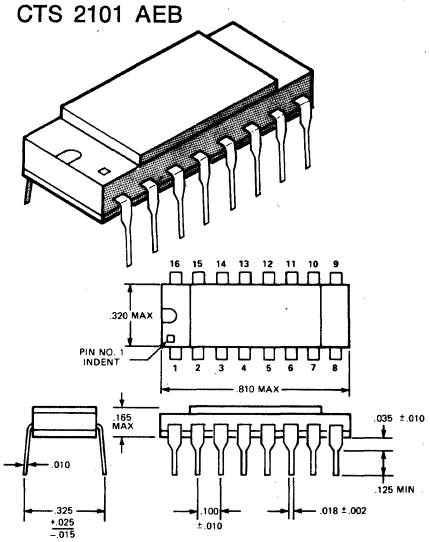
PIN CONFIGURATION

1. V+ A
2. Freq. Comp. A
3. Freq. Comp. A
4. Inverting Input A
5. Non-Inverting Input A
6. V− A and B
7. NC
8. Output B
9. V+ B
10. Freq. Comp. B
11. Freq. Comp. B
12. Inverting Input B
13. Non-Inverting Input B
14. NC
15. NC
16. Output A



NOTE 1: The Dual-In-Line package must be derated based on a thermal resistance of 100°C/W, junction to ambient.
NOTE 2: The inputs are shunted with back-to-back diodes for overvoltage protection. Therefore, excessive current will flow if a differential input voltage in excess of 1V is applied between the inputs unless some limiting resistance is used.
NOTE 3: For supply voltage less than ±15V, the absolute maximum input voltage is equal to the supply voltage.

DUAL OPERATIONAL AMPLIFIER/ CTS 2101 AEB



FEATURES

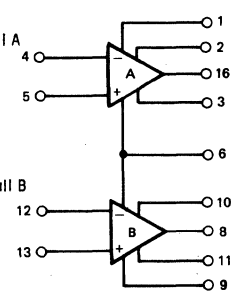
1. Short circuit protection.
2. Offset null capability.
3. Large common-mode and differential voltage range.
4. Low power consumption.
5. No latch up.
6. Options on high reliability processing.
7. Moisture less than 1000 ppm.
8. Solderability shall conform to MIL-STD-883B, Method 2003.

The CTS 2101 AEB Dual Operational Amplifier consists of two 101A type Op Amps in a single hermetic package. The 101A Op Amp is a general purpose operational amplifier featuring high gain, short circuit protection, simplified compensation and excellent temperature stability.

SCHEMATIC DIAGRAM

PIN CONFIGURATION

1. V+ A
2. Freq. Comp. A
3. Freq.Comp./Offset Null A
4. Inverting Input A
5. Non-Inverting Input A
6. V− A and B
7. Offset Null B
8. Output B
9. V+B
10. Freq. Comp. B
11. Freq. Comp./Offset Null B
12. Inverting Input B
13. Non-Inverting Input B
14. Offset Null A
15. NC
16. Output A



NOTE 1: The Dual-In-Line package must be derated based on a thermal resistance of 100°C/W, junction to ambient.
NOTE 2: For ambient voltage less than ±15V, the absolute maximum input voltage is equal to the supply voltage.

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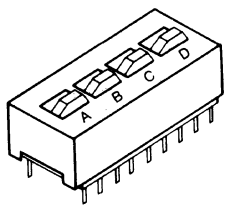
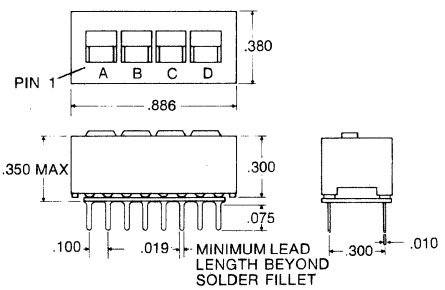
ATTENUATORS

DIP ATTENUATOR/SERIES 196



NOTES:
1. Refer to drawing above and to schematic below
2. Switch positions as shown have all attenuators in.
3. Dimensions shown are nominal.

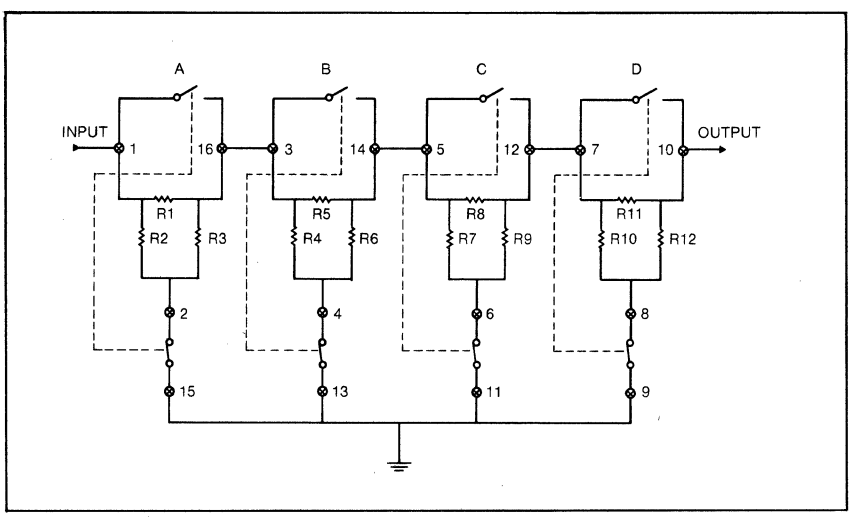


The 196 Series is a very reliable replacement for thumbwheel switch-type attenuators providing substantial cost savings. It is available with a bottom-seal or both top and bottom sealed switch. When ordering or requesting pricing please specify seal type, part number, and attenuation option required. For example:
"196600-02 top and bottom seal" is a totally sealed 600 ohm 1, 2, 4, and 8 dB attenuator.
"196075-04 bottom seal" is a 75 ohm attenuator with bottom seal and 2, 4, 8, and 16 dB attenuation values.

The 196 Series Switchable Attenuator is available in 75 Ohm and 600 Ohms and is in a standard DIP package. Attenuators are 600 Ohm or 75 Ohm unbalanced PI or T configuration networks. Standard attenuators are available in values ranging from .1 dB to 16 dB in increments of .1 dB to 2 dB. This product can be designed to meet your attenuation characteristics. The following are some popular attenuation values:

OPTION VAR.	ATTENUATOR SECTION			
	A	B	C	D
-01-	.1	.2	.4	.8
-02-	1	2	4	8
-03-	1.6	3.2	6.4	12.8
-04-	2	4	8	16
-05-	.25	.5	1	2
-06-	1.5	3	6	12

UNBALANCED "PI" ATTENUATOR



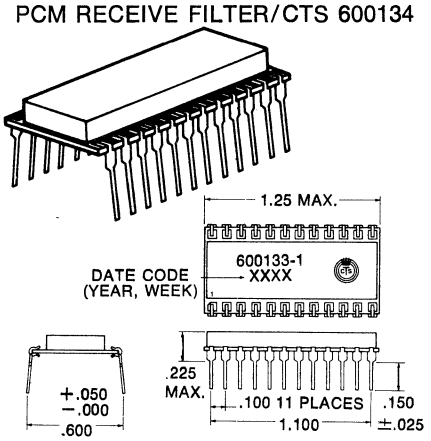
NOTE 1: Switch positions are with all attenuators in.
NOTE 2: X indicates switch terminals.
NOTE 3: Interconnections shown by heavy lines are typical.

Attenuation Range (see note 1)	Individual Attenuation Tolerance dB		Attenuation Range (see note 1)	Individual Attenuation Tolerance dB		Attenuation Range (see note 1)	Individual Attenuation Tolerance dB	
	75 ohm	600 ohm		75 ohm	600 ohm		75 ohm	600 ohm
≤.8 dB	±.0125	±.0125	4 dB	±.040	±.025	12 dB	±.090	±.050
≤2 dB	±.025	±.025	6 dB	±.054	±.025	16 dB	±.105	±.050
3 dB	±.029	±.025	8 dB	±.070	±.025	20 dB	±.115	±.050

NOTE 1: Please consult the factory for other attenuation values available between .1 dB and 20 dB.
NOTE 2: The maximum cumulative tolerance for any combination of attenuations from different ranges may be calculated by summing the individual attenuator tolerances.

PCM TRANSMIT FILTER/ CTS 600133

PCM RECEIVE FILTER/CTS 600134

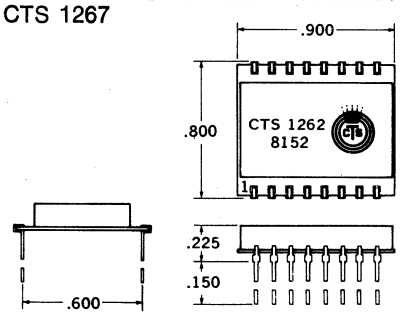


The 600133 is a modified fifth order elliptic lowpass filter which passes frequencies to 3.2 kHz and attenuates all stopband frequencies above 4.5 kHz. The 600133 is a plug in replacement for the National AF133.

The 600134 is a modified fifth order elliptic lowpass filter which passes frequencies to 3.2 kHz while compensating for the (SIN X) /X response and attenuates stopband frequencies above 4.5 kHz. The 600134 is a plug in replacement for the National AF134.

300 BAUD FSK TRANSMIT HYBRID/ CTS 1262

300 BAUD FSK RECEIVE HYBRID/ CTS 1267



The CTS 1262 is a switchable bandpass transmit filter which includes a duplexer (two-to-four wire converter) and a voltage-controlled squelch. The part is fully electrically compatible (pin-for-pin) with Cermetek's CH 1262. It is intended for use between an FSK modulator and the telephone line in 103/113-type modems.

The CTS 1267 is a switchable bandpass/ bandreject filter and a soft-limiter/amplifier. The part is fully electrically compatible (pin-for-pin) with Cermetek's CH 1267. It is intended for use between a telephone line, data coupler, or line hybrid and an FSK demodulator in 103/113-type modems.

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Floppy Disk Write Amplifier — XR-2247/XR-2247A — Provides the complete interface function between write data signals and a tunnel-erase magnet head. Incorporates diode switching for read/write transfer, eliminating the need for external diodes.

Pulse-Width Modulating Regulator — XR-494/XR-495 — Provides the functions necessary to configure a pulse-width modulating regulator. Includes 5-volt regulator, error detectors, an oscillator, dead-time control comparator and necessary control circuits.

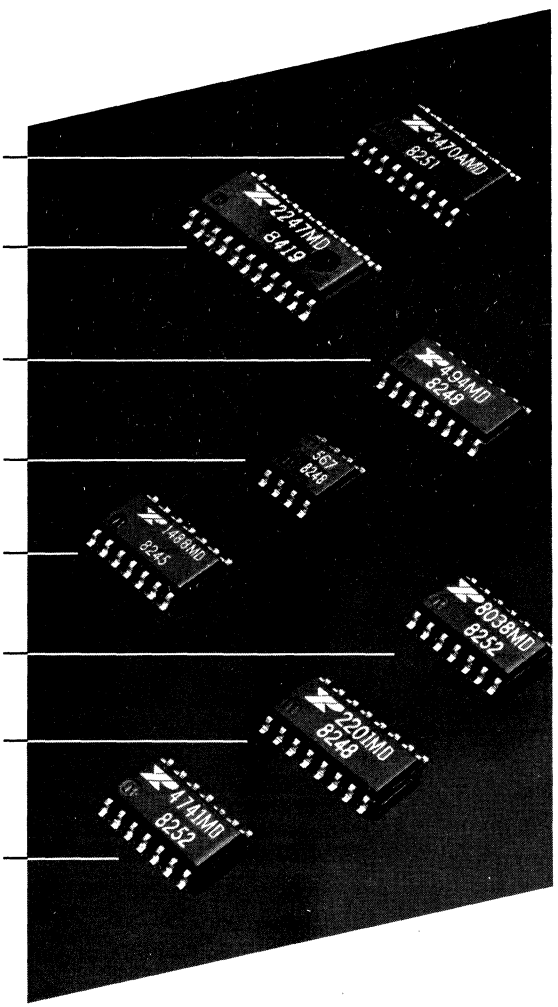
Monolithic Tone Decoder — XR-567 — A monolithic single chip phase-locked loop ideal for Touch-Tone® decoding, sequential tone decoding, communications paging, ultrasonic remote control and telemetry decoding.

Quad Line Driver/Receiver — XR-1488/XR-1489A — The Exar XR-1488 Quad Line Driver and 1489A Quad Line Receiver devices enable interfacing with data terminal TTL levels to RS-232C compatible systems. Both devices feature output current limiting.

Precision Waveform Generator — XR-8038/XR-8038A — The XR-8038 is a precision waveform generator in a single IC package. It produces sine, square, triangular, sawtooth and pulse waveforms with distortion of 0.5%, or less, and operates to 1 MHz.

High-Voltage, High-Current Darlington Transistor Arrays — XR-2201, XR-2202, XR-2203, XR-2204 — Each IC comprises 7 NPN Darlington pairs. All feature open-collector outputs and protection diodes for driving inductive loads and other high-current drive applications.

Quad and Dual Operational Amplifiers — XR-4741/XR-3403; XR-4558 — XR-4741 is a quad op amp, similar to the popular 741 but superior in slew rate, bandwidth and noise level. It's fine for audio amplifiers and active filters.



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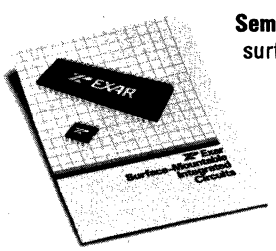

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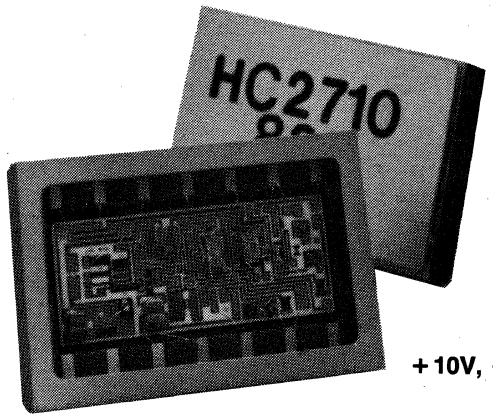
HyComp Delivers

Precision Thin-Film VOLTAGE REFERENCES



+10V, −10V, ±10V

FEATURES

- **MIL-STD-883C** and industrial versions
- Excellent **thermal stability** over temperature (to ±1 ppm/°C)
- **Fully guaranteed** to ±10mA output over full operating temperature range
- Short circuit **protected**
- **No need** for external temperature-stabilizing elements
- Available in **several packages** (hermetically sealed 14 pin DIP, leadless chip carrier, flatpacks)
- Proprietary **Nichrome** resistors, **laser** trimming and **stabilization**

PARAMETERS MODEL⟶	HC2700/2720/2701/2702	HC2710/2721/2711/2712
Output Voltage		
HC2700/2710	+10.000 ±0.005V	+10.000 ±0.001V
HC2720/2721	+10.000 ±0.002V	+10.000 ±0.001V
HC2701/2711	−10.000 ±0.005V	−10.000 ±0.001V
HC2702/2712	±10.000 ±0.005V	±10.000 ±0.001V
Temperature Drift (1)		
HC2700/2710	±3ppm/°C max.	±1ppm/°C max. (2)
HC2720/2721	±4ppm/°C max.	±1ppm/°C max. (2)
HC2701/2711	±5ppm/°C max.	±1ppm/°C max. (2)
HC2702/2712 +10V Output	±5ppm/°C max.	±1ppm/°C max. (2)
HC2702/2712 −10V Output	±5ppm/°C max.	±2ppm/°C max. (2)
Line Regulation		
HC2720/2721	200μV/V max.	200μV/V max.
All Others	250μV/V max.	200μV/V max.
Load Regulation		
HC2720/2721	50μv/mA. typ.	50μV/mA. typ.
All Others	100μV/mA. max.	50μV/mA. max.
Output Current (3)		
HC2720/2721	5mA	5mA
All Others (Over Temp.)	±10mA	±10mA
Long Term Stability	25ppm/1000 Hours, All Models	
Operating Temperature (4)		
HC27XX	−25°C to +85°C	
HC27XX-883	−55°C to +125°C	
Package Style		
HC2720/2721	TO-99	TO-99
HC2720/2721-LCC	Leadless Chip Carrier	Leadless Chip Carrier
All Others	14-Pin DIP	14-Pin DIP

NOTES: 1. Measured from 25°C to T (min) and 25°C to T (max).
2. Temperature drift ±5ppm/°C outside the −25°C to +85°C range.
3. For specified load regulation.
4. For specified temperature drift.

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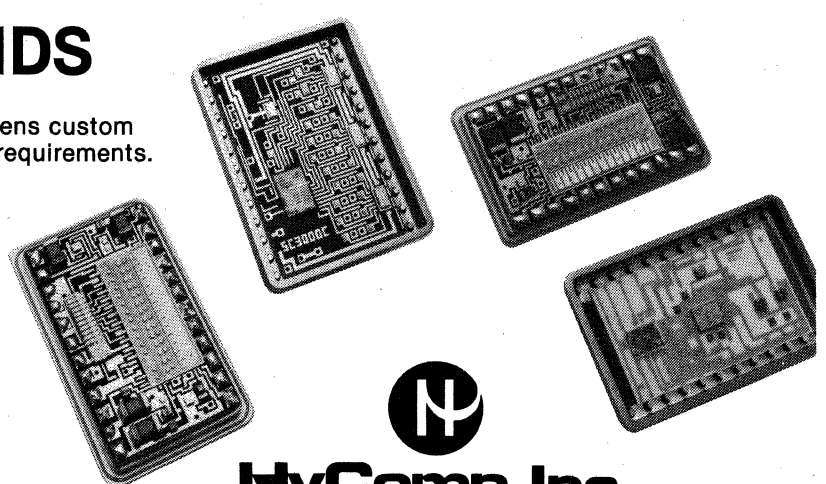

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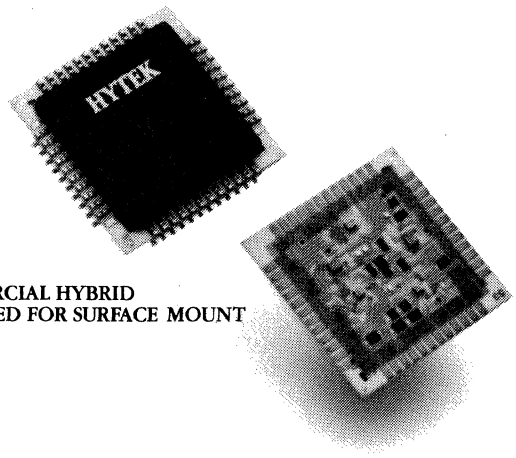

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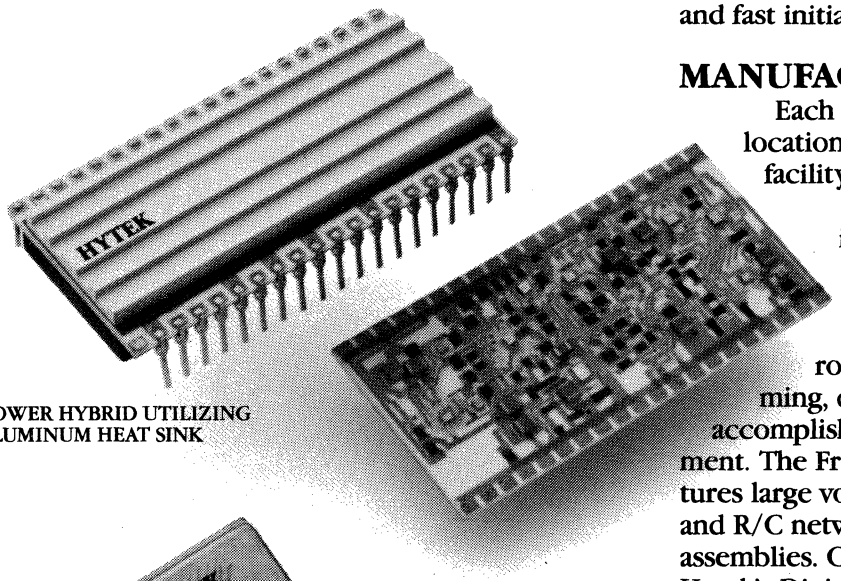
ENGINEERING

Hytek's engineering capabilities include Circuit Design, Gate Array Design and Hybrid Design. Hytek's Calma and Hewlett Packard CAD Systems allow Hytek to provide accurate and fast initial designs.



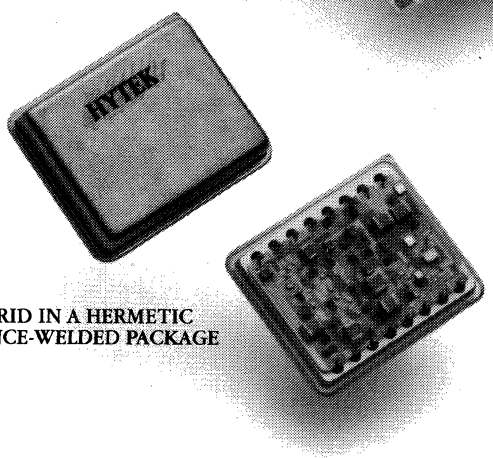
POWER HYBRID UTILIZING
ALUMINUM HEAT SINK

MANUFACTURING

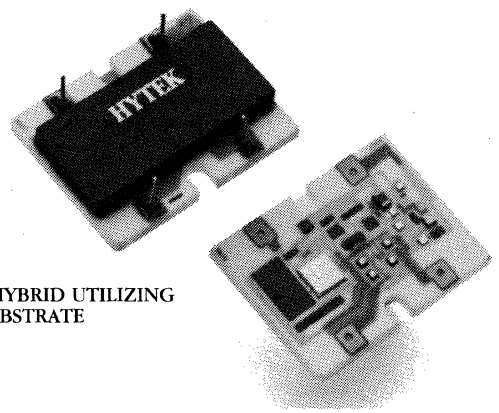
Each of Hytek's three manufacturing locations is a modern, well equipped facility.

The Los Gatos, California facility is designed to produce large volumes of complex chip and wire hybrid circuits. The thick film is produced in a new, clean room environment and laser trimming, die attach and wire bonding are accomplished with new automatic equipment. The Fremont, California plant manufactures large volumes of custom molded resistor and R/C networks as well as surface mounted assemblies. Carson City, Nevada produces Hytek's Digital Delay Lines.

Hytek's Quality Assurance program incorporates the applicable requirements of MIL-Q-9858, MIL-I-45208 and calibration certification of MIL-STD-45662 traceable to the National Bureau of Standards. Furthermore, it's Hytek's intention to have in place in 1985, a facility certified to MIL-STD-883C, MIL-STD-38510 Appendix G and MIL-STD-1772.



MIL HYBRID IN A HERMETIC
RESISTANCE-WELDED PACKAGE



POWER HYBRID UTILIZING
A BeO SUBSTRATE

HYTEK MICROSYSTEMS, INC.
980 UNIVERSITY AVENUE
LOS GATOS, CA 95030
TELEPHONE 408/395-2300
TWX 910-597-5393

intech:

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- ***Signal Conditioning Products***
- ***Data Acquisition Systems***
- ***Hybrid Circuits***
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Analog-To-Digital Converters
- Resolution to 16 Bits
- Full Line of Integrating and Successive Approximation Types

Digital To Analog Converters
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- Multiplying DACs
- Video DACs to 100 MHz
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Data Acquisition Systems
- 12, 14 and 16 Bit Resolution
- Up to 16 Input Channels
- Complete System in Hybrid or Module

Sample & Hold Amplifiers
- Acquisition Times to 15 ns
- Aperture Times to 0.2 ns
- Bandwidth to 60 MHz

Function Modules
- Log Amplifiers
- Multipliers
- Dividers
- Multifunction

Amplifiers
- Wideband to 50 MHz
- Fast Slew to 1KV/μsec
- High Voltage and Current
- Electrometer Amps
- Instrumentation Amps
- Chopper Stabilized

Power Hybrids
- Actuator Drivers
- Gyro Drivers
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V/Fs and F/Vs
- To 10 MHz
- To +10 Volts

Monolithic V/F/V
- Frequency to 1 MHz
- Single Ended Supply
- 14 Pin Dip Package

Pincushion Module
- Corrects Pincushion Error in CRT Displays

Power Supplies
- Module Supplies
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Scale Systems
- Custom Designed
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Custom Products
- Guaranteed to Perform Satisfactorily in Your System

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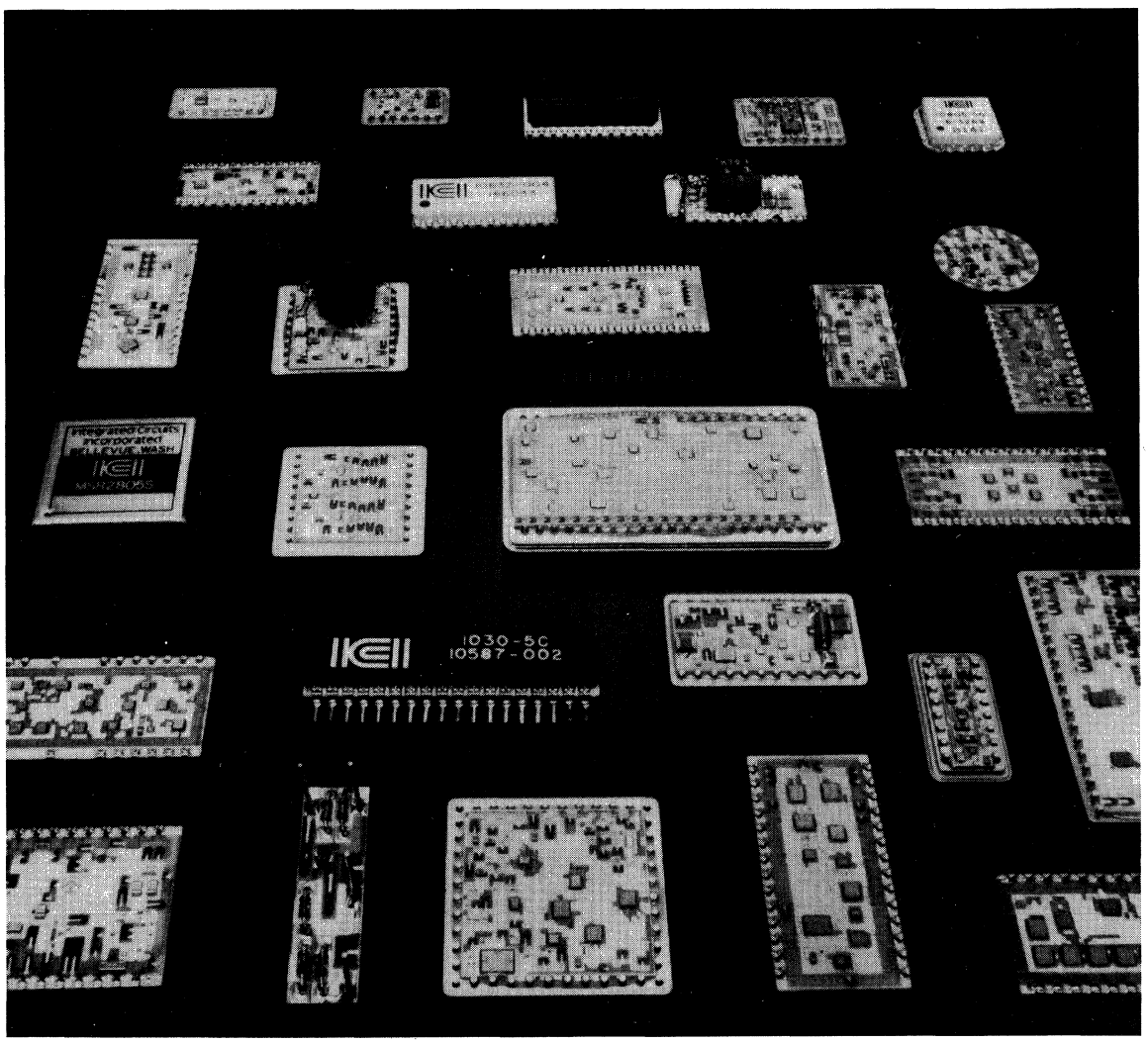
For more information on these and other Intech products, contact Derrell Bridgman at:
Intech Microcircuits Division
2270 Martin Avenue
Santa Clara, California 95050
Telephone: 408/988-4930
TWX: 910-338-2213

Integrated Circuits Incorporated

CUSTOM HYBRID CIRCUITS



Producing high quality custom hybrid circuits is an art no one learns overnight. And producing circuitry consistently recognized as the finest in the industry takes years.

That's the secret behind the success of Integrated Circuits Incorporated. Building custom thick-film hybrid circuits has been our specialty since 1969. And we've used all of that experience to perfect our expertise in not only technical capabilities and quality, but also in program management and customer coordination.

We can design a circuit to your specification, or convert your circuit to a miniature hybrid design. Either way, it must pass the rigid quality assurance requirements basic at ICI - MIL-I-45208, MIL-STD-883, MIL-M-38510, and MIL-Q-9858 as applicable.

For military, airborne or industrial requirements, you'll find ICI to be responsive, capable and reliable.

Integrated Circuits Incorporated

10301 Willows Road
Redmond, Washington 98052
(206) 882-3100
TWX: 910-443-2302

International Microelectronic Products

CUSTOM & SEMI-CUSTOM LSI PRODUCTS

TECHNOLOGY	GEOMETRY	METAL	POLY	FOUNDRY SERVICES	FULL CUSTOM	SEMI CUSTOM
NMOS	5μ	SINGLE	SINGLE	✓		
	3.5μ	SINGLE	SINGLE	✓		
	3μ	SINGLE	SINGLE	✓	✓	
	2μ	1986	1986	✓	✓	
P-WELL CMOS	5μ	SINGLE	SINGLE	✓	✓	
	5μ	SINGLE	DOUBLE	✓	✓	
	3.5μ	SINGLE	SINGLE	✓		
	3μ	SINGLE	SINGLE	✓	✓	✓
	3μ	SINGLE	DOUBLE	✓	✓	✓
	3μ	DOUBLE	SINGLE	✓	✓	✓
	2μ	DOUBLE	SINGLE	✓	✓	✓
N-WELL CMOS	3μ	SINGLE	SINGLE	✓		
	3μ	DOUBLE	SINGLE	✓		
	2μ	DOUBLE	SINGLE	✓ ✳		✓

✳ INCLUDES NSC SCX6200 GATE ARRAY FAMILY

SEMI-CUSTOM VIA **IMP** STANDARD CELL/CELL LIBRARY

- FULL DESIGN SERVICES
- DAISY AND MENTOR WORK STATION INTERFACE
- GATE ARRAY NET LIST CONVERSIONS
- MIXED MODE DESIGNS WITH ANALOG AND/OR MEMORY

Sales Offices

IMP Corporate Headquarters
2830 North First Street
San Jose, CA 95134
PH (408) 262-9100
TWX 910-338-2274
TLX 449-1041

IMP Eastern Area Sales Office
555 Broad Hollow Road
Melville, NY 11747
PH (516) 752-1166
TLX 497-0515

IMP (U.K.) Ltd.
10 Bath Road, Old Town
Swindon, Wiltshire
ENGLAND SN1 4BA
PH (0793) 61.51.66
TLX 444263 IMP-G

IMP (Belgium) SA/NV
Keizerlaan 18
1900 Overijse
BELGIUM
PH (02) 657.2403
TLX 26319 IMPBRU-B

International Microelectronic Products

DIGITAL CELLS

CELL NAME	FUNCTION	TTL TYPE	CMOS TYPE	NO. OF EQUIVALENT GATES
AN2	2-INPUT AND GATE BUILT AS NAND & INVERTER	7408	4081	1.5
AN3	3-INPUT AND GATE BUILT AS NAND & INVERTER	7411	4073	2
AN4	4-INPUT AND GATE BUILT AS NAND & INVERTER	7421	4082	2.5
CB2	CLOCK GENERATOR FOR TRANSMISSION GATE FLIP FLOPS			3
CB3	CLOCK GENERATOR FOR TRANSMISSION GATE FLIP FLOPS			4
CB4	CLOCK GENERATOR FOR TRANSMISSION GATE FLIP FLOPS			6
CLKBUF1	2 PHASE CLOCK GENERATOR			4
CLKBUF2	2 PHASE CLOCK GENERATOR WITH 2P 2N DRIVER NODES			5
DFF	FULLY STATIC D FLIP FLOP			6
DFF1	FULLY STATIC D FLIP FLOP (D- & CLK- IN CELL)			7
DFF2	FULLY STATIC D FLIP FLOP (D- IN CELL)	74175		6.5
DFFC	FULLY STATIC D FLIP FLOP WITH CLEAR (ACTIVE HIGH)			7
DFFC1	FULLY STATIC D FLIP FLOP WITH CLEAR (ACTIVE HIGH)(D- & CLK-)			8
DFFL	FULLY STATIC D FLIP FLOP WITH LOAD (ACTIVE LOW)			10.5
DFFP	FULLY STATIC D FLIP FLOP WITH PRESET (ACTIVE HIGH)			7
DFFP1	FULLY STATIC D FLIP FLOP WITH PRESET (ACTIVE HIGH)(D- & CLK-)			8
DFFPC	FULLY STATIC D FLIP FLOP WITH PRESET & CLEAR (ACTIVE HIGH)			8
DFFPC1	FULLY STATIC D FLIP FLOP WITH PRESET & CLEAR (ACTIVE HIGH/D- & CLK- IN CELL)			9
DFFPC2	FULLY STATIC D FLIP FLOP WITH ACTIVE LOW PRESET & CLEAR			10
DEMUX24	2 LINE TO 4 LINE DECODER/DEMULTIPLEXER WITHOUT ENABLE			10
DEMUX38	3 LINE TO 8 LINE DECODER/DEMULTIPLEXER WITHOUT ENABLE			13
INV	INVERTER	7404	4069	0.5
INV2	INVERTING BUFFER (2P 2N)		4009	1
INV3	INVERTING BUFFER (3P 3N)		4009	1.5
INV4	INVERTING BUFFER (4P 4N)		4009	2
NA2	2-INPUT NAND GATE	7400	4011	1
NA2X2	NAND-OR COMBINATION			1.5
NA2X2X2	NAND-OR COMBINATION			2
NA2X3	NAND-OR COMBINATION			2
NA2X3X3	NAND-OR COMBINATION			3
NA2X4	NAND-OR COMBINATION			2.5
NA2X4X4	NAND-OR COMBINATION			4
NA3	3-INPUT NAND GATE	7410	4023	1.5
NA3X2X2	NAND-OR COMBINATION			2.5
NA4	4-INPUT NAND GATE	7420	4012	2
NA5	5-INPUT NAND GATE			2.5
NO2	2-INPUT NOR GATE	7402	4001	1
NO2X2	NOR-AND COMBINATION			1.5
NO2X2X2	NOR-AND COMBINATION	7451		2
NO2X3	NOR-AND COMBINATION			2
NO2X3X3	NOR-AND COMBINATION			3
NO2X4	NOR-AND COMBINATION	7455		2.5
NO2X4X4	NOR-AND COMBINATION			2
NO3	3-INPUT NOR GATE	7427	4000/25	1.5
NO3X2	NOR-AND COMBINATION			2
NO3X222	NOR-AND COMBINATION			3
NO3X2X2	NOR-AND COMBINATION			2.5
NO4	4-INPUT NOR GATE	7423/25	4002	2
NO5	5-INPUT NOR GATE	7453		2.5
OR2	2-INPUT OR GATE BUILT AS NOR & INVERTER	7432	4071	1.5
OR2X2X2	OR-AND COMBINATION			2.5
OR2X3X3	OR-AND COMBINATION			3.5
OR3	3-INPUT OR GATE BUILT AS NOR & INVERTER	4075		2
OR4	4-INPUT OR GATE BUILT AS NOR & INVERTER	4072		2.5
TBDL	TRANSPARENT LATCH WITH TRISTATE BUS DRIVER			3
TDFF	D FLIP FLOPS USING TRANSMISSION GATES			4
TDFF2	D FLIP FLOPS USING TRANSMISSION GATES			5
TDFFP	D FLIP FLOP WITH PRESET USING TRANSMISSION GATES			5
TDFFPR	D FLIP FLOP WITH PRESET & RESET USING TRANSMISSION GATES			6
TDFFPR1	D FLIP FLOP WITH PRESET & RESET USING TRANSMISSION GATES			7
TDFFR	D FLIP FLOP WITH RESET USING TRANSMISSION GATES			5
TL	HALF LATCH USING TRANSMISSION GATES			5
TL1	TRANSPARENT LATCH (Q & Q- OUT)			2
TL2	HALF LATCH USING TRANSMISSION GATES (Q & Q- OUT)			2
TL3	HALF LATCH USING TRANSMISSION GATES			3
TLP	TRANSPARENT LATCH WITH PRESET			2.5
TLR2	LATCH WITH TRANSMISSION GATES & ACTIVE LOW CLEAR			3.5
TPLCH	1-BIT TRANSPARENT LATCH WITH ENABLE AND ENABLE- INPUTS			2.5
TRIH	INTERNAL INVERTING TRISTATE DRIVER (HIGH FOR TRISTATE)			2.5
TRIL	INTERNAL INVERTING TRISTATE DRIVER (LOW FOR TRISTATE)			2.5
XNOR	EXCLUSIVE NOR GATE			2.5
XOR	EXCLUSIVE OR GATE	7486	4030/70	2.5

International Microelectronic Products

PAD CELLS

CELL NAME	FUNCTION
INPUT PADS	
IWT	INPUT PAD WITH INVERTING TTL BUFFER
IWC	INPUT PAD WITH INVERTING CMOS BUFFER
IWSC	INPUT PAD WITH INVERTING TTL CMOS SCHMITT TRIGGER
IWST	INPUT PAD WITH INVERTING TTL SCHMITT TRIGGER
IXT	INPUT PAD WITH NON-INVERTING TTL BUFFER
IXC	INPUT PAD WITH NON-INVERTING CMOS BUFFER
IXSC	INPUT PAD WITH NON-INVERTING TTL CMOS SCHMITT TRIGGER
IXST	INPUT PAD WITH NON-INVERTING TTL SCHMITT TRIGGER
OUPUT PADS	
OWT2	OUTPUT BUFFER (1TTL U.L. DRIVE)
OWT4	OUTPUT BUFFER (2TTL U.L. DRIVE)
OWT8	OUTPUT BUFFER (4TTL U.L. DRIVE)
OWZ2	TRISTATE OUTPUT BUFFER (1TTL U.L. DRIVE)
OWZ4	TRISTATE OUTPUT BUFFER (2TTL U.L. DRIVE)
OW28	TRISTATE OUTPUT BUFFER (4TTL U.L. DRIVE)
OWV4	TRISTATE OUTPUT BUFFER WITH OPEN DRAIN (2TTL U.L. DRIVE)
I/O PADS	
B2WC	TRISTATE I/O WITH INVERTING CMOS LEVEL BUFFER INPUT (1TTL U.L. DRIVE)
B4WC	TRISTATE I/O WITH INVERTING CMOS LEVEL BUFFER INPUT (2TTL U.L. DRIVE)
B8WC	TRISTATE I/O WITH INVERTING CMOS LEVEL BUFFER INPUT (4TTL U.L. DRIVE)
B2WT	TRISTATE I/O WITH INVERTING TTL LEVEL BUFFER INPUT (1TTL U.L. DRIVE)
B4WT	TRISTATE I/O WITH INVERTING TTL LEVEL BUFFER INPUT (2TTL U.L. DRIVE)
B8WT	TRISTATE I/O WITH INVERTING TTL LEVEL BUFFER INPUT (4TTL U.L. DRIVE)
B2WSC	TRISTATE I/O WITH INVERTING SCHMITT TRIGGER CMOS LEVEL INPUT (1TTL U.L. DRIVE)
B4WSC	TRISTATE I/O WITH INVERTING SCHMITT TRIGGER CMOS LEVEL INPUT (2TTL U.L. DRIVE)
B8WSC	TRISTATE I/O WITH INVERTING SCHMITT TRIGGER CMOS LEVEL INPUT (4TTL U.L. DRIVE)
B2WST	TRISTATE I/O WITH INVERTING SCHMITT TRIGGER TTL LEVEL INPUT (1TTL U.L. DRIVE)
B4WST	TRISTATE I/O WITH INVERTING SCHMITT TRIGGER TTL LEVEL INPUT (2TTL U.L. DRIVE)
B8WST	TRISTATE I/O WITH INVERTING SCHMITT TRIGGER TTL LEVEL INPUT (4TTL U.L. DRIVE)
	NOTE: ALL INPUTS CAN HAVE EITHER A PULL-UP OR A PULL-DOWN RESISTOR INCORPORATED.

ANALOG CELLS

CELL NAME	FUNCTION
O1	OPERATIONAL AMPLIFIER, GENERAL PURPOSE, INTERNAL
O2	OPERATIONAL AMPLIFIER, GENERAL PURPOSE, INTERNAL, LOW OUTPUT IMP
O3	OPERATIONAL AMPLIFIER, GENERAL PURPOSE
O4	OPERATIONAL AMPLIFIER, HIGH GAIN EXTERNAL
O5	OPERATIONAL AMPLIFIER, CASCODE AMPLIFIER, N CHANNEL INPUT
O6	OPERATIONAL AMPLIFIER, CASCODE AMPLIFIER, P CHANNEL INPUT
O7	OPERATIONAL AMPLIFIER, HIGH GAIN AMPLIFIER, N CHANNEL INPUT
O8	OPERATIONAL AMPLIFIER, HIGH GAIN AMPLIFIER, P CHANNEL INPUT
O9	OPERATIONAL AMPLIFIER, GENERAL PURPOSE, INTERNAL, SINGLE SUPPLY
1O	OPERATIONAL AMPLIFIER, GENERAL PURPOSE, EXTERNAL, SINGLE SUPPLY
C1	COMPARATOR, HIGH GAIN, LOW INPUT OFFSET VOLTAGE
C2	COMPARATOR, HIGH SPEED
C3	COMPARATOR, HIGH SPEED WITH HYSTERESIS
C4	COMPARATOR, SINGLE SUPPLY
C5	COMPARATOR, GENERAL PURPOSE, EXTERNAL
C6	COMPARATOR, GENERAL PURPOSE, WITH HYSTERESIS
C7	COMPARATOR, GENERAL PURPOSE
I1	CURRENT SOURCE, N CHANNEL DEVICES
I2	CURRENT SOURCE, P CHANNEL DEVICES
I3	CURRENT SOURCE, WILSON CURRENT SOURCE
DA1	4 BIT D/A CONVERTER, EXPANDABLE
AD1	4 BIT A/D CONVERTER, EXPANDABLE
VR1	BAND GAP VOLTAGE REFERENCE

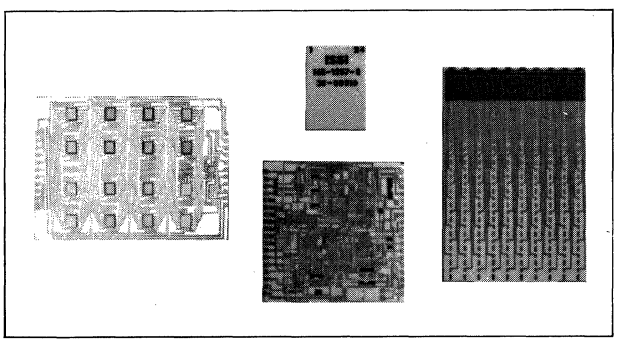
INTERNATIONAL SENSOR SYSTEMS INC.

P.O. Box 345 - Industrial Park - Aurora, NE 68818 - Telephone (402) 694-6111

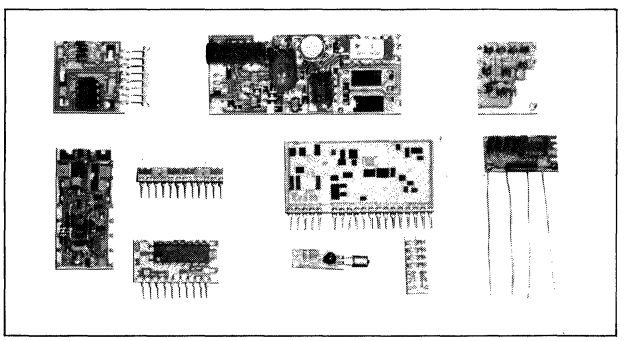
HYBRID THICK FILM TECHNOLOGY

FEATURES

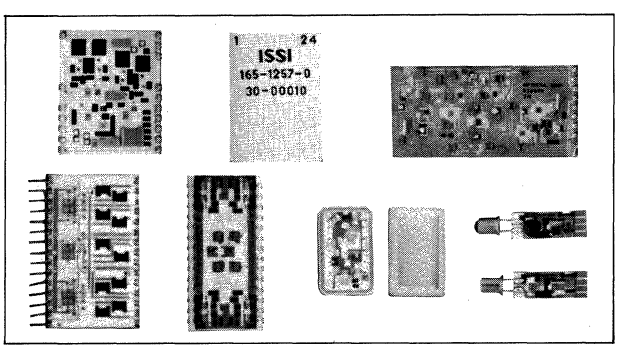
- one time insertion costs
- functional modularity
- high quality components
- compact
- low profile
- low mass
- high performance
- small
- extreme temperature operating range
- military specification capabilities



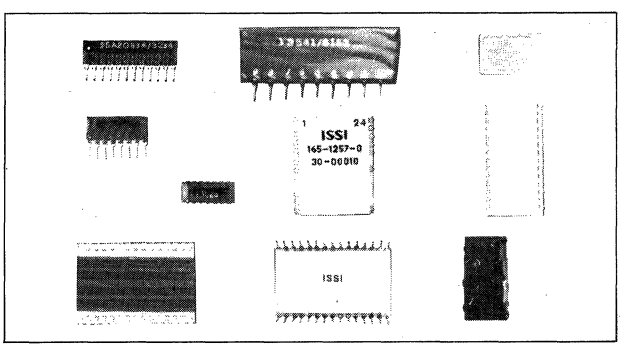
METALIZED SUBSTRATES — Simple or complex, single or multi-layer conductor patterns with Pd. Ag (Palladium Silver), Pt. Ag. (Platinum Silver), Au, (Gold), Pt. Au. (Platinum Gold) inks. Insulation with high temperature glass dielectric or low temperature glaze. Film Resistors from 1 ohm to 150 megohm, tolerances to ±0.1%, T.C.R. to 50 ppm, 1/10 w to 10 watt power dissipation, laser or abrasive trimming.



SOLDER REFLOW TECHNOLOGY — Compact networks with thick film resistors, IC packages, chip capacitors, inductors, discrete components, SOT package, diode bridge assembly, high and low temperature solder, standard or custom pinouts. Special devices with photo-transistors, LED's and functional sub-assemblies.



CHIP AND WIRE TECHNOLOGY — Microcircuit assembly of functional thin film integrated circuit or component chips into operational devices. All available IC & component chips assembled to a thick film circuit by solder or epoxy bonding. Chips wired into circuit with either gold or aluminum wire. (Thermocompression or thermosonic wire bonding). Special handling for static control. Components actively or passively trimmed to guarantee functional specifications.



CUSTOM PACKAGES — Single-in-line or Dual-in-line pinout packages, conformally coated, metal can, plastic or ceramic covered and sealed. Customer markings as well as manufacturer's identification for traceability. Leak tested, temperature cycling and burn-in before final test to insure reliability. Heat sink attached to either alumina or beryllium oxide to obtain maximum power dissipation.

TECHNICAL SERVICES

• Circuit design • layout (including conversion of existing circuitry to thick film technology) • material selection • rubylith production • screen fabrication • product tooling • product testing • and building to print. Testing includes functional electrical and mechanical parameters • burn-in • leak testing • and temperature cycling.

APPLICATIONS

• Memory • logic • linear circuits • A-D • D-A • timing • filters • isolation • pulse shaping • impedance matching • signal generation • switching • sequencing • and many other medium range energy dissipation functions or a combination thereof.

ISSI MILITARY SPECIFICATION CAPABILITIES

MIL-I-45208 Inspection System Requirements
MIL-C-45662 Calibration System Requirements
MIL-STD-883 Test Methods & Procedures for Microelectronics
Certificate of Compliance furnished upon request.

LEACH® CONTROL PRODUCTS DIVISION — HYBRID CIRCUITS

65 YEARS OF EXCELLENCE . . . . .

LEACH, CPD has consistently demonstrated its excellence in the design, development and manufacture of high quality, thick film hybrid microcircuits for aerospace, military and industrial applications. These high reliability hybrids are currently used on the Space Shuttle, B-1B, navigation satellites, missiles, numerous airborne systems and other demanding applications.

LEACH continues its committment to excellence thru:

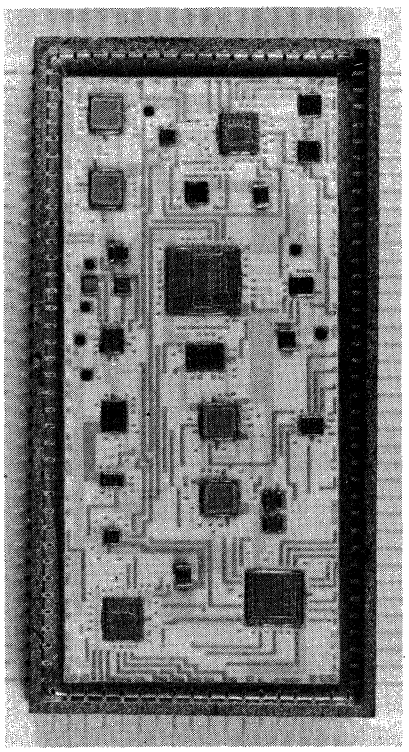
DESIGN: ..... Proven excellence in the design of multi-layer hybrids using both analog and digital integrated circuits, with "State of the Art" products for 1553B Data Bus requirements, crystal controlled programmable timing arrays, low noise pre-amps, and line drivers satisfy the most exacting applications. Customers are provided with engineering assistance for hybrid circuit applications, specification requirements, and circuit design.

MANUFACTURE: .... Fabrication to the most exacting NASA and military specifications. Production can handle both high volume commercial and high reliability space and military projects.

QUALITY ASSURANCE ..... Established to a MIL-Q-9858 level, the quality program is upgraded to meet or exceed those requirements relative to MIL-M-38510.

TESTING ..... Testing capabilities include complete automated electrical testing from chip probing to computerized functional device testing. In addition, LEACH has the ability to perform shock, vibration, thermal cycling and other appropriate screens to meet MIL spec requirements.

FOR MILITARY/ AEROSPACE AND HIGH RELIABILITY INDUSTRIAL APPLICATIONS



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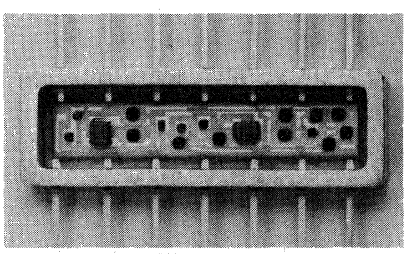

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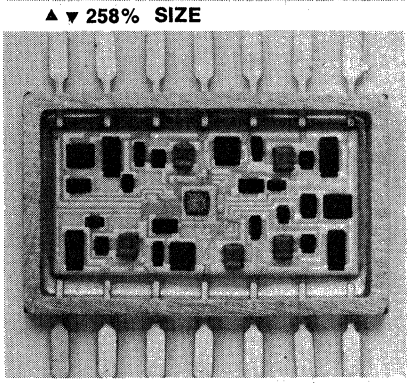

SEND YOUR DRAWINGS AND SPECIFICATIONS OR CALL THE LEACH SALES DEPARTMENT FOR IMMEDIATE ASSISTANCE AND/OR PRODUCT INFORMATION.

CRYSTAL CLOCK OSCILLATORS

Please turn to the Leach page in this volume of EEM (Section 2300) for a description of Leach Crystal Clock Oscillators. These high reliability products offer the highest quality at competitive prices and with excellent delivery.

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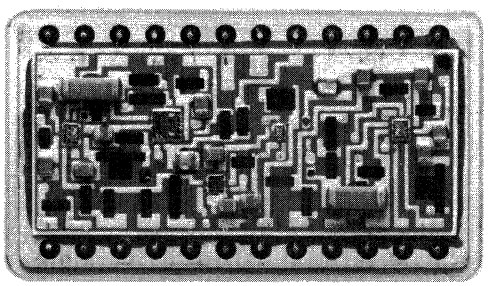
LEACH® CONTROL PRODUCTS DIVISION — HYBRID CIRCUITS

LEACH Control Products Division — a complete hybrid micro-electronics manufacturer dedicated to forwarding advances in custom hybrid circuits, crystal clock oscillators, and frequency related products.

EXPERIENCE

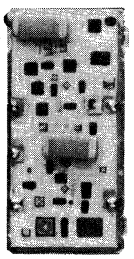
We're a hybrid ourselves, an organization built on more than 65 years of electronic experience and performance in major programs like the Space Shuttle and the B-1B, and for tomorrow's sophisticated industrial, military and aerospace applications.

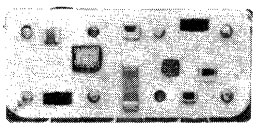


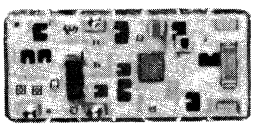
We represent progress — the kind of progress that makes reliability second nature. Progress that produces MIL-approved quality second to none.

CAPABILITY

One of the secrets to our success is our in-depth house design and manufacturing capability — a state-of-the-industry capability that has kept LEACH on the forefront of advanced microelectronics technology for more than a decade. Our 110,000 square foot facility houses a full complement of services: Design, Engineering, Manufacturing, Production, Environmental Testing, Quality Assurance and Program Management. Each coordinated for optimum quality and efficiency. Each integrated to guarantee project control. With certified clean room, inspection, and manufacturing capability, automatic testing, automatic wire bonding, auto laser trim, beam welding, and computerized production and inventory control.







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We've designed circuits with seven metalization layers — with package density as high as 40 components per square inch. Metal and ceramic packages, TTL, MOS, ECL, CCD, bi-polar, and gate array technologies. Digital and analog frequencies. Thick and thin film.

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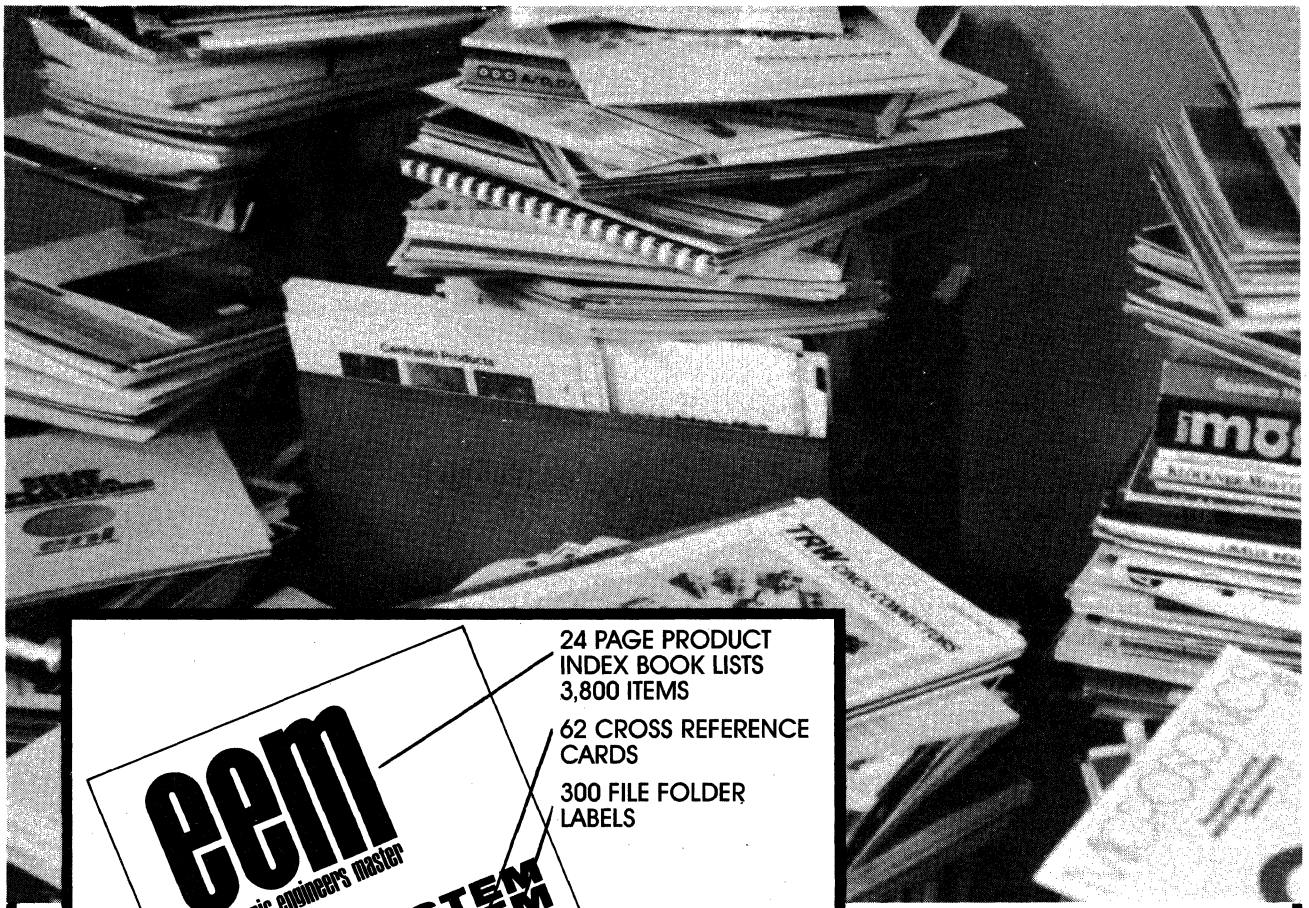

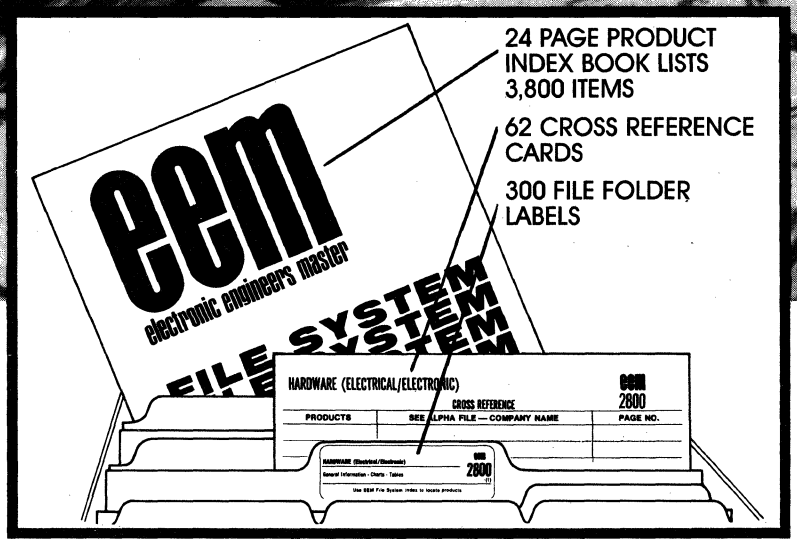

24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS

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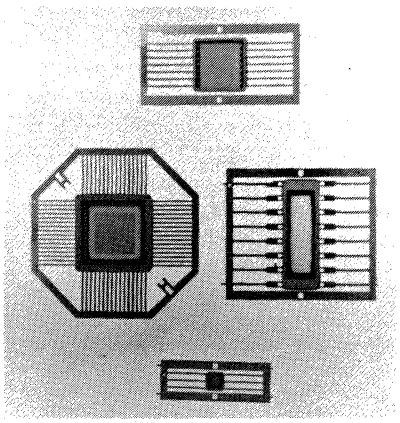
GLASS FLATPACKS & CHIP-CARRIERS



- Most economical means of hermetically enclosing small hybrids
- Easily and economically customized to your needs
- Meet MIL-M-38510 requirements
- Sealed by reflow soldering with combination lids

SELECTION GUIDE

Case Size: Flatpack — case sizes ⅛″ x ⅛″ to 1″ x 1″; Dual-In-Line — case size ¼″ x ¾″

Glass Free Area: Flatpack — .040″ x .070″ to .810″ x .810″

Number of Leads: 1 to 84, depending on case size

Lead Centers: .050″, .040″, .030″, or as specified

Configuration: Leads and pads on 2 sides; Leads on 2 sides; Pads on 4 sides; Leads and pads on 4 sides

Base Material: Metal, ceramic, or beryllia

Plating: Gold or Nickel, all over or selective

AVAILABILITY

Popular Packages — 2 weeks

Custom Packages — 8 weeks

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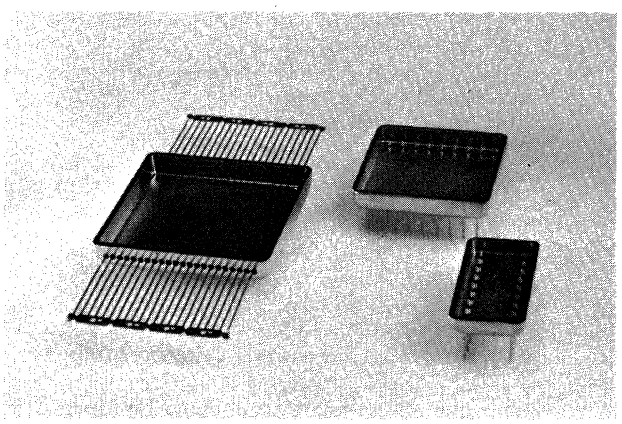
METAL PLUG-INS AND FLATPACKS



- Strongest and most reliable means of enclosing all size hybrids
- Package variations available built to your requirements
- Meet MIL-M-38510 Class S and all highest reliability requirements
- Sealed by seam welding with stepped lids or reflow combination lids

SELECTION GUIDE

Case Size: Plug-In and Flatpack case sizes ranging from .380″ x .625″ to 1.970″ x 2.970″

Number Pins/Leads: 1 to 188, depending on case size

Pin/Lead Centers: .100″ Plug-In; .050″ Flatpack

Configuration: Pins/Leads on 1, 2, 3, or 4 sides

Plating: Gold or Nickel, all over or selective

AVAILABILITY

Tooled Packages — 4 weeks

Custom Packages — 10 weeks

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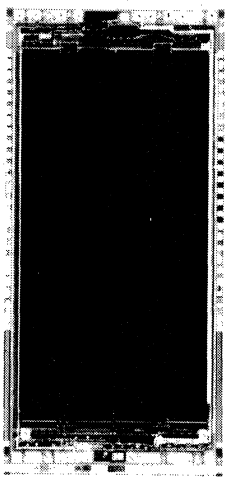
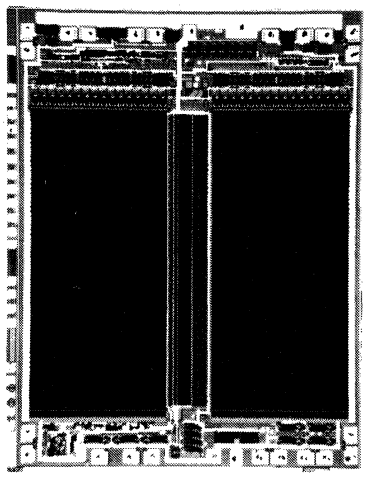
MEMORIES

MCM6257
256K Dynamic RAM



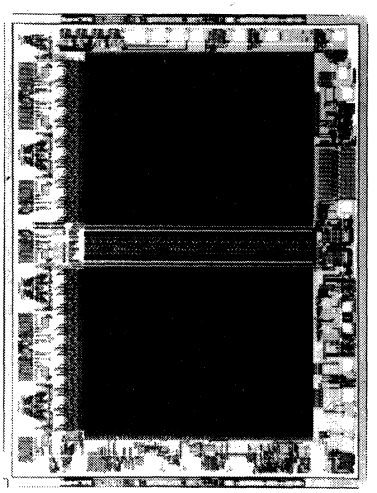
Organization — 262,144 x 1
Access Times — 100, 120 or 150 ns (Max)
Nibble Mode Access Time — 20 ns
Supply Current — 70 mA (Max) Active

MCM2016H
16K Static RAM



Organization — 2048 x 8
Access Time — 45, 55, or 70 ns (Max)
Supply Current — 150 mA (Max) Active

MCM2833
32K EEPROM



Organization — 4096 x 8
Access Time — 150 and 200 ns
Supply Current — 125 mA (Max) Active

As one of the foremost manufacturers of microcomputer components, Motorola also serves the industry with memory products that satisfy the entire spectrum of potential applications requirements.

Random Access Memories (RAMs)

NMOS — Dynamic

High speed, high density and low cost have made N-Channel HMOS dynamic Random Access Memories the cornerstones of the expanding computer industries. Motorola HMOS RAMs combine high performance with excellent reliability and offer state-of-the-art chip densities. The basic memory chips defined below, together with their variations, represent the leading edge of today's memory capabilities.

Organization	Part Number	Available Access Time (ns Max.)
16K x 1	MCM4517	100, 120, 150
64K x 1	MCM6665B	150, 200
	MCM4164B	150
256K x 1	MCM6256/ MCM6257	100, 120, 150

NMOS — Static

Fabricated with Motorola's high-performance silicon-gate MOS (HMOS) technology, these static RAMs offer the most popular memory organizations with RAM capacity up to 16K bytes. All operate from a single 5.0 V supply and are TTL compatible.

Organization	Part Number	Available Access Time (ns Max.)
128 x 8	MCM6810,A10,B10	450, 360, 250
1K x 4	MCM2114/21L14	200, 250, 300, 350
2K x 8	MCM2016H	45, 55, 70
16K x 1	MCM2167H	35, 45, 55
2K x 8	MCM2018	35, 45
	MCM2128	100, 120, 150

CMOS — Static

Motorola CMOS memories are fabricated with a high-performance silicon-gate CMOS technology and designed with chip-enable circuitry which reduces the inherent low power dissipation of CMOS still further during standby operation.

Organization	Part Numbers	Available Access Time (ns Max.)	Power Diss. Active/Standby (mA Max.)
4K x 1	MCM6147/ MCM61L47	55, 70	35/12
4K x 4	MCM6168 MCM6169 MCM6178	45, 55, 70	80/20
8K x 8	MCM6164	45, 55, 70	80-70-60/20
16K x 4	MCM6288	35, 45, 55	50/5
64K x 1	MCM6287	35, 45, 55	50/5

Bipolar Dynamic — ECL10K/10KH

Emitter-coupled logic (ECL) represents today's fastest logic form; ECL memories complement this characteristic. Motorola ECL RAMs are available to match the speed capabilities of the ECL10K and 10KH logic families, the two most pervasive ECL lines available.

Organization	Part Numbers	Access Time (ns Max.)
8 x 2 Multiport Register File	MCM10143	15
16 x 4 Register File	MC10H145	6.0
64 x 1	MCM10148	15
128 x 1	MCM10147	15
256 x 1	MCM10144	26
1K x 1	MCM10415-15/-20	15, 20
256 x 4	MCM10422-10/-15	10, 15
4K x 1	MCM10470-15/-25	15, 25
1K x 4	MCM10474-15/-25	15, 25

TTL

Fully compatible with all standard TTL logic families.

Organization	Device Type	Access Time (ns Max.)	Power Dissipation (mW Typ)
1K x 1	MCM93415/25	45	775
256 x 4	MCM93422	45	775
	MCM93422A	35	
	MCM93L422	60	
	MCM93L422A	45	

Read Only Memories (ROMs)

NMOS Mask Programmable ROMs — Factory programmed to user specifications, except (*) preprogrammed as indicated and MCM68768 which is programmed electrically at the test site.

Organization	Part Numbers	Access Time (ns Max.)
2K x 8	MCM68A316E	350
4K x 8	MCM68A332	350
8K x 8	MCM68364/65/66 MCM68369/70	200, 250, 300, 350
	MCM68768	300, 350
16K x 8	MCM63128	150, 175, 200
32K x 8	MCM63256	150, 175, 200

CMOS Mask Programmable ROMs

High capacity and low power consumption are typical of complementary MOS Read Only Memories. Single 5.0 V supply operation. Available with 2K x 8 and 32K x 8 organization.

Special Purpose Memories

NMOS ROM/EEPROMS — MCM6836E16/R16

Nonvolatile N-Channel 114K x 8 MOS Read Only Memory combines with a 2K x 8 EEPROM offering user reprogrammability of a portion of the memory during use. Electrically erasable, the unit can be in-system reprogrammed. Industry standard pinout makes the device compatible with 128K bit ROMs and EPROMs.

HMOS EEPROM — MCM2833

An Electrically Erasable 4K x 8 Programmable Read Only Memory (EEPROM) designed for applications requiring both nonvolatile memory and in-system reprogramming. This device is fabricated using Motorola's FET MOS (Floating-gate Electron Tunneling MOS) technology.

CMOS EPROM — MCM67256

Erasable and reprogrammable ROM designed for systems requiring high speed and low power consumption. It is organized in a 32K x 8 configuration with access times of 150 and 200 ns.

NMOS EPROMS — MCM68764/766

Erasable (ultraviolet light) and reprogrammable Read Only Memory designed for system prototyping, debug and similar applications requiring nonvolatile memory that can be reprogrammed periodically. 8K x 8 organization.

MOS PROM — MCM68769

This One-Time Programmable ROM is designed for high volume productions requiring non-volatile memory. The 8K x 8 PROM is available with access times of 300 and 350 ns.

MOS DUAL-PORT RAM — MCM68HC34

Dual port RAM enables two microprocessors operating on separate buses to exchange information without interfering with other devices on the bus. 256 x 8 organization.

Available Literature

DL113 — This data book on memories offers complete specifications for Motorola's extensive line of MOS, MECL, TTL and bubble memories.

This Literature is available free from your nearest Motorola Sales Office or Distributor. With new memory products being introduced continually, the reader is advised to contact a Motorola Sales Office or Distributor for possible additional product offerings.

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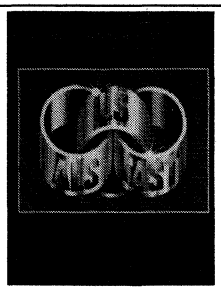
STANDARD LOGIC PRODUCTS

LSTTL:	SN54/74LS Series	**MECL10K:**	MC10000 Series	**Standard CMOS:**	MC14000 Series
ALSTTL:	SN54/74ALS Series	**MECL10KH:**	MC10H000 Series	**High-Speed CMOS:**	MC54/74HC Series
FAST™:	MC54/74F Series	**MECL III:**	MC1600 Series		

The variety of established and newly introduced logic families challenges the system designer with choosing the best available technology for each design. Each family offers distinct advantages and limitations.

The three most often used characteristics for determining family selection are propagation delay, operating frequency, and power consumption. For Motorola logic families, these characteristics are defined and compared in the information below. And for each logic family Motorola offers a large selection of components ranging from simple SSI gates to complex MSI and LSI circuits.



DL121R1

Schottky TTL

For many years, Transistor-Transistor Logic (TTL), specifically the 54/74 TTL series, has been the dominant logic family for general-purpose applications. Within the last few years, low-power Schottky (LSTTL) has taken over, replacing the original 54/74 series with lower power and higher speed. The latest in this progressive logic series are the Advanced Low-Power Schottky (ALSTTL) family and the FAST™ Schottky TTL series.

The **Low Power Schottky (LSTTL)** family combines a current and power reduction improvement over standard 54/7400 TTL by a factor of 5. This is accomplished by advanced processing and by using Schottky diode clamping to prevent saturation.

The **Advanced Low Power Schottky TTL** family (ALSTTL) provides a 50% power reduction compared to standard 54/74 LSTTL and yet offers improved circuit performance over standard LS due to Motorola's state-of-the-art oxide isolated process (MOSAIC). ALS also differs from LS in that PNP transistors on the input stage are utilized to lower input currents and raise thresholds.

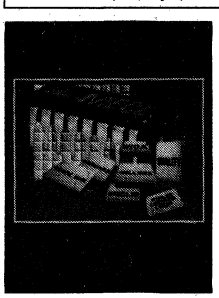
The **FAST Schottky TTL** family provides a 75–80% power reduction compared to standard Schottky (54/74S) TTL and yet offers a 20–40% improvement in circuit performance over the standard Schottky due to the MOSAIC process. Also, FAST circuits contain additional circuitry to provide a flatter power/frequency curve. The input configuration of FAST uses a lower input current which translates into higher fanout.

Speed/Power comparisons between these three families are as follows:

SPEED/POWER CHARACTERISTICS FOR SCHOTTKY TTL LOGIC

(ALL TYPICAL RATINGS)

Characteristic	LS	ALS	FAST
Quiescent Supply Current/Gate (mA)	0.4	0.2	1.1
Power/Gate (Quiescent) (mW)	2.0	1.0	5.5
Propagation Delay (ns)	9.0	7.0	3.7
Speed Power Product (pJ)	18	7.0	19.2
Clock Frequency (D-F/F) (MHz)	33	35	125
Clock Frequency (Counter) (MHz)	40	45	125



DL122R1

MECL (ECL)

Motorola's Emitter Coupled Logic (MECL) is a nonsaturating form of digital logic which eliminates transistor storage time as a speed limiting characteristic, permitting very high speed operation.

There are three versions of MECL: MECL 10K, MECL 10KH, and MECL III.

The *MECL 10K* series has become the industry standard for high-speed applications. In order to make the circuits comparatively easy to use, edge speed was slowed to 2.0 ns while the important propagation delay was held to 2.0 ns. The slow edge speed permits use of wire-wrap and standard printed circuit lines; however, the circuits are specified to drive transmission lines for optimum performance.

The newer *MECL 10KH* family features 100% improvement in propagation delay and clock speeds while maintaining power supply current equal to MECL 10K. This new MECL family is voltage compensated which allows guaranteed dc and switching parameters over a ±5% power supply range. Noise margins of MECL 10KH are 75% better than the MECL 10K series. MECL 10KH is compatible with MECL 10K and MECL III, a key element in allowing users to enhance existing systems by increasing the speed in critical timing areas.

MECL III, with its 1 ns gate propagation delays and greater than 1 GHz flip-flop toggle rates, remains the industry speed leader. The 1 ns rise and fall times require a transmission line environment for all but the smallest systems. For this reason, all circuit outputs are designed to drive transmission lines and all output logic levels are specified when driving 50-ohm loads. Because of MECL III's fast edge speeds, multilayer boards are recommended above 200 MHz. MECL III's popularity is with high-speed test and communications equipment.

Speed/power comparisons for Motorola ECL families are as follows:

SPEED/POWER CHARACTERISTICS FOR (MECL)

(ALL TYPICAL RATINGS)	MECL 10K				10KH	III
Characteristic	**MC101xx**	**MC102xx**	**MC105xx**	**MC106xx**	**MC10H1xx**	**MC16xx**
Quiescent Supply Current/Gate (mA)	5.0	5.0	5.0	5.0	5.0	10
Power/Gate (Quiescent) (mW)	26	26	26	26	26	54
Propagation Delay (ns)	2.0	1.5	2.0	1.5	1.0	1.1
Speed Power Product (pJ)	52	39	52	39	26	59
Clock Frequency (D-F/F) (MHz)	150	225	150	225	300	550
Clock Frequency (Counter) (MHz)	150	—	150	—	300	1200

DL130

CMOS

Complementary MOS (CMOS) technology provides the lowest power consumption logic circuits available in the industry.

Motorola offers two versions of CMOS logic circuits: *Standard CMOS* in metal gate technology, and *High-Speed CMOS* in silicon gate technology.

Standard CMOS logic is best suited for systems which require low power and low-to-medium speed (1 MHz) operation. Some devices are available in both B and UB series, as designated by EIA/JEDEC specifications. UB series gates and inverters are constructed with a single inverting stage between input and output, as opposed to multiple gain stages in the B series. The subsequent decreased gain in the UB series results in less noise immunity; however, these UB devices are useful when CMOS gates and inverters are used in a "Linear" mode to form oscillators, monostables, or amplifiers. These devices also exhibit higher speed since only a single stage is involved.

SPEED/POWER CHARACTERISTICS FOR CMOS LOGIC

(ALL TYPICAL RATINGS)

Characteristic	Standard CMOS	Hi-Speed CMOS
Quiescent Supply Current/Gate (mA)	.0001	.0003
Power/Gate (Quiescent) (mW)	.0006	.001
Propagation Delay (ns)	125	8.0
Speed Power Product (pJ)	.075	.01
Clock Frequency (D-F/F) (MHz)	4.0	40
Clock Frequency (Counter) (MHz)	5.0	40

The new High-Speed CMOS family consists of a full-line of products that are pinout compatible with the most popular LSTTL and MC14000B Standard CMOS series parts. The latest silicon-gate processing technology allows the High-Speed CMOS family to combine the switching speeds and operating frequencies of LSTTL with the low power-consumption advantages of CMOS. The devices feature the high noise immunity that is characteristic of CMOS, and a wide power-supply operating range (2 to 6 volts).

High-Speed CMOS logic circuits may interface with LSTTL circuits directly when driving, and through a level shifter when being driven. The latter is due to the selection of slightly different threshold voltages for the High-Speed CMOS than those of LSTTL to provide higher DC Noise Margins.

Speed/power comparisons between the two CMOS families are as follows:

Available Literature

DL121R1/D — The Schottky TTL Data Book provides complete data sheets on Motorola's TTL devices while functioning selector guides provide an overview of all available devices, plus an advanced look at new products.

DL122R1/D — The MECL Device Data Book contains technical data on Motorola's high-speed ECL ICs in the form of data sheets, selector guides and quality and reliability chapters.

HB205R1/D — The MECL System Design Handbook contains information on the special design considerations needed when utilizing MECL digital logic. This handbook introduces all the MECL digital logic. This handbook introduces all the MECL Families, the design rules, printed circuit considerations, system interconnections, power distribution, thermal characteristics, transmission line theory, and a variety of MECL applications.

DL131/D — The MOS Metal Gate Logic Data Book (due 3Q '85) contains technical data in the form of complete data sheets and mechanical data.

DL129/D — The High-Speed CMOS Logic Data Book provides complete technical information on Motorola's High-Speed silicon-gate CMOS Logic Family.

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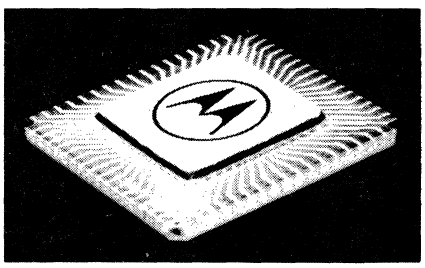
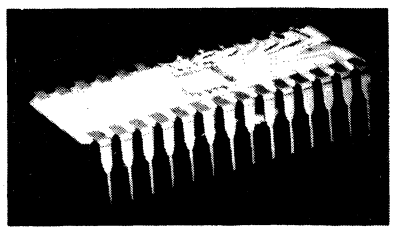
SEMICUSTOM LOGIC MACROCELL ARRAYS

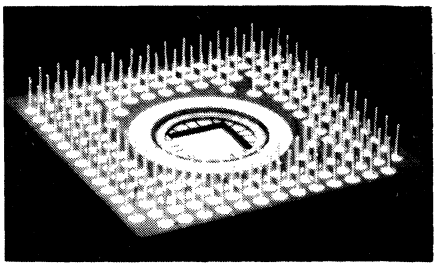
Typical Array Packages



Leadless chip carriers



Dual in line packages



Pin-arrays

The Practical Way To (Semi) Custom VLSI Designs . . . In Three Uniquely Compatible Technologies.

Motorola Macrocell Arrays represent a practical means for gaining the benefits of custom VLSI designs without the accompanying quantity and time constraints.

The Macrocell Array is an advanced form of gate array in which a computer-stored library of optimized logic circuits such as gates, flip-flops, counters, etc. take the place of simple gates as building blocks for VLSI circuit design. The ingredients (transistors, resistors, etc.) for fashioning the basic circuits are prediffused into selective regions of the silicon chip. By assigning a circuit function from the library to each of these selective regions, the designer can request the computer to convert these ingredients into the desired functions and, subsequently, to produce a mask set that will connect these functions into a working VLSI circuit.

To the user, the benefits of semi-custom VLSI designs with Macrocell Arrays are impressive:

Compared to equivalent designs made of standard SSI/MSI circuits, the Macrocell approach results in improved performance due to the reduction of propagation delays, and an improvement in reliability because of the lowered package count.

Compared with custom VLSI circuits, the Macrocell approach, with its proven computer-aided design system, considerably reduces product development time and tooling costs. This allows the profitable manufacturing of small quantities of end-use products rather than the tens-of-thousands of end-use products required to justify travelling the full custom route.

Motorola Macrocell Arrays give the designer the same choice of process technologies that are available for discrete-logic designs.

- For very high speed requirements, there is ECL technology.
- For the pervasive TTL market, there is ALS-TTL technology.
- And for applications demanding very low power consumption, there is high-speed, high-density CMOS (HCMOS) with its current 2 and 3 micron silicon-gate technology.

To permit cost-effective implementation, Motorola Macrocells are stocked in a variety of prediffused array sizes to permit the optimized utilization of die space for varying VLSI circuit complexities.

Motorola Macrocell Array Families

Array Type	No. of Gate Equivalents	Toggle Freq. (max)	Power Diss. (w)
ECL			
MCA600ECL	652	160	2.2
MCA1200ECL	1192	160	4.0
MCA2500ECL	2472	400	6.5
TTL			
MCA500ALS	533	80	1.0
MCA1300ALS	1280	80	1.4
MCA2800ALS	2720	125	3.5
MCA2800RAM	1800 w/16x8 multiport RAM		3.0
ECL/TTL			
MCA2900ETL	2958	125	4
HCMOS			
3 Micron Silicon Gate			
HCA6306	648	70 typ.	Low
HCA6312	1200	70 typ.	Low
HCA6324	2295	70 typ.	Low
HCA6348	4860	70 typ.	Low
HCMOS			
2 Micron Silicon Gate			
HCA6225	2430	85 typ.	Low
HCA6238	3699	85 typ.	Low
HCA6248	4860	85 typ.	Low

Available Literature

BR107/D — The MECL 10,000 Macrocell design manual contains all the information necessary to transform a system into VLSI logic designs utilizing the high-speed MECL 10,000 — compatible MCA600ECL and MCA1200ECL Macrocell Arrays.

BR165/D — The MCA2500ECL Macrocell Array design manual explains the logic design characteristics, performance guidelines, and CAD layout considerations while offering the designer the specifications necessary to meet design requirements.

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INTERFACE CIRCUITS

The economics of semiconductors prohibits the specific tailoring of integrated circuits — except custom and semi-custom circuits — to the vast variety of potential end uses. Most commonly, off-the-shelf circuits, even MSI and LSI circuits, are designed to perform a major generic function that can be adapted to numerous applications. Direct adaptation to specific peripherals or ancillary circuits is then performed by appropriate interface circuits.

A few potential interface requirements may demand custom interface designs. Most, however, are served adequately by a variety of standardized interface ICs.

Motorola's line of off-the-shelf interface circuits marries peripherals and memories to microcomputers, and instruments and microprocessors to their respective bus systems. It provides the matching and level translation between various logic families and technologies, and the conversion from digital-to-analog signal requirements. In short, by satisfying these requirements with standard, off-the-shelf components, it offers time- and cost-saving alternatives to custom interface circuit designs.

MOTOROLA INTERFACE CIRCUITS . . . IN BRIEF

Memory Interface

Floppy Disk Write Controller/Head Driver System provides the entire interface between floppy disk heads and the head control signals.

For Straddle Erase Heads — MC3469P
For Tunnel or Straddle Erase System — MC3471P

Floppy Disk Read Amplifier System for obtaining digital information from floppy disk storage. Provides all active circuitry to perform the read amplifier function on a single chip.
MC3470

Sense Amplifier for Magnetic Tape Memories provides three independent preamplifiers with individual electronic gain control. Optimized for 9-track magnetic tape memory systems where low noise and low distortion are paramount objectives.
MC3467

Microprocessor Bus Extenders

Address Bus Extender expands the drive capabilities of today's standard 8-bit microprocessors. Provides six unidirectional buffers to interface between the MPU and its address and control bus. High impedance input prevents bus loading; 40 mA output increases driving power.
MC6885 Series

Data Bus Extender consists of four bidirectional transceivers which provide 48 mA driver and 20 mA receiver outputs. Input current requirement of 200 μA maximum at any pin assures proper operation despite limited drive capability of the MPU.

Line Drivers and Receivers

A variety of drivers, receivers and transceivers provide from two to eight circuits per package for applications including:

IEEE Standard 488, GPIB Instrumentation Bus
IBM 360/370 Computer Interface
EIA Standards
Current Mode Applications
Peripheral Interface

Data Conversion Circuits

Motorola's line of data conversion products spans a wide spectrum of speed and accuracy. Utilization of CMOS and bipolar technologies provide speed-power trade offs. A-D and D-A converters are available in both processes.

Available Literature

DL128/D — The Linear and Interface Integrated Circuits Data Book provides the designer with nine chapters of data sheets on Motorola's extensive line of linear and interface ICs divided by product type for easy reference. Also included in this text are selector guides, package outlines, mounting hardware drawings and abstracts of other available applications literature.

SG96/D — The Linear and Interface Selector Guide and Cross Reference offers complete technical data in the form of an easy-to-use selector guide. The guide is divided by product type for ease of use and contains an extensive industry cross reference.

This literature is available free from you local Motorola Sales Office or Distributor.

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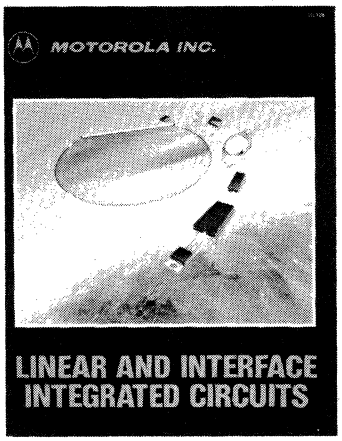
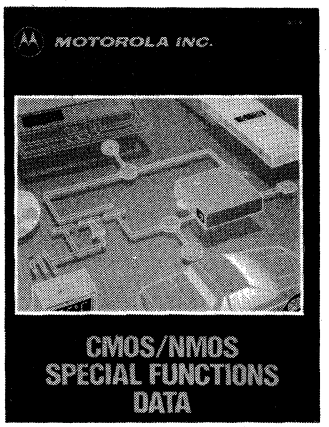
ANALOG CIRCUITS



DL128



DL130

Starting with the now all-pervasive operational amplifiers, linear integrated circuit technology currently influences the design and architecture of equipment for all major markets. Motorola offers analog functions including amplifier circuits, data conversion circuits, comparators, and a host of special-purpose circuits for communications and power control markets.

Operational Amplifiers

From low-cost industry-standard types to high precision circuits, the span of operational amplifiers encompasses a large range of performance capabilities including I_{IB} ranges from 50 pA to 30 μA and open-loop gains from 1.0 to 1000 V/mV min. These linear integrated circuits are available as single, dual, and quad monolithic devices in a variety of temperature ranges and package styles. Most of the devices can be obtained in unencapsulated "chip" form as well.

Analog Amplifiers

Multifunction CMOS amplifiers are available for applications such as active filters, voltage reference circuits, function generators, oscillators, and limit set alarms.

A variety of high-frequency circuits with features ranging from low-cost simplicity to multifunction versatility marks Motorola's line of integrated amplifiers. **AGC amplifiers** include wide-band general purpose and gated 2-channel input amplifiers with gains ranging from 4 dB to 44 dB at bandwidths from 10 MHz to 100 MHz. **Non-AGC amplifiers** are also available.

Consumer Circuits

Also included in Motorola's broad line of analog circuits is an assortment of circuits for consumer applications. These applications include Television, Audio, Radio, and Automotive entertainment applications, and are also involved in RF Modems and Personal Communications.

Data Converters

A line of A/D and D/A converters spans a wide spectrum of speed and resolution/accuracy. Bus compatability minimizes external parts count and provide easy interface to microprocessor systems. Bipolar and CMOS technologies are utilized to achieve functional capability, accuracy and production repeatability. Bipolar technology generally results in higher speed, while CMOS devices offer greatly reduced power consumption.

Analog-to-Digital converters are available with conversion times as low as 50 ns up to 40 ms with resolutions of 7, 8, and 8–10 bits and also 3-1/2 digits. The accuracy ranges from $\pm$1/2 LSB for the 7, 8, and 8–10 bit devices to $\pm$0.05% for the device with a resolution of 3-1/2 digits.

Digital-to-Analog converters range from 6 to 12 bit resolutions with settling times ranging from 10 ns to 1.2 μs. These devices have accuracy ratings from 1/4 LSB to 2.0 LSB. They come with a variety of functions including hex outputs, quad outputs, multiplying, and high speed.

Available Literature

DL128 — The Linear and Interface Integrated Circuits Data book provides the designer with nine chapters of data sheets on Motorola's extensive line of linear and interface ICs divided by product type for easy reference. Also included in this text are selector guides, package outlines, mounting hardware drawings, and abstracts of other available literature.

DL130 — The CMOS/NMOS Special Functions Data book offers technical information on Motorola products that do not lend themselves to inclusion into specific product families. Complete data sheets and various other chapters on handling and design guidelines, reliability, and packaging provide the designer with a handy reference to Motorola's line of special function devices.

SG99 — The CMOS Special Functions selector guide offers a quick reference for designers of systems requiring converters, PLL/frequency synthesizers, drivers or other various control circuits.

This literature is available free from your local Motorola Sales Office or Distributor.

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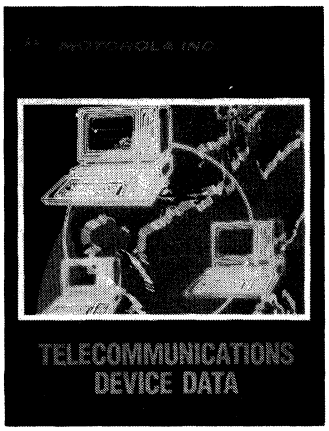
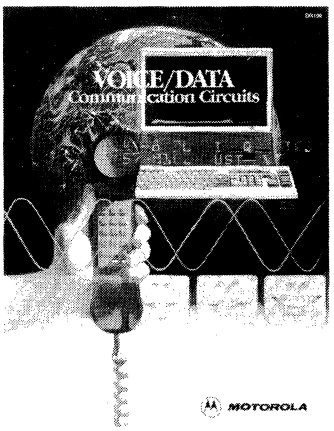
COMMUNICATIONS CIRCUITS

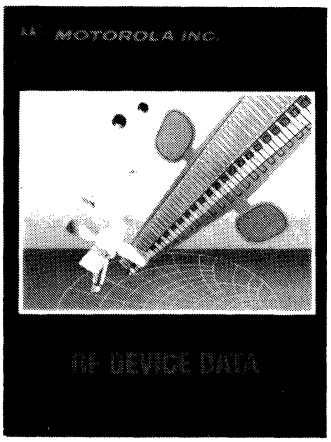


DL136



MOTOROLA BR188

DL110



VOICE/DATA CIRCUITS

An inexpensive family of CMOS ICs provide simultaneous and independent voice/data service over one twisted pair for a distance of up to 2 kilometers (1.3 miles). The MC145422/26 (master and slave Universal Digital-Loop Transceiver) pair operates at 80,000 bits-per-second full-duplex ping-pong in the office or factory environment. A more economical solution, the MC145418/19 (Digital-Loop Transceiver) pair, provides the same service up to one kilometer in distance. The DLT and UDLT solutions are complemented by a family of single-chip PCM codec/filters, the MC14400 series mono-circuits. Also available from Motorola now — the MC145428 (Data Set Interface) and the MC145429 (Telset Audio Interface Circuit). The DSI provides conversion of various asynchronous data rates to the synchronous equivalent, and vice versa. The TAIC provides enhanced digital phone features including volume adjustment for the ringer and earpiece, as well as an external speaker option. All of these ICs are fabricated in the CMOS technology and are available now.

TELEPHONE CIRCUITS

The conventional transformer-driven telephone handset is being replaced with integrated circuits that perform all the major handset functions simply, reliably, and inexpensively.

The MC34010/11 Complete Electronic Telephone Circuits reliably and inexpensively replace such functions as 2-to-4 wire conversion, DTMF dialing, tone ringing and a variety of related activities. All of these capabilities have been placed on a single monolithic chip.

These telephone circuits utilize advanced bipolar linear (I^2L) technology and provide all the necessary elements of a modern tone dialing interface. The MC34010 even incorporates an MPU interface circuit for the potential inclusion of automatic dialing in the final system.

Motorola also offers a broad selection of additional telephone components for customizing systems design . . . from ringer circuits to audio control circuits and dialers.

A two-chip switchable hands-free telephone system — is available, consisting of the **MC34018 Speakerphone** integrated circuit and the **MC34014 Speech Network** with Dialer Interface. This system features adjustable transmit, receive and sidetone gains, loop length equalization for transmit and receive, and an adjustable DTMF output level. The system is also compatible with 150–300 ohm receivers and two terminal electret microphones. The MC34014 offers all necessary level detection and attenuation controls in a single integrated circuit and includes an equalization circuit to compensate for various line lengths. Conversion from 2-to-4 wire is accomplished with line voltages as low as 1.4 volts. Together these two components facilitate the design of a completely hands-free (dialing and speech) telephone system.

PBX Circuits

MC14400 Series PCM Mono-Circuit (Single-Chip Codec/Filter)

Motorola offers five variations of the mono-circuit. These devices provide serial coding and decoding of voiceband and PCM signals which meet Bell and CCITT specifications. The MC14402 is the "top-of-the-line" mono-circuit offering all mono-circuit capabilities in a 22-pin package. The MC14401 is an 18-pin device that simplifies SLIC Interface on the linecard. Additional variations of the mono-circuit include the MC14400, MC14403, and the MC14405 each cased in 16-pin packages.

The Subscriber Loop Interface Circuit (SLIC) family — performs 2-to-4 wire conversion while providing suppression of longitudinal signals at the two-wire input and dc line current for powering the telset. The SLIC family also provides overvoltage protection, ring trip detection and supervisory features such as hook status and dial pulsing.

Modem Circuits

Motorola offers a wide variety of low speed modems, a videotext modem, and a limited distance modem solution.

MC14412/MC14544xx Bell 103 or CCITT V.21 Compatible Modem/Filter Chip-Set — provides low cost 300 baud capability. Implementation of these complementary Motorola filters meet both Bell 103 (MC145440) and CCITT V.21 (MC145441) specifications.

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COMMUNICATIONS CIRCUITS (CONT)

The MC145445/MC14544x Bell 103 or CCITT V.21 Compatible Modem/Filter Chip-Set — is similar to the MC14412, but offers higher performance characteristics. The MC145445 modem includes Request-to-Send and Clear-to-Send handshake functions with eight selectable variations. To meet Bell 103 specifications, the MC145440 filter must be used; whereas CCITT specifications require the MC145441 filter.

The MC145450 Bell 202 or CCITT V.23 1200 Baud Modem — provides the user with Bell 202 or CCITT V.23 video-text capability. In certain applications, the MC145415 (Linear Phase Filter) may be used in conjunction with the MC145450 to achieve a cost effective, two-chip solution.

MC145418/19 Digital-Loop Transceivers MC145422/26 Universal Digital-Loop Transceivers

In addition to the voice/data features, the DLT and UDLT are capable of offering one and two kilometers, respectively, point-to-point or limited distance modem capabilities for private premise applications; that is, office or factory environments. When teamed with the MC145428 (DSI), the DLT or UDLT pair can multiplex up to eight 9600 baud channels per transceiver pair.

MC145406 RS232-C or V.28 Driver/ Receivers

A new product for 1985 is Motorola's MC145406. This device houses three driver and three receiver pairs in a single-chip CMOS solution. The drivers can operate at ±5 volts to ±12 volts and the receivers at ±25 volts.

The MC145411 Bit Rate Generator — employs a frequency divider network, which in turn provides a wide range of output frequencies. The internal oscillator crystal is the clock source for the network and maintains stability up to four megahertz. This CMOS device provides sixteen different output clock rate options. This device is a 16-pin version of the MC14411, 22-pin package and was designed to optimize customer costs.

RF COMMUNICATIONS CIRCUITS

Recent advances in RF communications include both the proliferation of cordless telephones and the development of cellular radio networks. In addition to these new product lines, Motorola offers the circuits for the traditional communication bands. These products range from applications-dedicated components to a wide assortment of integrated circuits for phase lock loop tuning systems.

Applications-Dedicated Circuits

Many different components are dedicated for specific applications. Among these are three hybrid amplifier modules fully characterized for **800 MHz cellular mobile radio** applications. The MHW808 series has a typical output power of 7.5 W, a typical power gain of 25 dB, and an automatic gain control over a 35 dB range in output power.

The MC1376 is a **voltage-controlled oscillator/ modulator** circuit designed for the base station of a **cordless telephone** operating at 1.76 MHz. Its frequency range of 1.4 to 14 MHz makes it equally suitable as a 4.5 or 5.5 MHz intercarrier sound modulator for TV signal generation.

The MC3357/3359/3361 are FM IF circuits used principally in **noise-activated band-scanning receivers.** The input frequency is mixed with an oscillator signal to provide a 455 kHz IF. The audio is recovered with a conventional quadrature FM detector and the "noise," which indicates the absence of an input signal, is used to control scanning.

Motorola also offers analog mixers, balanced modulator-demodulators, and a wideband FSK receiver to round out the selection.

Phase-Locked-Loop Frequency Synthesizers

A choice of phase-lock-loop components ranging from complete, functional PLL circuits for dedicated applications to a wide selection of basic PLL circuit elements is available. **Full functional phase-locked-loops** include devices having serial and parallel inputs, as well as 4-bit data inputs for MPU data-bus interfacing. Options include single or dual-modulus capability, transmit/receive offsets, choice of phase detectors and choice of reference/divider integer values. **Basic PLL building-block circuits** include a large variety of counters and prescalers and other integral functions such as oscillators, phase detectors and control circuits.

General purpose PLLs are available for applications including CATV, AM/FM Radio, Two-Way Radio, TV Tuning, Scanning Receivers, and Amateur Radio. Common characteristics for this family of PLLs include 3.0 to 9.0 Vdc Supply Range, On- or Off-chip Reference Oscillator Operation, Lock Detect Signal, and Single-Ended or Double-Ended Error Signal Option. These devices utilize CMOS technology for very low power consumption and are available with a wide range of inputs and divider options that make each device uniquely qualified for a specific end use.

Available Literature

DL136 — The Telecommunications Device Data book pulls together all data sheets concerning Motorola CMOS and Bipolar ICs which are dedicated to applications in telecommunications. The product data sheets are supplemented by over 100 pages of applications information and additional chapters on reliability, handling and design guidelines, and mechanical data.

DL110 — The RF Device Data book provides the specifications on over 500 of Motorola's RF products, including telecommunications devices, along with 19 applications notes, 22 engineering bulletins, and chapters on reliability and general technical information.

BR188 — The Voice/Data Communications Circuits brochure offers a more complete look at Motorola's voice/data ICs with block diagrams of basic circuits, and circuit features and specifications.

This literature is offered free from your local Motorola Sales Office or Distributor.

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POWER SUPPLY/ POWER CONTROL CIRCUITS

POWER SUPPLY CIRCUITS

Power Supplies have changed . . . and are still changing. Today's sophisticated computing equipment no longer tolerates the output voltage and current swings that were acceptable to the less demanding applications of yesteryear. The shrinking space requirements for electronic equipment, made possible by LSI and VLSI circuitry, demand equivalent size and weight reductions for power supplies, and the ever-present pressure on costs poses a continual challenge to circuit designers and component suppliers. The development and rapid penetration of switching power supplies attest to the success of designers in meeting the challenge. The increased component complement for these designs indicates that component suppliers are keeping pace.

Since the inception of solid-state technology, Motorola's product portfolio supported the advance of power-supply design trends. From the first pressfit rectifiers (whose low cost precipitated the switch from the generator to the alternator in automotive applications) to the SMARTpower concept implemented first in power-supply regulator and supervisory components, Motorola has provided the means with which to implement the designer's plans. The wealth of integrated circuits dedicated to power-supply applications include ***voltage regulators*** *and* ***voltage references*** *as well as power supply* ***supervisory and control circuits.*** *These are detailed in the literature indicated here.*

Accompanying rectifiers, zeners, power and small-signal transistors that round out the requirements for today's designs are described in the Discrete Components section of this catalog. Together, these products represent the most complete and most competitive power-supply component lines available from the industry.

Voltage Regulators

Fixed Output Voltage Regulators — are offered as low-cost, monolithic circuits for positive and/or negative regulation of output voltage from 2 volts to 24 volts, at currents from 100 mA to 3.0 A. SOP-8 and D-pack versions are ideal for on-card regulation of subsystems.

Adjustable Output Voltage Regulators — are available for regulation of positive and/or negative voltages ranging from 1.2 V to 37 V, at currents from 100 mA to 3.0 A.

Switching Regulators — are used as control circuits in pulse-width modulated, push-pull, bridge and series type switchmode supplies. These devices include the reference oscillator, pulse width modulator, phase splitter and output sections. Frequency and duty cycle are also independently adjustable. Current range — 40 mA to 1.5 A; VCC range — 1 V to 40 V; Frequency range — 0.1 to 400 kHz.

Floating Voltage and Current Regulators and Dual ±15 V Tracking Regulators. The Floating Voltage and Current Regulator's voltage is limited only by the break down voltage of associated external, series-pass transistors. The Dual ±15 V Tracking Regulator, designed for laboratory power supplies, is set internally for ±15 V, but an external adjustment can change both outputs simultaneously, from 8.0 V to 20 V.

Voltage References

A family of low-voltage bandgap voltage reference devices is also available for applications requiring low temperature drift. These devices offer output voltage ratings from 1.235 V ±12 mV to 37 V and output currents of 20 mA, ±10 mA and 100 mA.

Supervisory Circuits

MPC2000 Series of SMARTpower™ Overvoltage/ Overtemperature Protection Circuits. SMARTpower is the combination of IC logic with discrete power processing to yield high-density integrated circuits with significant on-chip power capability.

Typical of Motorola's SMARTpower devices is this series of overvoltage/overtemperature protection circuits designed to protect 5-, 12- and 15-volt bus systems by shunting the bus system if either voltage or temperature exceeds preset levels. Devices are available with 7.5 A, 15 A and 35 A (continuous) current ratings.

The TCA5600/TCF5600 Universal Microprocessor Power Supply Controller is a versatile circuit for microprocessor-based systems and is mainly intended for automotive applications and battery powered instruments. This device offers high circuit flexibility with a minimum of external components. The chip boasts a temperature compensated voltage reference, on-chip dc-dc converter, programmable and remote controlled voltage regulator, fixed 5.0 V supply voltage regulator with external PNP power device, under-voltage detection circuit, power-on RESET delay and watchdog feature for orderly microprocessor operations.

The TDA4600 Control IC for Line Isolated Free-Running Flyback Converters regulates and monitors the switching transistor in power supplies based on the free oscillating flyback converter principle.

Other Power Supply Over/Under Voltage Protection Circuits requiring external SCRs are also available.

POWER CONTROL CIRCUITS

Circuits for the control of electric motors and for driving and controlling the operation of thyristors for power switching applications.

Motor Controllers

. . . for Servo Motors. A Complete Controller In One Package. This dc servo motor controller/driver has all the active functions necessary for the control of a complete closed-loop fractional horsepower system.

The new MC33030 circuit is powerful enough to handle the sophisticated requirements of robotics and inexpensive enough to be used in consumer applications such as antenna rotators and toys. It contains:

- An error amplifier and window detector.
- Drive and brake logic with motor direction memory.
- A 1 ampere power H switch.
- Programmable over-current protector and shutdown delay.
- Over-voltage shutdown.

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POWER SUPPLY/ POWER CONTROL CIRCUITS (CONT)

. . . for Stepper Motors. This driver provides up to 500 mA of drive per coil for two-phase 6.0 V to 24 V motors. Control logic accepts commands for clockwise and counterclockwise, half or full-step operation. Output impedance control and phase A drive state indicator is provided on one MC3479 of two models available.

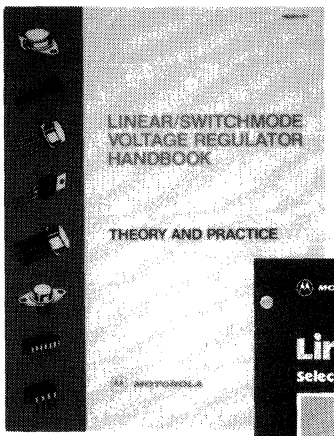
. . . for Universal Motor Speed Control. All the necessary functions for ac/dc motors in open or closed loop configuration. This TDA1285AD circuit has facilities for defining the initial speed/time characteristic and provides a phase angle varied trigger pulse to the motor control triac.

Triac Drivers

Zero-voltage controllers and switches incorporate detectors that synchronize triac gate pulses with zero crossing of the ac line voltage to eliminate RFI when used with resistive loads.

- Direct ac line operation
- Sensor fail-safe
- High current pulses for control of external thyristor

A variety of devices of varying complexity are available under type numbers MC3370, CA3079 and UAA1016B.



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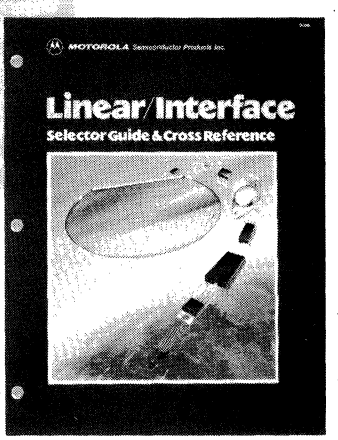


SG96

Available Literature

HB206R1 — The Linear/Switchmode Voltage Regulator handbook covers basic linear regulator theory, switching regulator topologies, and includes several practical design examples. Complete data sheets for all Motorola voltage regulator ICs are provided along with an industrial cross reference and a supplementary transistor and rectifier selector guide for switching regulators of various configurations and power levels.

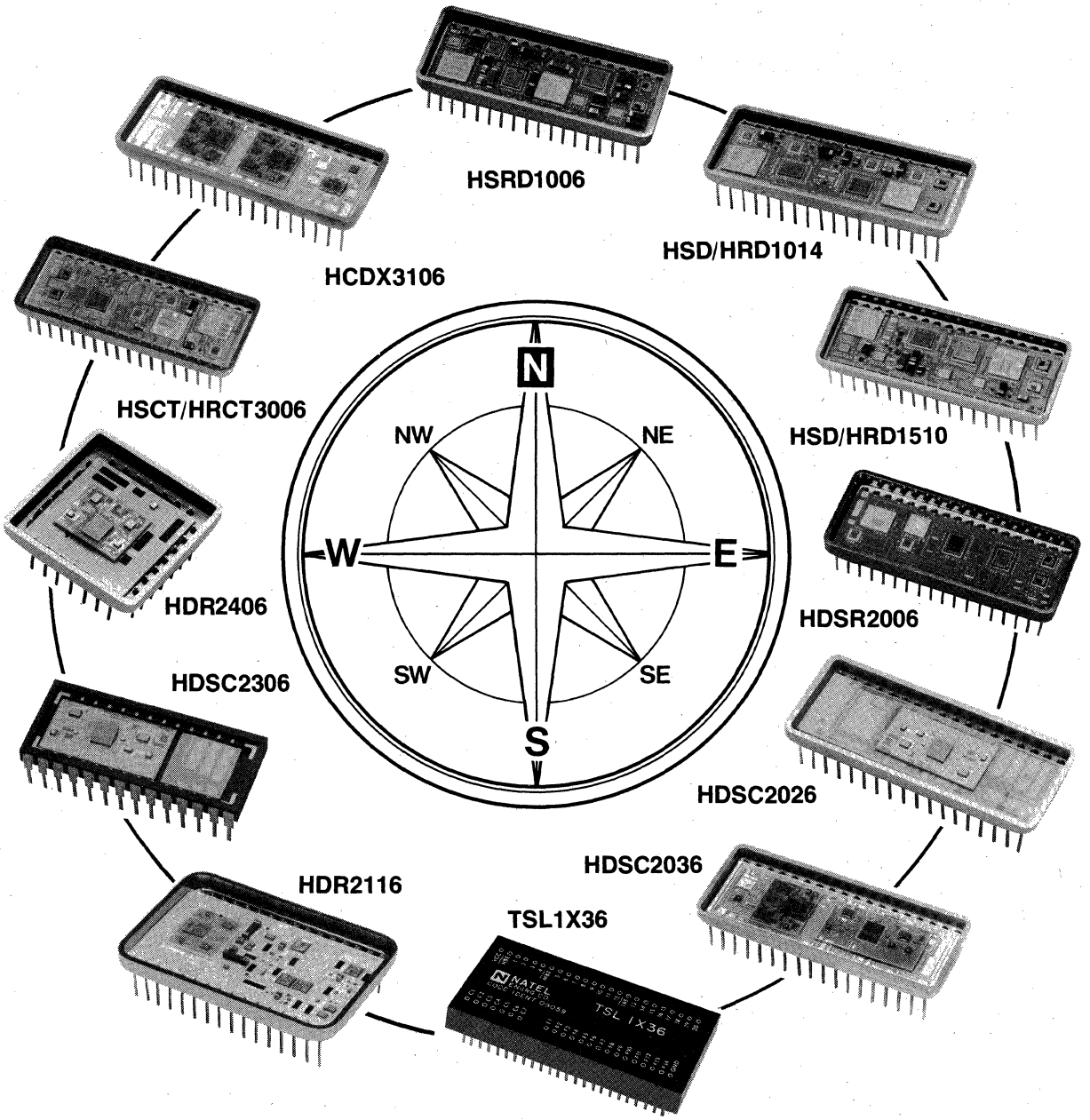
SG96 — The Linear/Interface Selector Guide and Cross Reference contains information on many of Motorola's devices including Voltage Regulators. For this group of devices, specifications and packaging information provide a means for making quick design decisions for optimum design performance.

This literature is available free from your local Motorola Sales Office or Distributor.

EEM PRODUCT SELECTION GUIDES

Use the EEM Product Selection Guides. There are 34 Guides in this edition of EEM. See page 2 (A•2, B•2, C•2, D•2) of each volume to locate the Product Selection Guides that pertain to your needs.

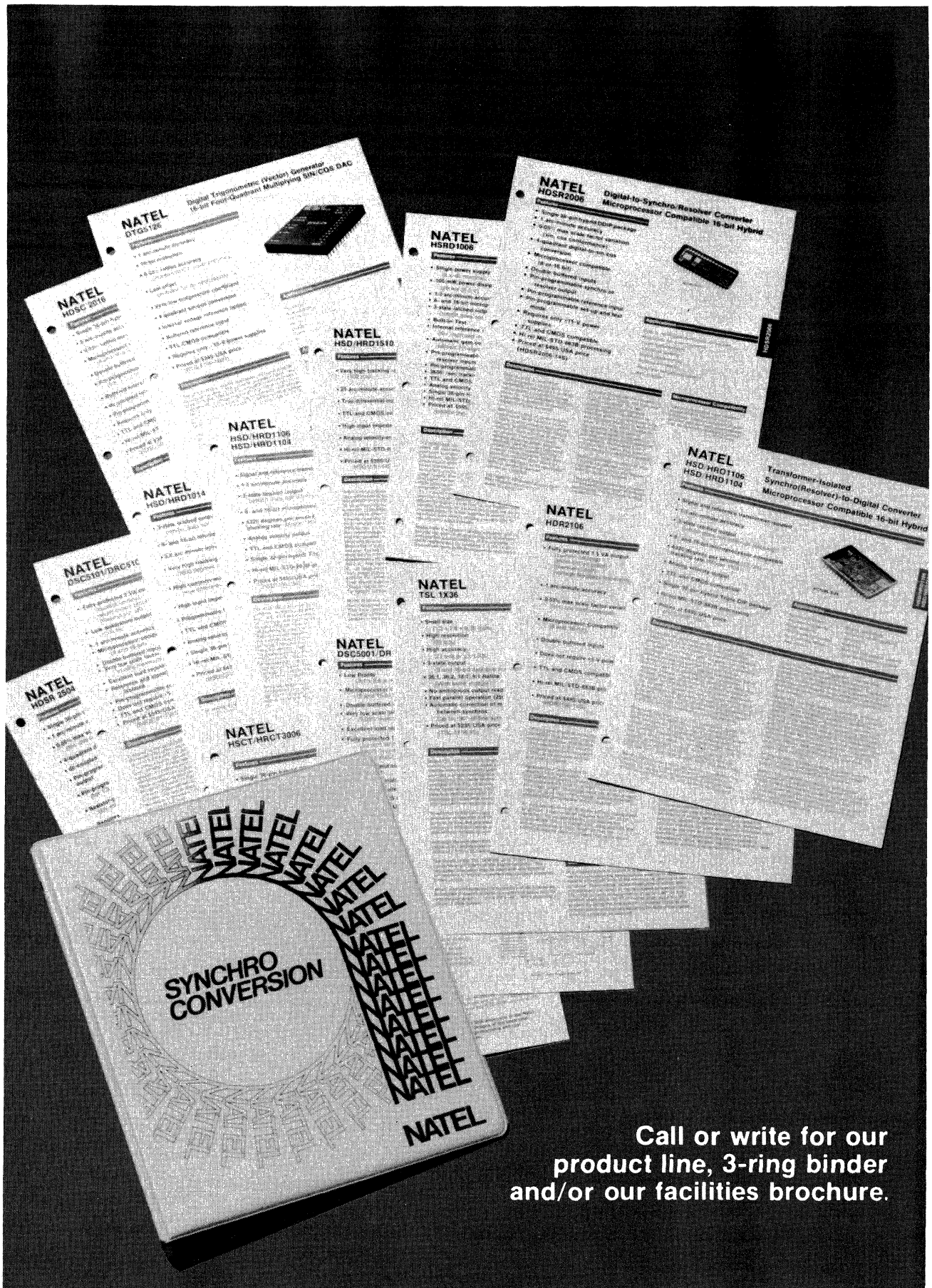
Charting the course for synchro conversion



N NATEL Engineering Co., Inc.

4550 Runway Street, Simi Valley, CA 93063 (USA)

Phone: (805) 581-3950 TWX: 910-494-1959


NATEL
DTGS12S
Digital Trigonometric (Vector) Generator
16-bit Four-Quadrant Multiplying SIN/COS DAC
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HDSC 2016
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HSD/HRD1510
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HSD/HRD1106
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HDSR 2508
NATEL
HSCT/HRCT3006
NATEL
DSC5001/DR
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TSL 1X36
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HSRD1006
NATEL
HOSR2006
Digital-to-Synchro/Resolver Converter
Microprocessor Compatible 16-bit Hybrid
NATEL
HSD/HRDT106
HSD/HRD1104
Transformer-Isolated
Synchro(Resolver)-to-Digital Converter
Microprocessor Compatible 16-bit Hybrid
NATEL
SYNCHRO
CONVERSION
NATEL
Call or write for our
product line, 3-ring binder
and/or our facilities brochure.

PICONICS®

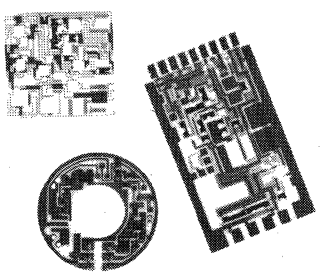
HYBRID MICROCIRCUITS
THICK FILM — THIN FILM — HYBRIDS

Piconics, an innovative microtechnology company has developed an extensive in-house hybrid capability. This capability encompasses hybrid microcircuit design and layout, thick film processing, thin film precision resistor technology and assembly. The assembly area utilizes both chip and wire as well as SMD reflow techniques in both hermetic (parallel seam seal welding) as well as non-hermetic packaging.

Our *in house* Quality Assurance test capability covers hermeticity (gross and fine), shock, vibration, moisture, burn-in, x-ray and most other common military screening tests. Documentation can be provided if necessary.

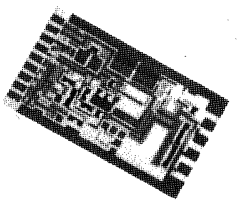
With Piconics full technology in-house options, we can select your hybrid circuit to the most advantageous cost effective production methods.

Our full source capability provides a choice by combining the best features of thick film, thin film and hybrid assembly technologies.



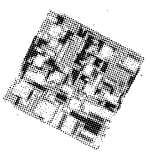
CALL OR WRITE FOR COMPLETE CATALOG AND FOR DESIGN/APPLICATION ENGINEERING SUPPORT.

THICK FILM



FEATURES:
Gold, Platinum Gold, Palladium Silver, Silver Conductors
Solderable, Wire Bondable Conductor
Multi-Layer Capability
Resistor Range: 1 ohm to 100 megohm
Tolerance ta: ± .5% Absolute
Adaptable to Standard Assembly Methods
Glazed or Unglazed Resistor Films
Beryllia Subtrates for Higher Power Available

THIN FILM
PRECISION NICHROME THIN FILM



FEATURES:
Gold Conductors
Passivated or non-passivated
TCR: ± 25 ppm — can be tailored to ± 5 ppm within this range
TC Tracking: 1-2 ppm
Tolerance: ta ± .1% Absolute
(Value Dependent) Ratio to 12 Bit accuracy (.005%)
Noise: <– 35 dB Johnson Noise
Stability: Absolute < .1% with 150°C Bake
< .2% with 200°C Bake
Value Range: 2 ohm to 10 megohm

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FEATURES:
Thermosonic Automatic Gold Ball Bonds
Eutectic or Epoxy Chip Mount
SMD Solder Capability
Parallel Seam Seal Welding (Hermetic)
Laser Trim Capability
Full In-House Environmental Lab
Hermeticity, Shock, Vibration, Moisture, X-Ray, etc.

See section 1800 pg. **A•1273** for your INDUCTOR requirements and section 2700 pg. **A•1618** for FILTERS.

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LINEAR INTEGRATED CIRCUITS

Pulse Width Modulators

UNITRODE

TYPE	Voltage Reference ± 4%	Voltage Reference ± 1%	Soft Start	PWM Latch	Under-Voltage Lockout	Pulse-by-Pulse Current Limiting	Shutdown Terminal	Output Current	Feed Forward	Maximum Frequency Oscillator	Dual Uncommitted Outputs	Single-Ended Output	Totem Pole Outputs	Separate Oscillator Sync Terminal	Adjustable Deadtime Control	Latch Off or Continuous Retry Mode	Double Pulse Suppression	Low Current Start Up	Package
Regulating PWMs UC1524/2524/3524 UC1524/883B	X						X	100mA		300kHz	X								16 Pin DIP
Advanced Regulating PWMs UC1524A/2524A/3524A UC1524A/883B		X		X	X	X	X	200mA		500kHz	X					X			16 Pin DIP
Advanced Regulating PWMs UC1525A/2525A/3525A UC1525A/883B		X	X	X	X		X	100mA 0.4A Pulse		500kHz			X	X	X				16 Pin DIP
Advanced Regulating PWMs UC1527A/2527A/3527A UC1527A/883B		X	X	X	X		X	100mA 0.4A Pulse		500kHz			X	X	X				16 Pin DIP
Advanced Regulating PWMs UC1526/2526/3526 UC1526/883B		X	X	X	X	X	X	100mA		400kHz			X	X	X		X		18 Pin DIP
Regulating PWMs UC493/UC494/		X						200mA		300kHz	X				X		X		16 Pin DIP
UC495																			18 Pin DIP
Advanced Regulating PWMs UC493A/UC493AC UC494A/UC494AC		X			X			200mA		300kHz	X				X		X		16 Pin DIP
UC495A/UC495AC UC495B/UC495BC																			18 Pin DIP
Current Mode PWM Controllers UC1846/2846/3846 UC1846/883B		X	X	X	X	X	X	200mA	X	500kHz			X	X	X	X	X		16 Pin DIP
Current Mode PWM Controllers UC1847/2847/3847 UC1847/883B		X	X	X	X	X	X	200mA	X	500kHz			X	X	X	X	X		16 Pin DIP
Programmable Primary Side PWMs UC1840/2840/3840 UC1840/883B		X	X	X	X	X	X	200mA	X	500kHz		X			X	X	N/A	X	18 Pin DIP
Programmable Primary Side PWMs UC1842/2842/3842		X		X	X	X		100mA 1A Pulse	X	500kHz		X			X		N/A	X	8 Pin DIP
High Frequency PWM Controllers UC1825/2825/3825 UC1825/883B		X	X	X	X	X		500mA 1.5A Pulse		500kHz & up		X	X	X	X		X	X	16 Pin DIP

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LINEAR INTEGRATED CIRCUITS

Power Supply Support Functions

UNITRODE

TYPE	DESCRIPTION	KEY FEATURES	PACKAGE
UC1543/2543/3543 UC1544/2544/3544	Power Supply Supervisory Circuit, Monitors and Controls Power Supply Output	• Over/Under-Voltage, and Current Sensing Circuits • Programmable Time Delays • SCR "Crowbar" Drive of 300mA • Optional Over-Voltage Latch • Internal 1% Accurate Reference • Remote Activation Capability • Uncommitted Comparator • Inputs for Low Voltage Sensing (UC1544 series only)	16 Pin DIL (1543 Series) 18 Pin DIL (1544 series)
UC1706/2706/3706 UC1707/2707/3707	Dual High Current MOSFET Compatible Output Driver Dual Uncommitted High Current MOSFET Compatible Output Driver	• Dual, 1.5A, Totem Pole Outputs • Parallel or Push-Pull Operations • Single-Ended to Push-Pull Conversion (1706 series) • Internal Overlap Protection • Analog, Latched Shutdown • High-Speed, Power MOSFET Compatible • Thermal Shutdown Protection • 5 to 40V Operation • Low Quiescent Current	16 Pin DIL "Batwing"
UC1834/2834/3834	High Efficiency Linear Regulator, Low Input-Output Differential	• Minimum V_{IN}—V_{OUT} less than 0.5V at 5A Load with External Pass Device • Equally Usable for either Positive or Negative Regulator Design • Adjustable Low Threshold Current Sense Amplifier • Under- and Over-Voltage Fault Alert with Programmable Delay • Over-Voltage Fault Latch with 100mA Crowbar Drive Output	16 Pin DIL
UC1901/2901/3901	Isolated Feedback Generator Stable and Reliable Alternative to an Optical Coupler	• An Amplitude-Modulation System for Transformer Coupling an Isolated Feedback Error Signal • Internal 1% Reference and Error Amplifier • Loop Status Monitor • Low-Cost Alternative to Optical Couplers • Internal Carrier Oscillator Usable to 5MHz • Modulator Synchronizable to an External Clock	14 Pin DIL
UC1903/2903/3903	Quad Supply and Line Monitor Precision System	• Monitor Four Power Supply Output Voltage Levels • Both Over- and Under-Voltage Indicators • Internal Inverter for Negative Level Sense • Adjustable Fault Window • Additional Input for Early Line Fault Sense • On Chip, High-Current General Purpose OP-AMP	18 Pin DIL

Product Applications

PRODUCT/SERIES	TYPICAL APPLICATIONS
UC1704/3704 Bridge Transducer Switch	Any Analog to Digital monitoring system; coupled with any of a wide range of sensors almost any type of physical phenomena may be monitored. Samples: • Air-Flow Sensor Circuits • Liquid or Gas Flow Circuits • Passing Object circuits
UC1906/2906 Lead-Acid Battery Charger	"IC Circuitry that results in optimized charge cycles for specific battery applications" • Uninterruptable Power Supplies • Portable Electrical Equipment • Emergency Power and Light Systems • Volatile Data Handling Computers — Power back-up

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MOTOR CONTROL DESIGNERS' GUIDE

Motor Control Integrated Circuits

UNITRODE

TYPE	DESCRIPTION	TYPICAL APPLICATION	Vc	Vss	IOUT	PD	PACKAGE
L292	H-Bridge Transconductance Amplifier with PWM Current Control.	DC Motors, Torque Control, Stepping Motors, Microstepping, Solenoid Controlled Valves.	18V to 36V		2.0A Cont.	25W Max.	15 Pin Power Tab
L293	Four Totem-Pole Drivers.	DC Motors Stepping Motors Solenoids Other Inductive or Resistive Loads.	36V Max.	4.5V to 36V	1.0A Cont.	2.0W Max.	16 Pin Dip "Batwing"
L293D	L293 with Eight Bridge Diodes; Reduced IOUT.		36V Max.	4.5V to 36V	0.6A Cont.	2.0W Max.	
L295	Dual Solenoid Driver with Current Control.	Hammer Driver in Matrix Printers Solenoid Driver Motor Driver	12V to 46V	4.5V to 10V	2.0A Cont.	25W Max.	15 Pin Power Tab
L298	Dual Full-Bridge with Individual Logic Inputs for Each Bridge.	Power Stage for Motor and Solenoid Drivers. Low Standby Power Drain makes it Ideal for Battery Operated Equipment.	Vss to 46V	4.5V to 7.0V	2.0A Cont.	25W Max.	15 Pin Power Tab
UC1610 UC3610	Dual Diode Bridge with Eight Schottky Diodes (V_f = 1V @ 2A)	Use as Circulating Diodes with Motor or Solenoid Drivers.	40V Max.		3.0A Max.	1.0W Max.	8 Pin Dip
UC3620	Brushless DC Motor with Switching Current Control.	Drive Brushless DC Motors with 60 Mechanical Degree Hall Devices. Other Decoding Options available.	40V Max.		2.0A Cont.	25W Max.	15 Pin Power Tab
UC1637 UC2637 UC3637	PWM Driver for DC Servomotors; Current Limit, Under-Voltage Lock-Out.	Drive Bipolar or MOSFET Power H-Bridge in DC Velocity and Position Servo-Loops.	40V Max.		500mA Peak	2.0W Max.	18 Pin Dip
UC1706 UC2706 UC1707 UC2707	Dual Driver for Power MOSFETs; 50nsec into 1000pF, 1.5A Peak. TTL Compatible Inputs.	Interface between Low-Level Functions and High Power Control Devices, Particularly Power MOSFETs.	40V Max.	40V Max.	1.5A Peak	2.0W Max.	16 Pin Dip "Batwing"
UC1717 UC2717 UC3717	Stepping Motor Phase Driver; TTL Compatible Inputs. Pulse-by-Pulse Current Control, and Full Output H-Bridge with Diodes	Stepping Motor Driver in Full-Step, Half-Step, or Microstep Mode. Separate Digital Control Sets Current at 100%, 60%, 19%. Bipolar Operation.	10V to 40V	4.75V to 5.25V	1.0A Peak	2.0W Max.	16 Pin Dip "Batwing"
UC3517	Stepping Motor Driver Unipolar, Bilevel. Minimal RFI. Activates Both Motor Phases.	Driver for Stepping Motor in Applications Requiring Least Possible RFI. Internal Logic for Full-Step/Half-Step. High Voltage Pulse Width Set by Single RC.	10V to 40V	4.75V to 5.25V	350mA Cont.	1.6W Max.	16 Pin Dip
UC3770	Stepping Motor Phase Driver Pin Compatible with UC3717, but with Higher Output Current and No Circulating Diodes.	See UC3717 Application	10V to 40V	4.75V to 5.25V	1.5A Peak	2.0W Max.	16 Pin Dip "Batwing"

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over 50 off-the-shelf models
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Choose impedance ratios from 1:1 up to 36:1, connector or pin versions (plastic or metal case built to meet MIL-T-21038 and MIL-T-55831 requirements*). Fast risetime and low droop for pulse applications; up to 1000 M ohms (insulation resistance) and up to 1000V (dielectric withstanding voltage). Available for immediate delivery with one-year guarantee.

See our pages, this section pages **A**•1716-•**A**1779

*units are not QPL listed

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eem selection guide — microwave components-3450

Manufacturer	Terminations				RF Switches				Phase Shifters	Mixers	Oscillators	RF Relays	Phase Detectors
	EEM Page No.	Antenna	Coaxial	Feed-through	EEM Page No.	Diodes	Transfer	MIC					
Andersen Laboratories										A•1591*			
Applied Research	A•1703												
Arra, Inc.	A•1705				A•1705	•			A•1705				
Compac	A•1706		•	•	A•1707		•					A•1707	
Daico Industries					A•1708* A•1709*	•		•	A•1709*			A•1709*	
Dow Key Microwave												A•1710	
Elcom Systems	A•1711*			•						A•1711*			
General Microwave					A•1712	•		•		A•1712			
Kay Elemetrics					A•1713								
Matrix Systems					A•1715								
Mini-Circuits					A•1719	•				A•1719*			A•1719
North Hills	A•1780												
Premier Microwave	A•1781								A•1781				
Trak Microwave										A•1782	A•1782*		

* Mil. Spec.

Manufacturer	Attenuators						Couplers & Hybrids (Dirct'l)	Power Dividers		Filters		
	EEM Page No.	Fixed	Variable	Step	Coaxial	Program-mable		(Micro-wave)	(UHF/ VHF)	EEM Page No.	Wave-Guide	Coax
Applied Research	A•1703	•					A•1702*			A•1702		
Arra, Inc.	A•1705*	•	•		•		A•1705*	A•1705		A•1705	•	•
Compac	A•1706	•			•							
Daico Industries	A•1708* A•1709*			• •	• •	• •						
Elcom Systems	A•1711*	•					A•1711*	A•1711*				
General Microwave	A•1712*				•	•						
Kay Elemetrics	A•1713		•	•		•						
Mini-Circuits	A•1719	•			•	•	A•1719*	A•1719*	A•1719*			
North Hills							A•1780	A•1780	A•1780	A•1780		
Premier Microwave	A•1781						A•1781			A•1781		
Trak Microwave										A•1782		

* Mil. Spec.

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Over 30 Years as a Supplier to the Military/Industrial RF Markets.

RF FILTERS, MULTIPLEXERS, CONVERTERS, POWER AMPLIFIERS, MULTIPLIERS, SIGNAL SOURCES, MULTICOUPLERS and COMPLETE RF SYSTEMS.

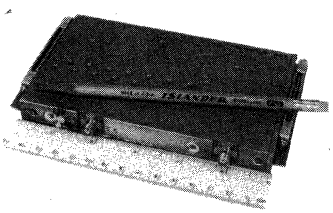
MULTIPLIERS

FREQUENCY GENERATION THROUGH MULTIPLICATION OR PHASE-LOCK TECHNIQUES/VHF to Ku-Band (10 MHz to 1.5 GHz)

Applied Research offers many proven designs using either technique or combinations. And we're capable of meeting your exact requirements, precisely.

Our Phase-lock loops, comprised of I.C. components, together with RF devices, yield outputs of up to 10 watts at microwave frequencies. And our multipliers are available as passive devices or in combination with amplifiers having multiplication factors of from 2 to 2000. In combination with varactor multiplier devices output in Ku-band can be obtained.

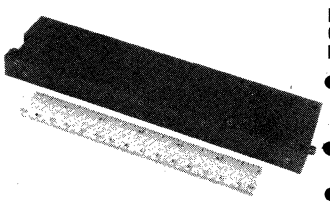
What's more, we can supply crystal oscillators or internal drivers to provide a self-contained source.



Frequency sources with mutiplication up to 29 and multiples thereof are available deriving signals in the L, S, and C-bands.

ELECTRICAL CHARACTERISTICS (TYPICAL)

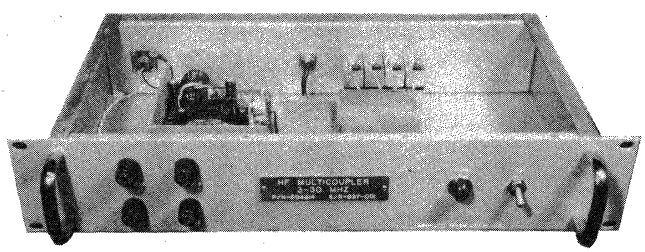
- Input Frequency: 100 MHz ±10 MHz
- Output Frequency:
  Type-1, 6400 MHz (X64)
  Type 2, 5800 MHz (X58)
- RF Power
  Input Power: +5 dBm, ±3 dB
  Output Power: +5 dBm, ±2 dBm over temperature
- Discrete spurious outputs: Harmonics below −60 dBc, others at a maximum of −60 dBc.
- Temperature: −54°C to +85°C



ELECTRICAL CHARACTERISTICS
C-BAND PASSIVE BROADBAND HIGH POWER MULTIPLIERS

- Input Power: +40 dBm
  Output Power: +32.6 dBm ±0.5 dB
- Spurious Response: >−70 dBc inband
- Bandwidth: 5.9 to 6.4 GHz

MULTICOUPLERS



Multicoupler Model HFM-2 (TX)-230-8-40 is one of a series of multicouplers designed and manufactured by Applied Research Inc. This model, operating over a frequency range of 2 to 32 MHz, has 8 to 32 independent outputs for inputs of up to +20 dBm.

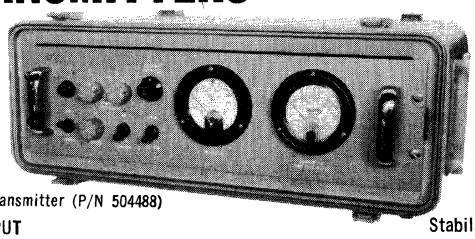
PERFORMANCE SPECIFICATIONS
Frequency Range: 0.5 to 32 MHz
Number of Outputs: Up to 32
Isolation Between Outputs: To be specified by customer — Up to 70 db.
Overall Gain (Input to Output): 0 dB
Connectors: To be specified by customer.

The HFM Series covers the frequency range of 0.5 MHz to the Telemetery Bands, and has been designed for applications where weight and space are critical such as submarine, shipboard, or mobile installations.

MODEL	NO. OF OUTPUTS	FREQUENCY RANGE
HFM-2(TX)0532 8/40	6 to 32	500 KHz-32 MHz
HFM-2(TX)232 8/40	6 to 32	2 MHz-32 MHz
HFM-2(TX)140 12/40	6 to 32	10 MHz-400 MHz
HFM-2(TX)2410 8/40	6 to 32	20 MHz-1100 MHz
HFM-2(TX)1415 6/50	6 to 32	1400 MHz-1600 MHz
HFM-2(TX)2223 8/50	6 to 32	2200 MHz-2300 MHz
HFM-2(TX)1423 8/50	6 to 32	1400 MHz-2300 MHz

SOLID STATE TRANSMITTERS and POWER AMPLIFIERS in P, L, S and C BANDS.

TRANSMITTERS



Transmitter (P/N 504488)

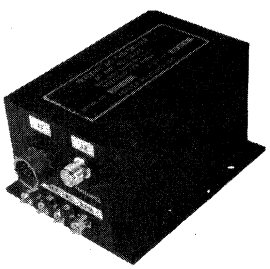
RF OUTPUT
Range: 400-550 MHz
Control: Field Tuneable in 0.5 MHz increments
DC/AC Power: 24-30 volts at 9 amperes/115/230 VAC 5/2 Amps
Stability: ±0.005%
Power: 30 watts, minimum
MODULATION: Frequency Modulation

POWER AMPLIFIERS

200 Watt RF Power Amplifier (P/N 504495)

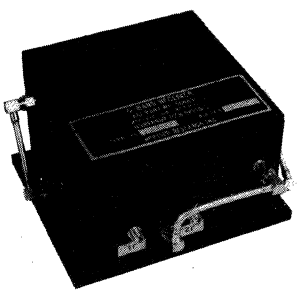
Frequency Range: 400 to 550 MHz

AEROSPACE COMPONENTS



L-BAND TRANSMITTER

Frequency: Tunable, 1650-1670 MHz
Power Output: +28 dBm min.
Modulation: FM; 1-35 KHz
Stability: ±3 MHz
Power Input: +22 to +34 VDC, .75A max.
Weight: 1 kg max.

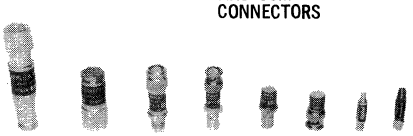


G-BAND RECEIVER

Frequency: 4.4 to 5.0 GHz*
Stability: ±.005%
Sensitivity: −90 dBm for 10 dB S/N and ±250 KHz deviation
IF Bandwidth: 1 MHz nominal
Power Input: +21 to 30 volts, .75A max.
Weight: 3.5 lbs. max.
* Factory set

FIXED PAD ATTENTUATORS & TERMINATIONS (DC-2GHz)

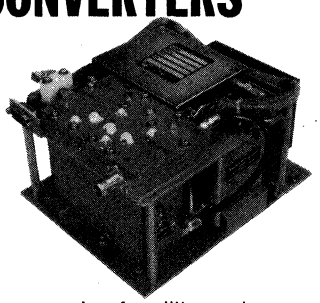
FOR TYPES BNC, TNC, C, N, AND OSM CONNECTORS



Integrated line of fixed pad attenuators, terminations, and impedance-matching transformers provides means for rapid and accurate division of voltages over the frequency range of DC-2 GHz, and for the matching of different impedances with minimum loss over a broad frequency band. The unit cost is within the practical price range of the large and small equipment user, as well as the research and experimental user.

GENERAL CHARACTERICTICS
Frequency Range: DC-2 GHz
VSWR: 1.25:1
Attenuation Accuracy:
−0.1 dB +0.3 dB for values of 1 to 12 dB
−0.2 dB +0.5 dB for values of 15 to 20 dB
Impedances (Nominal): 50, 75 90 ohms
Attenuation Values:
1, 2, 3, 4, 6, 10, 12, 15, 20 dB (standard).
Other values up to 30 dB Special

TELEMETRY CONVERTERS



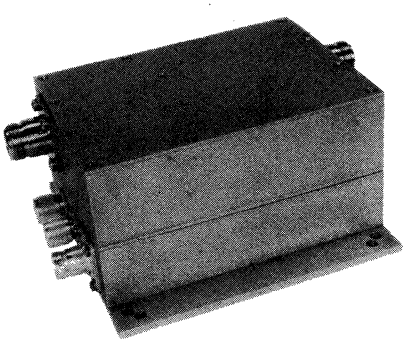
Down converters for military and commercial application are available throughout the frequency range from VHF to K-band. Applied Research manufacturers the filters, oscillator sources, the IF amplifiers, and complete packages that are associated with down converters.

These units permit the ready adapting of existing UHF telemetry receiving equipment for use in the 1435 to 1540 and 2200 to 2300 MHz telemetry band with high conversion gain.

GENERAL CHARACTERISTICS
Long Term Stability: Better than ±.1 PPM over temperature range
Image Rejection: >50 dB
Noise Figure: Better than 5 dB for 100 mc bandwidth (2.2 to 2.3 GHz)

Converters meeting special requirements which include group delay or phase and amplitude characteristics can be designed to meet special needs.

MULTIPLEXERS



State of the Art Multiplexers, applying Applied Research Inc.'s experience in the design and manufacture of NOTCH FILTERS, BANDPASS FILTERS, and BAND REJECT FILTERS allows for the ultimate in performance.

TYPICAL TRIPLEXER CHARACTERISTICS
Frequency Range: 5 kHz to 500 MHz
Frequency Breaks: 500 kHz and 32 MHz
Passband Attenuation: 1.5 dB maximum
Crossover Losses: 4.5 dB maximum
Reject Characteristics: 42 dB minimum, other bands
Ripple: 0.5 dB peak to peak maximum
Impedance: All ports shall be 50 ohms unbalanced
VSWR: 1.5:1 maximum, 2:1 through crossover

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K
kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L
LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microforad
MHz megahertz
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOSIGT metal-oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM nuclear instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLL phased lock loop
PPI plan position indicator
PROM programmable read only memory
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

ARRA INC.
ANTENNA & RADOME RESEARCH ASSOCIATES

Coaxial • Waveguide • Solid State

microwave

Components • Assemblies • Sub-Systems

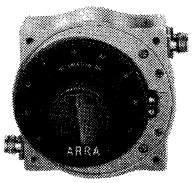
VARIABLE ATTENUATORS DC THRU 18000 MHz

Direct Reading

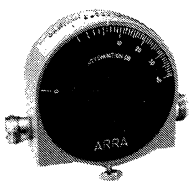
Low Ins. Loss • 1.5 Max. VSWR • 10 Watts Aver. Power

Freq. Range (GHz)	Atten. Range (dB)	Atten. vs. Freq. (±dB)	Form Type	Model No.
DC-0.1	30	0.5	4450	†0682-30F
DC-0.5	10	0.25	4450	†0682-10G
0.5-1.0	60	1.0	0-214	2952-60
0.5-1.0	100	1.5	0-214	2952-100
0.9-1.3	60	1.0	0-660	2-3952-60
0.9-1.3	100	1.5	0-660	2-3952-100
1.0-2.0	10	1.0	0-1014	3617-10F
1.0-2.0	60	1.0	0-660	3952-60X
1.0-2.0	100	1.5	0-660	3952-100X
1.4-2.4	80	1.25	0-660	3-4952-80
2.0-4.0	10	1.0	0-51	4674-10F
2.0-4.0	20	1.5	0-51	4674-20F
2.0-4.0	30	2.0	0-51	4674-30F
2.0-4.0	60	1.0	0-660	4952-60X
2.0-4.0	100	1.5	0-660	4952-100X
2.5-4.0	10	0.75	0-51	4674-10G
2.5-4.0	20	1.0	0-51	4674-20G
4.0-8.0	10	0.6	0-701-2	5684-10F
4.0-8.0	20	1.0	0-701-2	5684-20F
4.0-8.0**	60	1.0	0-660	5952-60X
4.0-8.0**	100	1.5	0-660	5952-100X
5.4-11.0	10	1.0	0-701-2	5-6684-10F
5.4-11.0	20	1.5	0-701-2	5-6684-20F
7.0-11.0	10	0.5	0-701-2	6684-10F
7.0-11.0	20	1.0	0-701-2	6684-20F
8.0-12.4	10	0.5	0-701-2	6684-10X
8.0-12.4	20	1.0	0-701-2	6684-20X
12.4-18.0	10	0.5	0-701-2	9684-10F
12.4-18.0	20	1.0	0-701-2	9684-20F
12.4-18.0	30	1.0	0-701-2	9684-30F

*See catalog for VSWR, Ins. Loss and Power.
**Only less than octave — consult factory.
†1 Watt Average Power.



Form 0-660: 5″ Dia.
Form 0-214: 6″ Dia.



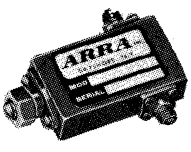
Form 0-701: 3″ Dia.
Form 0-51: 5″ Dia.

Miniature

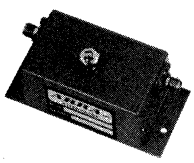
0.5 dB Max. Ins. Loss • 5 Watts Aver. 3 KW Peak • 2 Ounces

Freq. Range (GHz)	Atten. Range (dB)	Atten. vs. Freq. (±dB)	Max. VSWR	Form Type	Model No.
DC-0.1	20	0.6	1.3	4242	**0682-20
DC-0.25	15	1.5	1.5	4242	**0682-15
DC-0.5	10	0.25	1.5	4449	**0682-10
1.0-2.0	10		1.8	3651	3814-10
1.5-2.0	15		1.7	3651	3814-15
2.0-4.0	10		1.8	2191	4804-10
2.0-4.0	20		1.5	3651	4814-20
2.5-4.0	10		1.5	2191	4804-10X
4.0-8.0	10		1.5	2191	5804-10
4.0-8.0	20		1.5	2191	5804-20
4.0-8.0	30		1.5	3651	5814-30
6.0-11.0	10		1.5	2191	5-6804-10
6.0-11.0	20		1.5	2191	5-6804-20
6.0-11.0	30		1.5	2191	5-6804-30
6.0-11.0	40		1.5	3651	5-6814-40
8.0-18.0	10	1.5	1.5*	2191	9803-10
8.0-12.4	10		1.5*	2191	6804-10
8.0-12.4	20		1.5*	2191	6804-20
8.0-12.4	30		1.5*	2191	6804-30
8.0-12.4	40		1.5*	3651	6814-40
8.5-10.5	10	0.5	1.5	2191	6803-10A
8.5-10.5	20	0.5	1.5	2191	6803-20A
10.5-12.4	10	0.5	1.6	2191	6803-10B
10.5-12.4	20	0.5	1.6	2191	6803-20B
12.0-18.0	10		1.5	2191	9804-10X
12.0-18.0	20		1.5	2191	9804-20X
12.0-18.0	30		1.7	2191	9804-30X
12.0-18.0	40		1.7	2191	9804-40X
12.0-18.0	10	1.0	1.5	2191	9803-10A
12.0-18.0	15	1.0	1.7	2191	9803-15A

*1.7 VSWR above 11.0 GHz.
**1 Watt Average Power.



Form 2191: 1¾x1x½″
Form 3651: 2x1¼x½″



Form 4242: 2.2x1.37x1.2″

BROADBAND DIODE DEVICES

SP4T

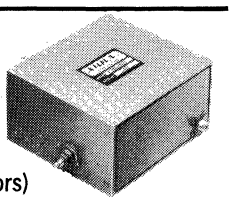
SPST & SPNT Switches

- High Isolation • Low Insertion Loss
- Integrated Drivers Available

Configuration	Freq. Range (MHz)	Switching Time (nsec)	Average Power (Watts)	Model Number With Driver	Model Number Without Driver
SPST	100-18000	50	5	8753-40D	8753-40
SPST	500-18000	10	2	H8753-40D	H8753-40
SPST	200-18000	50	5	8753-80D	8753-80
SPST	500-18000	10	2	H8753-80D	H8753-80
SPDT	2000-18000	2000	2	2-9753R	2-9753
SP3T	2000-18000	2000	2	3-9753R	3-9753
SP4T	2000-18000	2000	2	4-9753R	4-9753

Attenuators & Modulators

- Absorptive for all Values
- Each Model 200-18000 MHz
- Low Insertion Loss
- Integrated Linearized Driver (Attenuators)
- TTL Compatible Driver (Modulators)



Model 8752-30D

Configuration	Attenuation (dB)	Switching Time	Model No.
Cont. Variable	35	50 μsec	8752-35D
Cont. Variable	65	50 μsec	8752-65D
On/Off	30	20 nsec	8752-30M
On/Off	65	20 nsec	8752-65M

COAXIAL COMPONENTS

Phase Shifters

DC-18GHz Models

Microwave Filters

.03-18GHz Bandpass & Reject

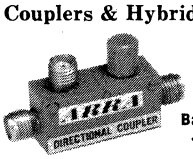
Broadband Fixed Attenuators

DC-18GHz High Power

Broadband Terminations

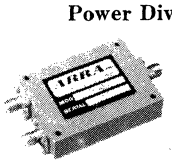
DC-18GHz High Power

Couplers & Hybrids



Bands from .5-18GHz

Power Dividers

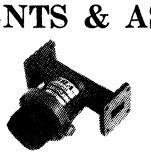


Bands from .25-18GHz

Motorized Variable Attenuators
500 Watt Variable Attenuators . . . Lots More

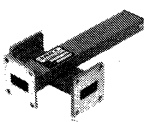
WAVEGUIDE COMPONENTS & ASSEMBLIES

Broadband Diode Switches



Variable Attenuators

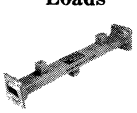
ARRA will fabricate your special waveguide assemblies in any material and finish . . . from the simplest straight section and single bend to complex combinations of bends, miters, twists, etc.



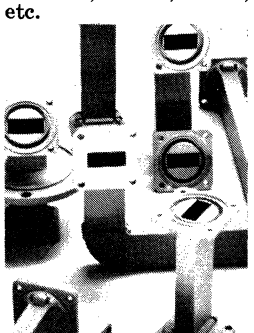
Cross Guide Couplers

Dummy Loads

Fixed Attenuators



Filters



Send for Complete New Catalog

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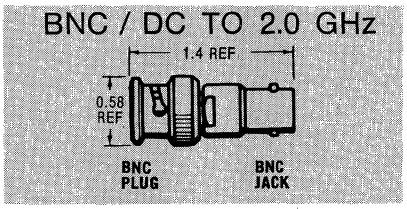
COMPAC™

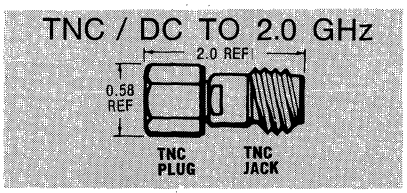
COAXIAL ATTENUATORS



BNC/DC TO 2.0 GHz

Operating Temperature Range: −55 to +125°C
Total Input Power: 1 watt average
Impedance: 50 ohms
VSWR: DC to 1 GHz 1.2 to 1
1 GHz to 2 GHz 1.4 to 1
Accuracy: DC to 1 GHz ±.5 dB
1 GHz to 2 GHz ±.8 dB

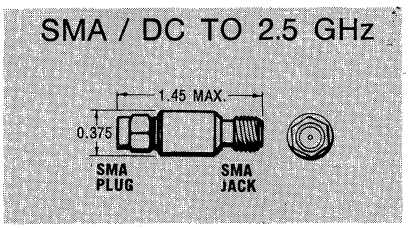
PART NO.	ATTENUATION VALUE
130-1001	1 dB
130-1002	2 dB
130-1003	3 dB
130-1006	6 dB
130-1010	10 dB
130-1020	20 dB
130-1030	30 dB



TNC/DC TO 2.0 GHz

Operating Temperature Range: −55 to +125°C
Total Input Power: 1 watt average
Impedance: 50 ohms
VSWR: DC to 1 GHz 1.2 to 1
1 GHz to 2 GHz 1.4 to 1

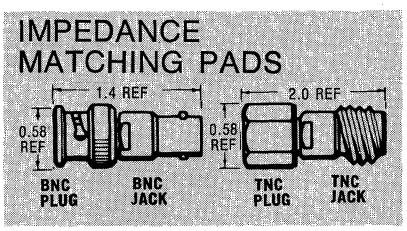
PART NO.	ATTENUATION VALUE
130-2001	1 dB
130-2002	2 dB
130-2003	3 dB
130-2006	6 dB
130-2010	10 dB
130-2020	20 dB
130-2030	30 dB



SMA/DC TO 2.5 GHz

Operating Temperature Range: −20 to +125°C
Total Input Power: 1 watt average
Finish: Passivated Stainless
Accuracy: DC to 1 GHz ±.5 dB
1 GHz to 2.5 GHz ±1 dB
Impedance: 50 ohms
VSWR: DC to 1 GHz 1.2 to 1 Max.
1 GHz to 2.5 GHz 1.4 to 1 Max.

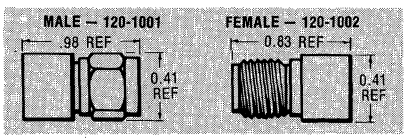
PART NO.	ATTENUATION VALUE
130-3001	1 dB
130-3002	2 dB
130-3003	3 dB
130-3006	6 dB
130-3010	10 dB
130-3020	20 dB
130-3030	30 dB



IMPEDANCE MATCHING PADS

SPECIFICATION	MODEL 130-1050	MODEL 130-2050	MODEL 130-1075	MODEL 130-2075
Frequency Range	DC to 1 GHz	DC to 1 GHz	DC to 1 GHz	DC to 1 GHz
Impedance	50 ohm male 75 ohm female	75 ohm male 50 ohm female	50 ohm male 75 ohm female	75 ohm male 50 ohm female
Attenuation (Loss)	5.7 dB	5.7 dB	5.7 dB	5.7 dB
VSWR (Max)	1.2 to 1	1.2 to 1	1.2 to 1	1.2 to 1
Connections	BNC	BNC	TNC	TNC
Accuracy	±.5 dB	±.5 dB	±.5 dB	±.5 dB

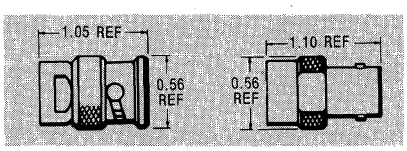
COAXIAL TERMINATIONS



SMA/DC TO 2.5 GHz

SPECIFICATIONS
120-1001/120-1002
Power: 1 watt average
Material: Passivated stainless steel

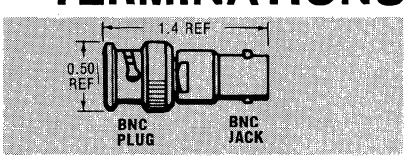
Impedance: 50 ohm nominal
Temperature Range: −20 to +125°C
VSWR: DC to 2.5 GHz 1.2 to 1 maximum



FEED-THRU TERMINATIONS

BNC

SPECIFICATIONS
Power: 1 watt average
VSWR: 1.1 to 1 maximum
DC to 2 GHz — 50 ohms
Male: 120-1003
Female: 120-1004
DC to 1 GHz — 75 ohms
Male: 120-1005
Female: 120-1006



	MODEL 120-1007	MODEL 120-1008
Power	1 watt average	1 watt average
Ohms	50	75
Frequency	DC to 1000 MHz	DC to 500 MHz
VSWR	DC to 500 MHz 1.1 to 1/500 to 1000 MHz 1.2 to 1	1.2 to 1

All dimensions in inches.
Additional products which do not appear on this page can be designed to meet your requirements.

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279 SKIDMORE ROAD
DEER PARK, NEW YORK 11729
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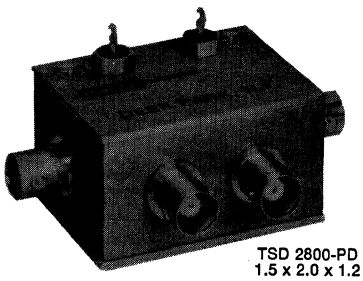
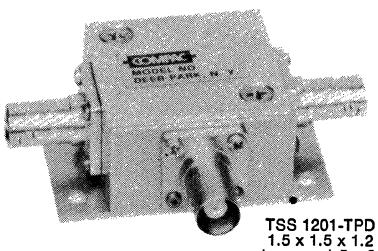
COMPAC™

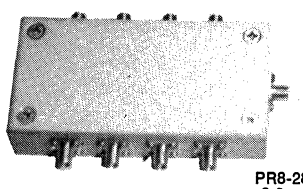
RF RELAYS & TRANSFER SWITCHES



TSD 2800-PD
1.5 x 2.0 x 1.2



TSS 1201-TPD
1.5 x 1.5 x 1.2
ext. cover 1.5 x 2.25



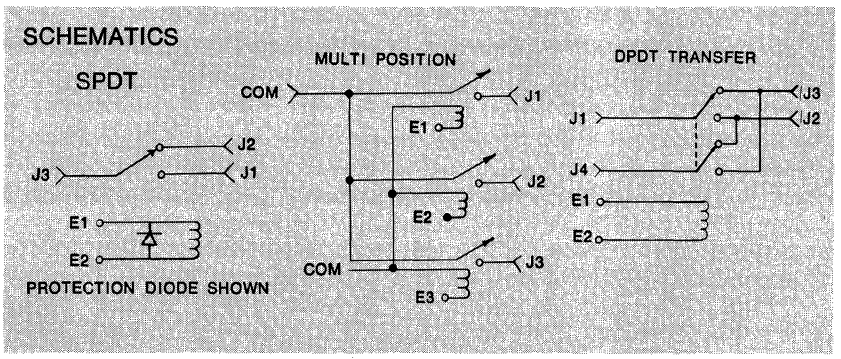
PR8-2831-TTLF
3.0 x 5.0 x 1.5
ext. cover 3 x 5.75

Single Pole 2 to 16 Position
Double Pole Double Throw Transfer
Signal and Power Lever Units

- ☐ Lightweight
- ☐ Low Cost
- ☐ Small Size

Also Available:
Custom Power Attenuators, Power Terminations, Flange mounted, no air flow required
50 — 800 watts
DC — 1 GHz

SCHEMATICS



SPECIFICATIONS:

	Signal Level	Power Level
Frequency Range	DC-500 MHz	DC-400 MHz
Power Level	1 Watt	75 Watts
VSWR	1.2 Typ.	1.3 Typ.
Isolation	40 dB	35 dB
Insertion Loss	0.3 dB	0.2 dB
Switching Speed	10 m Sec	15 m Sec

DETAILED SPECIFICATIONS UPON REQUEST

HOW TO ORDER

TS 4 — 28 0 1 — TPD

SWITCH TYPE
TS — Signal
PR — Power

SWITCH CONFIGURED
D — Transfer
S — SPDT
3-16 — Multi Position

COIL VOLTAGE
05, 06, 12, 18, 24, 28

CONNECTOR TYPE
0 - BNC
1 - SMA
2 - TNC
3 - N

MOUNTING
0 - Flush
1 - Extended Flange

OPTIONS
T — Termination 50 ohm ⅛W STD
PD — Protection Diode POS COM STD
TTL — TTL Interface Active High STD
C — DC Connector D Submin Type STD
L — Latching
F — Failsafe
SPECIAL CONFIGURATIONS
Other Options Available

* OTHER OPTIONS AVAILABLE. CONSULT FACTORY *

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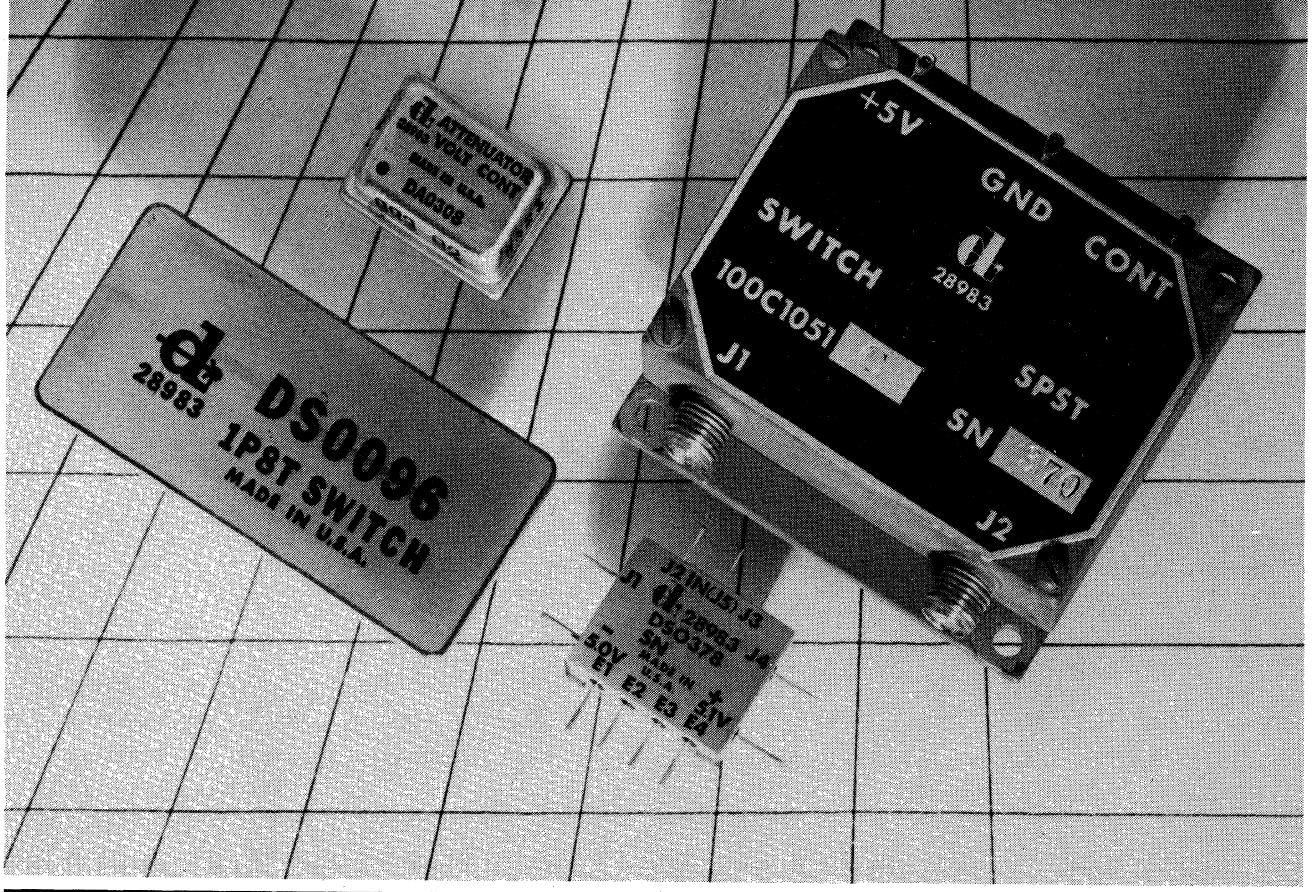
DAICO IF/RF SOLID-STATE MIL-SPEC DEVICES

SWITCHES ☐ ATTENUATORS ☐ PHASE SHIFTERS ☐ SUBSYSTEMS



Designing and manufacturing solid-state switches, attenuators, phase shifters and sub-systems to meet the MIL-Spec requirements of the defense oriented, communications, radar and countermeasures system companies have been our specialty since 1967.

More than 2,400 different field proven part types have been engineered and manufactured during the past two-decades.

Frequency ranges from DC to 6GH$_Z$ and switching speeds as low as 5 nanoseconds (RF transition time) are currently being supplied.

Phase and amplitude critical devices are supplied maintaining specified parameters over −55°C to +125°C.

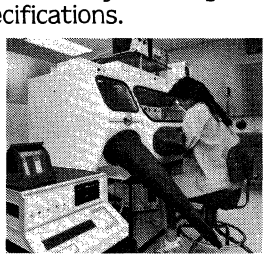
One of our many standard devices may solve a design problem for you with little or no modification.

If your application requires a special device not met by one of our standard units, our technical staff will welcome your call. You can depend upon Daico for a prompt, realistic response.

At the three Daico manufacturing facilities, totaling 46,000 square feet, IF/RF solid-state components in three construction types are produced.

- ☐ **THIN-FILM:** Our in-house high-reliability thin-film manufacturing facility produces MIC (Microwave Integrated Circuits) in line with MIL-STD-883C for surface mounted applications. Products include switches, analog as well as step attenuators, and phase shifters.
- ☐ **DISCRETE:** The discrete connectorized devices are built utilizing our in-house circuit board manufacturing facility. Products are built in accordance with MIL-E-5400 and MIL-STD-454.
- ☐ **CONNECTORIZED MIC:** To take advantage of the small MIC size, but with the convenience of connectors, Daico offers a combination MIC with connectors. The MIC is built in line with MIL-STD-883C with the connectorized body meeting the appropriate discrete specifications.

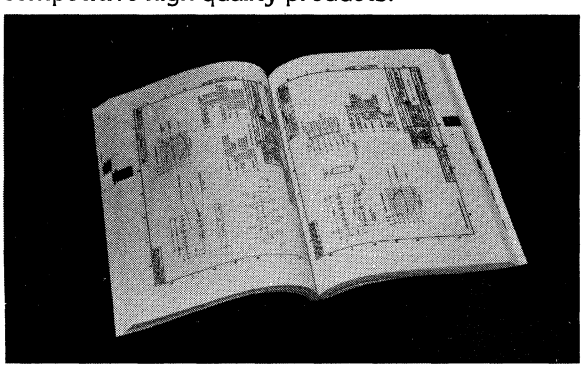
Our Quality Assurance Program is designed around MIL-Q-9858, MIL-I-45208, as well as engineering design and Quality Controls based on MIL-M-38510F Appendices A and G.



Electrical, mechanical and environmental tests are performed in-house, many on computer controlled equipment; thus assuring accuracy and saving time and money.

MIC case sealing is performed in one of the computer controlled seam welding environmental chambers.

State-of-the-art equipment includes: Computer aided design optimization; computer controlled pattern recognition ultrasonic wire bonder; HP 8510 and 8505 Network Analyzers along with other IEEE bus interface test equipment controlled by HP 9825 computers. The results are competitive high quality products.



The Daico 292-page Engineering Handbook and Reference Drawings contains detailed engineering data for the most popular proven standard devices. Daico engineering drawings for each product include specifications, performance curves, pin-outs, connector, and outline-drawing details. Logic tables are provided where appropriate,

In addition the handbook contains Quality Assurance information, design aids, nomographs, and transmission-line relationships. The Engineering Handbook may be obtained by qualified persons directly from Daico or from your Daico representative listed in the yellow pages of EEM.

Write, phone or TWX for your free copy of the Daico Engineering Handbook: P.O. Box 5225, Compton, CA 90224, Telephone 213/631-1143, TWX 910-346-6741.

DAICO INDUSTRIES, INC.

2139 East De Amo Blvd.
Compton, CA 90220

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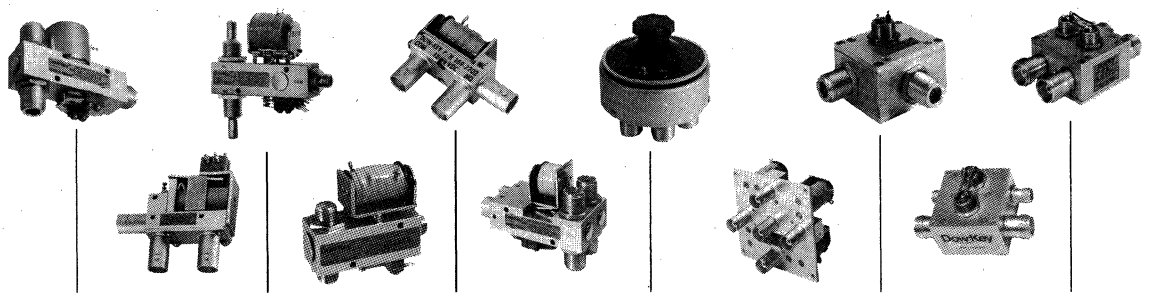
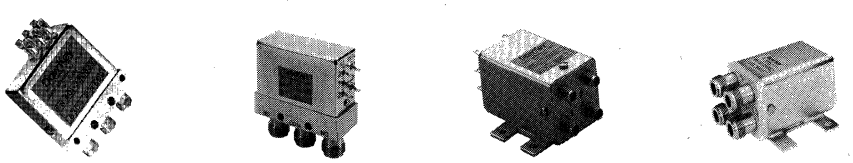
Coaxial Relays



Dow-Key Series No.	60	61	66	77	169	260	78	115 116	310	312	313
Contact Arrangement	SPDT	SPDT	SPDT	SPDT	SPDT	DPDT	Multi-Throw Manual	115: 3 position 116: 4 position	SPDT	By-Pass	Transfer
Connector Options	BNC, N, UHF, C[3]	BNC	F	BNC, F	BNC	UHF, N, BNC	UHF, BNC	BNC	SC, HN, N	SC, HN, N	SC, HN, N
Frequency, max	1000 MHz	1000 MHz	500 MHz[2]	1000 MHz	1000 MHz	1000 MHz	500 MHz	3000 MHz	400 MHz	400 MHz	400 MHz
Power Rating (CW) at 30 MHz	1000W	150W	45W	150W	150W	1000W	1000W	200W	3000W	3000W	3000W
Power Rating (CW) at max freq	350W	50W	20W	50W	50W	350W	450W	30W	850W	850W	850W
VSWR	1.3	1.2	1.3	1.3	1.3	1.3	1.2	1.4	1.1	1.1	1.1
Impedance (ohms)	50	50	75	50/75	50	50	50	50	50	50	50
Size (LxWxH, inches)[1]	3.0 x 1.16 x 1.9	1.6 x .64 x 1.67	3.0 x 1.1 x 1.35	1.88 x .75 x 1.63	1.55 x .63 x 1.2	3.0 x 2.03 x 1.75	3.0D x 1.0H	2.5 Sq x 1.4H	2.0 x 1.68 x 1.3	2.0 x 2.13 x 1.3	2.0 x 2.13 x 1.3
Approx Weight (oz)	10	4.5	10	3	3.5	12	10	12	8	12	12

[1]Does not include connectors.
[2]Minimum -100 dB Isolation dc to 500 MHz.
[3]Special connectors producing -100 dB isolation available. Power rating is reduced to 20 CW.

Microwave Relays

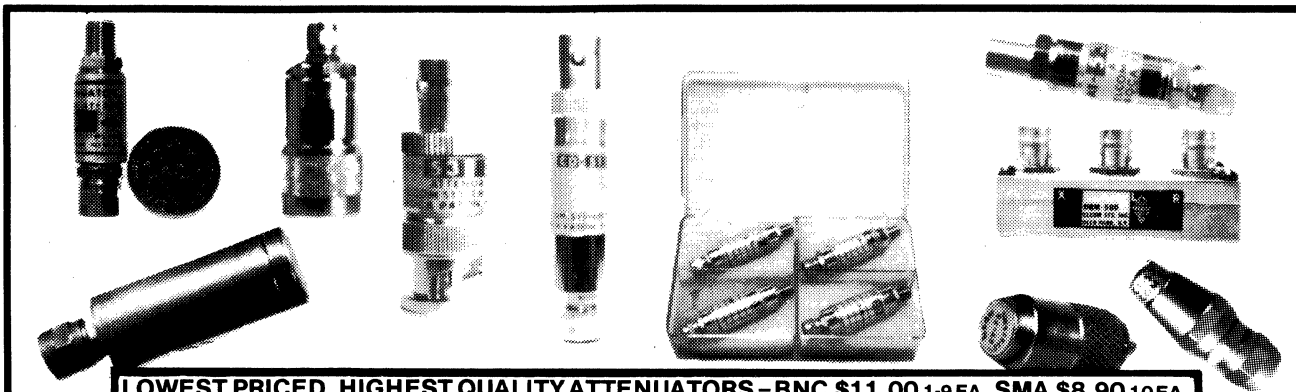


Dow-Key Series No.	401	402	411	412
Contact Arrangement	SPDT	SPDT	Transfer	Transfer
Connector Options	SMA	N	SMA	N
Frequency, max	18 GHz	12.4 GHz	18 GHz	12.4 GHz
Isolation-dB, min 0-1 GHz	85	85	80	85
Isolation-dB, min at max freq	60	60	60	60
VSWR, max	1.5	1.5	1.5	1.5
Insertion Loss-dB, max	0.5	0.5	0.5	0.5
Size (inches)*	1.40H x 1.34L x.50W	2.2H x 2.64L x 1.09W	2.1L x 1.26 Sq	3.0L x 1.75 Sq
Approx Weight (oz)	1.5	9	6	16

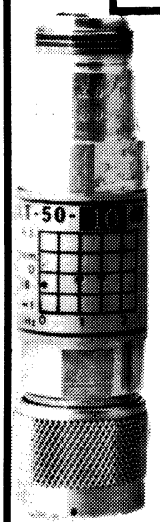
*Excludes mounting bracket, terminals, and connectors.

Dow-Key Microwave Corp.
1110 Mark Ave.
Carpinteria, CA 93013
(805) 684-0427; TWX 910-380-4327

DowKey® Microwave CORPORATION



LOWEST PRICED, HIGHEST QUALITY ATTENUATORS – BNC $11.00 1-9 EA, SMA $8.90 10 EA. AND TERMINATIONS – BNC $5.60 10 EA., SMA $5.60 10 EA., MIL. HI-REL. NETWORKS

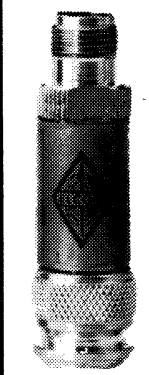


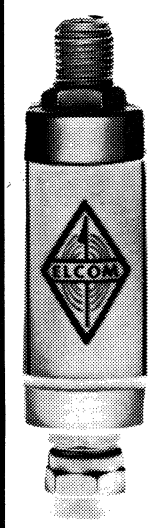
Model Number (2)	Impedance Ohms (Power W)	Frequency Range	UNIT PRICE (4) EFFECTIVE 1-15-85 BNC	TNC	N	SMA	UHF	PC
Fixed Attenuators, 1 to 20 dB:								
AT-50(3)	50 (.5W)	DC-1.5GHz	14.00	20.00	20.00	18.00	—	—
AT-51	50 (.5W)	DC-1.5GHz	11.00	15.00	15.00	14.00	—	12.00
AT-52	50 (1W)	DC-1.5GHz	14.50	20.50	20.50	19.50	—	—
AT-53	50 (.25W)	DC-3.0GHz	14.00	17.00	—	15.00	—	—
AT-54	50 (.25W)	DC-4.2GHz	—	—	—	18.00	—	—
AT-55	50 (.25W)	DC-4.2GHz	—	—	—	8.90 (10 Pc.)	—	—
AT-75 or AT-90	75 or 93 (.5W)	DC-1.5GHz (750MHz)	14.00	20.00	20.00	18.00	—	—
Detector, Mixer, Zero Bias Schottky:								
CD-51	50	.01-4.2GHz	54.00	—	—	54.00	—	—
DM-51	50	.01-4.2GHz	—	—	—	64.00	—	—
Resistive Impedance Transformers, Minimum Loss Pads:								
RT-50/75	50 to 75	DC-1.5GHz	10.50	19.50	19.50	17.50	—	—
RT-50/93	50 to 93	DC-1.0GHz	13.00	19.50	19.50	17.50	—	—
Terminations:								
CT-50 (3)	50 (.5W)	DC-4.2GHz	11.50	15.00	15.00	17.50	—	—
CT-51	50 (.5W)	DC-4.2GHz	9.50	12.00	12.00	9.50	—	—
CT-52	50 (1W)	DC-2.5GHz	10.50	15.00	15.00	13.00	15.50	—
CT-53/M	50 (.5W)	DC-4.2GHz	5.60 (10 Pc.)	—	—	5.60 (10 Pc.)	—	—
CT-54	50 (2W)	DC-2.0GHz	14.00	15.00	15.00	17.50	—	—
CT-75	75 (.25W)	DC-2.5GHz	10.50	15.00	15.00	13.00	15.50	—
CT-93	93 (.25W)	DC-2.5GHz	13.00	15.00	—	—	15.50	—
Mismatched Terminations, 1.05:1 to 3:1, Open Circuit, Short Circuit:								
MT-51	50	DC-3.0GHz	45.50	45.50	45.50	45.50	—	—
MT-75	75	DC-1.0GHz	—	—	45.50	—	—	—
Feed thru Terminations, shunt resistor:								
FT-50	50	DC-1.0GHz	10.50	19.50	19.50	17.50	—	—
FT-75	75	DC-500MHz	10.50	19.50	19.50	17.50	—	—
FT-90	93	DC-150MHz	13.00	19.50	19.50	17.50	—	—
Directional Coupler, 30 dB:								
DC-500	50	250-500MHz	60.00	—	—	—	—	—
Resistive Decoupler, series resistor or Capactive Coupler, series capacitor:								
RD or CC-1000	1000 (1000PF)	DC-1.5GHz	12.00	18.00	18.00	17.00	—	—
Adapters:								
CA-50 (N to SMA)	50	DC-4.2GHz	—	—	13.00	13.00	—	—
Inductive Decouplers, series inductor:								
LD-R15	0.17uH	DC-500MHz	12.00	18.00	18.00	17.00	—	—
LD-6R8	6.8uH	DC-55MHz	12.00	18.00	18.00	17.00	—	—
Fixed Attenuator Sets, 3, 6, 10, and 20 dB, in plastic case:								
AT-50-SET (3)	50	DC-1.5GHz	60.00	84.00	84.00	76.00	—	—
AT-51-SET	50	DC-1.5GHz	48.00	64.00	64.00	60.00	—	—
Reactive Multicouplers, 2 and 4 output ports:								
TC-125-2	50	1.5-125MHz	64.00	—	67.00	67.00	—	—
TC-125-4	50	1.5-125MHz	67.00	—	81.50	81.50	—	—
Resistive Power Dividers, 3, 4 and 9 ports:								
RC-2-30	50	DC-2.0GHz	64.00	—	—	64.00	—	—
RC-3-30	50	DC-500MHz	64.00	—	—	64.00	—	—
RC-8-30	50	DC-500MHz	—	—	—	84.50	—	—
RC-3-75, 4-75	75	DC-500MHz	64.00	—	—	64.00	—	—
Double Balanced Mixers:								
DBM-1000	50	5-1000MHz	61.00	—	71.00	61.00	—	34.00
DBM-500PC	50	2-500MHz	—	—	—	—	—	34.00
RF Fuse, 1/8 Amp. and 1/16 Amp.:								
FL-50	50	DC-1.5GHz	12.00	18.00	—	17.00	—	—
FL-75	75	DC-1.5GHz	12.00	18.00	—	17.00	—	—

NOTE: 1) Critical parameters fully tested and guaranteed. Fabricated from Mil. Spec. High-Rel. resistors. Schottky diodes. Mil. Spec. plated parts, and connectors in nickel, silver, and gold. 2) See catalog for complete Model Number. Specify connector sexes. Specials available. 3) Calibration marked on label of unit. 4) Price subject to change without notice. Shipping $5.00 Domestic or $15.00 Foreign on Prepaid Orders.

(C) 1985-A

Delivery is stock to 30 days ARO.





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Elcom SYSTEMS INC. **305-994-1774**

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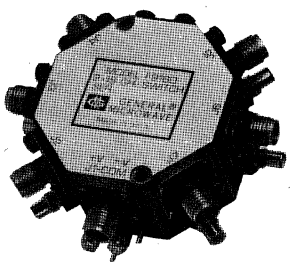
PIN DIODE CONTROL DEVICES FROM GENERAL MICROWAVE

PIN Diode Switches

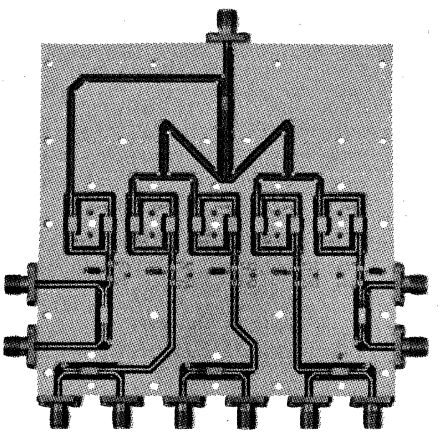


General Microwave's complete line of high performance broadband switches, with and without integral drivers, are available in three basic series.

- Ultra Broadband Series: 0.2 to 18 GHz, SPST to SP5T
- Multi Octave Band - Miniature Series: 0.2 to 4 GHz (Series 92) 2-18 GHz (Series 91); SPST TO SP7T
- Octave Band - High Speed Series: 10 nsec switching speed, 2-18 GHz; SP2T

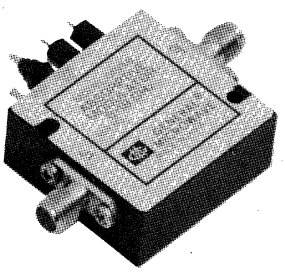
Many models of each type are available to satisfy most requirements. Non-reflective switches, space qualified units and other special designs are also available.

MIC Assemblies



General Microwave MIC assemblies can combine: • Frequency Translators • High Speed Digitally Controlled Attenuators • Power Combiners and Dividers • High Speed Switches • Mixers • Amplifiers • Isolators • Directional Couplers • Phase Modulators • Filters and other signal conditioning and processing devices.

PIN Diode Modulators/ Attenuators



General Microwave's Series of PIN diode modulators/attenuators provide octave-band and greater than octave-band performance from 0.5 to 18 GHz. All at low cost.

Series	Bandwidth	Atten. Range (dB)	Control
D195	Octave	60	Linear Voltage
D196	Multi-octave	60	Linear Voltage
195	Octave	60	Current
M180	Ultra-broadband	60	Linear Voltage

Digitally Programmable PIN Diode Attenuators

General Microwave's Series of Digitally Programmable PIN Diode Attenuators provide octave-band and greater than octave-band performance from 0.2 to 18 GHz with wide programming flexibility. All at low cost. Their compact, rugged packages are well suited to military applications. They are available in drop-in module type configurations and hermetically sealed packages. Nanosecond switching speed modules are also available.

Series	Bandwidth	Atten. Range (dB)	LSB (dB)
329	Octave	80&120	0.1
345	Octave	60	0.25
346	Multi-octave	60	0.25
325	Ultra-broadband	120	1.0

GENERAL MICROWAVE

155 Marine Street, Farmingdale, L.I., New York 11735, Tel: 516-694-3600

HIGH QUALITY ATTENUATORS!

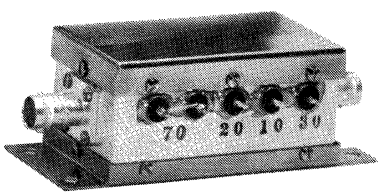
Kay Elemetrics Corp offers a complete line of Programmable, Toggle Switch, Rotary and Continuously Variable attenuators. All Kay attenuators are equipped with precision, field replaceable resistors. Kay is able to produce durable toggle switch attenuators with superior specifications by using teflon, gold and silver components in our custom developed and in-house manufactured switches. Our Rotary attenuators use dual gold plated printed circuit contacts at each connector for superior electrical contact.

If you don't see an attenuator that fits your requirements call us. Kay can design an attenuator to fit your specific OEM needs. We have designed over 250 different special attenuators in the past.

Please call or write to the address listed below for our complete attenuator catalog and price sheet. Our quantity discounts start as low as two (2) units!

OEM PROGRAMMABLE ATTENUATORS

- LOGIC ADAPTORS AVAILABLE

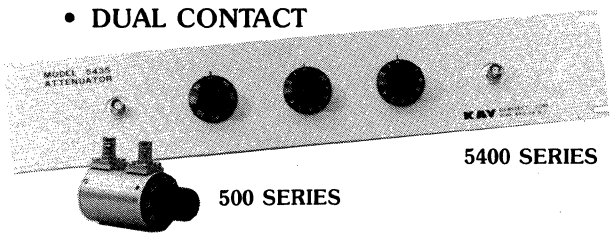


4000 SERIES

IMP. Ω	MODEL	FREQ. RANGE	ATTEN. RANGE
50	1/4450	DC- 1GHz	0-16.5dB in .1dB steps
50	4460	DC- 1.5GHz	0-31dB in 1dB steps
50	4480M	DC- 1.5GHz	0-63dB in 1dB steps
50	4450	DC- 1.5GHz	0-127dB in 1dB steps
50	4440	DC- 1.5GHz	0-130dB in 10dB steps
75	1/4457	DC-750MHz	0-16.5dB in .1dB steps
75	4467	DC- 1GHz	0-31dB in 1dB steps
75	4487M	DC- 1GHz	0-63dB in 1dB steps
75	4457	DC- 1GHz	0-127dB in 1dB steps
75	4447	DC- 1GHz	0-130dB in 10dB steps

OEM STEP ATTENUATORS

- HIGH RELIABILITY
- DUAL CONTACT



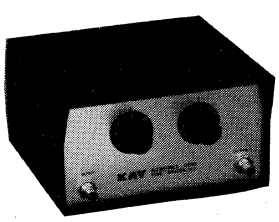
5400 SERIES

500 SERIES

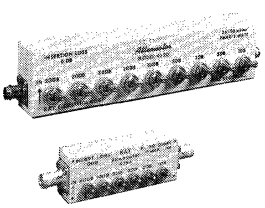
IMP. Ω	MODEL	FREQ. RANGE	ATTEN. RANGE
50	1/500	DC- 1GHz	0-1dB in .1dB steps
50	500	DC- 2GHz	0-10dB in 1dB steps
50	520	DC- 2GHz	0-70dB in 10dB steps
75	1/510	DC-500MHz	0-1dB in .1dB steps
75	510	DC- 1.5GHz	0-10dB in 1dB steps
75	530	DC- 1.5GHz	0-70dB in 10dB steps
50	5436	DC- 2GHz	0-80dB in 1dB steps
50	5435	DC- 1GHz	0-81dB in .1dB steps
75	5446	DC- 1.5GHz	0-80dB in 1dB steps
75	5445	DC- 1GHz	0-81dB in .1dB steps

BENCH STEP ATTENUATORS

- HIGH ACCURACY
- POSITIVE REPEATABILITY
- COMPACT DESIGN



5000, 5100 SERIES

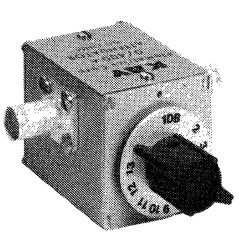


400 SERIES

IMP. Ω	MODEL	FREQ. RANGE	ATTEN. RANGE
50	1/432	DC-500MHz	0-22.1dB in .1dB steps
50	1/439M	DC- 1GHz	0-22.1dB in .1dB steps
50	431	DC- 1GHz	0-41dB in 1dB steps
50	438M	DC- 1GHz	0-41dB in 1dB steps
50	430	DC- 1GHz	10-51dB in 1dB steps
50	432	DC- 1GHz	0-101dB in 1dB steps
50	439M	DC- 1.5GHz	0-101dB in 1dB steps
50	437M	DC- 1GHz	0-102.5dB in .5dB steps
50	460M	DC- 1GHz	0-132dB in 1dB steps
75	1/442	DC-500MHz	0-22.1dB in .1dB steps
75	1/449M	DC-500MHz	0-22.1dB in .1dB steps
75	441	DC- 1GHz	0-41dB in 1dB steps
75	442	DC- 1GHz	0-101dB in 1dB steps
75	449M	DC- 1GHz	0-101dB in 1dB steps
75	447	DC- 1GHz	0-102.5dB in .5dB steps
75	470M	DC- 1GHz	0-132dB in 1dB steps
50	5150	DC- 2GHz	0-80dB in 1dB steps
50	5050	DC- 1GHz	0-81dB in .1dB steps
75	5175	DC- 1.5GHz	0-80dB in 1dB steps
75	5075	DC- 1GHz	0-81dB in .1dB steps

*M-MINIATURE HOUSING 90 Ω ALSO AVAILABLE

CONTINUOUSLY VARIABLE ATTENUATORS

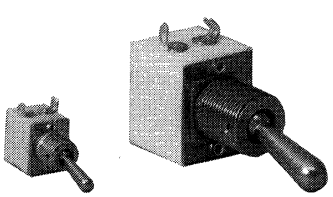


0/400, 0/410 SERIES

0/400 DC-500MHz 1-13dB
0/410 DC-400MHz 2-14dB

R.F. MEGA SWITCHES

- DC-1000 MHz
- LOW INDUCTANCE, CAPACITANCE & RESISTANCE



254 SERIES

0.15pf Between switch arms.
0.1pf Between open contacts and switch arms.

KAY Kay Elemetrics Corp, 12 Maple Ave. Pine Brook, NJ 07058-9797

TEL: (201) 227-2000, TWX: 710-734-4347

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 85/86 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1166, **B**•1012, **C**•1028, **D**•1016
ASCII Code ..... **D**•1087
Batteries, Product Selection Guide ..... **D**•1413
Batteries & Fuel Cells, Characteristics ..... **D**•1430
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide ..... **A**•1003
Circuit Boards (Printed) Product Selection Guide ..... **C**•1099
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1205
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1863
Connectors, Miniglossary ..... **C**•1129
Connectors, Terminals, & Sockets, Product Selection Guide ..... **C**•1105
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Gude ..... **A**•1309
Delay Lines, Product Selection Guide ..... **A**•1459
Discrete Semiconductors, Product Selection Guide ..... **A**•2067
Displays, Readouts, Lamps, & Lights, Product Selection Guide ..... **B**•1015
EBCDIC Code ..... **D**•1092
Encapsulation, Miniglossary ..... **C**•1086
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide .. **C**•1623
Filters, Product Selection Guide ..... **A**•1583
Instruments, Graphic Recording Product Selection Guide ..... **D**•1401
Instruments, Panel Meters, Product Selection Guide ..... **D**•1329
Instruments, Test & Measuring Product Selection Guide ..... **D**•1175
Interconnection Systems, Product Selection Guide ..... **C**•1699
Keyboards & Keypads, Product Selection Guide ..... **B**•1705
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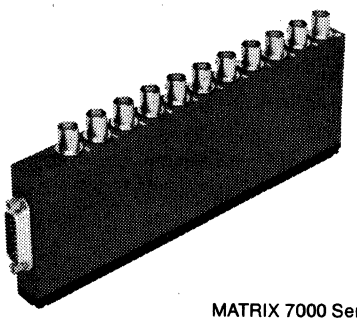
MATRIX
SYSTEMS CORPORATION
5177 NORTH DOUGLAS FIR ROAD
CALABASAS, CALIFORNIA 91302
(818) 992-6776 • TWX 910-494-4975

COAXIAL RELAY MODULE



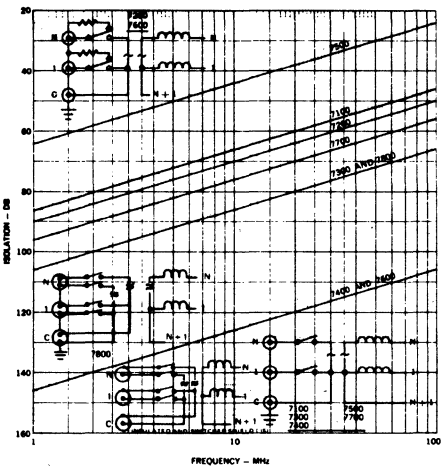
FEATURES

- Two to twenty four throws
- Continuous shield continuity
- Rugged machined aluminum housing
- Crosstalk always less than isolation
- Switchpoints individually field replaceable
- Extremely low EMI
- Low VSWR
- Maitrix configuration easily assembled using 9000 series cross straps
- Signal circuits isolated from control circuitry

MATRIX 7000 Series Switch Modules are designed to maintain coaxial switching continuity over a wide range of critical and high environmental applications. The switch housings are constructed on precision machined aluminum alloy for structural integrity and hard anodized for durability.All signal shield paths are silver plated with covers gasketed for maximum EMI protection. The basic reed switch elements are hermetically sealed in nitrogen filled gas envelopes and employ rhodium plated contacts to insure non-stick operation. Applications for MATRIX 7000 Series include:

— R.F. and I.F. switching where a low VSWR is required .
— CCTV, base band video and pulse switching where low phase distortion and high pulse fidelity are required.
— Applications requiring a high degree of shielding integrity and low contact and induced noise such as pre amp input switching or the switching of high impedance operational amplifier inputs.

Matrix and hybrid switching systems are easily constructed by using Series 9000 (no output), 9100 (one output) or 9200 (two output) push-on cross straps which mate with the BNC connectors on the switch modules. The cross strap output connectors are BNC female type UG 1094/U. The model number of the cross strap is assigned by replacing the two zeros of the series number with the number of inputs desired. For example, a Model 9108 has eight inputs and one output.



SERIES 7000

7100— Standard
7200— Self-terminating
7300— High isolation
7400— Highest isolation
7500— High power
7600— Highest isolation self-terminating
7700— Mercury wetted contacts
7800— Twinax
7900— Triax

MODEL NUMBER ASSIGNMENT

7 X XX -X

Series — 7 — XX — -X — T

Number of throws — XX

Coil suppression diodes — DR
TNC connectors — T
Self-terminating resistance — ohms
Insulated shield — I
Insulated and switched shield — IS
Expander output — E
Chassis mount — C

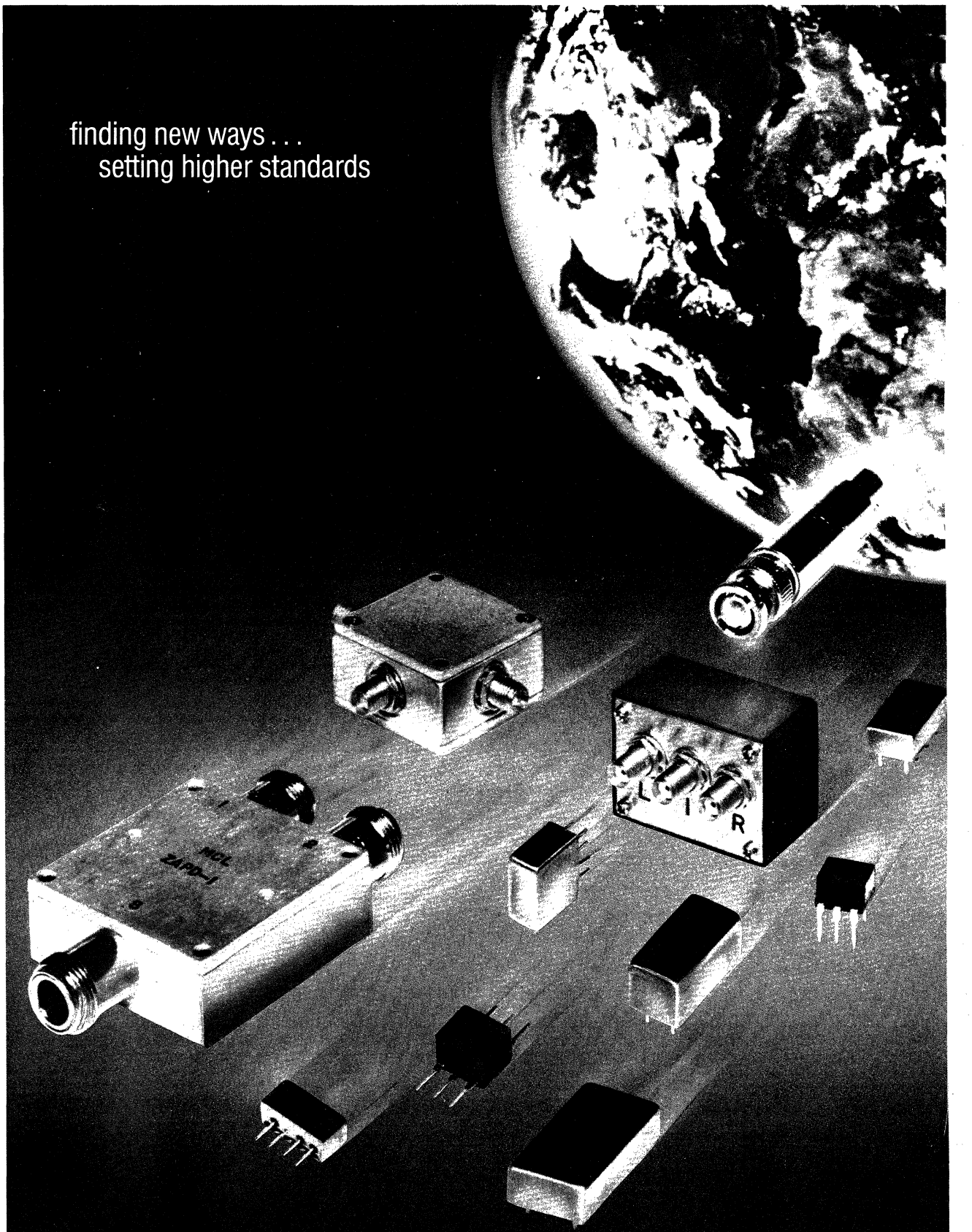
SPECIFICATIONS

FREQUENCY RANGE:	0 - 300MHz
CHARACTERISTIC IMPEDANCE:	50 ohms - 75 ohm optional
SWITCHING CONFIGURATION:	Single or double pole, two thru twenty four throws
SWITCHING SPEED:	Less than one millisecond
ISOLATION:	See graph
CONTROL - CONNECTOR:	28 VDC,30 MA D type - subminiature connector
SIGNAL CONNECTOR:	BNC - UG1094/U, TNC and SMA optional
OPERATING TEMPERATURE AND HUMIDITY RANGE: −30°F to + 150°F, 0 to 98 percent R.H.	
OPERATING SHOCK AND VIBRATION:	50 G's -1MS,2G's p-p 20-2000 Hz
DIMENSIONS:	.625″ W × 3.25″ H × 1.44″ + .625″ × Number of throws
MOUNTING:	Three 6-32 tapped holes in base

	7100	7200	7300	7400	7500	7600	7700	7800
CONTACT RATING:	100 vdc .250 amp 10 W	28 vdc .250 amp 3 W	100 vdc .250 amp 10 W	28 vdc .250 amp 3 W	400 vdc 1 amp 15 W	28 vdc .250 amp 3 W	100 vdc 2.0 amp 50 W	100 vdc .250 amp 10 W
CONTACT RESIST-ANCE:	.150ohm	.300ohm	.300ohm	.300ohm	.060ohm	.300ohm	.050ohm	.300ohm

Matrix Systems Corporation manufactures a variety of Switching Devices. Whether you are Switching VHF,Video, Pulse or Audio or your control requirements are programmable or manual. Give us a call. We specialize in specials. (818) 992-6776

finding new ways . . .
setting higher standards



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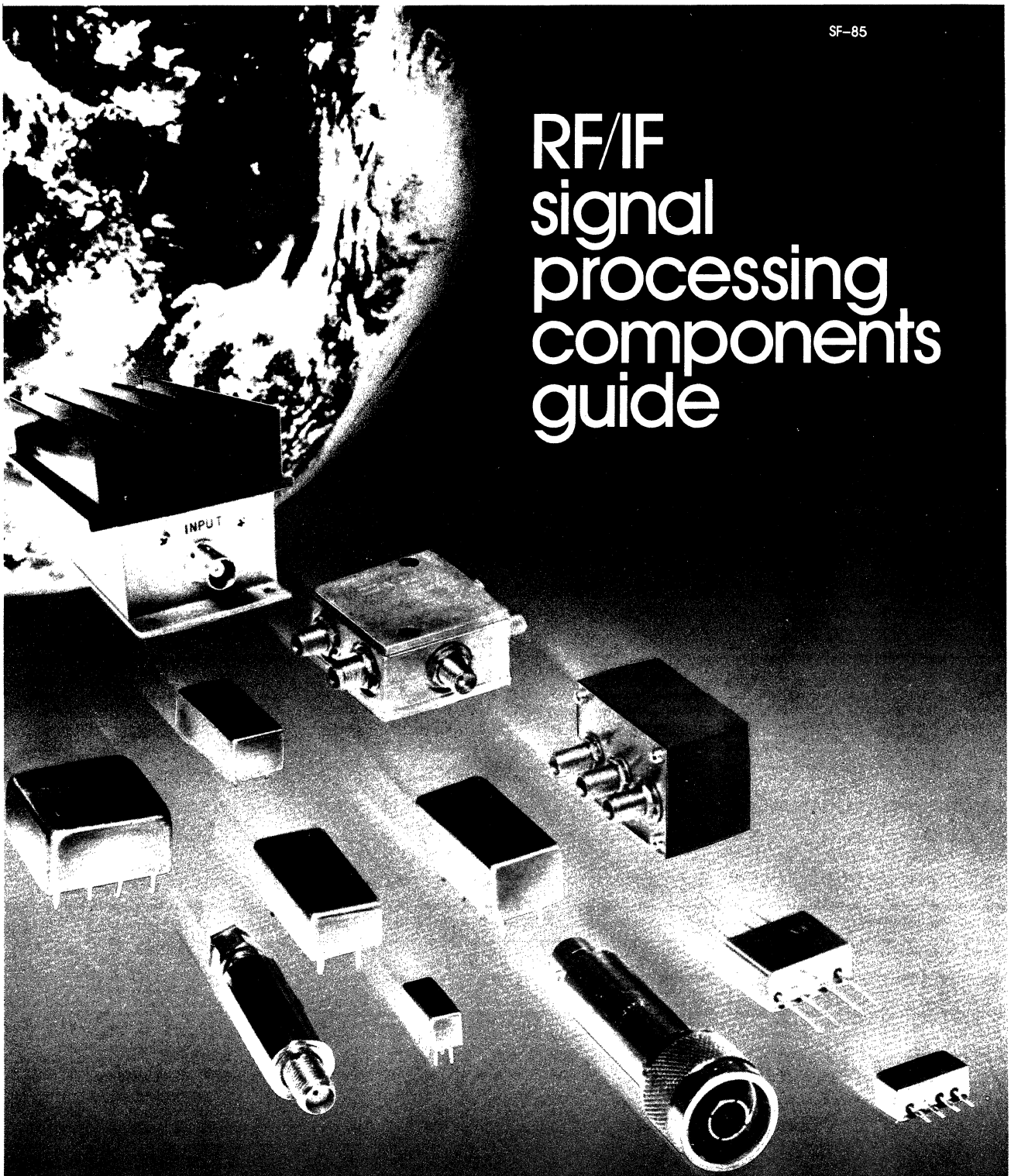
SF–85

RF/IF signal processing components guide



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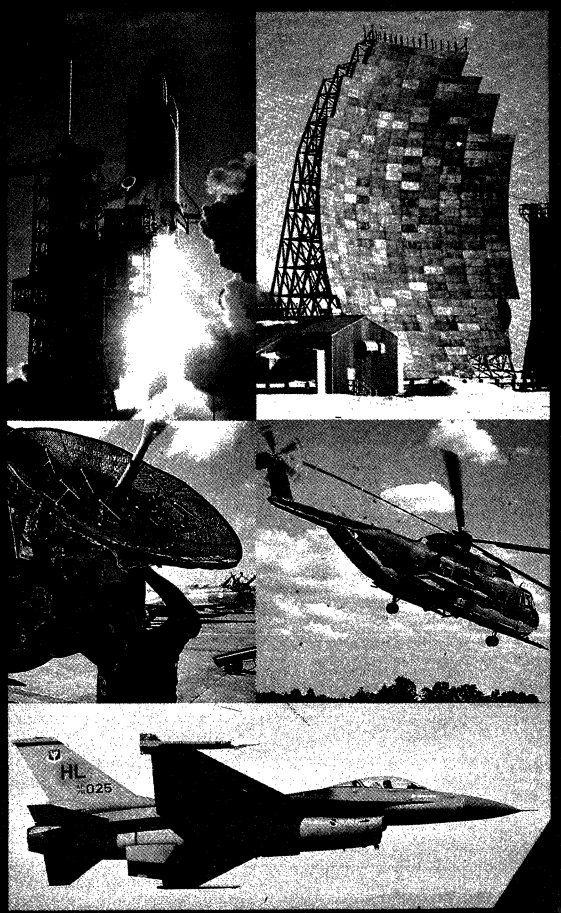
setting higher standards

Mini-Circuits



at Mini-Circuits, we're dedicated to pursue product innovations and improvements to satisfy our customers' current and future needs.

finding new ways...
such as a proprietary HTRB diode-screening technique, computer-automated performance data (CAPD) documentation and off-the-shelf TX mixers.

setting higher standards
with the industry's only 3-year guaranteed mixers, −55 dB guaranteed third-order IM mixers, highest output (1000 mv) phase detectors, widest bandwidth directional couplers ...just to name a few.

Our committment to the customer never ends.

finding new ways . . .
setting higher standards

Mini-Circuits

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ordering information *Federal supply code: 15542*

how to order

Your local representative or distributor is the contact for both sales and service assistance for products listed in this catalog. These local offices have the latest price and delivery information on all models. They can also provide details on ordering procedures, service information and application engineering data.
Your order may be sent directly to Mini-Circuits or to any of the local sales offices listed.
Prices listed in this catalog are domestic F.O.B. Brooklyn, New York. Mini-Circuits reserves the right to change specifications, models, prices or designs without prior notice and without liability for such changes.

shipping instructions

Shipments can be made by either air or surface carriers. If specific shipping instructions do not accompany the order, Mini-Circuits will specify the carrier to be used.

terms

Net 30 days from date of invoice. If credit is not established with Mini-Circuits, shipments will be made C.O.D. (cash on delivery) or prepaid. When sending prepayments, please include freight.

warranty

Scientific Components Corporation, Mini-Circuits division, warrants each product manufactured by Mini-Circuits to meet all published specifications and to be free from defects in material and workmanship. The Company's liability under this warranty is limited to repair, adjustment and/or replacement of defective parts returned, freight paid by Buyer, to the factory within a period of one year from date of shipment from the factory unless a shorter period is specified. International customers may ship to the Company's nearest Distributor.
Damage by misuse or abnormal conditions of operation, or evidence of partial or complete disassembly voids this warranty.
SINCE MINI-CIRCUITS HAS NO CONTROL OVER CONDITIONS OF USE, NO WARRANTY IS MADE OR IMPLIED AS TO SUITABILITY FOR CUSTOMER'S INTENDED USE, BEYOND SUCH PERFORMANCE SPECIFICATIONS AS ARE MADE A PART OF THE PURCHASE ORDER. Equipment shipped F.O.B. Mini-Circuits' plant shall become the property of the Buyer upon delivery to carrier. Damage in shipment should be handled by the Buyer directly with the carrier by immediately requesting carrier's inspection upon evidence of damage in shipment.
A fee will be charged to the Buyer to cover the costs of inspection and test of units returned under this warranty and subsequently found to meet specifications or to be faulty for reasons which are not Mini-Circuits' responsibility. This warranty excludes all other warranties expressed or implied. Mini-Circuits shall not be liable for any special, indirect or consequential damages.

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Mini-Circuits

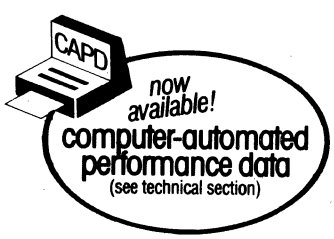
how to use this catalog

Over 1,000 RF/microwave signal-processing components are available to the design engineer from Mini-Circuits. This catalog has been organized to simplify the process of selecting the component best suited to your application and need, to speed location of specs for a particular model, and to provide helpful application assistance.

A complete listing of all the product family groups — from frequency mixers to power splitters to RF transformers — plus warranty and ordering details are found on page 3.

Looking for data on a specific model? Page 4 contains a list of all models in alphabetical/numerical order, available from Mini-Circuits with reference to specific data pages.

For a concise production/test flow diagram illustrating Mini-Circuits quality-control procedures. Turn to pages 6 and 7. Also detailed information on our Hi-Rel, HTRB and TX products for your military, space or rugged industrial applications.



Computer-automated-performance data (CAPD) is a Mini-Circuits' innovation offering the most complete data base for catalog RF signal-processing components. What's involved in CAPD and its benefits towards your new designs are described on pages 8-13.

"Mastering the Mixer Maze"...
Mixer selection, with hundreds of models to choose from, can be confusing. The penalty for improper selection? Overspecify and pay extra; underspecify and face marginal performance. Read pages 14-15 for a clearly-detailed procedure for choosing the optimum mixer for your needs.

Data pages are grouped by product line. Each data page is organized by series within the product line and by models within the series.

Information given includes CAPD data, National Stock Numbers (NSN), equivalent MIL — part numbers, pin connection designations, case styles, and notes to the tables.

Full technical data for each model is given in table form. The tables are arranged by sequence of model number for each series. The various models within a series differentiate from each other by the frequency range they cover. Frequency range is defined in the tables by the lowest frequency fL to the highest frequency fu. For most models, the frequency range is further subdivided into three segments; L = low range, M = mid range, and U = upper range. Each range L, M, U is defined at the bottom of each table in terms of fL and fu.

Mixer selection is primarily determined by selecting a mixer level suitable for the application. Therefore, to aid the designer, frequency mixers are organized in sequence of mixer level — Level 7, 10, 13, 17, 17S, 23, 23S and 27. A Level 7 mixer operates with +7 dBm LO drive, a Level 13 mixer operates with +13 dBm LO drive, etc. For each level mixer, a maximum RF input level for linear operation is specified.

Power splitters are organized in numerical sequence of power split; from 2 way 0°, 2 way 90°, 2 way 180°, 3-, 4-, 5-, 6-, 8-, 12-, 24-, to 48 way 0°.

Case style and dimensions are easy to find... each data page includes a photo of the particular case style for each series and, within the data, there is reference to case style number and outline drawing letter. Turn to pages 58 to 62 for case style dimensions, tolerances and bracket options where applicable.

For example, the SRA-1 mixer detailed on page 16 calls for case A 01. The dimensions and outline drawing are given in the table on page 58 and figure A on page 59.

Need Mini-Circuits components in a hurry? Refer to page 63 for a listing of our world-wide network of sales representatives and distributors ready to serve your needs, supply your orders, and answer your questions promptly and courteously.

reliability and

All Mini-Circuits' RF signal-processing components are subjected to rigid quality control procedures starting from raw material procurement through product production and final inspection; the objective—to supply our customers with the finest RF signal-processing components available. Here's a list of some of the procedures taken to insure high-quality performance and product reliability:

A. 100% testing of each diode.

B. 100% testing of each unit.

C. 100% inspection of every solder connection.

D. All transformers bonded to the header for protection against severe shock and vibration.

E. All diodes, resistors and capacitors bonded to the header for protection against severe shock and vibration conditions.

F. Diode and resistor power dissipation derated greater than 50%.

G. All components rated for greater than + 125°C.

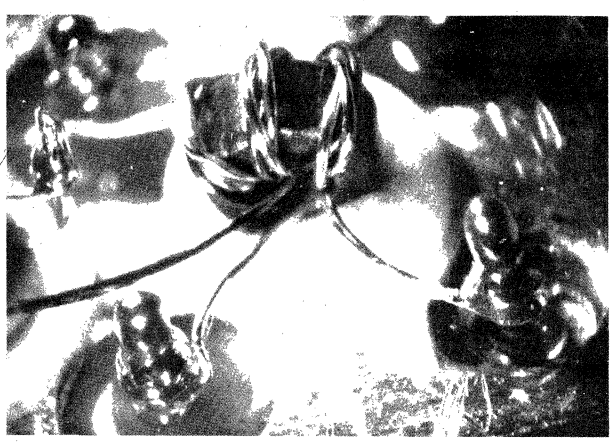
H. All transformer leads double wrapped.

I. Heavy coated wire insulation for HiPot/altitude.

J. Completely encapsulated for protection against mechanical shock and vibration as well as temperature shock.

K. Permanent case marking of model number cannot be removed by cleaning agents.

L. Cupro-Nickel case for long-lasting finish especially under salt atmosphere conditions.



Every unit shipped from Mini-Circuits carries a full-year guarantee; in fact, our industry-standard SRA-1 mixer offers an exclusive three-year guarantee.

hi-rel components

High-temperature, Reverse-bias (HTRB) testing is an accelerated-life screening test generally reserved for space applications. Here the Schottky and PIN diodes are subjected to a one-volt negative bias at 150°C for 168 hours. The objective of this accelerated aging stress is to force time/temperature-related failures and thus screen out potentially unreliable devices; in conventional "baking" processes, the diode does not experience anywhere near the stress imposed by the HTRB program. The result: highly-reliable Schottky and PIN diodes ready for wiring into assemblies.

Next, the assembled units are subjected to additional testing procedures including
(1) burn-in for 96 hours at 100°C with 8 ma at 1 KHz
(2) thermal shock per MIL-STD 202, Method 107
(3) Gross and fine leak tests according to MIL-STD 202, Test Method 112B, Conditions A and C

As a consequence of the above HTRB, final seal, and burn-in testing, Mini-Circuits components offer an unprecedented high level of reliability. In fact, Mini-Circuits' industry-standard SRA-1 is the only double-balanced mixer in the world to be offered with an exclusive *three-year* guarantee.

TX mixers

For the most critical space, military or industrial applications in hostile environments, Mini-Circuits offers TX mixers. Stringent screening and stressing are applied to the TX mixers which employ TX hermetically-sealed diodes that have passed the following tests per MIL-STD-750:
(1) high-temperature storage for 340 hours at 150°C, Method 1032; (2) thermal shock, Method 1051, Test Condition C (−65°C to +150°C, 10 cycles); (3) constant acceleration, Method 2006, Y1 orientation, 20,000 G's; (4) fine leak, Method 1071, Condition H; (5) gross leak, Method 1071, Condition C; (6) burn-in for 96 hours at 25°C, 75mW/junction at 60 Hz, Method 1038, Condition B.
Those diodes that pass these rigid tests are then electrically tested to ensure that they meet specifications. They are then assembled into TX mixers which are then further exposed to these stress tests: (1)thermal shock, MIL-STD 202, Method 107; (2) burn-in for 96 hours at 100°C, with 8 ma at 1 KHz; (3) gross and fine leak, MIL-STD 202, Method 112B, Conditions A and C
The SRA-1TX is the first off-the-shelf TX mixer in the industry available for immediate delivery. All other Mini-Circuits' mixers are available with TX screening and testing.

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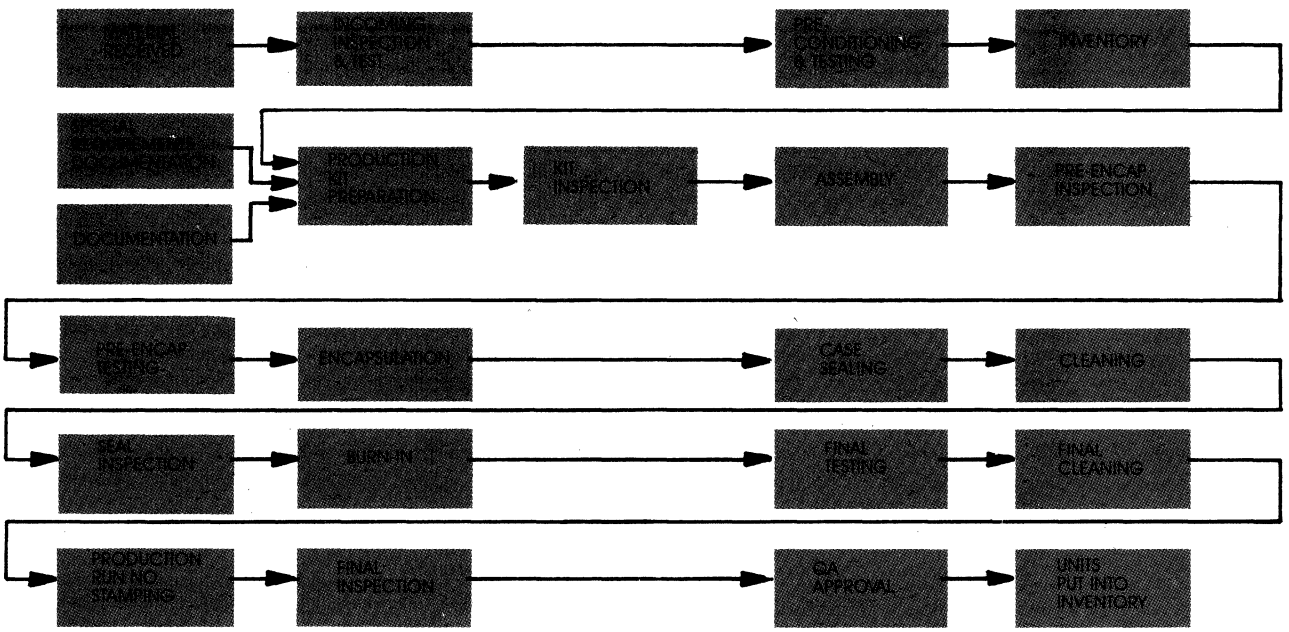
quality control

how Mini-Circuits achieves high reliability



environmental specifications

All MCL components are manufactured under exacting quality assurance and control standards. They will meet or exceed published specifications over the operating temperature range of −54° to +100°C, and after being subjected to any or all of the following physical or environmental tests of MIL-STD 202E which are applicable.

	TEMPERATURE CYCLING: −65° to +125°C	102 C
	ALTITUDE: 656,000 feet	105 G
(2)	HUMIDITY: 90% RH, 65°C	106
	THERMAL SHOCK: −65°C to +125°C	107 B
(1) (2)	SEAL: Less than 10^5 Atm. cc/sec	112 A
	DROP: Random, 45 min.	203
	VIBRATION: 2 to 2,000 cps, 20g, 12 hrs.	204 D
	SOLDER HEAT: 260°C, 10 sec.	210 B
(1)	SOLDERABILITY: 95% coverage	208
	TERMINAL TENSILE STRENGTH: 4½ lbs., 10 sec.	211 A
(1)	TERMINAL FATIGUE: 2 lbs., 3 cycles	211 C
	MECHANICAL SHOCK: 100g, 6ms	213 I
	SOLVENT RESISTANCE: Alcohol, Trichloroethan, Freon	215

NOTE:
(1) These specifications do not apply to coaxial connector models.
(2) Exceptions are non-hermetic case styles 6, 38, 46.

absolute maximum ratings

OPERATING AND STORAGE TEMPERATURE −55°C to +100°C

eliminating guesswork in systems design

CAPD (computer-automated performance data)

Today, RF and Microwave subsystem and system designs must be more precisely detailed as performance demands become more stringent. Radars must be more accurate, communications systems must be more noise-free, and guidance systems must be more rigorous, and all are required to meet quality and reliability levels considered unattainable a decade ago. These new demands place a heavy burden on the design engineer, the project manager, the quality assurance group...and the suppliers of the components to be assembled into these systems. In addition to the stricter performance and reliability specs, the designer faces escalating costs if, at the last stages before system delivery, unexpected surprises occur in the form of spurious signals, high VSWR or other pitfalls not anticipated.

Until now, the designer selected his RF/Microwave components, such as mixers, power splitters, and amplifiers, using manufacturers' data sheets to provide detailed specs, performance curves, and environmental ratings. Indeed, the design engineer did receive a workable package of information to see how his design might proceed...but it was not a detailed, close-up look. The reason is simple—it has just been too expensive to take an enormous number of test points, at a considerable number of specific frequencies, tabulate the results and then repeat at other input levels.

As an example, a two-tone intermodulation distortion chart for mixer performance would require at least 100 measurement points plus 10 additional calibration points and would take an experienced technician at least a half-day to complete.

For those customers who required their data at specific frequencies or under conditions other than is offered on the manufacturers' data sheets, extra charges were justifiably added to offset the additional labor costs.

Now, a new computer-automated performance data (CAPD) service offered exclusively by Mini-Circuits to its customers at no additional charge. Based on over 20 years of RF test experience and six years of engineering manpower-hours, the CAPD service provides detailed specs never available previously on mixer conversion loss, isolation, VSWR and intermod; for directional couplers and power splitters, details on insertion loss, isolation, phase unbalance and VSWR vs. frequency; for amplifiers, VSWR, gain changes and compression point vs frequency. In fact, all Mini-Circuits' products are available with CAPD specs.

test setup is self checking

The heavy investment in CAPD, using a Hewlett-Packard Model 85 computer and HP8566A spectrum analyzer as key elements, allows the previously-mentioned, two-tone IM test to be completed in less than ten minutes compared with the manually performed sequence requiring 4-5 hours. Here's how stringent the computer-automated set up dictates each measurement: each point is measured three times, with a maximum allowable deviation of less than 0.05 dB between the three; otherwise the test is repeated. Before each measurement is taken, the computer checks the reference voltage level for any variation due to line voltage, temperature, etc., changes and compensates as required. Similarly, frequency is monitored before each test and any drift is automatically corrected. Such continuous and rapid inspection and correction ensure highly-reliable CAPD data. And, by using a large number of closely-spaced frequency points for component measurement, effects of narrow-band suck-outs or resonances (often missed with manual test procedures) are immediately identified.

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Mini-Circuits

a close-up view of performance

What's the significance of CAPD to the designer? Is it a sales "gimmick" or is it truly a design tool? Review these points and judge for yourself.

A competent RF/Microwave design engineer, drawing on his experience and expertise over years of varied projects, still must be concerned with unforeseen problems when the prototype is first turned on. Generation of spurious signals, changes in dc offset level, affects of LO drive variations and other vexing problems often become evident to extend delivery time and escalate costs. In many instance, a more precise definition of the component specs could have pinpointed the potential problem areas; with CAPD, it's now possible.

Let's assume you are specifying a double-balanced mixer for a wideband front-end design. Here are a number of profound questions you face:

- In a wideband design, the local oscillator (LO) output might vary over the band and could fall below the level required by the mixer spec. Should you spend additional money to flatten LO output or do you boost LO output if it is not sufficient?... Wouldn't it be valuable to know exactly how performance will be affected since you might find performance acceptable without any additional investment? with CAPD, a close point-by-point printout of key parameters as a function of LO level is available (fig. 1) — now you can make your decision based on a close-up, view of LO drive effects on mixer performance.
- How about VSWR over the full range of receiver specs? Generally, mixer VSWR specs are given at one particular frequency. With manual-test procedures, it's a time-consuming task for the components manufacturer or systems house; with CAPD it's available at no extra charge (fig. 2).
- How does the filter in the design match the mixer IF output and what is the impedance match in-band as well as out-of-band where spurious responses become a threat? CAPD VSWR data tells it all. How will the mixer conversion loss affect receiver sensitivity over the full frequency range? And, how will flatness of conversion loss affect the degree of image rejection in an image-reject mixer? CAPD data (fig. 1) will pinpoint these details.

If the mixer is being used as a phase detector, it may be critical to know how dc offset voltage varies with frequency. Most mixer specs list dc offset at only one frequency; with CAPD, this parameter is given over the full range of frequency (fig 4).

- Harmonic and intermod signals invariably plague your final design. The effects of, for example, a 4th harmonic of the LO mixing with the 5th harmonic of the RF is given on many spec sheets, but at a specific LO and RF level. The effects of LO level changes might be crucial to your design; with manual point-by-point testing, extensive and costly technician test time would be demanded or, more likely, such tests just won't be performed. With CAPD capabilities, such intricate interactions are quickly run, and made available to the designer (fig. 3).

If you are specifying directional couplers and/or power splitter/combiners in your systems, you can now closely examine how VSWR, insertion loss, isolation and amplitude/phase unbalance vary at closely-spaced points over the frequency range of interest, (fig. 5). You can now evaluate the effects of the VSWR of the termination at the S-port and, another industry-first, inspect intermod data of a power splitter caused by saturation of the cores within the unit.

Amplifier performance is clearly shown with CAPD data as a function of dc power supply changes, (fig. 6). You'll be able to closely examine how VSWR, compression point and gain are influenced by dc supply fluctuations; this could reduce your power-supply costs, since it will conveniently point to the degree of voltage regulation required to meet the amplifier performance needed. Also, it's common to furnish amplifier specs over the frequency band of interest, but CAPD testing offers an opportunity to examine the amplifier characteristics, outside the band to foresee the effects of harmonic and spurious signals; for example, an amplifier that is flat to 1200 MHz offers what gain and what VSWR for second-harmonic 2400 MHz signals? Knowing these details can thwart potential systems problems.

Even a relatively common component such as an RF transformer is now available with CAPD data, (fig. 7). The significance...previously insertion loss vs frequency was considered flat over a specified frequency range. With closely spaced CAPD test prints, even slight variations which could affect systems performance become apparent.

CAPD is your microscope

Look at CAPD as a microscope, revealing the "real world" details affecting your design decisions. Most important, CAPD was involved with one uppermost objective—to assist you, the design engineer, in producing a more effective end product. To accomplish this, you may require CAPD data at very specific frequency points not provided by our programmed steps. Not to worry...just furnish us with precise needs for your specific application. Be assured we'll do our best to comply.

eliminating guesswork in systems design

CAPD (computer-automated performance data) SRA-1 mixer

mixer conversion loss and isolation

RF (MHz)	RF-Level (dBm)	LO (MHz)	C-LOSS (dB) LO +1dBm	LO +4dBm	LO +7dBm	LO +10dBm	L-R (dB) LO +1dBm	LO +4dBm	LO +7dBm	LO +10dBm	L-I (dB) LO +1dBm	LO +4dBm	LO +7dBm	LO +10dBm
10.00	−14.97	40.00	6.84	6.21	5.48	5.73	48.83	51.66	56.57	56.14	48.48	51.72	56.14	55.84
35.78	−14.92	65.78	7.32	6.68	5.71	5.91	49.28	51.47	54.93	54.83	48.04	50.90	54.75	53.93
61.56	−14.97	91.56	6.96	6.30	5.82	5.76	49.31	50.86	53.42	51.81	48.16	49.62	52.86	51.92
87.34	−14.96	57.34	6.99	6.38	5.77	5.86	49.40	51.62	54.58	55.74	48.70	50.97	54.02	54.69
113.12	−14.96	83.12	6.65	6.73	5.66	6.01	49.23	51.39	54.09	52.15	48.11	50.40	53.81	52.37
138.90	−14.95	108.90	6.10	5.52	5.81	5.05	49.03	50.58	52.04	50.35	48.10	48.84	51.56	50.73
164.68	−14.96	134.68	6.49	5.56	5.77	5.16	48.24	49.50	48.19	48.13	47.47	48.08	48.20	48.64
190.46	−15.02	160.46	6.14	5.41	5.62	5.01	47.61	48.20	46.85	46.44	46.51	47.18	46.27	46.53
216.24	−14.96	186.24	6.03	5.49	5.85	5.11	47.27	45.80	44.88	45.34	44.96	46.25	44.72	45.78
242.02	−14.99	212.02	7.11	6.53	5.91	6.05	46.49	44.25	43.74	43.47	44.64	44.80	43.20	43.56
267.80	−14.92	237.80	6.88	6.33	5.79	5.87	45.17	43.44	42.49	42.93	44.18	44.21	42.27	43.21
293.58	−14.96	263.58	7.08	6.61	6.01	6.17	42.69	42.29	40.93	40.87	42.63	42.74	40.33	40.79
319.36	−15.00	289.36	6.97	6.41	6.03	6.04	41.59	40.77	38.59	39.64	41.75	41.10	39.70	39.51
345.14	−14.97	315.14	7.41	6.71	5.99	6.26	39.60	39.02	37.93	37.84	41.39	40.74	38.97	38.82
370.92	−14.95	340.92	7.58	6.91	6.62	6.17	40.15	38.78	37.22	37.21	41.67	39.80	39.26	37.44
396.70	−15.00	366.70	8.22	7.42	6.93	6.39	39.81	38.10	36.79	35.84	40.85	38.81	37.86	37.46
422.48	−14.97	392.48	8.46	6.99	7.27	5.57	39.50	38.16	36.76	35.79	38.93	36.27	34.74	36.69
448.26	−14.96	418.26	9.44	7.80	7.76	6.22	39.02	37.60	36.14	36.29	38.29	36.00	34.76	33.54
474.04	−15.02	444.04	10.04	8.03	8.13	6.49	39.39	38.03	37.53	36.73	36.78	34.93	35.30	33.84
500.00	−14.92	470.00	10.31	8.43	8.10	6.84	41.24	40.71	40.19	40.14	36.15	34.30	33.89	33.63

FIG. 1

mixer VSWR

Freq.	VSWR, RF port			VSWR, LO port			VSWR, IF port		
Freq. (MHz)	LO +4dBm	LO +7dBm	LO +10dBm	LO +4dBm	LO +7dBm	LO +10dBm	LO +4dBm	LO +7dBm	LO +10dBm
.500	2.57		2.52	3.57		3.82	1.37		1.07
5.000	1.16			2.28			1.16		
26.789	1.06	1.08	1.25	1.41	2.28	3.09	1.43	1.19	1.09
53.079	1.12	1.13	1.24	1.33	2.10	2.99	1.41	1.24	1.14
79.368	1.18	1.18	1.27	1.37	2.08	3.24	1.46	1.29	1.21
105.658	1.30	1.23	1.43	1.37	2.13	2.82	1.73	1.37	1.37
131.947	1.35	1.29	1.46	1.42	2.16	3.01	1.77	1.47	1.45
158.237	1.41	1.35	1.49	1.47	2.12	3.07	1.82	1.54	1.47
184.526	1.48	1.42	1.53	1.46	2.12	2.73	1.96	1.67	1.59
210.816	1.53	1.47	1.57	1.53	2.16	2.83	2.09	1.74	1.67
237.105	1.78	1.53	1.80	1.53	2.19	2.77	2.67	1.82	1.99
263.395	1.81	1.62	1.84	1.57	2.19	2.61	2.60	1.95	2.00
289.684	1.65	1.70	1.66	1.64	2.19	2.72	2.23	2.07	1.83
315.974	1.82	1.76	1.78	1.67	2.22	2.52	2.74	2.16	2.08
342.263	1.88	1.83	1.84	1.79	2.32	2.55	2.94	225	2.21
368.553	1.96	1.87	1.90	1.77	2.40	2.56	3.15	2.29	2.35
394.842	2.00	1.92	1.91	1.70	2.43	2.44	3.11	2.36	2.31
421.132	1.75	2.02	1.71	1.66	2.43	2.54	2.47	2.48	2.00
447.421	1.91	2.04	1.85	1.61	2.40	2.44	3.15	2.41	2.35
473.710	2.06	2.03	1.94	1.57	2.35	2.39	3.56	2.35	2.47
500.000	1.94	2.07	1.85	1.47	2.32	2.37	3.12	2.37	2.30

FIG. 2

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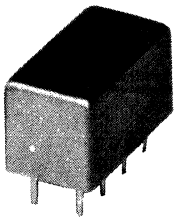


Mini-Circuits

mixer harmonic intermodulation

(Relative to desired IF Output)

LO at +4dBm

Harmonic RF Order	RF CAL	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	0	—	36	17	24	24	29	33	45	49	49	65	57	59	60	65	58
1	0	18	—	33	18	35	31	45	40	52	50	55	58	49	63	54	65
2	74	42	49	41	63	45	57	57	58	55	67	69	72	72	71	70	70
3	78	66	40	51	35	54	38	57	57	69	63	70	70	72	72	71	71
4	79	68	72	66	69	63	69	63	69	71	72	67	71	70	70	71	72
5	78	72	71	72	65	68	59	60	59	71	70	70	70	71	71	72	72
6	77	70	71	71	72	73	72	73	72	71	71	72	71	70	71	70	72
7	78	71	69	71	71	71	72	71	71	71	71	71	72	71	72	70	70
8	78	72	71	71	70	71	71	70	71	72	71	72	71	71	70	72	70
9	80	72	72	68	70	71	71	72	72	71	71	72	71	71	71	72	70
10	80	71	72	71	70	72	71	71	72	73	71	70	72	72	71	72	72
11	79	71	72	72	72	71	70	70	71	72	72	71	73	72	72	72	71
12	79	71	71	72	71	72	71	71	71	71	71	72	71	71	71	70	72
13	78	71	71	71	70	72	71	71	71	70	71	70	72	71	71	71	72
14	80	72	71	72	71	71	71	71	71	70	71	71	71	72	71	72	72
15	73	66	73	71	71	71	71	72	72	72	72	70	70	71	71	73	71

Harmonic LO Order

LO at +7dBm

Harmonic RF Order	RF CAL	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	0	—	31	17	27	22	28	30	39	49	46	58	57	58	59	66	53
1	0	17	—	37	11	33	37	47	36	50	53	60	58	59	62	61	67
2	74	48	47	50	52	49	60	56	58	50	69	65	72	73	72	73	71
3	78	66	56	58	46	57	44	68	60	64	58	72	69	72	74	72	74
4	79	71	71	72	70	73	69	70	72	73	73	71	72	71	73	72	73
5	78	73	73	72	73	73	71	72	68	72	73	72	72	71	73	72	73
6	77	73	71	72	71	73	73	73	73	72	73	72	74	73	73	71	72
7	78	73	71	72	71	73	73	73	73	72	73	72	74	73	73	71	72
8	78	74	72	72	71	74	74	73	71	72	73	72	72	73	73	72	72
9	80	74	72	73	72	72	72	73	73	73	72	73	72	74	73	72	73
10	80	73	74	73	71	73	73	73	73	72	73	73	74	72	73	74	72
11	79	71	73	73	72	72	72	71	73	72	74	73	73	73	75	72	73
12	79	73	73	72	74	72	73	72	72	73	74	72	71	72	73	73	71
13	78	73	73	73	73	72	73	73	71	72	72	72	73	72	73	73	71
14	80	73	72	73	73	73	73	73	71	72	72	71	72	73	73	72	73
15	73	66	73	72	73	73	73	73	73	73	72	71	71	73	73	72	73

Harmonic LO Order

LO at +10dBm

Harmonic RF Order	RF CAL	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	0	—	26	13	25	16	21	21	34	43	38	61	48	54	50	54	47
1	0	19	—	42	10	30	30	39	34	49	50	52	58	57	59	60	64
2	74	63	53	71	59	58	62	58	59	54	71	66	71	73	73	73	74
3	78	69	63	70	69	73	64	72	72	70	63	71	71	73	74	74	73
4	79	72	73	74	72	73	73	74	73	72	72	71	72	73	72	73	73
5	78	72	72	74	74	74	72	73	73	72	72	72	73	73	73	72	73
6	77	71	72	73	72	73	73	72	73	74	73	72	72	72	72	73	72
7	78	72	72	71	73	72	73	73	74	73	73	74	72	71	73	72	72
8	78	72	71	72	72	72	74	73	73	73	73	73	71	72	73	73	73
9	80	74	71	71	71	72	73	73	71	73	73	71	73	73	72	73	73
10	80	73	73	72	72	74	72	73	71	74	74	73	74	71	74	73	71
11	79	73	73	72	73	73	73	71	70	74	73	72	72	74	74	73	72
12	79	73	73	73	73	73	73	72	71	73	74	73	73	72	72	71	73
13	78	73	73	74	72	73	72	73	72	72	71	73	74	72	73	73	73
14	80	72	73	72	74	74	74	73	71	72	73	71	72	72	74	73	72
15	73	66	73	73	73	72	73	73	73	72	73	73	72	72	73	72	73

Harmonic LO Order

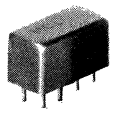
test conditions

RF = 400.1 MHz at −10dBm
LO = 370.01 MHz
For other test frequencies, contact factory.

FIG 3

eliminating guesswork in systems design

CAPD (computer-automated performance data)



SRA-1 mixer

mixer phase detection (+7 dBm)

model SRA-1

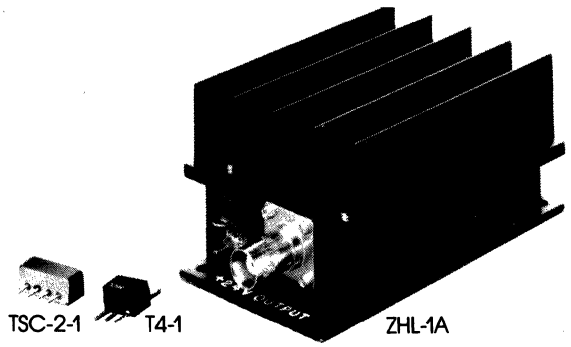
max. output/DC offset Vs. freq.

Freq. (MHz)	max. DC output mV	DC offset mV
10.00	−262.53	− .57
30.42	−263.46	− .54
50.83	−260.71	− .54
71.25	−260.38	− .51
91.67	−264.70	− .46
112.08	−265.05	− .42
132.50	−266.23	− .38
152.92	−263.79	− .34
173.33	−263.92	− .34
193.75	−268.92	− .37
214.17	−274.08	− .32
234.58	−276.75	− .33
255.00	−275.81	− .53
275.42	−270.65	− .63
295.83	−266.67	− .35
316.25	−256.71	− .52
336.67	−251.84	− .82
357.08	−236.17	− .63
377.50	−228.06	−1.01
397.92	−217.55	−1.38
418.33	−214.55	−1.88
438.75	−214.43	−1.58
459.17	−210.65	−1.86
479.58	−206.27	−2.74
500.00	−204.64	−2.69

output voltage Vs. phase, 10 MHz

Phase, degrees	output, mV
0 deg.	−262 mVOLT
10 deg.	−258 mVOLT
20 deg.	−246 mVOLT
30 deg.	−227 mVOLT
40 deg.	−200 mVOLT
50 deg.	−168 mVOLT
60 deg.	−131 mVOLT
70 deg.	−89 mVOLT
80 deg.	−45 mVOLT
90 deg.	0.6 mVOLT
100 deg.	46 mVOLT
110 deg.	90 mVOLT
120 deg.	132 mVOLT
130 deg.	169 mVOLT
140 deg.	202 mVOLT
150 deg.	228 mVOLT
160 deg.	247 mVOLT
170 deg.	259 mVOLT
180 deg.	263 mVOLT
190 deg.	259 mVOLT
200 deg.	247 mVOLT
210 deg.	228 mVOLT
220 deg.	292 mVOLT
230 deg.	169 mVOLT
240 deg.	132 mVOLT
250 deg.	90 mVOLT
260 deg.	46 mVOLT
270 deg.	0.6 mVOLT
280 deg.	−45 mVOLT
290 deg.	−89 mVOLT
300 deg.	−131 mVOLT
310 deg.	−168 mVOLT
320 deg.	−200 mVOLT
330 deg.	−227 mVOLT
340 deg.	−246 mVOLT
350 deg.	−258 mVOLT
360 deg.	−262 mVOLT

FIG. 4



Mini-Circuits

power splitter/combiners

model TSC-2-1

MHz	REF. (dBm)	S-1 (dB)	S-2 (dB)	Unbal. (dB)	ISO (dB)
1.00	−4.99	3.25	3.21	−.04	36.02
22.00	−4.95	3.20	3.20	0.00	46.30
43.00	−4.97	3.24	3.21	−.03	40.42
64.00	−4.99	3.25	3.25	0.00	36.77
85.00	−4.92	3.30	3.29	−.01	34.79
106.00	−4.99	3.28	3.28	0.00	33.30
127.00	−5.06	3.29	3.32	.03	32.27
148.00	−5.02	3.31	3.33	.02	31.51
169.00	−5.02	3.31	3.36	.05	30.95
190.00	−5.08	3.30	3.40	.10	30.64
211.00	−4.91	3.30	3.44	.14	30.51
232.00	−4.91	3.30	3.47	.17	30.62
253.00	−4.99	3.33	3.49	.16	31.06
274.00	−4.96	3.34	3.52	.18	31.94
295.00	−5.03	3.32	3.57	.25	33.35
316.00	−4.95	3.39	3.62	.23	35.36
337.00	−5.02	3.39	3.67	.28	39.90
358.00	−4.95	3.40	3.78	.38	45.13
379.00	−5.00	3.44	3.83	.39	40.23
400.00	−4.00	3.49	3.97	.48	32.15

Insertion loss, Amplitude Unbalance, Isolation

MHz	S	1	2
5.00	1.12	1.12	1.12
25.78	1.13	1.11	1.11
46.56	1.13	1.10	1.10
67.34	1.12	1.09	1.09
88.12	1.12	1.09	1.09
108.90	1.12	1.09	1.09
129.68	1.11	1.08	1.10
150.46	1.11	1.08	1.10
171.24	1.10	1.08	1.11
192.02	1.10	1.08	1.12
212.80	1.09	1.08	1.14
233.58	1.10	1.09	1.16
254.36	1.11	1.11	1.16
275.14	1.12	1.13	1.18
295.92	1.15	1.15	1.21
316.70	1.18	1.18	1.24
337.48	1.22	1.21	1.28
358.26	1.27	1.24	1.31
379.04	1.32	1.28	1.35
400.00	1.39	1.33	1.40

VSWR

FIG. 5

RF transformers

model T4-1

MHz	REF. (dBm)	I.L. (dB)
.200	−14.95	3.29
.350	−14.92	2.34
2.001	−15.03	1.58
18.612	−14.97	1.21
37.021	−14.99	1.30
55.433	−15.03	1.37
73.843	−14.99	1.39
92.253	−15.02	1.49
100.001	−14.99	1.50
110.661	−14.96	1.67
129.070	−15.06	1.71
147.480	−14.98	1.73
165.890	−15.09	1.85
184.310	−14.93	2.04
202.720	−15.00	2.07
221.131	−15.09	2.12
239.540	−14.94	2.29
257.850	−15.06	2.43
276.359	−14.93	2.49
294.770	−15.03	2.54
299.999	−15.03	2.59
313.180	−15.03	2.71
331.590	−15.09	2.79
350.000	−14.96	2.81

Insertion loss

REMARK: 2 units connected back to back

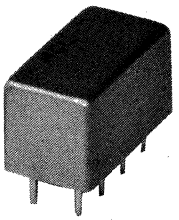
FIG. 7

power amplifiers

model ZHL-1A

FREQ. (MHz)	GAIN (dB) 12V	15V	20V	24V	REVERSE GAIN (dB) 12V	15V	20V	24V	VSWR (IN) 12V	15V	20V	24V	VSWR (OUT) 12V	15V	20V	24V
2.00	17.90	18.27	18.46	18.52	29.03	29.07	28.96	28.88	1.09	1.13	1.14	1.14	1.10	1.16	1.15	1.15
28.21	17.88	18.27	18.48	18.52	29.53	29.72	29.54	29.24	1.09	1.11	1.13	1.14	1.20	1.19	1.19	1.18
54.42	17.88	18.33	18.54	18.59	29.57	29.62	29.58	29.39	1.12	1.12	1.13	1.14	1.24	1.24	1.24	1.24
80.63	17.94	18.41	18.65	18.70	29.91	29.78	29.64	29.56	1.19	1.17	1.16	1.16	1.30	1.29	1.30	1.30
106.84	17.90	18.41	18.69	18.78	29.85	30.12	29.97	29.75	1.31	1.24	1.21	1.21	1.36	1.36	1.37	1.37
133.05	17.91	18.42	18.75	18.83	30.02	30.06	30.15	29.87	1.42	1.32	1.28	1.27	1.41	1.41	1.42	1.44
159.26	17.68	18.34	18.71	18.81	30.25	30.32	30.03	30.00	1.56	1.42	1.36	1.34	1.46	1.48	1.50	1.52
185.47	17.64	18.34	18.78	18.84	30.50	30.36	30.12	29.99	1.71	1.553	1.45	1.43	1.50	1.53	1.57	1.60
211.68	17.52	18.25	18.74	18.82	30.50	30.64	30.19	30.05	1.83	1.63	1.52	1.50	1.51	1.56	1.63	1.67
237.89	17.46	18.20	18.73	18.81	30.85	30.64	30.35	30.32	1.96	1.72	1.59	1.57	1.52	1.58	1.67	1.73
264.10	17.34	18.09	18.66	18.74	30.99	30.75	30.40	30.43	2.04	1.79	1.64	1.62	1.48	1.56	1.66	1.75
290.31	17.28	18.03	18.58	18.69	31.08	30.89	30.66	30.58	2.14	1.86	1.69	1.66	1.44	1.53	1.66	1.76
316.52	17.33	18.08	18.69	18.79	30.64	30.77	30.51	30.49	2.16	1.88	1.70	1.67	1.40	1.50	1.64	1.75
342.73	17.32	18.06	18.69	18.79	30.50	30.44	30.41	30.44	2.17	1.87	1.69	1.65	1.33	1.43	1.59	1.71
368.94	17.30	18.04	18.71	18.79	30.09	30.23	30.24	30.27	2.09	1.81	1.63	1.59	1.27	1.35	1.49	1.62
395.15	17.23	18.02	18.67	18.82	29.81	29.95	29.91	30.18	2.03	1.75	1.57	1.53	1.24	1.28	1.41	1.55
421.36	17.32	18.13	18.83	18.98	29.19	29.36	29.52	29.85	1.96	1.68	1.49	1.44	1.32	1.29	1.36	1.50
447.57	17.37	18.23	18.96	19.08	28.50	28.79	29.05	29.22	1.90	1.61	1.41	1.36	1.47	1.36	1.34	1.43
473.78	17.17	18.10	18.90	19.08	27.94	28.28	28.64	28.82	1.93	1.64	1.42	1.37	1.68	1.51	1.39	1.42
500.00	17.07	18.14	19.06	19.26	27.68	27.17	28.22	28.50	2.07	1.79	1.57	1.54	1.01	1.79	1.61	1.58

FIG. 6



mastering the mixer maze...

or selecting the right model for your application.

Mixers are abundant in electronic systems ranging from inexpensive consumer products to sophisticated military hardware. You'll find them in video games, TV sets and video cassette recorders as well as communications gear, test instruments, radar units and countermeasure systems. Mini-circuits offers well over a hundred different off-the-shelf models with thousands of variations. Different connector configurations, tighter specs, Hi-Rel options are available on request. Improper mixer selection bears a penalty—underspecify and face marginal performance; overspecify and pay extra for unnecessary performance characteristics.

making the right choice

Simply stated, there are three basic steps—
(1) deciding on a printed-circuit (PC) or connector version, (2) selecting the mixer level required in the applications, and (3) picking a model that extends over the frequency range involved. Sounds simple enough so let's examine some of the details.
The first step involves the decision on whether the mixer will be mounted to a PC board or be connected by cable to other subsystem components. The next two steps require understanding your specific needs; so it is strongly recommended that you organize the requirements for your application and put it in writing. Decide what frequency range is involved, the LO drive available, the level of harmonic and two-tone, third-order intermodulation (IM) distortion you can tolerate and other dynamic range factors, see Fig. 1.

1 dB compression point key to mixer level

What does the 1 dB compression point signify? As RF input level is increased, IF output should follow in a linear manner. However, after a certain point, IF output increases at a lower rate until mixer output becomes fairly constant. The point at which IF output deviates from linearity with RF input 1 dB is termed the 1 dB compression point. This figure is useful in comparing dynamic range, maximum output and two-tone performance of various mixers. It is a basis on which mixer level is established.

The 1 dB compression point, which defines the linearity of a mixer at high RF input levels, is relatively simple to test and thus this parameter is included on data sheets supplied by all mixer manufacturers. But, in real life, mixer linearity may be specified in accordance with the intended application. For example, in a receiver application, two-tone, third-order intermod may be the critical parameter; for TV applications, percent distortion or intercept point may be specified; and in an attenuator measurement system, compression point may be important for a given RF input level. With this in mind, the engineer needs a convenient means to relate the particular parameter for his application with the published spec, the 1 dB compression point.

Fig. 1 lists the various ways mixer linearity might be specified.

FIG. 1

Dynamic range parameters affecting mixer selection

1. maximum RF input level anticipated
2. percent distortion acceptable
3. intercept point
4. Two-tone, 3rd order IM _____dB at _____dBm, RF input
5. 1 dB RF input compression level
6. LO power available
7. none of the above specified

Let's convert every parameter with the published 1 dB compression point and then show how simple it is to select the proper mixer level, *see Fig. 2 for Mini-Circuits' mixer level/1 dB compression point chart.*

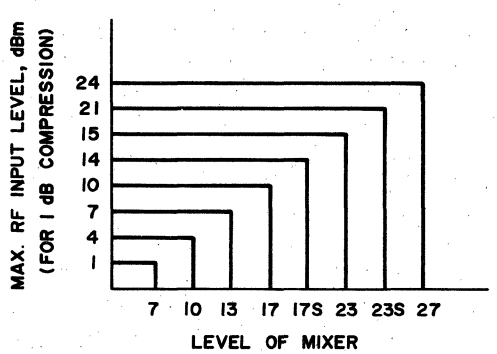


FIG. 2 THE 1 dB COMPRESSION POINT AS A FUNCTION OF THE LEVEL OF MIXER.

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (718) 934-4500

1. Maximum RF input level anticipated. If you know this parameter, simply select the lowest level mixer whose maximum RF input level exceeds your requirement. For example, if the maximum encountered RF level is +5 dBm, select a Level 13 mixer, rated at +7 dBm maximum RF input for 1 dB compression point.

2. Percent distortion. The percent distortion is usually specified in voltage. Thus, a 0.1% distortion figure means 0.999 of the input voltage appears at the mixer output. Next, convert this voltage ratio to a power ratio in dB by squaring and taking ten times the log. The resultant figure is the amount of compression for the specified RF input level. Now this must be extrapolated to 1 dB compression for a corresponding RF input level. As a rule of thumb, extrapolation may be achieved by assuming a linear relationship, in dB, between compression and RF input level. So a ten-times increase in compression corresponds to a ten-times increase in RF input level.

Let's illustrate with an example using a 0.1 percent distortion spec at −10 dBm RF input level. The 0.1 percent corresponds to a 0.999 voltage output; squaring this yields 0.998 power ratio or 0.009 dB. We, therefore, know that 0.1% distortion at −10 dBm input means the maximum allowable compression is 0.009 dB. Extrapolating, using the rule-of-thumb relationship, states that 0.09 dB compression corresponds to an allowable RF of 0 dBm, and further extrapolating results in 0.9 dB compression at a maximum allowable RF input level of 10 dBm. So which mixer level is appropriate? A Level 17S, with +13 dBm RF Input level at the 1 dB compression point, see Fig. 2.

3. Intercept point.

This parameter is a figure of merit corresponding to the amount of intermodulation products generated relative to the desired IF output. An intercept point can be defined for a second order, third order, fifth order, product, etc. As a rule-of-thumb, two-tone third order intercept point is approximately 15 dB above the 1 dB compression point. So, if the intercept point figure is given, merely subtract 15 dB from this figure and pick a mixer which meets the 1 dB compression point spec, see Fig. 2.

4. Two-tone, third-order intermodulation (IM).

When a two-tone, third-order IM spec is given, the intercept point can be calculated. Remember that for each 10 dB increase in signal level, there is a 20 dB degradation in two-tone, third-order product. Once the intercept point is calculated, simply subtract 15 dB from the figure to find the 1 dB compression point and select the appropriate mixer.

5. 1dB Rf input compression level.

This key parameter is listed on mixer spec sheets so merely choose the lowest level mixer that will meet the requirement.

6. LO drive.

The LO dirve is critical since the function of the LO drive is to switch the mixer diodes fully on and off for lowest distortion. So, for optimum performance, select the mixer level to match the LO drive. Mini-Circuits conveniently identifies its mixer levels by the LO drive requirement; thus a Level 7 mixer refers to a LO drive level of +7 dBm. If there are constraints on the LO power available, select the lowest level mixer closest to the available LO power. For example, if +12 dBm LO drive is available, select a Level 10 mixer.

7. No particular spec to meet.

Choose a Level 7 mixer. Why? Because it is the most popular and it offers the widest choice of models at lowest cost.

Freq. range last deciding factor

Once the mixer level has been decided, you may find a wide variety of models to exercise your decision making. You may notice models within a series with overlapping frequency ranges. Why? So you can choose the optimum mixer for your requirement. Each model within a series has a different low-frequency limit. Select a mixer with the highest low frequency limit and whose mid-band range best covers your application.

Specs on the data sheets are given in three ranges. The lower frequency range, L, covers the lowest specified frequency to one decade higher; the upper frequency range, U, covers the highest frequency to one octave lower and mid-range, M, covers the frequency between L and U. Thus, a mixer specified from 0.5 to 500 MHz could offer a low-frequency range of 0.5 to 5 MHz, an upper frequency range of 250 to 500 MHz, and a mid-range of 5 MHz to 250 MHz.

What about "Specials"?

Although most Mini-Circuits mixers are 50 ohm devices, models are available in 75 ohms. Need connector types different than those listed for standard models? No problem. Some applications require matched mixer pairs that must be amplitude (conversion loss) and phase matched. Most Mini-Circuits mixers are tested to within 0.2 dB for the entire production run. Not tight enough? Let us know your exact requirement and we'll screen and test to meet it.

In summary, contact us about "specials" and we'll do our best to satisfy your needs without excessive cost or delivery date extensions. Sometimes, "special" means shipping a quantity of mixers within a very short time span; since Mini-Circuits is the largest manufacturer of mixers in the world, this may hardly be considered "special" and you may be pleasantly surprised. Try us.

order Mini-Circuits Q&A No. 4 Now...

There's lots more to mixer specs, applications and testing. Phone or write for Mini-Circuits' Q&A #4 for a provocative question-and-answer exchange on these topics.

most widely-used

Frequency Mixers

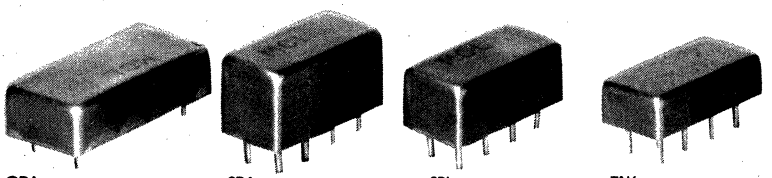
LEVEL 7 (+7 dBm LO, up to +1 dBm RF)

performance data

curves, tables, page 4 Model Index

case style selection

outline drawings see page 3



	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
GRA case D09	GRA-1	.5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	12.95	(6-49)
	GRA-3	.025-200	DC-200	5.5	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	15.95	(6-49)
	GRA-6	.003-100	DC-100	5.5	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	22.95	(5-24)
	GRA-8	.0005-10	DC-10	6.5	7.5	7.0	8.5	60	50	50	40	45	35	60	50	50	40	45	35	25.95	(5-24)
SRA case A01	•SRA-1	.5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	11.95	(1-49)
	SRA-1TX	.5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	49.95	(1-49)
	SRA-1W	1-750	DC-750	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	14.95	(5-24)
	SRA-1-1	.1-500	DC-500	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	13.95	(5-24)
	SRA-2	1-1000	.5-500	5.5	7.5	6.5	8.5	45	30	35	20	30	20	45	30	30	20	30	20	14.95	(5-24)
	SRA-2CM	5-1000	DC-1000	6.0	7.0	6.5	8.5	60	50	35	30	30	25	50	45	30	25	25	20	14.95	(1-49)
	SRA-3	.025-200	DC-200	5.5	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	14.95	(5-24)
	SRA-4	5-1250	.5-500	5.5	7.5	6.5	8.5	50	40	40	20	30	20	50	40	40	20	30	20	16.95	(5-24)
	SRA-5	5-1500	10-600	7.0	8.0	7.5	8.5	50	45	35	30	30	20	45	40	30	25	25	15	21.95	(5-24)
	SRA-6	.003-100	DC-100	5.5	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	21.95	(5-24)
	SRA-8	.0005-10	DC-10	6.5	7.5	7.0	8.5	60	50	50	40	45	35	60	50	50	40	45	35	26.95	(5-24)
case A06	SRA-11	5-2000	10-600	7.0	8.5	7.5	9.0	50	45	35	25	30	20	45	40	30	20	25	15	26.95	(5-24)
	SRA-12	800-1250	50-90	—	—	6.0	7.5	32	25	35	25	35	25	30	20	30	20	30	20	24.95	(5-24)
	SRA-2000 NEW	100-2000	DC-600	6.0	8.0	7.0	9.5	—	—	37	20	—	—	—	—	—	—	30	20	31.95	(1-24)
SBL case A06	SBL-1	1-500	DC-500	5.5	7.5	6.5	8.5	50	35	45	30	35	25	45	30	40	25	30	20	4.50	(10-49)
	SBL-1X	10-1000	5-500	6.0	7.5	7.0	9.0	50	35	40	25	30	20	45	30	35	20	25	20	5.95	(10-49)
TAK case A04	TAK-5	.01-250	DC-250	5.5	7.0	6.5	8.5	60	50	50	35	40	35	55	45	45	30	35	25	18.95	(1-4)
	TAK-5R	.05-200	DC-200	5.5	6.5	6.5	8.0	55	50	45	35	45	35	50	45	40	30	40	30	15.95	(5-24)
	TAK-6	.5-600	DC-600	5.5	7.5	6.5	8.5	60	50	50	30	40	25	55	45	45	30	30	20	18.95	(1-4)
	TAK-6R	5-500	DC-500	6.0	7.0	6.5	8.0	55	50	45	30	35	40	45	40	40	25	30	25	15.95	(5-24)
	TAK-7	2-1000	5-500	5.5	7.5	6.5	8.5	45	30	35	20	30	20	45	30	35	20	30	20	20.95	(1-4)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

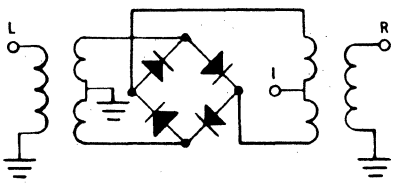
m = mid band (2f_L to f_U/2)

NOTES:

• HTRB tested, 3 year guarantee

1. For typical characteristics, compression level, phase detection and electronic attenuation, see "Mixer Technical Section."
2. For Quality Control procedures, see page 6.
3. For environmental specifications see page 7.
4. For High-Rel and TX description, see page 6.
5. Absolute Maximum Ratings; RF power 50 mW, peak IF current 40 mA, see pg. 7.
6. Prices and specifications subject to change without notice.
7. PAM-42 protected under patent 4,430,758.

schematic



pin connections

see case style outline drawing

Series	GRA	SRA					SBL		TAK			
models	all models	−1 −1TX −1−1 −3	−2 −4	−6 −8	−1W −2cm	−5 −11 −12	−1	−1X	−5 −6	−7	−5R	−6R
LO	1	8	8	8	8	8	8	8	8	8	8	1
RF	6	1	3,4	1	1	1	1	3,4	1	3,4	1	8
IF	4	3,4*	1	3,4*	3,4*	3	3,4*	1	3,4*	1	3,4*	5,6*
GND	2,3,5	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,3,4,7
CASE GND	—	2	2,5,6,7	—	2,5,6,7	2,5,6,7	—	2,5,6,7	2	2,5,6,7	—	3,4,7

*pins must be connected together externally

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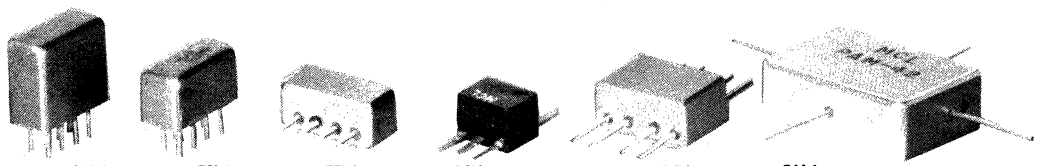
500 Hz to 4.2 GHz

Mini-Circuits



SAM TSM TFM *ASK LMX PAM

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
SAM case A03	SAM-1	1-600	DC-600	5.5	7.0	6.5	8.5	55	45	45	30	35	20	50	40	40	25	30	20	15.95	(1-24)
	SAM-2	1-1000	DC-1000	6.0	7.5	7.0	9.5	55	45	40	25	35	20	50	40	40	25	30	25	17.95	(1-24)
	SAM-3	0.1-500	DC-500	5.5	7.0	6.5	8.5	60	50	50	35	35	30	50	40	45	30	30	20	17.95	(1-24)
	SAM-4	5-1250	0.5-1000	6.5	8.5	6.5	8.5	55	40	35	25	30	20	50	40	35	25	30	20	19.95	(1-24)
	SAM-5	5-1500	0.5-1000	6.5	7.5	6.5	8.5	55	40	35	25	30	20	50	40	35	25	30	20	24.95	(1-24)
TSM case A11	TSM-1	1-500	DC-500	6.0	7.5	6.5	8.5	60	45	45	35	35	25	55	45	40	30	35	25	17.95	(5-24)
	TSM-3	0.1-400	DC-400	5.3	7.5	6.5	8.5	60	50	50	35	35	25	55	45	45	30	35	25	19.95	(5-24
TFM case B02	TFM-2	1-1000	DC-1000	6.0	7.5	7.0	8.5	50	45	40	25	30	25	45	40	35	25	25	20	11.95	(1-49)
	TFM-3	0.04-400	DC-400	5.3	7.0	6.0	8.0	60	50	50	35	35	25	55	40	45	30	35	25	19.95	(5-49)
	TFM-4	5-1250	DC-1250	6.0	7.5	7.5	8.5	50	45	40	30	30	25	45	40	35	25	25	20	21.95	(5-49)
case B13	TFM-11	1-2000	5-600	7.0	8.5	7.5	9.0	50	45	35	25	25	10	45	40	27	20	25	20	39.95	(1-24)
	TFM-12	800-1250	50-90	—	—	6.0	7.5	35	25	35	25	35	25	30	20	30	20	30	20	39.95	(1-24)
ASK case W38	ASK-1 NEW	1-600	DC-600	5.5	7.0	6.0	8.5	50	40	35	25	30	20	45	35	30	20	25	15	5.95	(10-49)
LMX case BB48	LMX-113 NEW	5-1000	DC-1000	6.5	7.0	7.0	8.0	50	40	40	30	35	25	45	35	35	30	30	20	14.95	(6-24)
	LMX-124 NEW	0.5-500	DC-500	5.5	6/5	6.0	7.0	50	40	45	30	45	25	45	40	40	30	30	20	22.95	(6-24)
	LMX-149 NEW	10-1500	DC-1500	6.0	7.0	6.0	10.0	55	45	45	35	30	20	50	45	40	25	20	12	24.95	(6-24)
PAM case AA46	PAM-42 NEW	2.0-4.2GHz	DC-1.3GHz	—	—	7.0	8.5	—	—	25 (typ)	17 (min)	—	—	—	—	18 (typ)	10 (min)	—	—	26.95	(1-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

* Surface Mounting Available
See case KK81, page 18

SAM			TSM	TFM	ASK	LMX	PAM
−1 −3	−4 −5	−2	all models	all models	all models	all models	all models
8	8	8	8	4	1	8	3
1	3,4	1	1	1	4	5	1
3,4*	1	3,4*	3,4*	2	5	4	4
2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	3	2,3,6	2,3,6,7	2
2	2,5,6,7	2,5,6,7	2	3	—	2,3,6,7	2

MIL-M-288837/1A, NSN GUIDE

MCL NO.	NSN	MIL-M-28837/1A*
GRA-1		07 N
GRA-1 HI-REL		07 S
SAM-1	5895-01-117-2926	
SAM-3	5895-01-062-9973	
SAM-5	5895-01-036-9507	
SBL-1	9058-00-256-6818	
SRA-1	6625-00-008-8272	03 N
SRA-1 HI-REL		03 S
SRA-1-1	5962-01-113-5431	
SRA-1W		09 N
SRA-1W HI-REL		09 S
SRA-3	5895-01-021-5914	
SRA-6	5895-01-124-0117	
SRA-8	5985-01-081-0977	12 N
SRA-8 HI-REL		12 S
TAK-5R		01 N
TAK-5R HI-REL		01 S
TAK-6R		02 N
TAK-6R HI-REL		02 S
TFM-2-408	5821-01-076-2497	
TFM-3	5840-01-112-0031	
TSM-1	5895-01-121-7958	

*units are not QPL-listed

In Stock... Immediate Delivery

widest-variety of connector types

Frequency Mixers

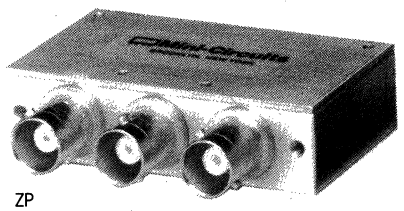
LEVEL 7 (+7 dBm LO, up to +1 dBm RF)

performance data

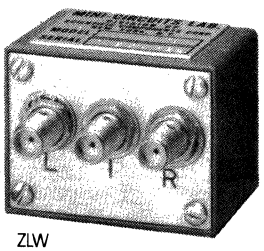
curves, tables, page 4 Model Index

case style selection

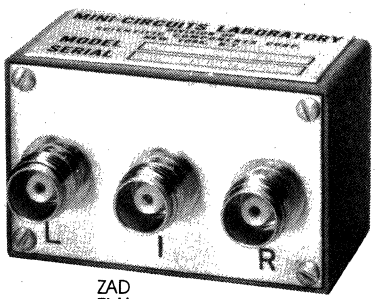
outline drawings see page 3



ZP



ZLW



ZAD
ZMA

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
ZP case GG60	ZP10514 NEW	.2-500	DC-500	5.5	7.0	6.5	8.5	55	45	50	35	35	30	50	40	36	30	30	20	51.95	(1-49)
ZLW case M21	ZLW-1	.5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	39.95	(4-24)
	ZLW-1W	1-750	DC-750	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	44.95	(4-24)
	ZLW-1-1	.1-500	DC-500	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	41.95	(4-24)
	ZLW-2	1-1000	DC-1000	6.0	7.5	7.0	9.5	55	45	40	25	35	20	50	40	40	25	30	20	44.95	(4-24)
	ZLW-3	.025-200	DC-200	5.5	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	41.95	(4-24)
	ZLW-5	5-1500	5-100	6.5	7.5	6.5	8.5	55	40	35	25	30	20	50	40	35	25	30	20	51.95	(4-24)
	ZLW-6	.003-100	DC-100	5.5	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	49.95	(4-24)
	ZLW-8	.0005-10	DC-10	6.5	7.5	7.0	8.5	60	50	50	40	45	35	60	50	50	40	45	35	54.95	(4-24)
	ZLW-11	5-2000	10-600	7.0	8.5	7.5	9.0	50	45	35	25	30	20	45	40	30	20	25	15	61.95	(4-24)
	ZLW-12	800-1250	50-90	—	—	6.0	7.5	35	25	35	25	35	25	30	20	30	20	30	20	61.95	(4-24)
ZAD case M22	ZAD-1	.5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	29.95	(4-24)
	ZAD-1W	1-750	DC-750	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	34.95	(4-24)
	ZAD-1-1	.1-500	DC-500	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	31.95	(4-24)
	ZAD-2	1-1000	.5-500	5.5	7.5	6.5	8.5	45	30	35	20	30	20	45	30	35	20	30	20	39.95	(4-24)
	ZAD-3	.025-200	DC-200	5.5	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	31.95	(4-24)
	ZAD-4	.5-1250	.5-500	5.5	7.5	6.5	8.5	50	40	40	20	30	20	50	40	40	20	30	20	41.95	(4-24)
	ZAD-6	.003-100	DC-100	5.5	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	39.95	(4-24)
	ZAD-8	.0005-10	DC-10	6.5	7.5	7.0	8.5	60	50	50	40	45	35	60	50	50	40	45	35	44.95	(4-24)
	ZAD-11	5-2000	10-600	7.0	8.5	7.5	9.0	50	45	35	25	30	20	45	40	30	20	25	15	51.95	(4-24)
	ZAD-12	800-1250	50-90	6.0	7.5	6.0	7.5	35	25	35	25	35	25	30	20	30	20	30	20	51.95	(4-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

single-balanced (1 to 3 GHz)

	MODEL NO.	LO/RF f_L-f_U	IF	Mid-Band m* Typ.	Mid-Band m* Max.	Total Range Typ.	Total Range Max.	L* Typ.	L* Min.	M* Typ.	M* Min.	U* Typ.	U* Min.	L* Typ.	L* Min.	M* Typ.	M* Min.	U* Typ.	U* Min.	Ea.	Qty.
ZMA case M23	ZMA-2*	1-2.5GHz	DC-150	7.0	8.5	8.0	9.0	25	20	22	17	20	15	50	35	40	30	35	25	63.95	(1-9)
	ZMA-3*	1.4-3.0GHz	DC-500	6.5	8.0	7.0	9.0	25	20	28	18	23	15	50	35	50	30	50	30	67.95	(1-9)

*m = 500MHz *L = f_L to (f_L + 500) *M = (f_L + 500) to (f_U − 500) *U = f_U to (f_U − 500)

NOTES:

1. For typical characteristics, compression level, phase detection and electronic attenuation, see "Mixer Technical Section."
2. For Quality Control procedures, see page 6.
3. For environmental specifications see page 7.
4. For High-Rel and TX description, see page 6.
5. Absolute Maximum Ratings; RF Power 50mW, peak IF current 40mA.
6. For connector types and case mounting options, see case style outline drawing.
7. Prices and specifications subject to change without notice.

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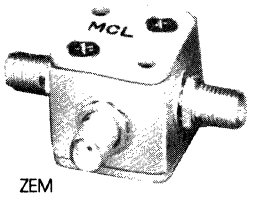
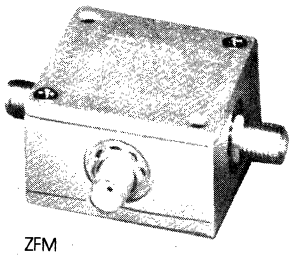
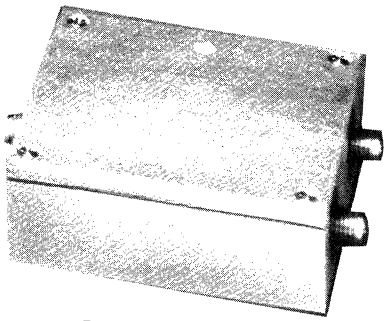
500 Hz to 4.2 GHz

Mini-Circuits



ZEM


ZFM

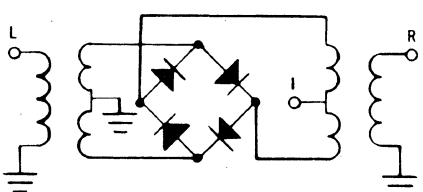

ZAM

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m Typ.	Max.	Total Range Typ.	Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	PRICE, $ Ea.	Qty.
ZEM case V37	ZEM-2	10-1000	DC-1000	6.0	7.0	6.5	8.5	55	50	30	25	25	20	55	45	30	20	25	20	49.95	(4-24)
ZFM case K18	ZFM-1W	10-750	DC-750	6.0	7.0	6.2	8.0	50	45	45	30	35	25	45	40	40	25	27	20	41.95	(4-24)
	ZFM-2	1-1000	DC-1000	6.0	7.5	7.0	8.5	50	45	40	25	30	25	45	40	35	25	25	20	43.95	(1-24)
	ZFM-3	.04-400	DC-400	5.3	7.0	6.0	8.0	60	50	50	35	35	25	55	40	45	30	35	25	51.95	(1-24)
	ZFM-4	5-1250	DC-1250	6.0	7.5	7.5	8.5	50	45	40	30	30	25	45	40	35	25	25	20	51.95	(1-24)
	ZFM-11	1-2000	5-600	7.0	8.5	7.5	9.0	50	45	35	25	25	20	45	40	27	20	25	20	81.95	(1-24)
	ZFM-12	800-1250	50-90	—	—	6.0	7.5	35	25	35	25	35	25	30	20	30	20	30	20	71.95	(1-24)
	NEW ZFM-2000	100-2000	DC-600	6.0	8.0	7.0	9.5	—	—	37	20	—	—	—	—	—	—	30	20	61.95	(1-24)
	NEW ZFM-4212	2000-4200	DC-1300	—	—	7.0	8.5	—	—	25	17	—	—	—	—	18	10	—	—	39.95	(1-9)
ZAM case F14	ZAM-42 NEW	1500-4200	DC-500	—	—	7.0	8.5	25	20	25	17	25	20	18	10	18	10	18	10	39.95	(1-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

schematic



MIL-M-28837/1A, NSN GUIDE

MCL NO.	NSN
ZAD-1B	5895-00-280-7750
ZAD-4B	5895-01-127-0376
ZAD-6B	5865-21-200-6364
ZFM-12-1	5825-01-127-3377
ZLW-1W	5840-00-607-7010
ZLW-2B	6920-01-037-1974
ZLW-5-1	4920-01-017-2753
ZMA-3	5865-01-064-0212

coaxial connections

see case style outline drawing

Series	ZP	ZLW	ZAD (ex-2, -4)	ZAD -2, -4	ZMA	ZEM	ZFM	ZAM
models	all models	all models	all models	all models	all models	all models	all models	all models
L	L	1	1	1	1	1	1	2
R	X	3	3	2	2	2	2	1
I	R	2	2	3	3	3	3	3

In Stock... Immediate Delivery

broadband, high dynamic range

Frequency Mixers

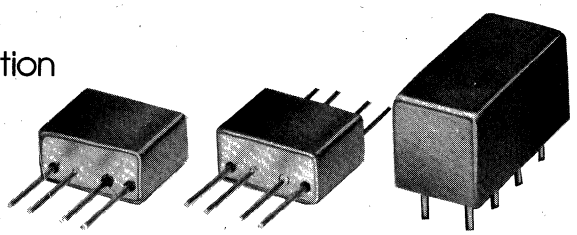
LEVEL 10 (+10dBm LO, up to +5dBm RF)

performance data

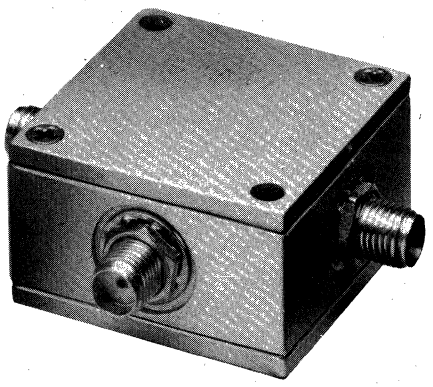
curves, tables, page 4 Model Index

case style selection

outline drawings see page 3



TFM LMX SRA



ZFM

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
TFM case B13	**TFM-15**	10-3000	10-800	6.3	8.0	6.5	8.5	35	25	35	25	35	25	30	20	30	20	30	20	49.95	(1-9)
	TFM-150*	10-2000	DC-1000	6.0	8.0	6.5	8.0	32	25	35	25	35	25	33	20	30	20	30	20	39.95	(1-9)
LMX case BB48	**LMX-123** NEW	10-3000	10-3000	7.5	8.0	7.5	8.5	35	25	35	20	30	15	35	25	30	25	30	20	59.95	(6-24)
	LMX-148 NEW	10-1500	DC-1500	6.0	7.0	6.0	10	45	40	35	30	25	20	40	35	35	25	20	12	24.95	(6-24)
SRA case A01	**SRA-215**	.05-1500	.05-500	6.0	7.5	7.0	9.0	25	20	35	25	30	20	25	20	35	25	25	15	23.95	(5-24)
	SRA-220	.05-2000	.05-500	6.0	7.5	7.0	9.0	25	20	40	30	30	20	25	20	40	30	25	15	26.95	(5-24)
ZFM case K18	**ZFM-15**	10-3000	10-800	6.3	7.5	6.5	8.5	35	25	35	25	35	25	30	20	30	20	30	20	79.95	(1-9)
	ZFM-150	10-2000	DC-1000	6.0	7.0	6.5	8.0	32	25	35	25	35	20	33	28	30	20	25	20	59.95	(1-9)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

harmonic attenuation

MODEL TFM-15

Harmonics RF Order	RF CAL	1	2	3	4	5	6	7	8	9	10
1	0	0	31	17	42	32	48	47	52	65	59
2	83	38	45	39	48	46	76	69	70	64	71
3	87	39	49	37	52	42	57	63	65	65	65
4	89	64	60	58	56	59	60	62	69	74	70
5	90	74	69	59	72	55	74	58	71	67	72
6	83	83	76	74	67	69	67	72	70	74	78
7	83	76	83	81	79	69	71	66	70	69	77
8	84	75	76	81	82	77	77	80	78	78	77
9	84	77	76	75	82	80	81	82	80	79	80
10	81	76	76	74	75	80	81	81	81	80	81

Harmonic LO Order

Model: TFM-15 S/N: sample band-width: 0-99999 MHz
999.100 MHZ input P. −.06 dBm
969.010 MHz input P. +9.96 dBm

IF = 30.090 MHz | LO = +10 dBm, 969.01 MHz
IF amplit. −7.14 dBm | RF = 0 dBm, 999.1 MHz

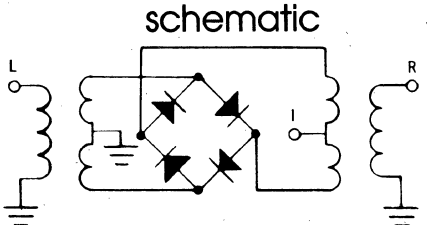
Final Spectrum Analyzer HP-8566A Parameters:
RES BW 1KHz VBW 3kHz
SWP 300 msec ATTEN 10 dB 5 dB/ div SPAN 100 kHz

LO drive adjusted with 19.75db Weinschel S/N:G4047 RF,IF attenuator
10.0dB Tektronix S/N:011-0085-00

NOTES:

* Below 10 MHz IF, conversion loss increases up to 6dB higher as frequency decreases to DC.
1. For typical characteristics, compression level, phase detection and electronic attenuation, see "Mixer Technical Section."
2. For Quality Control procedures, see page 6.
3. For environmental specifications see page 7.
4. For High-Rel and TX description, see page 6.
5. Absolute Maximum Ratings, RF power 50 mW level 10, 200mW level 13, peak IF current 40 mA, see pg. 7.
6. For connector types and case mounting options, see case style outline drawings.
7. Prices and specifications subject to change without notice.

schematic



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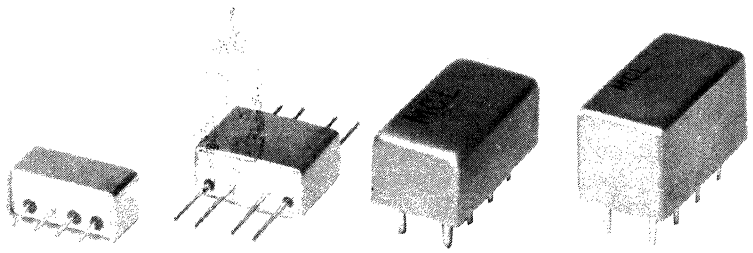
50 KHz to 3 GHz

Mini-Circuits

LEVEL 13 (+13dBm LO, up to +9dBm RF)

NEW



TFM-MH LMX-MH SBL-MH SRA-MH

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
TFM-MH case B02	**TFM-1MH**	2-500	DC-500	6.0	7.5	7.0	8.5	50	45	40	30	30	20	45	40	35	25	25	20	21.95	(5-24)
	TFM-3MH	.1-250	DC-250	5.0	7.0	6.0	8.5	50	45	40	30	28	23	45	40	35	25	26	20	21.95	(5-24)
LMX-MH case BB48	**LMX-125MH**	0.5-500	DC-500	6.0	7.0	7.0	9.0	45	40	45	40	40	30	45	40	40	35	35	25	54.95	(6-24)
SBL-MH case A06	**SBL-1MH**	1-500	DC-500	5.5	7.5	6.5	8.5	50	35	45	30	35	25	45	30	40	25	30	20	9.50	(10-49)
SRA-MH case A01	**SRA-1MH**	5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	13.95	(5-24)
	SRA-3MH	.025-200	DC-200	5.5	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	15.95	(5-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

pin and coaxial connections

see case style outline drawing

Series	TFM	LMX	SRA	ZFM	TFM-MH	LMX-MH	SBL-MH	SRA-MH
Models	all models	all models	all models	all models	all models	all models	all models	all models
LO	4	8	8	1	4	8	8	8
RF	1	5	1	2	1	5	1	1
IF	2	4	3	3	2	4	3,4*	3,4*
GND	3	2,3,6,7	2,5,6,7	—	3	2,3,6,7	2,5,6,7	2,5,6,7
CASE GND	3	2,3,6,7	2,5,6,7	—	3	2,3,6,7	—	2

*pins must be connected together externally

CAPD now available! computer-automated performance data

In Stock... Immediate Delivery

very high dynamic range

Frequency Mixers

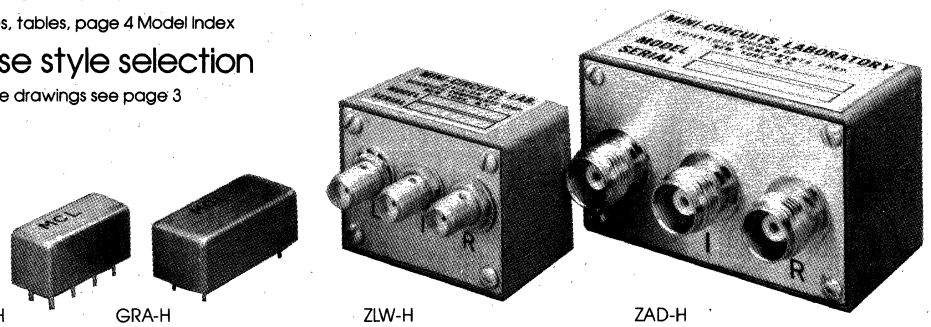
LEVEL 17 (+17 dBm LO, up to +10 dBm RF)

performance data

curves, tables, page 4 Model Index

case style selection

outline drawings see page 3



SRA-H GRA-H ZLW-H ZAD-H

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
SRA-H case A01	● SRA-1H	.5-500	DC-500	5.5	7.5	6.5	8.5	55	45	45	30	35	25	45	35	40	30	30	20	17.95	(5-24)
	● SRA-1WH	1-750	DC-750	5.5	7.5	6.5	8.5	50	40	45	25	35	25	45	35	40	30	30	20	21.95	(5-24)
	● SRA-2H	2-1000	DC-1000	6.0	7.5	8.5	10	50	40	35	25	35	25	45	30	30	20	25	20	29.95	(5-24)
	● SRA-3H	.05-200	DC-200	5.5	7.0	5.5	7.5	50	45	40	30	35	25	45	35	40	30	30	20	19.95	(5-24)
	SRA-11H	10-3000	10-1000	8.0	10	10	12	27	20	25	18	23	16	27	20	25	18	23	16	39.95	(1-24)
	SRA-173H NEW	5-1200	DC-1200	6.0	7.0	7.0	9.0	25	20	25	18	25	18	27	20	25	18	25	18	29.95	(1-5)
GRA-H case D08	GRA-1H	.5-500	DC-500	5.5	7.5	6.5	8.5	55	45	45	30	35	25	45	35	40	30	30	20	18.95	(5-24)
	GRA-3H	.05-200	DC-200	5.5	7.0	5.5	7.5	55	45	45	30	35	25	45	35	40	30	30	20	20.95	(5-24)
	GRA-6H	.01-50	DC-50	5.5	6.0	5 5	7.0	50	45	45	30	35	25	50	40	47	35	32	25	26.95	(5-24)
ZLW-H case M21 SMA	● ZLW-1H	.5-500	DC-500	5.5	7.5	6.5	8.5	55	45	45	30	35	25	45	35	40	30	30	20	45.95	(4-24)
	● ZLW-1WH	1-750	DC-750	5.5	7.5	6.5	8.5	50	45	45	25	35	25	45	35	40	25	30	20	49.95	(4-24)
	● ZLW-2H	2-1000	DC-1000	6.0	7.5	8.5	10	50	40	35	25	35	25	45	35	30	20	25	20	59.95	(4-24)
	● ZLW-3H	.05-200	DC-200	5.5	7.0	5.5	7.5	55	45	45	30	35	25	45	35	40	30	30	20	47.95	(4-24)
	ZLW-11H	10-3000	10-1000	8.0	10	10	12	27	20	25	18	23	16	27	20	25	18	23	16	91.95	(4-24)
ZAD-H case M22 BNC, TNC	● ZAD-1H	.5-500	DC-500	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	35	40	30	30	20	35.95	(4-24)
	● ZAD-1WH	1-750	DC-750	5.5	7.5	6.5	8.5	50	45	45	25	35	25	45	35	40	25	30	20	39.95	(4-24)
	● ZAD-2H	2-1000	DC-1000	6.0	7.5	8.5	10	50	40	35	25	35	25	45	35	30	20	25	20	49.95	(4-24)
	● ZAD-3H	.05-200	DC-200	5.5	7.0	5.5	7.5	55	45	45	30	35	25	45	35	40	30	30	20	37.95	(4-24)
	ZAD-11H	10-3000	10-1000	8.0	10	10	12	27	20	25	18	23	16	27	20	25	18	23	16	81.95	(4-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

NOTES:
● HTRB tested

1. For typical characteristics, compression level, phase detection and electronic attenuation, see "Mixer Technical Section."
2. For Quality Control procedures, see page 6.
3. For environmental specifications see page 7.
4. For High-Rel and TX description, see page 6.
5. Absolute Maximum Ratings, RF power 200 mW, peak IF current 40 mA, see pg. 7.
6. For connector types and case mounting options, see case style outline drawings.
7. Prices and specifications subject to change without notice.

MIL-M-28837/1A, NSN GUIDE

MCL NO.	NSN	MIL-M-28837/1A*
GRA-1H		06N
GRA-1H Hi-Rel		06S
GRA-1H		10N
GRA-1H		10S
GRA-3H		05N
GRA-3H Hi-Rel		05S
SRA-1H	6625-00-594-0223	08N
SRA-1 Hi-Rel		08S
SRA-1WH	5840-00-576-0716	
SRA-2H	5895-01-063-1078	
SRA-3H	5895-01-117-4537	
ZAD-1WH	5895-01-045-4647	
ZLW-1H	5985-01-080-7637	
ZLW-1H-B	5962-045-7500	

*units are not QPL listed

pin and coaxial connections

see case style outline drawing

Series	SRA					GRA-H	ZLW-H	ZAD-H
Models	−1H −3H	−1WH −2H	−11H	−173H Configuration 1	−173H Configuration 2	all models	all models	all models
LO	8	8	8	3,4*	8	1	1	1
RF	1	1	1	1	1	6	3	3
IF	3,4*	3,4*	3	8	3,4*	4	2	2
GND	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,3,5	—	—
CASE GND	2	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	—	—	—

*pins must be connected together externally

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (718) 934-4500

10 KHz to 3 GHz

Mini-Circuits

computer-automated performance data

typical production unit / for data of other models consult factory

SRA-1H

RF (MHz)	LO (MHz)	CONVERSION LOSS (dB)			ISOLATION (dB)								VSWR (+17dBm LO)		
					L-R				L-I						
		LO+10 dBm	LO+15 dBm	LO+17 dBm	LO+7 dBm	LO+10 dBm	LO+15 dBm	LO+17 dBm	LO+7 dBm	LO+10 dBm	LO+15 dBm	LO+17 dBm	LO	RF	IF
10.00	40.00	6.99	6.36	6.15	54.08	56.43	54.97	54.54	52.32	51.54	50.87	50.53	—	—	—
35.70	65.70	7.32	6.45	6.24	53.91	51.73	49.79	49.89	50.23	48.49	47.55	46.59	2.40	1.13	1.21
61.56	91.56	6.91	6.19	6.06	52.44	50.08	48.37	47.04	48.30	46.56	44.44	44.06	2.68	1.13	1.20
87.34	57.34	6.87	6.27	6.09	53.43	54.16	51.79	51.34	51.12	50.03	48.89	47.85	2.33	1.13	1.20
113.12	83.12	7.22	6.46	6.28	52.65	50.32	48.99	47.43	48.68	47.19	45.07	44.75	2.63	1.16	1.24
138.90	108.90	5.83	6.18	6.09	51.41	48.68	46.06	45.59	46.51	44.71	42.83	42.51	2.48	1.22	1.36
164.68	134.68	6.06	6.38	6.24	48.62	46.56	43.46	43.17	44.84	42.84	40.96	40.59	2.30	1.31	1.47
190.46	160.46	5.91	6.24	6.12	47.58	44.71	41.57	41.29	43.33	41.13	39.43	38.96	2.46	1.34	1.58
216.24	186.24	5.89	6.27	6.14	46.31	43.35	40.90	40.77	41.89	40.25	38.44	37.95	2.15	1.32	1.57
242.02	212.02	6.97	6.39	6.27	44.86	41.28	39.90	39.73	41.22	39.15	37.32	36.66	2.44	1.30	1.56
267.80	237.80	6.89	6.27	6.14	43.39	40.11	38.57	38.38	40.38	37.88	36.03	35.60	2.13	1.29	1.60
293.58	263.58	7.12	6.57	6.35	42.94	39.51	37.78	37.29	39.34	36.32	34.56	34.34	2.20	1.35	1.86
319.36	289.36	6.82	6.36	6.25	42.95	39.40	38.51	37.90	38.29	35.30	33.21	32.87	2.00	1.40	2.26
345.14	315.14	7.16	6.67	6.48	40.60	37.77	38.42	37.63	37.52	34.26	32.09	31.51	2.10	1.39	2.51
370.90	340.92	7.31	6.73	6.46	38.07	36.51	38.02	36.99	36.70	33.98	31.44	30.59	1.88	1.32	2.38
396.70	366.70	7.80	6.91	6.57	38.32	36.15	37.63	37.27	37.02	34.60	31.29	30.28	2.21	1.25	2.11
422.48	392.48	8.05	6.97	6.57	38.36	36.13	36.72	37.13	35.55	33.82	31.33	30.13	1.82	1.22	2.02
448.26	418.26	7.89	7.43	7.02	38.68	36.11	35.45	35.92	33.99	32.13	31.15	30.54	2.09	1.26	2.18
474.04	444.04	8.48	7.74	7.34	38.75	36.37	35.46	35.47	32.62	30.50	29.83	39.60	1.88	1.30	2.46
500.00	470.00	8.84	7.62	6.95	37.95	36.25	35.58	35.66	30.74	28.73	28.642	28.63	1.99	1.35	2.58

SRA-1H

harmonic intermodulation

(Relative to desired IF Output)

RF Input power 0dBm

Harmonics RF Order	RF CAL	1	2	3	4	5	6	7	8	9	10
1	0	0	46	10	44	17	45	28	48	33	50
2	75	75	75	75	75	73	75	71	75	69	75
3	73	64	73	66	72	55	70	51	66	50	64
4	105	74	84	82	85	79	86	78	91	78	93
5	106	74	82	72	80	68	80	65	82	64	81
6	105	83	84	83	84	84	86	86	90	88	92
7	104	84	85	82	85	80	87	78	90	79	91
8	104	86	74	85	84	86	84	87	88	92	91
9	102	83	86	84	85	85	86	86	89	89	93
10	105	84	84	83	84	84	84	87	87	90	92

Harmonic LO Order

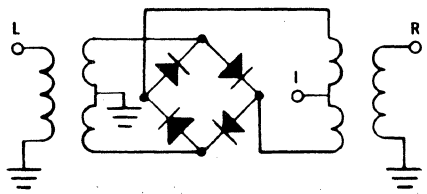
RF Input power −10dBm

Harmonics RF Order	RF CAL	1	2	3	4	5	6	7	8	9	10
1	0	0	47	10	44	18	44	30	46	36	47
2	84	78	78	76	78	72	78	70	83	70	82
3	91	73	79	70	79	65	78	62	78	62	77
4	95	64	83	82	85	83	86	86	87	88	86
5	95	84	80	84	82	83	84	86	88	88	88
6	95	82	81	83	83	84	84	86	87	87	87
7	95	81	84	81	82	83	85	85	86	86	87
8	96	82	65	84	83	83	83	85	86	88	87
9	95	81	85	82	83	82	85	85	87	88	86
10	95	83	83	83	82	83	83	85	87	87	88

Harmonic LO Order

test conditions RF = 10 MHZ LO = 40 MHz at +17dBm
for other test frequencies, contact factory

schematic



In Stock... Immediate Delivery

very low distortion

Frequency Mixers

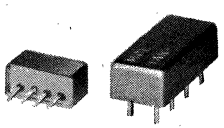
LEVEL 17S (+17dBm LO, up to +14dBm RF)

performance data

curves, tables, page 4 Model Index

case style selection

outline drawings see page 3



TFM-H TAK-H

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	FREQUENCY MHz IF	CONVERSION LOSS dB Mid-Band m Typ.	CONVERSION LOSS dB Mid-Band m Max.	CONVERSION LOSS dB Total Range Typ.	CONVERSION LOSS dB Total Range Max.	LO-RF ISOLATION, dB L Typ.	LO-RF ISOLATION, dB L Min.	LO-RF ISOLATION, dB M Typ.	LO-RF ISOLATION, dB M Min.	LO-RF ISOLATION, dB U Typ.	LO-RF ISOLATION, dB U Min.	LO-IF ISOLATION, dB L Typ.	LO-IF ISOLATION, dB L Min.	LO-IF ISOLATION, dB M Typ.	LO-IF ISOLATION, dB M Min.	LO-IF ISOLATION, dB U Typ.	LO-IF ISOLATION, dB U Min.	PRICE, $ Ea.	PRICE, $ Qty.
TFM-H case B02	**TFM-1H**	2-500	DC-500	6.0	7.5	7.0	8.5	50	45	40	30	30	20	45	40	35	25	25	20	23.95	(5-24)
	TFM-2H	5-1000	DC-1000	6.2	7.0	7.0	10	50	45	40	30	30	20	45	40	35	25	25	17	31.95	(5-24)
	TFM-3H	.1-250	DC-250	5.0	7.0	6.0	8.5	50	45	40	30	28	23	45	40	35	25	26	20	23.95	(5-24)
case B13	**TFM-4H** NEW	5-1200	DC-1200	6.5	8.0	7.0	9.0	50	40	35	25	30	20	50	40	35	20	30	20	33.95	(5-24)
TAK-H case A05	**TAK-1H**	2-500	DC-500	6.0	7.5	7.0	8.5	50	40	40	30	30	25	45	35	35	25	25	20	19.95	(5-24)
	TAK-1WH	5-750	DC-750	6.2	7.5	7.0	9.0	50	40	40	30	30	25	45	35	35	25	30	20	23.95	(5-24)
	TAK-3H	.05-300	DC-300	5.0	7.0	6.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	21.95	(5-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

NOTES:
1. For typical characteristics, compression level, phase detection and electronic attenuation, see "Mixer Technical Section."
2. For Quality Control procedures, see page 6.
3. For environmental specifications, see page 7.
4. For High-Rel and TX description, see page 6.
5. Absolute Maximum Ratings; RF power 200 mW, peak IF current 40 mA, see pg. 7.
6. For connector types and case mounting options, see case style outline drawings.
7. Prices and specifications subject to change without notice.

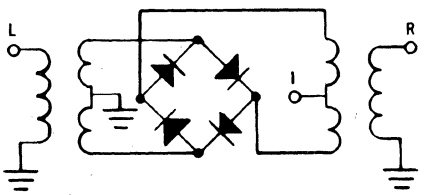
pin and coaxial connections

see case style outline drawing

Series	TFM-H	TAK-H		ZFM-H	ZLW-SH	ZAD-SH
Models	all models	−1H −3H	−1WH	all models	all models	all models
LO	4	8	8	1	1	1
RF	1	1	1	2	3	3
IF	2	3,4*	3,4*	3	2	2
GND	3	2,5,6,7	2,5,6,7	—	—	—
CASE GND	3	2	2,5,6,7	—	—	—

*pins must be connected externally

schematic



MIL-M-28837/1A, NSN GUIDE

MCL NO.	NSN
TFM-1H	5895-01-129-0110

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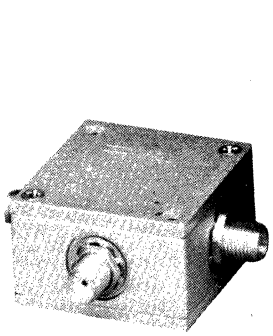
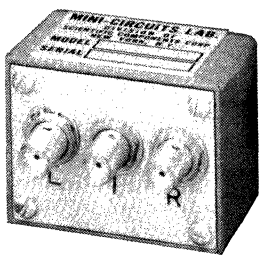
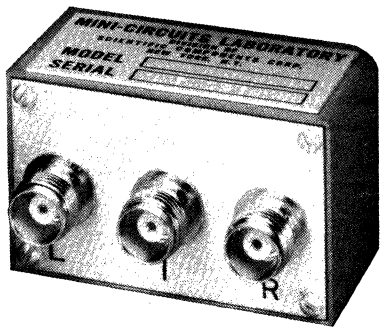
10 KHz to 1.2 GHz

Mini-Circuits


ZFM-H


ZLW-SH


ZAD-SH

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
ZFM-H case K18	ZFM-1H	2-500	DC-500	6.0	7.5	7.0	8.5	50	45	40	30	30	25	45	35	35	25	25	20	53.95	(1-24)
	ZFM-2H	5-1000	DC-1000	6.2	7.0	7.0	10	50	40	40	30	30	20	45	40	35	25	25	17	61.95	(1-24)
	ZFM-3H	.05-300	DC-300	5.0	7.0	6.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	54.95	(1-24)
ZLW- SH case M21	ZLW-1H	2-500	DC-500	6.0	7.5	7.0	8.5	50	40	40	30	30	25	45	35	35	25	25	20	50.95	(4-24)
	ZLW-1WSH	5-750	DC-750	6.2	7.5	7.0	9.0	50	45	40	30	30	20	45	40	35	25	30	20	54.95	(4-24)
	ZLW-3SH	.05-300	DC-300	5.0	7.0	6.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	52.95	(4-24)
ZAD-SH case M22	ZAD-1SH	2-500	DC-500	6.0	7.5	7.0	8.5	50	40	40	30	30	25	45	35	35	25	25	20	40.95	(4-24)
	ZAD-1WSH	5-750	DC-750	6.2	7.5	7.0	9.0	50	45	40	30	30	20	45	40	35	25	30	20	44.95	(4-24)
	ZAD-3SH	.05-300	DC-300	5.0	7.0	6.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	42.95	(4-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)
m = mid band (2f_L to f_U/2)

computer-automated performance data

typical production unit / for data of other models consult factory

TFM-1H

RF (MHz)	LO (MHz)	CONVERSION LOSS (dB)	ISOLATION (dB) L-R	L-R	VSWR LO	RF	IF
10.00	40.00	5.89	52.26	54.10	1.59	1.15	1.33
35.78	65.78	6.15	47.79	50.70	1.67	1.10	1.34
61.56	91.56	6.24	45.16	47.94	1.51	1.09	1.34
87.34	57.34	6.16	48.87	51.91	1.53	1.08	1.35
113.12	83.12	6.03	46.18	48.52	1.57	1.08	1.35
138.90	108.90	6.29	43.89	45.76	1.57	1.08	1.36
164.68	134.68	6.13	41.75	44.17	1.55	1.08	1.37
190.46	160.46	5.89	40.42	42.16	1.50	1.07	1.38
216.24	186.24	6.13	38.76	40.87	1.51	1.07	1.40
242.02	212.02	6.00	37.29	38.89	1.47	1.07	1.41
267.00	237.80	5.86	36.41	37.32	1.47	1.06	1.42
293.58	263.58	6.12	35.27	36.40	1.48	1.06	1.44
319.36	289.36	6.03	34.46	34.97	1.44	1.05	1.45
345.14	315.14	5.94	33.99	34.19	1.48	1.05	1.48
370.92	340.92	6.01	33.19	32.90	1.47	1.04	1.50
396.70	366.70	6.00	32.52	32.93	1.45	1.04	1.52
422.48	392.48	6.19	32.12	32.12	1.48	1.04	1.56
448.26	418.26	6.39	31.50	31.13	1.47	1.05	1.57
474.04	444.04	6.22	31.48	30.35	1.50	1.05	1.61
500.00	470.00	6.44	31.93	29.87	1.47	1.06	1.64

In Stock... Immediate Delivery

ultra-low distortion

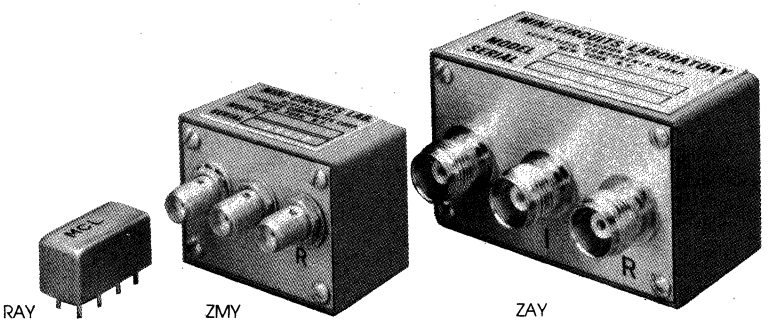
Frequency Mixers

LEVEL 23 (+23dBm LO, up to +15dBm RF)
10 KHz to 1 GHz
performance data

curves, tables, page 4 Model Index

case style selection

outline drawings see page 3



	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	FREQUENCY MHz IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
RAY case A01	●RAY-1	5-500	DC-500	6.0	7.5	7.5	8.5	55	45	40	30	30	25	55	45	40	30	30	20	34.95	(4-9)
	●RAY-2	10-1000	DC-1000	7.0	8.5	8.5	10	50	35	40	30	35	25	50	35	35	25	25	20	54.95	(4-9)
	●RAY-3	.07-300	DC-200	6.0	7.5	6.5	8.0	55	45	40	30	30	25	55	45	40	30	30	20	34.95	(4-9)
	RAY-6 NEW	0.01-50	DC50	5.5	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	31.95	(1-24)
ZMY case M21	●ZMY-1	5-500	DC-500	6.0	7.5	7.5	8.5	55	45	40	30	30	25	55	45	40	30	30	20	57.95	(1-9)
	●ZMY-2	10-1000	DC-1000	7.0	8.5	8.5	10	50	35	40	30	35	25	50	35	35	25	25	20	77.95	(1-9)
	●ZMY-3	.07-300	DC-200	6.0	7.5	6.5	8.0	55	45	40	30	30	25	55	45	40	30	30	20	57.95	(1-9)
ZAY case M22	●ZAY-1	5-500	DC-500	6.0	7.5	7.5	8.5	55	45	40	30	30	25	55	45	40	30	30	20	47.95	(1-9)
	●ZAY-2	10-1000	DC-1000	7.0	8.5	8.5	10	50	35	40	30	35	25	50	35	35	25	25	20	67.95	(1-9)
	●ZAY-3	.07-300	DC-200	6.0	7.5	6.5	8.0	55	45	40	30	30	25	55	45	40	30	30	20	47.95	(1-9)

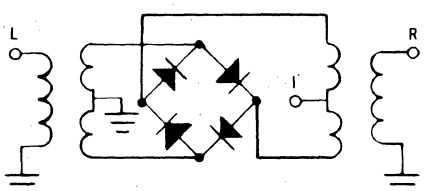
L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

NOTES:
● HTRB tested

1. For typical characteristics, compression level, phase detection and electronic attenuation, see "Mixer Technical Section".
2. For Quality Control procedures, see page 6.
3. For environmental specifications see page 7.
4. For High-Rel and TX description, see page 6.
5. Absolute Maximum Ratings; RF power 350 mW for level 23, 23S and 700 mW for level 27. Peak IF current 40 mA.
6. For connector types and case mounting options, see case style outline drawing.
7. Prices and specifications subject to change without notice.

schematic



pin and coaxial connections

see case style outline drawing

Series	RAY			ZMY	ZAY	SAY	ZFY	VAY
Models	−1 −3	−2	−6	all models	all models	all models	all models	all models
LO	8	8	8	1	1	8	1	8
RF	1	1	1	3	3	1	2	1
IF	3,4*	3,4*	3,4*	2	2	3	3	3
GND	2,5,6,7	2,5,6,7	2,5,6,7	—	—	2,5,6,7	—	2,5,6,7
CASE GND	2	2,5,6,7	—	—	—	2,5,6,7	—	2,5,6,7

*pins must be connected externally

MIL-M-28837/1A, NSN GUIDE

MCL NO.	NSN	MIL-M-28837/1A*
RAY-1	5825-01-105-6188	04N
RAY-1 Hi-Rel		04S
RAY-2	5895-01-111-7368	
RAY-3	5895-01-064-5082	
ZMY-2	4935-01-080-7636	

*units are not QPL listed

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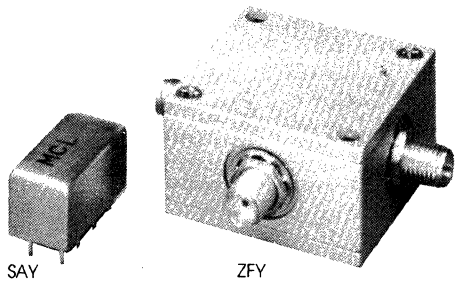
LEVEL 23S (+23dBm LO, up to +20dBm RF)
100 KHz to 2.4 GHz

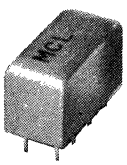


SAY ZFY

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m Typ.	Max.	Total Range Typ.	Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	PRICE, $ Ea.	Qty.
SAY case A01	SAY-1	0.1-500	.01-500	5.3	6.0	5.3	7.5	47	40	46	35	40	30	47	40	46	35	40	30	54.95	(1-9)
	SAY-2	0.1-1000	.01-500	5.3	7.5	7.5	9.5	47	40	40	30	30	25	47	40	40	25	25	20	59.95	(1-9)
	SAY-11	10-2400	5-1000	7.0	8.5	8.0	10	28	20	26	20	25	20	28	20	26	20	25	20	64.95	(1-9)
ZFY case K18	ZFY-1	0.1-500	.01-500	5.3	6.0	5.3	7.5	47	40	46	35	40	30	47	40	46	35	40	30	74.95	(1-9)
	ZFY-2	0.1-1000	.01-500	5.3	7.5	7.5	9.5	47	40	40	30	30	25	47	40	40	25	25	20	79.95	(1-9)
	ZFY-11	10-2400	5-1000	7.0	8.5	8.0	10	28	20	26	20	25	20	28	20	26	20	25	20	84.95	(1-9)

L = low range (f_L to 10 f_L) · M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)
m = mid band (2f_L to f_U/2)

LEVEL 27 (+27dBm LO, up to +24dBm RF)
50 KHz to 500 MHz



VAY-1

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m Typ.	Max.	Total Range Typ.	Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	PRICE, $ Ea.	Qty.
VAY-1 case A01	NEW VAY-1	.05-500	.02-500	6.0	7.5	7.5	8.5	47	40	46	35	35	25	47	40	46	35	35	25	74.95	(1-9)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)
m = mid band (2f_L to f_U/2)

CAPD now available! computer-automated performance data

In Stock... Immediate Delivery

Power Splitter/Combiners

2 WAY-0°

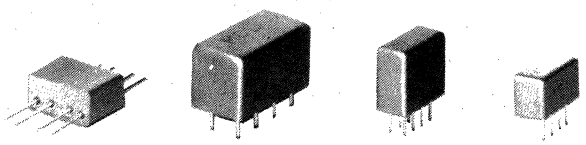
2 KHz to 4.2 GHz

performance data

curves, tables, page 4 Model Index

case style selection

outline drawings see page 3



LPS PSC-2 MCS-2 TSC-2

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 3dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
LPS case BB48	LPS-109 NEW	10-500	35	25	30	25	30	25	0.3	0.5	0.4	0.6	0.5	0.8	2.0	3.0	2.0	0.15	0.2	0.3	15.95	(5-24)
PSC-2 case A01	PSC-2-1	0.1-400	20	15	25	20	25	20	0.2	0.6	0.4	0.75	0.6	1.0	2.0	3.0	4.0	0.15	0.2	0.3	9.95	(6-49)
	PSC-2-1W	1-650	25	20	35	25	25	20	0.3	0.6	0.5	0.9	0.7	1.0	2.0	3.0	4.0	0.15	0.2	0.3	14.95	(6-49)
	PSC-2-2	0.002-60	27	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	0.15	.25	0.3	19.95	(6-49)
	PSC-2-4	10-1000	30	25	25	20	25	20	0.6	1.0	0.6	1.2	0.7	1.2	2.0	8.0	20	0.15	0.2	0.4	19.95	(6-49)
	■ PSC-2375	55-85	—	—	35	25	—	—	—	—	0.3	0.5	—	—	—	1.0	—	—	0.1	—	19.95	(6-24)
	■ PSC-2-1-75	0.25-300	20	15	30	20	20	15	0.4	0.75	0.4	0.75	0.4	1.0	2.0	3.0	5.0	0.15	0.2	0.3	11.95	(6-49)
MSC-2 case A03	MSC-2-1	0.1-450	20	15	30	20	30	20	0.3	0.5	0.4	0.75	0.6	1.0	2.0	3.0	4.0	0.15	0.2	0.3	16.95	(5-24)
	MSC-2-1W	2-650	22	18	30	25	22	18	0.3	0.5	0.5	0.8	0.8	1.2	1.0	2.0	4.0	0.15	0.2	0.3	17.95	(5-24)
TSC-2 case B02	TSC-2-1 NEW	1-400	30	25	30	25	30	20	0.25	0.5	0.4	0.75	0.8	1.0	2.0	3.0	4.0	0.15	0.2	0.6	13.95	(5-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

computer-automated performance data

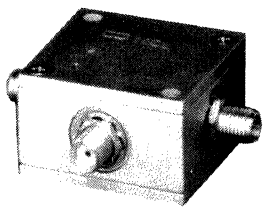
typical production unit / for data of other models consult factory

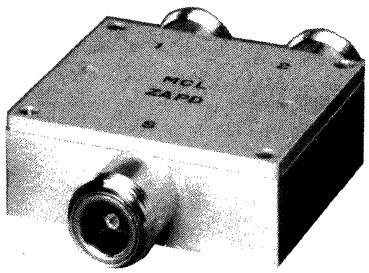
PSC-2-1

FREQUENCY MHz	INSERTION LOSS (dB) S-1	S-2	UNBALANCE (dB) 1-2	ISOLATION (dB) 1-2	VSWR SUM	1	2
.10	3.33	3.33	.02	21.96	1.40	1.14	1.14
21.147	3.19	3.19	0.00	33.40	1.12	1.11	1.12
42.194	3.19	3.19	0.00	34.63	1.13	1.11	1.11
63.241	3.27	3.25	−.02	33.73	1.13	1.11	1.11
84.288	3.24	3.25	.01	32.70	1.13	1.11	1.11
105.335	3.27	3.27	.00	31.70	1.13	1.11	1.10
126.382	3.27	3.27	0.00	31.06	1.13	1.11	1.11
147.429	3.29	3.29	0.00	30.47	1.13	1.11	1.11
168.476	3.29	3.29	0.00	30.05	1.14	1.11	1.11
189.523	3.32	3.32	0.00	29.71	1.15	1.12	1.12
210.570	3.34	3.34	0.00	29.42	1.16	1.14	1.14
231.617	3.36	3.37	.01	29.18	1.18	1.15	1.15
252.664	3.37	3.41	.04	28.85	1.21	1.17	1.17
273.711	3.43	3.47	.04	28.53	1.25	1.20	1.20
294.758	3.45	3.45	0.00	27.90	1.30	1.23	1.23
315.805	3.47	3.49	.02	27.03	1.34	1.26	1.26
336.852	3.48	3.50	.03	25.92	1.40	1.29	1.29
357.899	3.50	3.56	.06	24.51	1.46	1.32	1.33
378.946	3.58	3.62	.06	22.93	1.54	1.36	1.37
400.000	3.70	3.74	.04	21.19	1.63	1.40	1.41

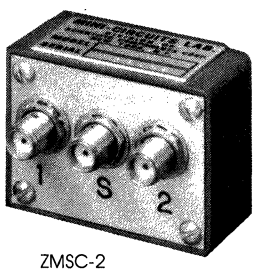
50 ohms and 75 ohms

Mini-Circuits

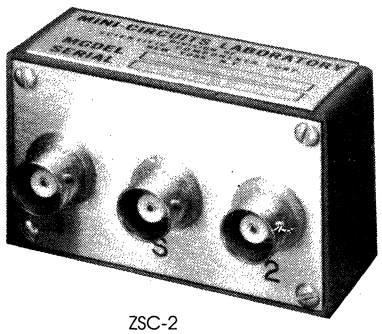

ZFSC-2



ZAPD



ZMSC-2



ZSC-2

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 3dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
ZFSC-2	**ZFSC-2-1**	5-500	30	25	28	20	25	20	0.2	0.5	0.3	0.6	0.6	0.8	2.0	4.0	4.0	.15	.15	0.3	31.95	(4-24)
case K18	■ **ZFSC-2-1-75** NEW	0.25-300	20	15	30	20	20	15	0.4	0.75	0.4	0.75	0.4	1.0	2.0	3.0	5.0	.15	0.2	0.3	32.95	(4-24)
	ZFSC-2-1W	1-750	30	20	28	20	25	20	0.2	0.5	0.4	0.8	0.8	1.0	2.0	4.0	4.0	.15	.15	0.3	35.95	(4-24)
	ZFSC-2-2	10-1000	30	20	25	20	23	18	0.2	0.5	0.5	1.0	0.9	1.2	2.0	4.0	4.0	.15	.15	0.3	39.95	(4-24)
	ZFSC-2-4	0.2-1000	20	15	25	20	23	18	0.2	0.5	0.5	1.0	0.9	1.2	2.0	4.0	4.0	.15	.15	0.3	44.95	(4-24)
	ZFSC-2-5	10-1500	25	15	30	20	25	18	0.25	0.6	0.5	1.0	0.8	1.5	5.0	8.0	10.0	.15	0.2	0.5	49.95	(4-24)
	ZFSC-2-6	0.002-60	27	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	36.95	(4-24)
	■ **ZFSC-2-6-75**	0.004-60	30	20	35	20	25	20	0.5	0.8	0.4	0.8	0.7	1.0	1.0	2.0	3.0	.15	0.2	0.3	38.95	(4-24)
		GHz																				
ZAPD	**ZAPD-1**	0.5-1.0	25	19	25	19	25	19	0.25	0.6	0.25	0.6	0.25	0.6	—	1	—	—	0.2	—	39.95	(1-9)
case F14	**ZAPD-2**	1.0-2.0	25	19	25	19	25	19	0.25	0.6	0.25	0.6	0.25	0.6	—	2	—	—	0.2	—	39.95	(1-9)
	ZAPD-4	2.0-4.2	25	19	25	19	25	19	0.4	0.8	0.4	0.8	0.4	0.8	—	6	—	—	0.4	—	39.95	(1-9)
case F53	**ZAPD-21** NEW	0.5-2.0	25	19	25	19	25	19	0.25	0.8	0.25	0.8	0.25	0.8	—	2	—	—	0.2	—	49.95	(1-9)
		MHz																				
ZMSC-2	**ZMSC-2-1**	0.1-400	20	15	25	20	25	20	0.2	0.5	0.4	0.75	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	37.95	(4-24)
case M21	**ZMSC-2-1W**	1-650	25	20	35	25	25	20	0.3	0.5	0.5	0.8	0.7	1.0	2.0	3.0	4.0	.15	0.2	0.3	42.95	(4-24)
	ZMSC-2-2	0.002-60	27	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	.15	.25	0.3	47.95	(4-24)
ZSC-2	**ZSC-2-1**	0.1-400	20	15	25	20	25	20	0.2	0.5	0.4	0.75	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	27.95	(4-24)
case M22	**ZSC-2-1W**	1-650	25	20	35	25	25	20	0.3	0.5	0.5	0.8	0.7	1.0	2.0	3.0	4.0	.15	0.2	0.3	32.95	(4-24)
	ZSC-2-2	0.002-60	25	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	.15	.25	0.3	37.95	(4-24)
	ZSC-2-4	10-1000	25	20	35	20	25	20	0.2	0.5	0.5	0.8	0.7	1.3	2.0	4.0	6.0	.15	0.2	0.3	37.95	(4-24)
	■ **ZSC-2375**	55-85	35	25	35	25	35	25	0.3	0.5	0.3	0.5	0.3	0.5	—	1.0	—	—	0.1	—	37.95	(4-24)
	■ **ZSC-2-1-75**	0.25-300	20	15	30	20	20	15	0.4	0.75	0.4	0.75	0.4	1.0	2.0	3.0	5.0	.15	0.2	0.3	29.95	(4-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

1. For Quality Control procedures, see page 6.
2. For environmental specifications, see page 7.
3. Absolute Maximum Ratings, Matched power rating ZAPD 10W all other models 1W, Internal load dissipation 0.125W, see page 6.
4. For connector types and case mounting options, see case style outline drawing.
5. Prices and specifications subject to change without notice.

pin and coaxial connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Ground
LPS	1	4	5	2,3,6,7,8
PSC-2	1	5	6	2,3,4,7,8
MSC-2	1	5	6	2,3,4,7,8
TSC-2	1	2	4	3
ZFS-2	3	1	2	—
ZAPD-2	3	1	2	—
ZMSC-2	2	1	3	—
ZSC-2	2	1	3	—

MIL-P-23971/15, NSN GUIDE

MCL NO.	NSN	MIL-P-23971/15*
MSC-2-1	6625-01-124-8595	02
PSC-2-1	5820-00-548-0739	01
PSC-2-2	5825-01-044-8944	
ZFSC-2-2A	6625-01-079-7021	
ZMSC-2-1W	5895-01-127-0232	
ZSC-2-1-BNC	5895-01-036-6254	
ZSC-2-1B	5820-00-270-3055	
ZSC-2-1-B-TNC	5820-01-109-3706	
ZSC-2-2-75B	5915-01-012-8162	

*units are not QPL listed

In Stock... Immediate Delivery

Power Splitter/Combiners

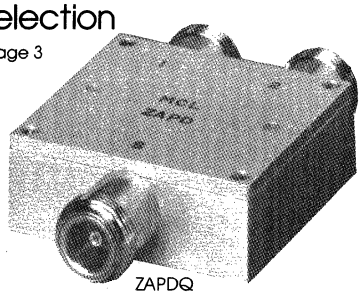
2 WAY-90°

1.4 MHz to 4.2 GHz
performance data
curves, tables, page 4 Model Index

case style selection

outline drawings see page 3

PSCQ-2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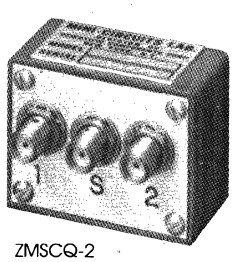
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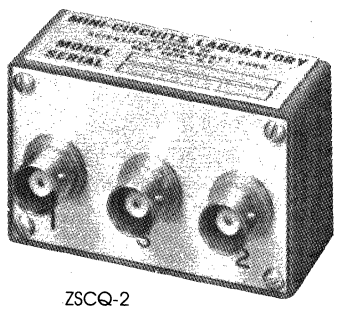

ZSCQ-2

	MODEL NO.	FREQ. RANGE MHz	ISOLATION dB Typ.	ISOLATION dB Min.	INSERTION LOSS dB Avg. of Coupled Outputs less 3 dB Typ.	INSERTION LOSS dB Avg. of Coupled Outputs less 3 dB Max.	PHASE UNBALANCE Degrees Max.	AMPLITUDE UNBALANCE dB Max.	PRICE $ Ea.	PRICE $ Qty.
PSCQ-2 case A01	**PSCQ-2-1.5**	1.4-1.7	29	25	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-3.4	3.0-3.8	30	25	0.4	0.7	3.8	1.2	16.95	(5-49)
	PSCQ-2-6.4	5.8-7.0	30	25	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-7.5	7.0-8.0	35	25	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-10.5	9.0-11.0	25	20	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-13	12-14	29	25	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-14	12-16	30	25	0.3	0.6	3.0	1.8	16.95	(5-49)
	PSCQ-2-21.4 NEW	20-23	30	25	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-50	25-50	30	20	0.3	0.7	3.0	1.5	19.95	(5-49)
	PSCQ-2-70 NEW	40-70	30	20	0.3	0.7	3.0	1.5	19.95	(5-49)
	PSCQ-2-90	55-90	30	20	0.3	0.7	3.0	1.2	19.95	(5-49)
	PSCQ-2-120 NEW	80-120	25	18	0.3	0.7	3.0	1.5	19.95	(5-49)
	PSCQ-2-180	120-180	23	15	0.3	0.7	4.0	1.2	19.95	(5-49)
	PSCQ-2-250 NEW	150-250	25	18	0.4	0.8	4.0	1.5	19.95	(5-49)
	PSCQ-2-400 NEW	250-400	23	16	0.5	0.9	4.0	1.5	19.95	(5-49)
	PSCQ-2-450 NEW	350-450	23	16	0.5	0.9	5.0	1.5	19.95	(5-49)
ZAPDQ case F14	**ZAPDQ-2**	1000-2000	22	16	0.4	0.9	5.0	1.0	59.95	(1-9)
	ZAPDQ-4	2000-4200	22	16	0.4	0.9	5.0	1.0	59.95	(1-9)
ZMSCQ-2 case M21	**ZMSCQ-2-50**	25-50	30	20	0.3	0.7	3.0	1.5	49.95	(4-24)
	ZMSCQ-2-90	55-90	30	20	0.3	0.7	3.0	1.2	49.95	(4-24)
	ZMSCQ-2-180	120-180	23	15	0.3	0.7	4.0	1.2	49.95	(4-24)
ZSCQ-2 case M22	**ZSCQ-2-50**	25-50	30	20	0.3	0.7	3.0	1.5	39.95	(4-24)
	ZSCQ-2-90	55-90	30	20	0.3	0.7	3.0	1.2	39.95	(4-24)
	ZSCQ-2-180	120-180	23	15	0.3	0.7	4.0	1.2	39.95	(4-24)

NOTES:
1. For Quality Control procedures, see page 6.
2. For environmental specifications see page 7.
3. Absolute Maximum Ratings,
   Matched power rating ZAPDQ(10W),
   all other models (1W),
   Internal load dissipation (0.125W), see page 7.
4. For connector types and case mounting options, see case style outline drawings.
5. Prices and specifications subject to change without notice.

pin and coaxial connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Ground	Terminate 50 ohms
PSCQ-2	1	2	5	3,4,7,8	6
PSCJ-2	1	5	6	2,3,4,7,8	—
ZAPDQ	3	1	2	—	—
ZMSCQ-2	2	1	3	—	—
ZSCQ-2	2	1	3	—	—
ZFSCJ-2	3	1	2	—	—
ZMSCJ-2	2	1	3	—	—
ZSCJ-2	2	1	3	—	—

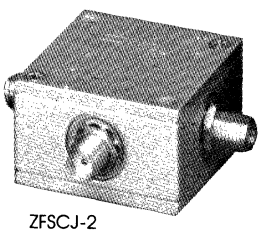
50 ohms

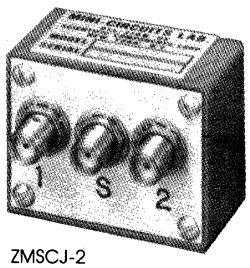
Mini-Circuits

2 WAY-180°

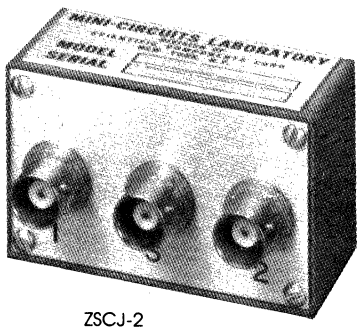
10 KHz to 500 MHz

PSCJ-2


ZFSCJ-2



ZMSCJ-2



ZSCJ-2

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 3dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
PSCJ-2 case A01	**PSCJ-2-1**	1-200	35	30	35	25	30	23	.75	1.0	0.5	0.8	.75	1.2	2.0	2.5	4.0	.15	.15	0.3	19.95	(5-49)
	PSCJ-2-2	0.01-20	35	25	30	25	25	18	0.3	0.8	0.2	0.5	0.3	0.6	1.0	2.0	2.5	0.1	0.1	0.2	29.95	(5-49)
ZFSCJ-2 case K18	**ZFSCJ-2-1**	1-500	30	20	33	25	30	18	1.0	1.5	1.0	1.5	1.0	1.5	2.0	4.0	6.0	.15	0.2	0.5	49.95	(4-24)
	ZFSCJ-2-3	5-300	30	20	33	25	30	18	1.0	1.5	1.0	1.5	1.0	1.5	2.0	4.0	6.0	.15	0.2	0.5	39.95	(4-24)
ZMSCJ-2 case M21	**ZMSCJ-2-1**	1-200	35	30	35	25	30	23	.75	1.0	0.6	0.8	.75	1.2	2.0	2.5	4.0	.15	.15	0.3	47.95	(4-24)
	ZMSCJ-2-2	0.01-20	35	25	30	25	25	18	0.3	0.8	0.2	0.5	0.3	0.6	1.0	2.0	2.5	0.1	0.1	0.2	57.95	(4-24)
ZSCJ-2 case M22	**ZSCJ-2-1**	1-200	35	30	35	25	30	23	.75	1.0	0.6	0.8	.75	1.2	2.0	2.5	4.0	.15	.15	0.3	37.95	(4-24)
	ZSCJ-2-2	0.01-20	35	25	30	25	25	18	0.3	0.8	0.2	0.5	0.3	0.6	1.0	2.0	2.5	0.1	0.1	0.2	47.95	(4-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

computer-automated performance data

typical production unit / for data of other models consult factory

PSCJ-2-1

FREQUENCY MHz	INSERTION LOSS (dB) S-1	S-2	UNBAL. (dB) 1-2	ISOLATION (dB) 1-2	VSWR Sum	1	2
1.20	3.79	3.64	.15	30.98	1.06	1.15	1.15
11.473	3.60	3.44	.16	32.77	1.04	1.19	1.19
21.946	3.56	3.47	.09	33.61	1.06	1.20	1.20
32.419	3.60	3.51	.09	34.38	1.08	1.21	1.22
42.892	3.61	3.52	.09	35.06	1.10	1.22	1.24
53.365	3.72	3.53	.19	35.92	1.11	1.24	1.25
63.838	3.64	3.53	.11	36.93	1.13	1.25	1.27
74.311	3.79	3.58	.21	38.25	1.15	1.26	1.29
84.784	3.77	3.57	.20	39.86	1.17	1.28	1.31
95.257	3.82	3.62	.20	41.94	1.19	1.29	1.33
105.73	3.88	3.65	.23	45.24	1.22	1.31	1.36
116.203	3.83	3.66	.17	48.23	1.24	1.33	1.38
126.676	3.92	3.66	.26	48.12	1.27	1.34	1.41
137.149	3.92	3.65	.27	44.90	1.29	1.36	1.43
147.622	3.96	3.65	.31	40.93	1.31	1.38	1.46
158.395	4.02	3.69	.33	39.29	1.34	1.40	1.50
168.568	3.97	3.68	.29	35.97	1.36	1.42	1.53
179.041	4.08	3.66	.42	34.09	1.39	1.45	1.56
189.514	4.09	3.68	.41	32.50	1.42	1.47	1.60
200.00	4.03	3.65	.38	30.89	1.44	1.49	1.64

In Stock... Immediate Delivery

Power Splitter/Combiners

3 WAY-0°

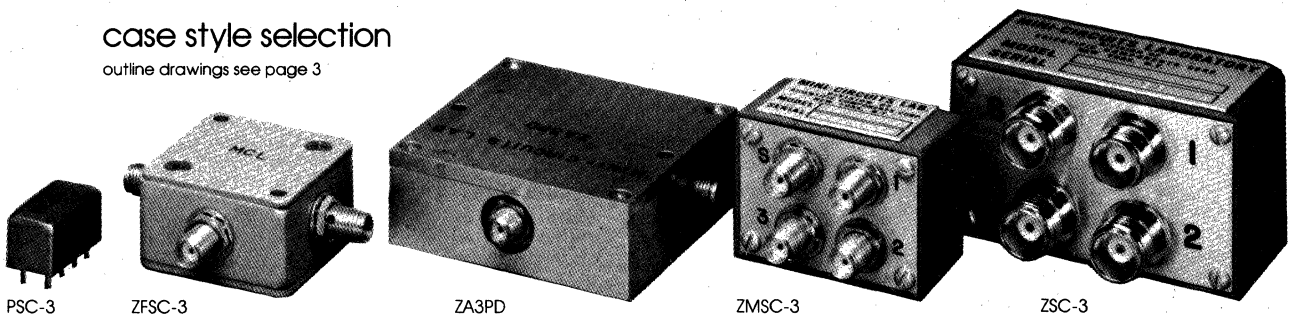
10 KHz to 4.2 GHz

performance data

curves, tables, page 4 Model Index

case style selection

outline drawings see page 3



PSC-3 ZFSC-3 ZA3PD ZMSC-3 ZSC-3

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 4.8dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
PSC-3 case A01	•PSC-3-1	1-200	45	30	40	30	40	25	0.6	1.0	0.4	0.7	0.6	1.0	1.0	2.0	4.0	.15	0.2	0.3	19.95	(5-49)
	PSC-3-1W	5-500	25	20	31	15	25	15	0.4	0.8	0.4	1.4	0.8	1.4	6.0	14.	20.	0.1	0.3	0.6	29.95	(5-49)
	PSC-3-2	0.01-30	35	30	40	35	30	25	.25	.45	.15	0.3	.45	.75	1.0	2.0	4.0	0.2	0.3	0.4	29.95	(5-49)
	■ PSC-3-1-75	1-200	35	30	35	25	35	25	0.6	1.0	0.3	0.7	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	20.95	(5-49)
	NEW ■ PSC-3-1-75-2	10-300	28	20	25	20	28	20	0.2	0.4	0.3	0.5	0.4	0.7	2.0	3.0	4.0	.15	0.2	0.3	22.95	(5-49)
	PSC-3-13	1-200	45	35	45	35	37	30	.25	0.5	.35	0.6	.35	0.6	1.0	3.0	4.0	0.1	0.2	0.2	24.95	(5-49)
ZFSC-3 case J17	ZFSC-3-1	1-500	30	20	30	20	25	18	0.4	.75	0.5	0.9	0.8	1.2	2.0	3.0	4.0	0.2	0.3	0.4	39.95	(4-24)
	ZFSC-3-1W	2-750	30	20	30	20	25	18	0.4	.75	0.5	1.0	1.0	1.6	3.0	5.0	7.0	0.2	0.3	0.5	41.95	(4-24)
	ZFSC-3-13	1-200	45	30	48	35	37	30	.25	0.5	.35	0.6	.35	0.6	1.0	3.0	5.0	0.1	0.2	0.2	39.95	(4-24)
		GHz																				
ZA3PD case CC51	ZA3PD-1 NEW	0.5-1.0	20	15	20	15	20	18	0.3	0.6	0.3	0.6	0.3	0.6	—	—	—	0.4	0.4	0.4	79.95	(1-9)
	ZA3PD-1.5 NEW	0.75-1.5	20	16	20	16	20	16	0.3	0.7	0.3	0.7	0.3	0.7	—	—	—	0.3	0.3	0.3	79.95	(1-9)
	ZA3PD-2 NEW	1-2	20	18	20	18	20	18	0.3	0.6	0.3	0.6	0.3	0.6	—	—	—	0.3	0.3	0.3	79.95	(1-9)
	ZA3PD-4 NEW	2-4.2	18	14	18	14	18	14	0.7	1.0	0.7	1.0	0.7	1.0	—	—	—	0.8	0.8	0.8	79.95	(1-9)
		MHz																				
ZMSC-3 case P26	ZMSC-3-1	1-200	45	35	40	30	40	25	0.6	1.0	0.4	0.7	0.6	1.0	1.0	2.0	4.0	.15	0.2	0.3	47.95	(4-24)
	ZMSC-3-2	0.01-30	35	30	40	35	30	25	.25	.45	.15	0.3	.45	.75	1.0	2.0	4.0	0.2	0.3	0.4	57.95	(4-24)
ZSC-3 case P25	ZSC-3-1	1-200	45	30	40	30	40	25	0.6	1.0	0.4	0.7	0.6	1.0	1.0	2.0	4.0	.15	0.2	0.3	37.95	(4-24)
	ZSC-3-2	0.01-30	35	30	40	35	30	25	.25	.45	.15	0.3	.45	.75	1.0	2.0	4.0	0.2	0.3	0.4	47.95	(4-24)
	■ ZSC-3-1-75	1-200	35	30	35	25	35	25	0.6	1.0	0.4	0.7	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	38.95	(4-24)
	■ ZSC-3-2-75	0.02-20	35	30	35	25	30	20	0.2	0.5	.25	0.6	.45	.75	2.0	3.0	4.0	0.2	0.3	0.4	48.95	(4-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

MIL-P-23971/15, NSN GUIDE

MCL NO.	NSN
PSC-3-1	5820-01-015-6027
ZSC-3-1B	5820-01-008-9566
ZSC-3-2B	5825-01-120-9320
PSC-4-1	5821-01-065-0106
PSC-4-2	5825-01-044-8945
PSC-4-3	5825-01-105-6189
ZSC-4-1B	5820-00-270-3056
ZSC-4-2B	5820-01-120-5238
ZSC-4-3B	6920-01-038-8553

pin connections

see case style outline drawing

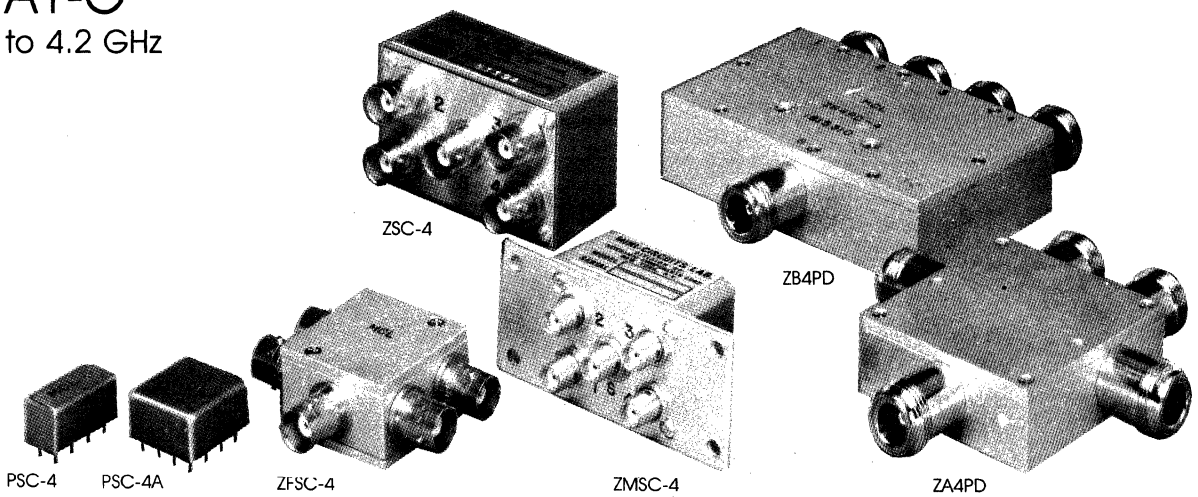
Series	Sum Port	Port 1	Port 2	Port 3	Port 4	Ground
PSC-3 except PSC-3-1W, PSC-3-1-75-2	6	1	2	5	—	3,4,7,8
PSC-3-1W PSC-3-1-75-2	1	5	7	8	—	2,3,4,6
PSC-4	4	7	8	1	2	3,5,6
PSC-4A	2	8	12	5	9	1,3,4,6,7,10 11,13,14,15,16

50 ohms and 75 ohms

Mini-Circuits

4 WAY-0°

2 KHz to 4.2 GHz



	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 6dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
PSC-4 case A01	**PSC-4-1**	0.1-200	33	20	30	20	27	20	0.4	0.6	0.5	.75	0.7	1.0	4.0	6.0	8.0	.15	.20	.25	28.95	(6-49)
	■ **PSC-4-1-75**	1-200	30	20	25	20	25	20	0.4	0.7	0.5	0.9	0.7	1.2	4.0	6.0	10.0	.15	.20	0.3	24.95	(6-49)
	PSC-4-3	0.25-250	33	20	30	20	27	20	0.4	0.7	0.5	.75	0.7	1.2	4.0	6.0	8.0	.15	.20	.25	23.95	(6-49)
	PSC-4-6	0.01-40	35	29	32	25	25	18	0.4	0.8	0.3	0.5	0.5	1.0	4.0	6.0	8.0	.10	.15	.20	29.95	(6-49)
PSC-4A case C07	**PSC-4A-4**	10-1000	25	20	21	15	18	15	0.5	0.8	0.8	1.1	1.5	2.5	4.0	16.0	20.0	.20	.30	.20	49.95	(6-49)
ZFSC-4 case G15	**ZFSC-4-1**	1-1000	25	20	23	18	20	15	0.4	0.8	0.6	1.5	1.6	2.5	4.0	8.0	8.0	0.2	0.4	0.7	89.95	(1-4)
	ZFSC-4-1W	10-500	23	20	23	20	23	20	0.6	1.5	0.6	1.5	0.6	1.5	4.0	8.0	8.0	0.2	0.3	0.4	74.95	(1-4)
	ZFSC-4-3	10-300	32	28	38	30	38	30	0.5	0.8	0.6	0.9	0.9	1.2	4.0	6.0	8.0	0.1	0.1	0.2	69.95	(1-4)
	■ **ZFSC-4375** NEW	50-90	34	30	34	30	34	30	0.3	0.8	0.3	0.8	0.3	0.8	4.0	6.0	8.0	0.15	0.15	0.15	89.95	(1-4)
NEW ▲	■ **ZFSC-4-2-75-1**	200-800	25	20	25	20	25	20	0.8	1.0	0.8	1.0	0.8	1.0	4.0	16.0	20.0	0.4	0.4	0.4	74.95	(1-4)
ZMSC-4 case N24	**ZMSC-4-1**	0.1-200	33	20	30	20	27	20	0.4	0.6	0.5	.75	0.7	1.0	4.0	6.0	1.0	.15	.20	.25	56.95	(4-24)
	ZMSC-4-2	0.002-20	30	20	33	25	33	25	.45	.75	0.3	0.5	0.7	1.0	4.0	6.0	8.0	.15	.20	.25	69.95	(4-24)
	ZMSC-4-3	0.25-250	33	20	30	20	27	20	0.4	0.7	0.5	.75	0.7	1.2	4.0	6.0	10.0	.15	.20	.25	53.95	(4-24)
ZSC-4 case N27	**ZSC-4-1**	0.1-200	33	20	30	20	27	20	0.4	0.6	0.5	.75	0.7	1.0	4.0	6.0	8.0	.15	.20	.25	46.95	(4-24)
	■ **ZSC-4-1-75**	1-200	30	20	25	20	25	20	0.4	0.7	0.5	0.8	0.7	1.2	0.4	6.0	10.0	.15	.20	0.3	46.95	(4-24)
	ZSC-4-2	0.002-20	30	20	33	25	33	25	.45	.75	0.3	0.5	0.7	1.0	4.0	6.0	8.0	.15	.20	.25	69.95	(4-24)
	ZSC-4-3	0.25-250	33	20	30	20	27	20	0.4	0.7	0.5	.75	0.7	1.2	4.0	6.0	10.0	.15	.20	.25	43.95	(4-24)
		GHz																				
ZA4PD case DD52	**ZA4PD-2**	1-2	25	18	25	18	25	18	0.3	0.8	0.3	0.8	0.3	0.8	—	6.0	—	0.7	0.7	0.7	79.95	(1-9)
	ZA4PD-4	2-4.2	25	18	25	18	25	18	0.5	0.8	0.3	0.8	0.3	0.8	—	16.0	—	0.8	0.8	0.8	79.95	(1-9)
ZB4PD case EE54	**ZB4PD-42** NEW	1.7-4.2	23	16	23	16	23	16	0.5	1.1	0.5	1.1	0.5	1.1	—	8.0	—	0.8	0.8	0.8	99.95	(1-9)
	ZB4PD-4 NEW	3.7-4.2	24	16	24	16	24	16	0.6	1.1	0.6	1.1	0.6	1.1	—	16.0	—	0.8	0.8	0.8	89.95	(1-9)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.
● Model PSC-3-1 manufactured under license protected by patent 3,428,920.
▲ On Model ZFSC-4-2-75-1, up to 15V and 15mA DC may be passed from input to all outputs.

1. For quality control procedures, see page 6.
2. For environmental specifications see page 7.
3. Absolute Maximum Ratings;
   Matched power rating ZA3PD, ZA4PD, ZB4PD(10W.)
   all other models (1W)
   Internal load dissipation
   all 3-way models (0.375W) all 4-way models (0.25W), see page 7.
3. For connector types and case mounting options, see case style outline drawing.
4. Prices and specifications subject to change without notice.
5. All 3-way power dividers with exception of ZA3PD are licensed under U.S. Patent 3,428,920; reissued as RE 27,299.

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Power Splitter/Combiners

5 WAY-0°

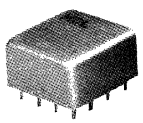
1 MHz to 300 MHz

performance data

curves, tables, page 4 Model Index

case style selection

outline drawings see page 3



PSC-5

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 7.0dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE. $ Ea.	Qty.
PSC-5	PSC-5-1 NEW	1-300	25	20	23	18	20	17	0.2	0.5	0.6	1.0	1.5	2.0	2.0	4.0	8.0	0.2	0.3	0.6	59.95	(1-5)
case C07	■ PSC-5-1-75 NEW	1-300	35	25	30	23	25	18	0.4	0.6	0.6	0.9	0.9	1.3	2.0	4.0	8.0	0.2	0.3	0.6	59.95	(1-5)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

1. Matched power rating, 1 watt
   Internal load dissipation, 0.5 watt.
2. Refer to table of contents for quality control procedures, environmental specifications, and absolute maximum ratings.
3. For connector types, see case style outline drawing.
4. Prices and specifications subject to change without notice.

pin connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Ground	Not Used
PSC-5	1	4	8	12	16	15	—	2,5,7,11,13,14	3,6,9,10
PSC-6	1	3	4	8	12	16	15	2,5,7,11,13,14	6,9,10

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50 ohms and 75 ohms

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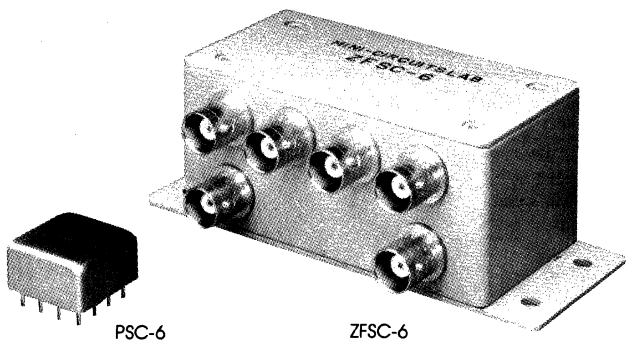
1 MHz to 300 MHz



PSC-6 ZFSC-6

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 7.8dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
PSC-6 case C07	PSC-6-1	1-175	30	24	26	18	26	18	0.5	0.8	0.7	1.0	1.0	1.5	4.0	6.0	12.0	0.2	0.4	0.8	68.95	(1-5)
	■ PSC-6-1-75 NEW	1-300	35	25	30	23	25	18	0.4	0.6	0.6	0.9	0.6	1.1	2.0	6.0	12.0	0.2	0.3	0.6	78.95	(1-5)
ZFSC-6 case Q28	ZFSC-6-1	1-175	27	22	26	20	26	20	0.75	1.0	0.75	1.2	0.8	1.2	2.0	6.0	12.0	0.2	0.4	0.6	89.95	(1-4)
	■ ZFSC-6-1-75	1-200	30	25	30	22	20	18	0.75	1.0	0.75	1.0	0.9	1.2	2.0	6.0	12.0	0.2	0.4	0.6	89.95	(1-4)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

PSC-6-1 CAP-D computer-automated performance data

typical production unit / for data of other models consult factory

INSERTION LOSS MHz	S-1 (dB)	S-2 (dB)	S-3 (dB)	S-4 (dB)	S-5 (dB)	S-6 (dB)	UNBAL.
1.00	8.39	8.40	8.42	8.43	8.45	8.43	0.06
10.157	8.16	8.17	8.14	8.19	8.19	8.20	0.05
28.471	8.24	8.24	8.23	8.27	8.27	8.29	0.04
55.942	8.32	8.36	8.30	8.35	8.35	8.36	0.06
83.413	8.39	8.43	8.38	8.42	8.46	8.43	0.08
101.727	8.48	8.52	8.49	8.48	8.52	8.52	0.04
120.041	8.62	8.62	8.55	8.58	8.62	8.63	0.07
138.355	8.62	8.65	8.56	8.58	8.68	8.67	0.12
156.669	8.68	8.72	8.60	8.65	8.75	8.72	0.15
175.00	8.76	8.80	8.65	8.70	8.84	8.77	0.19

ISOLATION MHz	1-2 (dB)	1-3 (dB)	1-5 (dB)	2-3 (dB)	4-5 (dB)	4-6 (dB)	5-6 (dB)
1.00	30.19	31.52	40.69	28.79	29.26	31.97	27.69
10.157	28.66	29.66	41.38	27.98	27.74	30.15	26.56
28.471	28.10	29.10	40.68	27.35	26.92	29.51	26.09
55.942	27.03	28.32	38.27	25.95	25.40	28.46	25.26
83.413	25.99	27.54	36.33	24.53	23.90	27.41	24.34
101.727	25.30	27.03	35.43	23.65	23.00	26.76	23.74
120.041	24.71	26.59	34.81	22.91	22.22	26.24	23.22
138.355	24.15	26.16	34.29	22.19	21.43	25.74	22.69
156.669	23.57	25.72	34.02	21.43	20.75	25.27	22.17
175.00	23.01	25.22	34.07	20.74	20.09	24.76	21.57

VSWR MHz	#S VSWR	#1 VSWR	#2 VSWR	#3 VSWR	#4 VSWR	#5 VSWR	#6 VSWR
1.00	1.12	1.11	1.10	1.10	1.11	1.09	1.10
10.00	1.25	1.09	1.07	1.08	1.09	1.06	1.12
27.36	1.26	1.08	1.07	1.08	1.08	1.04	1.11
53.40	1.30	1.08	1.08	1.08	1.09	1.05	1.09
88.12	1.37	1.08	1.09	1.09	1.09	1.05	1.11
105.48	1.39	1.08	1.10	1.09	1.09	1.05	1.12
122.84	1.40	1.08	1.11	1.10	1.10	1.05	1.13
140.20	1.39	1.08	1.11	1.10	1.10	1.05	1.15
157.56	1.37	1.08	1.12	1.11	1.11	1.05	1.15
175.00	1.34	1.09	1.13	1.13	1.13	1.05	1.16

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10 KHz to 4.2 GHz

performance data

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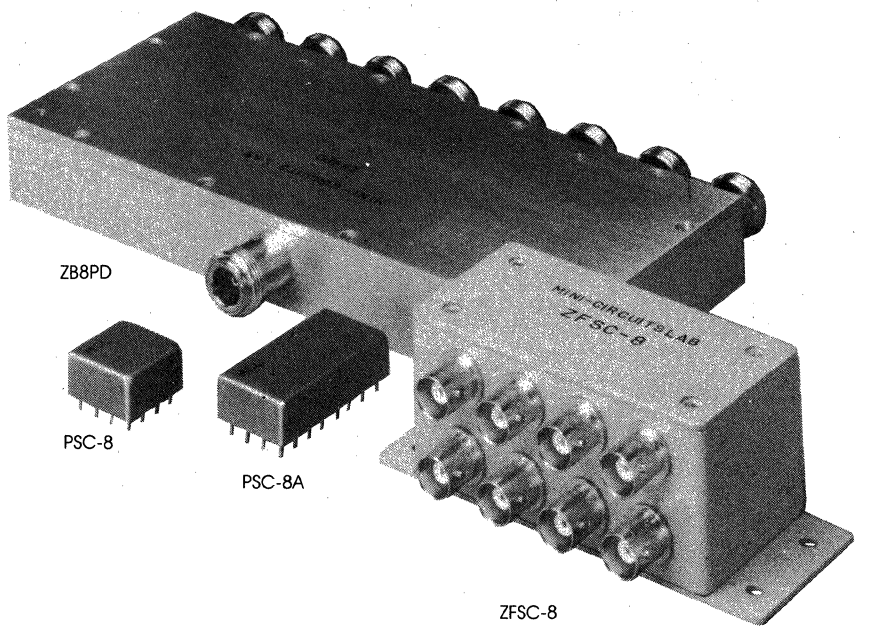
case style selection

outline drawings see page 3



	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 9dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
PSC-8	**PSC-8-1**	0.5-175	30	25	30	20	25	18	0.8	1.2	0.8	1.2	1.0	1.6	1.0	2.5	5.0	0.2	0.2	0.3	68.95	(1-5)
case C07 ■	**PSC-8-1-75**	0.5-175	25	20	30	20	25	20	0.5	1.0	0.6	1.1	0.7	1.3	1.0	2.5	5.0	0.2	0.2	0.3	69.95	(1-5)
	PSC-8-6	0.01-10	40	30	40	25	28	23	0.3	0.7	0.5	1.0	0.6	1.1	1.0	2.5	4.0	0.1	0.2	0.3	79.95	(1-5)
PSC-8A	**PSC-8A-4**	5-500	25	20	23	18	20	15	0.7	1.2	1.0	1.8	1.4	2.0	3.0	8.0	16.0	0.2	0.3	0.5	89.95	(1-4)
case E10 ■	**PSC-8A4-75** NEW	1-300	26	20	30	25	30	23	0.8	1.2	0.7	1.1	0.9	1.3	1.0	3.0	8.0	0.2	0.2	0.4	79.95	(1-4)
ZFSC-8	**ZFSC-8-1**	0.5-175	30	25	30	20	25	18	0.8	1.2	0.8	1.2	1.0	1.6	1.0	2.5	5.0	0.2	0.2	0.3	89.95	(1-4)
case R29	■ **ZFSC-8-1-75**	0.5-175	25	20	30	20	25	20	0.5	1.0	0.6	1.1	0.7	1.3	1.0	2.5	5.0	0.2	0.3	0.5	90.95	(1-4)
	■ **ZFSC-84-75** NEW	1-300	26	20	30	25	30	23	0.8	1.2	0.7	1.1	0.9	1.3	1.0	3.0	8.0	0.2	0.2	0.4	119.95	(1-4)
	■ **ZFSC-8375**	50-90	30	30	30	25	25	25	1.0	1.0	1.0	1.3	1.3	1.3	2.0	2.0	2.00	0.2	0.2	0.2	119.95	(1-4)
	ZFSC-8-4	5-700	35	25	25	20	20	17	0.8	1.2	1.2	1.8	1.8	2.5	2.0	5.0	15.0	0.2	0.4	0.7	129.95	(1-4)
	ZFSC-8-43 NEW	30-1000	23	20	25	20	26	20	1.0	1.3	1.4	1.8	2.1	2.7	5.0	10.0	20.0	0.2	0.4	0.7	139.95	(1-4)
	ZFSC-8-6	0.01-10	40	30	40	25	28	23	0.3	0.7	0.5	1.0	0.6	1.1	1.0	2.5	4.0	0.1	0.2	0.3	109.95	(1-4)
		GHz																				
ZB8PD	**ZB8PD-2**	1-2	24	16	24	16	24	16	0.8	1.3	0.8	1.3	0.8	1.3	1.3	1.3	1.3	0.7	0.7	0.7	149.00	(1-9)
case Z40	**ZB8PD-4**	2-4.2	23	16	23	16	23	16	0.8	1.4	0.8	1.4	0.8	1.4	—	—	—	0.9	0.9	0.9	149.00	(1-9)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

1. Matched power rating, 1 watt.
   internal load dissipation, 0.62 watts.
2. Refer to table of contents for quality control procedures, environmental specifications, and absolute maximum ratings.
3. For connector types, see case style outline drawing.
4. Prices and specifications subject to change without notice.

pin connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Port 7	Port 8	Ground	Not Used
PSC-8	2	1	5	9	13	16	12	8	4	3,6,7,14,15	10,11
PSC-8A	29	7	16	31	24	9	2	26	17	1,3,4,5,6,8,10,11, 12,13,14,15,18, 19,20,21,22,23,25, 27,28,30,32	

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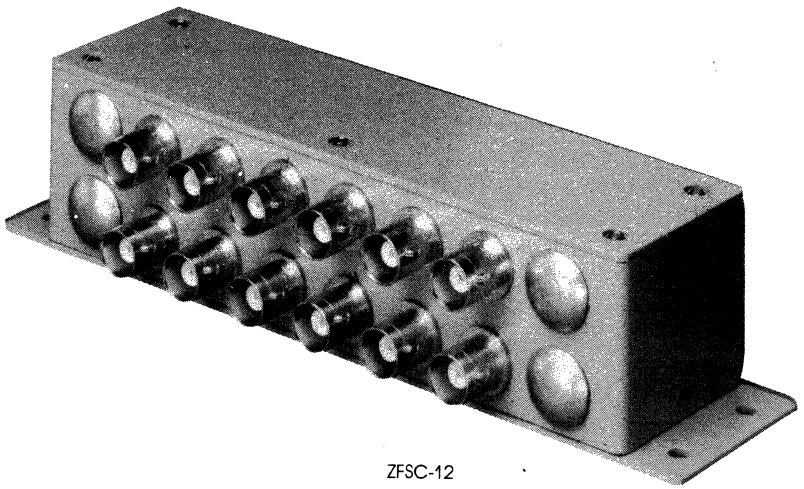


ZFSC-12

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 10.8dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
ZFSC-12 case R67	ZFSC-12-1 NEW	1-200	30	25	35	30	28	20	0.8	1.2	1.1	1.4	1.3	1.6	2.0	4.0	6.0	0.1	0.2	0.3	174.95	(1-4)
	ZFSC-12-11 NEW	10-300	28	20	33	25	28	20	1.1	1.3	1.1	1.5	1.5	1.8	2.0	4.0	6.0	0.2	0.3	0.4	174.95	(1-4)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

CAPD **computer-automated performance data**

typical production unit / for data of other models consult factory

PSC-8A-4

INSERTION LOSS, dB MHz	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	UNBAL.
5.00	9.60	9.60	9.60	9.62	9.62	9.62	9.59	9.60	.03
31.05	9.66	9.68	9.68	9.67	9.65	9.67	9.65	9.67	.03
57.11	9.78	9.80	9.81	9.80	9.79	9.77	9.77	9.78	.04
109.21	10.00	10.01	10.02	10.02	9.96	9.96	9.96	9.97	.06
161.32	10.35	10.36	10.36	10.36	10.27	10.27	10.26	10.29	.10
213.42	10.54	10.53	10.55	10.54	10.42	10.41	10.42	10.43	.14
265.53	10.72	10.69	10.72	10.70	10.56	10.55	10.57	10.59	.17
317.63	10.78	10.75	10.79	10.77	10.62	10.61	10.64	10.67	.18
395.79	10.79	10.76	10.79	10.79	10.63	10.60	10.65	10.68	.19
500.00	10.86	10.85	10.89	10.90	10.77	10.71	10.78	10.81	.19

ISOLATION, dB MHz	1-2	1-3	1-8	3-4	5-6	5-7	7-8
5.00	26.25	37.38	50.07	27.19	26.02	37.42	26.55
31.05	23.99	34.75	46.72	24.18	23.73	34.49	24.07
57.11	22.23	31.50	43.09	22.40	22.17	31.09	22.36
109.21	21.46	27.29	38.07	21.86	22.23	26.78	21.88
161.32	21.22	24.76	35.44	21.85	23.18	24.25	21.99
213.42	21.19	23.24	33.61	22.06	24.75	22.78	22.46
265.53	21.39	22.41	32.29	22.47	27.11	22.02	23.28
317.63	21.84	22.04	31.09	22.98	30.46	21.84	24.52
395.79	22.53	22.23	29.80	23.70	36.05	22.56	27.24
500.00	22.74	24.07	28.71	23.44	31.27	25.96	30.63

VSWR MHz	#S	#1	#2	#3	#4	#5	#6	#7	#8
5.00	1.30	1.36	1.36	1.38	1.38	1.35	1.35	1.37	1.37
31.05	1.33	1.31	1.31	1.32	1.32	1.30	1.30	1.31	1.31
57.11	1.38	1.27	1.28	1.28	1.28	1.25	1.26	1.27	1.27
109.21	1.51	1.28	1.29	1.29	1.29	1.23	1.24	1.26	1.26
161.32	1.63	1.30	1.31	1.32	1.31	1.23	1.24	1.26	1.27
213.42	1.71	1.32	1.33	1.33	1.32	1.22	1.23	1.26	1.26
265.53	1.73	1.32	1.32	1.33	1.32	1.20	1.21	1.25	1.25
317.63	1.68	1.31	1.31	1.31	1.30	1.17	1.18	1.23	1.23
395.79	1.50	1.28	1.27	1.27	1.26	1.15	1.15	1.20	1.21
500.00	1.19	1.27	1.25	1.23	1.23	1.17	1.15	1.22	1.22

Power Splitter/Combiners

16 WAY-0°

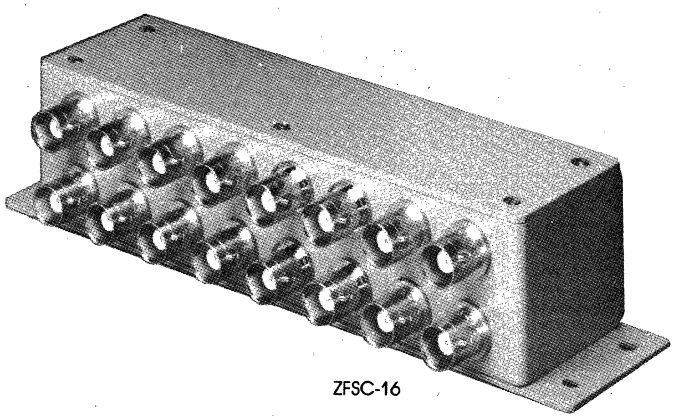
10 KHz to 200 MHz

performance data

curves, tables, page 4 Model Index

case style selection

outline drawings see page 3



ZFSC-16

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 12dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
ZFSC-16 case R30	ZFSC-16-1	0.5-125	30	24	25	18	20	15	1.0	1.2	1.1	1.3	1.2	1.4	1.0	3.0	5.0	0.1	0.2	0.5	174.95	(1-4)
	ZFSC-16-3 NEW	1-30	45	40	45	40	41	35	0.5	0.9	0.5	0.9	0.5	0.9	1.0	2.0	3.0	0.1	0.1	0.1	174.95	(1-4)
	■ ZFSC-16-675 NEW	0.01-25	25	20	40	25	25	20	0.8	1.1	0.4	0.8	1.0	1.6	1.0	3.0	5.0	0.1	0.2	0.4	189.95	(1-4)
	ZFSC-16-12 NEW	0.1-200	33	20	27	20	26	20	0.6	1.5	0.7	1.0	0.9	1.2	2.0	6.0	9.0	0.1	0.2	0.4	189.95	(1-4)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

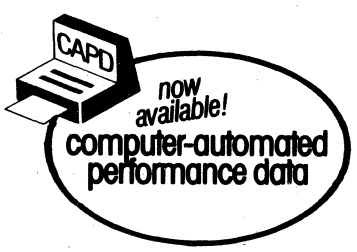
■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

1. Matched power rating, 1 watt
   Internal load dissipation, 0.87 watt.
2. Refer to table of contents for qualtiy control procedures, environmental specifications, and absolute maximum ratings.
3. For connector types, see case style outline drawing.
4. Prices and specifications subject to change without notice.

MIL-P-23971, *NSN GUIDE

MCL NO.	NSN
ZFSC-16-1	5820-01-120-9321

*Units are not QPL listed.



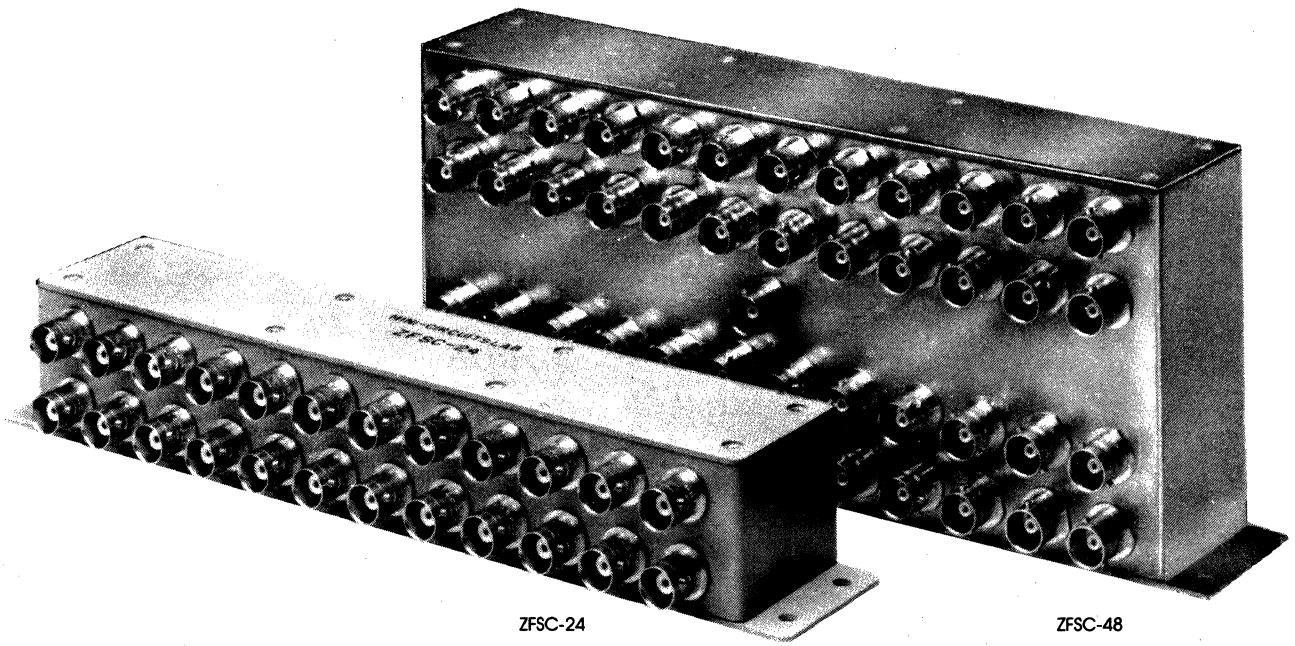
Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (718) 934-4500

50 ohms and 75 ohms

Mini-Circuits

24 WAY-0°
25 KHz to 200 MHz

48 WAY-0°
10 MHz to 300 MHz



ZFSC-24 ZFSC-48

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB 24 way (above 13.8dB) 48 way (above 16.8dB) L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
ZFSC-24 case R31	ZFSC-24-1	0.2-100	25	20	25	20	25	20	1.0	2.0	1.0	2.0	1.0	2.0	2.0	3.0	5.0	0.2	0.4	0.5	264.95	(1-4)
	ZFSC-24-11 NEW	1-200	33	25	22	20	20	17	0.4	0.8	0.6	1.0	1.3	2.0	2.0	4.0	8.0	0.2	0.4	0.6	274.95	(1-4)
	ZFSC-24-6 NEW	0.025-50	30	25	39	30	30	25	0.4	1.0	0.4	0.8	0.6	1.2	2.0	4.0	6.0	0.2	0.3	0.4	274.95	(1-4)
ZFSC-48 case HH68	ZFSC-48-1 NEW	10-300	30	25	28	20	23	20	1.0	1.5	1.8	2.2	2.0	2.5	—	—	—	0.6	0.7	0.9	595.00	(1-4)
	■ ZFSC-48-1-75 NEW	10-300	30	25	28	20	23	20	1.2	2.0	2.1	2.5	2.3	3.0	—	—	—	0.6	0.7	1.0	595.00	(1-4)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

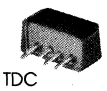
In Stock... Immediate Delivery

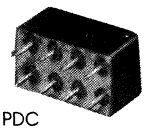
very broadband
Directional Couplers

10 to 30dB
10KHz to 2000 MHz

performance data
curves, tables, page 4 Model Index

case style selection
outline drawings see page 3


TDC


PDC

	MODEL NO.	FREQUENCY MHz f_L-f_U	COUPLING dB Nom.	COUPLING dB Flatness	MAINLINE LOSS* dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	DIRECTIVITY dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	VSWR Typ.	POWER INPUT, W L Max.	POWER INPUT, W M,U Max.	PRICE, $ Ea.	PRICE, $ Qty.
TDC case B02	**TDC 10-1**	1-400	10.0±0.5	±0.5	1.2	1.5	1.0	1.3	1.2	1.5	35	25	30	20	20	15	1.5	1	2	15.95	(5-49)
PDC case A01	**PDC-10-1**	0.5-500	11.5±0.5	±0.6	0.85	1.3	0.65	1.0	0.85	1.3	32	25	32	25	22	15	1.2	1.5	3	11.95	(5-49)
	PDC-10-2	250-1000	10.5±0.5	±1.0	1.1	1.4	—	—	1.6	1.9	40	30	30	20	20	15	1.5	—	5	27.95	(5-49)
	▲PDC-10-21	1-1000	11±0.5	±0.5	1.2	1.7	1.2	1.2	1.6	2	40	30	25	20	25	20	1.2	1	2	24.95	(5-49)
	PDC-10-22	5-750	11±0.5	±0.5	1.1	1.6	1.2	1.7	1.6	1.9	35	30	25	20	25	20	1.25	1	2	19.95	(5-49)
	PDC-15-6	0.01-35	15±0.5	±0.5	0.3	0.6	0.2	0.4	0.3	0.6	38	30	35	25	28	20	1.15	2	4	19.95	(5-49)
	†PDC-20-1	25-400	21±0.75	±0.5	0.2	0.25	0.3	0.35	0.35	0.5	25	20	35	25	25	20	1.25	3	5	19.95	(5-49)
	PDC-20-3	0.2-250	19.5±0.5	±0.5	0.35	0.6	0.25	0.5	0.35	0.6	36	30	33	25	25	20	1.2	1.5	4	13.95	(5-49)
	■PDC-10-1-75	1-250	10.5±0.5	±0.75	1.1	1.5	1.1	1.5	1.1	1.5	30	20	30	20	30	20	2	2	4	12.95	(5-49)
	■PDC-15-6-75	0.02-35	14.5±0.5	±0.5	0.3	0.7	0.3	0.7	0.3	0.7	35	20	35	20	35	20	1.3	1.5	4	20.95	(5-49)
	■PDC-20-3-75	1-150	19.5±0.5	±0.75	0.35	0.8	0.35	0.8	0.35	0.8	25	20	25	20	25	20	2	2	4	12.95	(5-49)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:
- ⋆ Includes theoretical power loss at coupled port.
- ■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.
- † Models PDC-20-1, ZDC-20-1, ZMDC-20-1: L = 25-50 MHz, M = 50-300 MHz, U = 300-400 MHz
- ● Model ZFDC-20-5: above 1000 MHz, coupling flatness ±1.5dB
- ▲ Models PDC-10-21, ZFDC-10-21: Upper range coupling ±0.75dB

1. For quality control procedures, see page 6.
2. For environmental specifications see page 7.
3. For connector types and case mounting options, see case style outline drawing.
4. Prices and specifications subject to change without notice.
5. All models are licensed under U.S. Patent 3,426,298.

MIL-M-15370/18, NSN GUIDE

MCL NO.	NSN	MIL-M-15370/18*
PDC-10-1		002
PDC-10-2		008
PDC-10-21	5985-01-130-0177	003
PDC-20-3	5985-01-076-8477	001
ZDC-10-1-BNC	5985-01-125-3467	
ZDC-20-3-BNC	5985-01-096-5007	
ZFDC-20-5	5985-01-097-2192	

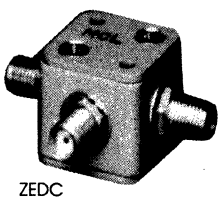
*units are not QPL listed

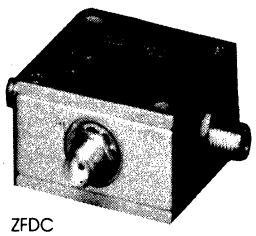
pin and coaxial connections
see case style outline drawing

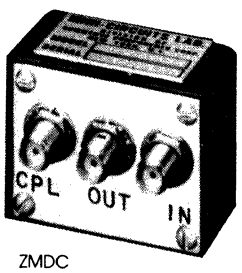
Series	In	Out	Cpl	Case Ground	Not Used
PDC	1	4	3	2,5,7,8	6
TDC	1	2	4	3	—
ZEDC	1	2	3	—	—
ZMDC	3	2	1	—	—
ZDC	3	2	1	—	—
ZFDC (except 20—4, —5)	1	2	3	—	—
ZFDC 20—4, —5	3	1	2	—	—

50 ohms and 75 ohms

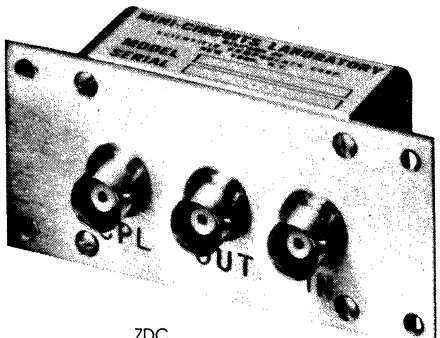
Mini-Circuits


ZEDC


ZFDC



ZMDC



ZDC

	MODEL NO.	FREQ. MHz f_L-f_U	COUPLING dB Nom.	Flatness	MAINLINE LOSS* dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	DIRECTIVITY dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	VSWR Typ.	POWER INPUT, W L Max.	M,U Max.	PRICE, $ Ea.	Qty.
ZEDC case V37	ZEDC-10-2	1-1000	11±0.5	±0.75	1.3	1.5	1.5	1.8	1.5	1.8	35	30	30	20	18	13	1.3	1.5	3	54.95	(4-24)
	ZEDC-15-2	1-1000	15±0.5	±0.5	0.5	1.0	0.8	1.2	1.0	1.4	35	30	30	25	25	15	1.15	1.5	3	54.95	(4-24)
ZFDC case K18	ZFDC-10-1	1-500	10.5±0.25	±0.6	1.0	1.3	0.8	1.1	1.0	1.3	32	25	33	25	22	15	1.2	1.5	3	29.95	(4-24)
	ZFDC-10-2	10-1000	10.75±0.5	±0.5	1.5	2.0	1.2	1.6	1.5	2.0	35	28	30	25	27	20	1.5	1.5	3	39.95	(4-24)
	▲ZFDC-10-21	1-1000	11±0.5	±0.5	1.2	1.7	1.2	1.7	1.6	2.0	40	30	25	20	25	20	1.2	1	2	44.95	(4-24)
	ZFDC-10-22	1-750	11±0.5	±0.5	1.1	1.6	1.2	1.7	1.4	1.9	35	30	25	20	25	20	1.25	1	2	34.95	(4-24)
	ZFDC-15-6	0.03-35	15±0.5	±0.5	0.3	0.6	0.2	0.4	0.3	0.6	38	30	35	25	28	20	1.15	2	4	34.95	(4-24)
	ZFDC-20-3	0.2-250	19.5±0.5	±0.25	0.35	0.6	0.25	0.5	0.35	0.6	36	25	33	25	25	20	1.2	1.5	4	29.95	(4-24)
	ZFDC-20-4	1-1000	19.5±0.5	±0.5	1.2	1.5	0.6	0.8	1.2	1.5	36	28	27	20	23	18	1.1	5	2	59.95	(1-4)
	●ZFDC-20-5	0.1-2000	19.5±0.5	±0.5	0.3	1	0.7	1.4	1.5	2.3	30	20	27	20	22	10	1.2	.5	2	79.95	(1-4)
	■ZFDC-15-6-75	0.02-35	14.5±0.5	±0.5	0.3	0.7	0.3	0.7	0.3	0.7	35	20	35	20	35	20	1.3	1.5	4	35.95	(4-24)
ZMDC case M21	ZMDC-10-1	0.5-500	11.5±0.5	±0.6	0.85	1.3	0.65	1.0	0.85	1.3	32	25	32	25	22	15	1.2	1.5	3	39.95	(4-24)
	ZMDC-10-2	250-1000	10.5±0.5	±0.5	1.1	1.4	—	—	1.6	1.9	40	30	30	20	20	15	1.5	—	5	47.95	(4-24)
	ZMDC-15-6	.01-35	15±0.5	±0.5	0.4	0.6	0.2	0.4	0.4	0.6	38	30	35	25	28	20	1.15	2	4	47.95	(4-24)
	†ZMDC-20-1	25-400	21±0.75	±0.5	0.2	0.25	0.3	0.35	0.35	0.5	25	20	35	25	25	20	1.25	3	5	47.95	(4-24)
	ZMDC-20-3	0.2-250	19.5±0.5	±0.5	0.35	0.5	0.25	0.5	0.35	0.6	36	30	33	25	25	20	1.2	1.5	4	39.95	(4-24)
	ZMDC-30-1	0.1-250	30±0.5	±0.5	0.4	0.6	0.5	0.8	0.55	0.85	23	18	20	15	17	10	1.5	1.0	3	39.95	(4-24)
ZDC case M22	ZDC-10-1	0.5-500	11.5±0.5	±0.6	0.85	1.3	0.65	1.0	0.85	1.3	32	25	32	25	22	15	1.2	1.5	3	29.95	(4-24)
	ZDC-10-2	250-1000	10.5±0.5	±0.5	1.1	1.4	—	—	1.6	1.9	40	30	30	20	20	15	1.5	—	5	37.95	(4-24)
	ZDC-15-6	.01-35	15±0.5	±0.5	0.3	0.6	0.2	0.4	0.3	0.6	38	30	35	25	28	20	1.15	2	4	37.95	(4-24)
	†ZDC-20-1	25-400	21±0.75	±0.5	0.2	0.25	0.3	0.35	0.35	0.5	25	20	35	25	25	20	1.25	3	5	37.95	(4-24)
	ZDC-20-3	0.2-250	19±0.5	±0.5	0.35	0.6	0.25	0.5	0.35	0.6	36	30	33	25	25	20	1.2	1.5	4	29.95	(4-24)
	■ZDC-10-1-75	1-250	10.5±0.5	±0.75	1.1	1.5	1.1	1.5	1.1	1.5	30	20	30	20	30	20	2	2	4	29.95	(4-24)
	■ZDC-15-6-75	.02-35	14.5±0.5	±0.6	0.3	0.6	0.2	0.4	0.4	0.6	35	30	35	25	28	20	1.5	2	4	38.95	(4-24)
	■ZDC-20-3-75	1-150	19.5±0.5	±0.75	0.35	0.8	0.35	0.8	0.35	0.8	25	20	25	20	25	15	2	2	4	30.95	(4-24)
	■ZDC-2375	55-85	10.5±0.5	±0.5	1.6	2.1	1.6	2.1	1.6	2.1	35	30	35	30	35	30	1.3	—	4	38.95	(4-24)
	■ZDC-20-3-75-1	55-90	18.6±0.5	±0.3	0.4	0.6	0.4	0.6	0.4	0.6	35	30	35	30	35	30	1.2	—	4	38.95	(4-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

computer-automated performance data

typical production unit / for data of other models consult factory

PDC-10-1

FREQUENCY (MHz)	MAINLINE LOSS (dB)	COUPLING (dB)	DIRECTIVITY (dB)	VSWR IN	VSWR OUT	VSWR CPL
.50	.73	11.17	37.21	1.11	1.13	1.09
26.789	.62	11.50	36.92	1.10	1.13	1.06
53.078	.66	11.49	36.96	1.09	1.13	1.08
105.656	.72	11.52	36.48	1.06	1.14	1.09
158.234	.74	11.52	35.07	1.04	1.14	1.12
210.812	.81	11.60	32.60	1.02	1.15	1.12
263.39	.84	11.59	30.32	1.01	1.15	1.12
315.968	.92	11.56	27.36	1.01	1.15	1.13
368.546	.95	11.50	24.22	1.01	1.15	1.15
421.124	1.02	11.49	21.84	1.01	1.14	1.17
500.00	1.12	11.43	18.71	1.01	1.12	1.22

In Stock... Immediate Delivery

highest figure of merit

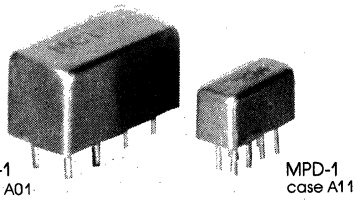
Phase Detectors

1000mV DC output, +7dBm RF

1MHz to 100 MHz

performance data

curves, tables, page 4 Model Index



RPD-1
case A01

MPD-1
case A11

case style selection

outline drawings see page 3

description

These new high efficiency phase detectors are the only units in the world offering a figure-of-merit greater than 125 for only $15.95.

The figure-of-merit M or efficiency of a phase detector can be defined as the ratio of maximum DC output voltage (in mV) divided by the RF power (in dBm). The maximum DC output from these units is 1000 mV with +7 dBm applied to the LO and RF ports, and DC offset is typically 400 micro-volts. Thus, its figure-of-merit M is 143, which indicates a highly efficient phase detector. For comparison, a double-balanced mixer used as a phase detector offers 350 mV DC output with the same LO and RF inputs for a figure-of-merit M of 50.

Both the RPD-1 and MPD-1 are packaged in a hermetically-sealed EMI-shielded metal case. The miniature RPD-1 measures 0.4 x 0.8 x 0.4 in. and the micromin MPD-1 is only 0.2 x 0.5 x 0.25 in.

So when your system requires a high output phase detector, specify the new RPD or MPD series.

applications

- Radar
- ECM Systems
- Test Instruments
- Phase-lock loops

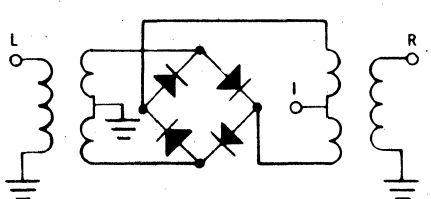
cost (5-24)

RPD-1 $15.95 MPD-1 $18.95

RPD-1, MPD-1 specifications

FREQUENCY RANGE:	
L and R ports	1-100 MHz
Output ports	DC-50 MHz
SCALE FACTOR	8 mV/Degree
IMPEDANCE	
L and R ports	50 ohms
I port	500 ohms
L and R SIGNAL LEVELS	+7 dBm
ISOLATION, L-R	40 dB min
MAXIMUM DC OUTPUT, mV	1000 mV typ 750 mV min
DC OUTPUT POLARITY (L and R in-phase)	Negative
DC OUTPUT OFFSET	0.2 mV typ 1 mV max
FIGURE-OF-MERIT, M	143 Typical
SIZE	
RPD-1	0.4 X 0.8 X 0.4
MPD-1	0.2 X 0.5 X 0.25

NOTES:
1. Maximum RF input power, 50mW. peak IF current, 20mA.
2. Refer to table of contents for quality control procedures, environmental specifications, absolute maximum ratings, and hi-rel testing.
3. Prices and specifications subject to change without notice.



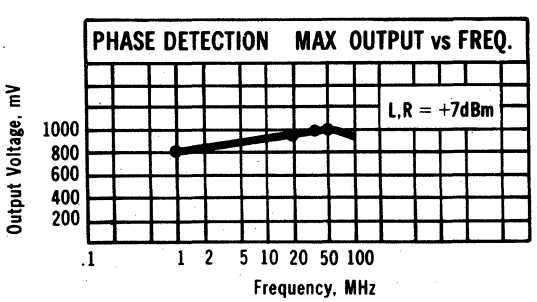
pin connections

see case style outline drawing

Series		RPD-1	MPD-1
REF.	L	8	8
RF in:	R	1	1
DC out:	I	*3,4	*3,4
GND.		2,5,6,7	2,5,6,7
CASE GND.		2	2

*pins must be externally connected together

Model RPD-1



Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (718) 934-4500

broadband, minimal phase change Limiters

50 ohms

Mini-Circuits

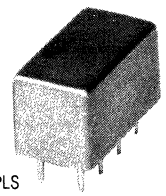
+3 to +20 dBm input

3 KHz to 900 MHz performance data

curves, tables, page 4 Model Index

case style selection

outline drawings see page 3



PLS

	Model No.	FREQUENCY MHz f_L f_U	INPUT dBm Min.	Max.	*OUTPUT dBm Typ.	CONTROL CURRENT (mA) Typ.	LIMITING Input range, dBm	Δ Output/Δ 1dB Input amp, dB	phase, deg.	PRICE, $ Ea.	Qtv.
PLS case A01	PLS-1	0.1-150	6	20	−1.6	3	6 to 10	0.1	0.5	18.95	5-49
							10 to 16	0.1	0.5		
							16 to 20	0.2	1.0		
	PLS-2	100-900	3	15	−5.0	10	3 to 8	0.2	2.0	18.95	5-49
							8 to 12	0.4	2.0		
							12 to 15	0.2	2.0		
	PLS-6	0.003-1	6	20	−3.0	5	6 to 10	0.2	1.0	29.95	5-49
							10 to 16	0.1	1.0		
							16 to 20	0.2	1.0		

* Typical output level at typical control current. Level may be changed by varying current.

pin connections

see case style outline drawing

Series	PLS		
Model	−1	−2	−6
INPUT	1	1	1
OUTPUT	8	8	8
CONTROL	*3,4	*3,4	*3,4
GND.	2,5,6,7	2,5,6,7	2,5,6,7
CASE GND.	2	2,5,6,7	—

*Pins must be externally connected together

NOTES:
1. Maximum RF input power, 100mW. Maximum control current, 10 mA.
2. Refer to table of contents for quality control procedures; environmental specifications, absolute maximum ratings, and hi-rel testing.
3. Prices and specifications subject to change without notice.

NSN GUIDE

MCL NO.	NSN
PLS-1	5825-01-105-7820

PLS-1 LIMITING

CAPD

computer-automated performance data

typical production unit / for data of other models consult factory

MHz	Output (20 dBm IN)	Output (16 dBm IN)	Output (10 dBm IN)	Output (6 dBm IN)	Delta, Out (20 to 16 dBm IN)	Delta, Out (16 to 10 dBm IN)	Delta, Out (10 to 6 dBm IN)
.100	−1.36	−1.47	−1.77	−2.15	.11	.30	.38
7.990	−.77	−1.02	−1.28	−1.65	.25	.26	.37
15.880	−.81	−.97	−1.35	−1.65	.16	.38	.30
23.769	−.79	−.95	−1.35	−1.64	.16	.40	.29
31.658	−.77	−.94	−1.38	−1.54	.17	.44	.16
39.547	−.71	−.93	−1.34	−1.47	.22	.41	.13
47.437	−.86	−1.08	−1.41	−1.46	.22	.33	.05
55.327	−.88	−1.03	−1.40	−1.73	.15	.37	.33
63.217	−.86	−1.05	−1.48	−1.63	.19	.43	.15
71.105	−1.02	−1.01	−1.42	−1.78	−.01	.41	.36
78.995	−1.05	−1.05	−1.37	−1.57	0.00	.32	.20
86.884	−.95	−1.08	−1.49	−1.78	.13	.41	.29
94.775	−.98	−1.12	−1.40	−1.73	.14	.28	.33
102.661	−1.06	−1.15	−1.50	−1.59	.09	.35	.09
110.551	−1.14	−1.29	−1.58	−2.32	.15	.29	.74
118.440	−1.09	−1.19	−1.58	−1.98	.10	.39	.40
126.330	−1.03	−1.21	−1.53	−1.65	.18	.32	.12
134.221	−1.10	−1.31	−1.59	−2.28	.21	.28	.69
142.111	−1.19	−1.44	−1.70	−1.98	.25	.26	.28
150.000	−1.16	−1.47	−1.72	−2.07	.31	.25	.35

REMARK: Control Current: 5.6mA

In Stock... Immediate Delivery

wideband RF Transformers

3KHz to 800MHz

performance data

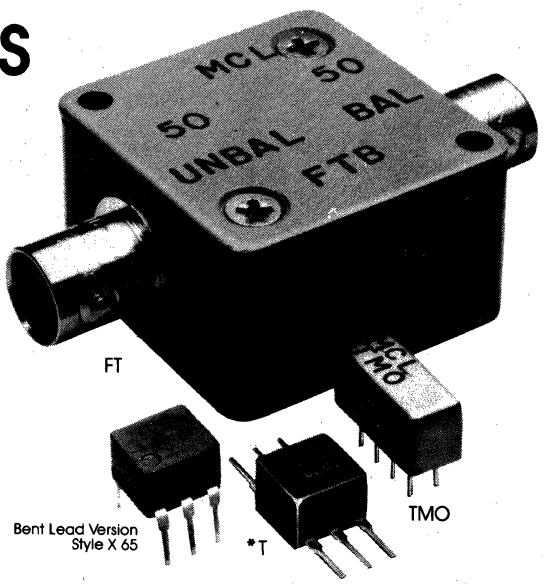
curves, tables, page 4 Model Index

case style selection

outline drawings see page 3

T, TH, case W 38, X 65 *
TMO, case A 11, †case B 13
FT, FTB, case H 16

*Surface Mounting Available
See case KK81, page 62



For PC applications, select from the low-cost, plastic-case T series (small enough to be inserted into a standard 1/3 DIP socket), or the hermetically-sealed RFI shielded TMO metal-case series (requiring less PC area than a flatpack or TO-5 can), or the plastic-case T-H series designed to handle up to 100 mA in the primary winding without appreciable saturation or change in RF characteristics.

Transformer core saturation is influenced by (1) dc current through the winding, (2) RF input power, and (3) frequency of operation. These three variables interact to affect the point at which saturation occurs, see Figs. (1) and (2). These curves show the point where distortion occurs, by visual observation, and illustrate how saturation is influenced by dc current through the winding, RF input power level and frequency of operation: See that (1) if the dc current through the winding increases, the allowable RF input power decreases and the minimum frequency of operation will increase, (2) if RF input power increases, the maximum allowable dc current through the winding will decrease and the minimum frequency of operation will increase, (3) if the frequency of operation increases, then the RF input power can be increased and the dc current through the winding can also be increased.

Now comparing the T-H series to the conventional T-series in Figs. (1) and (2), note that saturation effects are negligible with the T16-1H; so for wide dynamic range applications, specify the T-H series.

Coaxial connector models are available from 10 KHz to 500 MHz and are offered with 50 ohm and 75 ohm impedances; 75 ohm connectors are used at 75 ohm ports. The FT 1.5-1, with unbalanced input and output, is especially useful for 50 ohm to 75 ohm matching applications. The FTB series with unbalanced output and balanced input (connector ground insulated from the case) helps eliminate ground loop problems, especially when long cable runs are involved.

As shown in the data chart on the following page, models are available in five basic configurations.

These transformers may be operated as low as 12.5 ohms at the primary with essentially the same impedance matching ratio and only a slight change in frequency response.

For each RF transformer model, the minimum and maximum frequency is given for the insertion loss at the 3 dB, 2 dB and 1 dB points, as shown in Fig. (3) and listed in the data chart. For example, the T1-1 insertion loss is 1 dB from 2 to 50 MHz and 3 dB from 0.15 to 400 MHz.

performance saturation curves T, TH series

(RF power & DC current at which signal saturation begins)

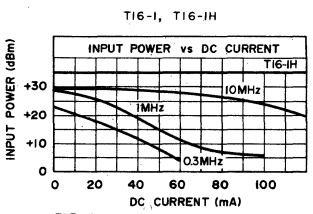


FIG. 1

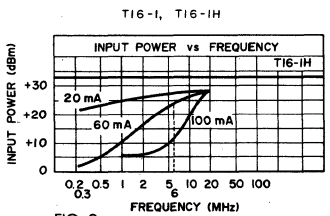


FIG. 2

frequency response curve

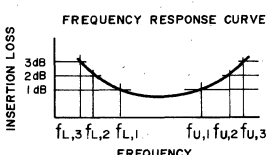


FIG. 3

NSN GUIDE

MCL NO.	NSN
T1-1	5950-01-128-3745
T2-1	5950-01-106-1218
T4-1	5950-01-024-7626
TMO4-1	5950-01-067-1012
TMO4-2	5950-01-091-3553
T9-1	5950-01-105-8153
TMO9-1A	5950-01-098-6315
T16-1	5950-01-094-7439

*FOR A AND B CONFIGURATIONS

Maximum Amplitude Unbalance	Maximum Phase Unbalance
0.1 dB over 1 dB frequency range	1.0° over 1 dB frequency range
0.5 dB over entire frequency range	5.0° over entire frequency range

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

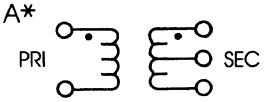
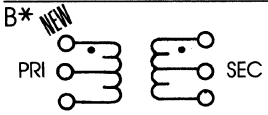
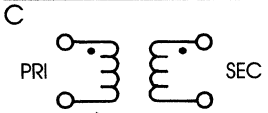
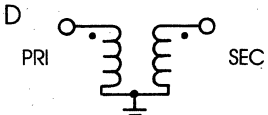
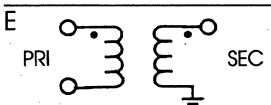
1. For Quality Control procedures, see page 6.
2. For environmental specifications see page 7.
3. Absolute Maximum Ratings, see page 7, except for T & TH Series, temperature range is −20 to +85°C.
4. For connector types and case mounting options, see case style outline drawings.
5. Prices and specifications subject to change without notice.

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (718) 934-4500

12.5 to 800 ohms

Mini-Circuits

case style number see opposite page.

		MODEL NO.	Ω RATIO	FREQUENCY MHz	INSERTION LOSS 3dB MHz	INSERTION LOSS 2dB MHz	INSERTION LOSS 1dB MHz	PRICE $ Ea.	PRICE $ Qty.
A* 	T	T1-1T	1	.05-200	.05-200	.08-150	.2-80	3.95	(10-49)
		T1-6T NEW	1	.003-300	.003-300	.01-150	.02-50	5.95	(10-49)
		T2-1T	2	.07-200	.07-200	.1-100	.5-50	4.25	(10-49)
		T2.5-6T	2.5	.01-100	.01-100	.02-50	.05-20	4.25	(10-49)
		T3-1T	3	.05-250	.05-250	.1-200	.5-70	3.95	(10-49)
		T4-1	4	.2-350	.2-350	.35-300	2-100	2.95	(10-49)
		T4-6T	4	.02-250	.02-250	.05-150	0.1-100	3.95	(10-49)
		T5-1T	5	.3-300	.3-300	.6-200	.5-100	4.25	(10-49)
		T8-1T NEW	8	.03-140	.03-140	.10-90	1-60	6.95	(10-49)
		T13-1T	13	.3-120	.3-120	.7-80	5-20	4.25	(10-49)
		T16-6T	16	.03-75	.03-75	.06-30	.1-20	4.95	(10-49)
	TH	T4-1H	4	8-350	8-350	15-300	25-200	4.95	(10-49)
	TMO	TMO1-1T	1	.05-200	.05-200	.08-150	.2-80	6.45	(10-49)
		TMO2-1T	2	.07-200	.07-200	.1-100	.5-50	6.75	(10-49)
		† TMO2.5-6T	2.5	.01-100	.01-100	.02-50	.05-20	6.75	(10-49)
		† TMO3-1T	3	.05-250	.05-250	.1-200	.5-70	6.45	(10-49)
		TMO4-1	4	.2-350	.2-350	.35-300	2-100	4.95	(10-49)
		TMO5-1T	5	.3-300	.3-300	.6-200	5-100	6.75	(10-49)
		TMO13-1T	13	.3-120	.3-120	.7-80	5-20	6.75	(10-49)
B* NEW 	TT	TT1-6	1	.004-500	.004-500	.02-200	.1-50	5.95	(10-49)
		TT1.5-1	1.5	.075-500	.075-500	.2-100	.1-50	4.95	(10-49)
		TT2.5-6	2.5	.01-50	.01-50	.025-25	.05-10	5.25	(10-49)
		TT4-1	4	.05-200	.05-200	.2-50	1-30	4.95	(10-49)
		TT25-1	25	.02-30	.02-30	.05-20	.1-10	7.95	(10-49)
	TTMO	TTMO1-1	1	.005-100	.005-100	.01-75	.05-40	10.95	(10-49)
C 	T	T1-1	1	.15-400	.15-400	.35-200	2-50	2.95	(10-49)
		T1-6	1	.01-150	.01-150	.02-100	.05-50	4.95	(10-49)
		T1.5-1 NEW	1.5	.1-300	.1-300	.2-150	.5-80	3.95	(10-49)
		T1.5-6	1.5	.02-100	.02-100	.05-50	0.1-25	4.95	(10-49)
		T2.5-6 NEW	2.5	.01-100	.01-100	.02-50	.05-20	3.95	(10-49)
		T4-6	4	.02-200	.02-200	.05-150	.1-100	3.95	(10-49)
		T9-1	9	.15-200	.15-200	.3-150	2-40	3.45	(10-49)
		T16-1	16	.3-120	.3-120	.7-80	.5-20	3.95	(10-49)
		T36-1	36	.03-20	.03-20	.05-10	.1-5	5.95	(10-49)
	TH	T1-1H	1	8-300	8-300	10-200	25-100	4.95	(10-49)
		T9-1H	9	2-90	2-90	3-75	6-50	5.45	(10-49)
		T16-1H	16	7-85	7-85	10-65	15-40	5.95	(10-49)
	TMO	TMO1-1	1	.15-400	.15-400	.35-200	2-50	4.95	(10-49)
		TMO1.5-1	1.5	.1-300	.1-300	.2-150	.5-80	6.75	(10-49)
		† TMO2.5-6	2.5	.01-100	.01-100	.02-50	.05-20	6.45	(10-49)
		† TMO4-6	4	.02-200	.02-200	.05-150	.1-100	6.45	(10-49)
		TMO6-1	6	.3-200	.3-200	.5-150	5-50	6.45	(10-49)
		TMO9-1	9	.15-200	.15-200	.3-150	2-40	6.45	(10-49)
		TMO16-1	16	.3-120	.3-120	.7-80	5-20	6.45	(10-49)
D 	T	T2-1	2	.025-600	.025-600	.05-400	.5-200	3.45	(10-49)
		T3-1	3	.5-800	.5-800	.2-400	—	4.25	(10-49)
		T4-2	4	.2-600	.2-600	.5-500	.2-250	3.45	(10-49)
		T8-1	8	.15-250	.15-250	25-200	2-100	3.45	(10-49)
		T14-1	14	.2-150	.2-150	.5-100	2-50	4.25	(10-49)
	TMO	TMO2-1	2	.025-600	.025-600	.05-400	.5-200	5.95	(10-49)
		TMO3-1	3	.5-800	.5-800	2-400	—	6.95	(10-49)
		TMO4-2	4	.2-600	.2-600	.5-500	2-250	5.95	(10-49)
		TMO8-1	8	.15-250	.15-250	.25-200	2-100	5.95	(10-49)
		TMO14-1	14	.2-150	.2-150	.5-100	2-50	6.75	(10-49)
E 	FT	FT1.5-1	1.5	.1-400	.1-400	.5-200	1-100	29.95	(1-4)
	FTB	FTB1-1	1	.2-500	.2-500	.5-300	10-100	29.95	(1-4)
		FTB1-6	1	.01-125	.01-125	.05-50	.1-25	29.95	(1-4)
		■ FTB1-1-75	1	.5-500	.5-500	5-300	10-100	29.95	(1-4)

pin connections see case style outline drawings

CONFIGURATION	*A DC Isolated Center-Tap Secondary		*B DC Isolated Center-Tap Primary, Secondary		C,E DC Isolated		D Unbalanced Primary, Secondary	
SERIES	T, TH	TMO	T	TMO	T, TH	TMO	T	TMO
Primary DOT	4	1	4	1	4	1	6	1
Primary	6	5	6	5	6	5	3◇	6◇◇
Primary CT	—	—	5	3	—	—	—	—
Secondary Dot	3	2	3	2	3	2	1	2
Secondary	1	6	1	6	1	6	3◇	6◇◇
Secondary CT	2	4	2	4	—	—	—	—
Case Gnd.	—	7,8	—	7,8	—	7,8	—	7,8

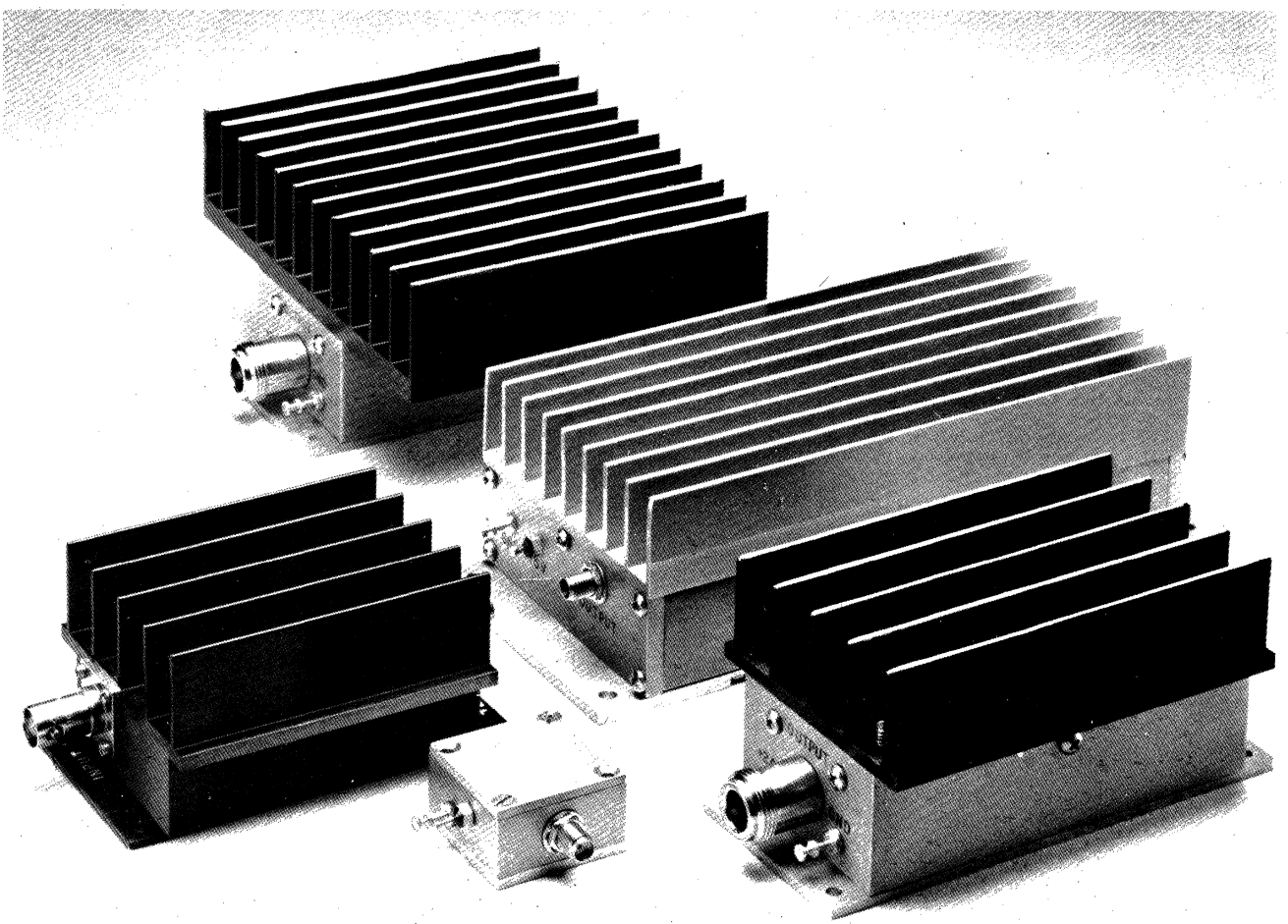
◇ pin 3 must be grounded
◇◇ pin 6 must be grounded

broadband linear

Power Amplifiers

up to 2 Watts (+33 dBm)

50 KHz to 4.2 GHz



Up to 1 watt linear output at 4.2 GHz, 2 watts at 800 MHz are now available at exceptionally low prices with Mini-Circuits' line of broadband amplifiers. Ultra-linear Class A design provides unconditional stability so any load impedance may be connected without concern for damage or oscilation. These amplifiers are ideally suited for TACAN, mobile radio, telemetry, anti-collision and satellite communications systems. Use these amplifiers to boost signal/sweep generator output to achieve broadband isolation, and to provide four test setups, using only one generator with a 4-way splitter...to name just a few applications.

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (718) 934-4500

50 ohms

Mini-Circuits

up to 1 Watt (+30 dBm)

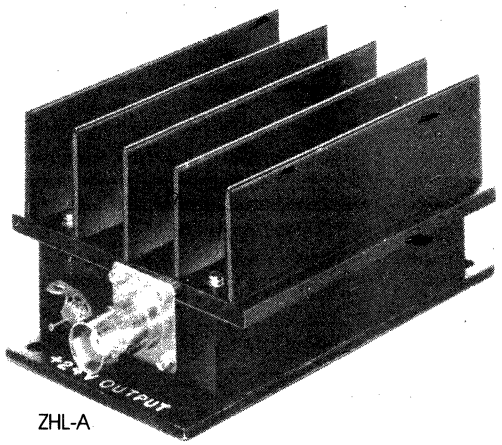
50 KHz to 500 MHz

performance data

curves, tables, page 4 Model Index

case style selection

outline drawings see page 3



ZHL-A

	MODEL NO.	FREQUENCY MHz	GAIN, dB Min.	GAIN, dB Flatness Max.	MAXIMUM POWER, dBm Output (1dB) Compression	MAXIMUM POWER, dBm Input (no damage)	DYNAMIC RANGE NF, dB Typ.	DYNAMIC RANGE Intercept pt., dBm 3rd order Typ.	VSWR In	VSWR Out	DC POWER Volt.	DC POWER Current	PRICE $ Ea.	PRICE $ Qty.
ZHL-A case S 32	**ZHL-1A**	2-500	16	±1.0	+28	+20	11	+38	2:1	2:1	+24V	0.6A	199	1-9
	ZHL-3A	0.4-150	24	±1.0	+29.5	+10	11	+38	2:1	2:1	+24V	0.6A	199	1-9
	ZHL-32A	0.05 -130	25	±1.0	+29	+10	10	+38	2:1	2:1	+24V	0.6A	199	1-9

NOTES:
1. Operating temperature −20°C to +65°C.
   Storage temperature −55°C to +100°C.
2. With no load on output, derate maximum input power (no damage) by 10dB.
3. Prices and specifications subject to change without notice.

MIL-M-28837/1A, NSN GUIDE

MCL NO.	NSN
ZHL-1A	6130-01-088-2322

computer-automated performance data

typical production unit / for data of other models consult factory

ZHL-1A

FREQ. (MHz)	GAIN (dB) 12V	15V	20V	24V	REVERSE GAIN (dB) 12V	15V	20V	24V	VSWR (IN) 12V	15V	20V	24V	VSWR (OUT) 12V	15V	20V	24V
2.00	17.90	18.27	18.46	18.52	29.03	29.07	28.96	28.88	1.09	1.13	1.14	1.14	1.10	1.16	1.15	1.15
28.21	17.88	18.27	18.48	18.52	29.53	29.72	29.54	29.24	1.09	1.11	1.13	1.14	1.20	1.19	1.19	1.18
54.42	17.88	18.33	18.54	18.59	29.57	29.62	29.58	29.39	1.12	1.12	1.13	1.14	1.24	1.24	1.24	1.24
80.63	17.94	18.41	18.65	18.70	29.91	29.78	29.64	29.56	1.19	1.17	1.16	1.16	1.30	1.29	1.30	1.30
106.84	17.90	18.41	18.69	18.78	29.85	30.12	29.97	29.75	1.31	1.24	1.21	1.21	1.36	1.36	1.37	1.37
133.05	17.91	18.42	18.75	18.83	30.02	30.06	30.15	29.87	1.42	1.32	1.28	1.27	1.41	1.41	1.42	1.44
159.26	17.68	18.34	18.71	18.81	30.25	30.32	30.03	30.00	1.56	1.42	1.36	1.34	1.46	1.48	1.50	1.52
185.47	17.64	18.34	18.78	18.84	30.50	30.36	30.12	29.99	1.71	1.553	1.45	1.43	1.50	1.53	1.57	1.60
211.68	17.52	18.25	18.74	18.82	30.50	30.64	30.19	30.05	1.83	1.63	1.52	1.50	1.51	1.56	1.63	1.67
237.89	17.46	18.20	18.73	18.81	30.85	30.64	30.35	30.32	1.96	1.72	1.59	1.57	1.52	1.58	1.67	1.73
264.10	17.34	18.09	18.66	18.74	30.99	30.75	30.40	30.43	2.04	1.79	1.64	1.62	1.48	1.56	1.66	1.75
290.31	17.28	18.03	18.58	18.69	31.08	30.89	30.66	30.58	2.14	1.86	1.69	1.66	1.44	1.53	1.66	1.76
316.52	17.33	18.08	18.69	18.79	30.64	30.77	30.51	30.49	2.16	1.88	1.70	1.67	1.40	1.50	1.64	1.75
342.73	17.32	18.06	18.69	18.79	30.50	30.44	30.41	30.44	2.17	1.87	1.69	1.65	1.33	1.43	1.59	1.71
368.94	17.30	18.04	18.71	18.79	30.09	30.23	30.24	30.27	2.09	1.81	1.63	1.59	1.27	1.35	1.49	1.62
395.15	17.23	18.02	18.67	18.82	29.81	29.95	29.91	30.18	2.03	1.75	1.57	1.53	1.24	1.28	1.41	1.55
421.36	17.32	18.13	18.83	18.98	29.19	29.36	29.52	29.85	1.96	1.68	1.49	1.44	1.32	1.29	1.36	1.50
447.57	17.37	18.23	18.96	19.08	28.50	28.79	29.05	29.22	1.90	1.61	1.41	1.36	1.47	1.36	1.34	1.43
473.78	17.17	18.10	18.90	19.08	27.94	28.28	28.64	28.82	1.93	1.64	1.42	1.37	1.68	1.51	1.39	1.42
500.00	17.07	18.14	19.06	19.26	27.68	27.17	28.22	28.50	2.07	1.79	1.57	1.54	1.01	1.79	1.61	1.58

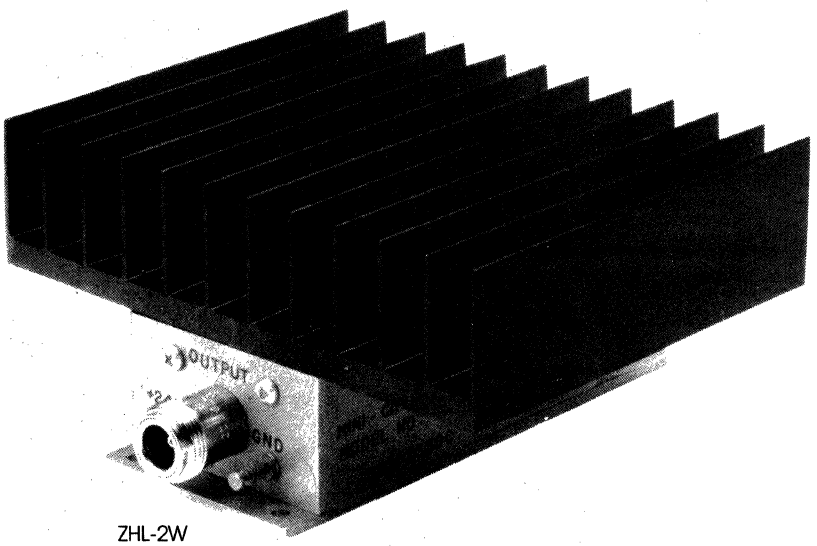
In Stock... Immediate Delivery

broadband linear
Power Amplifiers
up to 2 Watts (+33 dBm)
5 MHz to 800 MHz
performance data

curves, tables, page 4 Model Index

case style selection

outline drawings see page 3



ZHL-2W

	MODEL NO.		FREQUENCY MHz	GAIN, dB Min.	GAIN, dB Flatness Max.	MAXIMUM POWER, dBm Output (1dB) Compression	MAXIMUM POWER, dBm Input (no damage)	DYNAMIC RANGE NF, dB Typ.	DYNAMIC RANGE Intercept pt., dBm 3rd order Typ.	VSWR In	VSWR Out	DC POWER Volt.	DC POWER Current	PRICE $ Ea.	PRICE $ Qty.
ZHL-2W case T 35	ZHL-1-2W	NEW	5-500	29	±1.0	+33	+10	12	+44	2:1	2:1	+24V	0.9A	495	1-9
	ZHL-7-2W	NEW	600-800	28	±1.0	+33	+10	12	+43	2:1	2:1	+24V	0.9A	525	1-9

NOTES:

1. Operating temperature −20°C to +65°C.
   Storage temperature −55°C to +100°C.
2. With no load on output, derate maximum input power (no damage) by 10dB.
3. Prices and specifications subject to change without notice.

ZHL-1-2W

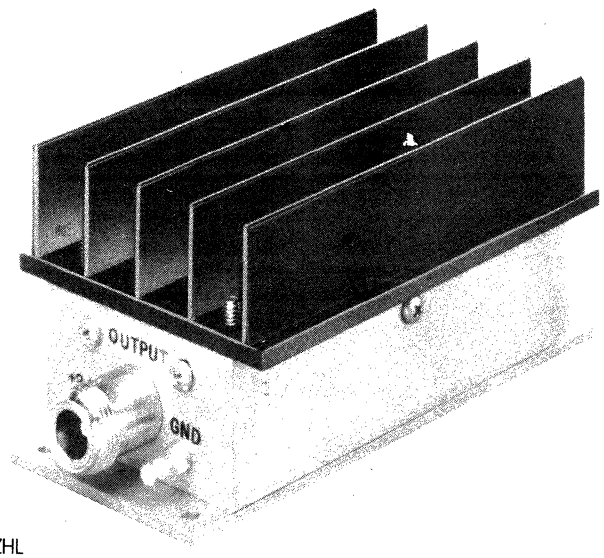
FREQ. (MHz)	GAIN (dB)	REVERSE GAIN (dB)	VSWR in	VSWR out	LINEARITY Pout (dBm)	LINEARITY Comp. (dB)
5.00	32.25	16.59	1.46	1.65	32.86	0.25
031.05	31.64	17.55	1.39	1.67	32.74	0.26
057.10	31.58	16.46	1.38	1.70	32.70	0.36
083.15	31.59	17.70	1.36	1.74	32.58	0.42
109.20	31.51	16.92	1.33	1.80	32.56	0.39
135.25	31.43	17.30	1.28	1.85	32.48	0.51
161.30	31.49	17.02	1.22	1.91	32.49	0.52
187.35	31.46	16.61	1.15	1.99	32.39	0.61
213.40	31.39	16.91	1.08	2.05	32.38	0.60
239.45	31.39	17.63	1.03	2.07	32.38	0.62
265.50	31.32	16.44	1.12	2.03	32.34	0.66
291.55	31.25	17.19	1.24	1.89	32.31	0.64
317.60	31.22	18.48	1.36	1.67	32.38	0.64
343.65	31.11	20.85	1.49	1.43	32.33	0.70
369.70	30.89	21.35	1.59	1.20	32.35	0.58
395.75	30.74	15.87	1.67	1.04	32.43	0.66
421.80	30.70	15.95	1.73	1.24	32.41	0.67
447.85	30.73	15.78	1.78	1.49	32.38	0.64
473.90	31.07	15.83	1.83	1.76	32.31	0.77
500.00	31.95	15.87	1.90	1.99	32.02	1.00

Mini-Circuits

50 ohms

up to 1 Watt (+30 dBm)

10 MHz to 1200 MHz



ZHL

	MODEL NO.	FREQUENCY MHz	GAIN, dB Min.	GAIN, dB Flatness Max.	MAXIMUM POWER, dBm Output (1dB) Compression	MAXIMUM POWER, dBm Input (no damage)	DYNAMIC RANGE NF, dB Typ.	DYNAMIC RANGE Intercept pt., dBm 3rd order Typ.	VSWR In	VSWR Out	DC POWER Volt.	DC POWER Current	PRICE $ Ea.	PRICE $ Qty.
ZHL case T 34	ZHL-2	10-1000	16	±1.0	+29	+20	18	+38	2:1	2:1	+24V	0.6A	349	1-9
	ZHL-2-8	10-1000	27	±1.0	+29	+10	10	+38	2:1	2:1	+24V	0.6A	474	1-9
	ZHL-2-12 *	10-1200	24	±1.0	+29*	+10	10	+38	2:1	2:1	+24V	0.75A	599	1-9

* + 28.5 dBm maximum output 1000 to 1200 MHz; available only with SMA

computer-automated performance data

typical production unit / for data of other models consult factory

ZHL-2

FREQ. (MHz)	GAIN (dB)	REVERSE GAIN (dB)	VSWR in	VSWR out	LINEARITY Pout (dBm)	LINEARITY Comp. (dB)
10.00	16.85	39.91	1.12	1.88	29.81	0.24
62.05	17.06	39.66	1.19	1.80	29.77	0.27
114.10	17.19	39.40	1.28	1.70	29.66	0.32
166.15	12.18	39.08	1.38	1.61	29.50	0.42
218.20	17.17	39.18	1.49	1.54	29.46	0.48
270.25	17.23	38.58	1.57	1.48	29.51	0.40
322.30	17.29	37.81	1.64	1.44	29.45	0.58
374.35	17.15	37.43	1.68	1.42	29.41	0.53
426.40	17.10	36.70	1.70	1.36	29.42	0.59
478.45	17.11	36.23	1.72	1.28	29.39	0.55
530.50	17.09	35.35	1.75	1.19	29.37	0.59
582.55	17.15	35.20	1.77	1.14	29.37	0.63
634.60	17.38	34.64	1.74	1.29	29.41	0.59
686.65	17.28	33.51	1.69	1.53	29.39	0.52
738.70	17.14	32.25	1.67	1.71	29.39	0.57
790.75	17.25	30.98	1.71	1.76	29.37	0.56
842.80	17.32	29.64	1.80	1.61	29.27	0.72
894.85	17.44	28.71	1.90	1.31	29.25	0.66
946.90	17.49	28.01	1.88	1.12	29.22	0.75
999.00	16.89	28.24	1.63	1.48	29.06	0.96

ZHL-2-8

GAIN (dB)	REVERSE GAIN (dB)	VSWR in	VSWR out	LINEARITY Pout (dBm)	LINEARITY Comp. (dB)
39.33	50.00	2.48	2.74	39.73	0.40
29.38	40.00	1.41	1.66	29.51	0.45
29.22	40.00	1.36	1.60	29.46	0.54
29.13	40.00	1.31	1.59	29.40	0.63
29.08	40.00	1.26	1.61	29.37	0.67
29.03	40.00	1.23	1.66	29.27	0.71
28.97	40.00	1.27	1.74	29.29	0.72
29.00	40.00	1.36	1.81	29.37	0.64
28.82	40.00	1.45	1.80	29.40	0.64
28.58	40.00	1.53	1.68	29.41	0.52
28.39	40.00	1.58	1.50	29.51	0.59
28.30	40.00	1.59	1.29	29.45	0.60
28.47	40.00	1.55	1.08	29.36	0.61
28.73	40.00	1.47	1.13	29.43	0.53
28.94	40.00	1.42	1.34	29.52	0.49
29.04	40.00	1.48	1.50	29.45	0.48
28.99	40.00	1.62	1.51	29.42	0.60
28.86	40.00	1.76	1.41	29.38	0.62
28.61	40.00	1.82	1.36	29.24	0.73
28.11	40.00	1.83	1.53	29.14	0.81

In Stock... Immediate Delivery

broadband linear
Power Amplifiers

up to 50mW (+17 dBm)

10 MHz to 2000 MHz

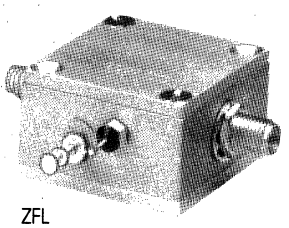
performance data

curves, tables, page 4 Model Index

case style selection

outline drawings see page 3

NEW



ZFL

	MODEL NO.	FREQUENCY MHz	GAIN, dB Min.	GAIN, dB Flatness Max	MAXIMUM POWER, dBm Output (1dB) Compression	MAXIMUM POWER, dBm Input (no damage)	DYNAMIC RANGE NF, dB Typ.	DYNAMIC RANGE Intercept pt., dBm 3rd order Typ.	VSWR In	VSWR Out	DC POWER Volt.	DC POWER Current	PRICE $ Ea.	PRICE $ Qty.
ZFL case Y 39	**ZFL-2000**	10-2000	20	±1.5	+17*	+5	7.0	+25	2:1	2:1	+15V	100mA	179	(1-9)

NOTES:

*+16dBm at 1000 MHz.

1. Operating temperature −55°C to +100°C
   Storage temperature −55°C to +100°C
2. With no load output, derate maximum input power (no damage) by 10 dB.
3. Prices and specifications subject to change without notice.

ZFL-2000

FREQUENCY (MHz)	GAIN (dB)	REVERSE GAIN (dB)	VSWR in	VSWR out	LINEARITY Pout (dBm)	LINEARITY Comp. (dB)
10.00	22.68	33.41	1.44	1.28	15.44	1.26
105.42	22.58	33.31	1.46	1.21	15.35	1.26
200.83	22.60	33.35	1.44	1.13	15.32	1.30
296.25	22.48	33.37	1.35	1.09	15.24	1.28
391.67	22.32	33.45	1.24	1.13	15.19	1.05
487.08	21.96	33.60	1.18	1.14	15.11	0.92
582.50	21.63	34.05	1.21	1.18	14.74	0.80
677.92	21.60	34.33	1.37	1.24	14.86	0.82
773.33	22.03	34.03	1.48	1.30	15.28	0.74
868.75	22.42	33.59	1.53	1.36	15.74	0.71
964.17	22.64	33.12	1.49	1.45	15.98	0.62
1059.40	22.89	32.74	1.39	1.59	16.25	0.68
1154.70	23.14	32.22	1.25	1.71	16.42	0.79
1250.20	23.44	31.64	1.05	1.76	16.54	0.88
1345.80	23.34	31.15	1.19	1.67	16.57	0.73
1441.00	23.18	30.81	1.44	1.52	16.55	0.63
1535.90	22.96	30.64	1.64	1.31	16.45	0.49
1631.50	22.64	30.73	1.77	1.10	16.22	0.38
1726.90	22.32	30.57	1.78	1.11	15.97	0.33
1822.20	22.08	30.05	1.67	1.28	15.80	0.26
1917.60	21.70	29.21	1.54	1.43	15.67	0.03
2014.80	21.03	29.26	1.55	1.53	15.58	−0.46
2108.20	20.24	28.70	1.97	1.57	15.20	−0.89
2204.00	19.23	28.44	2.93	1.48	14.47	−1.17
2299.70	18.26	28.28	4.15	1.29	13.35	−1.11

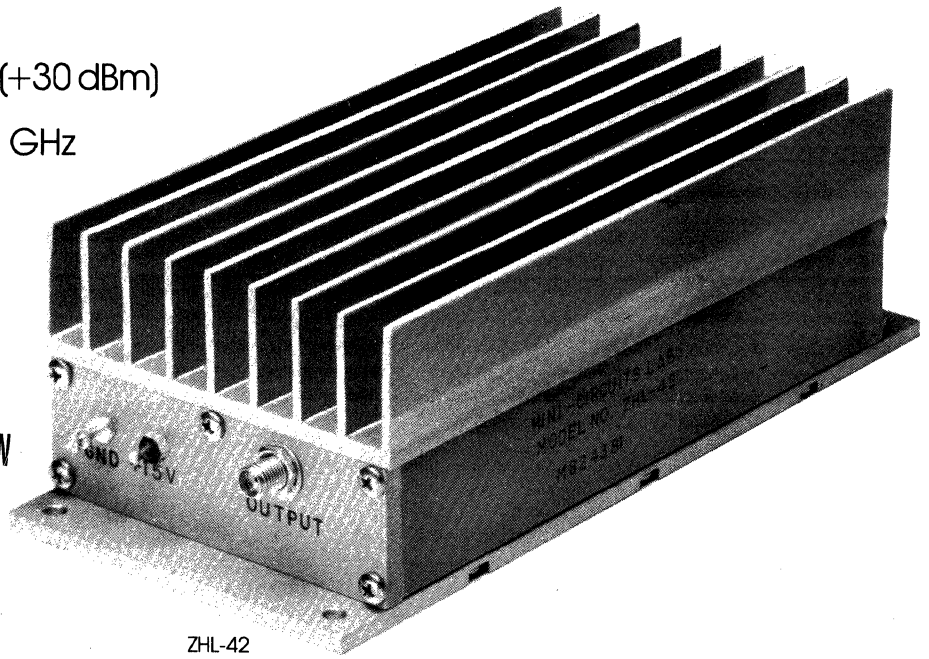
50 ohms

Mini-Circuits

up to 1 Watt (+30 dBm)

700 MHz to 4.2 GHz

NEW



ZHL-42

	MODEL NO.	FREQUENCY GHz	GAIN, dB		MAXIMUM POWER, dBm		DYNAMIC RANGE		VSWR		DC POWER		PRICE $	
			Min.	Flatness Max	Output (1dB) Compression	Input (no damage)	NF, dB Typ.	Intercept pt., dBm 3rd order Typ.	In	Out	Volt.	Current	Ea.	Qty.
ZHL-42 case U 36	ZHL-42	0.7-4.2	30	±1.0	+29	+10	10	+38	2.5:1	2.5:1	15	0.69A	895	(1-9)

NOTES:
1. Operating temperature −20°C to +65°C
   Storage temperature −55°C to +100°C
2. With no load output, derate maximum input power (no damage) by 10 dB.
3. Prices and specifications subject to change without notice.

computer-automated performance data

typical production unit / for data of other models consult factory

ZHL-42 FREQUENCY (MHz)	GAIN (dB)	REVERSE GAIN (dB)	VSWR in	VSWR out	LINEARITY Pout (dBm)	LINEARITY Comp. (dB)
700.25	33.56	47.42	1.57	1.98	28.91	1.18
845.84	33.44	47.61	1.54	1.67	28.82	1.05
991.85	33.61	47.66	1.51	1.42	29.29	0.86
1137.60	34.37	47.97	1.46	1.37	29.98	0.93
1283.50	34.54	47.96	1.43	1.36	30.42	0.61
1429.70	34.09	48.08	1.60	1.33	30.65	0.07
1575.50	34.06	48.00	1.67	1.47	30.53	0.16
1720.90	34.65	48.03	1.72	1.43	30.65	0.80
1866.60	35.05	48.15	1.62	1.32	30.46	1.41
2013.10	35.42	48.30	1.57	1.20	30.57	1.75
2158.00	35.21	48.36	1.47	1.21	30.53	1.40
2304.20	34.72	48.35	1.48	1.16	30.13	1.30
2448.60	34.42	48.27	1.49	1.15	29.77	1.22
2595.20	34.55	48.36	1.51	1.18	29.91	1.05
2741.40	33.78	48.26	1.37	1.24	30.01	0.31
2887.60	34.03	48.29	1.34	1.52	30.35	0.32
2999.40	34.25	48.39	1.28	1.94	30.38	0.49
3033.30	34.05	48.50	1.24	1.99	30.50	0.29
3179.70	33.85	48.35	1.24	1.74	30.27	0.36
3324.30	34.01	48.62	1.30	1.56	30.04	0.77
3470.30	34.34	48.51	1.39	1.43	30.19	0.79
3616.70	34.49	48.76	1.58	1.28	29.91	1.07
3763.00	34.65	48.61	1.67	1.11	29.73	0.72
3909.00	32.36	48.49	1.54	1.21	29.69	0.33
4053.50	33.32	48.74	1.39	1.39	30.30	0.05
4199.90	34.60	48.69	1.44	1.84	30.04	0.08

In Stock... Immediate Delivery

low current, low voltage

Electronic Attenuators/Switches

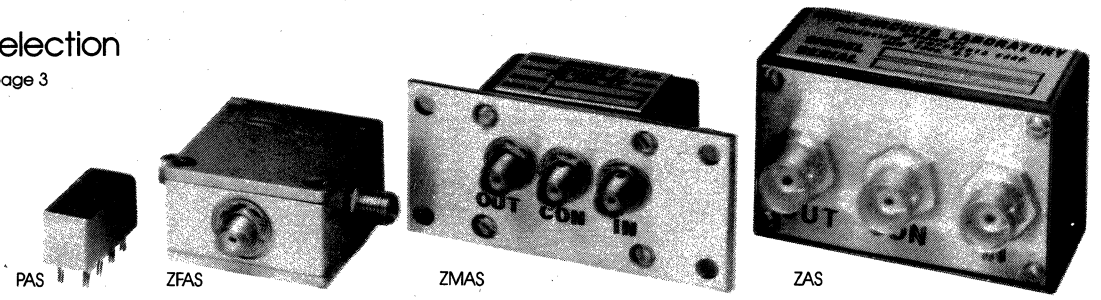
1.4 to 60 dB 1 MHz to 2.5 GHz

performance data

curves, tables, page 4 Model Index

case style selection

outline drawings see page 3



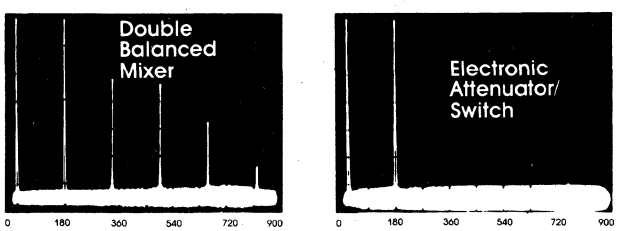
	MODEL NO.	FREQUENCY MHz IN f_L-f_U	CON	INSERTION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	IN-OUT ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	IN-CON ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
PAS case A01	**PAS-1**	5-450	DC-0.05	3.5	4.0	3.5	4.7	65	50	45	35	35	25	35	25	25	15	20	10	27.95	(5-24)
	PAS-2	10-1000	DC-0.05	4.0	6.0	6.5	8.5	50	40	40	30	35	25	30	20	17	10	17	10	37.95	(5-24)
	PAS-3	1-200	DC-0.05	1.4	2.0	1.6	2.5	65	50	50	40	50	35	35	25	20	15	15	10	28.95	(5-24)
ZFAS case K18	**ZFAS-15**	10-2500	DC-200	3.5	4.0	3.5	5.0	20	18	35	25	30	20	19	15	28	20	20	15	89.95	(1-4)
ZMAS case M21	**ZMAS-1**	5-450	DC-0.05	3.5	4.0	3.5	4.7	65	50	55	45	35	25	35	25	25	15	20	10	55.95	(4-24)
	ZMAS-3	1-200	DC-0.05	1.4	2.0	1.6	2.5	65	50	50	40	50	35	35	25	20	15	15	10	56.95	(4-24)
ZAS case M22	**ZAS-1**	5-450	DC-0.05	3.5	4.0	3.5	4.7	65	50	55	45	35	25	35	25	25	15	20	10	45.95	(4-24)
	ZAS-3	1-200	DC-0.05	1.4	2.0	1.6	2.5	65	50	50	40	50	35	35	25	20	15	15	10	46.95	(4-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

typical harmonic spectrum comparing attenuators

Double Balanced Mixer Vs. Electronic Attenuator



NOTES: (both pages)

1. Maximum RF input power, 1 watt. Maximum control current, 40 mA.
2. Refer to table of contents for quality control procedures, environmental specifications, absolute maximum ratings, and hi-rel testing.
3. For connector types and case mounting options, see case style outline drawings.
4. For PSW and ZMSW models
   a) VSWR 1.5 max. ("on" state)
   b) Switching speed 1μ sec. max.
   c) Maximum RF input +20 dBm
   d) Control voltage +5V (5mA max.) on condition
      0V off condition
5. Prices and specifications subject to change without notice.

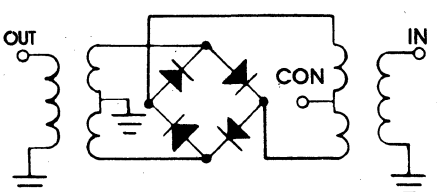
pin and coaxial connections

see case style outline drawings

Series	PAS		ZFAS	ZMAS	ZAS
Models	−1 −3	−2	all models	all models	all models
OUT	8	8	1	1	1
IN	1	1	2	3	3
CONTROL	*3,4	*3,4	3	2	2
GND	2,5,6,7	2,5,6,7	—	—	—
CASE GND	2	2,5,6,7	—	—	—

*pins 3 and 4 must be connected together externally

schematic



NSN GUIDE

MCL NO.	NSN
PAS-3	5985-01-067-3035

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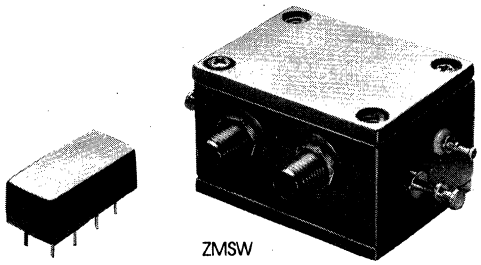
pin diode
Switches

Mini-Circuits

SPST/SPDT
10 to 2500 MHz



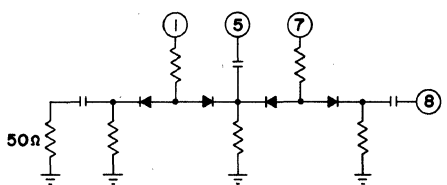
PSW ZMSW

	MODEL NO.	TYPE	FREQUENCY MHz f_L-f_U	INSERTION LOSS dB low-band lw Typ.	lw Max.	Upper band U Typ.	U Max.	IN-OUT ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
PSW case A06	**PSW-1111**	SPST	10-2500	1.1	1.7	1.7	2.7	50	40	35	30	28	22	29.95	(6-24)
	PSW-1211	SPDT	10-2500	1.1	1.7	1.7	2.7	50	40	35	30	28	22	29.95	(6-24)
ZMSW case JJ77	**ZMSW-1111**	SPST	10-2500	1.1	1.7	1.7	2.7	50	45	35	30	28	22	59.95	(1-4)
	ZMSW-1211	SPDT	10-2500	1.1	1.7	1.7	2.7	50	45	35	30	28	22	59.95	(1-4)

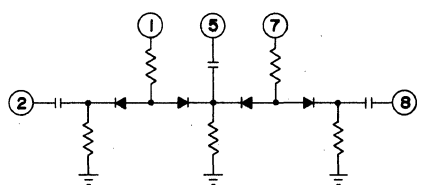
L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

lw = low-band (f_L to f_U/2)

Model PSW-1111



Model PSW-1211



pin and coaxial connections

see case style outline drawings

Series	PSW		ZMSW	
Models	1111	1211	1111	1211
RF COMMON	5	5	com	com
RF-1 port	8	2	—	RF-1
RF-2 port	—	8	RF-2	RF-2
CONTROL RF-1	7	1	—	1
CONTROL RF-2	—	7	2	2
CONTROL 50 ohm TERMINATION	1	—	1	—
GND	2,4	4	—	—
CASE GND	3,6	3,6	—	—

computer-automated performance data

typical production unit / for data of other models consult factory

PSW-1211

RF (MHz)	INSERTION LOSS, dB com RF-1	com RF-2	ISOLATION, dB com RF-1	com RF-2
10	−1.29	−1.38	−49.04	−49.44
110	− .93	− .97	−49.74	−49.78
210	− .91	− .90	−48.87	−44.32
310	− .92	− .84	−44.55	−45.60
410	− .83	− .71	−42.88	−44.53
610	−1.09	− .96	−39.47	−39.28
810	−1.13	−1.12	−37.53	−36.80
1010	−1.12	−1.09	−35.83	−34.95
1310	−1.14	−1.10	−33.28	−32.77
1510	−1.16	−1.12	−32.93	−32.41
1810	−1.30	−1.26	−31.80	−31.32
2010	−1.40	−1.32	−30.31	−29.93
2110	−1.45	−1.34	−28.33	−28.99
2310	−1.44	−1.31	−28.08	−28.09
2510	−1.59	−1.45	−27.89	−28.11

In Stock... Immediate Delivery

rugged, one-piece design

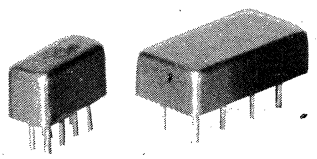
Fixed Attenuators NEW

3 to 40 dB
DC to 1500 MHz
performance data

curves, tables, page 4 Model Index

case style selection

outline drawings see page 3



MAT AT

	MODEL NO.	FREQUENCY MHz	ATTENUATION dB Nom.	Flatness Total Range	Flatness DC-1000MHz	VSWR Max. Total Range	VSWR Max. DC-1000 MHz	PRICE $ Ea.	PRICE $ Qty.
MAT case A11	MAT-3	DC-1500	3±0.2	1.0	0.6	1.5	1.3	4.95	(10-49)
	MAT-6	DC-1500	6±0.3	0.8	0.6	1.5	1.3	4.95	(10-49)
	MAT-9	DC-1500	9±0.3	0.8	0.6	1.5	1.3	4.95	(10-49)
	MAT-10	DC-1500	10±0.4	0.8	0.6	1.5	1.3	4.95	(10-49)
	MAT-12	DC-1500	12±0.4	0.8	0.6	1.5	1.3	4.95	(10-49)
	MAT-15	DC-1500	15±0.4	0.8	0.6	1.5	1.3	4.95	(10-49)
	MAT-20	DC-1500	20±0.5	1.0	0.6	1.5	1.3	4.95	(10-49)
	MAT-30	DC-1000	30±0.5	—	1.0	—	1.5	4.95	(10-49)
AT case A04	AT-3	DC-1500	3±0.2	1.0	0.6	1.5	1.3	3.95	(10-49)
	■ AT-3-75	DC-1000	3±0.3	—	1.0	—	1.5	3.95	(10-49)
	AT-6	DC-1500	6±0.3	0.8	0.6	1.5	1.3	3.95	(10-49)
	■ AT-6-75	DC-1000	6±0.4	—	1.0	—	1.5	3.95	(10-49)
	AT-10	DC-1500	10±0.3	0.8	0.6	1.5	1.3	3.95	(10-49)
	■ AT-10-75	DC-1000	10±0.5	—	1.0	—	1.5	3.95	(10-49)
	AT-20	DC-1500	20±0.4	0.8	0.6	1.5	1.3	3.95	(10-49)
	■ AT-20-75	DC-1000	20±0.6	—	1.2	—	1.5	3.95	(10-49)
	AT-30	DC-1000	30±0.5	—	1.0	—	1.5	3.95	(10-49)
	AT-40	DC-500	40±0.6	1.0	—	1.5	—	3.95	(10-49)

designers kit available

KAT-1... 4 of each (3, 6, 10, 20 dB), only $39.95
KMAT-1... 2 of each (3, 6, 9, 10, 12, 15, 20), only $39.95

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

1. For quality control procedures, see page 6.
2. For environmental specifications see page 7.
3. Absolute Maximum Ratings, see page 7; maximum RF power; AT, CAT, NAT, TAT series (1 watt). MAT, SAT series (0.5 watt).
4. Connector models available with female/male connectors. For other versions consult factory.
5. Prices and specifications subject to change without notice.

pin connections

see case style outline drawing

SERIES	In	Out	Ground
MAT	1	8	2,3,4,5,6,7
AT	1	8	2,3,4,5,6,7

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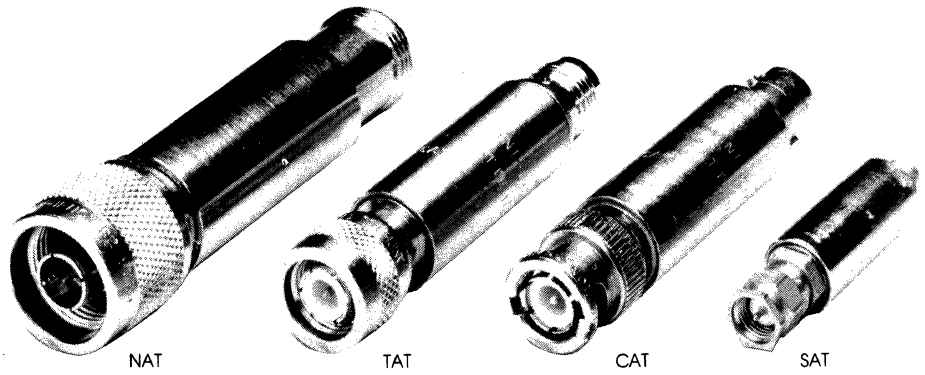
50 ohms and 75 ohms

Mini-Circuits



	MODEL* NO.	FREQUENCY MHz	ATTENUATION dB Nom.	Flatness Total Range	Flatness DC-1000MHz	VSWR Max. Total Range	VSWR Max. DC-1000 MHz	PRICE, $ Ea. NAT	TAT	CAT	Qty.
	___AT-3	DC-1500	3±0.2	1.0	0.6	1.5	1.3	15.95	12.95	11.95	(1-49)
■	CAT-3-75	DC-1000	3±0.3	—	1.0	—	1.5	15.95	12.95	11.95	(1-49)
	___AT-6	DC-1500	6±0.3	0.8	0.6	1.5	1.3	15.95	12.95	11.95	(1-49)
■	CAT-6-75	DC-1000	6±0.4	—	1.0	—	1.5	15.95	12.95	11.95	(1-49)
*NAT case FF57	___AT-10	DC-1500	10±0.3	0.8	0.6	1.5	1.3	15.95	12.95	11.95	(1-49)
■	CAT-10-75	DC-1000	10±0.5	—	1.0	—	1.5	15.95	12.95	11.95	(1-49)
*TAT case FF58	___AT-20	DC-1500	20±0.4	0.8	0.6	1.5	1.3	15.95	12.95	11.95	(1-49)
■	CAT-20-75	DC-1000	20±0.6	—	1.2	—	1.5	15.95	12.95	11.95	(1-49)
*CAT case FF55	___AT-30	DC-1000	30±0.5	—	1.0	—	1.5	15.95	12.95	11.95	(1-49)
	___AT-40	DC-500	40±0.5	1.0	—	1.5	—	15.95	12.95	11.95	(1-49)

***add suffix letter N, T, or C to ___AT, where applicable.**

								SAT	
SAT case FF56	SAT-3	DC-1500	3±0.2	1.0	0.6	1.5	1.3	14.95	(1-49)
	SAT-6	DC-1500	6±0.3	0.8	0.6	1.5	1.3	14.95	(1-49)
	SAT-9	DC-1500	9±0.3	0.8	0.6	1.5	1.3	14.95	(1-49)
	SAT-10	DC-1500	10±0.4	0.8	0.6	1.5	1.3	14.95	(1-49)
	SAT-12	DC-1500	12±0.4	0.8	0.6	1.5	1.3	14.95	(1-49)
	SAT-15	DC-1500	15±0.4	0.8	0.6	1.5	1.3	14.95	(1-49)
	SAT-20	DC-1500	20±0.5	1.0	0.6	1.5	1.3	14.95	(1-49)
	SAT-30	DC-1000	30±0.5	—	1.0	—	1.5	14.95	(1-49)

computer-automated performance data

typical production unit / for data of other models consult factory

SAT-SERIES FREQUENCY (MHz)	SAT-3	SAT-6	SAT-10	SAT-20
1.00	2.93	5.86	9.87	19.97
53.526	2.98	5.87	9.91	20.01
106.052	3.01	5.90	9.93	20.01
158.578	3.02	5.92	9.94	20.02
211.104	3.03	5.92	9.95	20.02
263.63	3.05	5.93	9.95	20.02
316.156	3.09	5.96	9.97	20.06
368.682	3.08	5.97	9.99	20.04
421.208	3.07	5.94	9.96	20.01
473.734	3.12	5.98	9.98	20.00
526.26	3.11	5.96	9.98	19.99
578.786	3.11	5.94	9.96	19.96
631.312	3.14	5.98	9.98	19.97
683.838	3.18	6.01	10.04	19.99
736.364	3.19	5.99	10.01	19.94
788.89	3.23	6.03	10.04	19.95
841.416	3.21	6.01	10.00	19.89
893.942	3.25	6.04	10.05	19.92
946.468	3.26	6.01	9.99	19.82
999.00	3.33	6.06	10.07	19.85
1250.00	3.52	6.20	10.36	19.77
1500.00	3.65	6.29	10.52	19.77

In Stock... Immediate Delivery

high rejection of 1st and 3rd harmonics

Frequency Doublers

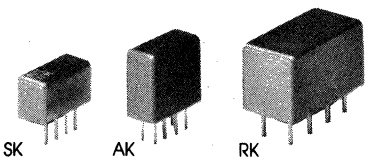
input power 0 to +20dBm

performance data

curves, tables, page 4 Model Index

case style selection

outline drawings see page 3



	MODEL NO.	FREQUENCY MHz		RF INPUT PWR. dBm		CONVERSION LOSS, dB			*HARMONIC OUTPUT, dB F1		F3		F4		PRICE, $	
		Input	Output	Min.	Max.	Input freq.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
SK case B02	SK-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	21.95	(5-24)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-500	14.0	16.5	20	15	30	25	16	12		
AK case A03	AK-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	19.95	(5-24)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-500	14.0	16.5	20	15	30	25	16	12		
RK case A01	RK-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	15.95	(5-24)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-500	14.0	16.5	20	15	30	25	16	12		
	RK-3	0.05-150	0.1-300	0	13	0.05- 50	11.0	13.0	40	30	45	30	16	12	14.95	(5-24)
						50-150	11.5	15.0	35	20	40	20	16	12		
	NEW RK-6	0.005-25	0.01-50	0	10	0.005-1	11.0	13.0	40	30	45	30	16	12	21.95	(5-24)
						1-25	11.5	15.0	35	20	40	20	16	12		

*Harmonic Output below power of F2.

NOTES:
1. Maximum RF input power, 200mW.
2. Refer to table of contents for quality control procedures; environmental specifications, absolute maximum ratings, and hi-rel testing.
3. For connector types and case mounting options, see case style outline drawings.
4. Prices and specifications subject to change without notice.

pin connections

see case style outline drawing

Series	SK	RK			AK
Models	all models	−2	−3	−6	all models
IN	*1,2	*1,3,4	*1,3,4	*1,3,4	*1,3,4
OUT	4	8	8	8	8
GND	3	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7
CASE GND	3	2,5,6,7	2	—	2,5,6,7

*pins must be connected together externally

applications

- Wideband frequency multiplier chains
- Low spurious frequency multiplier chains
- FM, PM modulation chains
- Double frequency range of signal generators

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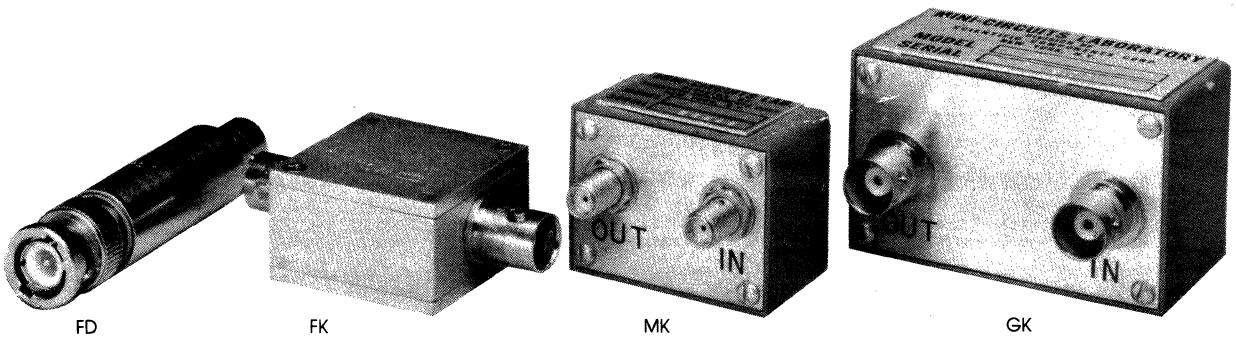
5 KHz to 2000 MHz

Mini-Circuits



FD FK MK GK

	MODEL NO.	FREQUENCY MHz Input	Output	RF INPUT PWR. dBm Min.	Max.	CONVERSION LOSS, dB Input freq.	Typ.	Max.	*HARMONIC OUTPUT, dB F1 Typ.	Min.	F3 Typ.	Min.	F4 Typ.	Min.	PRICE, $ Ea.	Qty.
FD case FF55	FD-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	32.95	(1-4)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-500	14.0	16.5	20	15	30	25	16	12		
FK case H16	FK-5	10-1000	20-2000	**10	20	10-600	13.0	15.0								
						600-1000	14.0	17.0	20	15	25	20	—	—	59.95	(1-4)
MK case L19	MK-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	42.95	(1-4)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-500	14.0	16.5	20	15	30	25	16	12		
	MK-3	0.05-150	0.1-300	0	13	0.05-50	11.0	13.0	40	30	45	30	16	12	37.95	(1-4)
						50-150	11.5	15.0	35	20	40	20	16	12		
	MK-5	10-1000	20-2000	**10	20	10-600	13.0	15.0							67.95	(1-4)
						600-1000	14.0	17.0	20	15	25	20	—	—		
GK case L20	GK-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	32.95	(1-4)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-600	14.0	16.5	20	15	30	25	16	12		
	GK-3	0.05-150	0.1-300	0	13	0.05- 50	11.0	13.0	40	30	45	30	16	12	30.95	(1-4)
						50-150	11.5	15.0	35	20	40	20	16	12		
	GK-5	10-1000	20-2000	**10	20	10-600	13.0	15.0								
						600-1000	14.0	17.0	20	15	25	20	—	—	57.95	(1-4)

*Harmonic Output below power of F2.
**ABOVE 700 MHz, min. input power +13dBm

computer-automated performance data

typical production unit / for data of other models consult factory

harmonic* attenuation tables

IN FREQ. MHz	MODEL FD-2				
	1	2	3	4	5
30	47.1	13.4	51.3	14.9	55.4
35	47.0	13.5	51.0	14.8	54.0
40	46.5	13.6	50.9	15.0	52.6
45	45.9	13.6	50.7	15.2	51.4
50	45.4	13.5	49.8	15.8	50.6
55	43.7	13.4	47.4	15.8	50.2
60	43.7	13.7	46.5	15.6	49.3
65	43.4	13.7	45.4	14.7	48.7
70	43.1	13.7	44.7	14.5	47.7
75	43.1	13.7	44.2	14.2	47.2
80	43.1	13.7	43.6	13.9	46.5

Harmonics Order

INPUT POWER, +5dBm

IN FREQ. MHz	MODEL FK-5				
	1	2	3	4	5
10	14.9	13.6	34.7	18.1	34.1
20	16.5	13.0	34.8	17.3	34.5
50	15.3	13.4	31.0	17.5	32.8
100	15.2	13.1	26.9	16.5	29.5
250	16.0	12.8	21.7	17.4	29.4
500	25.4	12.6	33.6	22.5	45.7
600	22.8	13.0	31.2	16.3	28.9
700	22.5	13.9	38.1	16.2	26.7
800	17.7	14.6	30.6	14.6	35.4
900	17.5	14.6	28.0	16.2	37.2
999	19.1	14.2	19.7	20.3	41.6

Harmonics Order

INPUT POWER, +13dBm

* all harmonics except 2nd order, are relative to F2
second order is relative to IN PWR

case style outline dimensions (inch / mm)

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
A01	.770 19.56	.800 20.32	.385 9.78	.400 10.16	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									5.2	A1
A03	.480 12.20	.500 12.70	.390 9.91	.405 10.29	.210 5.34	.230 5.85	.100 2.54	.20 5.08	.14 3.56	.020 .51									2.3	A1
A04	.770 19.56	.800 20.32	.200 5.08	.210 5.33	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									3.7	A1
A05	.770 19.56	.800 20.32	.240 6.10	.250 6.35	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									3.7	A1
A06	.770 19.56	.800 20.32	.285 7.24	.310 7.88	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									5.2	A1
A11	.480 12.20	.500 12.70	.240 6.10	.255 6.48	.210 5.34	.230 5.85	.100 2.54	.20 5.08	.14 3.56	.020 .51									1.9	A1
B02	.480 12.20	.500 12.70	.240 6.10	.255 6.48	.210 5.34	.230 5.85	.16 4.07	.100 2.54	.14 3.56	.20 5.08	.020 .51								1.9	A1
B13	.480 12.20	.500 12.70	.390 9.91	.405 10.29	.210 5.34	.230 5.85	.16 4.07	.100 2.54	.14 3.56	.20 5.08	.020 .51								2.3	A1
C07	.770 19.56	.810 20.58	.380 9.66	.410 10.42	.030 .77	.200 5.08	.20 5.08	.14 3.56											11.0	A1
D08	1.000 25.40	1.025 26.04	.390 9.91	.430 10.93	.500 12.70	.525 13.34	.025 .64	.300 7.62	.200 5.08	.09 2.29	.13 3.31	.150 3.81	.20 5.08	.14 3.56					8.5	A1
D09	1.000 25.40	1.025 26.04	.240 6.10	.280 7.12	.500 12.70	.525 13.34	.025 .64	.300 7.62	.200 5.08	.09 2.29	.13 3.31	.150 3.81	.20 5.08	.14 3.56					7.5	A1
E10	1.540 39.12	1.620 41.15	.380 9.66	.410 10.42	.770 19.56	.810 20.58	.030 .77	.200 5.08	.10 2.54	.20 5.08	.14 3.56								23.0	A1
F14	2.00 50.80	2.00 50.80	.75 19.05	1.00 25.40	.25 6.35	1.500 38.10	.13 3.31	.39 9.91											170.0	A4, B1, D2
F53	2.00 50.80	2.00 50.80	.75 19.05	1.00 25.40	.13 3.31	1.750 44.45	.13 3.31	.39 9.91											170.0	A4, B1, D2
G15	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	.63 16.01	— —	.800 20.32	.800 20.32	.76 19.31	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				85.0	A4, B1, D1
H16	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	1.000 25.40	.125 3.18	1.000 25.40	— —	— —	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				70.0	A4, A5, B1 D2, D3, D4
J17	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	1.000 25.40	.125 3.18	1.000 25.40	— —	— —	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				75.0	A4 or A5 B1, D2, D3
K18	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	1.000 25.40	.125 3.18	1.000 25.40	— —	— —	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				70.0	A4 or A5 B1, C1, D2, D3
L19	1.50 38.10	1.13 28.70	.97 24.64	.50 12.70	.155 3.94	2.345 59.57	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.31 7.88	1.19 30.23	— —	.66 16.77	— —	— —	.150 3.81		37.0	A4 or A6 B2, D6
L20	2.25 57.15	1.38 35.05	1.21 30.74	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.40 10.16	1.86 47.25	— —	.64 16.26	— —	— —	.150 3.81		74.0	A4 or A6 B2, D5
M21	1.50 38.10	1.13 28.70	.97 24.64	.50 12.70	.155 3.94	2.345 59.57	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.31 7.88	.75 19.05	1.19 30.23	.66 16.76	— —	— —	.150 3.81		40.0	A4 or A6 B2, C1, D6
M22	2.25 57.15	1.38 35.05	1.21 30.74	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.40 10.16	1.15 29.21	1.86 47.25	.64 16.26	— —	— —	.150 3.81		74.0	A4 or A6 B2, C1, D5
M23	2.25 57.15	1.38 35.05	1.21 30.74	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.63 16.00	1.06 26.93	1.63 41.40	.69 17.53	— —	— —	.150 3.81		70.0	A4 or A6 B2, C1, D6
N24	1.50 38.10	1.13 28.70	.97 24.64	.50 12.70	.155 3.94	2.345 59.57	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.32 8.13	.75 19.05	1.18 29.97	.31 7.88	.56 14.23	.81 20.58	.150 3.81		45.0	A4 or A6 B2, D6
N27	2.25 57.15	1.38 35.05	1.21 30.74	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.42 10.67	1.13 28.70	1.84 46.74	.38 9.65	.69 17.53	1.00 25.40	.150 3.81		92.0	A4 or A6 B2, D7
P25	2.25 57.15	1.38 35.05	1.21 30.74	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.78 19.81	1.47 37.34	— —	.38 9.65	1.00 25.40	— —	.150 3.81		86.0	A4 or A6 B2, D7
P26	1.50 38.10	1.13 28.70	.97 24.64	.50 12.70	.155 3.94	2.345 59.57	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.50 12.70	1.00 25.40	— —	.31 7.88	.81 20.58	— —	.150 3.81		42.5	A4 or A6 B2, D6
Q28	40.6 103.13	1.60 40.64	1.50 38.10	3.56 90.43	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.40 10.16	.69 17.53	.58 14.73	.66 16.77	3.13 79.50	.81 20.58	.06 1.53				300.0	A5, D8

tolerance x ± .1 xx ± .03 xxx ± .015 **oz. = grams x .0353**

*NOTES:

MATERIAL & FINISH

A1. Header material CRS; Pin material; #52 alloy.
Finish: electro tin hot-oil flowed, Cover material; cupro-nickel.

A4. Case material aluminum. Finish; iridite.

A5. Case material CRS. Finish; baked grey enamel over hot-tin dip.

A6. Case material aluminum. Finish; blue baked enamel over phosphoric etch per MIL-C-15328.

MOUNTING

B1. Mounting bracket available on request. Add suffix B to part number.

B2. Mounting bracket available on request. Add suffix B to part number. Add $1.50 to unit cost.

MARKING

C1. For port markings 1, 2, and 3 see specification data sheet.

CONNECTORS

D1. Connectors: SMA Standard. BNC on request (no charge). Male SMA on request (add $5.00 to unit cost).

D2. Connectors: please specify, unless otherwise noted; BNC is standard, TNC no charge, SMA and Type N add $5.00 per unit. (ZAPD only, Dash −4 units not available with BNC).

D3. For Type N or TNC connectors this dimension, "C"', changes from 0.75 to 0.94 inches.

D4. Isolated BNC connectors are standard, FTB models only.

D5. Connectors: BNC standard, TNC on request (no charge).

D6. Connectors: Female SMA only. Male SMA available on request, consult factory.

D7. Connectors: BNC only.

D8. Connectors: BNC standard, TNC on request (add $10.00 to unit cost), Female SMA on request (add $15.00 to unit cost).

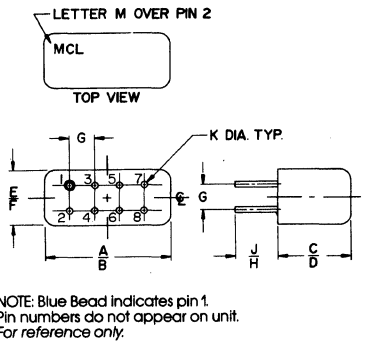
D9. Male BNC, Male N available:
(add $2.00 to unit price. Specify ports for Male connectors).

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (718) 934-4500

& outline drawings

Mini-Circuits

A



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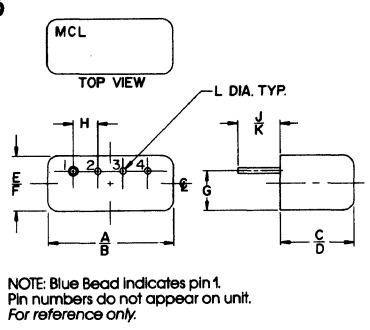

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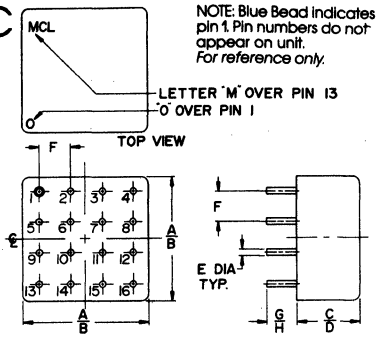

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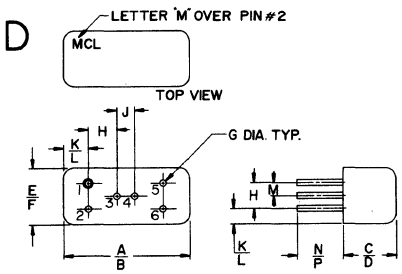

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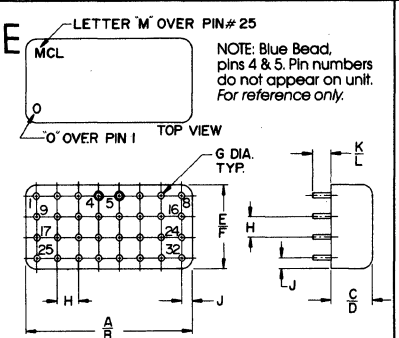

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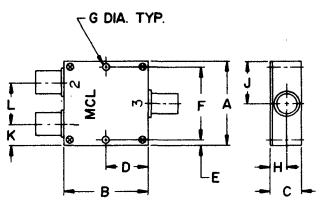

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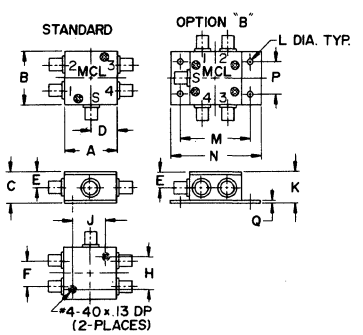

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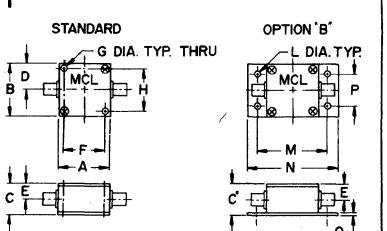

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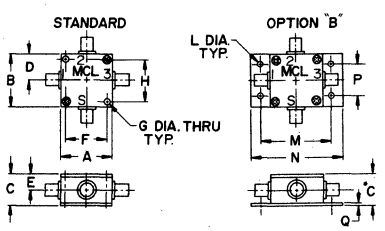

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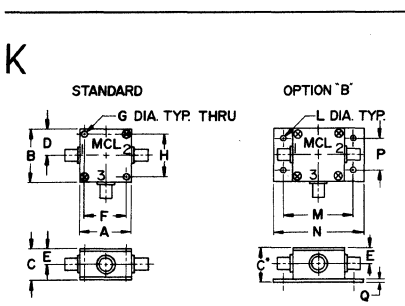

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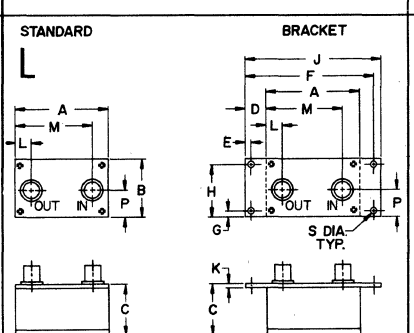

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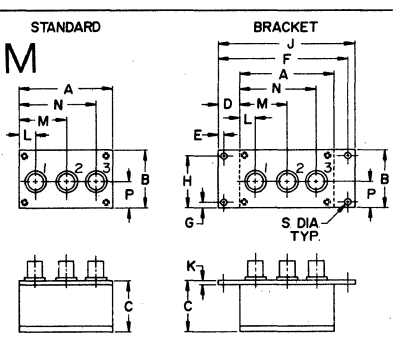

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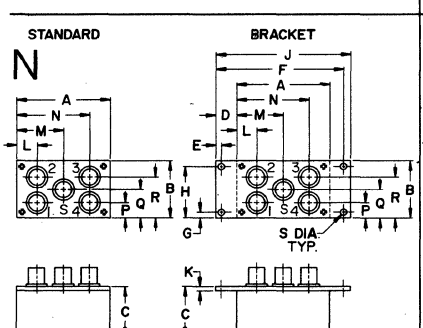

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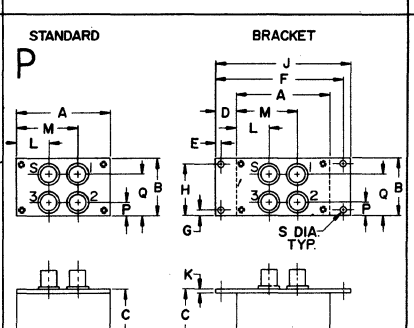

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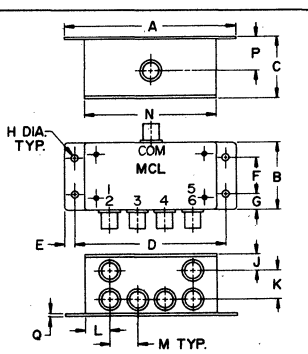


case style outline dimensions (inch mm)

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
R29	4.06 103.13	1.60 40.64	1.50 38.10	3.56 90.43	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.40 10.16	.69 17.53	.58 14.73	.66 16.77	3.13 79.50	.81 20.58	.06 1.53				300.0	A1, C2, D9
R30	6.69 169.93	1.60 40.64	1.50 38.10	6.22 157.99	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.40 10.16	.69 17.53	.55 13.97	.66 16.77	5.72 145.29	.81 20.58	.06 1.53				500.0	A5, C2, D10
R31	9.31 236.98	1.60 40.64	1.50 38.10	8.84 224.54	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.40 10.16	.69 17.53	.54 13.72	.66 16.77	8.34 211.84	.81 20.58	.06 1.53				700.0	A5, C2, D11
R67	6.69 169.93	1.60 40.64	1.50 38.10	6.22 157.99	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.40 10.16	.69 17.53	1.22 30.99	.66 16.77	5.72 145.29	.81 20.58	.06 1.53				500.0	A5, C2, D12
S32	3.75 95.25	2.00 50.80	1.8 45.7	.19 4.83	3.375 85.73	.19 4.83	1.625 41.28	.144 3.66	.6 15.24	.4 10.16	.5 12.7	1.30 33.02	.09 2.29						220.0	A7 D20
T34	4.75 120.65	2.00 50.80	2.21 56.14	.19 4.83	4.375 111.13	.23 5.84	1.540 39.12	.144 3.66	.58 14.73	.34 8.64	.50 12.70	1.50 38.10	1.00 25.40	.09 2.29	.38 9.65	4.00 101.60	.30 7.62	2.60 66.04	440.0	A8 D20
T35	4.75 120.65	2.00 50.80	2.46 62.49	.19 4.83	4.375 111.13	.23 5.84	1.540 39.12	.144 3.66	.58 14.73	.34 8.64	.50 12.70	1.50 38.10	1.00 25.40	.09 2.29	.38 9.65	4.00 101.60	1.50 38.10	5.00 127.00	700.0	A8 D20
U36	7.00 177.80	3.25 82.55	2.13 54.10	.25 6.35	6.500 165.10	.38 9.65	2.500 63.50	.156 3.97	.88 22.35	.73 18.54	.63 16.01	1.13 28.70	2.23 56.64	.125 3.18	.50 12.70	6.00 152.40			900.0	A8 D6
V37	.80 20.32	.80 20.32	.75 19.05	.40 10.16	.38 9.65	.485 12.32	.110 2.79	.485 12.32											33.0	A5, C1, D6
W38	.30 7.62	.27 6.86	.23 5.84	.010 .25	.042 1.07	.020 .51	.100 2.54	.05 1.27	.09 2.29	.37 9.40									.50	A3
X65	.30 7.62	.27 6.86	.23 5.84	.010 .25	.042 1.07	.020 .51	.100 2.54	.05 1.27	.04 1.02	.12 3.05	.300 7.62	.35 8.89							.50	A3
Y39	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.36 9.15	1.000 25.40	1.000 25.40	.125 3.18	.125 3.18	.46 11.69	2.18 55.38	1.688 42.88	.07 1.78	.750 19.05	.50 12.70	.80 20.32	.45 11.43	.29 7.37	50.0	A4, B1, D6
Z40	7.06 179.32	3.13 79.50	.88 22.35	.250 6.35	1.750 44.45	5.310 134.87	6.810 172.97	.312 7.92	2.875 73.03	.144 3.66	3.53 89.66	.44 11.18	.415 10.54	.89 22.61					800.0	A4 or D14
AA46	.830 21.08	.580 14.73	.265 6.73	.13 3.30	.415 10.54	.340 8.64	.025 .64	.50 12.70											6.4	A2
BB48	.50 12.70	.39 9.91	.225 5.72	.025 .64	.07 1.79	.100 2.54	.250 6.35	.350 8.89	.06 1.53	.31 7.87									3.0	A1
CC51	2.00 50.80	2.00 50.80	.75 19.05	.938 23.83	.13 3.30	1.750 44.45	.125 3.18	.375 9.53	1.00 25.40	1.25 31.75									120.0	A4, D14
DD52	2.00 50.80	2.00 50.80	.75 19.05	.900 22.86	.156 3.96	1.688 42.88	.125 3.18	.392 9.96	1.00 25.40	.50 12.70	1.00 25.40	1.25 31.75							225.0	A4, D14
EE54	3.50 88.90	2.13 54.10	.88 22.35	.250 6.35	1.750 44.45	3.250 82.55	.250 6.35	1.813 46.05	.125 3.18	.44 11.18	.415 10.54	.89 22.61							250.00	A4, D14
FF55	1.40 35.56	.58 14.73	.73 18.54	2.59 65.79	— —														40.0	A9, D15
FF56	.98 24.89	.43 10.92	.47 11.94	1.70 43.18	— —														18.0	A9, D16
FF57	1.54 39.12	.72 18.92	.81 20.58	3.05 77.47	.82 20.83														90.0	A9, D17
FF58	1.40 35.56	.58 14.73	.61 15.50	2.59 65.79	.64 16.26														45.0	A9, D18

tolerance x ± .1 xx ± .03 xxx ± .015 **oz. = grams x .0353**

*NOTES:

MATERIAL & FINISH

A1. Header material CRS; Pin material; #52 alloy.
Finish: electro tin hot-oil flowed, Cover material; cupro-nickel.

A2. Case material CRS; Pin material; #52 alloy; Covers stainless steel.
Finish; gold flash per MIL-G-45204.

A3. Case material plastic. Pin material; iron-nickel alloy.
Finish; bright tin-plate per MIL-T-10727.

A4. Case material aluminum. Finish; iridite.

A5. Case material CRS. Finish; baked grey enamel over hot-tin dip.

A7. Case material aluminum. Finish; black enamel. Heat Sink; black anodize.

A8. Case material aluminum. Finish; iridite. Heat sink; black anodize.

A9. Case material brass. Finish; nickel plate.

MOUNTING

B1. Mounting bracket available on request. Add suffix B to part number.

MARKING

C1. For port markings 1, 2, and 3 see specification data sheet.

C2. Consecutive marking, n = no. of way power splitter.

CONNECTORS

D6. Connectors: Female SMA only. Male SMA available on request, consult factory.

D9. Connectors: BNC standard, TNC on request (add $10.00 to unit cost), Female SMA on request (add $25.00 to unit cost).

D10. Connectors: BNC standard, TNC on request (add $20.00 to unit cost), SMA on request (add $45.00 to unit cost).

D11. Connectors: BNC standard, TNC on request (add $35.00 to unit cost), SMA on request (add $65.00 to unit cost).

D12. Connectors: BNC standard, TNC on request (add $15.00 to unit cost), SMA on request (add $35.00 to unit cost).

D14. Connectors: Please specify: Type N or SMA

D15. Connectors: male BNC, female BNC standard. Other combinations with SMA available on request (add $2.00 to unit cost).

D16. Connectors: male SMA, Female SMA only.

D17. Connectors: male N, female N standard. Combinations with BNC, SMA, TNC available on request (add $3.00 to unit cost).

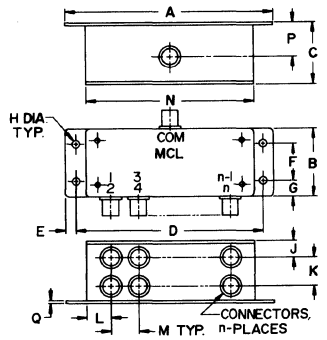
D18. Connectors: male TNC, Female TNC only.

D20. Connectors: please specify, unless otherwise noted. BNC is standard, TNC, SMA or Type N (add $10.00 to unit cost).

& outline drawings

Mini-Circuits

R



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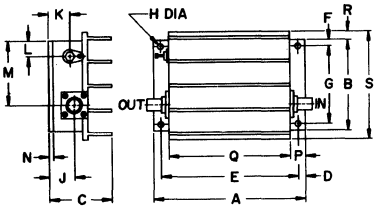

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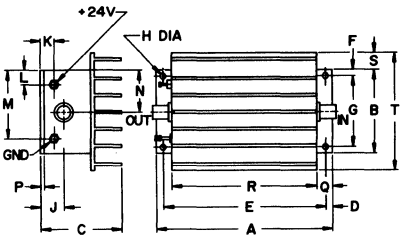

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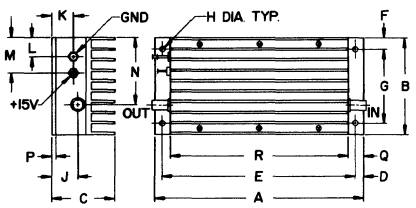

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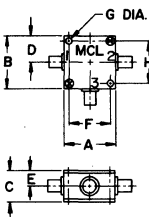

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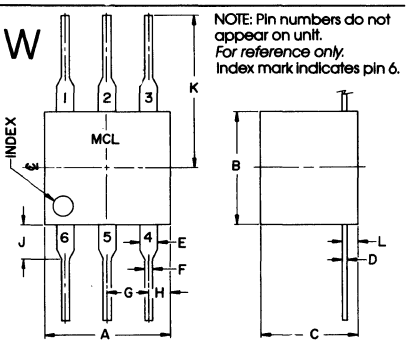

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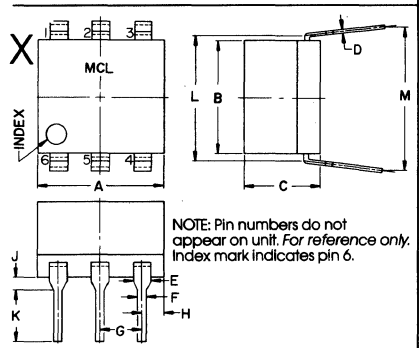

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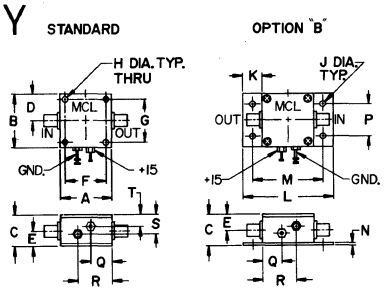

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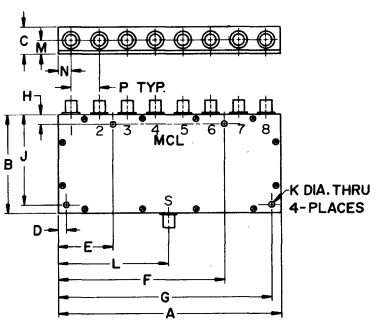

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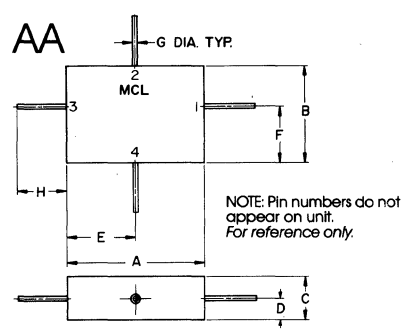

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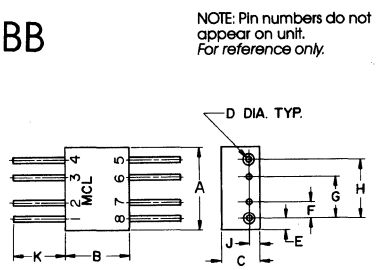

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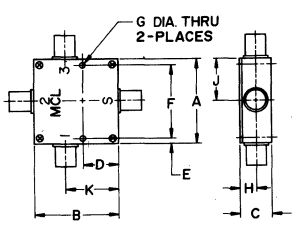

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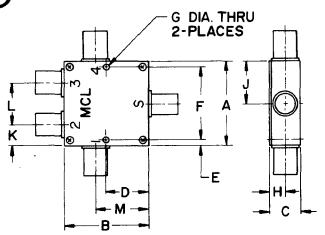

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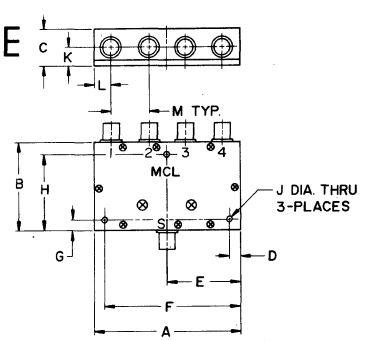

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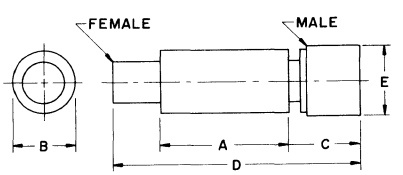


case style outline dimensions & outline drawings (inch mm)

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
GG 60	2.31 58.68	1.20 30.48	.60 15.24	.125 3.18	2.062 52.38	.30 7.62	.53 13.46	.63 16.00											75.0	A4, D19
HH 68	9.31 236.47	1.60 40.64	3.57 90.68	9.84 224.54	.25 6.35	.88 22.35	.36 9.14	.160 4.06	.34 8.37	.69 17.53	.54 13.72	.66 16.76	8.34 211.84	.33 8.38	.06 1.52				1090.0	A5, D13
JJ77	1.50 38.10	1.13 28.70	.97 24.64	.50 12.70	.155 3.94	2.345 59.57	.14 3.55	.850 21.60	2.50 63.50	.10 2.54	.44 11.17	.75 19.05	.63 16.00	.37 9.39	.54 13.71	.43 10.92	.150 3.81	.73 18.54	50.0	D6
KK 81	.30 7.62	.27 6.86	.23 5.84	.010 .25	.042 1.07	.020 .51	.100 2.54	.05 1.27	.05 1.27	.035 .88	.036 .91	.26 6.60	.575 14.60						.50	A3

tolerance x ± .1 xx ± .03 xxx ± .015 **oz. = grams x .0353**

*NOTES:

MATERIAL & FINISH

A4. Case material aluminum. Finish; iridite.

A5. Case material CRS. Finish; baked grey enamel over hot-tin dip.

A3. Case material plastic. Pin material; iron-nickel alloy. Finish; bright tin-plate per MIL-T-10727.

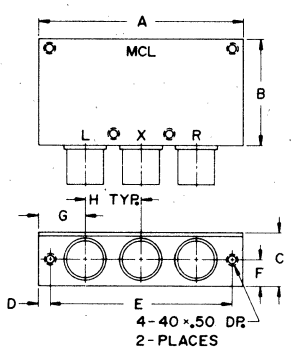
CONNECTORS

D6. Connectors: Female SMA only Male SMA available on request.

D13. Connectors: BNC standard, SMA on request (add $130.00 to unit cost).

D19. Connectors: BNC standard, SMA on request (add $15.00 to unit cost).

GG



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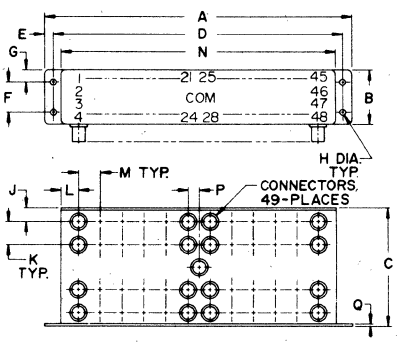

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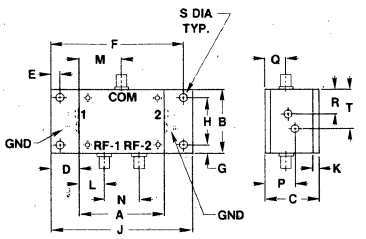

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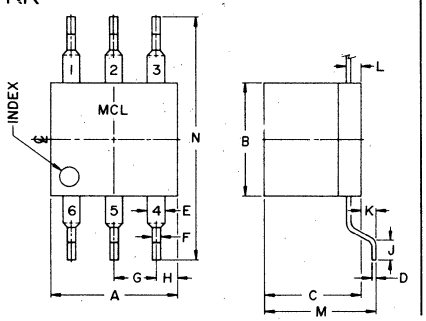
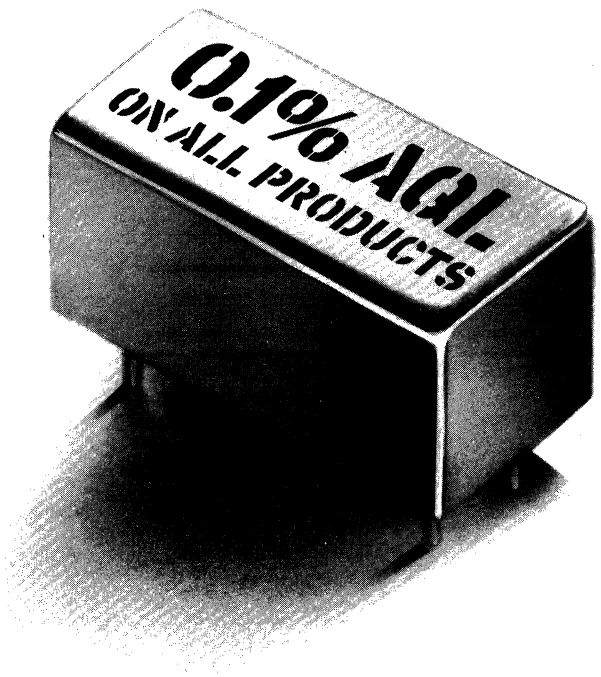


Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (718) 934-4500



We Guarantee Quality

Many manufacturers talk about quality rarely defining specific terms or numbers.

Mini-Circuits guarantees quality . . . clearly defined. Some manufacturers are content, and even boast, of their 1.0% Acceptable Quality Level (AQL). But a 1.0% AQL means it is o.k. to pass a 1,000 lot size even if 3 rejects are found in a sample lot of 125 units. Mini-Circuits considers 1.0% AQL dangerously inadequate for today's systems designers. Just one defective mixer or coupler appearing at the final test of a system can cause extensive delays and excess costs.

So we at Mini-Circuits guarantee our customers 0.1% AQL; no rejects ... not even one ... on every order shipped. If you encounter one failure, repack the entire lot and ship it back to us, collect. We will 100% retest every unit and return the entire order promply, postage prepaid.

It could cost us a lot of money. But we are not worried. We ship millions of RF signal-processing components, for thousands of military programs in the U.S. and over 20 foreign countries, to tight quality-control specs.

We have utmost confidence in our automated assembly system, our practice of 100% screening each diode, microscopic inspection of all solder connections, screening (burn-in, thermal shock, and gross/fine leak tests), complete encapsulation for shock and vibration, and thorough testing of each completed unit.

We encourage you to add a 0.1% AQL on all of your specs, drawings and purchase orders. You are entitled to such quality. Mini-Circuits will meet the 0.1% AQL spec now. And we will continue our quest to even further improve quality.

finding new ways ...
setting higher standards

Mini-Circuits

A Division of Scientific Components Corporation
World's largest manufacturer of Double Balanced Mixers
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CUSTOM INTEGRATED COMPONENT SUBASSEMBLIES*

North Hills

North Hills' custom-engineered, integrated-component subassemblies are used by many microwave systems manufacturers to provide a compact, high-performance alternative to circuits fabricated from discrete components. The benefits of our custom engineering and fabrication approach include:

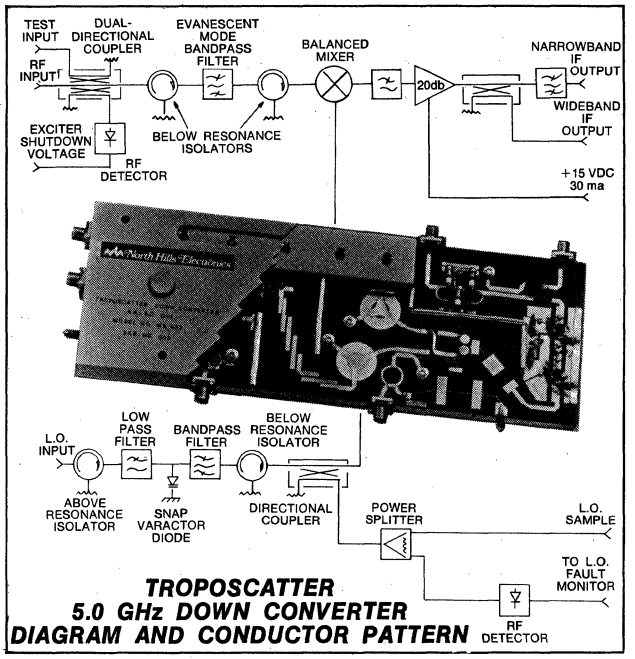
TECHNICAL BENEFITS

- Better electrical performance by eliminating mechanical component interconnections
- Reduced sensitivity to environmental extremes
- Reduced mechanical complexity, size and weight since there are no cables, connectors or support brackets for separate components
- A large choice of transmission line configurations yields optimal performance of each component element
- Improved reliability (better MTBF)

ECONOMIC BENEFITS

- Lower cost-per-unit
  Our cost will usually be lower than the aggregated cost of discrete components.
- Lower down time (reduced MTTR)
  Testing is quick and easy because there is only one suspect unit — one item to replace.
- Easier vendor communication
  You have only one company to contact for after-the-sale support.
- THREE YEAR WARRANTY ON ALL MICROWAVE PRODUCTS!

* DEFINITION: Custom-engineered, integrated-component microwave subassemblies are "supercomponents" such as receiver front ends, which are designed and fabricated as a single unit, permitting optimization of electrical performance within stringent size, weight and environmental restrictions.



TROPOSCATTER 5.0 GHz DOWN CONVERTER DIAGRAM AND CONDUCTOR PATTERN

THIS MICROWAVE DOWNCONVERTER IS JUST ONE EXAMPLE OF OUR CUSTOM INTEGRATED-COMPONENT SUBASSEMBLIES:

Downconverters • Multicouplers • Low-Noise Amplifiers • Phase Detectors
Mixer-Preamplifiers • Receiver Front Ends • RF Switch Matrices • Upconverters
RF Amplifiers • Filters • Antenna Systems • Power Dividers

STANDARD MICROWAVE COMPONENTS

North Hills

LAMINATED BANDPASS FILTERS ENCAPSULATED CONFIGURATION

SERIES FL-1000CE

FEATURES

- Rugged
- Highly stable over environmental extremes
- Inexpensive
- Readily available in both standard and custom passbands

The series FL-1000CE bandpass stripline filters are connectorized, encapsulated devices consisting of photo-etched conductor patterns thermally laminated within a low loss, dimensionally stable dielectric medium. They are particularly attractive for use in equipment that operates under extreme temperature, humidity, shock and vibration stresses. These units are small size, lightweight, have moderately low insertion loss, and are virtually immune to long-term electrical performance degradations.

TYPICAL PERFORMANCE

Model No.	No. of Sections	Passband (MHz)	Loss @ fo (dB)	Rejection From fo
FL-1832CE	3	860-900	0.95	34 dB @ ±140 MHz
FL-1608CE	8	2840-3300	1.05	66 dB @ ±630 MHz
FL-1691CE	5	3540-4300	0.80	32 dB @ ±880 MHz
FL-1868CE	5	4275-4980	0.35	29 dB @ ±749 MHz
FL-1713CE	8	5910-6480	1.60	65 dB @ ±850 MHz
FL-1582CE	7	6455-7140	1.20	68 dB @ ±1065 MHz
FL-1496CE	6	7425-8085	1.30	55 dB @ ±1250 MHz
FL-1541CE	7	8300-9050	1.50	69 dB @ ±1075 MHz
FL-1656CE	7	10000-10650	1.90	68 dB @ ±1250 MHz
FL-1263CE	6	10000-11680	1.85	72 dB @ ±1540 MHz
FL-1724CE	6	12120-12640	2.10	67 dB @ ±1300 MHz

SPECIFICATIONS

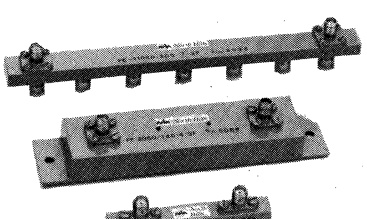
Center frequency, F_o:
700 MHz to 18 GHz
3-dB bandwidth (% of F_o):
2 to 24
Number of sections (n):
2 to 15
Nominal impedance level:
50 ohms input and output
VSWR at F_o:
1.35:1 typically
Connectors:
Type SMA

MINIATURE GHz BP FILTERS

SERIES FE-

The series FE- Bandpass Filters are of the Evanescent TE Mode type. Because this filter is realized in channel structures operating below cutoff, high "Q" low-loss filters can be obtained. These filters are less complex and usually smaller in size than other filters of similar electrical characteristics; e.g., combline, interdigital or waveguide.

These filters can be provided with either Chebyshev or Butterworth characteristics. Typically, 2 to 15 sections offer passbands of 2 to 24 percent.



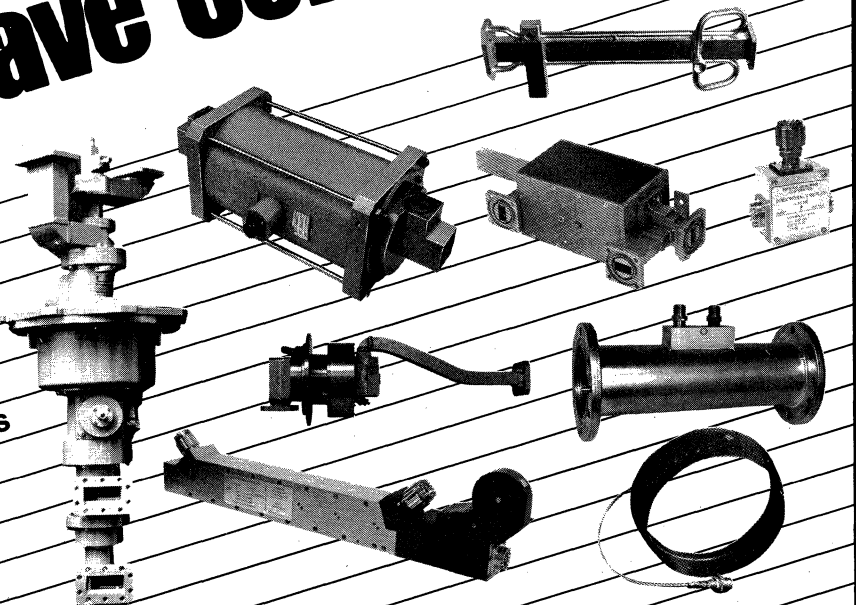
Some examples of the Series FE-

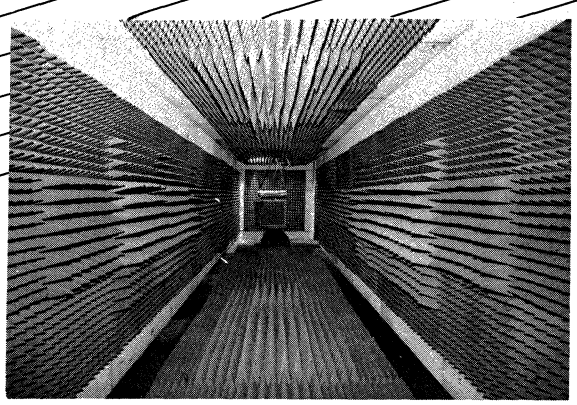
See our Wideband POWER DIVIDER/COMBINER, HYBRID TRANSFORMER and TERMINATION advertisement in SECTION 5600.
FOR MORE INFORMATION, PLEASE CALL OR WRITE MICROWAVE SALES ENGINEERING AT:

North Hills Electronics, INC.
1 ALEXANDER PLACE, GLEN COVE, NY 11542-3796 / TELEX: 46-6886 / TEL. (516) 671-5700

The Premier Source: Microwave Components

- Microwave Front Ends
- Microwave Filters
- Rotary Joints
- Antennas & Feeds
- Ferrite Devices
- Millimeter Components
- Diplexers
- Multiplexers
- Phase Shifters
- Isolators
- Loads
- Directional Couplers
- Hybrids
- Circulators
- Windows
- Attenuators





plus a complete, computerized Anechoic Antenna/Component/Sub-System Test Facility

Premier Microwave Corporation has been serving the Microwave Industry for almost half a century with narrow- and broad-band waveguide, strip and coax components and sub-systems. We design, manufacture and test fixed, variable and dc-controlled products, both active and passive, with emphasis on a superlative ferrite engineering section.

Write for a complete catalog of standard and custom microwave components and sub-systems, or send your specifications for evaluation/price/delivery to:

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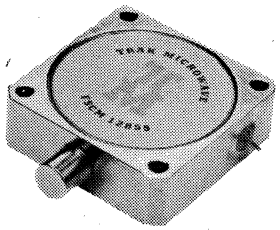
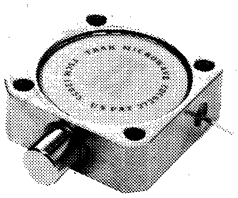
Designers and manufacturers of Rotary Joints, Ferrite Devices, Front Ends, Antennas and other microwave system components. Automated-computerized antenna test pattern facility available.

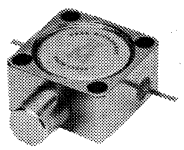
Qualified personnel are invited to send resume and salary requirement to Director of Personnel, Premier Microwave Corp., 33 New Broad Street, Port Chester, N.Y. 10573.

TRAK MICROWAVE

Circulators & Isolators (Drop-In Type)







Isolators

FREQ. RANGE (GHz)	MODEL # ISOLATORS	BANDWIDTH %	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR max.	OPERATING TEMP. °C.	POWER RATING PEAK POWER KW	POWER RATING AVERAGE POWER WATTS	POWER RATING HEAT SINK TEMP °C.	SIZE (INCHES NOMINAL) L W H
0.5-0.7	29*0401	3	20	0.7	1.25	-54 to +95	0.1	1.0	+95	1.00 x 1.00 x 0.30
0.7-1.0	29*0501	5	20	0.6	1.25	-54 to +95	0.1	1.0	+95	1.00 x 1.00 x0.30
1.0-1.3	29*1401	10	20	0.5	1.25	-54 to +95	0.1	1.0	+95	1.00 x 1.00 x 0.30
1.3-1.65	29*1501	10	20	0.5	1.25	-54 to +95	0.1	1.0	+95	1.00 x 1.00 x 0.30
1.65-2.0	29*1601	5	20	0.5	1.25	-54 to +95	0.1	1.0	+95	0.75 x 0.75 x 0.25
2.0-2.5	29*3401	5	20	0.5	1.25	-54 to +95	0.1	1.0	+95	0.75 x 0.75 x 0.25
2.5-3.7	29*3501	10	20	0.6	1.25	-54 to +95	0.1	1.0	+95	0.75 x 0.75 x 0.25
2.5-3.7	29*3601	5	18	0.6	1.30	-54 to +95	0.1	1.0	+95	0.50 x 0.50 x 0.25
3.7-4.6	29*6401	5	18	0.6	1.30	-54 to +95	0.1	1.0	+95	0.50 x 0.50 x 0.25
4.6-6.2	29*6501	10	18	0.6	1.30	-54 to +95	0.1	1.0	+95	0.50 x 0.50 x 0.25
6.2-8.0	29*6601	10	18	0.6	1.35	-54 to +95	0.1	1.0	+95	0.50 x 0.50 x 0.25
8.0-10.0	29*9401	10	18	0.6	1.35	-54 to +95	0.1	1.0	+95	0.50 x 0.50 x 0.25
10.0-12.0	29*9501	10	18	0.6	1.35	-54 to +95	0.1	1.0	+95	0.50 x 0.50 x 0.25
12.0-15.0	29*2401	10	17	0.6	1.45	-54 to +95	0.1	1.0	+95	0.50 x 0.50 x 0.25
15.0-18.0	29*2501	10	17	0.6	1.45	-54 to +95	0.1	1.0	+95	0.50 x 0.50 x 0.25

*Specify center frequency when ordering. Model designation will be completed by TRAK.

NOTE: Circulators are also available.

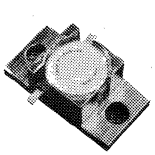
µicropuck® Circulators & Isolators

The Micropuck™ family of circulators and isolators was designed to maximize the use of isolators and circulators in stripline and microstrip applications. They are easy-to-mount devices with magnetic shielding which prevents detuning or changes in performance when operating in magnetic fields or in close proximity to ferrous metals. The round design and tab lead configuration allow installation at a reduced cost, replacing milling operations with a simple drilled hole.

The Micropuck™ isolator is also available in a flange mount similar to the mounting used on some power transistors. This construction has input and output tabs located 180° from each other as opposed to the 120° separation of the round version. This provides an alternative choice for system designers who prefer the screw-down mounting and can allow the extra space it requires.

Specifications for these microminiature ferrite devices are as good as you'll find anywhere. Look at the data and call our ferrite sales group or local representative.

Flange Mount Micropuck™ Isolators



MODEL #	FREQUENCY (GHz)	BANDWIDTH %	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR MAX.	OPERATING TEMP. °C.	PEAK PWR watts	AVG. PWR watts	HEAT SINK TEP °C.	SIZE L x W x H INCHES
F9*6101	4-8	10	20	0.5	1.25	−54 to +95	50	0.7	95	.62 x .375 x .21
F9*9001	8-12	10	20	0.4	1.25	−54 to +95	50	0.5	95	.50 x .25 x .18
F9*2001	12-18	10	17	0.5	1.35	−54 to +95	50	0.5	95	.50 x .25 x .18
F9A9101	8-12	FULL BAND	16	0.7	1.45	−54 to +95	50	0.7	95	.62 x .375 x .21
F9A2201	12-18	FULL BAND	17	0.7	1.50	−55 to +100	50	0.5	95	.50 x .25 x .18

Micropuck™ Circulators

MODEL #	FREQUENCY (GHz)	BANDWIDTH %	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR MAX.	OPERATING TEMP. °C.	PEAK PWR (W)	AVG. PWR (W)	HEAT SINK TEMP.	SIZE DIA. INCH	SIZE HEIGHT INCH
79*6101	4 - 8	10	18	.5	1.30	-54 to +95	500	25	50	.375	.200
79*9001	8 - 12	10	18	.4	1.30	-54 to +95	50	20	50	.250	.156
79*2001	12 - 18	10	17	.5	1.35	-54 to +95	50	20	50	.250	.156
79A9101	8 - 12	FULL BAND	16	.7	1.45	-54 to +95	50	20	50	.375	.200

Micropuck™ Isolators

89*6101	4 - 8	10	20	.5	1.25	-54 to +95	50	.7	95	.375	.200
89*9001	8 - 12	10	20	.4	1.25	-54 to +95	50	.5	95	.250	.156
89*2001	12 - 18	10	17	.5	1.35	-54 to +95	50	.5	95	.250	.156
89A2201	12 - 18	FULL BAND	17	.7	1.50	-54 to +100	50	.5	95	.250	.156
89A9101	8 - 12	FULL BAND	16	.7	1.45	-54 to +95	50	.5	95	.375	.200

*Specify center frequency when ordering. Model designation will be completed by TRAK.

NOTE: Upper frequency limit cannot exceed 18 GHz.

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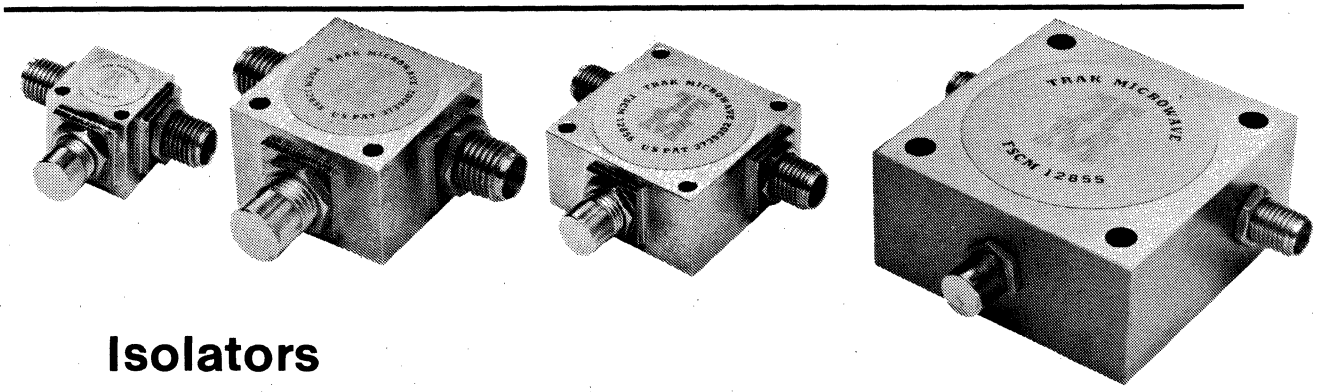
TRAK MICROWAVE

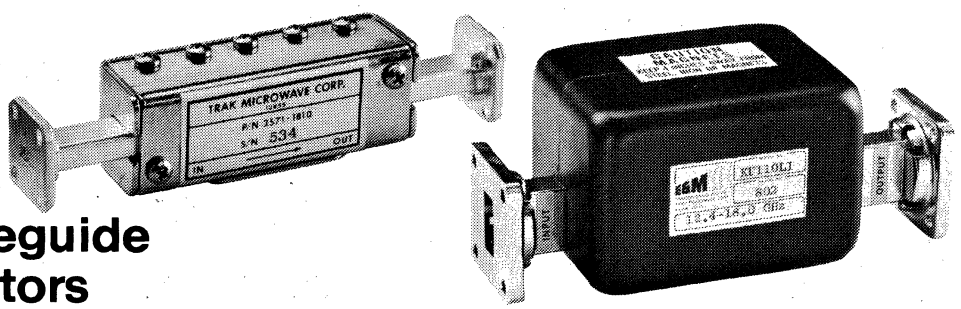
Circulators & Isolators (Octave and Broad Bandwidth Coaxial Type)



Isolators

FREQUENCY RANGE (GHz)	MODEL #	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR max.	OPERATING TEMP. °C.	PEAK POWER KW	AVERAGE POWER WATTS	HEAT SINK TEMP. °C.	SIZE (Inches Nominal) L W H
1.0-2.0	60A1101*	15	0.6	1.40	0 to +50	0.1	1.0	+50	1.60 x 1.60 x 0.75
2.0-4.0	60A3001*	18	0.5	1.30	-10 to +70	0.1	1.0	+70	1.00 x 1.00 x 0.50
2.0-6.0	60A3401	12	1.0	1.65	-10 to +60	0.1	1.0	+60	1.00 x 1.00 x 0.50
2.6-5.2	60A3011*	18	0.5	1.30	-25 to +80	0.1	1.0	+80	1.00 x 1.00 x 0.50
3.0-6.0	60A6301*	18	0.5	1.40	-45 to +85	0.1	1.0	+85	0.75 x 0.75 x 0.50
4.0-8.0	60A6001*	18	0.5	1.30	-45 to +95	0.1	1.0	+95	0.75 x 0.75 x 0.50
5.0-10.0	60A6071*	18	0.5	1.30	-55 to +95	0.1	2.0	+95	0.75 x 0.75 x 0.50
6.0-12.0	60A9201*	16	0.7	1.35	-55 to +95	0.1	1.0	+95	0.75 x 0.75 x 0.50
6.0-18.0	60A2601*	12	1.0	1.67	-40 to +80	0.1	1.0	+80	0.50 x 0.50 x .375
7.0-18.0	60A2171	13	0.75	1.58	-40 to +65	0.5	3.0	+65	0.50 x 0.50 x .375
7.5-18.0	60A2301	14	0.9	1.50	-54 to +95	0.5	3.0	+95	0.50 x 0.50 x 0.50
8.0-12.4	20B9201*	20	0.5	1.30	-55 to +110	0.5	3.0	+95	0.50 x 0.50 x 0.50
8.0-16.0	60A2001*	17	0.5	1.35	-40 to +95	0.5	3.0	+95	0.50 x 0.50 x 0.50
8.0-16.0	60A2501	17	0.5	1.35	-40 to +95	0.1	3.0	+95	0.50 x 0.50 x .375
8.0-18.0	60A2051*	14	0.6	1.50	-54 to +95	0.5	3.0	+95	0.50 x 0.50 x 0.50
12.0-18.0	20B2201*	18	0.5	1.30	-55 to +110	0.5	3.0	+95	0.50 x 0.50 x 0.50
18.0-22.0	20A8021*	18	0.7	1.30	-54 to +95	0.5	3.0	+95	0.50 x 0.50 x .375
18.0-26.5	60A8101*	14	1.0	1.50	-54 to +95	0.1	1.0	+95	0.50 x 0.50 x .375

*These units are normally available from stock.
NOTE: Circulators are also available.



Waveguide Isolators

FREQEUNCY GHz	MODEL #	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR BILATERAL max.	POWER KW PEAK	MAX. W. AVE.	LENGTH INCHES	WEIGHT OUNCES NOMINAL	WAVEGUIDE TYPE	FLANGE TYPE
5.85-8.2	XB951LI	30	1.0	1.15	20	20	5.00	32	RG-50/U	UG-344/U
5.85-8.2	XB103LI	30	1.0	1.15	20	20	6.13	56	RG-50/U	UG-344/U
7.05-10.0	XL103LIA	30	1.0	1.15	5	20	6.13	36	RD-51/U	UG-51/U
8.2-12.4	X956LI	30	1.0	1.10	10	40	4.50	24	RG-52/U	UG-39/U
8.2-12.4	X110LIA*	30	1.0	1.10	5	20	5.00	28	RG-52/U	UG-39/U
10.0-15.0	M111LI	30	1.0	1.15	10	10	5.00	32	WR-75	WR-75
12.4-18.0	Ku915LI	30	1.0	1.10	10	20	4.00	24	RG-91/U	UG-419/U
12.4-18.0	Ku110LI*	30	1.0	1.15	10	10	5.00	28	RG-91/U	UG-419/U
18.0-26.5	2561-1810*	25	1.0	1.25	3	3	4.50	6.0	WR-42	UG-595/U
26.5-40.0	2571-1810*	23	1.5	1.15	3	3	4.125	5.5	WR-28	UG-599/U

*These units are normally available from stock.

Specifications subject to change without notice.

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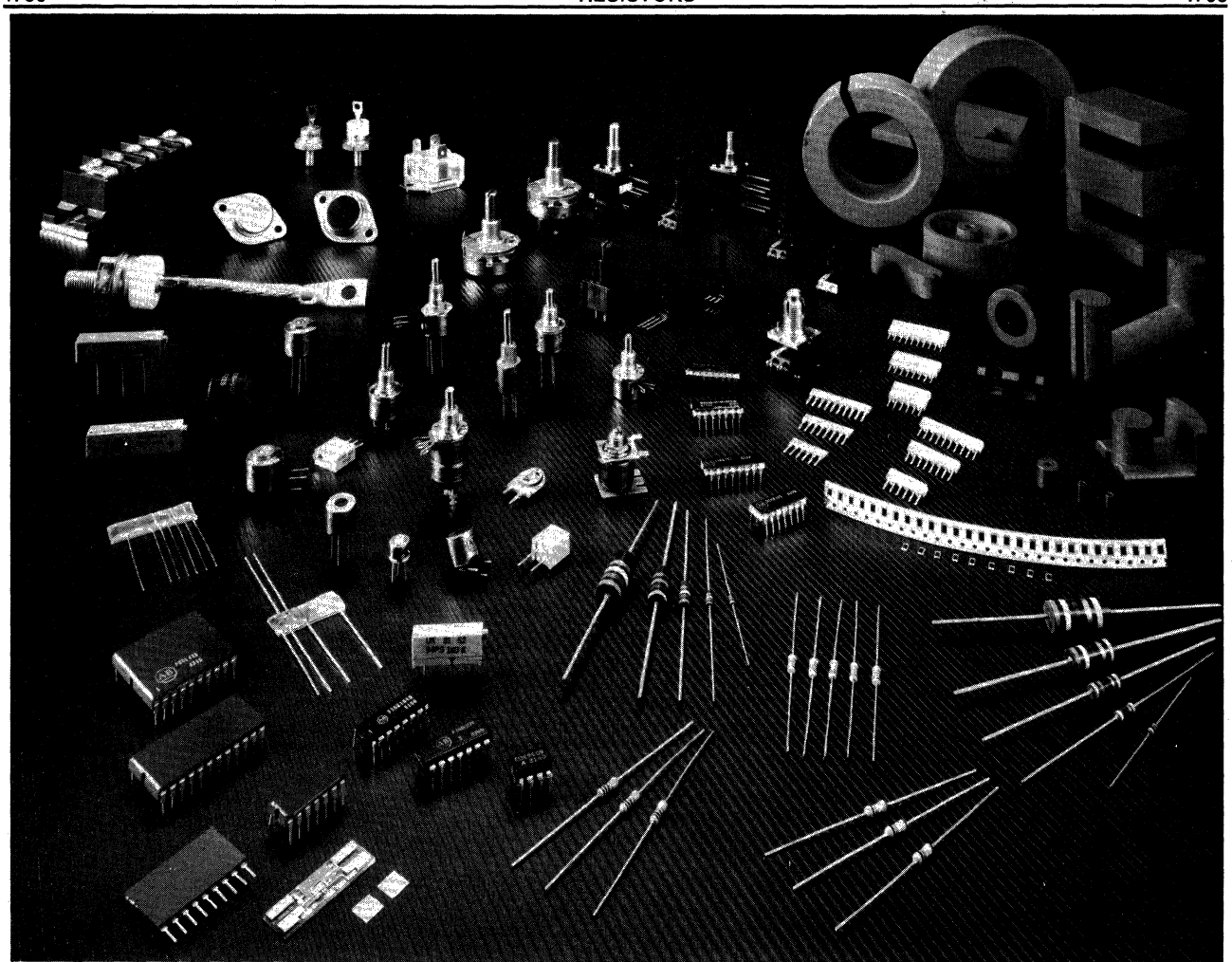


COMPONENT DESCRIPTION			TYPE/SERIES	PAGE
FIXED RESISTORS	Hot-Molded Composition		Types BB, CB, EB, GB, HB Types GM, HM	A•1787
	Metal Film		Types RN, RNK	A•1788
RESISTOR NETWORKS	Thick Film (Cermet) Networks	Ceramic I-SIP	Series 100, 400	A•1789
		Conformal Coated C-SIP	Series 700	A•1790
		Ceramic I-DIP	Series 314, 316	A•1791
		Military DIP	Series 514, 516	A•1792
		Molded Plastic DIP	Series 600	A•1793
	Thin Film (Precision) Networks	Standard DIP	Series F08, F14, F16	A•1794
		Voltage Divider	Series FGST1000	A•1795
		Custom	Series FC, FG	A•1796
SURFACE MOUNT COMPONENTS	Surface Attachable Resistor Arrays SARA		Series 800	A•1798
	Standard Chip Resistors		Type BC	A•1799
TRIMMING POTENTIOMETERS	Cermet		Types S, 81, 85, 90, 94	A•1993
	Hot-Molded Composition		Types F, N, R, Y, BT	A•1993
PANEL POTENTIOMETERS	Cermet		MOD POT®, Type SP	A•1994
	Conductive Plastic		MOD POT®, Types M, 2000	A•1994
	Hot-Molded Composition		MOD POT®, Types J, EJ, G, W, WR	A•1994
POWER TRANSISTOR COMPONENTS (PTC)	High Voltage NPN Darlington Transistors		Various	A•2068
	High Voltage NPN Transistors		Various	A•2068
	Fast Recovery Rectifiers		Various	A•2068
	Power Modules		Various	A•2068
MAGNETIC PRODUCTS	Soft Ferrite Materials		W5, R02, R03	A•1298
	Ceramic Permanent Magnets		M6, M7, M8, M9, M9B, M10	A•1300

ALLEN-BRADLEY

Electronics Group
1201 South Second Street
Milwaukee, Wisconsin 53204

RESISTORS

Manufacturer	Bulk Ceramic	Ceramic Core	Cermet	Carbon Comp.	Film		Wire-wound	Power			Foil	Fused	Chip	Networks	Precision	Features		
					Metallized & Non-metallized	Carbon		2W<R<5W	5 to 15W	>15W						High Voltage >1000V	Non-Inductive	Flame Retardant
Allen-Bradley				A•1787*	A•1788*			A•1787					A•1799	A•1789-A•1797*				
Bourns														A•1800 A•1802				
Caddock Electronics					A•1808-A•1817 A•1822-A•1825 A•1827				A•1810-A•1813	A•1815				A•1818-A•1821 A•1826	A•1808-A•1817 A•1822-A•1825 A•1827	A•1810 A•1811	A•1808-A•1817 A•1822-A•1825 A•1827	
Cal-R							A•1830* A•1831		A•1831*	A•1830*			A•1829	A•1829 A•1831	A•1830 A•1831			
Capar Comps.					A•1828	A•1828		A•1828						A•1828				
Colber							A•1832			A•1832		A•1832						A•1832
Concept	A•1833	A•1833				A•1833	A•1833	A•1833	A•1833								A•1833	A•1833
Corning Electronics														A•1835*				
CTS Berne			A•1836-A•1844											A•1836-A•1844				
Dale Electronics					A•1852* A•1853*	A•1860-A•1863*	A•1854-A•1863*		A•1859 A•1862-A•1864*	A•1860 A•1861* A•1864			A•1853* A•1854	A•1845-A•1858 A•1849*	A•1858* A•1861-A•1863*	A•1859 A•1860		A•1856* A•1857*
Electro Comp		A•1865					A•1865		A•1865	A•1865					A•1865			
Electro-Films													A•1866 A•1867	A•1866 A•1867				
Electronic Precision							A•1868*		A•1868*					A•1868	A•1868*			
E-Systems							A•1869			A•1869								
General Resistance							A•1870								A•1870			
Huntington Electric		A•1871					A•1871											
HyComp					A•1872								A•1872	A•1872	A•1872			
IEI-Iskra Electronics						A•1874*						A•1874*						A•1874
International Comps.					A•1876	A•1876								A•1876				A•1876
ISL Products					A•1877	A•1877	A•1877											
Julie Research							A•1878*		A•1878*					A•1878*	A•1878*			A•1878*
K&M Electronics									A•1879*					A•1879*	A•1879*	A•1879*		
KDI Electronics													A•1881	A•1881*		A•1881		
Kelvin							A•1882* A•1883*	A•1882*		A•1882*				A•1882	A•1882* A•1883*	A•1883*		
KOA Speer Electronics					A•1884*	A•1884*							A•1886	A•1884 A•1885	A•1884*			
Marcon America								A•1887	A•1887									
Meissner							A•1889*		A•1889*						A•1889*		A•1889*	
Mepco//Electra					A•1890*	A•1890*							A•1890*	A•1891	A•1890*			

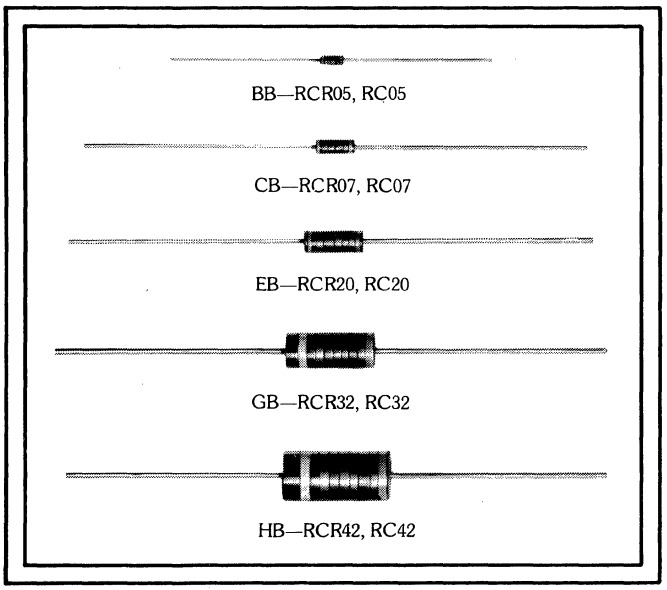
* Mil. Spec.

RESISTORS

Manufacturer	Bulk Ceramic	Ceramic Core	Cermet	Carbon Comp.	Film: Metallized & Non-metallized	Film: Carbon	Wire-wound	Power: 2W<R<5W	Power: 5 to 15W	Power: >15W	Foil	Fused	Chip	Networks	Precision	Features: High Voltage >1000V	Features: Non-Inductive	Features: Flame Retardant
Micro-Ohm					A•1893 A•1896	A•1893 A•1895	A•1892- A•1894			A•1892 A•1894			A•1896	A•1897	A•1892 A•1894	A•1892 A•1894	A•1892	A•1895*
Mills Resistor							A•1899		A•1899					A•1899	A•1899			
Milwaukee Resistor							A•1900- A•1902*			A•1900- A•1905*							A•1900*	A•1900- A•1905*
Mini-Systems													A•1906*	A•1906*				
Murata Erie														A•1907		A•1909		
NIC Components		A•1910			A•1910	A•1910									A•1910		A•1910	A•1910
Nytronics		A•1911*					A•1911*		A•1911*	A•1911*							A•1911*	
Ohmite							A•1912- A•1919*		A•1912- A•1915*	A•1916- A•1918					A•1914*			A•1912- A•1919*
Ohmtek			A•1924										A•1923- A•1925*	A•1923- A•1925*			A•1924	
Pacific Resistor							A•1926 A•1927	A•1927	A•1926						A•1926		A•1927	
Precision Resistive					A•1929*									A•1929	A•1929			
Precision Resistor							A•1930- A•1933								A•1930- A•1933			
RCD Comps.			A•1935*		A•1935*	A•1935*	A•1935*	A•1935*	A•1935*	A•1935*			A•1935*	A•1935*	A•1935*	A•1935*	A•1935*	A•1935*
RCL/Shallcross							A•1936- A•1940*		A•1936*	A•1937* A•1938*		A•1941		A•1941	A•1939* A•1940*		A•1936 A•1937 A•1941	
Resistors, Inc.							A•1942			A•1942							A•1942	
Res-Net					A•1943				A•1943					A•1943	A•1943			
Sohio	A•1944 A•1946								A•1945	A•1944				A•1944 A•1947			A•1944 A•1947	
State of the Art					A•1949 A•1950*								A•1949 A•1950*	A•1951				
Tel Labs					A•1952*		A•1953*		A•1953*						A•1952*			
TRW Resistive Prods.		A•1954*																
Ultronix							A•1960- A•1965*		A•1965*	A•1962 A•1964*	A•1958* A•1959*			A•1959 A•1963	A•1958- A•1960*			A•1964*
Vamistor					A•1967*			A•1967*										
Victoreen					A•1968	A•1968				A•1969 A•1970				A•1969 A•1971	A•1968	A•1969 A•1970		
Vishay					A•1984*		A•1979- A•1983*			A•1977				A•1976 A•1978	A•1972- A•1975* A•1979- A•1985*			
Ward Leonard		A•1986 A•1987															A•1986 A•1987	

* Mil. Spec.

Types BB, CB, EB, GB, HB, GM, HM Hot-Molded Fixed Resistors



Allen-Bradley hot-molded composition resistors are high quality units intended for general purpose use in the electronics industry.

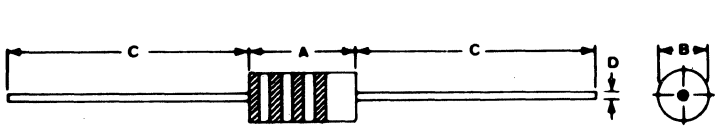
Allen-Bradley Style RCR resistors not only meet all requirements of MIL-R-39008 but also exceed the S level (best level) of Established Reliability of 0.001% failure rate per 1000 hours. And only Allen-Bradley resistors are available in S level reliability in all five wattage sizes over the entire resistance range. The S reliability level is indicated by a yellow 5th color band on the resistor body.

Metal-clad hot-molded resistors (Types GM and HM) are fitted with metal clamps which surround the major portion of the resistor. The metal clamps provide rigid mounting and efficient heat transfer from the resistors to the metal chassis or panels on which they are mounted.

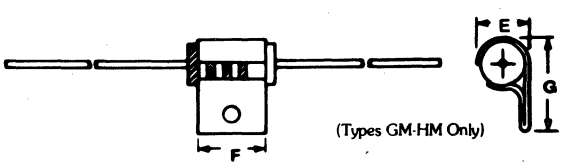
For more information request Publication EC5021-2.1.

SPECIFICATIONS

Type	Power at 70° C	Resistance Range	Tolerance	Voltage Rating (RMS)	Maximum Ambient Temperature	Dimensions in Inches (millimeters)						
						A	B	C	D	E	F	G
BB	1/8 watt	2.7 Ohms to 100 Megohms	±5, 10, 20%	150V	+130° C	0.145 (3,68)	0.062 (1,59)	1.000 (25,40)	0.015 (0,38)			
RCR05		2.7 Ohms to 22 Megohms	±5, 10%									
CB	1/4 watt	2.7 Ohms to 100 Megohms	±5, 10, 20%	250V		0.250 (6,35)	0.090 (2,29)	1.500 (38,10)	0.025 (0,64)			
RCR07		2.7 Ohms to 22 Megohms	±5, 10%									
EB	1/2 watt	1.0 Ohm to 100 Megohms	±5, 10, 20%	350V		0.375 (9,52)	0.140 (3,56)	1.500 (38,10)	0.033 (0,84)			
RCR20		1.0 Ohm to 22 Megohms	±5, 10%									
GB	1 watt	1.0 Ohm to 100 Megohms	±5, 10, 20%	500V	+150° C	0.562 (14,29)	0.225 (5,72)	1.500 (38,10)	0.041 (1,04)			
RCR32		1.0 Ohm to 22 Megohms	±5, 10%									
HB	2 watts	10 Ohms to 100 Megohms	±5, 10, 20%	750V		0.688 (17,46)	0.312 (7,94)	1.500 (38,10)	0.045 (1,14)			
RCR42		10 Ohms to 22 Megohms	±5, 10%	500V								
GM	3 watts	1.0 Ohm to 22 Megohms	±5% ±10%	500V		0.562 (14,29)	0.225 (5,72)	1.500 (38,10)	0.041 (1,04)	0.305 (7,75)	0.438 (11,11)	0.656 (16,67)
HM	4 watts	10 Ohms to 22 Megohms		750V		0.688 (17,46)	0.312 (7,94)	1.500 (38,10)	0.045 (1,14)	0.391 (9,92)	0.562 (14,29)	0.766 (19,45)



(Types BB-CB-EB-GB-HB)

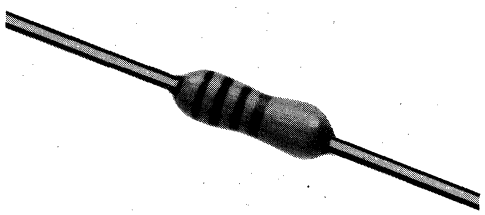


(Types GM-HM Only)

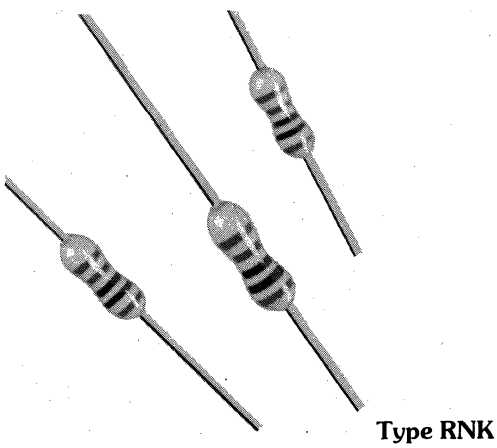
ALLEN-BRADLEY

El Paso, Texas 79935

Types RN, RNK
Metal Film Fixed Resistors



Type RN



Type RNK

1/4 Watt at 70° C
10 Ohms to 1 Megohm
±1% Tolerance, ±5% Tolerance
±100 PPM/° C, ±200 PPM/° C

FEATURES

- Highly Stable Metal Film
- Tight TCR
- Laser Trimmed Element
- High Quality Performance
- Standard Tape Reel Packaging
- Box Packaging
- Automatically Insertable

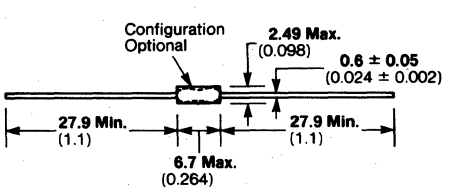
Allen-Bradley metal film resistors are high quality units intended for general purpose use in the electronics industry.

Nichrome resistance element provides stable performance under load, in various environments, and on the shelf. Type RN performance characteristics are better than MIL-R-22684 (RL07) requirements. Type RNK performance characteristics are better than MIL-R-10509 (RN55D) requirements.

For more information request Publication EC5030-2.1 (Type RN) or Publication EC5032-2.1 (Type RNK).

SPECIFICATIONS

Type	Power at 70°C	Resistance Range	Tolerance	RCWV	Maximum Ambient Temperature
RN	¼ Watt	10 Ohms to 1.0 Megohm	± 5, 2%	250V or Less	+ 155°C
RNK	¼ Watt	10 Ohms to 1.0 Megohm	± 1%	250V or Less	+ 155°C



Note: Dimensions in Millimeters (inches).

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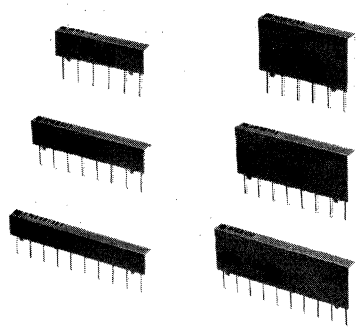


I-SIP
Single In-Line Package

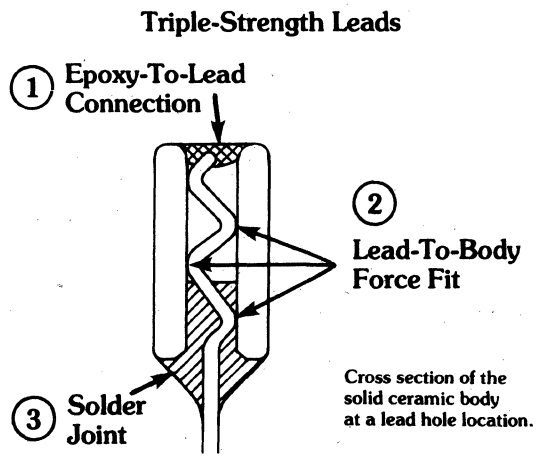
Series 100 400 Cermet Resistor Networks

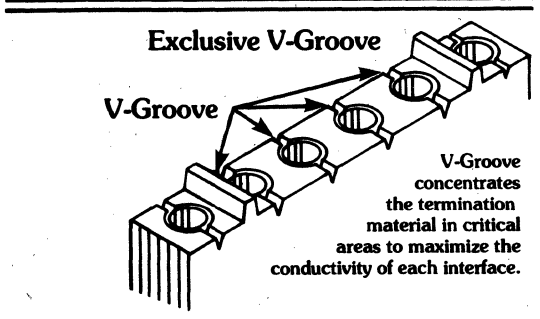
FEATURES

- Solid Ceramic Body, with V-Groove
- Triple-Strength Leads
- 0.100 Inch (2,54mm) Lead Spacing
- Two Package Heights: 0.190 Inch (4,83mm), 0.350 Inch (8,89mm)
- 6, 8 and 10 Pins
- Automatically Insertable
- Permanent Laser Marking
- Part Markings — Side and Top

For more information request Publication EC5420-2.1

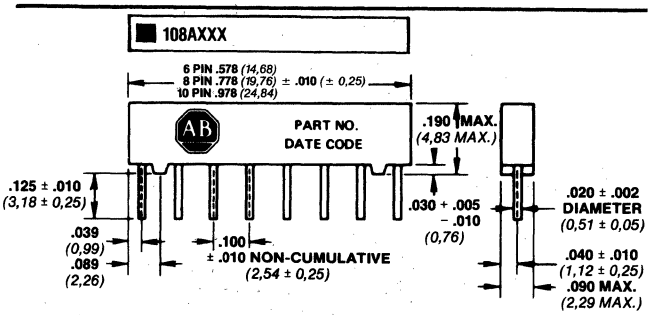
Tough new package



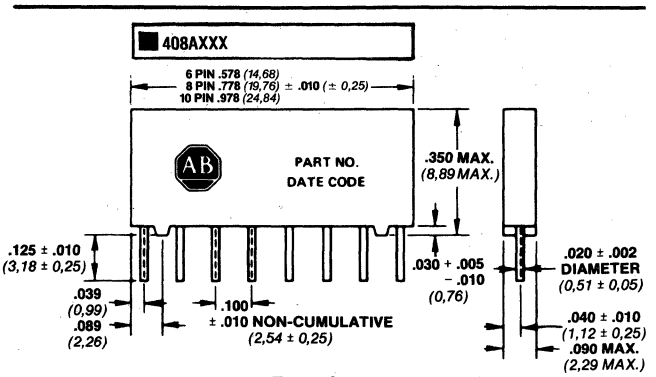


DIMENSIONS

Low profile 100 series



High profile 400 series



Basic dimensions in inches.
Dimensions shown in parentheses are in millimeters.

TOLERANCES
Dimensional Tolerance ±.005 (0,13)
Angular Tolerance ±5° Except as Specified.

NOT TO SCALE

Applications

- Pull-up and pull-down arrays
- Transmission line terminators
- Current limiting resistors
- ECL terminating networks
- A wide array of custom designs

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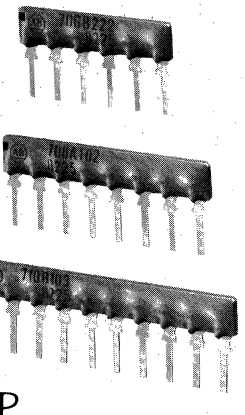
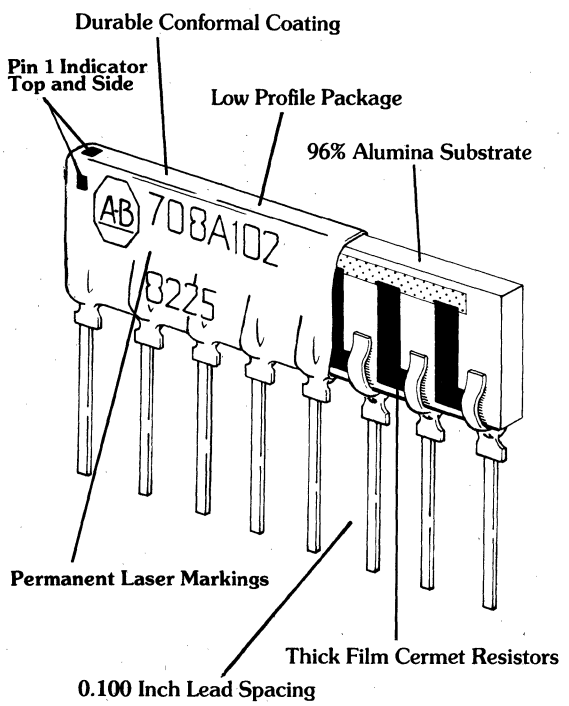


C-SIP
Single In-Line Package

Series 700 Conformal Coated Cermet Resistor Networks

FEATURES

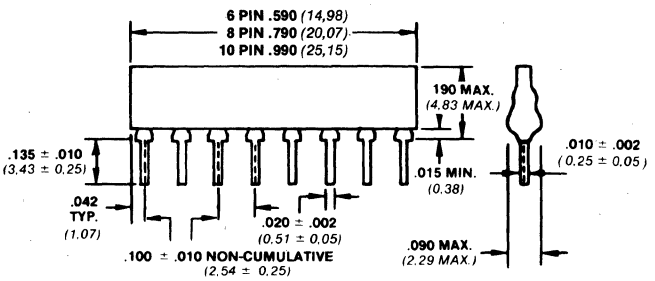
- 96% Alumina Substrate
- Permanently Laser Marked, Top and Side
- 0.100 Inch (2,54mm) Lead Spacing
- Low Package Height
  0.190 Inch (4,83mm)
- 6, 8 and 10 Pins
- Durable Conformal Coating
- Standard Circuits
- High Quality



For more information request Publication EC5440-2.1

DIMENSIONS

Low profile 700 series

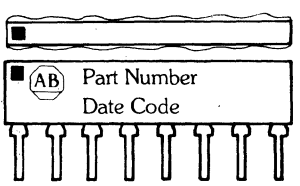


NOT TO SCALE

Basic dimensions in inches.
Dimensions shown in parentheses are in millimeters.

Standard Markings

A-B Logo
A-B Part Number
Date Code
Pin #1 Indicator ■
Top and Side



Applications

— Pull-up and pull-down arrays
— Transmission line terminators
— Current limiting resistors
— ECL terminating networks

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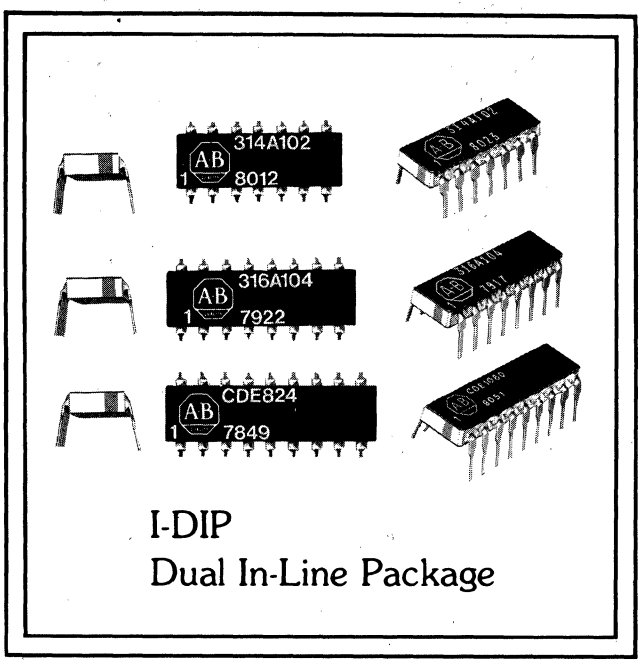


I-DIP
Dual In-Line Package

Series 314, 316 Cermet Resistor Networks

FEATURES

- Solid Ceramic Body
- Solder Coated Leads
- 0.100 Inch (2,54mm) Lead Spacing
- Low Profile
- 14, 16 and 18 Pin Construction
- Automatically Insertable

For more information request Publication EC5410-2.1.

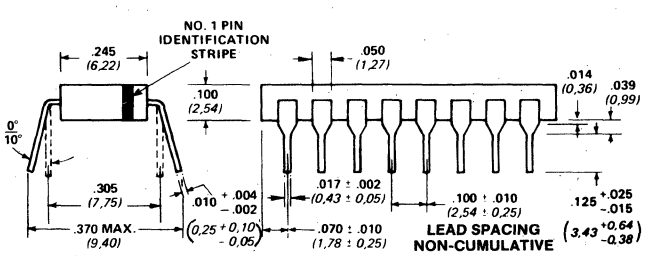
Standard network applications

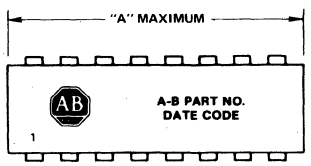
NETWORK								
314A 316A	314B 316B	314E 316E	316LR8 316L08 314L10	314M110 314M120 314M125	314M130	316T110	314X101 316X101	314Z
APPLICATIONS								
Pull-Up Resistor Arrays for Unused TTL Gates Parallel High Speed Circuitry Wired OR Configurations Pull-Down Applications TTL-MOS Interfacing Digital Pulse Squaring	Transmission Line Termination Power Gate Pull-Up Current Limiting Logic Level Translation	Digital Line Termination ECL and TTL Applications	8 BIT R/2R Ladder 10 BIT R/2R Ladder Network for D/A and A/D Converter with Bi Polar or CMOS Switches	Complement the 7520 Series of Core Memory Sense Amps	Core-Memory Sense Line Applications with Two 711 Dual Voltage Comparators	TTL to ECL Translator Network	Interconnect Networks Shorting Applications Matrix Interconnections Test Plugs	Fixed Voltage Attenuation with Impedance Matching

DIMENSIONS

"A" Maximum		Number of Leads
Decimal	Metric	
.745	18,92	14
.845	21,46	16
.945	24,00	18

Basic dimensions in inches.
Dimensions shown in parentheses are in millimeters.





TOLERANCES

Dimensional Tolerance ± .005 (0,13)
Angular Tolerance ± 5° Except as Specified.

NOT TO SCALE

Standard Markings
A-B Logo
A-B Part Number
Date Code
Pin #1

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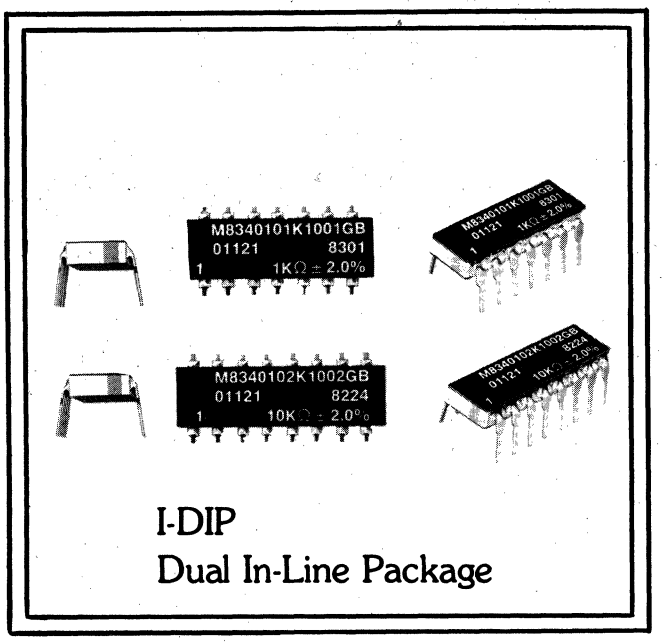


I-DIP
Dual In-Line Package

Series 514, 516 Military Resistor Networks MIL-R-83401

FEATURES

- Solid Ceramic Body
- Solder Coated Leads
- 100% Screened per MIL-R-83401
- Low Profile
- 14 and 16 Pin Construction
- Automatically Insertable
- MIL-R-83401 Qualified

For more information request Publication EC5430-2.1.

General capabilities

Package Style Number of Pins

M83401	Description
01	14 pin DIP
02	16 pin DIP

Schematic Circuit Layout

M83401	Description
A	Isolated resistors
B	Resistors with a common buss

Characteristic Temperature Coefficient

M83401	Description
K	±100 ppm/°C
M	±300 ppm/°C

Tolerance

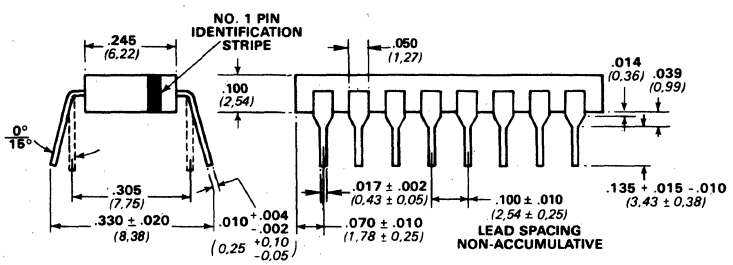
M83401	Description
F	±1%
G	±2%
J	±5%

Resistance Range

33 ohms to 1 megohm

DIMENSIONS

"A" Maximum		Number of Leads
Decimal	Metric	
.745	18,92	14
.845	21,46	16

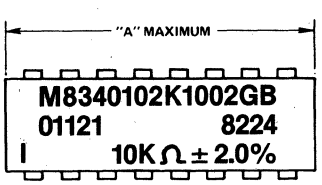


Basic dimensions in inches.
Dimensions shown in parentheses are in millimeters.

TOLERANCES

Dimensional Tolerance ±.005 (0,13)
Angular Tolerance ±5° Except as Specified.

NOT TO SCALE



Standard Markings
Military Part Number
Federal Source Code
Date Code
Pin 1

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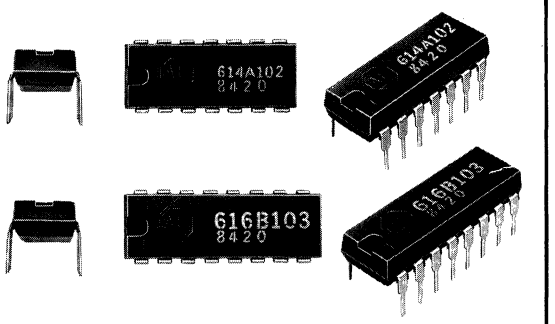


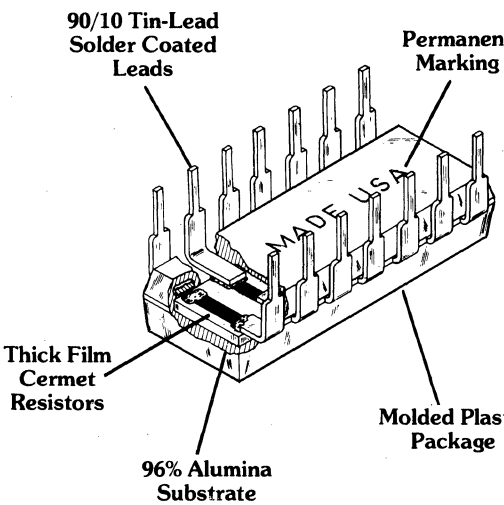
C-DIP
Dual In-Line Package

Series 600 Molded Plastic Cermet Resistor Networks

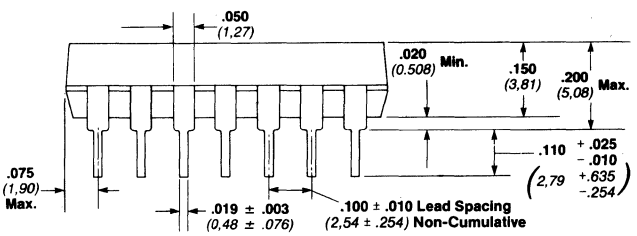
FEATURES

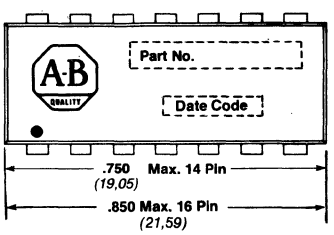
- 96% Alumina Substrate
- Durable Molded Plastic Package
- 0.100 Inch (2,54mm) Lead Spacing
- 14 and 16 Pin Construction
- Automatically Insertable
- Permanent Laser Marking

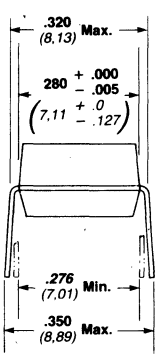
For more information request Publication EC5442-2.1.



DIMENSIONS







Applications

— Pull-up and pull-down arrays
— Transmission line terminators
— Current limiting resistors
— ECL terminating networks
— Logical level translation

Standard Markings

A-B Logo
A-B Part Number
Date Code
Pin #1 Indicator●

NOT TO SCALE

Basic dimensions in inches. Dimensions shown in parentheses are in millimeters.

TOLERANCES

Dimensional Tolerance ± .005 (0,13)
Angular Tolerance ± 5°
Except as Specified.

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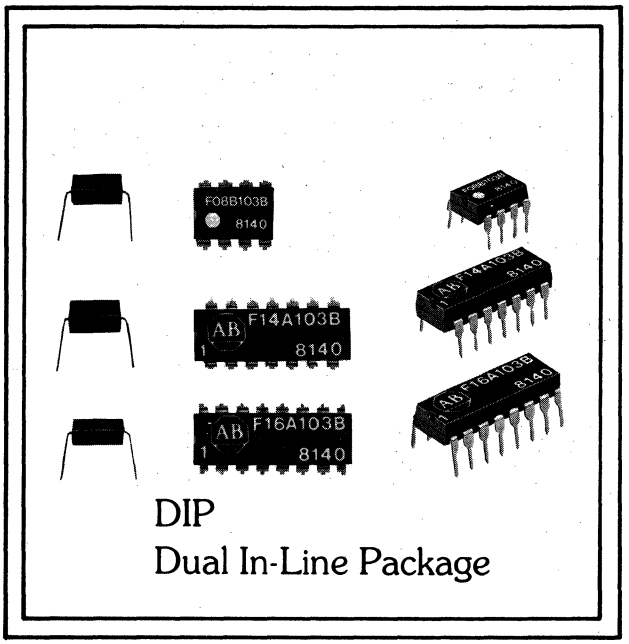


DIP
Dual In-Line Package

Series F08, F14, F16 Thin Film Resistor Networks

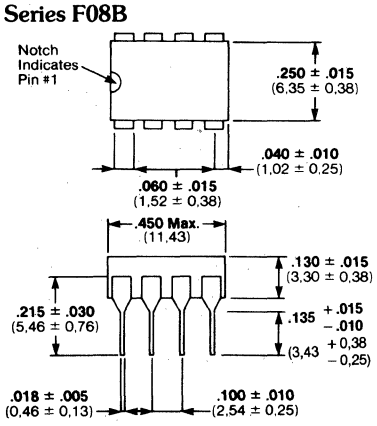
FEATURES

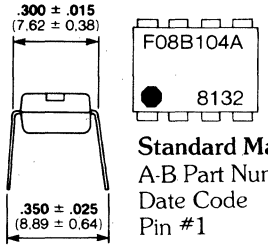
- 99.5% Alumina Substrate
- Molded Epoxy DIP Package
- 0.100 Inch (2,54mm) Lead Spacing
- Low Profile
- 8, 14 and 16 Pin Construction
- Automatically Insertable
- Meets Specifications of Characteristic V of MIL-R-83401

For more information request Publication EC5512-2.1.

DIMENSIONS

Series F08B





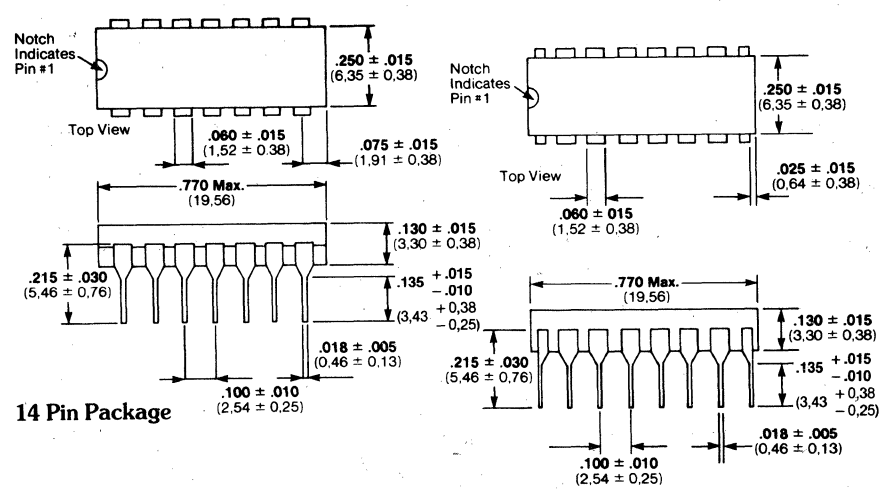
Standard Marking
A-B Part Number
Date Code
Pin #1

Basic dimensions in inches.
Dimensions shown in parentheses are in millimeters.

TOLERANCES
Dimensional Tolerance ±.005 (0,13)
Angular Tolerance ±5° Except as Specified.

NOT TO SCALE

Series F14A, F14B, F16A, and F16B

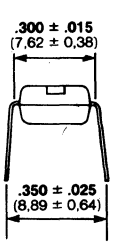


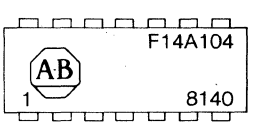
14 Pin Package

16 Pin Package

Standard network applications

NETWORK	
	F08B
F14A	F14B
F16A	F16B
APPLICATIONS	
Pull-Up Resistor Arrays for Open TTL Gates	Matched Pairs
Parallel High Speed Circuitry	Current Limiting
Wired OR Configurations	Transmission Line Termination
Pull-Down Applications	Power Gate Pull-Up
TTL-MOS Interfacing	Logic Level Translation
Digital Pulse Squaring	





Standard Marking
A-B Logo
A-B Part Number
Date Code
Pin #1

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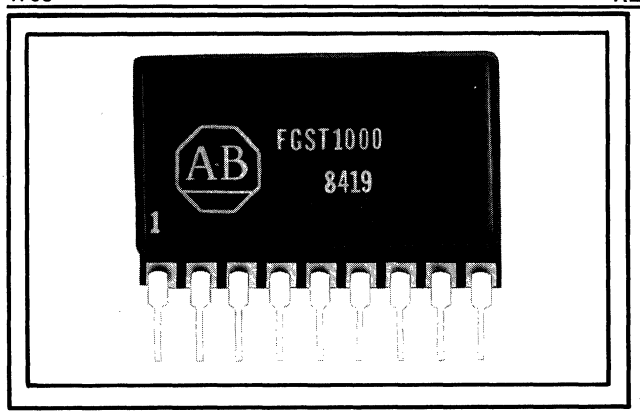
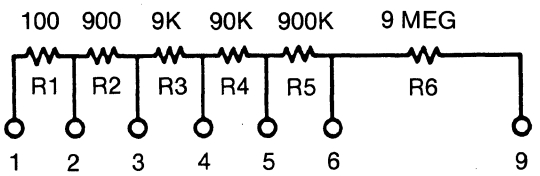


Series FGST1000

Precision Voltage Divider

Network schematic



Applications

— Input attenuation
— Range selection
— Digital instrumentation
— Digital voltmeters
— Digital multimeters

Standard
Thin Film Resistor Networks

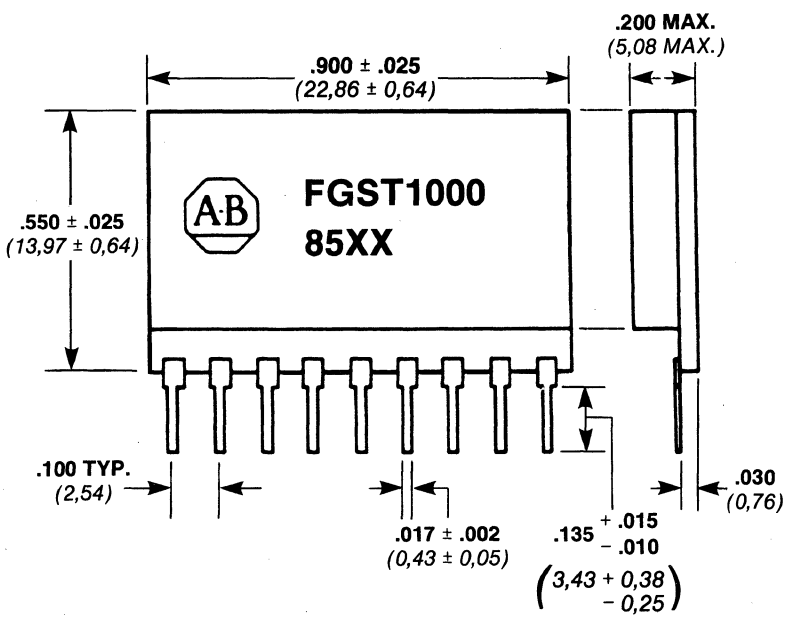
FEATURES

- 10 Megohms Range
- 6 Decades Attenuation
- 0.033% Resistance Ratio Match
- 0 to 1000 Volts
- Operating Temperature — 0°C to 70°C
- Storage Temperature — −65°C to 150°C

For more information request Publication EC5520-2.1.

DIMENSIONS

Series FGST1000



Basic dimensions in inches.

Dimensions shown in parentheses are in millimeters.

TOLERANCE
Dimensional Tolerance ±.015 (0,38)
Except as Specified.

NOT TO SCALE

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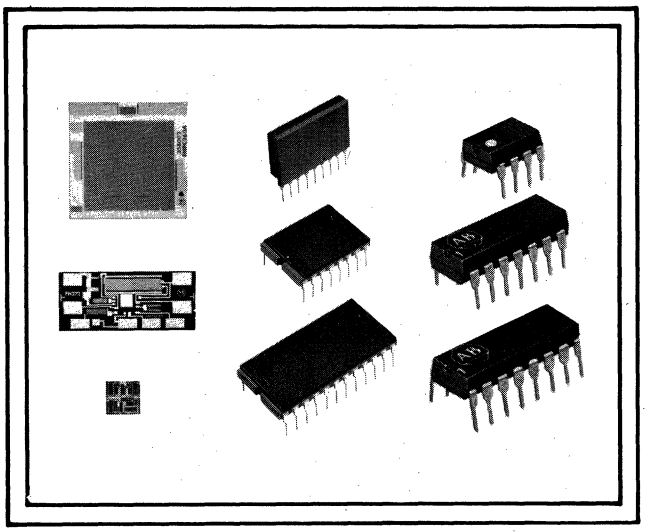


Series FC, FG

Precision Thin Film Custom Resistor Networks

FEATURES

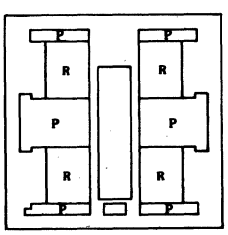
- 1K Ohms to 10 Megohms
- ± 0.015% Tolerance
- ± 0.015% Ratio
- ± 25 ppm/°C TCR
- ± 5 ppm/°C TCR Tracking
- SIP Package (ceramic)
- DIP Packages (molded and ceramic)
- Chip Resistor Networks (alumina or glass)
- Hybrid Network Substrates (alumina or glass)

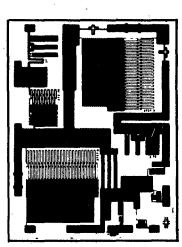
For more information request Publication EC5510-2.1.

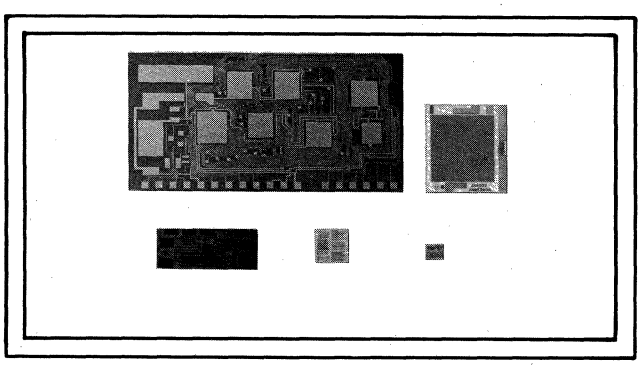
Applications

These precision networks are ideally suited for use on any electronic equipment requiring close tolerances and/or low temperature coefficient resistors. Some of these applications are listed below.

— Ladder networks
— Digital multimeters
— Current summing applications
— Precision attenuators
— A/D and D/A converters
— Communication equipment
— Precision voltage dividers
— Telemetry equipment
— Coding and decoding circuitry
— Measurement bridges
— Paging systems







Hybrid network substrates — Allen-Bradley hybrid network substrates contain resistors, bonding pads and interconnections used in producing hybrid networks. Allen-Bradley does not manufacture complete hybrid circuits, but does manufacture the basic hybrid network substrates.

Termination and bonding pad material — Gold, with a minimum thickness of 5000A, is used for all termination pads, bonding pads and interconnections. This material is compatible with ultrasonic and thermocompression bonding methods for attaching gold or aluminum wire, integrated circuit dice, LID's or beam leaded IC's. Chip capacitors can be attached by reflow solder methods.

Substrate material — Glass: Corning 7059 glass (Barium Alumino Silicate - electrically inert [Alkali-free]) .032 ± .005 inch (0,81 ± 0,13mm) thick. Ceramic: 99.5% Alumina, .010 ± .001 inch (2,54 ± 0,3mm) thick.

User trimmable option — Chip and hybrid network resistors can be trimmed to tolerance by Allen-Bradley or, if needed, resistors can be

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Greensboro, North Carolina 27405

designed for active trimming by the user during final hybrid assembly operations to meet predetermined functional requirements. The amount of adjustment available is dependent on the initial resistance value, resolution, final value and available substrate area. The active trimming results in a positive resistance change only and can be done by mechanical methods or a laser. These networks are referred to as user trimmable resistor networks.

Standard substrate sizes (in inches) —

.150 x .150	.350 x .150	.200 x .200	.600 x .200
.250 x .150	.450 x .150	.400 x .200	.250 x .250

Bonding pad sizes — 5 mils x 5 mils minimum.

Resistance range — 1K ohms to 10 megohms.

Tolerances — Absolute: as low as ± 0.015% at + 25°C. Ratio: as low as ± 0.015% at + 25°C.

TCR — ± 25 ppm/°C
TCRT — ± 5 ppm/°C

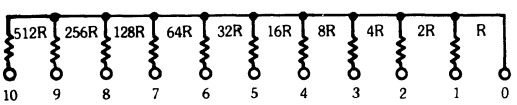
Temperature ranges of operation — −55°C to +125°C or 0°C to +70°C. Other ranges available.

Power rating — Up to 50mw per resistor.

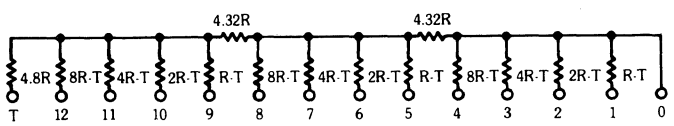
DIAGRAMS

Thin film custom resistor network suggestions

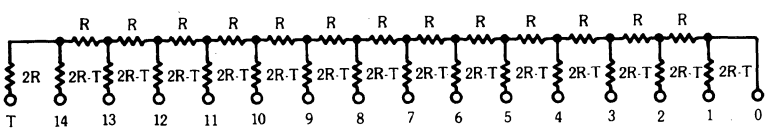
A/D — D/A Converter Networks



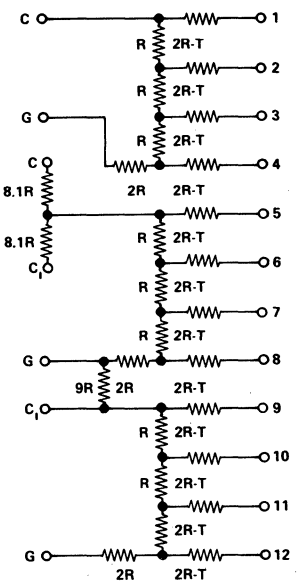
Binary Code — Summing Ladder Network



1-2-4-8 BCD Code Ladder Network

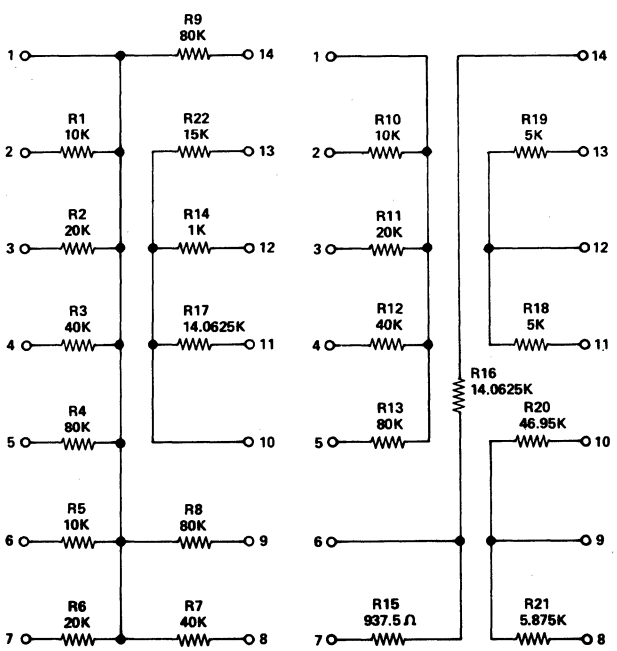


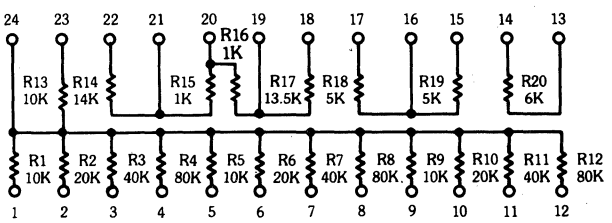
Binary Code — R/2R Voltage Ladder Network



1-2-4-8 BCD Code Ladder Network

A/D - D/A Converter Networks for use with integrated circuit quad current switches





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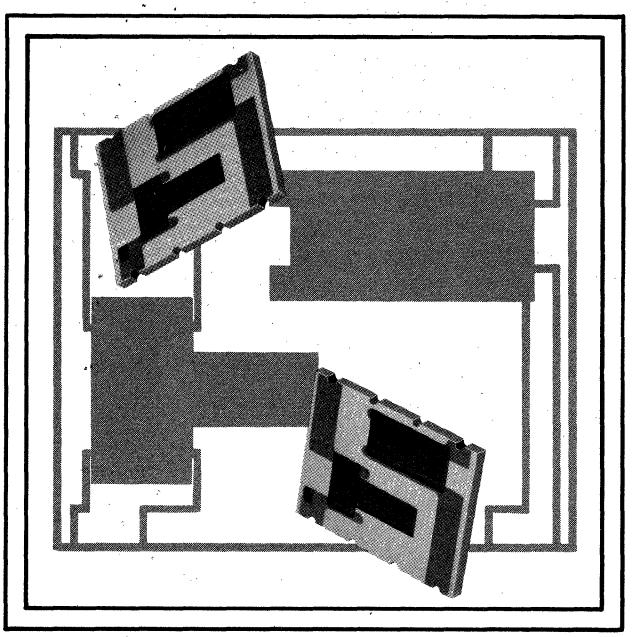

Series 800 SARA Surface Attachable Resistor Arrays

125mW at 70°C
10 Ohms to 10 Megohms
± 2% Tolerance
± 200 ppm/°C TCR
± 100 ppm/°C TCR Tracking

FEATURES

- Alumina Substrate
- Thick Film Resistor Element
- Environmental Protection Layer
- Surface Mount
- Standard and Custom Circuitry
- User Trimmable
- Standard and Custom Substrate
- Footprints Compatible with DIP and SOIC

For more information request Publication EC5450-2.1.

Outstanding characteristics

Surface mountable — Solder bumped termination pads allow surface mount to alumina, glass epoxy PWB's or porcelainized metal. Compatible with automatic placement equipment.

Proven technology — Thick film resistance elements on 96% minimum alumina substrate. Over 20 years of technological and manufacturing experience.

Precision performance — Tight performance characteristics provided by the thick film resistance material resulting in tight tolerance and tight TCR.

Cost effective — Enables size and weight reduction with lower assembly cost.

Electrical specifications

Nominal resistance range — 10 Ohms to 10 Megohms

Resistor tolerance — Absolute ± 2% Standard
± 1% Available
Ratio ± 1% Standard
±.5% Available

Temperature coefficient of resistance (TCR) — ± 200 ppm/°C Standard
± 100 ppm/°C Available

TCR tracking — ± 100 ppm/°C Standard
± 50 ppm/°C Available

Power dissipation rating individual resistors — 125mW at 70°C

Temperature range of operation —

Industrial	0° to 70°C
Automotive	-40°C to 85°C
Military	-55°C to 125°C

Package power [1] ratings —

SARA Footprint	Package Power on Glass Epoxy PWB to 70°C
8 pin SOIC	.25W
14 pin SOIC	.40W
16 pin SOIC	.50W
8 pin DIP	.30W
14 pin DIP	.50W
16 pin DIP	.60W

(Ratings apply to devices meeting standard DIP and SOIC footprints.)

[1] At 70°C power derates linearly from full rated power to 0 wattage at +125°C.

Rated continuous working voltage (RCWV) — Based on nominal resistance (R) in ohms is individual Resistor $\sqrt{\text{Power Rating} \times R}$ or 100 volts, whichever is less.

Temperature range of storage — -65°C to 150°C.

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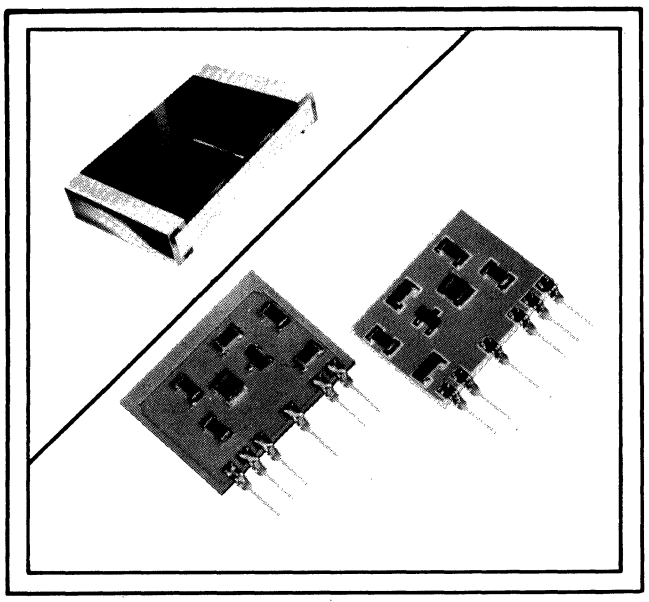
Type BC Chip Resistor



1/8 Watt at 70° C
±5%, 200 PPM/° C
±1%, 100 PPM/° C
Zero Ohm Jumper

FEATURES

- Thick Film Resistance Element
- High Purity Alumina Substrate
- Glass Passivated
- Environmental Protecting Epoxy Coating
- Tight TCR
- Standard Size, 1.6 x 3.2 x 0.6 mm
- Wrap-around Termination
- Inner Electrode Protection
- Wave or Reflow Solderable
- Surface Attachable

For more information request Publication EC5110-2.1.

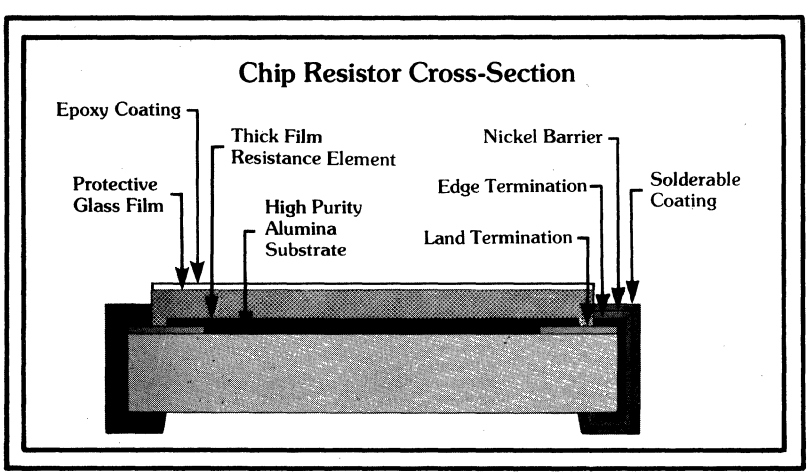
Nominal resistance range —
5% - 10 ohms to 2.2 megohms, E24 series
1% - 49.9 ohms to 2.2 megohms, E96 series.
Higher values available upon request.

Standard Resistance Values — 5% (E24)

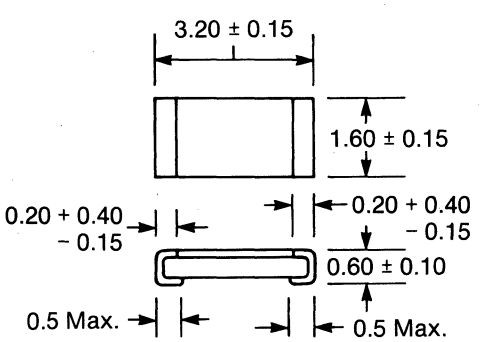
10	15	22	33	47	68
11	16	24	36	51	75
12	18	27	39	56	82
13	20	30	43	62	91

Standard Resistance Values — 1% (E96)

10.0	12.1	14.7	17.8	21.5	26.1	31.6	38.3	46.4	56.2	68.1	82.5
10.2	12.4	15.0	18.2	22.1	26.7	32.4	39.2	47.5	57.6	69.8	84.5
10.5	12.7	15.4	18.7	22.6	27.4	33.2	40.2	48.7	59.0	71.5	86.6
10.7	13.0	15.8	19.1	23.2	28.0	34.0	41.2	49.9	60.4	73.2	88.7
11.0	13.3	16.2	19.6	23.7	28.7	34.8	42.2	51.1	61.9	75.0	90.9
11.3	13.7	16.5	20.0	24.3	29.4	35.7	43.2	52.3	63.4	76.8	93.1
11.5	14.0	16.9	20.5	24.9	30.1	36.5	44.2	53.6	64.9	78.7	95.3
11.8	14.3	17.4	21.0	25.5	30.9	37.4	45.3	54.9	66.5	80.6	97.6



DIMENSIONS



Note: All dimensions in millimeters.

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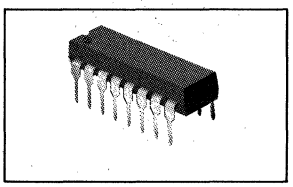
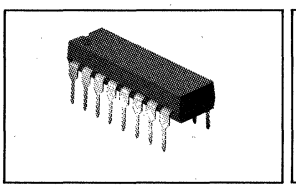
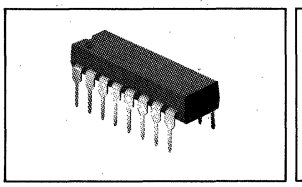
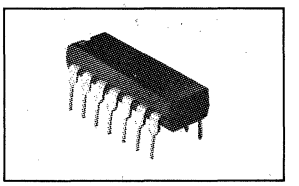
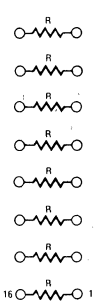
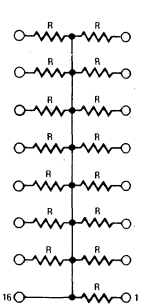
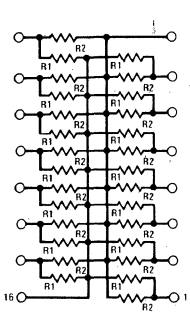
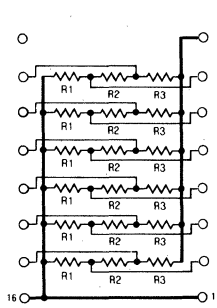
BOURNS®

BOURNS NETWORKS, 1200 Columbia Avenue, Riverside, CA 92507
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 • TEL (714) 781-5050

BOURNS® DIP RESISTOR NETWORKS

4114R-001 4116R-001	4114R-002 4116R-002	4114R-003 4116R-003	4114R-008
Dual-in-line isolated resistor circuits	Dual-in-line bussed resistor circuits	Dual-in-line terminator	TTL to ECL translator

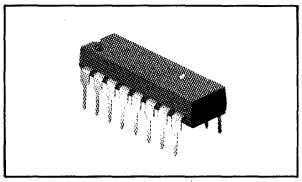
	4114R-001 4116R-001	4114R-002 4116R-002	4114R-003 4116R-003	4114R-008
Standard Resistance Range	22 ohms to 2.2 megohms	22 ohms to 2.2 megohms	R1 / R2 180 ohms / 390 ohms 220 ohms / 270 ohms 220 ohms / 330 ohms	R1 / R2 / R3 180 ohms / 270 ohms / 820 ohms
Operating Temperature	–55°C to +125°C ambient	–55°C to +125°C ambient	–55°C to +125°C ambient	–55°C to +125°C ambient
Resistance Tolerance	±2% (50 ohms to 2.2 megohms ±1 ohm (22 ohms to 49 ohms)	±2% (50 ohms to 2.2 megohms) ± 1 ohm (22 ohms to 49 ohms)	±2% (50 ohms to 2.2 megohms)	±2% (50 ohms to 2.2 megohms)
Insulation Resistance	10,000 megohms minimum	10,000 megohms minimum	10,000 megohms minimum	10,000 megohms minimum
Power Rating @ 75°C	(Derating curve) Package 14 pin - 2 watts 16 pin - 2.25 watts Single resistor - 0.25 watt	Package 14 pin - 2 watts 16 pin - 2.25 watts Single resistor - 0.125 watt	4114R-003 Package - 2 watts Single resistor - .125 watt 4116R-003 Package - 2.25 watts Single Resistor - .125 watt	Package - 2.0 watts Single resistor - 0.125 watt
Temperature Coefficient	±100ppm/°C (50 ohms to 2.2 megohms) ±250ppm/°C (<50 ohms)	±100ppm/°C (50 ohms to 2.2 megohms) ±250ppm/°C (<50 ohms)	±100ppm/°C	±100ppm/°C
Standard Load Life	±1.0%	±1.0%	±1.0%	±1.0%
Schematic (Highest pin configurations shown)				

Custom Resistor Networks are available in both DIP and SIP configurations. Specifications subject to change without notice.

BOURNS®

BOURNS® SIP RESISTOR NETWORKS

4114R-064
4116R-064
Logic memory network



Pass Thru	Pull-Up
*R1	*R2
20 ohms	1K
30 ohms	1K
40 ohms	1K

-55°C to +125°C ambient

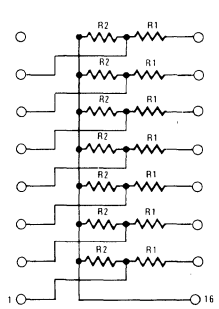
±2% or ±1 ohm

10,000 megohms minimum

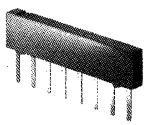
Package
14 pin - 2 watts
16 pin - 2.25 watts
Single resistor - 0.125 watt

±100ppm/°C (50 ohms to 2.2 megohms)
±250ppm/°C (< 50 ohms)

±1.0%



4306R-101
4308R-101
4310R-101
Single-in-line bussed



22 ohms to 2.2 megohms

-55°C to +125°C ambient

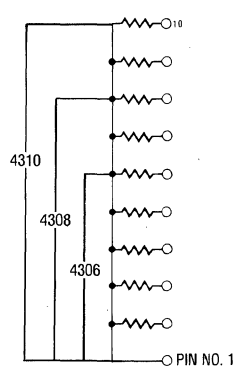
±2% (50 ohms to 2.2 megohms)
±1% (22 ohms to 49 ohms)

10,000 megohms minimum

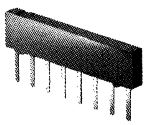
	6	8	10
	watt		
Package	0.75	1.0	1.25
Single resistor	0.2	0.2	0.2

±100ppm/°C (50 ohms to 2.2 megohms)
±250ppm/°C (< 50 ohms)

±1.0%



4306R-102
4308R-102
4310R-102
Single-in-line isolated



22 ohms to 2.2 megohms

-55°C to +125°C ambient

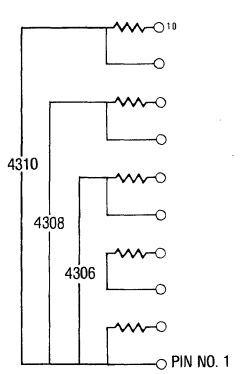
±2% (50 ohms to 2.2 megohms)
±1% (22 ohms to 49 ohms)

10,000 megohms minimum

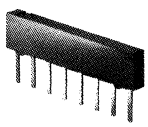
	6	8	10
	watt		
Package	0.75	1.0	1.25
Single resistor	0.2	0.2	0.2

±100ppm/°C (50 ohms to 2.2 megohms)
±250ppm/°C (< 50 ohms)

±1.0%



4306R-104
4308R-104
4310R-104
Single-in-line dual terminator



R1	R2
180 ohms	390 ohms
220 ohms	270 ohms
220 ohms	330 ohms
3000 ohms	6200 ohms

-55°C to ±125°C ambient

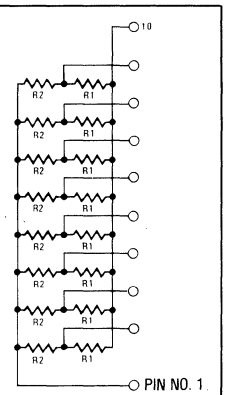
±2% (50 ohms to 2.2 megohms)
±1% (22 ohms to 49 ohms)

10,000 megohms minimum

	6	8	10
	watt		
Package	0.75	1.0	1.25
Single resistor	0.20	0.25	0.25

±100ppm/°C

±1.0%

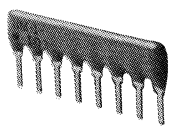
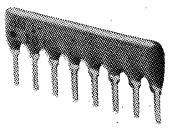
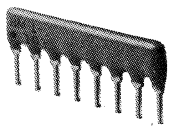
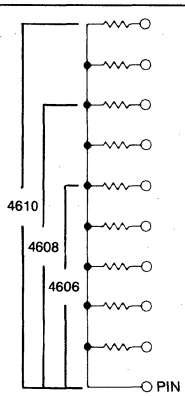
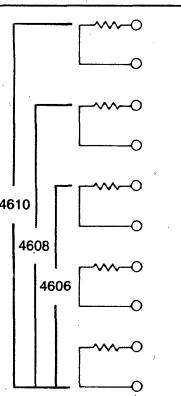
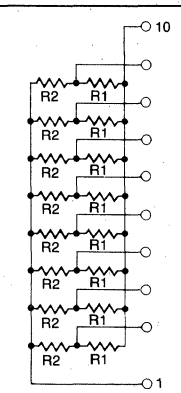


*Other values available.

Specifications subject to change without notice.

BOURNS®

BOURNS® MODEL 4600 SERIES CONFORMAL COATED SIP NETWORKS

	4600X-101 Bussed, pin 1 common to all resistors 4-14 pins available	4600X-102 Isolated resistors 4, 6, 8, 10, 12 or 14 pins available	4600X-104-R1/R2 Dual terminator 4-14 pins available
			
Resistance Range	22 ohms to 2.2 megohms	22 ohms to 2.2 megohms	R1 / R2 180 ohms / 390 ohms 220 ohms / 270 ohms 220 ohms / 330 ohms 3000 ohms / 6200 ohms other values available
Operating Temperature	–55°C to +125°C ambient	–55°C to +125°C ambient	–55°C to +125°C ambient
Resistance Tolerance	±2% or ±1 ohm	±2% or ±1 ohm	±2% or ±1 ohm
Insulation Resistance	10,000 megohms minimum	10,000 megohms minimum	10,000 megohms minimum
Power Rating @75°C* (low profile)	6 / 8 / 10 pin, watt Package: 0.75 / 1.0 / 1.25 Single resistor: 0.2 / 0.2 / 0.2	6 / 8 / 10 pin, watt Package: 0.75 / 1.0 / 1.25 Single resistor: 0.3 / 0.3 / 0.3	6 / 8 / 10 pin, watt Package: 0.75 / 1.0 / 1.25 Single resistor: 0.20 / 0.20 / 0.20
Temperature Coefficient	±100ppm/°C (≥50 ohms) ±250ppm/°C (<50 ohms)	±100ppm/°C (≥50 ohms) ±250ppm/°C (<50 ohms)	±100ppm/°C
Standard Load Life	±1.0%	±1.0%	±1.0%
Profiles	Maximum seated package height low - 0.200" medium - 0.250" high - 0.350"	Maximum seated package height low - 0.200" medium 0.250" high - 0.350"	Maximum seated package height low - 0.200" medium 0.250" high - 0.350"
Schematics			

*Higher power ratings are available on medium or high profile.

BOURNS® TRIMMERS · PANEL CONTROLS RESISTOR NETWORKS PRECISION POTENTIOMETERS IN STOCK FROM

ADVACOM, INC.

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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

High Performance Film Resistors

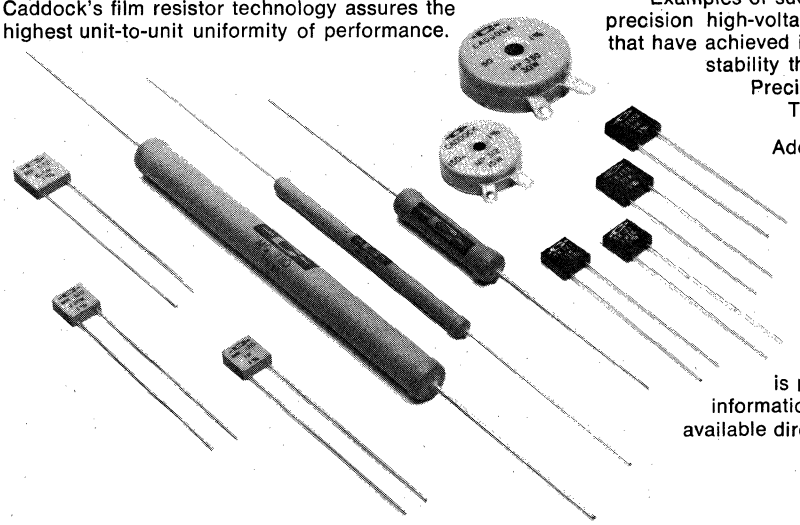
This 20th Edition of the Caddock Electronics General Catalog describes over 150 in-production models of precision discrete resistors and resistors networks that utilize Caddock's high-stability, extended-life Micronox® and Tetrinox™ resistance films. With 20 years of experience and an exceptional record of in-circuit performance and reliability, Caddock Electronics continues to lead the industry in the development, production and on-time delivery of high performance film resistors.

Caddock's Advanced Resistor Technology Provides Many Exceptional Performance Advantages:

Caddock's advanced resistor technology began in 1962 with the introduction of Micronox® harsh-environment high-power and high-voltage resistors. The Caddock technology was further extended in 1975 with the development of the Tetrinox™ resistance system that made possible the introduction of low TC, ultra-stable resistors and resistor networks.

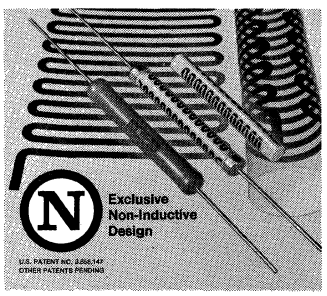
These technological advances have provided the electronics industry with a selection of precision resistor types that achieve many high-performance advantages:

- **Precision** — Tolerances as close as 0.01%.
- **Long-Term Stability** — Better than 0.005% per 1000 hours of operation under full load operating conditions.
- **Higher Power Ratings** — Up to five times higher than other resistor technologies.
- **High Operating Temperatures** — Up to +275°C.
- **Ultra-Low Temperature Coefficients** — Standard to less than 10 PPM/°C and custom values as low as 2 PPM/°C.
- **Unit-to-Unit Uniformity** — The inherent consistency of Caddock's film resistor technology assures the highest unit-to-unit uniformity of performance.



Caddock's Exclusive Non-Inductive Performance Is Available in Both High-Power and High-Voltage Micronox® Film Resistors.

For wide-band, high frequency applications, the advantages of Caddock's Exclusive Non-Inductive Design are available in most models of Micronox® resistors. This special serpentine pattern provides for neighboring lines to carry currents in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor.



The result is a truly non-inductive resistor that is about as inductive as a straight piece of wire the length of the resistor body. This efficient design means faster settling times and minimum distortion in all types of high frequency circuits.

The High-Performance Capabilities of Caddock Film Resistors Can Provide Improved Accuracy and Stability to Precision Circuitry:

Because of the special advantages of Caddock's resistance film technology, Caddock High Performance Film Resistors are often specified in the precision circuits that ultimately establish the overall accuracy and stability of the equipment.

Examples of such applications include many types of precision high-voltage supplies and voltage references that have achieved improved accuracy and extended-life stability through the use of Caddock Type MG Precision High-Voltage Resistors and Type T912 Precision Resistor Networks.

Additional examples of the application of this advanced resistor technology include the industry-wide use of Caddock Type 1776 and Type 1787 Precision Decade Divider Resistors in the signal input circuits of laboratory and bench-type digital voltage and current measuring instruments.

An introduction and index to these Caddock resistor technologies is provided on the next page. Additional information and technical assistance is also available directly from our technical staff.

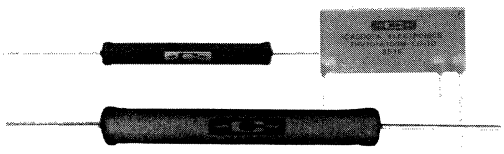
We welcome your call.

CADDOCK
ELECTRONICS, INCORPORATED.

Index to Caddock High Performance Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Precision High Voltage Resistors and High Voltage Divider Networks



Type MG Precision High Volage Resistors
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Type TG Precision Low TC High Voltage Resistors
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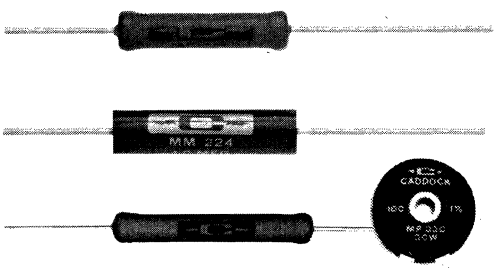

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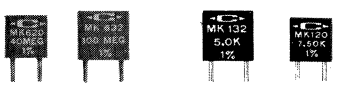

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Type MK632 and MK620 Extended Resistance Range
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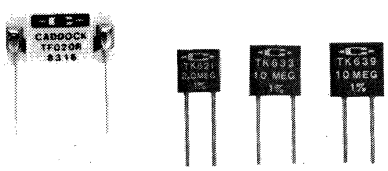

Type TK Temp-Stable Precision Film Resistors
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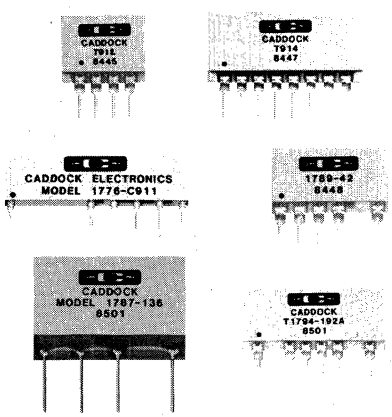

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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MG Precision High-Voltage Resistors

Highest Long-Term Stability Combined with Precision Tolerances and TC of 80 PPM/°C.

Caddock's Micronox® resistance films are the source of the Type MG Precision High Voltage Resistors' outstanding combination of performance features:

- Single-resistor values as high as 2000 Megohms.
- Maximum continuous operating voltages as high as 30,000 volts.
- Overvoltage capabilities of 150% of the standard working voltages for all models and values.
- Resistance Tolerances from ± 1.0% to ± 0.1%.
- Standard temperature coefficient of 80 PPM/°C in combination with resistance tolerances as tight as ±0.1%.

- plus

- Typical extended life stability of 0.02% per 1000 hours as demonstrated by reliability testing.

This exceptional performance has been proven through many years of use in equipment that demands the highest reliability and stability, including TWT amplifiers, X-ray systems, geophysical instruments and medical electronics.

Special High-Voltage Pulse Performance

All power ratings and maximum working voltage ratings are for continuous duty. These ratings are based on pre-stress voltage levels applied during the manufacturing process to provide for stable resistor performance even under momentary overload conditions.

Maximum working voltages up to 60% higher than the values listed in the table can be achieved through special factory conditioning, provided the power ratings are not exceeded. To specify maximum working voltages above the values listed in the table, add a "-15" to the model number (Example: MG750-15) and identify the overvoltage value with the initial order. (Note that the standard overload and overvoltage ratings do not apply to the "-15" resistors.)

Non-Inductive Performance

Caddock's patented Exclusive Non-Inductive Design uses a serpentine resistive pattern that provides for neighboring lines to carry currents in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor. This efficient non-inductive construction is accomplished without derating of any performance advantages.

Most models are available with Caddock's Patented Non-Inductive Design. To specify this performance, add an "N" to the standard model number. (Example: MG750N)

Model No.	Wattage	Max. Continuous Oper. Volt	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance		Dimensions		
						Min.	Max.	A	B	C
MG650	.5	600	225°C	750	80	200Ω	5 Meg	.313 ±.020	.094 ±.015	.025 ±.002
MG655	.5	600	225°C	750	80	200Ω	8 Meg	.313 ±.030	.109 ±.015	.025 ±.002
MG660	.6	1,000	225°C	750	80	400Ω	10 Meg	.500 ±.030	.094 ±.015	.025 ±.002
MG680	.8	2,000	225°C	750	80	600Ω	20 Meg	.750 ±.030	.094 ±.015	.025 ±.002
MG710	1.0	4,000	225°C	750	80	800Ω	50 Meg	1.000 ±.040	.094 ±.015	.025 ±.002
MG712	.6	1,000	225°C	750	80	800Ω	20 Meg	.400 ±.060	.140 ±.030	.025 ±.002
MG714	1.0	1,000	225°C	750	80	200Ω	20 Meg	.562 ±.060	.150 ±.030	.032 ±.002
MG715	1.0	2,000	225°C	750	80	400Ω	50 Meg	.750 ±.060	.140 ±.030	.025 ±.002
MG716	1.5	4,000	225°C	750	80	600Ω	75 Meg	1.000 ±.060	.140 ±.030	.025 ±.002
MG717	1.5	2000	225°C	750	80	600Ω	75 Meg	.710 ±.050	.240 ±.030	.040 ±.002
MG720	2.0	6,000	225°C	750	80	1K	150 Meg	1.500 ±.080	.140 ±.030	.025 ±.002
MG721	2.0	4,000	225°C	750	80	200Ω	100 Meg	1.000 ±.050	.240 ±.030	.040 ±.002
MG725	2.5	10,000	225°C	750	80	1.5K	200 Meg	2.000 ±.080	.140 ±.030	.025 ±.002
MG730	3.0	6,000	225°C	1000	80	500Ω	250 Meg	1.500 ±.080	.240 ±.030	.040 ±.002
MG735	3.6	10,000	225°C	1000	80	750Ω	300 Meg	2.000 ±.080	.240 ±.030	.040 ±.002
MG745	5.0	15,000	225°C	1000	80	1K	500 Meg	3.000 ±.100	.240 ±.030	.040 ±.002
MG750	5.0	10,000	225°C	1000	80	400Ω	500 Meg	2.125 ±.060	.315 ±.030	.040 ±.002
MG780	7.5	15,000	225°C	1000	80	600Ω	750 Meg	3.125 ±.060	.315 ±.030	.040 ±.002
MG785	8.0	20,000	225°C	1000	80	800Ω	1000 Meg	4.000 ±.120	.315 ±.030	.040 ±.002
MG810	10.0	25,000	225°C	1000	80	1K	1250 Meg	5.000 ±.120	.315 ±.030	.040 ±.002
MG815	15.0	30,000	225°C	1000	80	1K	2000 Meg	6.000 ±.120	.350 ±.040	.040 ±.002

†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C

Specifications

Resistance Tolerance: ±1% (tolerances to 0.1% on special order).

Insulation Resistance: 100 megohms, minimum.

Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds. ΔR, 0.8% max.

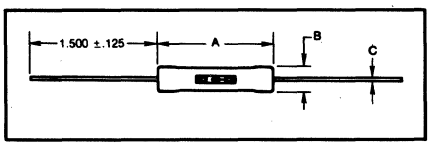
Thermal Shock: MIL-STD-202, Method 107, Cond. C, ΔR, 0.5% max.

Moisture Resistance: MIL-STD-202, Method 106, ΔR, 0.8% max.

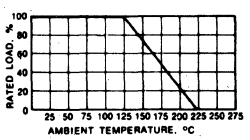
Loadlife: 1000 hours at rated power, ΔR 0.8% max.

Lead Material: Gold Plated.

Encapsulation: Silicone Conformal.

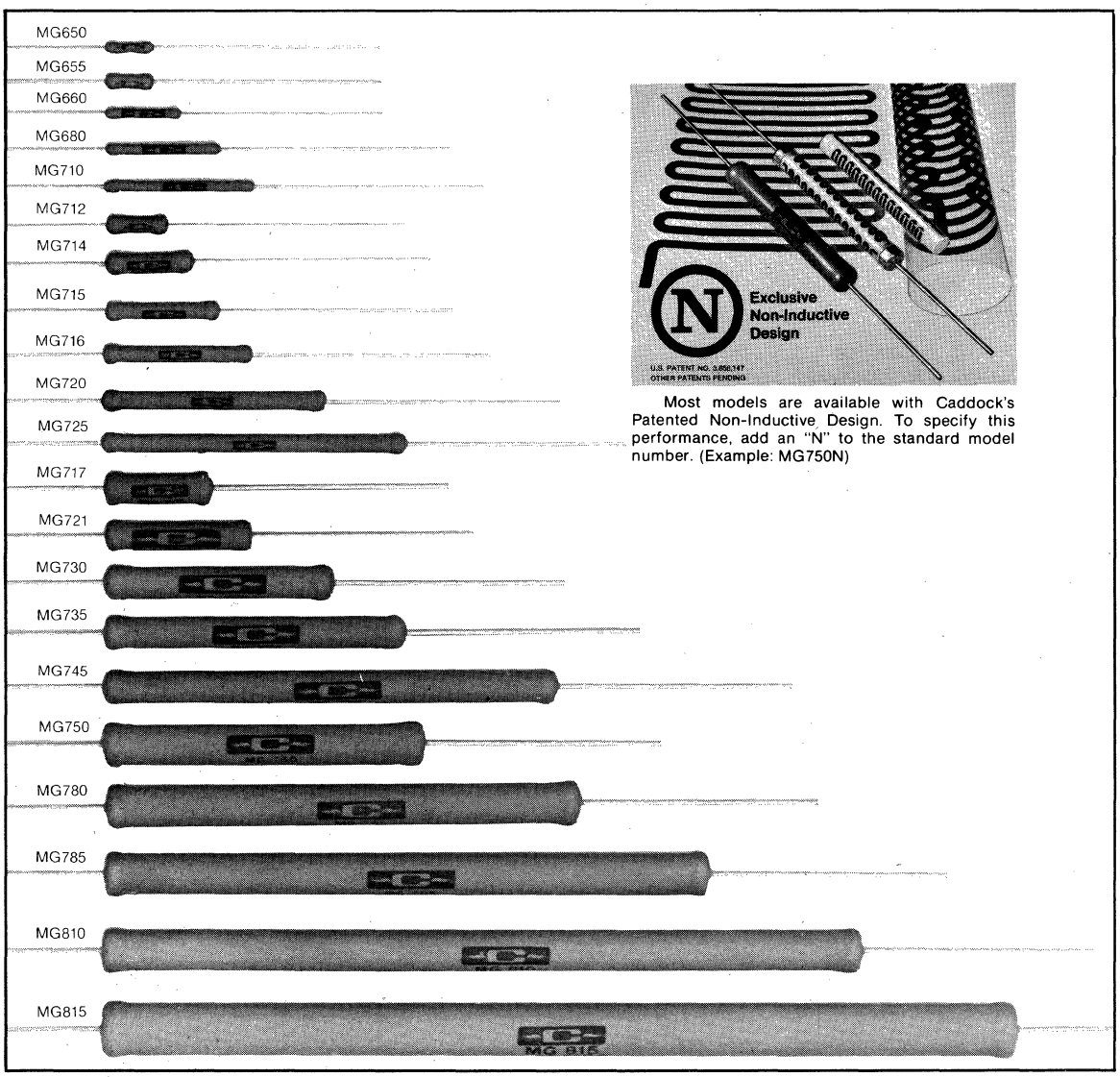


Derating Curve:



Type MG Precision High-Voltage Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS



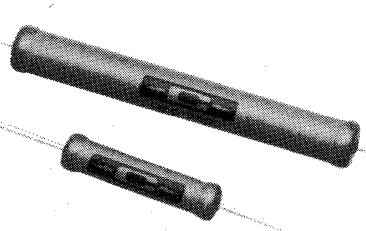
Most models are available with Caddock's Patented Non-Inductive Design. To specify this performance, add an "N" to the standard model number. (Example: MG750N)

Matched Type MG Resistor Sets with Tight Ratio Tolerances and Ratio TC Tracking.

The temperature coefficients of Caddock Micronox® resistance films can be controlled to provide matched sets of Type MG resistors with tight ratio TC from -55° C to +105° C.

For high voltage divider applications, ±2% ratio tolerance and 25 PPM/° C ratio tracking is available.

For low voltage, high resistance applications - such as electrometer circuits or high-gain amplifiers - ±0.1% ratio tolerance and 10 PPM/° C ratio tracking is available.



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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type TG Precision Low TC High Voltage Resistors

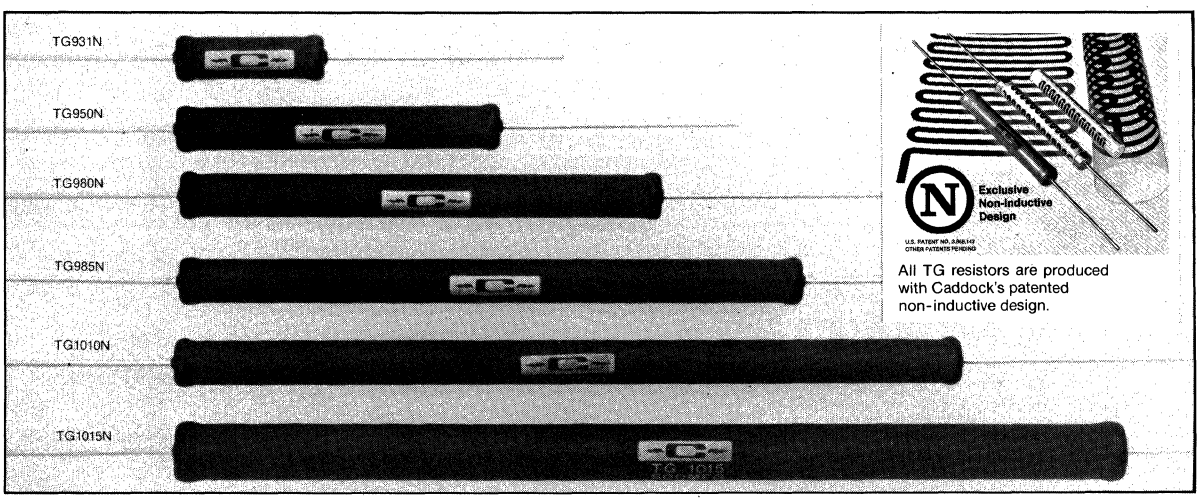
TC of 25 PPM/°C from −55°C to +125°C, Resistance Range from 1 Meg to 600 Meg.

To meet the precise temperature stability requirements of high accuracy high voltage systems, Caddock introduces the Type TG Precision Low TC High Voltage Resistors. These axial-lead precision high voltage resistors utilize our proven Tetrinox® resistance system to achieve this unique combination of low temperature coefficient with high stability performance at high operating voltages.

The Type TG Precision High Voltage resistors are designed to meet the demanding stability requirements of advanced TWT power supplies, electron microscopes, X-ray systems, high resolution CRT displays, and geophysical instruments.

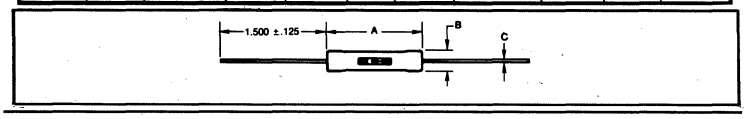
The features of the TG Precision High Voltage Resistors are:

- Temperature Coefficient: 25PPM/°C from -55°C to +125°C.
- Resistance Tolerance: From ±1.0% to ±0.1%.
- Resistance Range: From 1 Megohm to 600 Megohms.
- Maximum Continuous Operating Temperature of +225°C.
- Loadlife Stability of 0.25% per 1000 hours.
- The low temperature coefficient minimizes the self-heating drift due to power dissipation warm-up.



All TG resistors are produced with Caddock's patented non-inductive design.

Model No.	Wattage	Max. Continuous Oper. Volt	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C	Resistance Min.	Resistance Max.	Dimensions A	B	C
TG931N	1.0	4,000	225°C	750	25	1 Meg	50 Meg	1.000 ±.060	.315 ±.030	.040 ±.002
TG950N	2.0	10,000	225°C	1000	25	2 Meg	200 Meg	2.125 ±.060	.315 ±.030	.040 ±.002
TG980N	3.0	15,000	225°C	1000	25	3 Meg	300 Meg	3.125 ±.060	.315 ±.030	.040 ±.002
TG985N	4.0	20,000	225°C	1000	25	4 Meg	400 Meg	4.000 ±.120	.315 ±.030	.040 ±.002
TG1010N	5.0	25,000	225°C	1000	25	5 Meg	500 Meg	5.000 ±.120	.315 ±.030	.040 ±.002
TG1015N	6.0	30,000	225°C	1000	25	6 Meg	600 Meg	6.000 ±.120	.315 ±.030	.040 ±.002



Combine Type TG and Type TK Resistors for Low Ratio TC Tracking Performance.

The low TC Type TG Precision High Voltage Resistor can be used in combination with the low TC of the Type TK Temp-Stable Precision Resistors to achieve 30 PPM/°C Ratio TC without special matching.

The low temperature coefficient for both the Type TG and TK Resistors will also minimize ratio drift due to power dissipation warm-up.

Contact Caddock's Applications Engineering Group about your high voltage resistor requirements.

Specifications

Resistance Tolerance: ±1% (tolerances to 0.1% on special order).

Temperature Coefficient: 25 PPM/°C referenced to 25°C, ΔR taken at -55°C and +105°C.

Insulation Resistance: 10,000 megohms, minimum.

Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds. ΔR, 0.20% Max.

Thermal Shock: MIL-STD-202, Method 107, Cond. B, ΔR, 0.20% max.

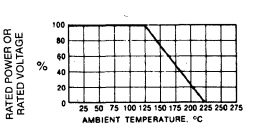
Load Life: 1000 hours at rated power, ΔR 0.25%.

Load Material: Gold Plated.

Encapsulation: Silicone Conformal.

Low Thermal EMF: Less than 1μV/°C.

Derating Curve



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Type THV Precision High Voltage Divider Networks

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

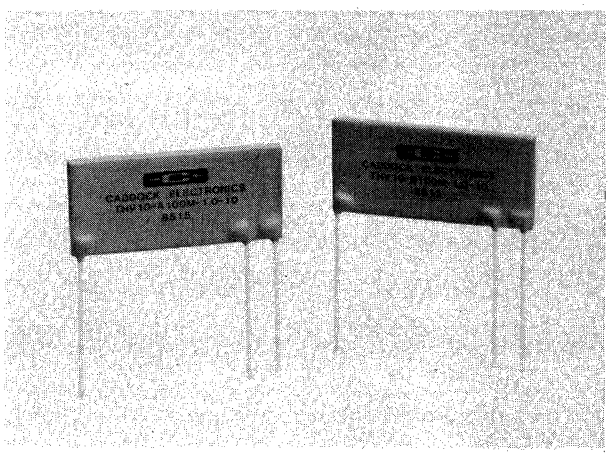
Ratio TC to 10 PPM/°C, Ratio Tolerance to 0.25%, Operating Voltage of 10KV

Type THV Precision High Voltage Divider Networks utilize Caddock's Tetrinox® resistance films to achieve the tight ratio temperature coefficients, ratio tolerance and ratio stability which is required by high performance TWT power supplies, X-ray systems, radar systems, analytical equipment and high resolution CRT displays.

Features of the THV Precision High Voltage Divider Network are:

- **Ratio Temperature Coefficient:** 10 PPM/°C or 25 PPM/°C
- **Ratio Tolerance:** 0.25%, 0.5%, 1.0% and 2.0%.
- **Operating Voltage:** 10 KVDC at 125°C.
- **Standard Voltage Division of 1000:1 or 100:1 with custom ratios available.**
- **Standard Input Resistance of 100Meg with custom resistances available**

For complete information on quantity price, and delivery call our main offices in Riverside, California.



Standard THV 10 Precision High Voltage Divider Networks

Ordering Information

THV10 - A 100M - 1.0 - 10

Model No.

Ratio Code Letter:

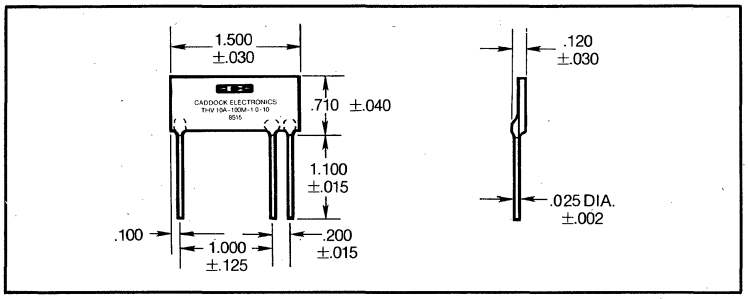
A - 100:1 Voltage Division
R_1 = 99.9 Meg
R_2 = 100K

B - 100:1 Voltage Division
R_1 = 99 Meg
R_2 = 1 Meg

Total Resistance Value of the Divider:
Standard Total Resistance of Model THV 10 is 100 Meg.

Standard Ratio Tolerance:
-2.0 = 2.0%
-1.0 = 1.0%
-0.5 = 0.5%
-0.25 = 0.25%

Ratio Temperature Coefficient:
(55°C to +125°C)
-25 = 25 PPM/°C
-10 = 10 PPM/°C

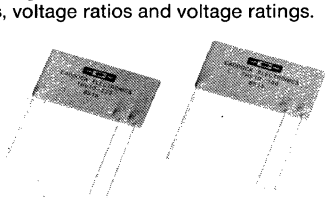


Custom Type THV Precision High Voltage Divider Networks

Custom Type THV Precision High Voltage Divider Networks can be produced with a broad range of resistance values, voltage ratios and voltage ratings.

Custom ratio tolerances and ratio temperature coefficients can also be produced.

Contact Caddock's Applications Engineering Group about your high voltage divider requirement.



Specifications

Ratio Tolerance: See ordering information per sample.

Absolute Tolerance: 1.0% for all resistors.

Ratio Temperature Coefficient: See ordering information.

Absolute Temperature Coefficient: 30 PPM/°C. Referenced to 25°C, ΔR taken at -55°C and +125°C.

Voltage Rating: 10 KVDC or RMS AC applied to R_1 and R_2 in series.

Load Life: Ratio change with 10 KVDC applied to the divider for 1000 Hrs at +125°C, 0.4% max.

Overvoltage: 1.5 times maximum continuous operating voltage for 5 seconds, ratio change 0.5% max.

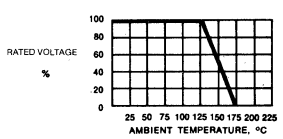
Thermal Shock: Mil-Std-202 Method 107, Cond. B, ratio change 0.25% max.

Moisture Resistance: Mil-Std-202 Method 106, ratio change 0.5% max.

Lead Material: Gold Plated

Encapsulation: Silicone Conformal with Dielectric Withstanding Voltage of 750 volts.

Derating Curve



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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MR & MS Power Film Resistors

Power Film Resistor Family with Wide Resistance Range and +275° C Maximum Temperature.

With power ratings to 15 watts and voltage ratings as high as 6000 volts in an axial-lead resistor with values to 30 Megohms, the Type MS Power Film Resistors deliver the performance capabilities that can simplify circuit design and reduce equipment cost and complexity.

Type MS Power Film Resistors provide all these features in a single resistor:

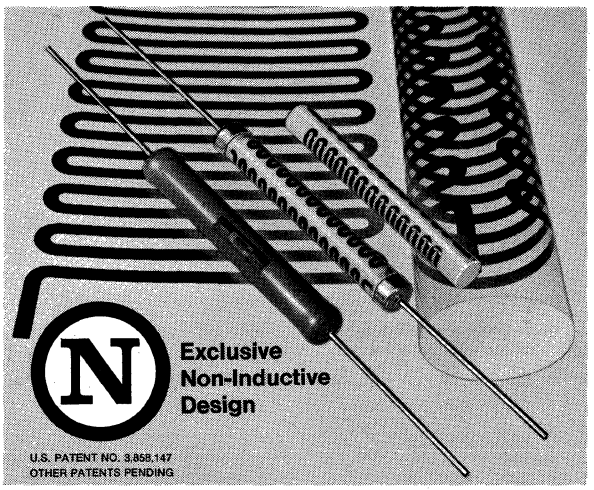
- Full power and voltage ratings, without derating —
  - for non-inductive performance.
  - for high resistance values that extend the critical resistance value up to 10 times.
- Higher voltage ratings without the limitations of minimum wire size and spacing.
- Excellent long-term stability.
  Tests demonstrate typical stability of 0.05% per 1000 hours over extended life.

Micronox® Resistance Films

Type MS performance begins with Micronox® resistance films, the basic element in every Caddock resistor. Produced exclusively by Caddock Electronics, these proven complex oxide films have been used reliably for 20 years in Caddock's precision power resistor products.

Micronox® resistance films are fired directly onto a ceramic core, in air, at 1400° F. These resistance films have demonstrated outstanding stability when exposed to a high ambient temperature, thermal shock and high power densities.

This unique approach to precision power resistors opens new design possibilities by providing wider resistance range, precise temperature characteristics, and higher temperature and power handling capability.



There's no derating of performance when you specify Caddock's Exclusive Non-Inductive Design.

When non-inductive performance is specified, we produce these power film resistors with a serpentine resistive pattern that provides for neighboring lines to carry currents in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor.

The result is a truly non-inductive resistor that is about as inductive as a straight piece of wire the length of the resistor body. This efficient design means faster settling times and minimum distortion in all types of high frequency circuits.

Non-inductive construction is available in most models. Specify by adding "N" suffix to Model Number. (Example: MS 310N)

Carefully Controlled Manufacturing and Test Procedures Assure Compliance with Strict Quality Control Requirements

Manufacturing Control

In addition to these procedures, all Type MS Resistors are produced under strict manufacturing controls with processes which include power conditioning, overvoltage conditioning and maximum temperature conditioning.

Quality Control

From the certification and testing of all materials to the supervision of manufacturing processes, all Caddock Type MS and MR Power Film Resistors are produced under procedures that have been approved for conformance to the requirements of NASA NHB5300.4(1C) and MIL-I-45208 in many recent surveys.

Reliability Verification

Type MS Resistors are included in the Caddock Reliability Testing Program. Conformance to specification parameters including Extended Life, Shock, Vibration and Humidity are verified on a periodic basis. Data from MS resistors can be compared by similarity to other Caddock resistor types, since Type ML, MM, MS, MP, MG and MK represent an identical combination of materials —aluminum oxide substrate, Micronox® resistance film and silicone insulating coating.

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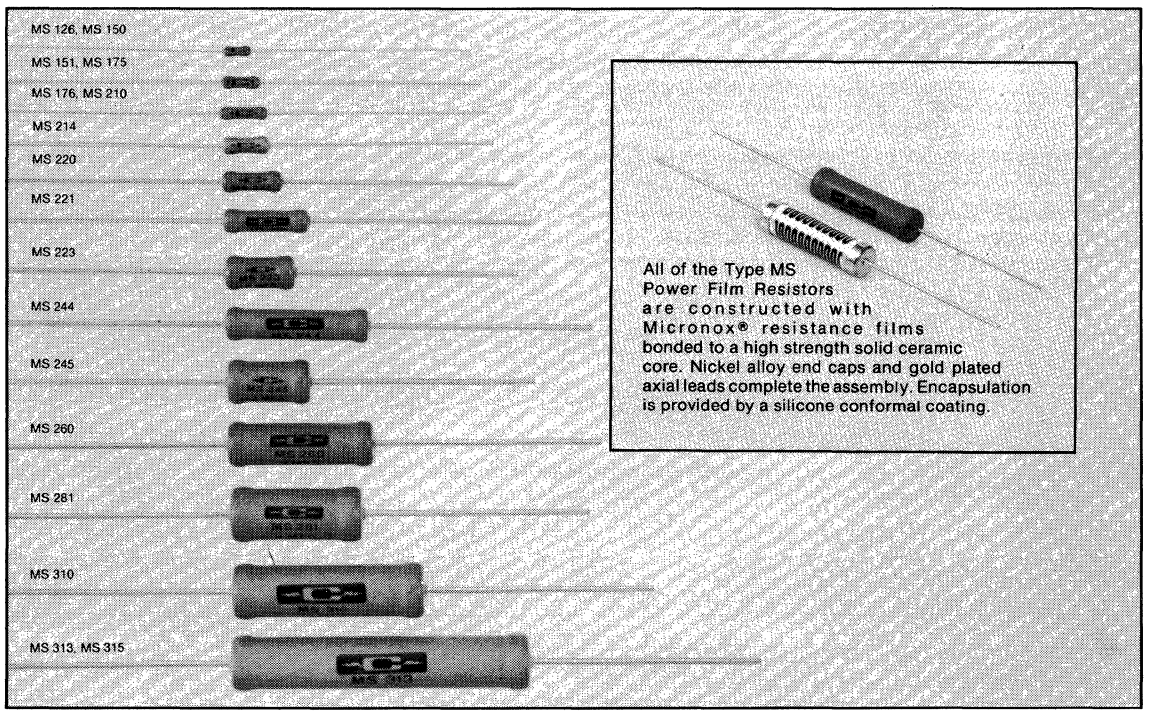
Type MR & MS Power Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS



Model No.	Wattage	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance Min.	Resistance Max.	Dimensions A	Dimensions B	Dimensions C	Encapsulation	Leadwire
MR 129	.25	200	275°C	500	150	50Ω	500 K	.188 ±.020	.070 ±.015	.020 ±.002	Silicone Conformal	Nickel
MR 154	.40	300	275°C	750	150	50Ω	1 Meg	.250 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Nickel
MR 178	.60	500	275°C	750	150	50Ω	3 Meg	.313 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Nickel
MS 126	.25	200	275°C	500	50	30Ω	1 Meg	.188 ±.020	.070 ±.015	.020 ±.002	Silicone Conformal	Gold Plated
MS 150	.5	—	275°C	500	50	30Ω	2 K	.188 ±.020	.070 ±.015	.020 ±.002	Silicone Conformal	Gold Plated
MS 151	.5	300	275°C	750	50	30Ω	2 Meg	.250 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated
MS 175	.75	—	275°C	750	50	30Ω	2 K	.250 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated
MS 176	.75	500	275°C	750	50	45Ω	5 Meg	.313 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated
MS 210	1.0	—	275°C	750	50	45Ω	3 K	.313 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated
MS 214	1.0	500	275°C	750	50	45Ω	5 Meg	.313 ±.030	.109 ±.025	.025 ±.002	Silicone Conformal	Gold Plated
MS 220	2.0	1000	275°C	800	50	45Ω	10 Meg	.400 ±.060	.140 ±.030	.025 ±.002	Silicone Conformal	Gold Plated
MS 221	3.0	1000	275°C	800	50	45Ω	10 Meg	.575 ±.050	.165 ±.030	.032 ±.002	Silicone Conformal	Gold Plated
MS 223	3.0	800	275°C	1000	50	30Ω	4 Meg	.480 ±.060	.230 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MS 244	4.0	2000	275°C	1000	50	45Ω	15 Meg	.950 ±.060	.230 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MS 245	4.0	800	275°C	1000	50	30Ω	6 Meg	.570 ±.060	.300 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MS 260	6.0	2000	275°C	1000	50	45Ω	15 Meg	.970 ±.060	.300 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MS 281	8.0	2000	275°C	1000	50	45Ω	8 Meg	.910 ±.060	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated
MS 310	10.0	4500	275°C	1000	50	45Ω	20 Meg	1.25 ±.070	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated
MS 313	12.5	6000	275°C	1000	50	50Ω	30 Meg	2.00 ±.080	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated
MS 315	15.0	—	275°C	1000	50	50Ω	1 Meg	2.00 ±.080	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated

†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C

Specifications

Resistance Tolerance: ±1% (tolerances to 0.1% on special order).

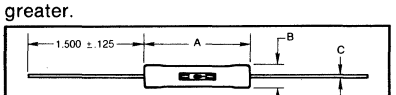
Insulation Resistance: 100 megohms, minimum.

Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds. ΔR, 0.5% max. or 0.5 ohms max., whichever is greater.

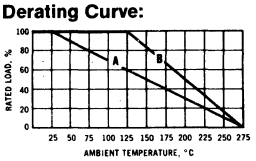
Thermal Shock: MIL-STD-202, Method 107, Cond. C, ΔR, 0.5% max. or 0.5 ohms max., whichever is greater.

Moisture Resistance: MIL-STD-202, Method 106, ΔR, 0.5% max. or 0.5 ohms max., whichever is greater.

Loadlife: 1000 hours at rated power, ΔR 0.5% max. or 0.5 ohms max., whichever is greater.



Derating Curve:



A – all MS models except MS 126, MS 151, MS 176.

B – MS 126, MS 151, MS 176, MR 129, MR 154, MR 178.

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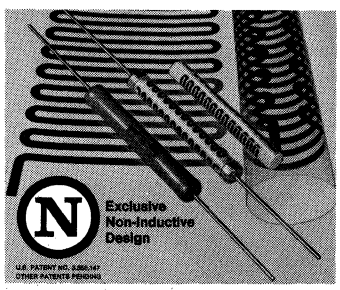
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type ML & MM Precision Film Resistors

High-Temperature Resistors for Geophysical, Aerospace and Industrial Requirements.

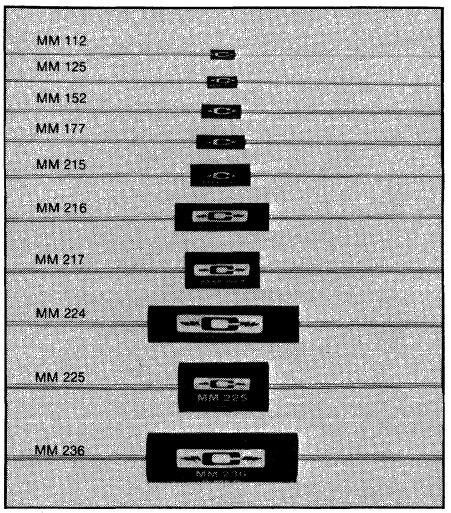
Type MM and ML resistors have a proven performance history in industrial, computer, military and space applications. With power ratings up to 3 watts and resistance values to 15 megohms, these outstanding resistors are ideal for applications requiring tolerances as close as 0.1% and extended life stability of 0.1% per 1000 hours.

The Type MM Precision Film Resistors provide a maximum operating temperature range of +275°C and both the Type MM and the Type ML have temperature coefficients of only 50 PPM/°C over the range from −15°C to +105°C.



Construction includes Micronox® resistance films fired onto a high strength solid ceramic core. End cap construction and a molded case completes the resistor assembly and provides increased resistance to abrasion and solvents.

Caddock's Exclusive Non-Inductive Performance can also be specified for most of these resistors by adding the "N" suffix to the model number. (Example: MM 236N)



Model No.	Wattage	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance Min.	Resistance Max.	Dimensions A	Dimensions B	Dimensions C	Encapsulation
MM 112	.12	200	275°C	400	50	45Ω	500 K	.160 ±.010	.065 ±.010	.016 ±.002	Black Molded Type
MM 125	.25	200	275°C	500	50	30Ω	1 Meg	.188 ±.020	.070 ±.015	.020 ±.002	Black Molded Type
MM 152	.4	300	275°C	750	50	30Ω	2 Meg	.250 ±.020	.094 ±.006	.025 ±.002	Black Molded Type
MM 177	.6	500	275°C	750	50	45Ω	5 Meg	.313 ±.020	.094 ±.006	.025 ±.002	Black Molded Type
MM 215	1.0	800	275°C	1000	50	45Ω	10 Meg	.400 ±.020	.150 ±.010	.025 ±.002	Black Molded Type
MM 216	1.5	1000	275°C	1000	50	45Ω	10 Meg	.625 ±.030	.190 ±.020	.032 ±.002	Black Molded Type
MM 217	1.5	800	275°C	1500	50	30Ω	4 Meg	.500 ±.030	.250 ±.020	.040 ±.002	Black Molded Type
MM 224	2.0	2000	275°C	1500	50	45Ω	15 Meg	1.00 ±.030	.250 ±.020	.040 ±.002	Black Molded Type
MM 225	2.0	800	275°C	2000	50	30Ω	6 Meg	.600 ±.030	.330 ±.020	.040 ±.002	Black Molded Type
MM 236	3.0	2000	275°C	2000	50	45Ω	15 Meg	1.00 ±.030	.330 ±.020	.040 ±.002	Black Molded Type
ML 104	.08	200	175°C	400	50	50Ω	300 K	.160 ±.010	.065 ±.010	.016 ±.002	Transfer Molded Type
ML 114	.15	200	175°C	500	50	50Ω	500 K	.188 ±.020	.070 ±.015	.020 ±.002	Transfer Molded Type
ML 124	.25	300	175°C	750	50	50Ω	600 K	.250 ±.020	.094 ±.006	.025 ±.002	Transfer Molded Type
ML 131	.4	500	175°C	750	50	50Ω	1 Meg	.313 ±.020	.094 ±.006	.025 ±.002	Transfer Molded Type
ML 181	.6	600	175°C	750	50	50Ω	5 Meg	.400 ±.020	.150 ±.010	.025 ±.002	Transfer Molded Type
ML 212	1.0	1000	175°C	1000	50	45Ω	10 Meg	.625 ±.030	.190 ±.020	.032 ±.002	Transfer Molded Type
ML 213	1.0	800	175°C	1500	50	30Ω	4 Meg	.500 ±.030	.250 ±.020	.040 ±.002	Transfer Molded Type
ML 218	1.25	2000	175°C	1500	50	45Ω	15 Meg	1.00 ±.030	.250 ±.020	.040 ±.002	Transfer Molded Type
ML 219	1.25	800	175°C	2000	50	30Ω	6 Meg	.600 ±.030	.330 ±.020	.040 ±.002	Transfer Molded Type
ML 226	2.0	2000	175°C	2000	50	45Ω	15 Meg	1.00 ±.030	.330 ±.020	.040 ±.002	Transfer Molded Type

†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C

Specifications

Resistance Tolerance: ±1% (tolerances to 0.1% on special order).

Insulation Resistance: 100 megohms, minimum.

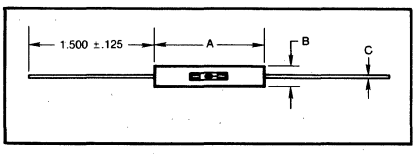
Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds. ΔR, 0.5% max. or 0.5 ohms max., whichever is greater.

Thermal Shock: MIL-STD-202, Method 107, Cond. F, ΔR, 0.2% max. or 0.5 ohms max., whichever is greater.

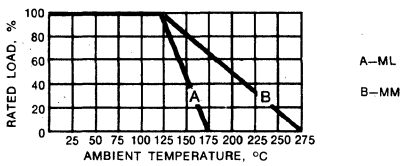
Moisture Resistance: MIL-STD-202, Method 106, ΔR, 0.5% max. or 0.5 ohms max., whichever is greater.

Loadlife: 1000 hours at rated power, ΔR 0.5% max. or 0.5 ohms max., whichever is greater.

Lead Material: Gold Plated.



Derating Curve:



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Type MV Low Resistance Power Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

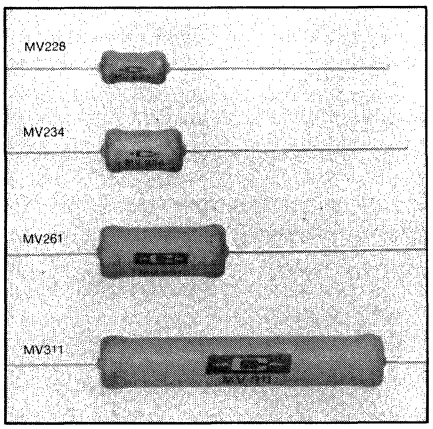
Values from 1 Ohm to 50 Ohms with Exclusive Non-Inductive Design

Type MV Low Resistance Power Film Resistors combine Caddock's Exclusive Non-Inductive Design with the many high performance capabilities of Micronox® resistance films to achieve these special advantages:

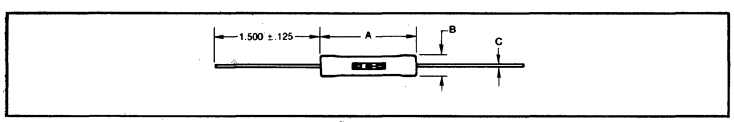
- Low Resistance - from 1 Ohm to 50 Ohms.
- Maximum Operating Temperature up to +275°C.
- Four Sizes and Power Ratings.
- Full Power Ratings without derating for Non-Inductive Performance.

The interdigitated terminations in the Type MV resistors provide a multiple-path distribution of the current into parallel resistance sections, which provides low resistance values and non-inductive performance. This Exclusive Non-Inductive Performance has provided significant improvements in performance to many types of electronic equipment, including wide-band power amplifiers, high-speed data transmission systems, current switching circuits and current sensing circuits.

For complete information quantity price and delivery for the Type MV resistors, call or write to our main offices in Riverside, California.

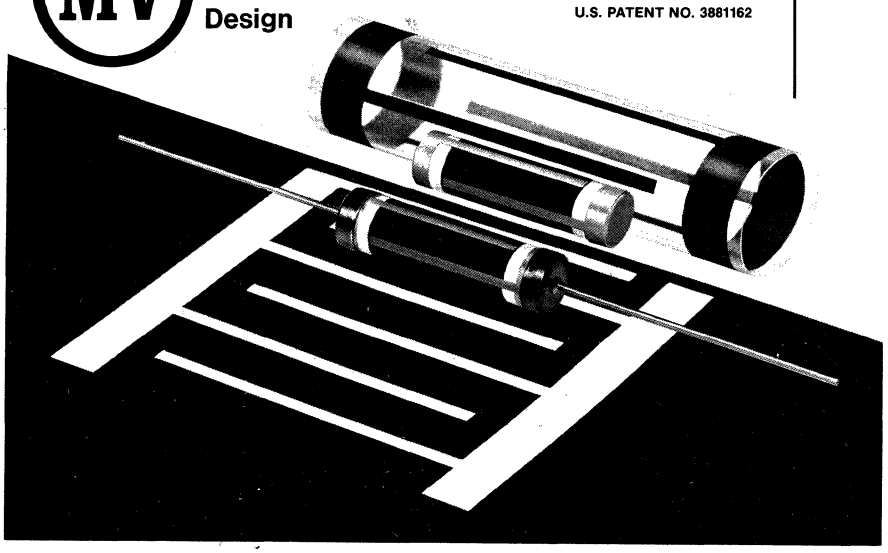


Model No.	Watt-age	Oper. Temp. (Max.)	Dielect. Str'gth	Resistance		Dimensions			Encap-sulation	Leadwire
				Min.	Max.	A	B	C		
MV228	2.0	275°C	1000	1Ω	50Ω	.480 ±.060	.230 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MV234	3.0	275°C	1000	1Ω	50Ω	.570 ±.060	.300 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MV261	6.0	275°C	1000	1Ω	50Ω	.910 ±.060	.350 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MV311	10.0	275°C	1000	1Ω	50Ω	2.00 ±.080	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated



MV **Exclusive Non-Inductive Design**

U.S. PATENT NO. 3881162



Specifications:

Resistance Tolerance: ±1%.

Temperature Coefficient: 100 PPM/°C above 5 Ohms, 200 PPM/°C at 5 Ohms or below, from -15°C to +105°C, referenced to +25°C.

Insulation Resistance: 100 megohms, minimum.

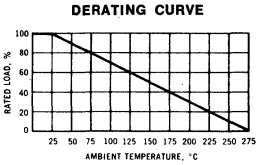
Overload: 5 times rated power for 5 seconds, ΔR 1% max.

Thermal Shock: MIL-STD-202, method 107, cond. C, ΔR 1% max.

Moisture Resistance: MIL-STD-202, method 106, ΔR 1% max.

Loadlife: 1000 hours at rated power, ΔR 1% max.

DERATING CURVE



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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

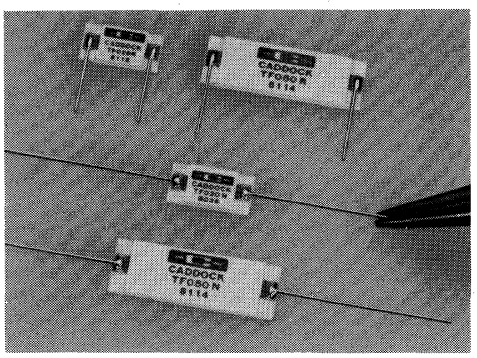
Type TF Low TC Ultra-Precision Film Resistors

Absolute TC to 5 PPM/°C — Values from 1 kohm to 125 Megohms — Absolute Tolerance to ±0.01%.

Type TF precision resistors employ the Caddock Tetrinox® resistance films — the resistance system that sets a new standard for high value, ultra-stable precision resistors that provide an exceptional combination of performance characteristics:

- **Ultra-Precision** – Seven standard resistance tolerances from ±1% to ±0.01%
- **A Wide Range of Resistance Values** – from 1 kohm to 125 Megohms.
- **Low Temperature Coefficients** – 5 PPM/°C, 10 PPM/°C and 15 PPM/°C.
- **Long-Term Stability** - to 0.01% per 1000 hours.

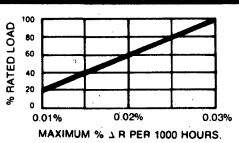
This completely new approach to quantity production of ultra-precision resistors is the result of combining our unique complex-oxide technology with an advanced high thru-put laser manufacturing capability.



Type TF - Standard Resistance Range - 1 kohm to 10 Megohms.

Model Number		Wattage @ +70°C.	Maximum Continuous Oper. Voltage	Resistance		Dimensions	
Axial Leads	Radial Leads			Min.	Max.	A	B
TF 020 N	TF 020 R	.33	300	1 K	2 Meg	.75 ±.020	.375 ±.020
TF 050 N	TF 050 R	.75	1400	10 K	10 Meg	1.5 ±.020	.50 ±.020

Load Stability:



Shelf Life: Typically 0.005% per year.

Type TF - Extended Resistance Range - 2 Megohms to 125 Megohms.

Model Number		Wattage @ +70°C.	Maximum Continuous Oper. Voltage	Resistance		Dimensions	
Axial Leads	Radial Leads			Min.	Max.	A	B
TF 626 N	TF 626 R	.33	300	2.01 Meg	35 Meg	.75 ±.020	.375 ±.020
TF 656 N	TF 656 R	.75	1400	10.01 Meg	125 Meg	1.5 ±.020	.50 ±.020

Load Stability: 1000 hours at rated voltage at +70°C, maximum ΔR 0.03%.

Shelf Life: Typically 0.010% per year.

Specifications

Apply to all Type TF resistor models

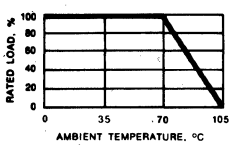
Absolute Temperature Coefficient: 5 PPM/°C, 10 PPM/°C or 15 PPM/°C. Referenced to 25°C, ΔR taken at -15°C and +105°C.

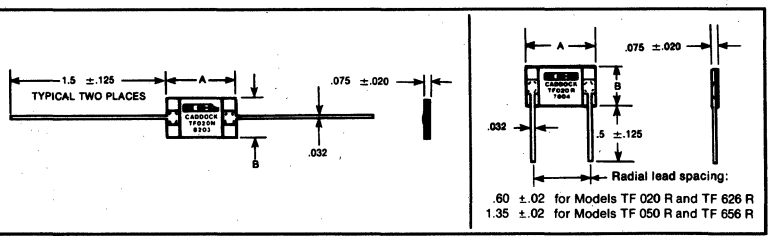
Resistance Tolerance: ±0.01%, ±0.025%, ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0%.

Storage Temperature: -55°C to +105°C.

Leadwire: Tinned Copper.

Derating Curve:





Ordering Information

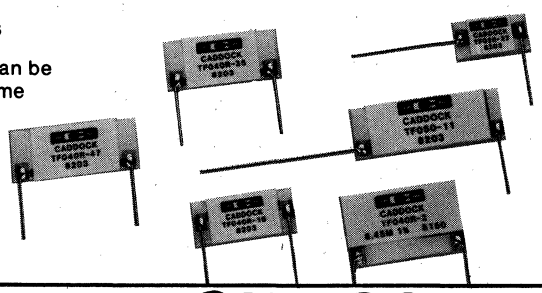
TF050R - 10 Meg - 0.01% - 10 PPM/°C

- Model Number
- Resistor Value
- Tolerance
- Temperature Coefficient

Custom Type TF Resistors

Additional cost savings can be realized when your high volume ultra-precision Type TF resistor is optimized for:

- Voltage rating.
- Power rating.
- Mechanical configuration.
- Ratio matched sets.



And for special requirements, custom Type TF resistors are available with:

- TCs of 5 ppm/°C, 10 ppm/°C 15 ppm/°C or 25 ppm/°C.
- Shelf stability of 0.0025% per year.

Type TF resistors can also be produced with custom-spaced radial leads that will plug directly into your existing circuit layouts.

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Type T912 and T914 Precision Resistor Networks

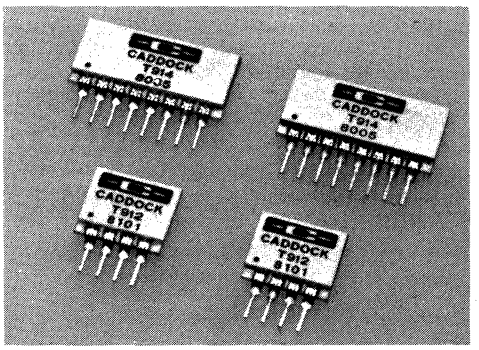
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Resistor Pairs and Quads with Matched Characteristics for Precision Analog Circuits.

Type T912 and T914 Precision Resistor Networks are constructed with Caddock Tetrinox® resistance films to achieve the matched resistor characteristics and stability required by highly accurate amplifier circuits, voltage reference circuits and precision bridge circuits.

- **Ratio Tolerances** – from ±0.1% to ±0.01%.
- **Ratio Temperature Coefficients** – 10 PPM/°C, 5 PPM/°C or 2 PPM/°C.
- **Absolute Temperature Coefficient** – 25 PPM/°C.
- **Ratio Stability of Resistance at Full Load for 2000 hours** – Within ±0.01%.
- **Shelf Life Stability of Ratio for 6 Months** – Within ±0.005%.

Both the T912 and T914 are available in 14 standard resistance values between 1000 ohms and 1 Megohm. Caddock's high thru-put manufacturing capability assures delivery of prototype and large-volume production quantities from stock to within 6 weeks after receipt of order.



Standard Type T912 and T914 Precision Resistor Networks

In addition to the 14 standard **equal value** models of the Type T912 and T914, the Type T912 can also be ordered with —

- **10:1 resistance ratio** — for use with gain-setting amplifiers.
- **9:1 resistance ratio** — for use in voltage reference dividers.

T912 - A 10K - 010 - 02

Model Number

Ratio Code Letter: *

A - T912 with R_1:R_2 where R_2 = 10R_1

1K:10K	5K:50K	20K:200K	40K:400K
2K:20K	10K:100K	25K:250K	50K:500K
			100K:1 Megohm

B - T912 with R_1:R_2 where R_2 = 9R_1

1K:9K	5K:45K	20K:180K	40K:360K
2K:18K	10K:90K	25K:225K	50K:450K
			100K:900K

No Letter — T912 with R_1 = R_2

No Letter — T914 with R_2 = R_2 = R_3 = R_4

Ratio Temperature Track: * (0°C to 70°C)
-10 = 10 PPM/°C -05 = 5 PPM/°C
-02 = 2 PPM/°C

Ratio Tolerance: * -100 = 0.1% -020 = 0.02%
-050 = 0.05% -010 = 0.01%

Standard Resistance Values: * (R_1)

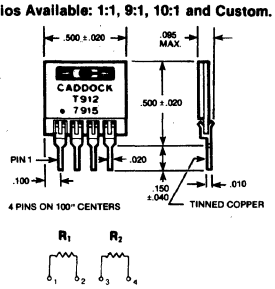
1K	10K	40K	200K	500K
2K	20K	50K	250K	1 Meg.
5K	25K	100K	400K	

Special or mixed resistance values are available as custom networks. See the custom section at the bottom of this page.

*(This information appears on the back side of the network)

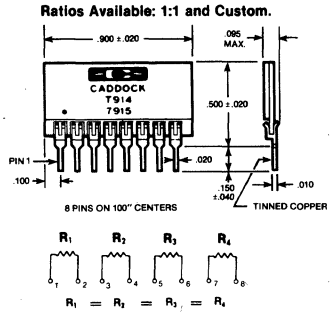
Type T912

Ratios Available: 1:1, 9:1, 10:1 and Custom.



Type T914

Ratios Available: 1:1 and Custom.



Specifications

Absolute Tolerance: 0.1% for all resistors.

Absolute Temperature Coefficient: ±25 PPM/°C. Referenced to 25°C, ΔR taken at 0°C and 70°C.

Voltage Rating: 30 Volts DC or RMS AC applied to R_1, R_2, R_3, or R_4.

Power Rating: 0.10 watt applied to R_1, R_2, R_3, R_4 (not to exceed rated voltage).

Package Power Rating: Type T912, 0.200 watt. Type T914, 0.400 watt.

Storage Temperature: -55°C to +105°C.

Insulation Resistance Between Isolated Pins: Pin 2 to Pin 3, Pin 4 to Pin 5, or Pin 6 to Pin 7, 1000 Megohms, minimum.

Dielectric Strength Between Isolated Pins: 50 volts RMS AC.

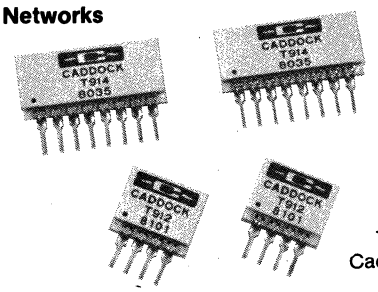
Ratio Stability Under Load: Ratio change between any two resistors in the network under full load for 2000 hours at 70°C, 0.01% maximum.

Shelf Stability of Ratio: Six months at shelf conditions, 50 PPM.

Custom Model T912 and T914 Precision Resistor Networks

For applications requiring non-standard resistance values, the T912 and T914 custom configurations can include these special features:

- Mixed resistance values with a maximum ratio of 250-to-1. (Example: 1.0 Megohm and 4K)
- Absolute TC as low as 15 PPM/°C.
- Ratio TC as low as 2 PPM/°C.
- Custom voltage ratings.
- Matched resistors of any special value between 1K and 2 Megohms.



Identification of the electrical characteristics of each T912 and T914 resistor network is included on the back side of the network.

For performance, price and availability of custom T912 and T914 resistor networks, contact Caddock Electronics' main offices in Riverside, California.

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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MK Low Cost Precision Film Resistors

Radial-Lead Resistors with Resistance Range from 10 ohms to 100 Megohms.

Here are the low cost precision resistors that provide high density packaging in large volume printed circuit applications. Available in two miniature rectangular package configurations with standard lead spacings, Type MK Precision Film Resistors now cover the entire resistance range from 10 ohms to 100 Megohms.

Constructed with Caddock Micronox® resistance films fired onto a solid ceramic substrate, Type MK Precision Film Resistors combine all of these outstanding advantages:

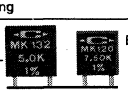
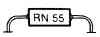
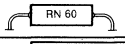
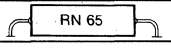
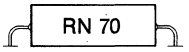
- ±1% resistance tolerance is standard and tolerances to ±0.1% are available on special order.
- Operating temperatures are from -55° C to +175° C.
- Full power rating at +125° C.
- Temperature Coefficient is only 50 PPM/° C up to 10 Megohms and 80 PPM/° C up to 100 Megohms, referenced to 25° C with the ΔR taken at -15° C and +105° C.
- Extended life stability is typically better than 0.1% per 1000 hours.
- Caddock's Non-Inductive Performance provides greater pulse fidelity and wider bandwidths in high frequency circuits.

This combination of performance advantages in a small, standardized case can simplify many engineering and production problems:

One size of Type MK resistor can replace many sizes of axial lead resistors.

This table of "RN" style axial lead resistors shows the many sizes and power ratings that can be replaced with either of the two models of Type MK Precision Film Resistors within the maximum allowable voltage ratings.

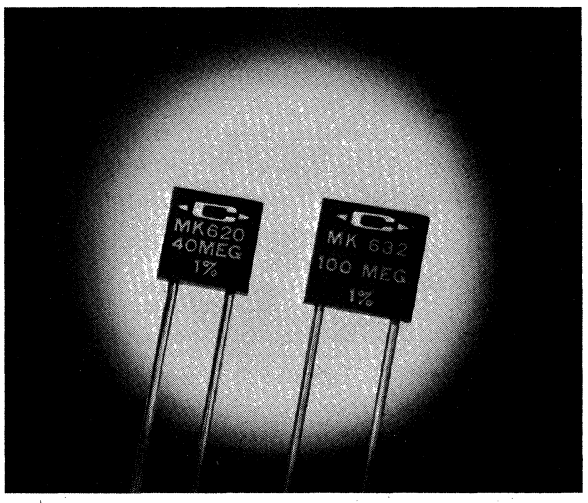
Comparison of Type MK and "RN" Ratings and Dimensions

Resistor Type	Power Rating	Maximum Resistance	Mounting Hole Spacing	
MK 120 or MK 620	**.50 WT.**	**40 Megohms**	**.150**	 Even the smallest Type MK resistor can replace all of these RN type resistors.
MK 132 or MK 632	**.75 WT.**	**100 Megohms**	**.200**	
RN50	.05 WT	1 Megohm	.400	
RN 55	.10 WT	5 Megohms	.500	
RN60	.125 WT	10 Megohms	.625	
RN65	.25 WT	20 Megohms	.875	
RN70	.50 WT	40 Megohms	1.000	

All outline drawings full size — dimensions in inches.

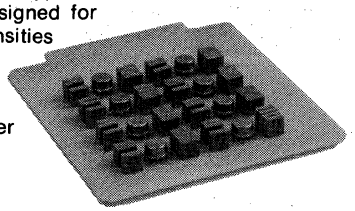
The largest Type MK — rated at .75 watt — requires less board space than even the 1/20th watt RN50.

The smallest Type MK — rated at .5 watt — provides power dissipation **equal** to the RN70 resistor. The RN70 resistor requires a mounting hole spacing of 1" and a side-to-side spacing of .250 inches, resulting in a total mounting area of .25 square inches — **10 times the area required for a .75 watt Type MK resistor!**



One standard resistor configuration can simplify board layouts.

With the exceptionally wide range of resistances that are available in each model of Type MK Precision Film Resistors, circuits can now be designed for maximum packaging densities without the need for leaving extra space where resistor value changes can require larger resistors or non-uniform lead spacings.



Standardization of resistor size can speed assembly procedures and reduce procurement costs.

The standardization of resistor size can pay additional dividends by simplifying assembly procedures. The radial leads do not require additional bending prior to insertion, and the standard lead spacing can reduce the time required for assembly.

The combination of higher power rating and smaller size can also lower procurement costs. By reducing the wide variety of sizes and types of axial lead resistors to a single, 'standardized' resistor type, unit prices can be lowered and inventory problems simplified.

Low Quantity Prices — Fast Delivery

Quantity prices for Type MK Precision Film Resistors are low, with many values priced under 60 cents each in medium-to-large production orders.

A pricing schedule for all values and models of Type MK Precision Film Resistors is available upon request. For specific price and delivery information, call or write to the main offices of Caddock Electronics in Riverside, California.

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Type MK Low Cost Precision Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MK Precision Film Resistors — Standard Resistance Range

Model No.	Wattage	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance Min.	Resistance Max.	Dimensions	Encapsulation	Leadwire
MK 120	.5	200	175°C	300	50	30 Ω	2 Meg.	Ref. Case "A" Dwg.	Transfer Molded Type	Tinned Copper
MK 132	.75	400	175°C	400	50	30 Ω	5 Meg.	Ref. Case "B" Dwg.	Transfer Molded Type	Tinned Copper

Resistance Tolerance: ±1% (tolerance to ±.1% on special order).
Operating Temperature: −55°C to 175°C.
Overload: 5 times rated power for 5 seconds, R shift .15% max., or .2 ohms max., whichever is greater.
Overvoltage: 1.5 times max. voltage for 5 seconds, R shift .15% max., or .2 ohms max., whichever is greater.
Thermal Shock: Mil-Std-202, Method 107, Cond. B, shift .2% max., or .2 ohms, max., whichever is greater.
Moisture Resistance: Mil-Std-202, Method 106, R shift .5% max., or .2 ohms, whichever is greater.
Loadlife: 1000 hours at rated power, R shift .4% max., or .2 ohms, whichever is greater.
Insulation Resistance: 10,000 Megohms, minimum.

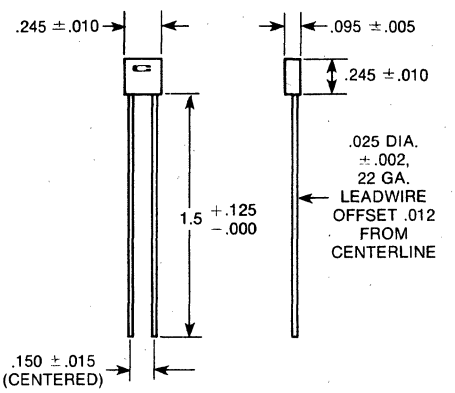
Type MK Precision Film Resistors — Extended Resistance Range

Model No.	Wattage	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance Min.	Resistance Max.	Dimensions	Encapsulation	Leadwire
MK 620	.5	200	175°C	300	80	2 Meg.	40 Meg.	Ref. Case "A" Dwg.	Transfer Molded Type	Tinned Copper
MK 632	.75	400	175°C	400	80	5.1 Meg.	100 Meg.	Ref. Case "B" Dwg.	Transfer Molded Type	Tinned Copper

Resistance Tolerance: ±1% (consult factory for tighter tolerances).
Operating Temperature: −55°C to 175°C.
Overvoltage: 1.5 times max. voltage for 5 seconds, R shift .5% max.
Thermal Shock: Mil-Std-202, Method 107, Cond. B, R shift .5% max.
Moisture Resistance: Mil-Std-202, Method 106, R shift .5% max.
Loadlife: 1000 hours at rated power, R shift .5% max.
Insulation Resistance: 10,000 Megohms, minimum.

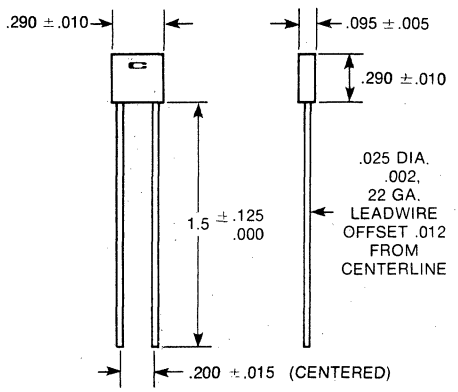
†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C

Case "A"
Model MK 120 and MK 620

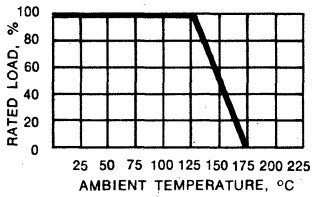


ALL DIMENSIONS IN INCHES

Case "B"
Model MK 132 and MK 632



DERATING CURVE



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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

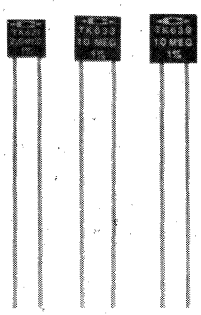
Type TK Temp-Stable Precision Film Resistors

Small Package with Low TC of 10 PPM/°C and Resistance Range from 1 kohm to 10 Megohms.

Caddock introduces a new design element for precision electronic circuitry — an advanced technology breakthrough that solves many critical circuit stability problems — the **Type TK Temp-Stable Precision Film Resistors with the Tetrinox® resistance system.**

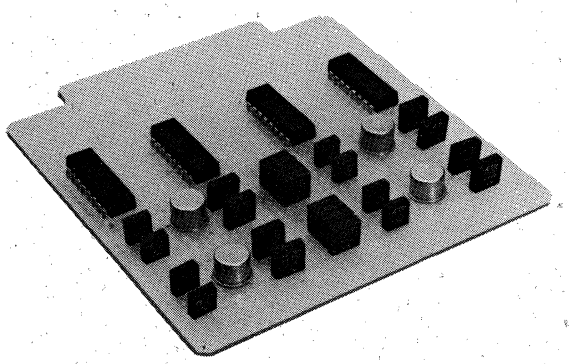
Type TK Temp-Stable Precision Film Resistors provide a combination of performance advantages never before available in a resistive component:

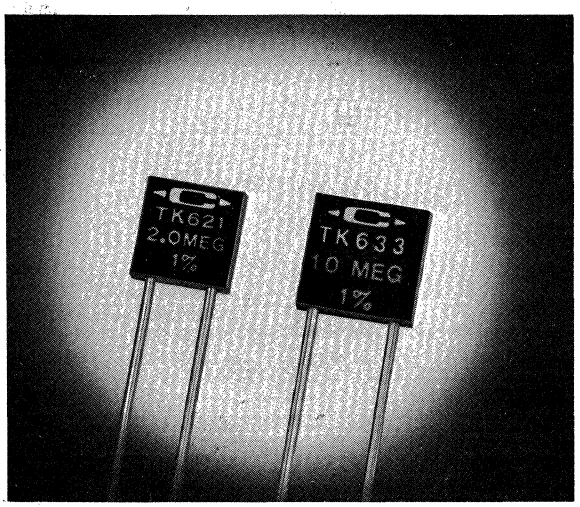
- **Temperature Stability** — better than 10 PPM/°C over the entire temperature range from −55°C to +125°C!
- **Long-Term Absolute Stability** — better than ±0.05% per 2000 hours of operation.
- **Extended Resistance Range** — from 1000 ohms to 10 Megohms.
- **Precision Tolerances** — ±1% is standard, and tolerances as close as ±0.05% are available.
- **Wide Operating Temperature Range**—from −55°C to +175°C.
- **Small Size** — with two miniature rectangular cases for maximum packaging density and minimum mounting area.
- **High Power Density** — with power ratings of .2 watt and .3 watt in molded cases, the largest of which is a standard CK 06 package.
- **Highest Performance-to-Cost Ratio** — with many values priced below $2.00 each in 1000 lot quantities.



(Photos show resistors full size)

Building on 20 years of experience with our unique complex-oxide technology, Caddock has perfected the Tetrinox® resistance system — the first high resistance system to provide a TC that is well within 10 PPM/°C and that is also essentially linear over the entire temperature range from −55°C to +125°C.





The exceptional performance of Type TK resistors can achieve improvements in many circuit applications:

Low TC "Matched-Pair" Voltage Dividers Can be Assembled Without Pre-Selection of Resistors.

An important application for Type TK resistors is in "matched-pair" voltage dividers where the low 5 PPM/°C temperature coefficient provides ratio tracking of less than 10 PPM/°C without resistor pre-selection or special testing.

With factory selection, Type TK resistor pairs can be matched to within 1 PPM/°C.

Extended Resistance Range Reduces Power Requirements

Because the Type TK resistors provide resistance values as high as 10 Megohms — values that are up to 100 times higher than other types of ultra-low TC resistors — engineers can now design precision circuits with lower current drain and lower power requirements.

High Density Packaging

The radial lead mounting and small rectangular case of Type TK resistors permits high packaging densities in low profile electronic circuitry. And because both models of Type TK resistors are available in an exceptionally wide range of resistances, lead spacing and mounting space can be standardized.

For additional information on the Type TK resistors for your high stability circuits, contact the engineering staff of Caddock Electronics in Riverside, California. They can assist you in determining the exact temperature coefficient and tolerances your application requires, and will provide both evaluation and production quantities of these new resistors on fast-delivery schedules.

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Type TK Temp-Stable Precision Film Resistors

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HIGH PERFORMANCE FILM RESISTORS

Type TK Temp-Stable Precision Film Resistors — Standard Resistance Range

Model No.	Temperature Coefficient ppm/°C †	Resistance		Wattage @ +125°C	Max. Working Voltage	Dielect. Str'gth	Dimensions	Encap-sulation	Leadwire
		Min.	Max.						
TK121	5, 10 or 20	1K	500K	.2	200	300	Ref. Case "A" Dwg.	Transfer Molded Type	Tinned Copper
TK133	5, 10 or 20	1K	1.5 Meg.	.3	300	400	Ref. Case "B" Dwg.	Transfer Molded Type	Tinned Copper
TK139	5, 10 or 20	1K	1.5 Meg.	.3	300	400	Ref. Case "C" Dwg.	Transfer Molded Type	Tinned Copper

† Specify TC when ordering. 10 PPM/°C is standard.

Resistance Tolerance: ±1% Standard. (Tolerances to ±0.05% on special order.)

Operating Temperature: −55°C to +175°C.

TC Temperature Range: −55°C to +125°C.

Overload:* 6.25 times rated power for 5 seconds at voltages not to exceed 1.5 times maximum rated working voltage, R shift less than 0.05%.

Thermal Shock: Mil-Std-202, Method 107, Condition B, R shift less than 0.05%.

Low Temperature Operation:* R shift less than 0.02%.

Dielectric Withstanding Voltage:* R shift less than 0.02%.

Moisture Resistance:* Mil-Std-202, Method 106, R shift less than 0.02%.

Load Life:* 2000 hours at +125°C, R shift less than 0.05%.

Shelf Life (Typical): 25 ppm/year.

Insulation Resistance: 10,000 Megohms.

Vibration:* R shift less than 0.01%.

Shock:* R shift less than 0.02%.

*Test methods per specifications and procedures of Mil-R-55182/9.

Type TK Temp-Stable Precision Film Resistors — Extended Resistance Range

Model No.	Temperature Coefficient ppm/°C †	Resistance		Wattage @ +125°C	Max. Working Voltage	Dielect. Str'gth	Dimensions	Encap-sulation	Leadwire
		Min.	Max.						
TK621	5, 10 or 20	501K	2 Meg	Limited by Maximum Working Voltage	200	300	Ref. Case "A" Dwg.	Transfer Molded Type	Tinned Copper
TK633	5, 10 or 20	1.51 Meg.	10 Meg.		300	400	Ref. Case "B" Dwg.	Transfer Molded Type	Tinned Copper
TK639	5, 10 or 20	1.51 Meg.	10 Meg.		300	400	Ref. Case "C" Dwg.	Transfer Molded Type	Tinned Copper

† Specify TC when ordering. 10 PPM/°C is standard.

Resistance Tolerance: ±1% Standard. (Tolerances to ±0.05% on special order.)

Operating Temperature: −55°C to +175°C.

TC Temperature Range: −55°C to +105°C.

Overload:* 1.5 times maximum rated working voltage for 5 seconds, R shift less than 0.2%.

Thermal Shock: Mil-Std-202, Method 107, Condition B, R shift less than 0.1%.

Low Temperature Operation:* R shift less than 0.05%.

Dielectric Withstanding Voltage:* R shift less than 0.05%.

Moisture Resistance:* Mil-Std-202, Method 106, R shift less than 0.05%.

Load Life:* 2000 hours at +125°C, R shift less than 0.2%.

Shelf Life (Typical): 200 ppm/year.

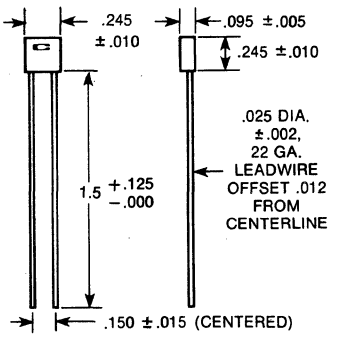
Insulation Resistance: 10,000 Megohms.

Vibration:* R shift less than 0.05%.

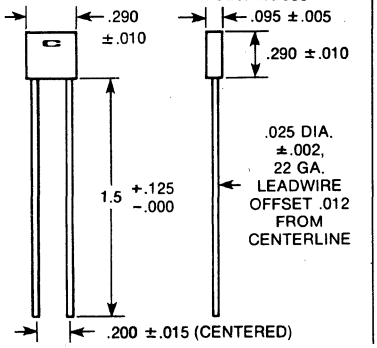
Shock:* R shift less than 0.05%.

*Test methods per specifications and procedures of Mil-R-55182/9.

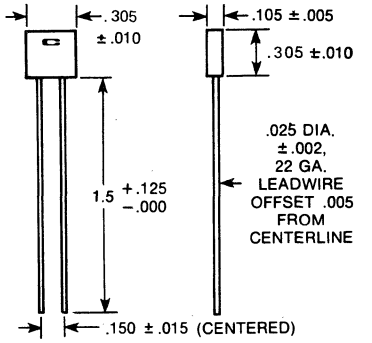
Case "A"
Model TK 121 and Model TK 621



Case "B"
Model TK 133 and Model TK 633



Case "C"
Model TK 139 and Model TK 639

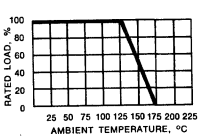


Ordering Information

TK633 - 10 Meg - 0.1% - 10 PPM/°C

- TK633 — Model Number
- 10 Meg — Resistor Value
- 0.1% — Tolerance
- 10 PPM/°C — Temperature Coefficient

Derating Curve:



APPLIES TO ALL MODELS OF TYPE TK RESISTORS

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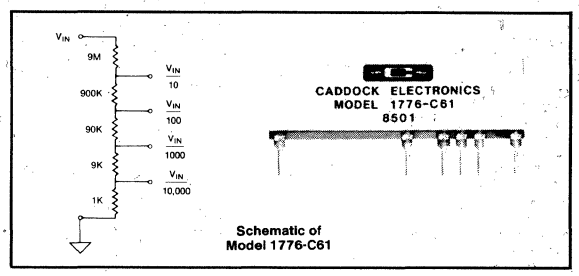
HIGH PERFORMANCE FILM RESISTORS

Type 1776 Precision Decade Resistor Voltage Dividers

Input Voltage Dividers for Digital Multimeters and Range-Switching Instruments.

The exceptional performance of this extensive 'family' of Type 1776 Precision Decade Resistor Voltage Dividers has been achieved through the special combination of advantages provided by Caddock's Tetrinox® resistance films. This advanced film resistor technology provides the performance characteristics required by the precision input signal circuits of both bench-type and laboratory digital instruments.

In addition to requiring less board space, these compact precision resistor networks deliver higher performance than selected discrete resistor sets and thin-film networks.



Schematic of Model 1776-C61

There are now 32 standard models in the expanded 'family' of Type 1776 precision resistor networks that include -

- 3-, 4- and 5-decade voltage dividers with ratios from 10:1 to 10,000:1.
- 1,200 volts continuous ratings and overvoltage to 2,000 volts.
- Many combinations of Ratio and Absolute Tolerances and Ratio and Absolute Temperature Coefficients.

For complete information on quantity price and delivery for any model of these Type 1776 Precision Decade Resistor Voltage Divider Networks, call or write to our main offices in Riverside, California.

Model No.	Resistance Values					Fig.	Voltage Rating ①	Absolute Tolerance %	Ratio Tolerance %	Absolute TC ppm/°C	Ratio TC ppm/°C	Voltage Coefficient of Ratio ppm/volt	Ratio Stability % Change in Ratio		
	R_1	R_2	R_3	R_4	R_5								Load Life ④	Shelf Life ⑤	Overvoltage ⑥
1776-C61	9 Meg	900 K	90 K	9 K	900	6	1200	0.1	0.1	30	15	0.1	0.01	0.005	0.01
1776-C611	9 Meg	900 K	90 K	9 K	900	6	1200	0.1	0.05	30	10	0.1	0.01	0.005	0.01
1776-C62	9 Meg	900 K	90 K	9 K	1 K	6	1200	0.1	0.1	30	15	0.1	0.01	0.005	0.01
1776-C621	9 Meg	900 K	90 K	9 K	1 K	6	1200	0.1	0.05	30	10	0.1	0.01	0.005	0.01
1776-C4	10 Meg	1.1111 M	101.01K	10.01K	1.0001K	8	1200	0.25	0.25	30	10	0.1	0.01	0.005	0.01
1776-C44	10 Meg	1.1111 M	101.01K	10.01K	1.0001K	8	1200	0.1	0.1	30	10	0.1	0.01	0.005	0.01
1776-C441	10 Meg	1.1111 M	101.01K	10.01K	1.0001K	8	1200	0.1	0.05	30	10	0.1	0.01	0.005	0.01
1776-C3	10 Meg	1.1111 M	101.01K	10.01K	1.0001K	8	1200	0.5	0.5	50	50	0.5	0.04	0.02	0.04
1776-C34	10 Meg	1.1111 M	101.01K	10.01K	1.0001K	8	1200	0.25	0.25	50	50	0.5	0.04	0.02	0.04
1776-C732	9 Meg	900 K	90 K	9 K	900	7	1200	0.25	0.25	50	50	0.5	0.04	0.02	0.04
1776-C73	9 Meg	900 K	90 K	9 K	900	7	1200	0.1	0.1	50	50	0.5	0.04	0.02	0.04
1776-C742	9 Meg	900 K	90 K	9 K	1 K	7	1200	0.25	0.25	50	50	0.5	0.04	0.02	0.04
1776-C74	9 Meg	900 K	90 K	9 K	1 K	7	1200	0.1	0.1	50	50	0.5	0.04	0.02	0.04
1776-C532	900 K	90 K	9 K	900	N/A	5	750	0.25	0.25	25	25	0.4	0.02	0.01	0.02
1776-C53	900 K	90 K	9 K	900	N/A	5	750	0.1	0.1	25	25	0.3	0.02	0.01	0.02
1776-C531	900 K	90 K	9 K	900	N/A	5	750	0.1	0.05	25	25	0.3	0.02	0.01	0.02
1776-C542	900 K	90 K	9 K	1 K	N/A	5	750	0.25	0.25	25	25	0.4	0.02	0.01	0.02
1776-C54	900 K	90 K	9 K	1 K	N/A	5	750	0.1	0.1	25	25	0.3	0.02	0.01	0.02
1776-C541	900 K	90 K	9 K	1 K	N/A	5	750	0.1	0.05	25	25	0.3	0.02	0.01	0.02
1776-232	9 Meg	900 K	90 K	9 K	900	3	1200	0.25	0.25	50	50	0.3	0.04	0.02	0.04
1776-23	9 Meg	900 K	90 K	9 K	900	3	1200	0.1	0.1	50	50	0.2	0.02	0.01	0.02
1776-231	9 Meg	900 K	90 K	9 K	900	3	1200	0.1	0.05	50	50	0.2	0.02	0.01	0.02
1776-242	9 Meg	900 K	90 K	9 K	1 K	3	1200	0.25	0.25	50	50	0.3	0.04	0.02	0.04
1776-24	9 Meg	900 K	90 K	9 K	1 K	3	1200	0.25	0.1	50	50	0.2	0.02	0.01	0.02
1776-241	9 Meg	900 K	90 K	9 K	1 K	3	1200	0.25	0.05	50	50	0.2	0.02	0.01	0.02
1776-10*	9 Meg	900 K	90 K	10 K	N/A	4	1200	+0, -0.5	0.1	30	10	0.02	0.01	0.005	0.01
1776-105*	9 Meg	900 K	90 K	10 K	N/A	4	1200	+0, -0.5	0.1	30	5	0.02	0.01	0.005	0.01
1776-1	9 Meg	900 K	90 K	10 K	N/A	2	1200	0.25	0.05	30	10	0.02	0.01	0.005	0.01
1776-14	9 Meg	900 K	90 K	10 K	N/A	2	1200	0.25	0.1	30	10	0.02	0.01	0.005	0.01
1776-9	9.9 Meg	90 K	10 K	N/A	N/A	1	1200	0.25	0.1	30	10	0.02	0.01	0.005	0.01
1776-91	9.9 Meg	90 K	10 K	N/A	N/A	1	1200	0.25	0.05	30	10	0.02	0.01	0.005	0.01
1776-912	9.9 Meg	90 K	10 K	N/A	N/A	1	1200	0.25	0.02	30	5	0.02	0.01	0.005	0.01

*Resistors Isolated

Specifications

(Numbers inside circles reference columns in Model No. table.)

① **Ratio Tolerance:** Maximum ratio difference between two resistors in the network. (See the specific Figures for the definition of Ratio Difference.)

② **Ratio Temperature Coefficient:** Ratio track from 0°C to +70°C.

③ **Voltage Coefficient of Ratio (ppm/volt):** R_1 in series with any combination of R_2, R_3, R_4 and R_5, 100 volts to rated voltage.

④ **Load Life:** Ratio stability of resistance under full load, rated voltage applied to R_1 in series with any combination of R_2, R_3, R_4 and R_5.

⑤ **Shelf Stability of Ratio:** Six months at shelf conditions.

⑥ **Overvoltage:** Maximum voltage of 1.67 times rated DC voltage. Volts DC or peak AC applied to R_1 and any combination of R_2, R_3, R_4 and R_5 in series with R_1 for 10 seconds.

⑦ **Voltage Rating:** DC or MRS Ac voltage applied to R_1 in series with any combination of R_2, R_3, R_4 and R_5.

Storage Temperature: -55°C to +85°C.

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Type 1776 Precision Decade Resistor Voltage Dividers

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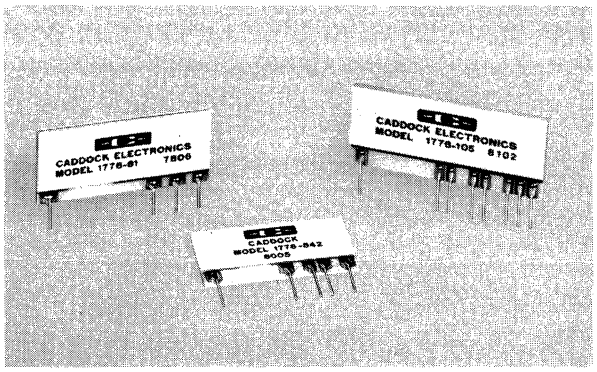


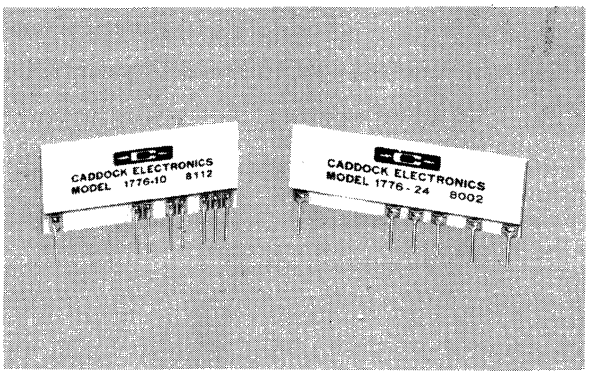
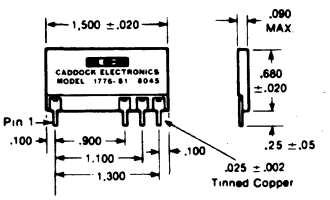


Figure 1



RATIO DEFINITION:
ALL RESISTORS RATIO ONE ANOTHER

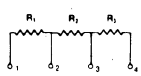
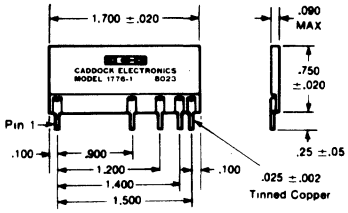


Figure 2



RATIO DEFINITION:
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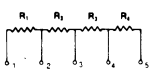
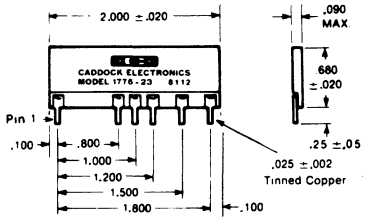


Figure 3



RATIO DEFINITION:
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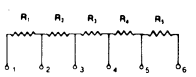
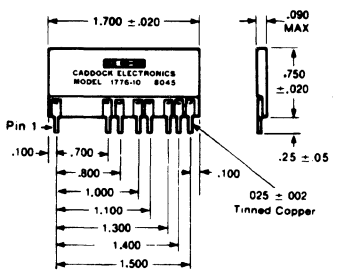
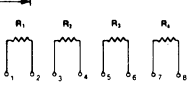


Figure 4



RATIO DEFINITION:
ALL RESISTORS RATIO ONE ANOTHER



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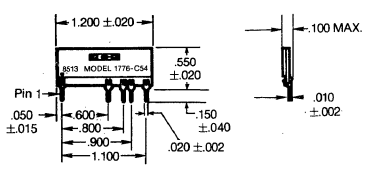


RATIO DEFINITION:
ALL RESISTORS RATIO ONE ANOTHER

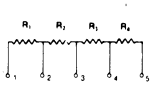
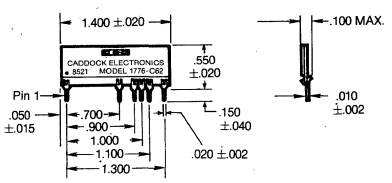


Figure 6



RATIO DEFINITION: Where $R_T = R_1 + R_2 + R_3 + R_4 + R_5$
RATIO 1 : $(R_2 + R_3 + R_4 + R_5) : R_T$
RATIO 2 : $(R_3 + R_4 + R_5) : R_T$
RATIO 3 : $(R_4 + R_5) : R_T$
RATIO 4 : $(R_5) : R_T$

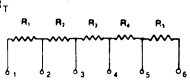
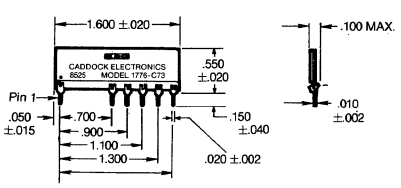


Figure 7



RATIO DEFINITION:
ALL RESISTORS RATIO ONE ANOTHER

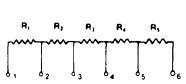
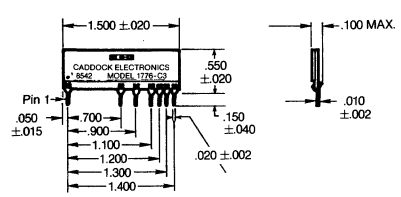
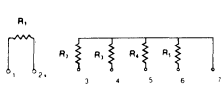


Figure 8



RATIO DEFINITION: RATIO 1 : $R_1 : R_T$
RATIO 2 : $R_1 : R_5$
RATIO 3 : $R_1 : R_4$
RATIO 4 : $R_1 : R_3$



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Type 1787 Current Shunt Resistor Networks

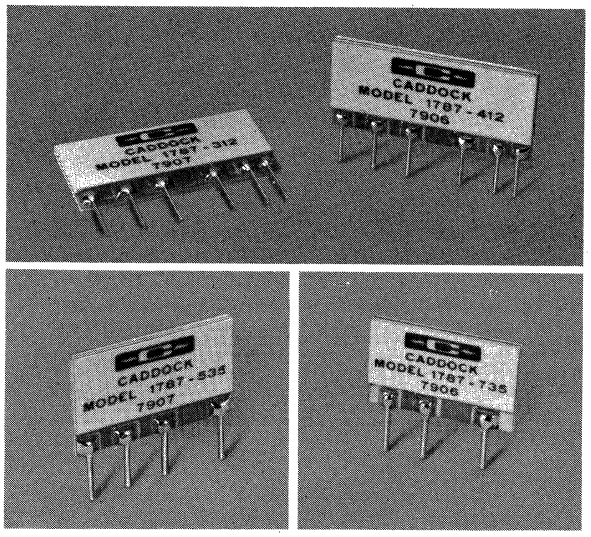
For Accurate Current Sensing in Multi-Range Instrumentation

Type 1787 Current Shunt Resistor Networks utilize Caddock's Micronox® resistance films and advanced high thru-put laser manufacturing capabilities to achieve many vital advantages in precision current measurement circuits, including laboratory and bench-type digital instrumentation:

- The thin-profile single-package configuration replaces as many as four discrete current shunt resistors.
- The monolythic construction and standardized lead spacing simplifies installation.
- Caddock Micronox® resistance films provide exceptional stability for improved long-term measurement accuracy.

Thirteen standard models in five network arrangements provide the specific accuracy and resistance values required for a wide range of current measuring instruments and circuits.

Prototype quantities of most models of the Type 1787 Current Shunt Resistor Networks can be delivered from stock to within 6 weeks ARO.



Model No.	Resistance Values				Power Rating Watts				Max. Power Rating Watts Total Pkg.	Fig.	Absolute Resistance Tolerance % ①	Maximum Absolute TC ppm/°C ②	Absolute Stability Max. % Change in Resistance Value	
	R_A	R_B	R_C	R_D	R_A	R_B	R_C	R_D					Load Life ③	Shelf Life ④
1787—31	999.9 Ω	99.9 Ω	9.9 Ω	0.9 Ω	0.25	0.25	0.50	1.0	1.0	1	0.25	80	0.05	0.03
1787—312	999.9 Ω	99.9 Ω	9.9 Ω	0.9 Ω	0.25	0.25	0.50	1.0	1.0	1	0.10	80	0.03	0.02
1787—41	1000 Ω	100 Ω	10 Ω	1 Ω	0.25	0.25	0.50	1.0	1.0	2	0.25	80	0.05	0.03
1787—412	1000 Ω	100 Ω	10 Ω	1 Ω	0.25	0.25	0.50	1.0	1.0	2	0.10	80	0.03	0.02
1787—5	999 Ω	99 Ω	9 Ω	N/A	0.25	0.25	0.75	N/A	0.75	3	0.25	50	0.04	0.02
1787—53	999 Ω	99 Ω	9 Ω	N/A	0.25	0.25	0.75	N/A	0.75	3	0.10	50	0.02	0.01
1787—535	999 Ω	99 Ω	9 Ω	N/A	0.25	0.25	0.75	N/A	0.75	3	0.05	50	0.02	0.01
1787—6	1000 Ω	100 Ω	10 Ω	N/A	0.25	0.25	0.75	N/A	0.75	4	0.25	50	0.04	0.02
1787—64	1000 Ω	100 Ω	10 Ω	N/A	0.25	0.25	0.75	N/A	0.75	4	0.10	50	0.02	0.01
1787—645	1000 Ω	100 Ω	10 Ω	N/A	0.25	0.25	0.75	N/A	0.75	4	0.05	50	0.02	0.01
1787—6452	1000 Ω	100 Ω	10 Ω	N/A	0.25	0.25	0.75	N/A	0.75	4	0.02	50	0.01	0.01
1787—13	99.9 Ω	9.9 Ω	0.9 Ω	N/A	0.25	0.50	1.0	N/A	1.0	6	0.25	100	0.05	0.03
1787—132	99.9 Ω	9.9 Ω	0.9 Ω	N/A	0.25	0.50	1.0	N/A	1.0	6	0.10	100	0.03	0.02

① **Absolute Resistance Tolerance:** Tolerance of R_A, R_B, R_C or R_D when measured in accordance with proper Figure No.

② **Absolute Temperature Coefficient:** Temperature coefficient of R_A, R_B, R_C or R_D from 0°C to 70°C, referenced to +25°C.

③ **Load Life:** Stability of R_A, R_B, R_C or R_D with full power applied individually for 2000 hours at +70°C.

④ **Shelf Life:** Stability of R_A, R_B, R_C or R_D for six months at shelf conditions.

Storage Temperature: −55°C to +105°C.

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Type 1787 Current Shunt Resistor Networks

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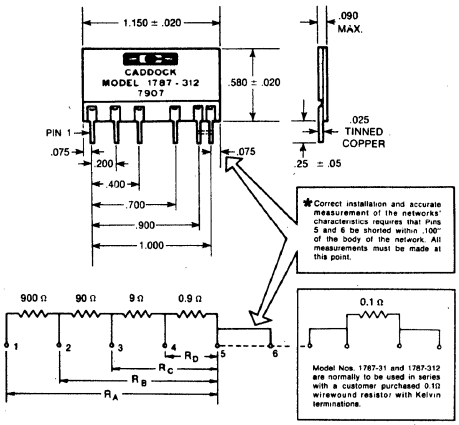
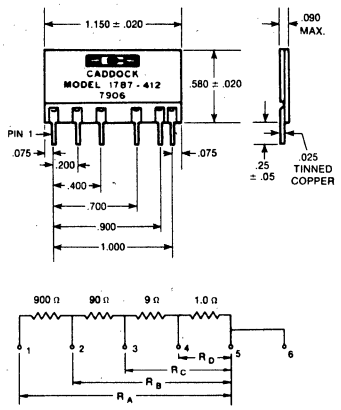
Figure 1 — Model Nos. 1787-31 and 1787-312



Model Nos. 1787-31 and 1787-312 Measurement Connections

Resistances		Kelvin Connections			
"R"	Total Value	Sense Lead P_1	Current Lead C_1	Current Lead C_2	Sense Lead P_2
R_A	999.9 Ω	Pin 1	Pin 1	Pin 5 *	Pin 6 *
R_B	99.9 Ω	Pin 1	Pin 2	Pin 5 *	Pin 6 *
R_C	9.9 Ω	Pin 1	Pin 3	Pin 5 *	Pin 6 *
R_D	0.9 Ω	Pin 1	Pin 4	Pin 5 *	Pin 6 *

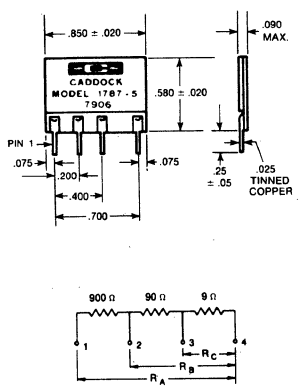
Figure 2 — Model Nos. 1787-41 and 1787-412



Model Nos. 1787-41 and 1787-412 Measurement Connections

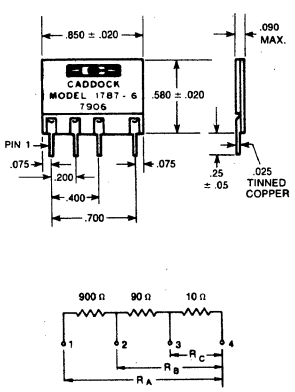
Resistances		Kelvin Connections			
"R"	Total Value	Sense Lead P_1	Current Lead C_1	Current Lead C_2	Sense Lead P_2
R_A	1000 Ω	Pin 1	Pin 1	Pin 5	Pin 6
R_B	100 Ω	Pin 1	Pin 2	Pin 5	Pin 6
R_C	10 Ω	Pin 1	Pin 3	Pin 5	Pin 6
R_D	1 Ω	Pin 1	Pin 4	Pin 5	Pin 6

Figure 3 — Model Nos. 1787-5, 1787-53 and 1787-535



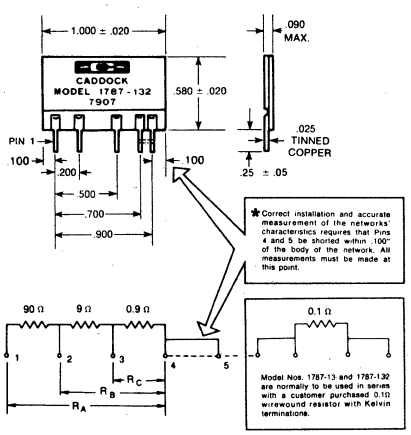
Resistances	
"R"	Total Value
R_A	999 Ω
R_B	99 Ω
R_C	9 Ω

Figure 4 — Model Nos. 1787-6, 1787-64, 1787-645 and 1787-6452



Resistances	
"R"	Total Value
R_A	1000 Ω
R_B	100 Ω
R_C	10 Ω

Figure 6 — Model Nos. 1787-13 and 1787-132



Model Nos. 1787-13 and 1787-132 Measurement Connections

Resistances		Kelvin Connections			
"R"	Total Value	Sense Lead P_1	Current Lead C_1	Current Lead C_2	Sense Lead P_2
R_A	99.9 Ω	Pin 1	Pin 1	Pin 4 *	Pin 5 *
R_B	9.9 Ω	Pin 1	Pin 2	Pin 4 *	Pin 5 *
R_C	0.9 Ω	Pin 1	Pin 3	Pin 4 *	Pin 5 *

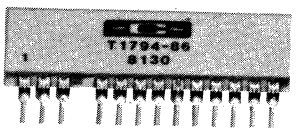
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

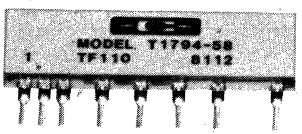
Type T1794 Custom Precision SIP Resistor Networks

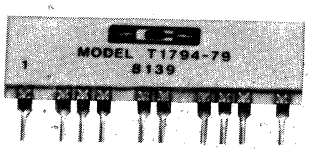
Resistor Networks with Custom Package Size and Custom Performance.

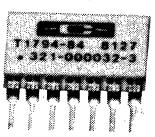
For precision analog designs with special circuit requirements Caddock Type T1794 Custom Precision SIP Resistor Networks can include from 2 to 15 resistors per assembly and are available with performance that includes -

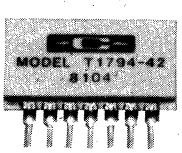
- Absolute tolerances from 1.0% to 0.1% - to as close as 0.025%.
- Ratio tolerances from 1.0% to 0.1% - to as close as 0.025%.
- Resistance values from 500 ohms to 50 Megohms.
- Absolute temperature coefficients of 50 PPM/°C, 25 PPM/°C and 15 PPM/°C.
- Ratio temperature coefficients from 25 PPM/°C to 10 PPM/°C - to as close as 5 PPM/°C.
- Ratio stability of resistance at full load for 2000 hours to within ±0.02%.
- Shelf life stability of ratio for six months to within ±0.005%.
- Custom voltage and power ratings.

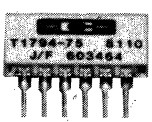












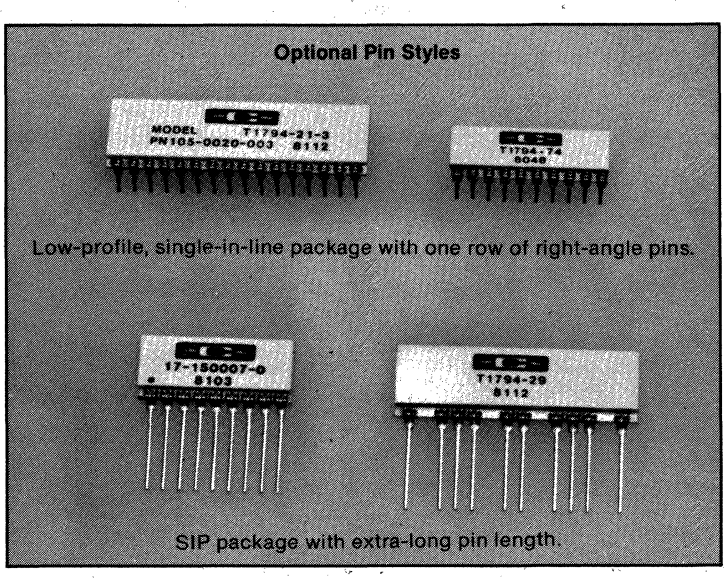
The unique thin-profile, single-in-line edge-mount package design allows the wide range of flexibility necessary to blend the performance of Tetrinox® resistance technology with particular circuit specifications to arrive at the final network package size, pin spacing and pin style.

In addition to the normal upright configuration with SIP-socket pin spacing, special low-profile packages with extended leads and right-angle leads are also available.

By optimizing both performance and configuration many designers find that these precision networks can achieve savings in both component cost and insertion costs — even in production-lot quantities as low as 1000 units.

A large part of our high thru-put manufacturing capacity is now committed to the production of these custom precision resistor networks. Custom network designs for requirements that range from 500 networks per year to over 400,000 networks per year are now in production.

For immediate engineering information on the custom precision resistor network configuration that can best meet your needs, call or write to our Applications Engineering Group in Riverside, California, and we will be pleased to provide both technical performance and pricing information.



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ELECTRONICS, INCORPORATED
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

Type 1789 Custom Low Resistance Value Precision Resistor Networks

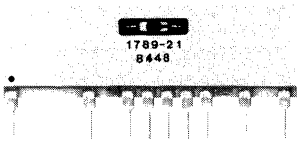
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Low Resistance Custom Resistor Networks for Precision Analog Circuit Designs.

The design flexibility achieved by Caddock's advanced resistance film technology is extended to low resistance networks through the application of Caddock Micronox® resistance films.

By applying this technology to the thin-profile single-in-line package configuration, the Type 1789 Custom Precision Low Resistance Value Networks can provide a combination of performance specifications that are exclusive with Micronox® resistance films:

- **Resistance Values** - from 1.0 Ohm to 10,000 Ohms.
- **Absolute Tolerances** - 1.0%, 0.50%, 0.25%, 0.20%, 0.10%, and 0.05%.
- **Ratio Tolerances** - 1.0%, 0.50%, 0.25%, 0.20%, 0.10% and 0.05%.
- **Absolute Temperature Coefficients** - 100 PPM/°C, 80 PPM/°C and 50 PPM/°C from 0°C to +70°C.
- **Ratio Temperature Coefficients** - 80 PPM/°C, 50 PPM/°C, 25 PPM/°C and 15 PPM/°C.
- **Power Rating** - 100 mW to 2 Watts per resistor.

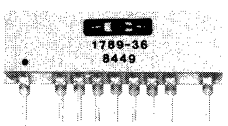


Current Summing Network.

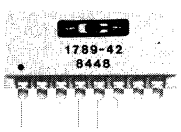
Current Sensing Network.

The optimum design of a Type 1789 Custom resistor network is best achieved when all of the circuit requirements and specification limits are carefully balanced.

To assist you in achieving the goal of optimum performance and maximum cost effectiveness, the resistor network specialists in the Network Product Engineering Group at Caddock's main offices will be pleased to provide any information you may need.



Precision Termination Network.



Impedance Matching Network.

Precision Current Shunt.

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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MP Chassis Mounted Power Film Resistors

Type MP Chassis Mounted Power Film Resistors are made with Micronox® resistance films fired onto a ceramic substrate which is thermally bonded to an anodized aluminum base. By mounting this assembly directly to a metal surface for improved heat transfer, the high power capabilities of these unique resistors can provide increased packaging densities in many types of electronic equipment.

The special performance features of the Type MP Power Film Resistors include:

- Two case sizes that provide 15 watt and 30 watt ratings.
- Single-screw mounting to simplify attachment to the chassis or other heat conducting surface.
- A molded silicone case that encapsulates the resistor assembly to meet stringent environmental specifications.
- Extended-life stability better than 0.01% per 1000 hours has been demonstrated through a 5½ year, 50,000 hour program of continuous load-life testing.

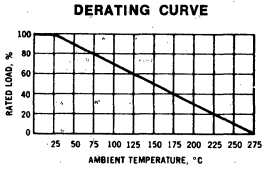
Detailed information on power ratings versus ambient temperature and chassis area has been provided on this page. A detailed report on the results of extended-life stability tests is available from the applications engineering group at Caddock Electronics, Inc.

Model No.	Power Rating†	Max. Voltage	Diel. Str.	High Temp. TC‡	Resistance Range		Dimensions				Terminals
					Min.	Max.	A	B	C	D	
MP312	15 Watts	300	600	50	10Ω	200 K	.600	.188	.185	.092	Gold Plated Solder Lugs
MP330	30 Watts	450	1000	50	10Ω	200 K	.850	.250	.250	.142	Gold Plated Solder Lugs

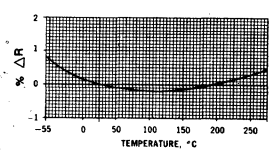
† Power rating based on chassis mounting with MP 312 on a 6" x 4" x 2" x .040" aluminum chassis and MP 330 on a 5" x 7" x 2" x .040" aluminum chassis.

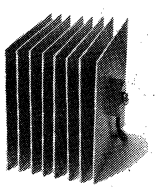
‡ TC: 50 ppm referenced to 25°C, ΔR taken at +150°C and +275°C. (Low temp. TC will be nominally −85 ppm/°C at −55°C. See typical R-T curve.)

DERATING CURVE



TYPICAL R-T CURVE

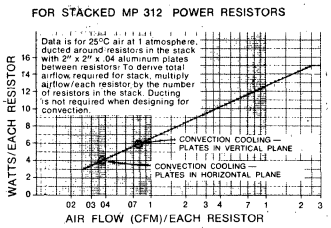




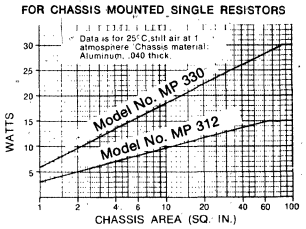
Stacked Type MP assemblies — constructed by bolting resistors between aluminum heat dissipating plates — provide a simple means of further improving packaging densities.

These charts of power ratings versus ambient temperature and chassis area show the high power levels that can be achieved with forced air cooling and with convection cooling in either vertical or horizontal orientation.

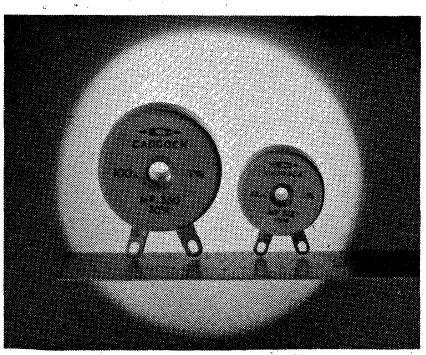
POWER RATING
FOR STACKED MP 312 POWER RESISTORS



POWER RATING
FOR CHASSIS MOUNTED SINGLE RESISTORS



U.S. Patent No's 3,636,493 and 3,649,944 Other patents pending.



SPECIFICATIONS

Resistance Tolerance: ±1% standard (Other tolerances on special order.)

Insulation Resistance: 10,000 Megohms, dry. Method — Mil-R-18546D, para. 4.6.8.

Solderability: Per Mil-R-18546D, para. 3.7, para. 4.6.4.

Terminal Strength: Per Mil-Std-202, Method 211, Cond. A (Pull Test), 5 lbs., and Cond. B (Bend Test). Max. ΔR, .2% or .2Ω, whichever is greater.

Thermal Shock: Per Mil-R-18546D, para. 4.6.9, max. ΔR, .5% or .2Ω, whichever is greater.

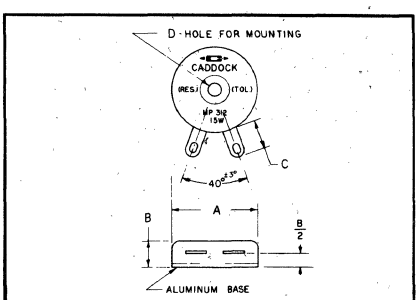
Momentary Overload: 2 times rated power or 1.5 times max. allowable working voltage, whichever gives the lower power, for 5 seconds. Max. ΔR, .5% or .2Ω, whichever is greater.

Moisture Resistance: Mil-Std-202, Method 106B, less steps 7a and 7b, max. ΔR, .5% or .2Ω, whichever is greater.

Life: Per Mil-R-18546D, para. 4.6.12, 1,000 hrs., Max. ΔR, 1% or .2Ω, whichever is greater.

Shock, Medium Impact: 50G, per Mil-Std-202, Method 205, Cond. C.

Vibration, High Frequency: Per Mil-Std-202, Method 204, Cond. B, Max. ΔR .2% or .2Ω, whichever is greater, through shock and vibration sequence.



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High Performance Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

The outstanding levels of performance and reliability that Caddock resistors provide is maintained through a continuous program of testing and process control that includes every step in the production process.

Manufacturing Control

Our manufacturing controls include processes for power conditioning, over-voltage conditioning and maximum temperature conditioning. We also perform many in-process tests to verify the performance levels and consistency of all of our resistor types, and to screen out defects not detectable by visual inspection.

Quality Control

The Caddock Quality Control System covers every step in the manufacturing process from the examination of incoming raw materials to the final testing and packaging of each resistor.

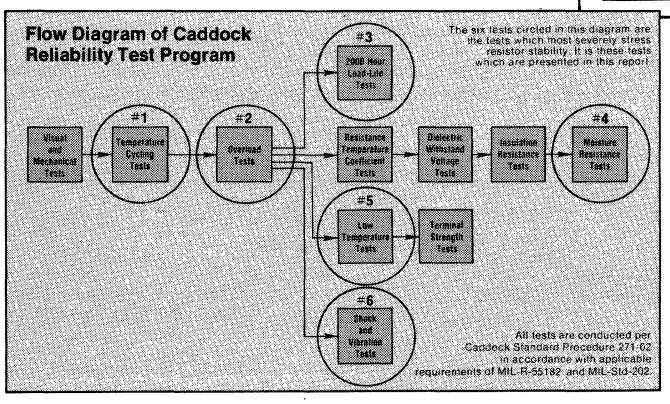
To meet the most stringent QC requirements, Caddock's Quality Control Procedures have been approved as being in conformance to the requirements of NASA NHB5300.4(1C) and MIL-1-45208 in recent surveys.

Reliability Verification

In addition to the tests for tolerance, stability and temperature characteristics that are part of our normal manufacturing procedures, we also perform semi-annual reliability tests to confirm compliance to our exacting product specifications.

The flow diagram of the Caddock Reliability Test Program illustrates the sequence of the eleven tests in this program.

The test procedures in the Caddock Reliability Testing Specification 271-02 generally follow the format of MIL-R-55182 and MIL-Std-202. The results of these tests may be used to qualify Caddock resistors for substitution in existing designs.



Reliability Test Summary — "Caddock Report No. 1".

To provide electronic engineers with actual stability data — data that can be used to determine actual improvements in circuit performance — we have compiled test results taken since 1972 from our continuing reliability program.

Of the eleven tests in this program, we have graphically summarized data from the six tests that measure resistor stability under conditions most important to circuit designers:

1 — Temperature Cycling Tests

2 — Overload Tests

3 — 2000 Hour Load-Life Tests

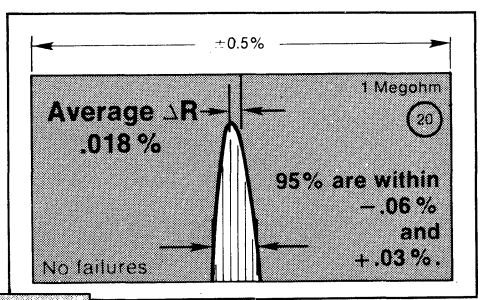
4 — Moisture Resistance Tests

5 — Low Temperature Operation

6 — Shock and Vibration Tests

This stability data appears in a series of 96 graphs that show the actual stability of 740 Caddock High Performance Film Resistors.

The individual and average resistance change is also shown in these graphs for the low, high and 'critical' values, to provide data that can be used to pre-determine actual circuit performance and long-term equipment specifications.



A copy of the 12-page brochure describing the results of these reliability and stability tests is available from the main offices of Caddock Electronics, Inc. in Riverside, California.

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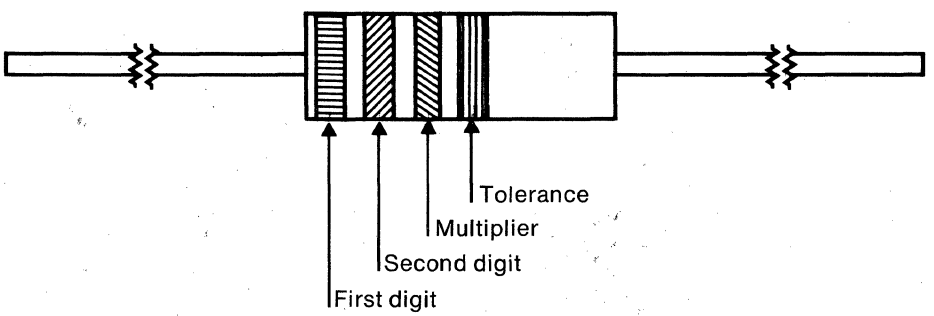
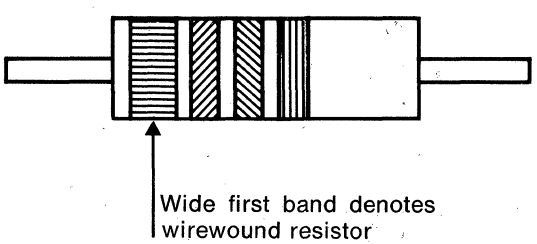
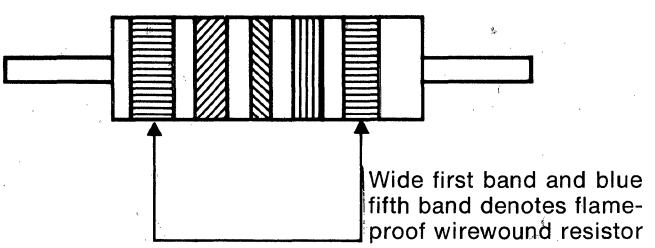
MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes



Color code for general-purpose industrial resistors

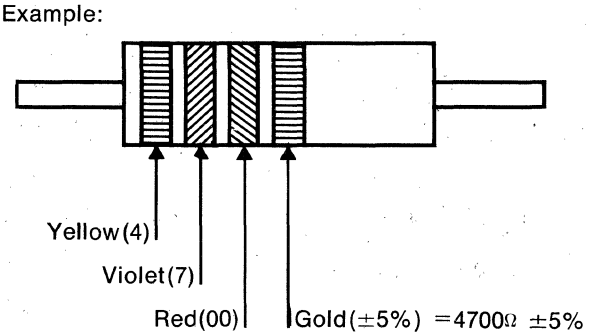




Color code for general-purpose wirewound resistors

Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

Example:

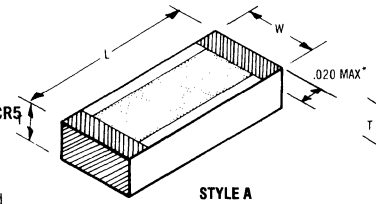


CAL-R, INC. THICK FILM

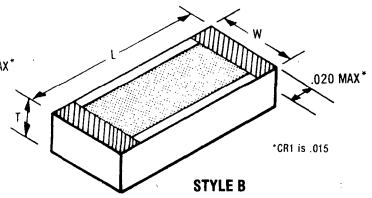
CERMET CHIP RESISTORS

ELECTRICAL

Resistance Range: 10 ohms to **40** megohms
Tolerance: 1% (F), 2% (G), 5% (J), 10% (K) standard and 20% (M)
Power Rating: 100 Milliwatts CR1, 200 Milliwatts CR2. **250 Milliwatts CR3 & 300 Milliwatts CR4, 350 Milliwatts CR5**
Short Time Overload: Less than 0.50% ΔR
Temperature Coefficient of Resistance: ±**150** ppm standard thru 1 megohm; ±350 ppm 1.1 megohm thru **10** megohms; ±50 ppm available 100 ohms thru 750K ohms. All TCR ratings as measured from −55°C to +125°C with 25°C reference point.
Standard MIL Decade Values: 10 ohms thru 20 megohms.



STYLE A



STYLE B

SIZE	LENGTH (L) ±.005	WIDTH (W) ±.005	THICKNESS (T) ±.003
CR1	.050	.040	.012
CR2	.075	.050	.016
CR3	.100	.050	.016
CR4	.150	.050	.016
CR5	.225	.075	.016
CR1010	.100	.100	.029
CR1025	.100	.025	.020
CR2010	.200	.100	.020
CR3535	.035	.035	.015
CR5025	.050	.030	.020
CR5050	.050	.050	.020

ENVIRONMENTAL

Operating Temperature: −55°C to +125°C.
Moisture Resistance: Less than 1% change when tested per method 106 of MIL-STD 202.
Life: Less than 1% change when tested per method 108D (+85°C) of MIL-STD 202.
MIL Specifications: Designed to meet MIL-R-55342 requirements.

MECHANICAL

Construction: 96% Alumina substrate with proprietary Cermet resistance element and specified termination material.

Terminations: STYLES
A 3 sided wrap-around
B Top termination
C 5 sided wrap-around

MATERIAL
A Palladium silver
B Platinum gold
C Gold
D Platinum silver
E palladium gold
Solder termination available
S1 — 60/40 S2 — SN62

CAL-R CHIP NUMBERING SYSTEM

SIZE	TERMINATION		VALUE * (OHMS)	TOLERANCE	TCR
	STYLE	MATERIAL			
CR1	A	A	1002	K	150

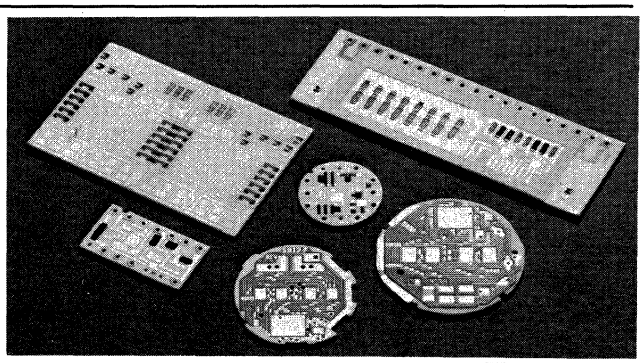
* The first 3 digits represent significant figures; the last digit specifies the number of zeros to follow.
Tolerance code: F −1%, G −2%, J −5%, K −10% & M −20%

PRECISION THICK FILM NETWORKS

Cal-R thick Film Passive Systems develops and produces, to customer requirements, packaged resistor networks including digital to analog A-D binary ladders (through 12 bits), BCD bipolar ladders and custom precision resistor networks.

Cal-R manufactures ceramic substrates for the Digital Watch market and custom R-C networks for hi-rel and commercial applications.

Cal-R thick film resistor compositions fused to a high purity 96% aluminum substrate insure low thermal gradients, high thermal stability and matched electrical characteristics.

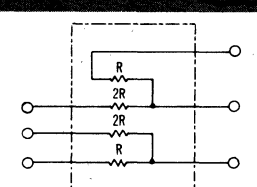


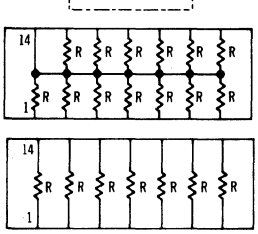
ELECTRICAL SPECIFICATIONS

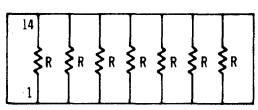
CHARACTERISTICS	DUAL and SINGLE IN-LINE AND FLATPACK RESISTOR NETWORKS	LADDER NETWORKS
Resistance Range	10 ohms to 1 megohm	10 ohms to 1 megohm
Temperature Coefficient	±150 PPM/°C STD ±50 PPM/°C Avail.	±150 PPM/°C STD ±50 PPM/°C Avail.
Tracking to:	15 PPM/°C	5 PPM/°C

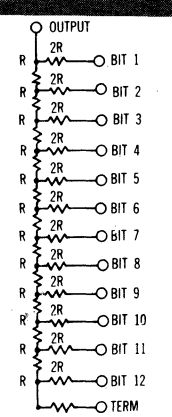
GENERAL SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C
Storage Temperature Range: −65°C to +150°C
Stability To: 25 PPM/year
Settling To: 50 nSec.
Fast Rise Time
Minimum size for maximum efficiency and quality.
All networks are 100% inspected to applicable requirements (MIL-Specs or inhouse).
All resistance parameters meet or exceed the performance requirements of MIL-R-55342A when applicable.









CAL-R, INC. 1601 Olympic Blvd., Santa Monica, California 90404 • (213) 450-1761 • TWX 910-343-6966

CAL-R®, INC. WIRE WOUND RESISTORS

PRECISION POWER RESISTORS

FEATURES

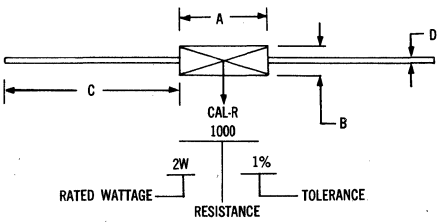
1. Copperweld leads standard. Nickel A or Alloy 180 available.
2. Core-alumina and steatite ceramics.
3. Silicone coating to give maximum wire protection and extra high resistance to moisture.
4. Failure rates of less than .006% per 1000 hours @ +25°C with 60% confidence.

ELECTRICAL CHARACTERISTICS

A. TOLERANCES: 5.0% to .01%. 1% standard for off-shelf delivery. Special matching available to .001% tolerance.
B. TEMPERATURE COEFFICIENT: 20 ppm/degree C standard. Special T.C.'s to 5 ppm/degree C available.
C. Dielectric strength greater than 1000 V.A.C.
D. Special configurations available on request.
E. SA (X) Types Thermal shock proof from 275°C to —55°C.
F. SAV (X) Types Thermal shock proof from 350°C to —55°C.
G. STABILITY: consistent with tolerances, all parts stabilized in production. Less than 0.1% drift in 2000 hours operation at full Cal-R wattage rating for 1% tolerance parts.
H. RESISTANCE RANGES: .05 ohms to 250K ohms.
I. INDUCTIVE TYPES: Single layer space wound with largest wire permissible.
J. Non-inductive Types feature dual balanced windings for minimum inductance.

ENVIRONMENTAL

Meet or exceed applicable paragraphs of MIL-R-26E and MIL-R-39007.



STANDARD RESISTANCE & TOLERANCE RANGES

*Type SA and SAX (Non-inductive)	1 Rated Wattage	*Type SAV and SAVX (Non-inductive)	2 Rated Wattage	MIL Equiv. MIL-R-26E & 39007	Dimensions A ± .062	B ± .032 3	C ± .062	D ± .002	4 Tolerances & Max. Resistance Based on .0007 Min. Wire Dia. 1% & Higher	.5%, .25%, .1% & .05%
SA 01	.4	SAV 03	.5		.250	.078	1½	.020 24 Ga.	1.4KΩ	950Ω
SA 02	.5	SAV 06	.6	RW 81U RWR 81	.250	.085	1½	.020 24 Ga.	2KΩ	1.2KΩ
SA 04	.75	SAV 09	.9		.312	.078	1½	.020 24 Ga.	3KΩ	1.3KΩ
SA 05	.8	SAV 12	1.2		.312	.094	1½	.020 24 Ga.	4.9KΩ	2.4KΩ
SA 10	.9	SAV 22	2.2		.344	.094	1½	.020 24 Ga.	5KΩ	2.5KΩ
SA 15	1.0	SAV 25	2.5	RW 70U RW 80U RWR 80	.406	.094	1½	.020 24 Ga.	7KΩ	3.5KΩ
SA 17	1.0	SAV 26	2.6		.531	.094	1½	.020 24 Ga.	10KΩ	5KΩ
SA 20	2.0	SAV 33	3.0		.500	.156	1½	.032 20 Ga.	15KΩ	7.5KΩ
SA 30	2.5	SAV 41	4.1	RW 69V	.500	.188	2	.032 20 Ga.	20KΩ	10KΩ
SA 31	3.0	SAV 45	4.5	RWR 89 RW 79U	.560	.187	2	.032 20 Ga.	25KΩ	12KΩ
SA 32	2.0	SAV 46	4.6	RWR 71	.812	.188	2	.032 20 Ga.	40KΩ	20KΩ
SA 35	3.0	SAV 52	5.2		.625	.250	2	.040 18 Ga.	35KΩ	17KΩ
SA 50	5.0	SAV 74	7.4	RWR 74 RW 74U RWR 84	.875	.312	2	.040 18 Ga.	60KΩ	30KΩ
SA 55	5.5	SAV 82	8.2	RW 67V	1.00	.313	2	.040 18 Ga.	70KΩ	35KΩ
SA 70	7.0	SAV 96	9.6		1.219	.312	2	.040 18 Ga.	90KΩ	45KΩ
SA 95	9.5	SAV 106	11.0	RW 55V	1.375	.469	1½	.040 18 Ga.	160KΩ	80KΩ
SA 100	10.0	SAV 145	14.5	RWR 78 RW 78U RW 68V	1.781	.375	2	.040 18 Ga.	200KΩ	100KΩ
SA 125	12.5	SAV 150	15.0	RW 56V	2.000	.469	1½	.040 18 Ga.	250KΩ	140KΩ

*—Available in Noninductive (code symbol "X").

1 —Nominal, based on maximum 275°C. Hot spot at 25°C. Ambient. (char. U)
2 —Nominal, based on maximum 350°C. Hot spot at 25°C. Ambient. (char. V).
3 —Tolerance for noninductive types below 150Ω ±.062.
4 —Noninductive maximum resistances are one-half of listed values.

WHEN ORDERING SPECIFY: TYPE, WATTAGE, RESISTANCE AND TOLERANCE.

POWER RESISTORS

FOUR STANDARD MC TYPE RESISTOR SPECIFICATIONS IN MIL-R SIZES

OUTSTANDING FEATURES

1. Copperweld leads hot tin dipped for maximum solderability.
2. Completely welded construction terminal to terminal.
3. High density extruded aluminum housing provides superior heat conduction.
4. Housing deep finned for maximum heat dissipation under natural and forced convection.
5. Windings—High uniformity single layer space wound, designed to give maximum core coverage for even heat dissipation. MCX (non-inductive) types have dual balanced windings for minimum inductance.
6. Core—Steatite ceramic, centerless ground for uniformity.
7. Silicone coated resistance element to give maximum wire protection and extra high resistance to moisture.

ELECTRICAL CHARACTERISTICS

Tolerances—5.0% to .05%, 1% standard for off-shelf delivery.

Temperature Coefficient—20 ppm/degree C standard. Special T.C.'s to 5 ppm/degree C available.

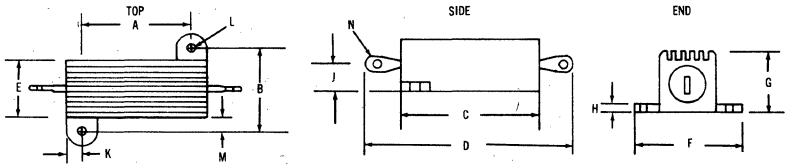
Dielectric strength greater than 1000 V.A.C. on MC-100 and MC-250, and greater than 2000 V.A.C. on MC-500.

Dielectric Test—performed on 100% basis.

Stability—consistent with tolerances, all parts stabilized in production. Less than 0.5% drift in 1000 hours operation at full Cal-R wattage rating for 1% tolerance parts. Resistance ranges—.05 ohms to 210K ohms.

ENVIRONMENTAL

Meet or exceed all requirements of MIL-R-18546D, including "N" characteristic and MIL-R-39009.



DIMENSIONS

Type	A	B	C	D	E	F	G	H	J	K	L	M	N
MC-80	.444	.490	.600	1.125	.334	.646	.317	.075	.139	.078	.093	.078	.050
MC-100	.562	.625	.750	1.375	.438	.873	.408	.094	.172	.093	.093	.094	.086
MC-250	.719	.781	1.063	1.938	.500	1.094	.531	.094	.219	.171	.125	.141	.086
MC-500	1.563	.844	1.969	2.781	.563	1.156	.625	.094	.281	.203	.125	.141	.086
TOL. ±	.005	.005	.016	.063	.031	.031	.031	.016	.031	.010	.005	.016	.015

STANDARD RESISTANCE & TOLERANCE RANGES

Type	Mil Equiv. Mil-R-18546C Mil-R-39009	Cal-R Watts Normal Rating	Watts Mil-R Rating	TOLERANCES AND MAXIMUM RESISTANCES* 1% Up	.5%	.25%	.1%	.05%
MC-80 (X)	RE 60 (N), RER 40, RER 60	8	5	.5 Ω to 20 K Ω	1 Ω to 10 K Ω	2.5 Ω to 10 K Ω	3 Ω to 10 K Ω	5 Ω to 10 K Ω
MC-100 (X)	RE 65 (N), RER 45, RER 65	10	10	.5 Ω to 25 K Ω	1 Ω to 10 K Ω	2.5 Ω to 10 K Ω	3 Ω to 10 K Ω	5 Ω to 10 K Ω
MC-250 (X)	RE 70 (N), RER 50, RER 70	25	20	.1 Ω to 70 K Ω	.2 Ω to 30 K Ω	.3 Ω to 30 K Ω	.5 Ω to 30 K Ω	1 Ω to 30 K Ω
MC-500 (X)	RE 75 (N), RER 55, RER 75	50	30	.1 Ω to 200 K Ω	.2 Ω to 80 K Ω	.3 Ω to 80 K Ω	.5 Ω to 80 K Ω	1 Ω to 80 K Ω

Available in Noninductive (code symbol "X"—Cal-R) (code symbol "N"—Mil)

*Noninductive maximum resistances are one-half of listed values.

CAL-R®, INC. 1601 Olympic Blvd., Santa Monica, California 90404 • (213) 450-1761 • TWX 910-343-6966
WIREWOUND RESISTORS • THICK FILM • THERMISTORS

CAL-R, INC. WIRE WOUND RESISTORS

POWER RESISTORS . . . Cont'd.

T-5 (5 WATTS) OUTSTANDING FEATURES

1. Copperweld leads hot tin dipped — Gold plated DUMET or "A" nickel available.
2. High density extruded aluminum housing provides superior heat conduction.
3. Housing deep finned for maximum heat dissipation.
4. Windings — high uniformity single layer space wound, designed to give maximum core coverage for even heat dissipation. T5X (non-inductive) types have dual balanced windings for minimum inductance.
5. Core — Alumina ceramic, centerless ground for uniformity.

T-3 (3 WATTS) OUTSTANDING FEATURES

1. Windings — Reverse pie wound — all pies filled for maximum heat dissipation.
2. Unique recessed end cap designed to isolate winding termination from all lead stress.
3. Protective overcoating covering entire resistor before molding insures maximum protection and secures winding without introducing stress.
4. Resistor element encased in nonburning epoxy by transfer molding techniques.
5. Copperweld leads hot tin dipped standard — Gold plated DUMET or "A" nickel available.

STANDARD RESISTANCE & TOLERANCE RANGES

Type	Normal Rating	Weight	Tolerances and Maximum Resistances 1% UP	.5%	.25%	.1%	.05%
T5	5 WATTS	.8 gr	1Ω-5K	1Ω-5K	5Ω-3K	10Ω-2.5K	10Ω-2.5K
T3*	3 WATTS	.8 gr	3K-300K	3K-300K	3K-300K	3K-300K	3K-300K

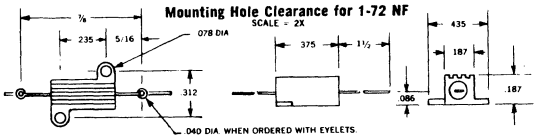
*200 VAC MAX.

T-5 ELECTRICAL CHARACTERISTICS

TOLERANCES: 5.0% to .05%. 1% standard for off-shelf delivery.
TEMPERATURE COEFFICIENT: 30 ppm/°C standard. Special T.C.'s to 5 ppm/°C available.
STABILITY: consistent with tolerances, all parts stabilized in production. Less than 0.5% drift in 1000 hours operation at full CAL-R wattage rating for 1% tolerance parts.
RESISTANCE RANGES: .5 ohms to 3 K ohms.
DIELECTRIC STRENGTH: greater than 500 V.A.C.
DIELECTRIC TEST: performed on 100% basis.

T-3 ELECTRICAL CHARACTERISTICS

TOLERANCE: 1 to .005% absolute. To .002% matching tolerance for matched sets.
TEMPERATURE COEFFICIENT: 10 ppm/°C is standard. Special TCs in ranges from +6000 ppm to 2 ppm/°C available.
STABILITY: consistent with tolerances. All parts stabilized in production, including 1% parts. Components available with stability of .002% per year.
WINDINGS: multiple pie reversed type to minimized inductance. Special windings available to provide fast rise times.
RESISTANCE: Ranges 3 K ohms to 300 K ohms.
MAXIMUM WORKING VOLTAGE: 200V.



PRECISION RESISTORS

OUTSTANDING FEATURES

1. All pies filled for maximum heat dissipation.
2. Unique recessed end cap designed to isolate winding termination from all lead stress.
3. Terminals welded to end cap for maximum strength — will withstand 15 lbs. linear pull.
4. Double slots tangent to mandrel to prevent shorting between pie windings eliminating space-wasting construction features or the need for insulating tape.
5. Protective overcoating covering entire resistor before molding insures maximum moisture protection and secures winding without introducing stress.
6. Standard leads — copperweld hot tin dipped or annealed Dumet gold plated.
7. Special matching available to .001% tolerance.

ELECTRICAL CHARACTERISTICS

TOLERANCE: 1 to .005% absolute. To .002% matching tolerance for matched sets.

TEMPERATURE COEFFICIENT: 10 ppm/°C is standard. Special TCs in ranges from +6000 ppm to 2 ppm/°C available.

STABILITY: consistent with tolerances. All parts stabilized in production, including 1% parts. Components available with stability of .002% per year.

WINDINGS: multiple pie reversed type to minimized inductance (except on Miniature Series). Special windings available to provide low rise times.

RESISTANCE: Ranges 1 ohm to 10 megohms.

PHYSICAL CHARACTERISTICS

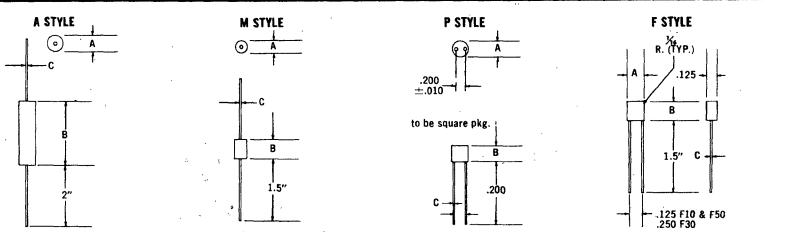
MATERIAL: Hi-Temp epoxy with matching coefficient of expansion between core and case. Leads are gold over Dumet.

ENVIRONMENTAL

Meet or exceed all requirements of MIL-R-93C and MIL-R-39005.

STANDARD RESISTANCE & TOLERANCE RANGES

CAL-R Part No.	Dimensions "A" ±.010	"B" ±.010	"C"	Rated Wattage	MIL Equiv. MIL-R-93C MIL-R-39005	Tolerances and Maximum Resistances ±1%	±.5%	±.1%	±.05%	±.01%
M10	.080	.200	.016 #26 AWG	.05		100Ω100K	300Ω-80K	1K-80K	3K-50K	1.0K-25K
M20	.100	.200	.016 #26 AWG	.06		25Ω-150K	50Ω-100K	100Ω-100K	500Ω-80K	2.5K-50K
M30	.125	.250	.020 #24 AWG	.08		10Ω-250K	20Ω-250K	80Ω-250K	300Ω-200K	1.5K-150K
M40 M41*	.125	.375	.020 #24 AWG	.10		10Ω-400K	20Ω-400K	80Ω-400K	300Ω-300K	1.K-200K
A2525	.250	.250	.032 #20 AWG	.2	RBR75	10Ω-750K	20Ω-750K	50Ω750K	200Ω-650K	1.K-500K
A2535	.250	.350	.032	.25	RBR56	10Ω-1MEG	20Ω-1MEG	50Ω-1MEG	200Ω-1MEG	800Ω-800K
A2537	.250	.375	.032	.25	RB56	10Ω-1MEG	20Ω-1MEG	50Ω-1MEG	200Ω-1MEG	800Ω-800K
A2550	.250	.500	.032	.25	RB55 RBR55	10Ω-2.5MEG	20Ω-2.5M	50Ω-2.5M	100Ω-2.5M	500Ω-2.5M
A2575	.250	.750	.032	.35	RB54 RBR54	5Ω-3M	10Ω-3M	50Ω-3M	100Ω-3M	500Ω-3M
A25100	.250	1.00	.032	.4		5Ω-3.5M	10Ω-3.5M	50Ω-3.5M	100Ω-3.5M	500Ω-3.5M
A3775	.375	.750	.032	.5	RB53 RBR53	5Ω-4M	10Ω-4M	50Ω-4M	100Ω-4M	400Ω-3M
A37100	.375	1.00	.032	1.0	RB52 RBR52	2Ω-5.5M	4Ω-5.5M	20Ω-5.5M	50Ω-5.5M	300Ω-4.5M
A5050	.500	.500	.032	.5		10Ω-4M	20Ω-4M	50Ω-4M	100Ω-4M	400Ω-3M
A5062	.500	.625	.032	.5						
A5070	.812	.312	.032	.5	RBR76	5Ω-5.5M	10Ω-5.5M	50Ω-5.5M	100Ω-5.5M	400Ω-4.5M
A50100	.500	1.00	.032	1.0	RB57 AFRT14	1Ω-7MEG	5Ω-7M	20Ω-7MEG	50Ω-7MEG	200Ω-5MEG
P2531	.250	.312	.025 #22 AWG	.12		10Ω-1MEG	20Ω-1M	50Ω-1M	100Ω-1M	800Ω-800K
P3750	.375	.500	.025	.35		5Ω-1.5M	10Ω-1.5M	30Ω-1.5M	100Ω-1.5M	800Ω-1.MEG
F10	.250	.250	.032 #20 AWG	.125		10Ω-750K	20Ω-750K	50Ω-750K	200Ω-650K	1.K-500K
F30	.500	.250	.032	.25		10Ω-1M	20Ω-1MEG	50Ω-1M	200Ω-1M	800Ω-800K
F50	.250	.500	.032	.25		5Ω-1.3M	10Ω-1.3M	20Ω-1.3M	100Ω-1.3M	200Ω-1.M



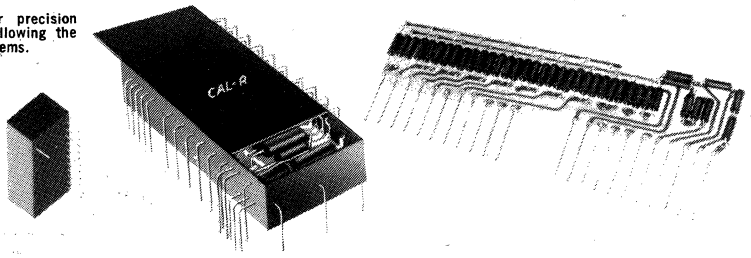
* NON INDUCTIVE

PRECISION RESISTOR NETWORKS

Cal-R engineers, specialists in advanced network design, offer precision assemblies, packaged to meet the most exacting specifications, allowing the circuit designer maximum freedom without costly packaging problems.

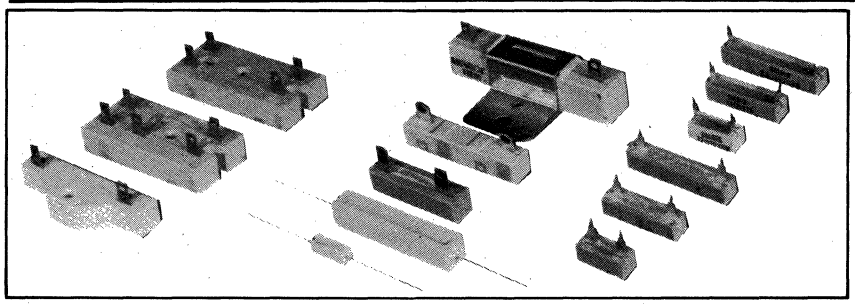
GENERAL SPECIFICATIONS

RESISTOR VALUES: From 1 ohm thru 5 megohms
FULL SCALE ACCURACY: to .005%.
TEMPERATURE COEFFICIENT TRACKING: to 1 PPM/°C.
TEMPERATURE COEFFICIENT ABSOLUTE: to 2 PPM/°C.
AMBIENT TEMPERATURE RANGE: —55°C to +125°C.
STANDARD TEMPERATURE COEFFICIENT: 0 to ±10 PPM.
STABILITY: to 10 PPM per year.
FAST RECOVERY TIME: to within .02% of final value within 100 ns.



COLBER RESISTORS

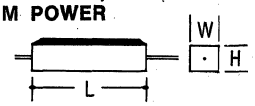
WIRE WOUND / TEMPERATURE SENSITIVE / CERAMIC ENCAPSULATED / CARBON & METAL FILM / FUSISTORS (FUSEABLE RESISTORS)



The resistance elements of the Colber resistors are uniformly and tightly wound on glass fiber cores using premium quality wires. Tinned steel or brass terminals are secured to the element by automatic assembly equipment. The high degree of automation used in manufacturing this resistor allows you to use a high quality wire wound unit at a cost of approximately two cents.

RESISTORS FIXED WIRE WOUND

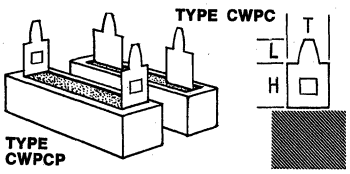
RESISTANCE TOLERANCE
10% STANDARD, 3% & 5% AVAILABLE
MEDIUM POWER



Part No.	Wattage Rating	L± 1/16"	H± 1/32"	W± 1/32"	Resist. Ranges (OHMS) Standard Temp. Coefficients .06%/°C	.03%/°C
CW2	2	45/64	1/4	1/4	.0035-.2	.22-1.5k
CW3	3	7/8	5/16	5/16	.005-.27	.3-2.5k
CW5	5	7/8	3/8	3/8	.005-.27	.3-2.5k
CW7	7	1 25/64	11/32	3/8	.0075-.7	.75-6k
CW10	10	1 7/8	11/32	3/8	.01-.9	1-8k
CW15	15	1 7/8	1/2	1/2	.01-.9	1-8k
CW20	20	2 1/2	1/2	1/2	.015-1.35	1.5-13k
CW25	25	2 1/2	5/8	5/8	.015-1.35	4-400

Consult Factory for Values as low as .0035Ω.

ENCAPSULATED RESISTORS



1. **Terminals** — Brass, tin plated, Parallel or perpendicular to the case.
2. **Body**—Ceramic Case, Inorganic, Fireproof Fill.
3. **Resistive Element** — High quality Colber type as in all our resistors.
4. **Tolerance** — 10% Standard, 5% Available.

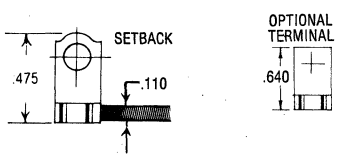
TERMINAL DIMENSIONS

Type	T	H	L	W
CWPC	—	—	.100-.120	.055
CWPC	.150	.050 Ref.	.180	.055
CWPC	.150	.210 Ref.	.180	.055
CWPCP	.150	.390 Ref.	.175	.055

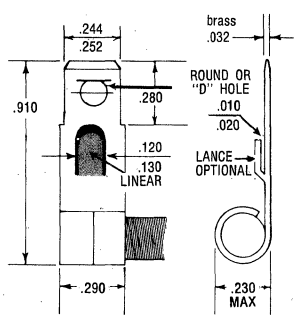
PCP available in 5, 7, & 10W only.

STANDARD COLBER RESISTORS

Approximately 4 watts per inch

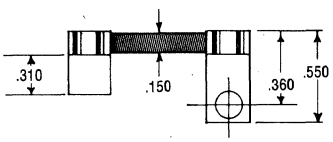


QUICK CONNECTION



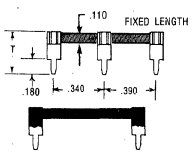
INTERMEDIATE COLBER RESISTORS

Approximately 5 watts per inch

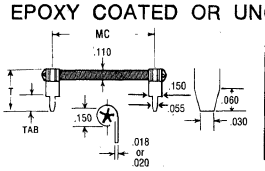


PRINTED CIRCUIT COLBER RESISTORS

Approximately 4 watts per inch



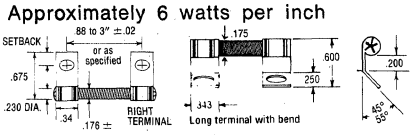
EPOXY COATED OR UNCOATED



TL	TAB	MC	Style
.400	.120	.500 2.125	A
.500	.180	.500 2.125	B
.700	.180	.500 2.125	C

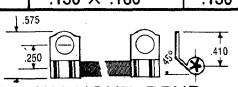
HIGH WATTAGE COLBER RESISTORS

Approximately 6 watts per inch



.675 TERM LENGTH

Setback	Left Hole	Right Hole
.130	.125	.125
.185	.240	.200 X .220
.140		.172 X .210
.140	.130 X .160	.130 X .160



WITH OR WITHOUT BEND

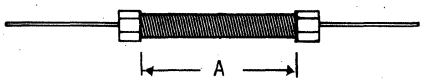
.575 TERM LENGTH

Setback	Left Hole	Right Hole
.225	.180	.180
.180	.130	.130
.180	.195	.195 X .180
.160	.130	.130 X .180
.160	.200 X .240	.130
.160	.180 X .130	.130 X .180
L Hole R Hole		
.115 .180	.130 X .160	.200 X .220
.210	.200 X .220	.200 X .220
.120	.130 X .160	.130 X .160
.180	.172 X .210	.172 X .210
.115	.104 X .130	.104 X .130
.135	.130 X .150	.130 X .150

Note: Any hole combination available with additional minor tooling.

AXIAL LEAD COLBER RESISTORS

TYPE AL — WIRE WOUND



LEAD SIZES AVAILABLE
.032 X .950 Tinned Copper
.032 X 1.200 Tinned Copper
.032 X .950 Tinned Copper
.032 X 1 1/16 Tinned Copper
.036 X 1 1/16 Tinned Copper
.040 X 1 1/16 Tinned Copperweld

LEAD MATERIAL:
Copper — Oxygen free, dead soft, Tinned Copperweld — Steel core, copper clad, Tinned.

CORE MATERIAL:
Silicone impregnated, braided fiberglas.

RESISTANCE TOLERANCE:
±10% Standard
±3% & ±5% Available
Tape & Reel and Color Coding Available

STANDARD SIZES
(alternate sizes available):

"A" Dimension	4 Watts per Inch Wattage Rating	Resistance Ranges (OHMS) Standard Temperature Coefficients .06%/°C	.03%/°C
AL-2 .280" (min.)	1.1	.015-.2Ω	.22-1.5k
AL-5 .400"	1.6	.02-.27Ω	.3-2.5k
AL-6 .650"	2.6	.03-.44Ω	.45-4k
AL-7 .925"	3.7	.05-.7Ω	.75-6k
AL-10 1.400"	5.6	.075-.9Ω	1-8k
AL-20 2.000" (max.)	8.	.1-1.35Ω	1.5-13k

5 watts per inch also available.

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QUALITY RESISTORS FOR INDUSTRY

CR CARBON FILM FIXED RESISTOR

Style	Power Rating (W)	Dimensions L	D	d	H	Max. Working V	Max. Overload V	Resistance Range Ω ±2% (G)	5% (J)
CR-12S	1/8 (0.125)	3.7 ±0.3	1.6 ±0.15	0.5	28 ±2	200	400	10 – 100K	2.2 – 4.7M
CR-16S	1/6 (0.16)	3.5 ±0.3	1.8 ±0.15	0.5	28 ±2	200	400	10 – 100K	2.2 – 4.7M
CR-25S	1/4 (0.25)	6.5 ±0.5	2.3 ±0.2	0.6	28 ±2	250	500	10 – 1M	1 – 10M
CR-33S	1/3 (0.33)	8.5 ±0.5	2.8 ±0.3	0.6	28 ±2	300	600	10 – 1M	1 – 10M
CR-50S	1/2 (0.5)	9.5 ±0.5	3.5 ±0.5	0.7 (0.6)	28 ±2	350	700	10 – 1M	1 – 10M
CR-1S	1	13 ±1	4.5 ±0.5	0.8	35 ±3	500	1000	10 – 1M	1 – 10M
CR-2S	2	18 ±1	6 ±1	0.8	35 ±3	500	1000	10 – 1M	1 – 10M

Higher and Lower resistance value are available upon request.

MF METAL FILM FIXED RESISTOR

Style	Power Rating (W)	ML-R-0509F	Dimensions (mm) L	D	d	H	Max. Working V	Max. Overload V	Resistance Range Ω ±0.5% E–192	±1% E–96	±2% E–24	±5% E–24
MF12S	0.125	RN50	3.7±0.3	1.6±0.15	0.5	28±2	150	300	–	10–560K	–	–
									–	10–560K	10–604K	–
									–	–	2.2–604K	1–1M
MF25S	0.25	RN55	6.5±0.5	2.3±0.2	0.6	28±2	250	500	10–1M	10–1M	–	–
									10–1M	10–1M	10–2.2M	–
									–	1–1M	1–2.2M	1–2.2M
MF50S	0.5	RN60	9.5±0.5	3.5±0.5	0.7(0.6)	28±2	350	700	10–1M	10–1M	–	–
									10–1M	10–1M	10–2.2M	–
									–	1–1M	1–2.2M	1–2.2M
MF100S	1	RN65	13±1	4.5±0.5	0.8	35±3	450	900	10–1M	10–1M	–	–
									10–1M	10–1M	10–2.2M	–
									–	1–1M	1–2.2M	1–2.2M

* Tighter tolerance, higher and lower resistance value are available upon request.

CRP FLAME PROOF CARBON FILM FIXED RESISTOR

Style	Power Rating (W)	Dimension (mm) L	D	d	H	Max. Working V	Max. Overload V	Resistance Range Ω ±2%	±5%
CRP25S	0.25	6.5 ±0.5	2.3 ±0.2	0.6	28 ±2	250	500	10 – 1M	1 – 10M
CRP50S	0.5	9.5 ±0.5	3.5 ±0.5	0.7 (0.6)	28 ±2	350	700	10 – 1M	1 – 10M

MFP FLAME PROOF METAL FIXED RESISTOR

Style	Power Rating (W)	Dimension (mm) L	D	d	H	Max. Working V	Max. Overload V	Resistance Range Ω ±0.5% E – 96 E – 192	±1% E – 24 E – 96	±2% E – 24	±5% E – 24
MFP25S	0.25	6.5 ±0.5	2.3 ±0.2	0.6	28 ±2	250	500	10 – 1M	10 – 1M	–	–
								10 – 1M	10 – 1M	10 – 2.2M	–
								–	1 – 1M	1 – 2.2M	1 – 2.2M
MFP50S	0.5	9.5 ±0.5	3.5 ±0.5	0.7 (0.6)	28 ±2	350	700	10 – 1M	10 – 1M	–	–
								10 – 1M	10 – 1M	10 – 2.2M	–
								–	1 – 1M	1 – 2.2M	1 – 2.2M

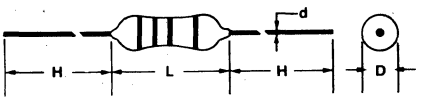
RSF METAL OXIDE FIXED RESISTOR (FLAME RETARDANT)

Style	Power Rating (W)	Dimension (mm) L	D	d	H	Max. Working V	Max. Overload V	Resistance Range Ω ±2% (G)	±5% (J)
RSF50S	0.5	9 ±1	3.5 ±0.5	0.7	30 ±3	250	400	5.1 ~ 100K	1 ~ 100K
RSF1S	1	11.5 ±1	4 ±0.5	0.8	30 ±3	350	600	5.1 ~ 100K	1 ~ 100K
RSF2S	2	15.5 ±1	5 ±1	0.8	30 ±3	350	600	5.1 ~ 120K	1 ~ 120K
RSF3S	3	24.5 ±1	9 ±1	0.8	38 ±3	500	800	5.1 ~ 150K	1 ~ 150K
RSF4S	4	34 ±1	9 ±1	0.8	38 ±3	500	800	5.1 ~ 240K	1 ~ 240K
RSF5S	5	41 ±1	9 ±1	0.8	38 ±3	750	1000	5.1 ~ 240K	1 ~ 240K

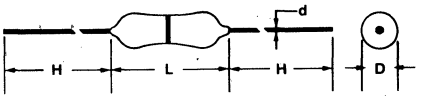
SQ WIRE-WOUND CEMENT RESISTORS

Style	Power Rating (W)	Dimensions (mm) L ±1	W ±1	H ±1	d ±1	t ±3	Resistance Range Ω	RESISTANCE TOLERANCE
SQ-2	2	18	6.5	6.5	0.80	35	0.2 – 150	F (±1%) G (±2%) J (±5%) K (±10%)
SQ-3	3	22	8.0	8.0	0.80	35	0.2 – 470	
SQ-5	5	22	9.5	9.0	0.80	35	0.2 – 1K	
SQ-7	7	35	9.5	9.0	0.80	35	0.2 – 1.5K	
SQ-10	10	48	9.5	9.0	0.80	35	1.1 – 2K	

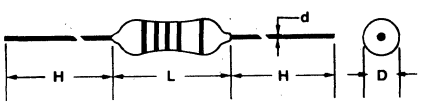
CR Coating Color: TAN
Marking: Color Code



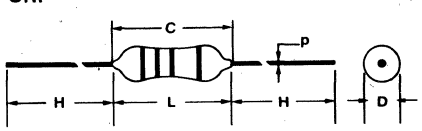
ZERO OHM RESISTORS Resistance: <0.01Ω
Coating Color: TAN
Marking: One Black Band



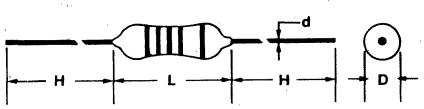
MF Coating Color: Light Blue
Marking: Color Code



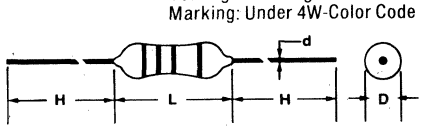
CRP



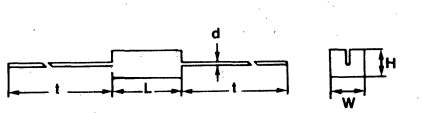
MFP



RSF Coating Color: Light Blue
Marking: Under 4W-Color Code



SQ



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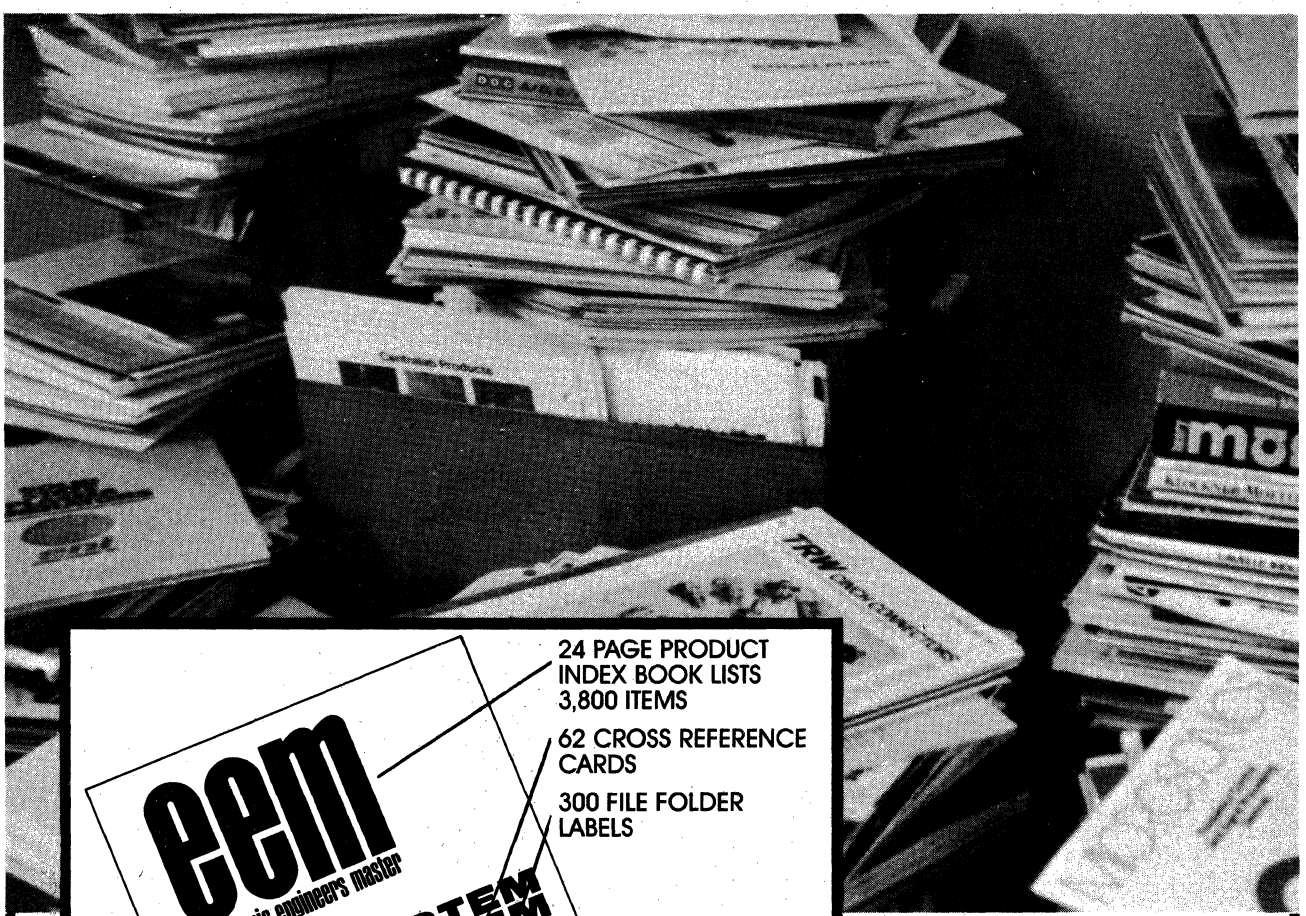

ALL NEW with this edition of EEM

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Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

The EEM File System was invented over twenty-five years ago to help people who specify, buy, or work with electronic products and equipment. It is upgraded on a constant basis to reflect the current state of the art. It's easy to use and easy to customize to your particular needs.

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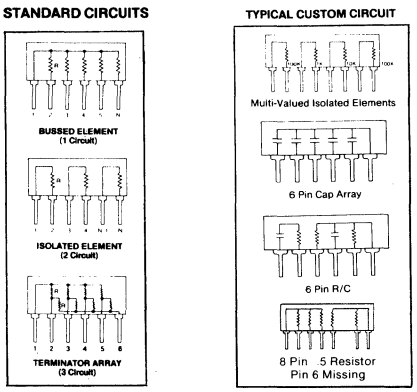
Customize Your Circuits With Corning Components

SIP Resistor Networks

Corning SIP Resistor Networks include 6- through 12-pin products with low (.200″), medium (.250″), and high (.350″) profiles. These conformally coated networks are rated at 70°C and meet all the environmental requirements of MIL-R-83401. Bussed element, isolated element, and terminator circuits are available.

Corning's expanded custom circuit capabilities now include custom resistor, resistor-capacitor, and capacitor array networks in the SIP configuration. Substrate packages up to 2″ x 2″ are available.

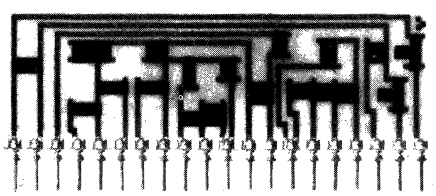
Special power and voltage requirements can also be provided.



Pulse Withstanding Resistors

These resistors provide protection against a variety of electrical hazards which can change or destroy sensitive electronic equipment. In particular:

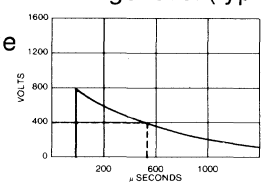
1. High voltage, short duration pulses from lightning strokes (attenuated direct or inductively coupled discharges).
2. High energy voltage surges caused by power line anomalies (direct power crosses or inductively coupled effects).
3. Other momentary over-voltages.



Lightning Pulse Wave Forms

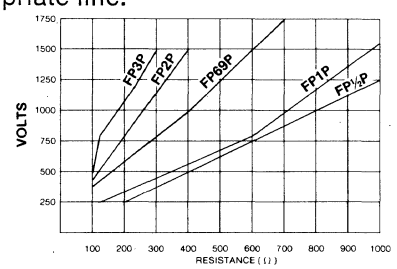
Lightning pulse wave forms are defined by three numbers:

- Maximum time to reach peak voltage level (typically 10 micro-seconds).
- Minimum time for voltage to decrease to half value.
- The peak voltage level.



10 by 560 — 800 Volts
FCC — Metallic Surge

This graph shows the relationship between resistance value and pulse withstanding voltage for FP1/2P thru FP3P using a 0.1% resistance shift after 10 pulses as the figure of merit. The stable operating region of each package is on the right hand side of the appropriate line.



Standard Products

Standard Corning Resistors for the Electronics Industry are segmented by stability, application and market. The products are:

MIL-R-55182	Commercial equivalents
MIL-R-39017	to the MIL Specs
MIL-R-10509	O OHM resistors
MIL-R-22684	Flameproof Power Resistors

Capitalize on Quality

"Quality" is a corporate byword at Corning where our extensive controls, built into component production processes, have proven effectiveness levels measured in parts per million. The many employee-generated productivity programs at Corning reflect the pride Corning employees take in their products.

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Bradford, PA 16701
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TLX - 914496

Customer Service
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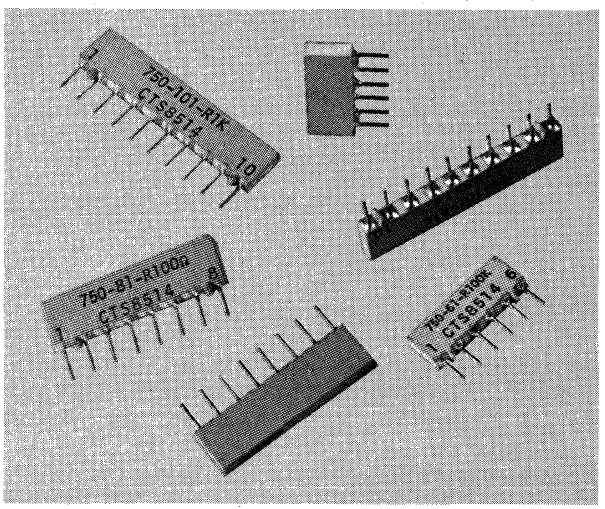
BERNE DIVISION

SINGLE-IN-LINE CERMET RESISTOR NETWORKS

750 SERIES SINGLE-IN-LINE SOLID CERAMIC CERMET RESISTOR NETWORKS

- Compact edge mount modules
- Ultra high stability and reliability
- Automatic insertion capabilities
- Available with capacitors
- Exclusive patented lead wire termination
- .100″ lead spacing
- Alumina substrate
- Machine insertable R/C package



A limited number of substrates are available with .125″ lead centers.

ELECTRICAL SPECIFICATIONS

Temperature Range:
−55°C to +125°C (operating)

Resistance Range:
Standard — 33Ω thru 1 MegΩ
Special — below 33Ω and above 1 MegΩ

Resistance Tolerance:
Standard ±2%
Special ±0.5% or 0.5Ω (whichever is greater)

Matching: (2 like resistors)
50Ω to 100 KΩ — 0.5% or 0.5Ω
(whichever is greater)
100 KΩ to 500 KΩ — 1%
500 KΩ to 3 MegΩ — 2.5%

Ratio Matching:
50Ω to 100Ω — ±1%
100Ω to 100 KΩ — ±0.5%
100 KΩ to 1 MegΩ — ±2%
Note: Multiple matches available upon engineering approval

Temperature Coefficient*:
Standard ±300 PPM/°C
Special ±100 PPM/°C
Tracking available to 50 PPM/°C with same formulation on same side of substrate

Max. Operating Voltage*:
100V not to exceed rated power

Dielectric Strength:
200V

MECHANICAL SPECIFICATIONS

Substrate Material:
Alumina

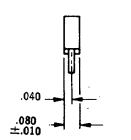
Resistor Material:
Cermet — thick film

Insulation Coating:
Organic — epoxy phenolic

Lead Material:
Solder coated copper alloy

Solder:
60/40 tin/lead

NO. OF PINS	"A" DIMENSION
4	.378
5	.478
6	.578
8	.778
9	.878
10	.978



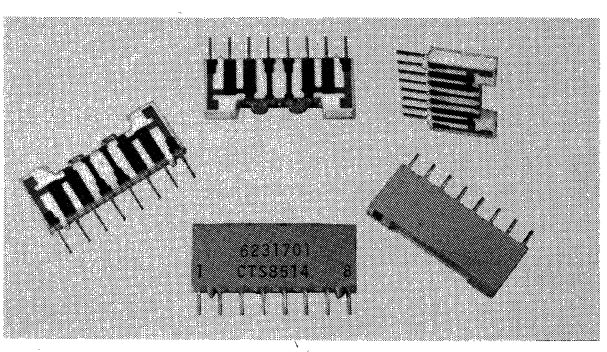
NOTE
INSULATION COATING APPLIED ON THE TWO FACES ONLY

* Custom networks can usually be designed to exceed resistance range, individual resistor power, maximum operating temperature and maximum operating voltage standards. TCR may be affected by some custom network requirements.

RESISTOR/CAPACITOR NETWORKS

750 Series R/C single-in-line resistor networks suitable for automatic insertion

750 R/C is available with 6 pins 2 capacitors, 8 pins 3 capacitors or 10 pins 4 capacitors.



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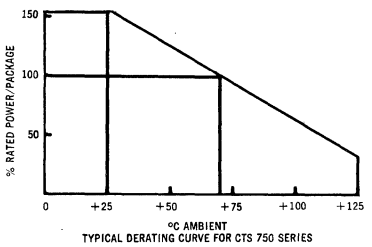
SINGLE-IN-LINE CERMET RESISTOR NETWORKS

750 SERIES SINGLE-IN-LINE SOLID CERAMIC CERMET RESISTOR NETWORKS

TOTAL NETWORK POWER @ 25°C

Package	Resistor Power	Number of Pins					
		4	5	6	8	9	10
.250″	.30	.7	1.1	1.4	1.7	2.0	2.3
.350″	.375	1.0	N/A	1.5	2.0	N/A	3.0
.350 R.C.	.30	N/A	N/A	1.4	1.7	N/A	2.3
TOTAL NETWORK POWER @ 70°C							
.250″	.20	.5	.7	.9	1.1	1.3	1.5
.350″	.25	0.7	N/A	1.0	1.3	N/A	2.0
.350″ R.C.	.20	N/A	N/A	0.9	1.1	N/A	1.5

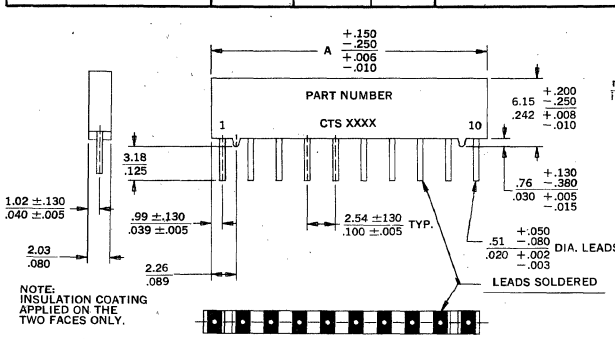


TYPICAL DERATING CURVE FOR CTS 750 SERIES

ENVIRONMENTAL PERFORMANCE SPECIFICATIONS

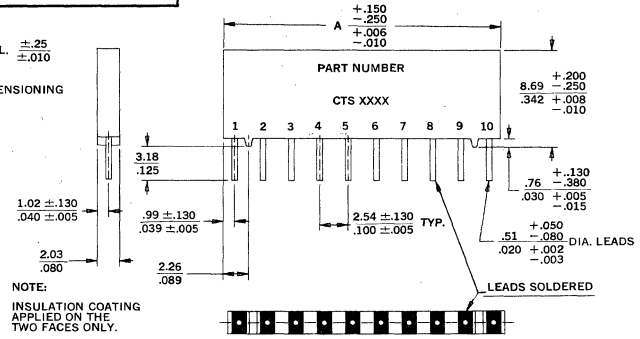
Test	Max. % △ R	Mil Std. 202 Method	Test Cond.	Test Description
Thermal Cycling	0.25%	107	B	5 cycles, −65°C to +125°C
Short Time Overload	0.25%	—	—	2½ x rated voltage 5 sec., 100V max.
Moisture Resistance	0.5%	106	0	240 hours, .1 rated load, −10°C to +65°C, 90% RH
Load Humidity	1.0%	—	—	1000 hours, .1 rated load, 70°C, 85-92% RH
High Temp Exposure	0.5%	—	—	100 hours, no load @ 125°C
Load Life	1.0%	—	—	1000 hours @ 70°C, rated load
Resistance to Solder Heat	.25%	210	A	350°C, 3 sec. dwell
Mechanical Shock	.25%	213	I	500g, 1 msec., 3 shocks ea. plane
Vibration	.25%	204	D	20g, 10-2000 Hz, 4 hours/plane
Terminal Strength	.25%	—	—	2.0 Kg pull, 30 sec., two 45° bends
Low Temp Storage	.25%	—	—	24 hours @ −65°C, no load
Low Temp Operation	.25%	—	—	45 min. @ −65°C, full load
Resistance to Solvents		215	—	Isopropyl alcohol, 1-1-1 Trichloroethane, Freon TMC

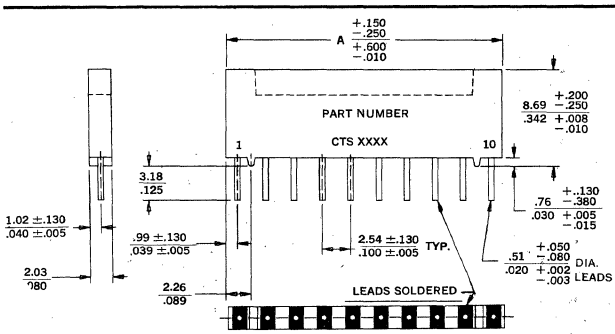
NO. OF PINS	"A" DIMENSION
4	.378
6	.578
8	.778
10	.978



GEN. TOL. ±.25 ±.010

mm / inch DIMENSIONING





GEN. TOL. ±.25 ±.010

mm / inch DIMENSIONING

NOTE:
INSULATION COATING APPLIED ON THE TWO FACES ONLY.

NO. OF PINS	"A" DIMENSION
6	.578
8	.778
10	.978

CAPACITORS

Temperature Range: −55°C to 125°C (operating)

	NPO	X75
Capacitance Range:	1 pf-680 pf	100 pf-.047 μf
Capacitance Tolerance:		
Standard—	±20%	±20%
Special—	±5%	±10%
Temperature Coefficient:	±30 ppm/°C	±15%
Voltage Rating:		
Standard—	25 VDC	25 VDC
Special—	50 VDC	50 VDC

QUALITY— HOW'S THIS!! 157,000 YEARS OF LIFE TESTING UNSURPASSED IN THE INDUSTRY

ORDERING INFORMATION: Place orders using following address:
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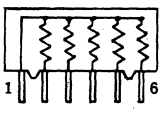
SINGLE-IN-LINE CERMET RESISTOR NETWORKS

750 SERIES SINGLE-IN-LINE SOLID CERAMIC CERMET RESISTOR NETWORKS

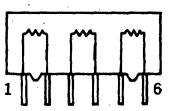
STANDARD "OFF THE SHELF" PART NUMBERS

Resistance Value, Tolerance	6 Pin, 3 Resistor	6 Pin, 5 Resistor	8 Pin, 4 Resistor	8 Pin, 7 Resistor	10 Pin, 5 Resistor	10 Pin, 9 Resistor
22Ω ±2%	—	—	750-83-R22Ω	—	—	—
33Ω ±2%	750-63-R33Ω	—	750-83-R33Ω	750-81-R33Ω	750-103-R33Ω	750-101-R33Ω
47Ω ±2%	—	—	750-83-R47Ω	—	750-103-R47Ω	750-101-R47Ω
51Ω ±2%	—	750-61-R51Ω	—	750-81-R51Ω	—	750-101-R51Ω
56Ω ±2%	—	—	750-83-R56Ω	750-81-R56Ω	—	750-101-R56Ω
62Ω ±2%	—	—	—	—	—	—
68Ω ±2%	750-63-R68Ω	750-61-R68Ω	750-83-R68Ω	750-81-R68Ω	750-103-R68Ω	750-101-R68Ω
75Ω ±2%	—	—	750-83-R75Ω	750-81-R75Ω	—	—
82Ω ±2%	—	750-61-R82Ω	750-83-R82Ω	750-81-R82Ω	—	—
91Ω ±2%	—	—	—	750-81-R91Ω	—	—
100Ω ±2%	750-63-R100Ω	750-61-R100Ω	750-83-R100Ω	750-81-R100Ω	750-103-R100Ω	750-101-R100Ω
110Ω ±2%	—	750-61-R110Ω	—	750-81-R110Ω	—	—
120Ω ±2%	—	750-61-R120Ω	750-83-R120Ω	750-81-R120Ω	750-103-R120Ω	750-101-R120Ω
150Ω ±2%	750-63-R150Ω	750-61-R150Ω	750-83-R150Ω	750-81-R150Ω	—	—
160Ω ±2%	—	750-61-R160Ω	—	750-81-R160Ω	—	750-101-R160Ω
180Ω ±2%	—	750-61-R180Ω	750-83-R180Ω	750-81-R180Ω	750-103-R180Ω	750-101-R180Ω
200Ω ±2%	—	750-61-R200Ω	—	750-81-R200Ω	—	—
220Ω ±2%	750-63-R220Ω	750-61-R220Ω	750-83-R220Ω	750-81-R220Ω	750-103-R220Ω	750-101-R220Ω
240Ω ±2%	—	750-61 R240Ω	—	—	—	—
270Ω ±2%	—	750-61 R270Ω	750-83-R270Ω	750-81-R270Ω	750-103-R270Ω	750-101-R270Ω
330Ω ±2%	750-63-R330Ω	750-61-R330Ω	750-83-R330Ω	750-81-R330Ω	750-103-R330Ω	750-101-R330Ω
360Ω ±2%	—	750-61-R360Ω	—	—	—	—
390Ω ±2%	—	750-61 R390Ω	—	750-81-R390Ω	—	750-101-R390Ω
430Ω ±2%	—	750-61-R430Ω	—	750-81-R430Ω	—	—
470Ω ±2%	750-63-R470Ω	750-61 R470Ω	750-83-R470Ω	750-81-R470Ω	750-103-R470Ω	750-101-R470Ω
500Ω ±2%	—	750-61-R500Ω	—	750-81-R500Ω	—	—
510Ω ±2%	—	750-61-R510Ω	—	750-81-R510Ω	—	750-101-R510Ω
560Ω ±2%	—	—	—	750-81-R560Ω	750-103-R560Ω	750-101-R560Ω
680Ω ±2%	750-63-R680Ω	750-61-R680Ω	750-83-R680Ω	750-81-R680Ω	750-103-R680Ω	750-101-R680Ω
820Ω ±2%	—	—	—	750-81-R820Ω	—	750-101-R820Ω
910Ω ±2%	—	—	—	750-81-R910Ω	—	—
1KΩ ±2%	750-63-R1KΩ	750-61-R1KΩ	750-83-R1KΩ	750-81-R1KΩ	750-103-R1KΩ	750-101-R1KΩ
1.1KΩ ±2%	—	—	—	—	—	750-101-R1.1KΩ
1.2KΩ ±2%	—	750-61-R1.2KΩ	750-83-R1.2KΩ	750-81-R1.2KΩ	—	750-101-R1.2KΩ
1.33KΩ ±2%	—	750-61-R1.33KΩ	—	—	—	—
1.5KΩ ±2%	750-63-R1.5KΩ	750-61-R1.5KΩ	750-83-R1.5KΩ	750-81-R1.5KΩ	—	750-101-R1.5KΩ
2KΩ ±2%	750-63-R2KΩ	750-61-R2KΩ	750-83-R2KΩ	750-81-R5.6KΩ	—	750-101-R2KΩ
2.2KΩ ±2%	750-63-R2.2KΩ	750-61-R2.2KΩ	750-83-R2.2KΩ	750-81-R2.2KΩ	750-103-R2.2KΩ	750-101-R2.2KΩ
2.7KΩ ±2%	—	750-61-R2.7KΩ	—	750-81-R2.7KΩ	—	—
3KΩ ±2%	—	—	750-83-R3KΩ	750-81-R3KΩ	—	—
3.3KΩ ±2%	750-63-R3.3KΩ	750-61-83.3KΩ	750-83-R3.3KΩ	750-81-R3.3KΩ	750-103-R3.3KΩ	750-101-R3.3KΩ
3.9KΩ ±2%	—	—	—	750-81-R3.9KΩ	—	—
4.7KΩ ±2%	750-63-R4.7KΩ	750-61-R4.7KΩ	750-83-R4.7KΩ	750-81-R4.7KΩ	750-103-R4.7KΩ	750-101-R4.7KΩ
5.1KΩ ±2%	—	—	750-83-R5.1KΩ	—	—	750-101-R5.1KΩ
5.6KΩ ±2%	—	750-61-R5.6KΩ	750-83-R5.6KΩ	750-81-R5.6KΩ	—	750-101-R5.6KΩ
6.8KΩ ±2%	750-63-R6.8KΩ	750-61-R6.8KΩ	750-83-R6.8KΩ	750-81-R6.8KΩ	750-103-R6.8KΩ	750-101-R6.8KΩ
10KΩ ±2%	750-63-R10KΩ	750-61-R10KΩ	750-83-R10KΩ	750-81-R10KΩ	750-103-R10KΩ	750-101-R10KΩ
12KΩ ±2%	—	—	—	—	—	750-101-R12KΩ
15KΩ ±2%	750-63-R15KΩ	750-61-R15KΩ	750-83-R15KΩ	750-81-R15KΩ	—	750-101-R15KΩ
18KΩ ±2%	—	—	—	750-81-R18KΩ	—	—
20KΩ ±2%	—	—	750-83-R20KΩ	—	—	—
22KΩ ±2%	750-63-R22KΩ	750-61-R22KΩ	750-83-R22KΩ	750-81-R22KΩ	750-103-R22KΩ	750-101-R22KΩ
33KΩ ±2%	750-63-R33KΩ	750-61-R33KΩ	750-83-R33KΩ	750-81-R33KΩ	750-103-R33KΩ	750-101-R33KΩ
47KΩ ±2%	750-63-R47KΩ	750-61-R47KΩ	750-83-R47KΩ	750-81-R47KΩ	750-103-R47KΩ	750-101-R47KΩ
56KΩ ±2%	—	—	—	750-81-R56KΩ	—	750-101-R56KΩ
68KΩ ±2%	750-63-R68KΩ	750-61-R68KΩ	750-83-R68KΩ	750-81-R68KΩ	750-103-R68KΩ	—
100KΩ ±2%	750-63-R100KΩ	750-61-R100KΩ	750-83-R100KΩ	750-81-R100KΩ	750-103-R100KΩ	750-101-R100KΩ
120KΩ ±2%	—	—	750-83-R120KΩ	—	—	—
150KΩ ±2%	750-63-R150KΩ	750-61-R150KΩ	750-83-R150KΩ	750-81-R150KΩ	—	750-101-R150KΩ
220KΩ ±2%	750-63-R220KΩ	750-61-R220KΩ	750-83-R220KΩ	750-81-R220KΩ	—	750-101-R220KΩ

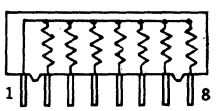
* **NOTE: Additional resistance values are constantly being added.** Please contact your local CTS Industrial Distributor to check availability of values not shown above.



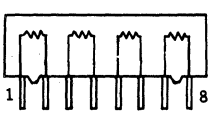
6 PIN-5 RESISTORS
SOLID CERAMIC
PART NUMBER
750-61-R (VALUE)



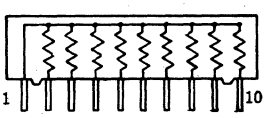
6 PIN-3 RESISTORS
SOLID CERAMIC
PART NUMBER
750-63-R (VALUE)



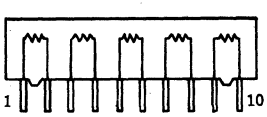
8 PIN-7 RESISTORS
SOLID CERAMIC
PART NUMBER
750-81-R (VALUE)



8 PIN-4 RESISTORS
SOLID CERAMIC
PART NUMBER
750-83-R (VALUE)

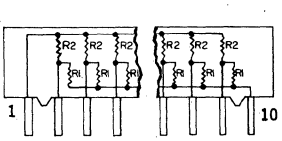


10 PIN-9 RESISTORS SOLID CERAMIC
PART NUMBER 750-101-R (VALUE)



10 PIN-5 RESISTORS SOLID CERAMIC
PART NUMBER 750-103-R (VALUE)

R1/R2 Ohms	Thevenin Impedance
Part Number 750-85-R (R1/R2)	
81/130	50Ω
121/195	75Ω
162/260	100Ω
180/390	123Ω
220/330	132Ω
330/390	180Ω
330/470	195Ω
Part Number 750-105-R (R1/R2)	
180/390	94Ω
220/270	121Ω
220/330	132Ω
220/470	150Ω
330/390	179Ω



NO. OF PINS	NO. RES.	PART NUMBER
8	12	750-85-R1/R2 (Values)
10	16	750-105-R1/R2 (Values)

ORDERING INFORMATION: Place orders using following address:
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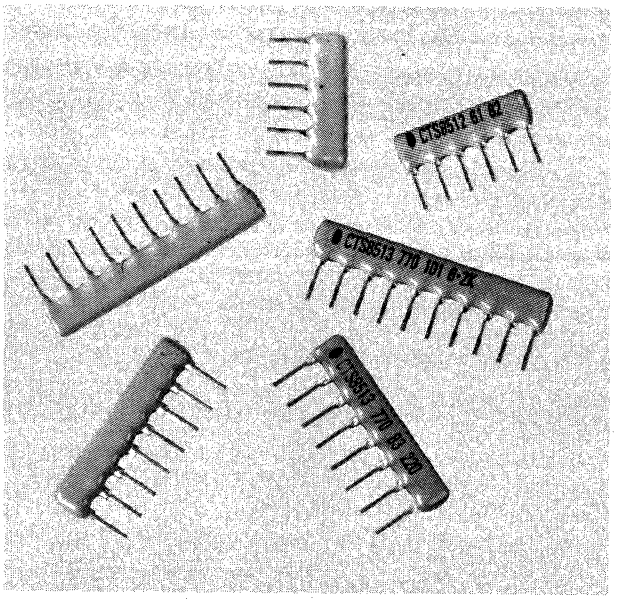
SINGLE-IN-LINE CERMET RESISTOR NETWORKS

770 SERIES SINGLE-IN-LINE CONFORMAL COATED CERMET RESISTOR NETWORKS

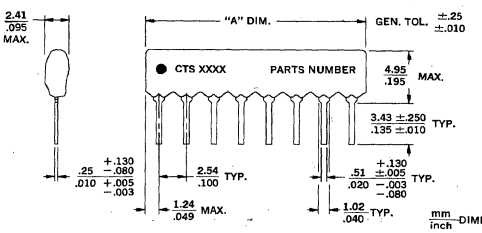


- High reliability cermet resistors
- Space saving over individual resistors
- Available in odd or even number of pins up to 20 leads maximum
- Available at 4.95 mm/.195 in. or 8.89 mm/.350 in. high
- 2.54 mm/.100 in. pin spacing

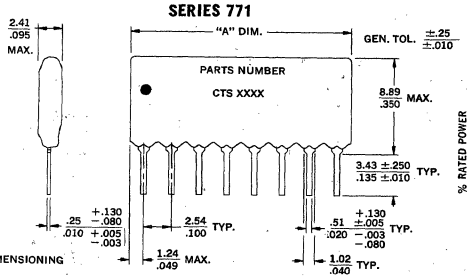
ELECTRICAL AND MECHANICAL SPECIFICATIONS

Resistance Range:	Standard 33Ω to 1.0 MegΩ
Resistance Tolerance:	Standard: ±2% Special: ±1% or 0.5Ω (whichever is greater)
Maximum Operating Voltage:	Series 770: 50V not to exceed rated power Series 771: 100V not to exceed rated power
Temperature Coefficient:	±100 PPM 33Ω to 220 KΩ ±175 PPM above 220 KΩ to 1.0 MegΩ @ −55° to +125°C
Temp. Range:	−55° to +125°C (operating)
Storage Temp. Range:	−55° to +125°C
Dielectric Strength:	100V
Lead Material:	Solder coated copper alloy

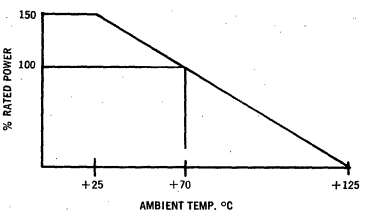
SERIES 770



SERIES 771



POWER DERATING CURVE



NO. OF PINS	"A" DIMENSION
2*	5.030/.198 Max
3*	7.570/.298 Max
4	10.110/.398 Max
5	12.650/.498 Max
6	15.190/.598 Max
7	17.730/.698 Max
8	20.270/.798 Max
9	22.810/.898 Max
10	25.350/.998 Max
11	27.890/1.098 Max
12	30.430/1.198 Max
13**	32.970/1.298 Max
14**	35.510/1.398 Max
15**	38.050/1.498 Max
16**	40.590/1.598 Max
17**	43.130/1.698 Max
18**	45.670/1.798 Max
19**	48.210/1.898 Max
20**	50.750/1.998 Max

* Series 770 only
** Series 771 only

TOTAL NETWORK POWER @ 25°C																					
			Number of Pins																		
Series	Package	Resistor Power	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
770	4.95/.195	.20	0.2	0.4	0.5	0.7	0.8	0.9	1.1	1.2	1.4	1.5	1.6	—	—	—	—	—	—	—	—
771	8.89/.350	.375	—	—	0.9	1.1	1.4	1.6	1.8	2.0	2.2	2.5	2.7	2.9	3.2	3.4	3.6	3.8	4.0	4.3	4.5
TOTAL NETWORK POWER @ 70°C																					
770	4.95/.195	.125	.125	0.25	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	—	—	—	—	—	—	—	—
771	8.89/.350	.25	—	—	0.6	0.8	0.9	1.0	1.2	1.4	1.5	1.6	1.8	2.0	2.1	2.2	2.4	2.6	2.7	2.8	3.0

* Custom networks can usually be designed to exceed resistance range, individual resistor power, maximum operating temperature and maximum operating voltage standards. TCR may be affected by some custom network requirements.

ENVIRONMENTAL PERFORMANCE SPECIFICATIONS

Test	Max. % △ R	Mil Std. 202 Method	Test Cond.	Test Description
Thermal Cycling	0.5%	107	B	5 cycles, −65°C to +125°C
Short Time Overload	0.5%	—	—	2½ x rated voltage, 5 sec. (Series 770: 100V max.) (Series 771: 200V max.)
Moisture Resistance	0.5%	106	—	240 hours, .1 rated load. −10°C to +65°C, 90% RH
Load Humidity	1.0%	—	—	1000 hours, .1 rated load, 70°C, 85-92% RH
High Temp. Exposure	1.0%	—	—	100 hours, no load @ 125°C
Load Life	1.0%	—	—	1000 hours @ 70°C, rated load
Resistance to Solder Heat	.25%	210	A	350°C, 3 sec. dwell
Mechanical Shock	.25%	213	I	500 g, 1 msec., 3 shocks ea. plane
Vibration	.25%	204	D	20g, 10-2000 Hz, 4 hours/plane
Terminal Strength	.25%	—	—	2.0 Kg pull, 30 sec., three 15° bends
Low Temp. Storage	.25%	—	—	24 hours @ −65°C, no load
Low Temp. Operation	.25%	—	—	45 min. @ −65°C, full load
Resistance to Solvents		215	—	Isopropyl alcohol, 1-1-1 Trichloroethane, Freon TMC

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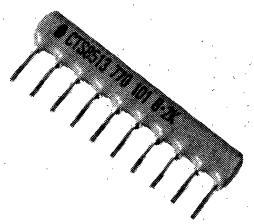
CTS® CORPORATION*
BERNE DIVISION

SIP RESISTOR NETWORKS

770 SERIES SINGLE-IN-LINE CONFORMAL COATED CERMET RESISTOR NETWORKS

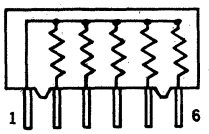


CTS Series	Description	Element Type	Resistance Range & Tol.	Power Rating (Watts)	TC
770-63	6, 8, and 10 Pin Single In-Line Conformal Coated Network on .100" Lead Centers	Cermet	33Ω-220KΩ* ±2%	6 Pin .5 Watt 8 Pin .7 Watt 10 Pin .9 Watt @ 70°C per module	±100 ppm/°C typical
770-61					
770-83					
770-81					
770-103					
770-101					

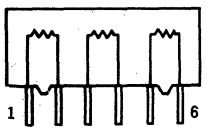
STANDARD "OFF THE SHELF" PART NUMBERS*

Resistance Value Tolerance	6 Pin, 3 Resistor	6 Pin, 5 Resistor	8 Pin, 4 Resistor	8 Pin, 7 Resistor	10 Pin, 5 Resistor	10 Pin, 9 Resistor
22Ω ±2%	770-63-R22Ω	—	770-83-R22Ω	—	—	—
33Ω ±2%	770-63-R33Ω	—	770-83-R33Ω	770-81-R33Ω	770-103-R33Ω	770-101-R33Ω
39Ω ±2%	—	—	—	—	770-103-R39Ω	—
47Ω ±2%	—	—	770-83-R47Ω	—	770-103-R47Ω	770-101-R47Ω
51Ω ±2%	—	770-61-R51Ω	—	770-81-R51Ω	—	—
56Ω ±2%	770-63-R56Ω	770-61-R56Ω	770-83-R56Ω	770-81-R56Ω	—	770-101-R56Ω
68Ω ±2%	770-63-R68Ω	770-61-R68Ω	770-83-R68Ω	770-81-R68Ω	770-103-R68Ω	770-101-R68Ω
75Ω ±2%	—	—	770-83-R75Ω	770-81-R75Ω	—	—
82Ω ±2%	—	770-61-R82Ω	770-83-R82Ω	770-81-R82Ω	—	770-101-R82Ω
100Ω ±2%	770-63-R100Ω	770-61-R100Ω	770-83-R100Ω	770-81-R100Ω	770-103-R100Ω	770-101-R100Ω
110Ω ±2%	—	—	—	770-81-R110Ω	—	—
120Ω ±2%	—	—	770-83-R120Ω	770-81-R120Ω	—	770-101-R120Ω
150Ω ±2%	770-63-R150Ω	770-61-R150Ω	770-83-R150Ω	770-81-R150Ω	—	—
160Ω ±2%	—	—	—	770-81-R160Ω	—	—
180Ω ±2%	—	—	770-83-R180Ω	770-81-R180Ω	770-103-R180Ω	770-101-R180Ω
200Ω ±2%	—	—	770-83-R200Ω	770-81-R200Ω	—	—
220Ω ±2%	770-63-R220Ω	770-61-R220Ω	770-83-R220Ω	770-81-R220Ω	770-103-R220Ω	770-101-R220Ω
270Ω ±2%	—	770-61-R270Ω	770-83-R270Ω	770-81-R270Ω	770-103-R270Ω	770-101-R270Ω
330Ω ±2%	770-63-R330Ω	770-61-R330Ω	770-83-R330Ω	770-81-R330Ω	770-103-R330Ω	770-101-R330Ω
390Ω ±2%	—	770-61-R390Ω	—	770-81-R390Ω	—	770-101-R390Ω
470Ω ±2%	770-63-R470Ω	770-61-R470Ω	770-83-R470Ω	770-81-R470Ω	770-103-R470Ω	770-101-R470Ω
500Ω ±2%	—	—	—	770-81-R500Ω	—	—
510Ω ±2%	—	770-61-R510Ω	—	770-81-R510Ω	—	770-101-R510Ω
560Ω ±2%	—	—	770-83-R560Ω	770-81-R560Ω	770-103-R560Ω	770-101-R560Ω
680Ω ±2%	770-63-R680Ω	770-61-R680Ω	770-83-R680Ω	770-81-R680Ω	770-103-R680Ω	770-101-R680Ω
820Ω ±2%	—	—	—	770-81-R820Ω	—	770-101-R820Ω
1KΩ ±2%	770-63-R1KΩ	770-61-R1KΩ	770-83-R1KΩ	—	770-103-R1KΩ	770-101-R1KΩ
1.1KΩ ±2%	—	—	—	—	—	770-101 R1.1KΩ
1.2KΩ ±2%	—	770-61-R1.2KΩ	770-83-R1.2KΩ	770-81-R1.2KΩ	—	770-101-R1.2KΩ
1.5KΩ ±2%	770-63-R1.5KΩ	770-61-R1.5KΩ	770-83-R1.5KΩ	770-81-R1.5KΩ	—	770-101-R1.5KΩ
2KΩ ±2%	770-63-R2KΩ	770-61-R2KΩ	770-83-R2KΩ	770-81-R2KΩ	—	770-101-R2KΩ
2.2KΩ ±2%	770-63-R2.2KΩ	770-61-R2.2KΩ	770-83-R2.2KΩ	770-81-R2.2KΩ	770-103-R2.2KΩ	770-101-R2.2KΩ
2.7KΩ ±2%	—	770-61-R2.7KΩ	—	770-81-R2.7KΩ	—	770-101-R2.7KΩ
3KΩ ±2%	—	—	—	770-81-R3KΩ	—	—
3.3KΩ ±2%	770-63-R3.3KΩ	770-61-R3.3KΩ	770-83-R3.3KΩ	770-81-R3.3KΩ	770-103-R3.3KΩ	770-101-R3.3KΩ
3.9KΩ ±2%	—	—	—	770-81-R3.9KΩ	—	—
4.7KΩ ±2%	770-63-R4.7KΩ	770-61-R4.7KΩ	770-83-R4.7KΩ	770-81-R4.7KΩ	770-103-R4.7KΩ	770-101-R4.7KΩ
5.1KΩ ±2%	—	—	770-83-R5.1KΩ	—	—	—
5.6KΩ ±2%	—	770-61-R5.6KΩ	770-83-R5.6KΩ	770-81-R5.6KΩ	—	770-101-R5.6KΩ
6.8KΩ ±2%	770-63-R6.8KΩ	770-61-R6.8KΩ	770-83-R6.8KΩ	770-81-R6.8KΩ	770-103-R6.8KΩ	770-101-R6.8KΩ
10KΩ ±2%	770-63-R10KΩ	770-61-R10KΩ	770-83-R10KΩ	770-81-R10KΩ	770-103-R10KΩ	770-101-R10KΩ
12KΩ ±2%	—	—	—	—	—	770-101-R12KΩ
15KΩ ±2%	770-63-R15KΩ	770-61-R15KΩ	770-83-R15KΩ	770-81-R15KΩ	—	770-101-R15KΩ
18KΩ ±2%	—	—	—	770-81-R18KΩ	—	—
20KΩ ±2%	—	—	770-83-R20KΩ	—	—	—
22KΩ ±2%	770-63-R22KΩ	770-61-R22KΩ	770-83-R22KΩ	770-81-R22KΩ	770-103-R22KΩ	770-101-R22KΩ
27KΩ ±2%	—	—	770-83-R27KΩ	—	—	—
33KΩ ±2%	770-63-R33KΩ	770-61-R33KΩ	770-83-R33KΩ	770-81-R33KΩ	770-103-R33KΩ	770-101-R33KΩ
47KΩ ±2%	770-63-R47KΩ	770-61-R47KΩ	770-83-R47KΩ	770-81-R47KΩ	770-103-R47KΩ	770-101-R47KΩ
56KΩ ±2%	—	—	—	770-81-R56KΩ	—	770-101-R56KΩ
68KΩ ±2%	—	—	770-83-R68KΩ	770-81-R68KΩ	—	—
100KΩ ±2%	770 63-R100KΩ	770-61-R100KΩ	770-83-R100KΩ	770-81-R100KΩ	770-103-R100KΩ	770-101-R100KΩ
120KΩ ±2%	—	—	770-83-R120KΩ	—	—	—
150KΩ ±2%	770-63-R150KΩ	—	770-83-R150KΩ	770-81-R150KΩ	—	770-101-R150KΩ
220KΩ ±2%	770-63-R220KΩ	770-61-R220KΩ	770-83-R220KΩ	770-81-R220KΩ	—	770-101-R220KΩ
470KΩ ±2%	—	—	—	770-81-R470KΩ	—	—

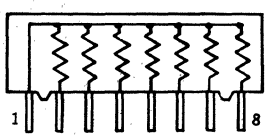
* **NOTE: Additional resistance values are constantly being added.** Please contact your local CTS Industrial Distributor to check availability of values not shown.



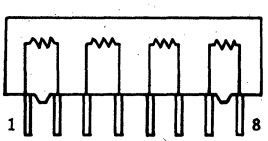
6 PIN-5 RESISTORS
CONFORMAL COATED
PART NUMBER
770-61-R (VALUE)



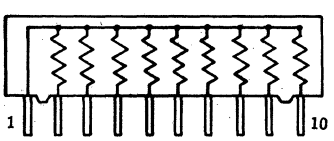
6 PIN-3 RESISTORS
CONFORMAL COATED
PART NUMBER
770-63-R (VALUE)



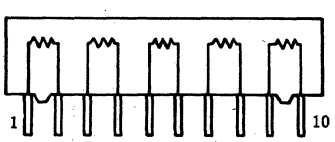
8 PIN-7 RESISTORS
CONFORMAL COATED
PART NUMBER
770-81-R (VALUE)



8 PIN-4 RESISTORS
CONFORMAL COATED
PART NUMBER
770-83-R (VALUE)



10 PIN-9 RESISTORS
CONFORMAL COATED
PART NUMBER
770-101-R (VALUE)



10 PIN-5 RESISTORS
CONFORMAL COATED
PART NUMBER
770-103-R (VALUE)

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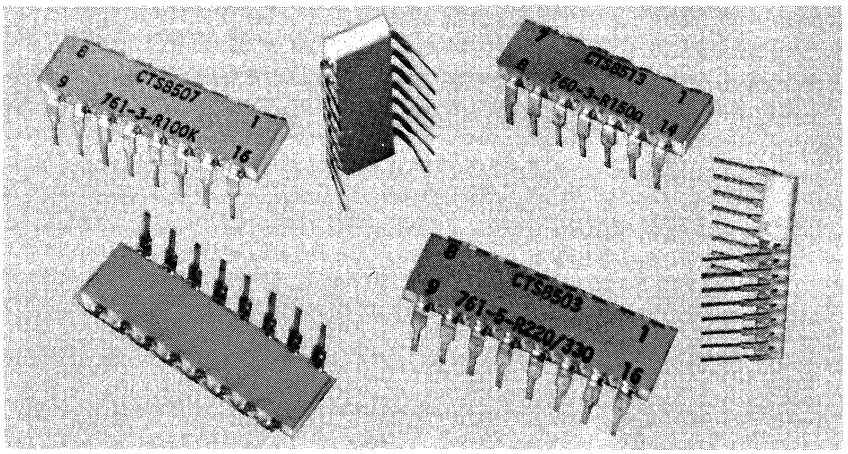
BERNE DIVISION

DUAL-IN-LINE CERMET RESISTOR NETWORKS

760 SERIES DUAL-IN-LINE SOLID CERAMIC CERMET RESISTOR NETWORKS

- Solid ceramic substrate
- Low height profile
- .100″ lead spacing
- High overload capabilities
- 8, 14, 16 and 18 pin constructions
- Compatible with automatic insertion equipment
- High power capabilities
- Reduced insertion time
- Available with capacitors



ELECTRICAL SPECIFICATIONS

Temperature Range:
−55°C to +125°C (operating)

Resistance Range:
Standard — 22Ω through 1 MegΩ
Special — Below 22Ω and above 1 MegΩ

Resistance Tolerance:
Standard — ±2%
Special — ±0.5% or ½Ω (whichever is greater)

Resistance Matching:
(2 like resistors)
50Ω to 100 KΩ — 0.5% or 0.5Ω whichever is greater)
100 KΩ to 500 KΩ — 1%
500 KΩ to 3 MegΩ — 2.5%

Ratio Matching:
50Ω to 100Ω — ±1%
100Ω to 100K — ±0.5%
100K to 1 Meg — ±2%
Multiple ratio matching available upon engineering approval

Temperature Coefficient:
Standard — ±300 PPM/°C
Special — ±100 PPM/°C
Tracking — Available to 50 PPM/°C with same formulation and on same side of substrate

Maximum Operating Voltage*:
100V not to exceed rated power

Dielectric Strength:
200V

TOTAL NETWORK POWER @ 25°C				
Resistor Power	Number of Pins			
.15	8	14	16	18
	1.1	2.2	2.6	3.0
TOTAL NETWORK POWER @ 70°C				
.10	.75	1.5	1.75	2.0

MECHANICAL SPECIFICATIONS

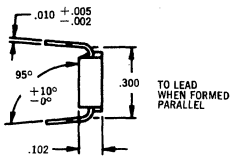
Substrate Material: Alumina

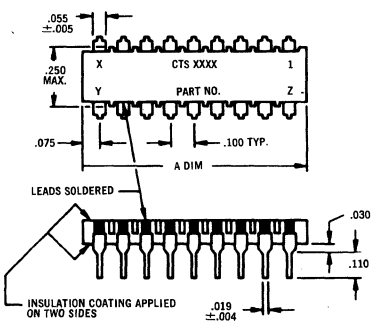
Resistor Material: Cermet — thick film

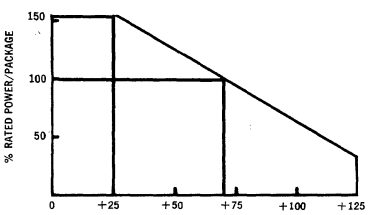
Insulation Coating: Organic — epoxy phenolic

Lead Material: Solder coated copper alloy

Solder: 60/40 tin/lead







NO. OF PINS	"A" DIM	PIN DESIGNATION X	Y	Z
8	.450	4	5	8
14	.750	7	8	14
16	.850	8	9	16
18	.950	9	10	18

Gen. Tol. ±.010

ENVIRONMENTAL PERFORMANCE SPECIFICATIONS

Test	Max. % △ R	Mil Std. 202 Method	Test Cond.	Test Description
Thermal Cycling	0.25%	107	B	5 cycles, −65° to +125°C
Short Time Overload	0.25%	—	—	2½ x rated voltage, 5 sec., 100V max.
Moisture Resistance	0.5%	106	0	240 hours, .1 rated load, −10°C to +65°C, 90% RH
Load Humidity	1.0%	—	—	1000 hours, .1 rated load, 70°C, 85-92% RH
High Temp. Exposure	0.5%	—	—	100 hours, no load @ 125°C
Load Life	1.0%	—	—	1000 hours @ 70°C, rated load
Resistance to Solder Heat	.25%	210	A	350°C, 3 sec. dwell
Mechanical Shock	.25%	213	I	500g, 1 msec., 3 shocks ea. plane
Vibration	.25%	204	D	20g, 10-2000 Hz, 4 hours/plane
Terminal Strength	.25%	—	—	2.0 Kg pull, 30 sec., three 15° bends
Low Temp. Storage	.25%	—	—	24 hours @ −65°C, no load
Low Temp. Operation	.25%	—	—	45 min. @ −65°C, full load
Resistance to Solvents		215	—	Isopropyl alcohol, 1-1-1 Trichloroethane, Freon TMC

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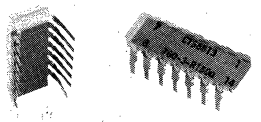
BERNE DIVISION

DUAL-IN-LINE CERMET RESISTOR NETWORKS

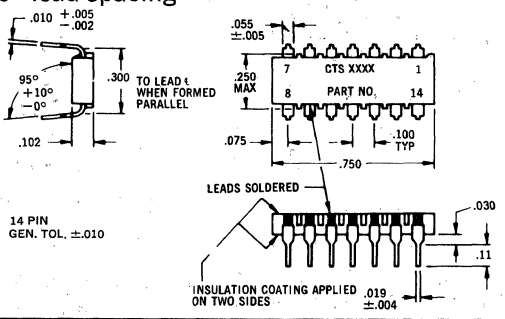
760 SERIES 14 LEAD, DUAL-IN-LINE SOLID CERAMIC CERMET RESISTOR NETWORKS

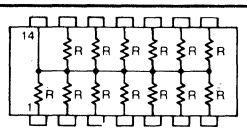


CTS Series	Description	Element Type	Resistance Range & Tol.	Power Rating (Watts)	TC
760-3	14 Pin Module on .100" x .300" DIP Centers	Cermet	22Ω-220KΩ* ±2%	1.5 @ 70°C per module	±100 ppm/°C typical
760-1					
760-5					

FEATURES:

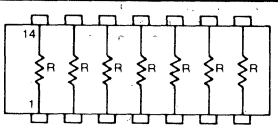
- Low cost automatic insertion and handling
- High overload capabilities
- Low height profile
- Package compatibility with monolithic packages
- .100" lead spacing





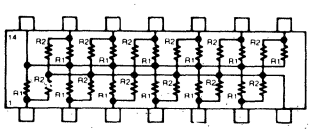
14 PIN-13 RESISTORS PART NUMBER 760-1-R + VALUE

APPLICATIONS: "Wired OR" pull-up; Power driver pull-up; Power gate pull-up; Line termination; Long-line impedance balancing; LED current limiting; ECL output pull-down resistors; TTL input pull-down.



14 PIN-7 RESISTORS PART NUMBER 760-3-R + VALUE

APPLICATIONS: MOS/ROM pull-up/pull-down; Open collector pull-up; "Wired OR" pull-up; Power driver pull-up; High speed parallel pull-up; TTL unused gate pull-up; TTL input pull-down; Digital pulse squaring.



14 PIN-24 RESISTORS PART NUMBER 760-5-R + VALUES

Pulse Squaring TTL Terminators

CTS 760-5 networks consist of two resistor pairs of the above value combinations. The resistors are connected together in series with a common line for power and a common line for ground. The junction of each pair is brought out to a separate terminal.

STANDARD "OFF THE SHELF" PART NUMBERS*

Resistance Value, ±2% Tolerance	14 Pin 7 Resistor	14 Pin 13 Resistor
22Ω	760-3-R22Ω	—
33Ω	—	760-1-R33Ω
39Ω	760-3-R39Ω	—
47Ω	760-3-R47Ω	760-1-R47Ω
51Ω	760-3-R51Ω	760-1-R51Ω
56Ω	—	760-1-R56Ω
68Ω	760-3-R68Ω	760-1-R68Ω
82Ω	—	760-1-R82Ω
91Ω	—	760-1-R91Ω
100Ω	760-3-R100Ω	760-1-R100Ω
110Ω	760-3-R110Ω	—
120Ω	—	760-1-R120Ω
150Ω	760-3-R150Ω	760-1-R150Ω
180Ω	760-3-R180Ω	760-1-R180Ω
200Ω	760-3-R200Ω	760-1-R200Ω
220Ω	760-3-R220Ω	760-1-R220Ω
240Ω	—	760-1-R240Ω
270Ω	760-3-R270Ω	760-1-R270Ω
330Ω	760-3-R330Ω	760-1-R330Ω
360Ω	760-3-R360Ω	—
390Ω	—	760-1-R390Ω
470Ω	760-3-R470Ω	760-1-R470Ω
500Ω	—	760-1-R500Ω
510Ω	760-3-R510Ω	760-1-R510Ω
560Ω	760-3-R560Ω	760-1-R560Ω
680Ω	760-3-R680Ω	760-1-R680Ω
820Ω	760-3-R820Ω	760-1-R820Ω
1KΩ	760-3-R1KΩ	760-1-R1KΩ
1.5KΩ	760-3-R1.5KΩ	760-1-R1.5KΩ
1.8KΩ	760-3-R1.8KΩ	—
2KΩ	760-3-R2KΩ	760-1-R2KΩ
2.2KΩ	760-3-R2.2KΩ	760-1-R2.2KΩ
2.4KΩ	—	760-1-R2.4KΩ
2.7KΩ	760-3-R2.7KΩ	760-1-R2.7KΩ
3KΩ	760-3-R3KΩ	760-1-R3KΩ
3.3KΩ	760-3-R3.3KΩ	760-1-R3.3KΩ
4.3KΩ	760-3-R4.3KΩ	—
4.7KΩ	760-3-R4.7KΩ	760-1-R4.7KΩ
5.1KΩ	—	760-1-R5.1KΩ
5.6KΩ	760-3-R5.6KΩ	760-1-R5.6KΩ
6KΩ	760-3-R6KΩ	760-1-R6KΩ
6.8KΩ	760-3-R6.8KΩ	760-1-R6.8KΩ
10KΩ	760-3-R10KΩ	760-1-R10KΩ
12KΩ	760-3-R12KΩ	760-1-R12KΩ
15KΩ	760-3-R15KΩ	760-1-R15KΩ
22KΩ	760-3-R22KΩ	760-1-R22KΩ
27KΩ	—	760-1-R27KΩ
33KΩ	760-3-R33KΩ	760-1-R33KΩ
47KΩ	760-3-R47KΩ	760-1-R47KΩ
68KΩ	760-3-R68KΩ	760-1-R68KΩ
100KΩ	760-3-R100KΩ	760-1-R100KΩ
150KΩ	760-3-R150KΩ	760-1-R150KΩ
220KΩ	760-3-R220KΩ	760-1-R220KΩ

*** NOTE: Additional resistance values are constantly being added.** Please contact your local CTS Industrial Distributor to check availability of values not shown above.

Resistance Values R1/R2	Part Numbers	Resistance Values R1/R2	Part Numbers
160Ω/240Ω	760-5-R160/240	330Ω/390Ω	760-5-R330/390
160Ω/270Ω	760-5-R160/270	330Ω/470Ω	760-5-R330/470
180Ω/390Ω	760-5-R180/390	680Ω/1.5KΩ	760-5-R680/1.5K
220Ω/270Ω	760-5-R220/270	1.5KΩ/3.3KΩ	760-5-R1.5K/3.3K
220Ω/330Ω	760-5-R220/330		
220Ω/470Ω	760-5-R220/470		

Other combinations available upon request.

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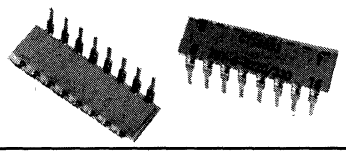
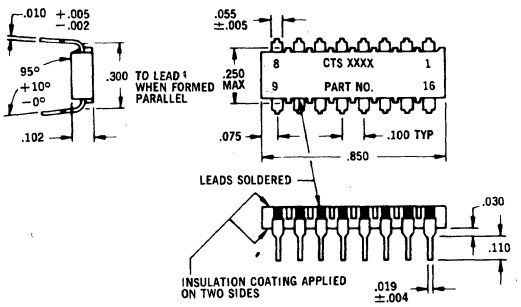
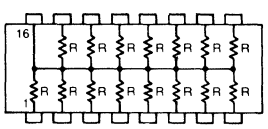
DUAL-IN-LINE CERMET RESISTOR NETWORKS

760 SERIES 16 LEAD, DUAL-IN-LINE SOLID CERAMIC CERMET RESISTOR NETWORKS



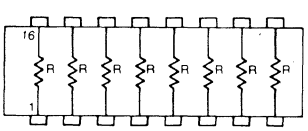
CTS Series	Description	Element Type	Resistance Range & Tol.	Power Rating (Watts)	TC
761-3	16 Pin Module on .100" x .300" DIP Centers	Cermet	22Ω-220KΩ* ±2%	1.75 @ 70°C per module	±100 ppm/°C typical
761-1					
761-5					





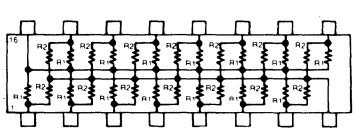
16 PIN-15 RESISTORS PART NUMBER 761-1-R + VALUE

APPLICATIONS: "Wired OR" pull-up; Power driver pull-up; Power gate pull-up; Line termination; Long-line impedance balancing; LED current limiting; ECL output pull-down resistors; TTL input pull-down.



16 PIN-8 RESISTORS PART NUMBER 761-3-R + VALUE

APPLICATIONS: MOS/ROM pull-up/pull-down; Open collector pull-up; "Wired OR" pull-up; Power driver pull-up; High speed parallel pull-up; TTL unused gate pull-up; TTL input pull-down; Digital pulse squaring.



16 PIN-28 RESISTORS PART NUMBER 761-5-R + VALUES

Pulse Squaring TTL Terminators
CTS 761-5 networks consist of two resistor pairs of the above value combinations. The resistors are connected together in series with a common line for power and a common line for ground. The junction of each pair is brought out to a separate terminal.

FEATURES:

- Low cost automatic insertion and handling
- High overload capabilities
- Low height profile
- Package compatibility with monolithic packages
- .100" lead spacing

STANDARD "OFF THE SHELF" PART NUMBERS*

Resistance Value, ±2% Tolerance	16 Pin 8 Resistor	16 Pin 15 Resistor
22Ω	761-3-R22Ω	761-1-R22Ω
33Ω	761-3-R33Ω	—
47Ω	761-3-R47Ω	—
51Ω	761-3-R51Ω	761-1-R51Ω
56Ω	—	761-1-R56Ω
62Ω	761-3-R62Ω	—
68Ω	761-3-R68Ω	761-1-R68Ω
100Ω	761-3-R100Ω	761-1-R100Ω
110Ω	761-3-R110Ω	—
150Ω	761-3-R150Ω	761-1-R150Ω
180Ω	761-3-R180Ω	761-1-R180Ω
220Ω	761-3-R220Ω	761-1-R220Ω
240Ω	761-3-R240Ω	761-1-R240Ω
270Ω	—	761-1-R270Ω
300Ω	761-3-R300Ω	761-1-R300Ω
330Ω	761-3-R330Ω	761-1-R330Ω
390Ω	—	761-1-R390Ω
470Ω	761-3-R470Ω	761-1-R470Ω
500Ω	—	761-1-R500Ω
510Ω	—	761-1-R510Ω
560Ω	761-3-R560Ω	761-1-R560Ω
680Ω	761-3-R680Ω	761-1-R680Ω
820Ω	761-3-R820Ω	—
1KΩ	761-3-R1KΩ	761-1-R1KΩ
1.5KΩ	761-3-R1.5KΩ	761-1-R1.5KΩ
2KΩ	761-3-R2KΩ	761-1-R2KΩ
2.2KΩ	761-3-R2.2KΩ	761-1-R2.2KΩ
2.4KΩ	761-3-R2.4KΩ	—
3KΩ	—	761-1-R3KΩ
3.3KΩ	761-3-R3.3KΩ	761-1-R3.3KΩ
4.7KΩ	761-3-R4.7KΩ	761-1-R4.7KΩ
5.1KΩ	761-3-R5.1KΩ	761-1-R5.1KΩ
5.6KΩ	761-3-R5.6KΩ	761-1-R5.6KΩ
6.8KΩ	761-3-R6.8KΩ	761-1-R6.8KΩ
8.2KΩ	761-3-R8.2KΩ	—
10KΩ	761-3-R10KΩ	761-1-R10KΩ
15KΩ	761-3-R15KΩ	761-1-R15KΩ
22KΩ	761-3-R22KΩ	761-1-R22KΩ
24KΩ	761-3-R24KΩ	—
27KΩ	761-3-R27KΩ	—
33KΩ	761-3-R33KΩ	761-1-R33KΩ
47KΩ	761-3-R47KΩ	761-1-R47KΩ
56KΩ	761-3-R56KΩ	761-1-R56KΩ
68KΩ	761-3-R68KΩ	761-1-R68KΩ
100KΩ	761-3-R100KΩ	761-1-R100KΩ
150KΩ	761-3-R150KΩ	761-1-R150KΩ
220KΩ	761-3-R220KΩ	761-1-R220KΩ

* **NOTE: Additional resistance values are constantly being added.** Please contact your local CTS Industrial Distributor to check availability of values not shown above.

Resistance Values R1/R2	Part Numbers	Resistance Values R1/R2	Part Numbers
180Ω/390Ω	761-5-R180/390	330Ω/680Ω	761-5-R330/680
220Ω/270Ω	761-5-R220/270	680Ω/1.5KΩ	761-5-R680/1.5K
220Ω/330Ω	761-5-R220/330	1.5KΩ/3.3KΩ	761-5-R1.5K/3.3K
330Ω/390Ω	761-5-R330/390		

Other combinations available upon request.

ORDERING INFORMATION: Place orders using following address:
BERNE DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • TWX 810-323-1880
* In Indiana, dba CTS Electronics Corporation

CTS® CORPORATION
BERNE DIVISION

SURFACE MOUNT RESISTOR NETWORK

SPECIFICATIONS

***Resistance Range:** Standard 22 ohm to 1.0 Megohm
Resistance Tolerance: Standard: ±2%
Special: 0.5% or 0.5 ohm (whichever greater)
***Max. Operating Voltage:** 50V not to exceed rated power
***Temp. Coefficient:** ±100 PPM @ −55°C to +125°C
***Operating Temp. Range:** −55°C to +125°C
Storage Temp. Range: −55°C to +125°C
Dielectric Strength: 100V
***Power Rating:**

	Resistor Power	Total Network Power			
		8P	14P	16P	18P
@ 70°C	.07 w	.25w	.4w	.5w	.62w
@ 25°C	.1 w	.38w	.6w	.75w	.9w

* Custom networks can usually be designed to exceed resistance range, individual resistor power, maximum operating temperature and maximum operating voltage standards. TCR may be affected by some custom network requirements.

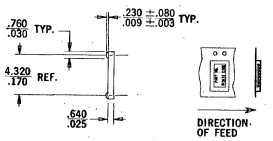
ENVIRONMENTAL PERFORMANCE SPECIFICATIONS

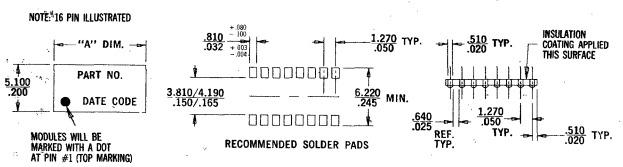
Test	Max % △ R	Mil Std. 202 Method	Test Cond.	Test Description
Thermal Cycling	0.5%	107	B	5 cycles −65°C to +125°C
Short Time Overload	0.5%	—	—	2½ x rated voltage 5 sec. (100V max.)
Moisture Resistance	0.5%	106	—	240 hours .1 rated load −10°C to +65°C 90% RH
Load Humidity	1.0%	—	—	1000 hours .1 rated load 65°C 90-98% RH
High Temp Exposure	1.0%	—	—	240 hours no load @ 125°C
Load Life	1.0%	—	—	1000 hours @ 70°C rated load
Resistance to Solder Heat	.25%	210	A	350°C 3 sec dwell
Mechanical Shock	.25%	213	D	500g 1 msec 3/shocks ea plane
Vibration	.25%	204	D	20g 10-2000 Hz 4 hours/ plane
Terminal Strength	.25%	—	—	2.0 pound pull 30 sec two 45° bends
Low Temp Storage	.25%	—	—	24 hours @ −65°C no load
Low Temp Operation	.25%	—	—	1 hour @ −65°C full load
Resistance to Solvents		215	—	Isopropyl alcohol, 1-1-1 Trichloroethane, Freon TMC
Solderability		208	—	RMA flux 230°C 5 sec dip 95% coverage

765/766 Series .050 Centerline

FLAT MOUNTED PACK TYPE 765
ALUMINA SUBSTRATE

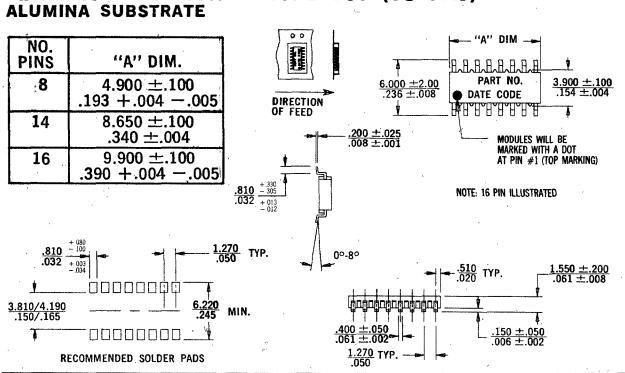
NO. PINS	"A" DIM.
8	4.900 ±.100 .193 +.004 −.005
14	8.650 ±.100 .340 ±.004
16	9.900 ±.100 .390 +.004 −.005





FLAT MOUNTED PACK TYPE 766 (SO PAC)
ALUMINA SUBSTRATE

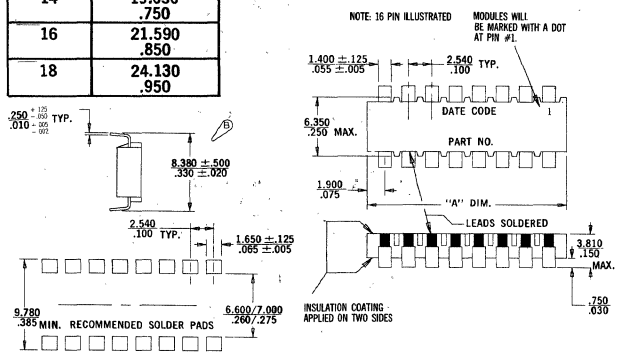
NO. PINS	"A" DIM.
8	4.900 ±.100 .193 +.004 −.005
14	8.650 ±.100 .340 ±.004
16	9.900 ±.100 .390 +.004 −.005



760/762 SERIES .100 Centerline

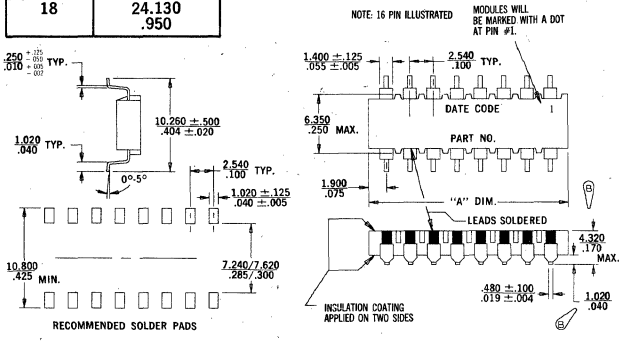
FLAT MOUNTED PACK TYPE 760

NO. PINS	"A" DIM.
8	11.430 .450
14	19.050 .750
16	21.590 .850
18	24.130 .950



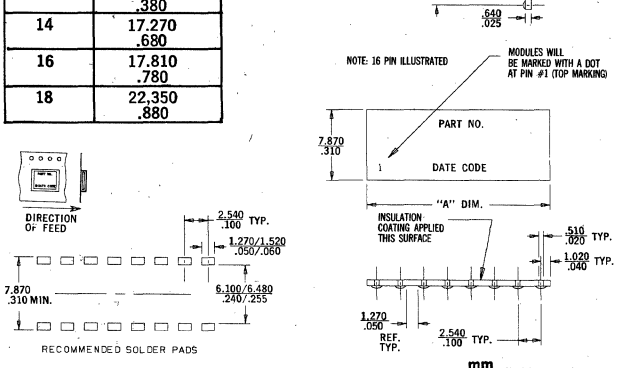
DUAL IN-LINE FLAT PACK TYPE 760
ALUMINA SUBSTRATE
CERMET RESISTORS

NO. PINS	"A" DIM.
8	11.430 .450
14	19.050 .750
16	21.590 .750
18	24.130 .950



DUAL IN-LINE FLAT PACK TYPE 762
ALUMINA SUBSTRATE
CERMET RESISTORS

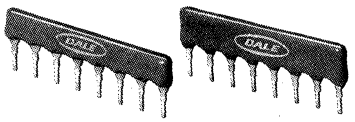
NO. PINS	"A" DIM.
8	9.650 .380
14	17.270 .680
16	17.810 .780
18	22,350 .880



mm / Inch DIMENSIONING
mm & Inch DIMENSIONS ARE NOT EQUIVALENT

ORDERING INFORMATION: Place orders using following address:
BERNE DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • TWX 810-323-1880
* In Indiana, dba CTS Electronics Corporation

SINGLE-IN-LINE, Coated THICK FILM RESISTOR NETWORKS



MODEL CSC

SPECIFICATIONS

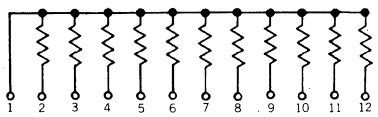
Resistance Range: 10Ω to 3.3 Meg.

Resistance Tolerance:
.01 and 03 schematic: ±2% standard. ±1%, ±5%, ±10% and ±20% available.
05 schematic: ±2% standard. ±5% available

Resistance Temperature Coefficient:
±100 PPM/°C (−55°C to +125°C) typical

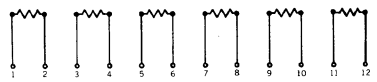
Terminals: Copper alloy, tin-lead plated

Body: High alumina. Resistors epoxy coated



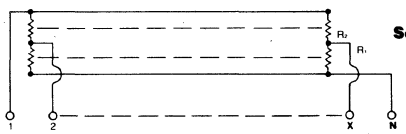
Schematic 01

(Available in 4, 5, 6, 7, 8, 9, 10, 11 or 12 pin package)



Schematic 03

(Available in 4, 6, 8, 10 or 12 pin package)



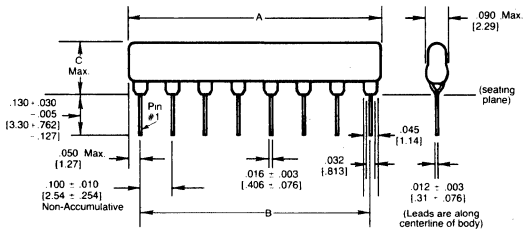
Schematic 05

N = Number of pins **X** = N-1
Example: CSC08 = 8 pins, 6 series pairs of resistors

(Available in 4, 5, 6, 7, 8, 9, 10, 11 or 12 pin package)

Choice of .195" [4.95] "A" and .250" [6.35] "B" maximum seated heights.

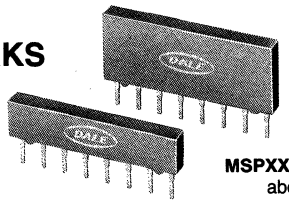
DIMENSIONAL AND TERMINAL CONFIGURATIONS [Numbers in brackets indicate millimeters]



SCHEMATICS	TYPE	A (Max.)	B	C (Max.)
01, 03, 05	CSC04	.390 [9.91]	.300 [7.62]	
01, 05	CSC05	.490 [12.45]	.400 [10.16]	
01, 03, 05	CSC06	.590 [14.99]	.500 [12.70]	
01, 05	CSC07	.690 [17.53]	.600 [15.24]	"A" Profile = .195 [4.95]
01, 03, 05	CSC08	.790 [20.07]	.700 [17.78]	"B" Profile = .250 [6.35]
01, 05	CSC09	.890 [22.61]	.800 [20.32]	
01, 03, 05	CSC10	.990 [25.15]	.900 [22.86]	
01, 05	CSC11	1.090 [27.69]	1.000 [25.40]	
01, 03, 05	CSC12	1.190 [30.23]	1.100 [27.94]	

Contact factory for stock values.

SINGLE-IN-LINE, Molded THICK FILM RESISTOR NETWORKS



MSPXXC, .350" [8.89] above board

MSPXXA, .195" [4.95] above board

MODEL MSP

SPECIFICATIONS

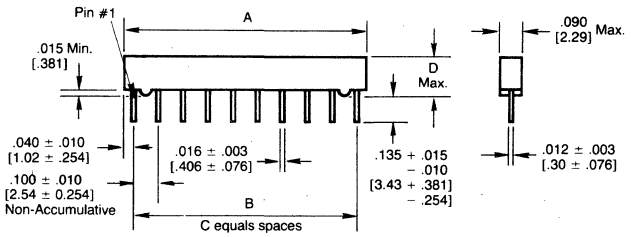
ELECTRICAL

Resistance Range: 10Ω to 3.3 Megohms

Resistance Tolerance: 01 and 03 schematic: ±2% standard. ±1%, ±5%, ±10% and ±20% available.
05 schematic: ±2% standard. ±5% available.

Temperature Coefficient: ±100 PPM/°C (−55°C to +125°C) typical

Terminals: Copper alloy, tin-lead plated

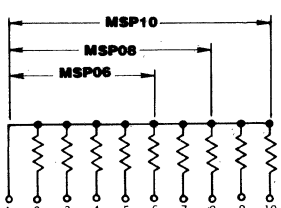


DIMENSIONAL AND TERMINAL CONFIGURATIONS [Numbers in brackets indicate millimeters]

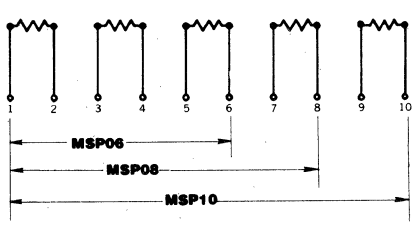
TYPE	A (Max.)	B	C	D
MSP06	.590 [14.99]	.500 [12.70]	5	.195" [4.95] for MSPXXA
MSP08	.790 [20.07]	.700 [17.78]	7	.350" [8.89] for MSPXXC
MSP10	.990 [25.15]	.900 [22.86]	9	

Contact factory for stock values.

01 SCHEMATIC

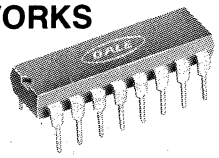


03 SCHEMATIC



For complete information, write or phone
DALE ELECTRONICS, INC., Box 26728, El Paso, TX 79926 • Phone 915-592-3253

DUAL-IN-LINE, Molded
THICK FILM RESISTOR NETWORKS



MODELS MDP14 and MDP16
01, 03, 05 Schematic

SPECIFICATIONS

ELECTRICAL

Resistance Range: 10Ω to 3.3 Megohms

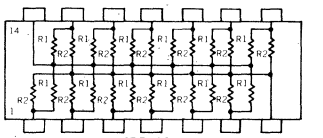
Resistance Tolerance: 01 and 03 schematic: ±2% standard. ±1%, ±5%, ±10% and ±20% available.
05 schematic: ±2% standard. ±5% available.

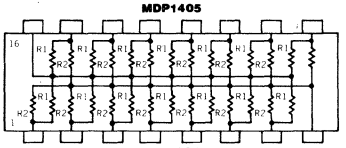
Resistance Temperature Coefficient: ±100 PPM/°C (−55°C to +125°C) standard

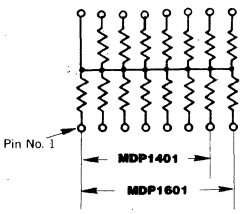
Terminals: Copper alloy, tin-lead plated

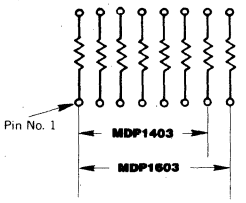
Body: Molded epoxy

STANDARD SCHEMATICS



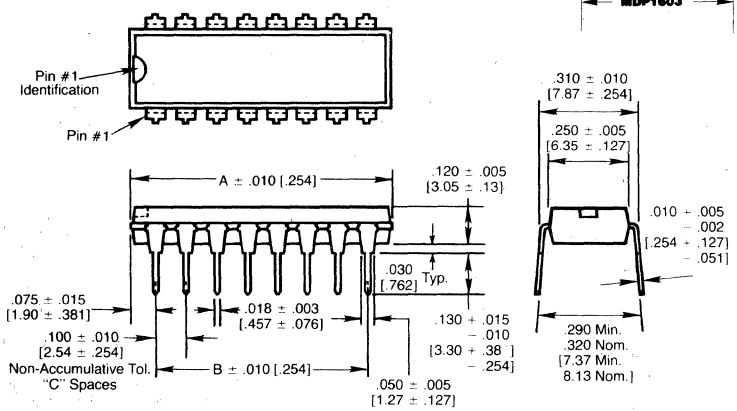




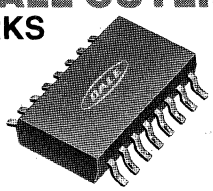


DIMENSIONS AND TERMINAL CONFIGURATIONS
[Numbers in brackets indicate millimeters]

TYPE	A	B	C
MDP14	.750" [19.05]	.600" [15.24]	6
MDP16	.850" [21.59]	.700" [17.78]	7



SURFACE MOUNTED, SMALL OUTLINE MOLDED DIP
THICK FILM RESISTOR NETWORKS



MODELS SOMC-14 and SOMC-16
01, 03, 05 Schematic

SPECIFICATIONS

ELECTRICAL

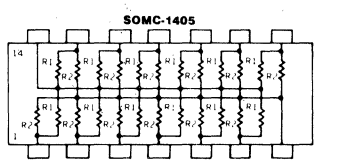
Resistance Range: 100 ohms to 100K ohms

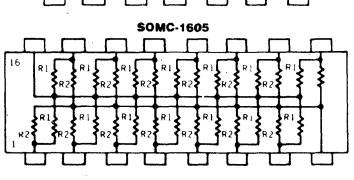
Resistance Tolerance:
01 and 03 schematic: ±2% standard. ±1%, ±5%, ±10% and ±20% available.
05 schematic: ±2% standard. ±5% available.

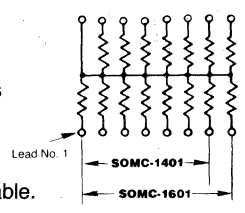
Resistance Temperature Coefficient: ±100 PPM/°C (−55°C to +125°C) typical

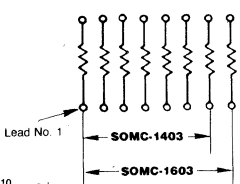
Terminals: Copper alloy, tin-lead plated

Body: Molded Epoxy



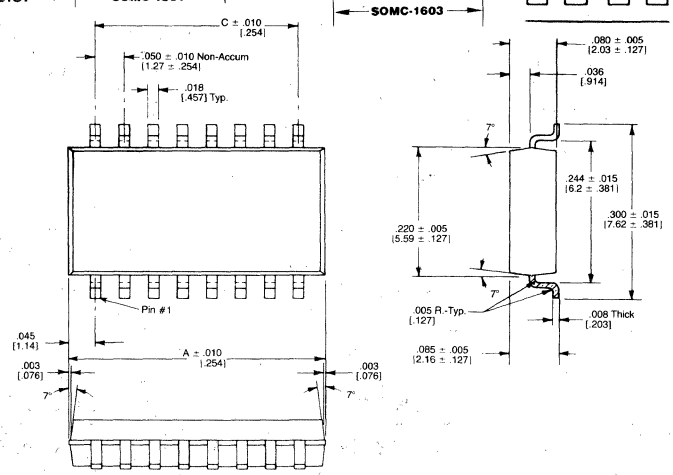






DIMENSIONAL AND TERMINAL CONFIGURATIONS
[Numbers in brackets indicate millimeters]

TYPE	A	B	C
14	.390" [9.906]	.350" [8.89]	.300" [7.62]
16	.440" [11.176]	.400" [10.16]	.350" [8.89]



For complete information, write or phone
DALE ELECTRONICS, INC., Box 26728, El Paso, TX 79926 • Phone 915-592-3253

MILITARY QUALIFIED THICK FILM RESISTOR NETWORKS

MIL-R-83401, STYLE RZ

SPECIFICATIONS (Applicable to all styles)

ELECTRICAL

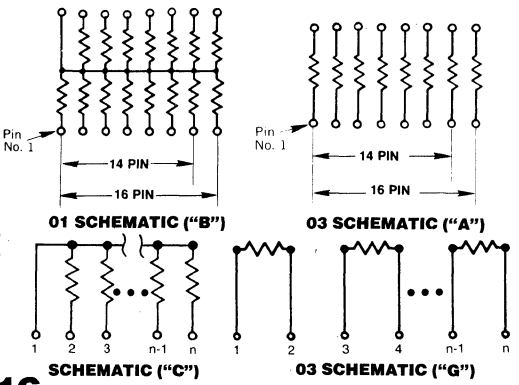
Resistance Range: 10Ω to 1 Megohm

Resistance Tolerances: ±1%, ±2%, ±5%

Temperature Coefficient: "M" = ±300 PPM/°C; "K" = ±100 PPM/°C over the temperature range of −55°C to +125°C (+25°C reference)

APPROVED SCHEMATIC ALTERNATIVES

NOTE: Mil-Qualified 05 schematics "H" and "J" also available.

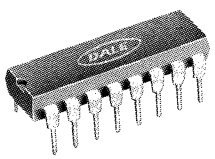


DUAL-IN-LINE, MODELS MDM14 & MDM16

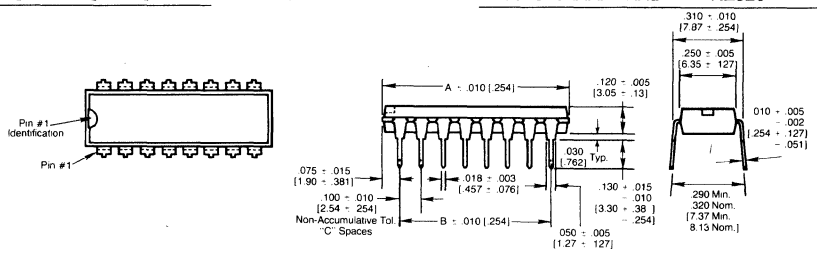
M8340101 = 14 PIN, M8340102 = 16 PIN

DIMENSIONAL AND TERMINAL CONFIGURATIONS
[Numbers in brackets indicate millimeters]

NO. OF PINS	A	B	C
14	.750 [19.05]	.600 [15.24]	6
16	.850 [21.59]	.700 [17.78]	7



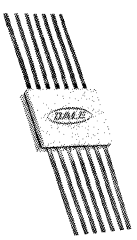
MIL P/N	MIL. STYLE	DALE TYPE	MILITARY RES. RANGE TOLERANCE ±1%, ±2%, ±5%
M8340101XXXXXXA	RZ010	MDM14-03	10Ω-1 Meg.
M8340101XXXXXXB	RZ010	MDM14-01	10Ω-1 Meg.
M8340102XXXXXXA	RZ020	MDM16-03	10Ω-1 Meg.
M8340102XXXXXXB	RZ020	MDM16-01	10Ω-1 Meg.



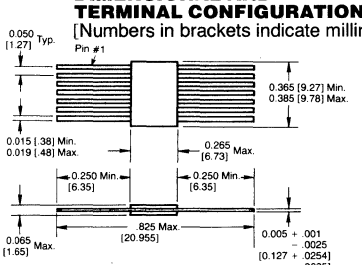
FLAT PACK, MODEL DFM M8340103 = 14 PIN

MIL P/N	MIL. STYLE	DALE TYPE	MILITARY RES. RANGE TOLERANCE ±1%, ±2%, ±5%
M8340103XXXXXXA	RZ030	DFM14-01 DFM14-11	10Ω-1 Meg. 10Ω-1 Meg.
M8340103XXXXXXB	RZ030	DFM14-02 DFM14-12	10Ω-1 Meg. 10Ω-1 Meg.

Leads: -01, -02 = gold plated, -11, -12 = tin-lead plated.

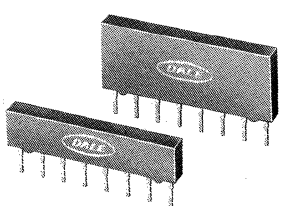


DIMENSIONAL AND TERMINAL CONFIGURATIONS
[Numbers in brackets indicate millimeters]



SINGLE-IN-LINE, MODEL MSM

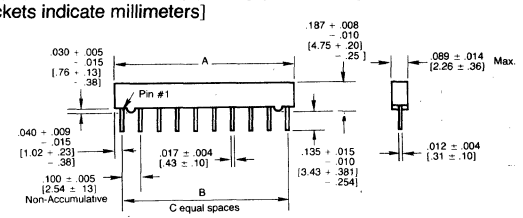
MIL P/N	MIL. STYLE	DALE TYPE	MILITARY RES. RANGE TOLERANCE ±1%, ±2%, ±5%
M8340104XXXXXXC M8340104XXXXXXG	RZ040 RZ040	MSM06C01 MSM06C03	10Ω-1 Meg. 10Ω-1 Meg.
M8340105XXXXXXC M8340105XXXXXXG	RZ050 RZ050	MSM08C01 MSM08C03	10Ω-1 Meg. 10Ω-1 Meg.
M8340106XXXXXXC M8340106XXXXXXG	RZ060 RZ060	MSM10C01 MSM10C03	10Ω-1 Meg. 10Ω-1 Meg.
M8340107XXXXXXC M8340107XXXXXXG	RZ070 RZ070	MSM06A01 MSM06A03	10Ω-1 Meg. 10Ω-1 Meg.
M8340108XXXXXXC M8340108XXXXXXG	RZ080 RZ080	MSM08A01 MSM08A03	10Ω-1 Meg. 10Ω-1 Meg.
M8340109XXXXXXC M8340109XXXXXXG	RZ090 RZ090	MSM10A01 MSM10A03	10Ω-1 Meg. 10Ω-1 Meg.



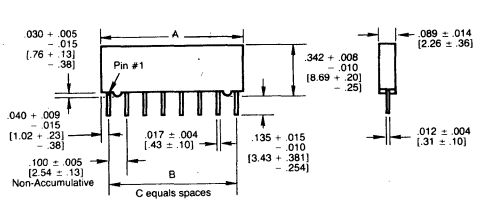
TYPE	A	B	C
MSM06	.583 ± .015 [14.81 ± .38]	.500 [12.70]	5
MSM08	.783 ± .015 [19.89 ± .38]	.700 [17.78]	7
MSM10	.983 ± .015 [24.97 ± .38]	.900 [22.86]	9

DIMENSIONAL AND TERMINAL CONFIGURATIONS
[Numbers in brackets indicate millimeters]

"A" PROFILE

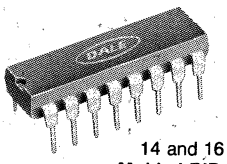


"C" PROFILE

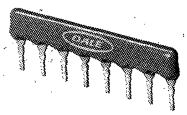


For complete information, write or phone
DALE ELECTRONICS, INC., Box 26728, El Paso, TX 79926 • Phone 915-592-3253

DUAL & SINGLE-IN-LINE PACKAGES
RESISTOR/CAPACITOR NETWORKS



14 and 16 Pin
Molded DIP styles



4 thru 12 Pin
Coated SIP styles

R/C Networks

FEATURES

- Ideal where repetitive circuits are required.
- Wide range of R/C values for special applications.
- High density packaging for reduced assembly costs, improved performance and simplified board layout.
- Utilize same thick film circuit materials as those qualified to MIL-R-83401.
- Capacitors available to EIA RS 198 or MIL-C-55681.

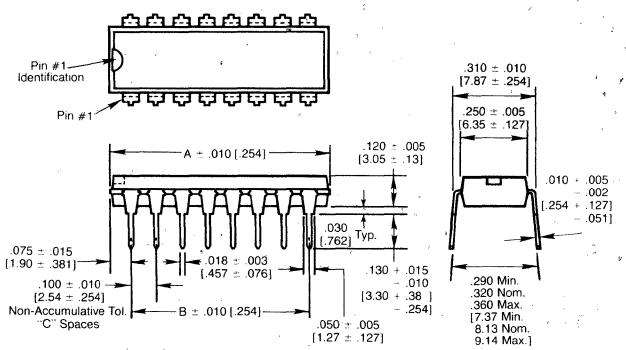
GENERAL SPECIFICATIONS

	RESISTORS	*CAPACITORS		
		NPO	BX	X7R
Value Range (SIP)	10Ω-3.3 meg	100pf-4700pf	500pf-0.1μf	500pf-0.1μf
(DIP)	10Ω-3.3 meg	100pf-2700pf	500pf-0.1μf	500pf-0.1μf
Tolerances	±2% standard, ±1%, ±5%, ±10%, ±20% available	±5% & ±10%	±10% & ±20%	±10% & ±20%
Temperature Characteristics (−55°C to +125°C)	±100ppm/°C Typical	±30ppm/°C	±15% @ OVDC & +15%, −25% @ rated VDC	±15%
Voltage Rating	100VDC	50VDC	50VDC	50VDC
Dissipation Factor (1 VRMS @ 1 KHZ)	N/A	0.1% max	2.5% max	3.0% max
Operating Temperature Range	−55°C to +125°C			

*Capacitors tested at 1 VRMS @ 1 KHZ @ 25°C

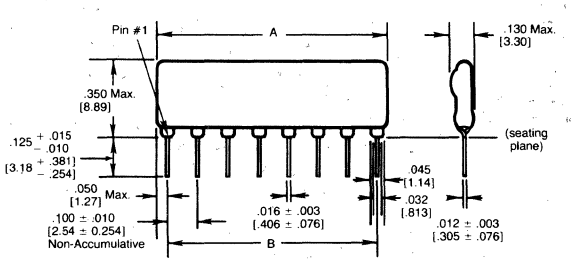
STANDARD PACKAGE CONFIGURATIONS
DIMENSIONAL AND TERMINAL CONFIGURATIONS: [Numbers in brackets indicate millimeters]

DUAL-IN-LINE



No. of Pins	A	B
14	.750 [19.05]	.600 [15.24]
16	.850 [21.59]	.700 [17.78]

SINGLE-IN-LINE

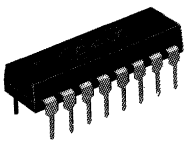


No. of Pins	A (Max.)	B
4	.390 [9.91]	.300 [7.62]
5	.490 [12.45]	.400 [10.16]
6	.590 [14.99]	.500 [12.70]
7	.690 [17.53]	.600 [15.24]
8	.790 [20.07]	.700 [17.78]
9	.890 [22.61]	.800 [20.32]
10	.990 [25.15]	.900 [22.86]
11	1.090 [27.69]	1.000 [25.40]
12	1.190 [30.23]	1.100 [27.94]

For complete information, write or phone
DALE ELECTRONICS, INC., Box 26728, El Paso, TX 79926 • Phone 915-592-3253

DUAL-IN-LINE
THIN FILM RESISTOR NETWORKS

MODELS TDP14 and TDP16



SPECIFICATIONS

Resistance Range: 100Ω to 100KΩ

Resistance Tolerance: 1%, .5%, .1%

Ratio Match: .05%, .1%, .5%

Resistance Temperature Coefficient: ±25 PPM/°C; ±10 PPM/°C available (−55°C to +125°C)

Resistor Power Rating:
01 Circuit = .05 watt/resistor at 25°C
03 Circuit = .1 watt/resistor at 25°C

Package Power Rating: .7 watt/package at 25°C

Maximum Operating Voltage: 100 VDC

Voltage Coefficient of Resistance: < 5 PPM/V typical

T.C. Tracking: ±5 PPM/°C (−55°C to +125°C)

Operating Temperature Range: −55°C to +125°C

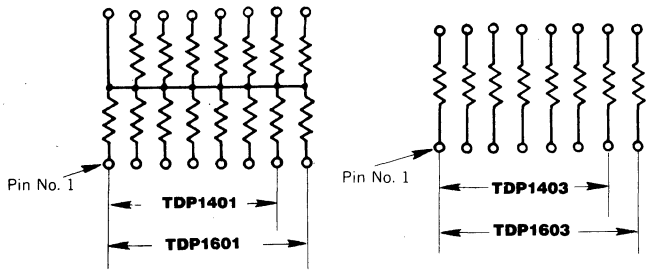
Storage Temperature Range: −55°C to +150°C

Terminals: Solder Coated Copper Alloy

Body: Molded Epoxy

Resistive Material: Nichrome film

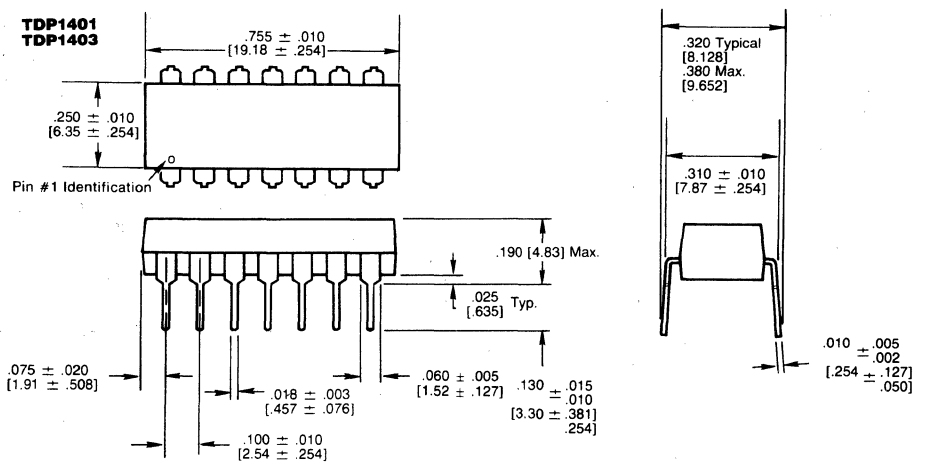
STANDARD SCHEMATICS

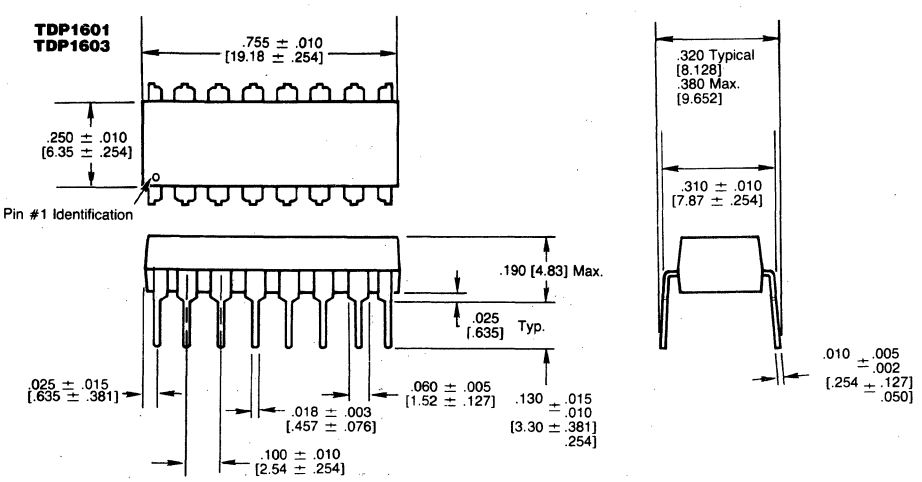


DIMENSIONS [Numbers in brackets indicate millimeters]

APPLICATIONS

- Precision voltage/current dividers
- Differential, instrumentation and summing amplifiers
- Converter ladder, scaling and range setting
- Oscillators and active filters



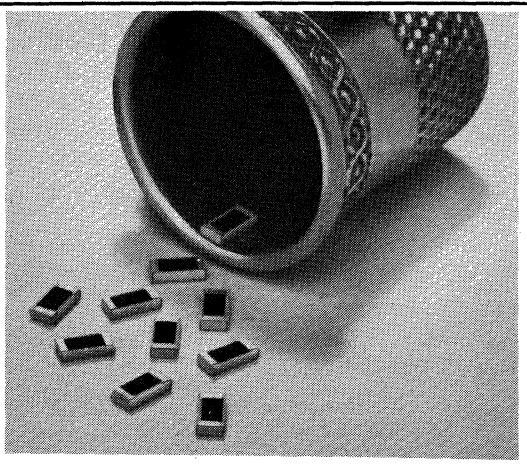


NOTE:
Other Dale thin film products include thin film chips, including styles compatible with chip carrier and custom packages. Consult factory.

For complete information, write or phone
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, Nebraska 68701 • Phone 402-371-0080

DALE®

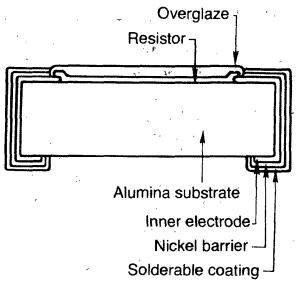
COMMERCIAL
THICK FILM CHIP RESISTORS



MODEL CRCW

FEATURES

- Internationally standardized size
- Automatic placement compatibility
- Flow solderable
- Thick film resistance element
- Wraparound termination
- Inner electrode protection



ELECTRICAL SPECIFICATIONS

Resistance Tolerance and Temperature Coefficient Range:

CRCW 0805: 20Ω to 150K, ±1%, ±100 PPM/°C
10Ω to 1 Meg., ±1%, ±2% and ±5%, ±200 PPM/°C
Zero ohm jumper (0.05Ω max., 1 amp max.)

CRCW 1206: 20Ω to 300K, ±1%, ±100 PPM/°C
10Ω to 2.2 Meg., ±1%, ±2% and ±5%, ±200 PPM/°C
Zero ohm jumper (0.05Ω max., 2 amp max.)

CRCW 1210: 20Ω to 220K, ±1%, ±100 PPM/°C
10Ω to 1.5 Meg., ±1%, ±2% and ±5%, ±200 PPM/°C
Zero ohm jumper (0.05 max., 4 amp max.)

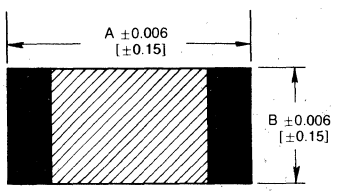
Power Rating and Maximum Operating Voltage: (@70°C)
CRCW 0805: 62.5MW, 100V
CRCW 1206: 125MW, 200V
CRCW 1210: 250MW, 200V

Maximum Ambient Temperature: 125°C (see derating curve)

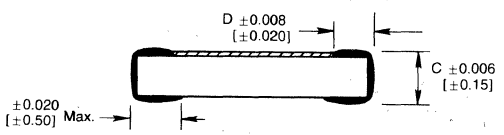
Temperature Range: −55°C to +125°C

DIMENSIONAL SPECIFICATIONS:

[Numbers in brackets indicate millimeters]



DALE TYPE	A (Length)	B (Width)	C	D
CRCW 0805	.081 [2.06]	.053 [1.35]	.015 [.38]	.015 [.38]
CRCW 1206	.126 [3.20]	.063 [1.60]	.024 [.61]	.018 [.46]
CRCW 1210	.126 [3.20]	.103 [2.62]	.024 [.61]	.018 [.46]

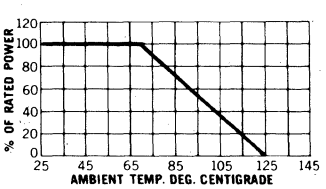


PERFORMANCE CHARACTERISTICS
(Test Methods per MIL-R-55342)

TEST	REQUIREMENT	SPECIFICATION
Thermal Shock	±(0.5% + 0.05Ω)	MIL-STD-202, Method 107
Low Temperature Operation	±(0.5% + 0.05Ω)	MIL-R-55342, Para. 4.7.4
Short Time Overload	±(0.5% + 0.05Ω)	MIL-R-55342, Para. 4.7.5
High Temp. Exposure	±(1% + 0.05Ω)	MIL-R-55342, Para. 4.7.6
Resistance to Bonding Exposure	±(0.25% + 0.05Ω)	MIL-R-55342, Para. 4.7.7
Moisture Resistance	±(0.5% + 0.05Ω)	MIL-STD-202, Method 106
Life	±(2% + 0.05Ω)	MIL-STD-202, Method 108
Solderability	95% min. coverage	MIL-STD-202, Method 208
Termination Adhesion	15 grams min.	MIL-R-55342, Para 4.7.12

DERATING

Dale CRCW resistors have an operating temperature range of −55°C to +125°C. They must be derated according to the curve.



HOW TO ORDER

CRCW	XXXX	–	XXX or XXXX	G	B
SERIES	SIZE		RESISTANCE VALUE	TOLERANCE	PACKAGING
	0805 1206 1210		First two digits (3 for "F" tolerance) are significant; last digit is the multiplier (1800Ω is illustrated).	F = ±1% G = ±2% J = ±5%	T = Standard 8mm reel B = Standard bulk

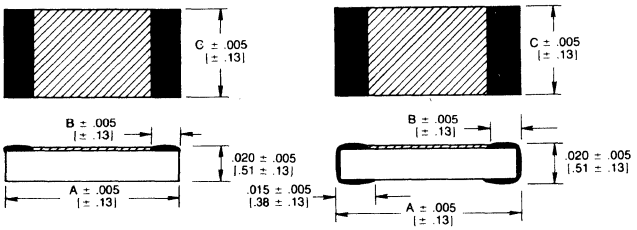
For complete information, write or phone
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, NE 68701 • Phone 402-371-0080

DALE® THICK FILM CHIP RESISTORS

MODELS RCM and RCWM
Established Reliability
Military Qualification MIL-R-55342/2, /3, /4, /6

MODELS RC and RCW
Commercial

DIMENSIONAL AND TERMINAL CONFIGURATIONS
[Numbers in brackets indicate millimeters.]



RC and RCM (One-surface termination) — **RCW and RCWM** (Wrap-around termination)

MILITARY STYLE	DALE TYPE	A (Length)	B	C (Width)
RM0505	RCM550	.050 [1.27]	.010 [.25]	.050 [1.27]
	RCWM550	.055 [1.40]		
RM0705	RCM575	.075 [1.91]	.015 [.38]	.050 [1.27]
	RCWM575	.080 [2.03]		
RM1005	RCM5100	.100 [2.54]	.015 [.38]	.050 [1.27]
	RCWM5100	.105 [2.67]		
RM1505	RCM5150	.150 [3.81]	.015 [.38]	.050 [1.27]
	RCWM5150	.155 [3.94]		

FEATURES

- Allows wide design flexibility for use with hybrid circuitry
- One-surface and wrap-around teminations
- Choices of sizes and power ratings
- Dale has complete capability to develop specific reliability programs designed to customer requirements
- Custom sizes can be designed for special applications

RCM and RCWM SPECIFICATIONS

ELECTRICAL

Resistance and Tolerance Range:
RCM/RCWM550: 10Ω to 500K, ±1%, 2%, 5% and 10%
10Ω to 500K, ±5% and 10%
RCM/RCWM575 and 5100:
10Ω to 1 Meg., ±1%, 2%, 5% and 10%
10Ω to 1 Meg., ±5% and 10%
RCM/RCWM5150 10Ω to 1 Meg., ±1%, 2%, 5% and 10%

Resistance Temperature Coefficient:
(−55°C to +125°C) "M" = ± 300 PPM/°C
"K" = ± 100 PPM/°C

Power Rating: Maximum at +70°C
RCM/RCWM550 = 50 MW
RCM/RCWM575 = 100 MW
RCM/RCWM5100 = 100 MW
RCM/RCWM5150 = 150 MW

RC and RCW SPECIFICATIONS

ELECTRICAL

Resistance Range:
RC/RCW550: 5Ω to 2 Meg.
RC/RCW575: 5Ω to 5 Meg.
RC/RCW5100: 10Ω to 10 Meg.
RC/RCW5150: 10Ω to 15 Meg.
RC/RCW1100: 5Ω to 5 Meg.
RC/RCW7225: 10Ω to 15 Meg.
RC/RCW2010: 10Ω to 15 Meg.
RC/RCW2512: 10Ω to 15 Meg.
RC/RCW1206: 10Ω to 1 Meg.

Resistance Tolerance: ±1%, ±2%, ±5%, ±10%, ±20%

Resistance Temperature Coefficient:
(−55°C to +125°C) ±200 PPM/°C

Power Rating (@ 70°C) and Maximum Operating Voltage:
RC/RCW550 = 100 MW, 50 VDC
RC/RCW575 = 150 MW, 70 VDC
RC/RCW5100 = 200 MW, 100 VDC
RC/RCW5150 = 350 MW, 125 VDC
RC/RCW1100 = 400 MW, 100 VDC
RC/RCW7225 = 600 MW, 200 VDC
RC/RCW2010 = 800 MW, 200 VDC
RC/RCW2512 = 1000 MW, 200 VDC
RC/RCW1206 = 250 MW, 100 VDC

Operating Temperature Range: −55°C to +125°C

Type	A (length)	B	C (Width)
RC550	.050 [1.27]	.010 [.25]	.050 [1.27]
RCW550	.055 [1.40]	.010 [.25]	.050 [1.27]
RC575	.075 [1.91]	.015 [.38]	.050 [1.27]
RCW575	.080 [2.03]	.015 [.38]	.050 [1.27]
RC5100	.100 [2.54]	.015 [.38]	.050 [1.27]
RCW5100	.105 [2.67]	.015 [.38]	.050 [1.27]
RC5150	.150 [3.81]	.015 [.38]	.050 [1.27]
RCW5150	.155 [3.94]	.015 [.38]	.050 [1.27]
RC1100	.100 [2.54]	.015 [.38]	.100 [2.54]
RCW1100	.105 [2.67]	.015 [.38]	.100 [2.54]
RC7225	.225 [5.72]	.015 [.38]	.075 [1.91]
RCW7225	.230 [5.84]	.015 [.38]	.075 [1.91]
RC2010	.200 [5.08]	.015 [.38]	.100 [2.54]
RCW2010	.205 [5.21]	.015 [.38]	.100 [2.54]
RC2512	.250 [6.35]	.015 [.38]	.125 [3.18]
RCW2512	.255 [6.48]	.015 [.38]	.125 [3.18]
RC1206	.120 [3.05]	.015 [.38]	.060 [1.53]
RCW1206	.120 [3.05]	.015 [.38]	.060 [1.53]

HOW TO ORDER—Military Part Number

M55342/2	M	1003	F	S	M
DETAIL SPEC. NO.	CHARACTERISTIC	RESISTANCE VALUE	TOLERANCE	TERMINATION	FAILURE RATE
M55342/2 = RM0505 M55342/6 = RM0705 M55342/3 = RM1005 M55342/4 = RM1505	**M** = ±300 PPM/°C **K** = ±100 PPM/°C	The first two digits (three for "F" tolerance) are significant figures and the last digit specifies the number of zeros to follow.	**F** = ±1% **G** = ±2% **J** = ±5% **K** = ±10%	**S** = Pre-tinned one-surface. **R** = Pre-tinned wrap-around. **T** = Untinned one-surface. **U** = Untinned wrap-around.	**M** = 1%/1000 hours **P** = 0.1%/1000 hours **R** = 0.01%/1000 hours

HOW TO ORDER: RC and RCW—Commercial Styles

RC	5100	103	G	40
STYLE	SIZE	RESISTANCE CODE	TOLERANCE	TERMINATION CODE
RC = One-surface termination. **RCW** = Wrap-around termination	550 5150 2010 575 1100 2512 5100 7225 1206	The first two digits (three for "F" tolerance) are significant figures and the last digit specifies the number of zeros to follow.	**F** = ±1% **G** = ±2% **J** = ±5% **K** = ±10% **M** = ±20%	No Code = Solder Pre-tinned (standard) **20** = Gold (RC only) **40** = Platinum Gold **42** = Palladium Silver

For complete information, write or phone
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, Nebraska 68701 • Phone 402-371-0080

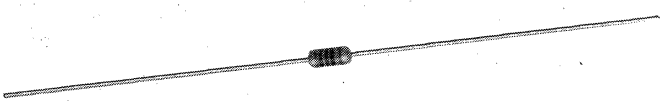
DALE®

COMMERCIAL METAL FILM RESISTORS

MODELS CCF-07, CCF-50 and CCF-55, COATED

1%, 2%, 5% Tolerance

TAPE AND REEL PACKAGING



FEATURES

- 1/4 watt at 70°C power rating
- Superior electrical performance. CCF-50 meets or exceeds MIL-R-10509. CCF-55 meets or exceeds MIL-R-22684 (RL07) and MIL-R-10509 (RN55D). CCF-07 meets electrical requirements of MIL-R-22684 (RL07) and MIL-R-11
- Flame retardant epoxy conformal coating
- Color band marking for ease of identification after mounting

SPECIFICATIONS

ELECTRICAL

Resistance Range: 10Ω to 1 Megohm, ±1%, ±2%
10Ω to 2 Megohms, ±5%

Resistance Tolerance: ±1% (CCF-50, CCF-55) ±2%, ±5% (CCF-07)

Resistance Temperature Coefficient: ±100 PPM/°C = CCF-07, 2% tolerance (−65°C to +150°C); CCF-50, CCF-55 (−65°C to +165°C). ±200 PPM/°C = CCF-07, 5% tolerance (−65°C to + 150°C)

Resistor Power Rating: 1/4 watt at +70°C

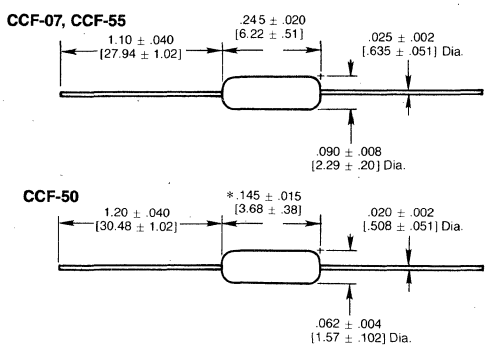
Maximum Working Voltage: 250 VRMS = CCF-07 and CCF-55
200 VRMS = CCF-50

Insulation Resistance: 10,000 Megohms

Operating Temperature Range: CCF-07 = −65°C to +150°C; CCF-50 and CCF-55 = −65°C to +165°C

PHYSICAL CONFIGURATION

[Numbers in brackets indicate millimeters]



*Leads solderable to within .062 [1.57] of the ends of the body.

RESISTANCE VALUES

CCF-07 is available in the standard 24 resistance values per decade. **CCF-50** and **CCF-55** are available in the standard 96 resistance values per decade. Values are obtained from the appropriate decade table by multiplying by powers of 10. Example: 24 = 24 ohms, 240 ohms, 2.4K, 24K or 240K.

CCF-07			CCF-50 and CCF-55										
10	22	47	10.0	12.1	14.7	17.8	21.5	26.1	31.6	38.3	46.4	56.2	68.1	82.5
11	24	51	10.2	12.4	15.0	18.2	22.1	26.7	32.4	39.2	47.5	57.6	69.8	84.5
12	27	56	10.5	12.7	15.4	18.7	22.6	27.4	33.2	40.2	48.7	59.0	71.5	86.6
13	30	62	10.7	13.0	15.8	19.1	23.2	28.0	34.0	41.2	49.9	60.4	73.2	88.7
15	33	68	11.0	13.3	16.2	19.6	23.7	28.7	34.8	42.2	51.1	61.9	75.0	90 9
16	36	75	11.3	13.7	16.5	20.0	24.3	29.4	35.7	43.2	52.3	63.4	76.8	93.1
18	39	82	11.5	14.0	16.9	20.5	24.9	30.1	36.5	44.2	53.6	64.9	78.7	95.3
20	43	91	11.8	14.3	17.4	21.0	25.5	30.9	37.4	45.3	54.9	66.5	80.6	97.6

HOW TO ORDER

CCF-07 CCF-50 or CCF-55	241 3010	G F J
MODEL NUMBER	RESISTANCE VALUE	TOLERANCE
	First two digits are significant for CCF-07; first three digits for CCF-50 and CCF-55. Last digit specifies the number of zeros.	CCF-50, -55 **F** = ±1% CCF-07 **G** = ±2% **J** = ±5%

EXAMPLE: CCF-07 241G = A 1/4 watt metal film resistor with ±100 PPM/°C T.C., resistance of 240 ohms and tolerance of ±2%.
CCF-50 3010F, CCF-55 3010F = A 1/4 watt metal film resistor with ±100 PPM/°C T.C., resistance of 301 ohms and tolerance of ±1%.

For complete information, write or phone
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, Nebraska 68701 • Phone 402-371-0080

DALE®

SPECIAL PURPOSE PRECISION THIN FILM RESISTORS

MODEL PTF, COATED
Low T.C.—Tight Tolerance

FEATURES

- Performance exceeds MIL-R-55182 requirements
- Extremely low temperature coefficients of resistance
- Very low noise and voltage coefficient
- Wide precision resistance range in small package
- 100% laser spiralled
- Very good high frequency characteristics
- Proprietary epoxy coating provides superior moisture protection
- Acceptance testing available
- Can replace wirewound bobbins

MATERIAL

Element: Precision deposited nickel-chrome alloy with controlled annealing

Core: Fire-cleaned high purity ceramic

Encapsulant: Specially formulated epoxy compounds. Coated construction.

Termination: Standard lead material is solder-coated copper. Solderable and weldable per MIL-STD-1276, Type C.

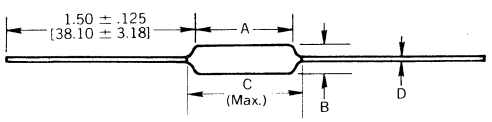
STANDARD ELECTRICAL SPECIFICATIONS

DALE TYPE	85°C RATING	MAX. WT. (Grams)	MAX. WORKING VOLTAGE	RESISTANCE RANGE
PTF 51	1/20 W	.11	200	50Ω to 100K
PTF 56	1/8 W	.35	300	50Ω to 499K
PTF 65	1/4 W	.75	500	50Ω to 1 Meg.

Standard tolerances from 1% to .01%.

PHYSICAL CONFIGURATIONS

TYPE	DIM. A	DIM. B.	DIM. C (MAX.)	DIM. D
PTF 51	.150 ± .020 [3.81 ± .51]	.070 ± .010 [1.78 ± .25]	.200 [5.08]	.016 [.406]
PTF 56	.250 + .031 − .046 [6.35 + .79 − 1.17]	.091 ± .009 [2.31 ± .23]	.300 [7.62]	.025 [.635]
PTF 65	.375 ± .062 [9.53 ± 1.57]	.145 ± .016 [3.68 ± .41]	.475 [12.07]	.025 [.635]



TEMPERATURE COEFFICIENT CODE −20° to +85°C

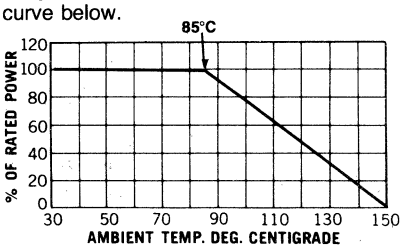
T.C. CODE	TEMPERATURE COEFFICIENT
T-10	0 ± 15 PPM/°C
T-13	0 ± 10 PPM/°C
T-16	0 ± 5 PPM/°C

PERFORMANCE DATA

TEST per MIL-R-55182 (Exceptions Noted)	MAX. ΔR (Typical Test Lots)	SPECIFICATION
Thermal Shock (−55°C to +85°C)	0.02%	MIL-STD-202, Method 107
Moisture	0.08%	MIL-STD-202, Method 106
Resistance to Solder Heat	0.02%	MIL-STD-202, Method 210
Dielectric Withstanding	0.01%	MIL-STD-202, Method 301 & 105
Short Time Overload	0.01%	MIL-R-10509, Para. 4.6.6
Damp Heat	0.08%	IEC Publication #68-2-3 (56 days)
Low Temperature Operation	0.02%	MIL-R-55182, Para. 4.7.9
Life (1000 hours rated power @ 85°C)	0.04%	MIL-R-55182, Para. 4.7.17

DERATING

Dale PTF resistors have an operating temperature range of −55°C to +150°C. They must be derated according to the curve below.



MATCHED SETS — NETWORKS

Dale's many years of experience in matching resistors for sets and networks, combined with the superb performance of the PTF product, provide the best and most economical solution to your precision resistor requirements. Why? Because most applications for precision resistors depend on two or more discretes having an initial tolerance ratio and a resistance tracking capability over temperature rather than each discrete resistor meeting the absolute requirements of the application.

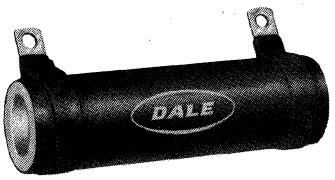
Cost savings approaching 50% can be realized when relatively tight matching requirements are specified while permitting the absolute parameters of the discrete resistors to have more relaxed specifications.

Dale application engineers are available to assist you in specifying your requirements in the most economical way possible.

For complete information, write or phone
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, NE 68701 • Phone 402-371-0080

INDUSTRIAL POWER WIREWOUND RESISTORS

(Includes coating and terminal band.)



MODEL HL
TUBULAR

For inexpensively dissipating larger amounts of power in DC or low frequency AC circuits.

Applications include:

- Grid resistor
- High voltage bleeder resistors in power supplies
- Voltage divider networks
- Load resistor
- Voltage dropping resistor
- Bias supply resistor
- Filament dropping resistor
- Shunt resistor

STANDARD TYPE SPECIFICATIONS

TYPE	WATTAGE RATING	DALE MAX.* RESISTANCE	MAX. WORKING VOLTAGE	A MAX.	CORE DIMENSIONS LENGTH ±1/16 [1.59]	O.D.	I.D. ±1/32 [.79]	TERMINAL SETBACK ±1/32 [.79]	STANDARD TERMINAL** DESIGNATION	MOUNTING HARDWARE OPTIONS
HL-12	12	70K	500	13/32 [10.32]	1-3/4 [44.45]	5/16 [7.94]	3/16 [4.76]	3/32 [2.38]	05	101, 204, 301
HL-20	20	120K	880	9/16 [14.29]	2 [50.80]	7/16 [11.11]	5/16 [7.94]	3/32 [2.38]	02	101, 203, 301
HL-25	25	155K	1.3K	11/16 [17.46]	2 [50.80]	9/16 [14.29]	5/16 [7.94]	3/32 [2.38]	06	101, 203, 301
HL-50	50	385K	1.9K	11/16 [17.46]	4 [101.60]	9/16 [14.29]	5/16 [7.94]	3/32 [2.38]	06	101, 203, 301
HL-100	100	870K	2.5K	29/32 [23.02]	6-1/2 [165.10]	3/4 [19.05]	1/2 [12.70]	1/8 [3.18]	06	102, 206, 303
HL-175	175	1.7 Meg.	5.2K	1-5/16 [33.34]	8-1/2 [215.90]	1-1/8 [28.58]	3/4 [19.05]	7/32 [5.56]	07	103, 205, 303
HL-225	225	2.1 Meg.	6.1K	1-5/16 [33.34]	10-1/2 [266.70]	1-1/8 [28.58]	3/4 [19.05]	7/32 [5.56]	07	103, 205, 303

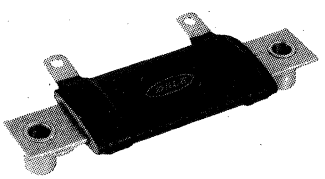
*Minimum resistance is .1 ohm for all models. **Contact factory for optional, non-standard terminals, including quick disconnect types.

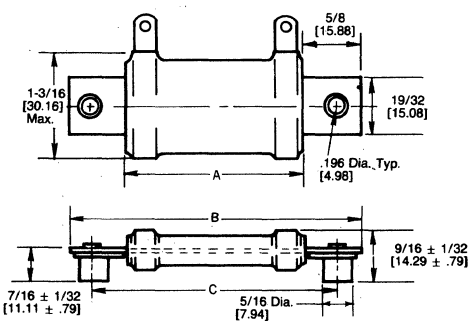
5% tolerance is standard on values 1 ohm and above, 10% on values below 1 ohm. Lower tolerances available.

MODEL HL
FLAT

FEATURES

- High power-to-size ratio
- Mounting accommodations ideally suited to high density packaging
- Self-stacking hardware for horizontal or vertical placement
- Withstand high vibration without loosening
- Mountings function as heat sinks allowing greater heat dissipation and less derating of stacked units





FLAT TYPE SPECIFICATIONS

TYPE	WATTAGE RATING	MAX.* RESISTANCE	MAX. WORKING VOLTAGE	DIMENSIONS A ±1/16 [1.59]	B ±1/16 [1.59]	C ±1/32 [.79]	TERMINAL SETBACK ±1/32 [.79]	STANDARD TERMINAL** DESIGNATION
HL-24	30	55K	800	1-1/4 [31.75]	2-1/2 [63.50]	2 [50.80]	5/64 [1.98]	09
HL-35	40	135K	1.4KV	2 [50.80]	3-1/4 [82.55]	2-3/4 [69.85]	5/64 [1.98]	09
HL-55	55	300K	1.8KV	3-1/2 [88.90]	4-3/4 [120.65]	4-1/4 [107.95]	5/64 [1.98]	09
HL-95	95	550K	2.6KV	6 [152.40]	7-1/4 [184.15]	6-3/4 [171.45]	5/64 [1.98]	09

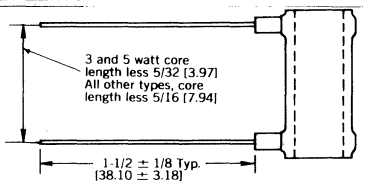
*Minimum resistance is .1 ohm for all models. 5% tolerance is standard on values 1 ohm and above, 10% on values below 1 ohm. Lower tolerances available.

**Contact factory for optional, non-standard terminals, including quick disconnect types.

For complete information, write or phone
DALE ELECTRONICS, INC., 2064 12th Avenue, Columbus, Nebraska 68601 • Phone 402-564-3131

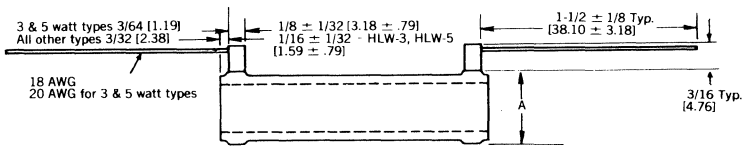
DALE®

INDUSTRIAL POWER WIREWOUND RESISTORS



MODEL HLW
TUBULAR, AXIAL LEAD

Construction identical to HL Series but with lug-attached leads to facilitate direct electrical connection by soldering.



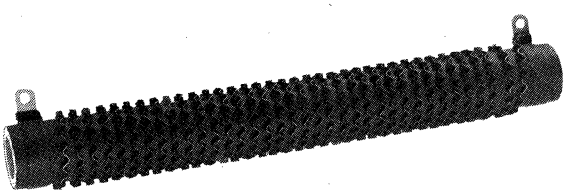
STANDARD TYPE SPECIFICATIONS

DALE TYPE	WATTAGE RATING	MAX. RESISTANCE*	LENGTH ±1/16 [1.59]	CORE O.D.	CORE I.D. ±1/32 [.79]	A (Max.)	AXIAL TERMINAL DESIGNATION	RADIAL TERMINAL DESIGNATION	MOUNTING HARDWARE
HLW-3	3	6K	7/16 [11.11]	13/64 [5.16]	1/8 [3.18]	19/64 [7.54]	A2	R2	—
HLW-5	5-1/4	15K	5/8 [15.88]	1/4 [6.35]	1/8 [3.18]	11/32 [8.73]	A2	R2	—
HLW-6	8	25K	1 [25.40]	5/16 [7.94]	3/16 [4.76]	13/32 [10.32]	A1	R1	101, 204, 301
HLW-12	12	70K	1-3/4 [44.45]	5/16 [7.94]	3/16 [4.76]	13/32 [10.32]	A1	R1	101, 204, 301
HLW-20	20	120K	2 [50.80]	7/16 [11.11]	5/16 [7.94]	9/16 [14.29]	A1	R1	101, 203, 301

*Minimum resistance is .1 ohm for all models. Consult factory for higher values.

5% tolerance is standard on values 1 ohm and above, 10% on values below 1 ohm. Lower tolerances available.

MODEL HLZ
EDGEWOUND



FEATURES

- Designed to meet heavy-duty requirements where space is at premium
- High thermal capacity for intermittent or short duration
- Silicone coating allows maximum heat transfer from wire surface

STANDARD TYPE SPECIFICATIONS

TYPE	WATTAGE RATING	RESISTANCE RANGE (Ohms) Min.	RESISTANCE RANGE (Ohms) Max.	CORE DIMENSIONS LENGTH ±1/16 [1.59]	CORE DIMENSIONS O.D.	CORE DIMENSIONS I.D. ±1/32 [.79]	STANDARD TERMINAL* DESIGNATION	MOUNTING HARDWARE
HLZ-33	35	.05	1.9	2 [50.8]	9/16 [14.29]	5/16 [7.94]	06	101, 203, 301
HLZ-90	90	.15	5.7	4 [101.6]	9/16 [14.29]	5/16 [7.94]	06	101, 203, 301
HLZ-165	165	.36	13	6-1/2 [165.1]	3/4 [19.05]	1/2 [12.70]	06	102, 206, 303
HLZ-300	300	.23	25	8-1/2 [215.9]	1-1/8 [28.58]	3/4 [19.05]	07	103, 205, 303

*Contact factory for optional non-standard terminals including quick disconnect types.

Tolerance: ±10% standard. Also available in ±5%.

Temperature Rise: 375°C at full power. Slightly higher temperatures will occur in maximum resistance units.

Dielectric: 1000 V from terminals to mounting hardware.

Construction: A ribbon element is edgewound onto a ceramic tube and is coated with silicone. Silicone coating holds ribbon wire firmly against core while allowing maximum exposure of wire surface for heat transfer by radiation.

ALSO AVAILABLE:

Dale Type NHL, Non-Inductive, Tubular Resistors. 12W, 20W, 25W, 50W, 100W, 175W and 225W.

Dale Type HLM, Miniature Flat Resistors. 10W and 20W.

Dale Type HLA, Adjustable Resistors. 12W, 20W, 25W, 50W, 100W, 175W and 225W.

Dale Type HLT, Tapped Resistors. Provides fixed taps for voltage dividers.

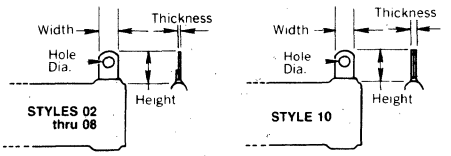
For complete information, write or phone
DALE ELECTRONICS, INC., 2064 12th Avenue, Columbus, Nebraska 68601 • Phone 402-564-3131

DALE®

SPECIFICATIONS
INDUSTRIAL POWER WIREWOUND RESISTORS

[Numbers in brackets indicate millimeters]

TERMINAL SPECIFICATIONS
Terminals for HL, HLM and HLW Power Wirewound Resistors



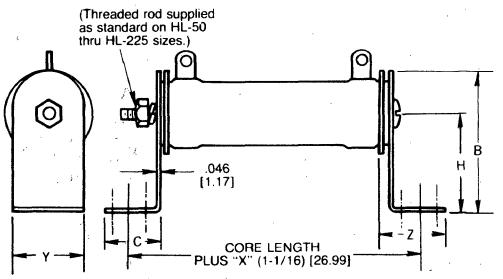
TERMINAL DIMENSIONS

TERMINAL DESIGNATION	02	05	06	07	09	10	A1, R1	A2, R2
WIDTH	3/16 [4.76]	3/16 [4.76]	1/4 [6.35]	3/8 [9.52]	3/16 [4.76]	1/8 [3.18]	1-1/2" [38.10] 18 AWG Lead	1-1/2" [38.10] 20 AWG Lead
HEIGHT	13/32 [10.32]	7/16 [11.11]	9/16 [14.29]	5/8 [15.88]	1/2 [12.70]	3/16 [4.76]		
HOLE DIA.	.093 [2.36]	.104 [2.64]	.166 [4.22]	.173 [4.39]	.104 [2.64]	.063 [1.60]		
THICKNESS	.020 [.51]	.020 [.51]	.020 [.51]	.020 [.51]	.020 [.51]	.030 [.76]		

All terminals will be supplied in tinned finish (Z) unless otherwise specified. Optional finishes are nickel plated (N) for HL's, bare alloy 180 (W) for HLW lead styles. Specify proper suffix in part number designation when ordering.

MOUNTING SPECIFICATIONS

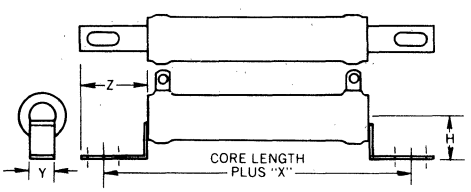
HORIZONTAL THRU-BOLT



Note: Flat washers are supplied on resistor cores through 9/16 [14.29] diameter.

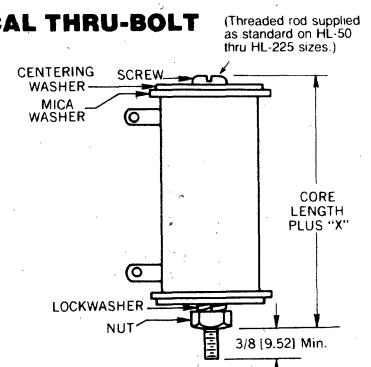
BRACKET TYPE	X	Y	Z	H	MOUNTING SLOT	C	B
101	1-1/16 [26.99]	1/2 [12.70]	55/64 [21.83]	1 [25.40]	7/32 x 7/16 [5.56 x 11.11]	3/4 [19.05]	1-3/8 [34.92]
102	1-1/16 [26.99]	3/4 [19.05]	55/64 [21.83]	1-1/4 [31.75]	7/32 x 7/16 [5.56 x 11.11]	3/4 [19.05]	1-3/4 [44.45]
103	1-1/16 [26.99]	1-1/4 [31.75]	1 [25.40]	1-1/2 [38.10]	9/32 x 9/16 [7.14 x 14.29]	7/8 [22.22]	2-1/8 [53.98]

PUSH-IN



BRACKET TYPE	X	H	Y	Z	HOLE
203	5/8 [15.88]	43/64 [17.06]	1/4 [6.35]	15/32 [11.91]	.161 Dia. [4.09]
204	3/8 [9.52]	9/32 [7.14]	1/4 [6.35]	11/32 [8.73]	.144 Dia. [3.66]
205	13/16 [20.64]	1-25/64 [35.32]	1/2 [12.70]	11/16 [17.46]	.196 x .260 [4.98 x 6.60]
206	23/32 [18.26]	31/32 [24.61]	3/8 [9.52]	5/8 [15.88]	.196 x .375 [4.98 x 9.52]

VERTICAL THRU-BOLT



Note: Flat washers are supplied on resistor cores through 9/16 [14.29] diameter.

BRACKET TYPE	X (Approximate)	THREAD
301	7/16 [11.11]	8-32
303	1/4 [6.35]	10-32

INDUSTRIAL POWER WIREWOUND RESISTORS

MODEL CW
COATED, AXIAL LEAD

FEATURES

- High performance for low cost
- High-temperature silicone coating
- Complete welded construction
- High power/size ratio
- Excellent stability in operation

STANDARD ELECTRICAL SPECIFICATIONS

DALE TYPE	MIL. TYPE	POWER RATING (Max. Hot Spot) 275°C	350°C	MIL.	RESISTANCE RANGE (Mil. Range shown in bold face)	MAX. WT. (Grams)	MAX.* WORKING VOLTAGE 275°C	350°C
CW-2	—	4.0	5.5	—	.1Ω to 22K	2.1	200	235
CW-2B**	—	3.0	3.75	—	.1Ω to 11K	.70	125	140
CW-2C	—	2.5	3.25	—	.1Ω to 15K	1.6	130	150
CW-2C-1	**RW69**	2.5	3.25	3.0	.1Ω to 15K **.1Ω to 2K**	1.6	130	150
CW-2C-14	—	2.5	3.25	—	.1Ω to 15K	1.6	130	150
CW-5**	—	5.0	6.5	—	.1Ω to 45K	4.2	320	365
CW-5-2	—	4.0	5.0	—	.1Ω to 30K	4.2	240	265
CW-5-3	—	5.0	6.5	—	.1Ω to 45K	4.2	320	365
CW-5-5	**RW67**	5.0	6.5	6.5	.1Ω to 45K **.1Ω to 8.2K**	4.2	320	365
CW-7	—	7.0	9.0	—	.1Ω to 75K	4.7	460	520
CW-10	—	10.0	13.0	—	.1Ω to 130K	9.0	765	875
CW-10-3	—	10.0	13.0	—	.1Ω to 130K	9.0	765	875
CW-10-4	**RW68**	10.0	13.0	11.0	.1Ω to 130K **.1Ω to 20K**	9.0	765	875

*Maximum working voltage determined at .0008" diameter wire resistance values.
**Values available down to .005Ω in 10% tolerance.

SPECIFICATIONS

MATERIAL

Core: Ceramic: Steatite or alumina, depending on physical size.

Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value.

End Caps: Stainless steel.

Coating: Special high temperature silicone.

Standard Terminals: Tinned Copperweld®

ELECTRICAL

Dielectric Strength: 1000 VAC minimum

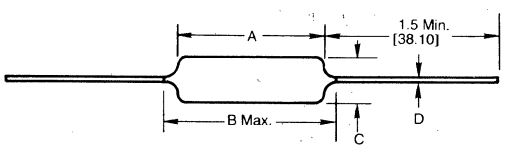
Tolerance: Standard tolerance is ±5% 1 ohm and above. ±10% below 1 ohm. 3% available.

Temperature Coefficient: ±90 PPM/°C below 1Ω; ±50 PPM/°C 1Ω to 9.9Ω; ±30 PPM/°C 10Ω and above.

Short Time Overload: 5 seconds at 5 times rated power for 3.75 watt size and smaller; 5 seconds at 10 times rated power for 4 watt size and larger.

DIMENSIONAL SPECIFICATIONS

[Numbers in brackets indicate millimeters]



DALE TYPE	A ±.062 [1.57]	B (Max.)	C ±.032 [.81]	D ±.002 [.051]
CW-2	.625 [15.8]	.765 [19.43]	.250 [6.35]	.040 [1.02]
CW-2B	.562 [14.27]	.622 [15.80]	.188 [4.78]	.032 [.81]
CW-2C	.500 [12.70]	.593 [15.06]	.218 [5.54]	.040 [1.02]
CW-2C-1	.500 [12.70]	.593 [15.06]	.218 [5.54]	.032 [.81]
CW-2C-14	.500 [12.70]	.593 [15.06]	.218 [5.54]	.032 [.81]
CW-5	.875 [22.22]	1.000 [25.40]	.312 [7.92]	.040 [1.02]
CW-5-2	.875 [22.22]	1.000 [25.40]	.250 [6.35]	.032 [.81]
CW-5-3	.875 [22.22]	1.000 [25.40]	.312 [7.92]	.032 [.81]
CW-5-5	.875 [22.22]	1.000 [25.40]	.312 [7.92]	.040 [1.02]
CW-7	1.218 [30.94]	1.281 [32.54]	.312 [7.92]	.040 [1.02]
CW-10	1.781 [45.24]	1.875 [47.62]	.375 [9.52]	.040 [1.02]
CW-10-3	1.781 [45.24]	1.875 [47.62]	.375 [9.52]	.032 [.81]
CW-10-4	1.781 [45.24]	1.875 [47.62]	.375 [9.52]	.040 [1.02]

POWER RATING

Dale CW Series have two power ratings, depending on operating temperature and stability requirements.

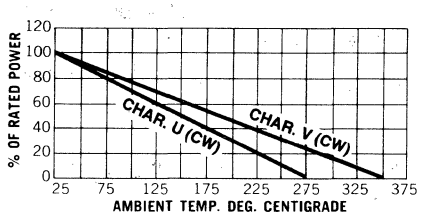
CHARACTERISTIC U

1. 275°C maximum hot spot temperature
2. .5% maximum ΔR in 2000 hour load life

CHARACTERISTIC V

1. 350°C maximum hot spot temperature
2. 3% maximum ΔR in 2000 hour load life

DERATING (Type CW)
Dale CW coated resistors have an operating temperature range of −55°C to +350°C. They must be derated at high ambient temperatures according to the curves at right.



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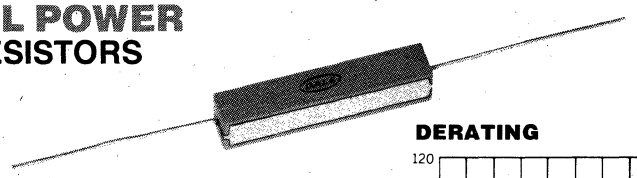
DALE®

COMMERCIAL POWER WIREWOUND RESISTORS

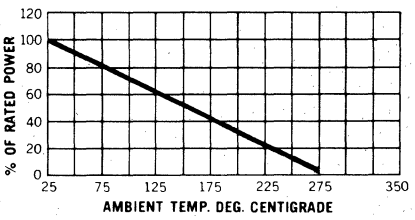


MODELS CP and CPL
AXIAL LEAD

FEATURES

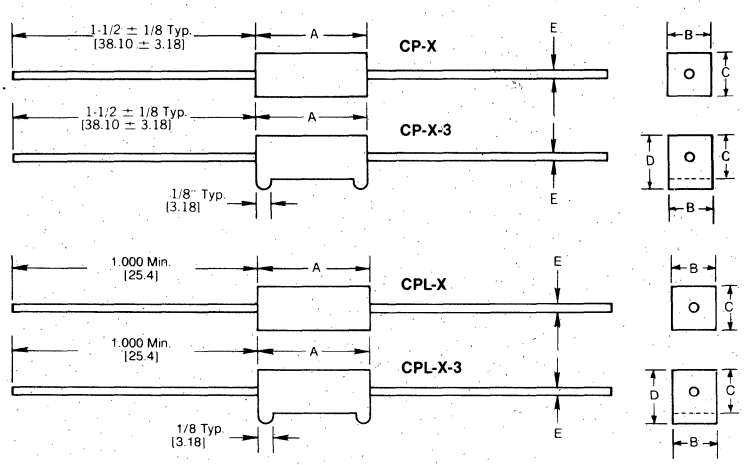
- Fireproof inorganic construction
- Special inorganic potting compound provides high thermal conductivity
- Extremely low resistance values (CPL)
- Complete welded construction (CPL)
- Fuse styles (Type RF) available (CP)

DERATING



CP and CPL SERIES AXIAL LEAD TYPE [Numbers in brackets indicate millimeters]

DALE TYPE	WATTAGE RATING	EIA STANDARD RS-344 TYPE	RESISTANCE	MAX. WORKING VOLTAGE	DIMENSIONS A ± 1/32 [.79]	B ± 1/32 [.79]	C ± 1/32 [.79]	D ± 1/32 [.79]	E ± .001 [.02]
CP-2	2	CRU2A	.1 to 2.4K	65	11/16 [17.46]	1/4 [6.35]	1/4 [6.35]	—	.032 [.81]
CP-2-3	2	—	.1 to 2.4K	65	11/16 [17.46]	1/4 [6.35]	1/4 [6.35]	5/16 [7.94]	.032 [.81]
CP-3 CPL-3	3 3	CRU3 —	.1 to 7.5K —	150 —	7/8 [22.22]	5/16 [7.94]	5/16 [7.94]	—	.036 [.91]
CP-3-3 CPL-3-3	3 3	— —	.1 to 7.5K —	150 —	7/8 [22.22]	5/16 [7.94]	5/16 [7.94]	3/8 [9.52]	.036 [.91]
CP-5 CPL-5	5 5	CRU5 —	.1 to 8.5K —	200 —	7/8 [22.22]	3/8 [9.52]	11/32 [8.73]	—	.036 [.91]
CP-5-3 CPL-5-3	5 5	— —	.1 to 8.5K —	200 —	7/8 [22.22]	3/8 [9.52]	11/32 [8.73]	13/32 [10.32]	.036 [.91]
CP-7 CPL-7	7 7	CRU7 —	.12 to 18K —	350 —	1-25/64 [35.32]	3/8 [9.52]	11/32 [8.73]	—	.036 [.91]
CP-7-3 CPL-7-3	7 7	— —	.12 to 18K —	350 —	1-25/64 [35.32]	3.8 [9.52]	11/32 [8.73]	15/32 [11.91]	.036 [.91]
CP-10 CPL-10	10 10	CRU10 —	.18 to 30K —	540 —	1-7/8 [47.62]	3/8 [9.52]	11/32 [8.73]	—	.036 [.91]
CP-10-3 CPL-10-3	10 10	— —	.18 to 30K —	540 —	1-7/8 [47.62]	3/8 [9.52]	11/32 [8.73]	15/32 [11.91]	.036 [.91]
CP-15 CPL-15	15 15	CRU15 —	.18 to 30K —	670 —	1-7/8 [47.62]	1/2 [12.70]	1/2 [12.70]	—	.036 [.91]
CP-15-3 CPL-15-3	15 15	— —	.18 to 30K —	670 —	1-7/8 [47.62]	1/2 [12.70]	1/2 [12.70]	5/8 [15.88]	.036 [.91]
CP-20	20	—	.25 to 30K	770	2-1/2 [63.50]	1/2 [12.70]	1/2 [12.70]	—	.036 [.91]
CP-20-3	20	—	.25 to 30K	770	2-1/2 [63.50]	1/2 [12.70]	1/2 [12.70]	5/8 [15.88]	.036 [.91]
CP-22	22	—	.25 to 30K	815	2-1/2 [63.50]	1/2 [12.70]	1/2 [12.70]	—	.036 [.91]
CP-22-3	22	—	.25 to 30K	815	2-1/2 [63.50]	1/2 [12.70]	1/2 [12.70]	5/8 [15.88]	.036 [.91]



SPECIFICATIONS

ELECTRICAL

TYPE CP

Tolerance: ±10% standard, ±5% also available

Operating Temperature: −55°C to +275°C

Temperature Coefficient:
Below 1 ohm 0 ± 800 PPM (Typ.)
1 ohm and above 0 ± 400 PPM (Typ.)

TYPE CPL

Resistance: .01Ω to .10Ω

Tolerance: ±5% standard, ±3% also available. Lower tolerances available.

Dielectric Strength: 1000 VAC

Temperature Coefficient: Varies with resistance values. Consult factory.

For complete information, write or phone
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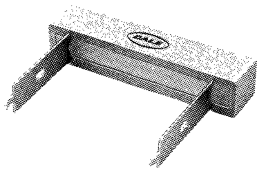
COMMERCIAL POWER WIREWOUND RESISTORS



MODEL CPR
RADIAL TERMINAL

FEATURES

- Fireproof inorganic construction
- Special inorganic potting compound provides high thermal conductivity
- Direct mounting on printed circuit board
- Circuit board lock-in mounting tabs
- Fuse styles (Type RF) available

(For derating see CP on opposite page.)

SPECIFICATIONS

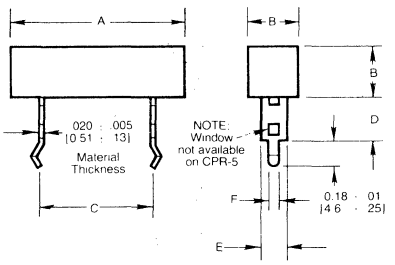
ELECTRICAL

Power Rating: 5 watts to 20 watts

Tolerance: ±10%, ±5%

Operating Temperature: −55°C to +275°C

Temperature Coefficient:
Below 1 ohm 0 ± 800 PPM
1 ohm and above 0 ± 400 PPM



CPR SERIES TERMINAL TYPE [Numbers in brackets indicate millimeters]

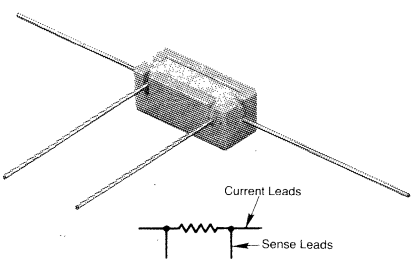
DALE TYPE	POWER AT 25°C (Watts)	DIMENSIONS A	B ±.04 [±1.0]	C ±.06 [±1.5]	D +.08 [+2.0] −.04 [−1.0]	E ±.012 [±0.3]	F ±.008 [±0.2]	RESISTANCE RANGE (Ohms)
CPR-5	5	1.070 ± .032 [27.2 ± .81]	.374 [9.5]	.590 [15.0]	.394 [10.0]	.287 [7.3]	.055 [1.4]	.1 to 400
CPR-7	7	1.43 ± .032 [36.3 ± .81]	.374 [9.5]	.886 [22.5]	.984 [25.0]	.287 [7.3]	.055 [1.4]	.1 to 1000
CPR-10	10	1.92 ± .032 [48.8 ± .81]	.374 [9.5]	1.38 [35.0]	.984 [25.0]	.287 [7.3]	.055 [1.4]	.15 to 1600
CPR-15	15	1.92 ± .032 [48.8 ± .81]	.492 [12.5]	1.28 [32.5]	1.18 [30.0]	.394 [10.0]	.106 [2.7]	.15 to 1600
CPR-20	20	2.53 ± .032 [64.3 ± .81]	.492 [12.5]	1.87 [47.5]	1.18 [30.0]	.394 [10.0]	.106 [2.7]	.2 to 2000

MODEL CPSL
FOUR LEAD

FEATURES

- Fireproof inorganic construction
- Special inorganic potting compound provides high thermal conductivity
- Extremely low resistance values
- Current sensing
- Low temperature coefficients
- Complete welded construction
- High power/size ratio

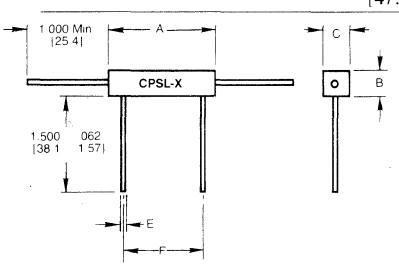
(For derating see CP on opposite page.)



SCHEMATIC

CPSL SERIES FOUR LEAD TYPE [Numbers in brackets indicate millimeters]

DALE TYPE	WATTAGE RATING	DIMENSIONS A ± 1/32 [.79]	B ± 1/32 [.79]	C ± 1/32 [.79]	D ± 1/32 [.79]	E ± .001 [.02]	F ± 1/16 [1.59]
CPSL-3	3	7/8 [22.22]	5/16 [7.94]	5/16 [7.94]	—	.036 [.91]	9/16 [14.30]
CPSL-3-3	3	7/8 [22.22]	5/16 [7.94]	5/16 [7.94]	3/8 [9.52]	.036 [.91]	9/16 [14.30]
CPSL-5	5	7/8 [22.22]	3/8 [9.52]	11/32 [8.73]	—	.036 [.91]	9/16 [14.30]
CPSL-5-3	5	7/8 [22.22]	3/8 [9.52]	11/32 [8.73]	13/32 [10.32]	.036 [.91]	9/16 [14.30]
CPSL-7	7	1-25/64 [35.32]	3/8 [9.52]	11/32 [8.73]	—	.036 [.91]	1 [25.40]
CPSL-10	10	1-7/8 [47.62]	3/8 [9.52]	11/32 [8.73]	—	.036 [.91]	1-3/8 [34.93]
CPSL-15	15	1-7/8 [47.62]	1/2 [12.70]	1/2 [12.70]	—	.036 [.91]	1-3/8 [34.93]



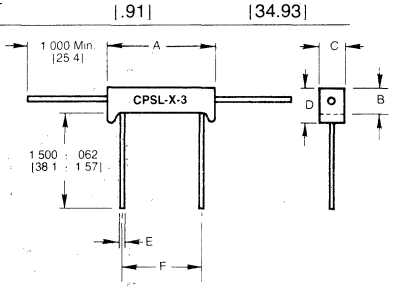
SPECIFICATIONS

ELECTRICAL

Resistance: .01Ω to .10Ω

Tolerance: ±5% standard, ±3% also available

Dielectric Strength: 1000 VAC



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DALE® RESISTOR SELECTION GUIDE

• Metal Film • Metal Oxide • Carbon Film • Wirewound

The industry's most complete selection of discrete resistors.
■ COMMERCIAL ■ INDUSTRIAL
■ PRECISION ■ ESTABLISHED RELIABILITY

TO USE:
Resistors are listed by power rating. Locate the wattage which matches your requirement, then match with the Dale Type closest to your needs in T.C., value, tolerance, etc. For more information, contact your Dale representative or the appropriate Dale factory listed at the right:

ELEMENT TYPE	FACTORY TO CONTACT
WW (Wirewound)	**Dale Electronics, Inc.,** 2064 12th Avenue, Columbus, NE 68601. Phone 402-564-3131
MF (Metal Film)	**Dale Electronics, Inc.,** 2300 Riverside Blvd., Norfolk, NE 68701. Phone 402-371-0080
CF (Carbon Film) **MO** (Metal Oxide) **OF** (Oxide Film)	**Dale Electronics, Inc.,** P.O. Box 1179, Robbinsville, NC 28771. Phone 704-479-6451

DALE RESISTOR QUICK REFERENCE LIST

POWER (1)	TYPE	TC (PPM) (2)	ELE-MENT (3)	VALUE RANGE (4)	STD. TOL. (5)	TOL. AVAIL.	MAX. WORKING VOLTAGE	PACKAGE	
								LENGTH	DIA.
1/20 W (85°C)	**PTF 51**	15/10/5	MF	50Ω-100K	1%	To .01%	200	.150	.070
1/10 W (70°C), 1/20 W (125°C)	**CMF-50** (RN50)	150/100	MF	10Ω-796K	1%	To .5%	200	.150	.065
1/10 W (70°C), 1/20 W (125°C)	**CMF-50** (RN50)	50/25	MF	10Ω-500K	1%	To .1%	200	.150	.065
1/10 W (70°C), 1/20 W (125°C)	**ERC 50** (RNC50)	100/50/25	MF	10Ω-796K	1%	To .1%	200	.150	.070
1/10 W (125°C), 1/8 W (70°C)	**CMF-55** (RN55)	150	MF	1Ω-15M	1%	To .5%	250	.250	.095
1/10 W (125°C), 1/8 W (70°C)	**CMF-55** (RN55)	100	MF	5Ω-15M	1%	To .5%	250	.250	.095
1/10 W (125°C), 1/8 W (70°C)	**CMF-55** (RN55)	50	MF	10Ω-10M	1%	To .1%	250	.250	.095
1/10 W (125°C), 1/8 W (70°C)	**CMF-55** (RN55)	25	MF	24.9Ω-2.5M	1%	To .1%	250	.250	.095
1/10 W (125°C), 1/8 W (70°C)	**ERC 55** (RNC55)	100/50/25	MF	10Ω-2M	1%	To .1%	200	.250	.091
1/10 W (125°C)	**SE-1/10** (RNR55)	50/25	MF*	24.9Ω-200K	1%	To .1%	200	.261	.130
1/8 W (85°C)	**PTF 56**	15/10/5	MF	50Ω-499K	1%	To .01%	300	.250	.091
1/8 W (125°C), 1/4 W (70°C)	**CMF-60** (RN60)	150	MF	1Ω-15M	1%	To .5%	300	.344	.145
1/8 W (125°C), 1/4 W (70°C)	**CMF-60** (RN60)	100	MF	5Ω-15M	1%	To .5%	300	.344	.145
1/8 W (125°C), 1/4 W (70°C)	**CMF-60** (RN60)	50	MF	10Ω-10M	1%	To .1%	300	.344	.145
1/8 W (125°C), 1/4 W (70°C)	**CMF-60** (RN60)	25	MF	24.9Ω-2.5M	1%	To .1%	300	.344	.145
1/8 W (125°C), 1/4 W (70°C)	**ERC 60** (RNC60)	100/50/25	MF	10Ω-3.01M	1%	To .1%	250	.375	.145
1/8 W (125°C)	**SE-1/8** (RNR60)	50/25	MF*	24.9Ω-499K	1%	To .1%	250	.360	.140
1/8 W (70°C)	**ERL-05** (RLR05)	100	MF	10Ω-300K	1%	2% & 5%	200	.150	.066
1/4 W (125°C)	**RNX-1/4**	200/100/50	MO	1K-100M	—	1%, 2%, 5%, 10%	750V	.270	.135
1/4 W (25°C)	**RFX-1/2**	200/100/50	MO	100Ω-10G	—	1%, 2%, 5%, 10%	3.75 KV	.570x.210**	
1/4 W (70°C)	**CCF-07**	100	MF	10Ω-1M	2%	2%	250	.240	.090
1/4 W (70°C)	**CCF-07**	200	MF	10Ω-2M	5%	5%	250	.240	.090
1/4 W (70°C)	**CCF-55**	100	MF	10Ω-1M	1%	1%	250	.240	.090
1/4 W (70°C)	**CMF-07** (RL07)	200	MF	1Ω-15M	2%	5%	250	.250	.090
1/4 W (70°C)	**ERL-07** (RLR07)	100	MF	10Ω-10M	1%	2% & 5%	250	.250	.090
1/4 W (85°C)	**PTF 65**	15/10/5	MF	50Ω-1M	1%	To .01%	500	.375	.145
1/4 W (125°C), 1/2 W (70°C)	**CMF-65** (RN65)	150	MF	1Ω-15M	1%	To .5%	350	.562	.185

*Hermetically Sealed. **Flat Radial Lead Package.

NOTES: (1) Military power ratings are shown for RN, RNC, RL, RLR metal film resistors. Note that CMF metal film resistors can be rated higher for commercial use...see catalog. (2) Where 20 PPM is specified on wirewound resistors, it applies to 10 ohms and up. 1-9.9 ohms = 50 PPM, 1 ohm = 90 PPM. (3) MF (Metal Film), OF (Oxide Film), MO (Metal Oxide), CF (Carbon Film), WW (Wirewound). (4) Other values available, consult factory. (5) On HL and CW resistors, standard tolerance is 10% below 1 ohm.

DALE® RESISTOR SELECTION GUIDE

POWER (1)	TYPE	TC (PPM) (2)	ELE-MENT (3)	VALUE RANGE (4)	STD. TOL. (5)	TOL. AVAIL.	MAX. WORKING VOLTAGE	PACKAGE	
								LENGTH	DIA.
1/4 W (125°C), 1/2 W (70°C)	**CMF-65** (RN65)	100	MF	5Ω-15M	1%	To .5%	350	.562	.185
1/4 W (125°C), 1/2 W (70°C)	**CMF-65** (RN65)	50	MF	10Ω-10M	1%	To .1%	350	.562	.185
1/4 W (125°C), 1/2 W (70°C)	**CMF-65** (RN65)	25	MF	24.9Ω-2.5M	1%	To .1%	350	.562	.185
1/4 W (125°C), 1/2 W (70°C)	**EMF 65** (RNC65)	100	MF	30.1Ω-3.01M	1%	To .1%	300	.593	.203
1/4 W (125°C), 1/2 W (70°C)	**EMF 65** (RNC65)	50/25	MF	49.9Ω-3.01M	1%	To .1%	300	.593	.203
1/4 W (125°C)	**SE-1/4** (RNR65)	50/25	MF*	24.9Ω-1M	1%	To .1%	300	.636	.215
.4 W	**RS-1/4**	20	WW	1Ω-3.4K	1%	5% to .05%	20	.250	.078
1/2 W (40°C)	**M51**	−1500	OF*	60M-1000KM	5%	To 1%	500	1.88	.220
1/2 W (125°C)	**RNX-3/8**	200/100/50	MO	1K-500M	—	1%, 2%, 5%, 10%	1.5K	.400	.135
1/2 W (25°C)	**FHV-1/2**	200/100/50	MO	10K-500M	—	1%, 2%, 5%, 10%	1.5KV	.350x.350**	
1/2 W (25°C)	**TAEW**	−400-8000	CF	1M-1G	—	5%, 10%, 15%, 20%	3KV	.80	.275
1/2 W (70°C)	**A21**	300	MF	.27Ω-10Ω	5%	2% & 1%	—	.375	.160
1/2 W (70°C)	**CMF-20** (RL20)	200	MF	1Ω-15M	2%	5%	350	.375	.145
1/2 W (70°C)	**ERL-20** (RLR20)	100	MF	4.3Ω-3.01M	1%	2% & 5%	350	.375	.138
1/2 W (125°C) 3/4 W (70°C)	**EMF 70** (RNC70)	100/50/25	MF	49.9Ω-2.49M	1%	To .1%	350	.730	.250
0.6 W (125°C)	**RNX-1/2**	200/100/50	MO	1K-1500M	—	1%, 2%, 5%, 10%	1.5KV	.525	.135
3/4 W	**RS-1/2**	20	WW	.1Ω-4.9K	1%	5% to .05%	29	.312	.078
0.8 W (25°C)	**RFX-1**	200/100/50	MO	100Ω-2000M	—	1%, 2%, 5%, 10%	7.5KV	1.070x.280**	
1 W (25°C)	**TAFW**	−400-8000	CF	1M-1G	—	5%, 10%, 15%, 20%	5KV	1.05	.275
1 W (125°C)	**RNX-3/4**	200/100/50	MO	1.2K-2500M	—	1%, 2%, 5%, 10%	2KV	.775	.135
1 W	**EGS-1-80** (RWR81)	20	WW	.1Ω-1K	1%	1% to .1%	32	.250	.078
1 W	**G-1-80** (RW81)	20	WW	.1Ω-3.4K	1%	3% to .05%	33	.250	.078
1 W	**RS-1A** (RW70)	20	WW	.1Ω-10.4K	1%	3% to .05%	52	.422	.110
1.25 W (125°C)	**RNX-1**	200/100/50	MO	1.5K-3000M	—	1%, 2%, 5%, 10%	4KV	1.025	.135
1.5 W	**G-2**	20	WW	.1Ω-4.9K	1%	3% to .05%	42	.312	.078
1.5 W	**EGS-2** (RWR82)	20	WW	.1Ω-1.3K	1%	1% to .1%	44	.312	.078
1.5 W (125°C)	**RNX-1¼**	200/100/50	MO	1.7K-4000M	—	1%, 2%, 5%, 10%	5KV	1.275	.135
1.5 W (125°C)	**ROX-3/4**	200/100/50	MO	1K-4000M	—	1%, 2%, 5%, 10%	5KV	.800	.270
1.5 W (25°C)	**TAKW**	−400-8000	CF	1M-1G	—	5%, 10%, 15%, 20%	7.5KV	1.55	.275
1.5 W (25°C)	**RFX-1½**	200/100/50	MO	100Ω-5000M	—	1%, 2%, 5%, 10%	11.25KV	1.570x.330**	
1.6 W (25°C)	**FHV-1**	200/100/50	MO	10K-2000M	—	1%, 2%, 5%, 10%	3.5KV	.520x.520**	
2 W (70°C)	**A31**	500	MF	.27Ω-27Ω	10%	5% & 2%	—	.585	.205
2 W (25°C)	**TAOW**	−400-8000	CF	1M-1G	—	5%, 10%, 15%, 20%	10KV	2.05	.275
2 W (125°C)	**RNX-1½**	200/100/50	MO	2K-5000M	—	1%, 2%, 5%, 10%	6KV	1.525	.135
2 W (125°C)	**ROX-1**	200/100/50	MO	1K-5000M	—	1%, 2%, 5%, 10%	7.5KV	1.05	.270
2 W (25°C)	**RFX-2**	200/100/50	MO	100Ω-8000M	—	1%, 2%, 5%, 10%	15KV	2.070x.330**	
2 W	**LVR-2**	70-300***	WW	.005Ω-.1Ω	1%	3%, 5% & 10%	—	.675	.250
2 W	**EGS-3-80** (RWR80)	20	WW	.1Ω-3.16K	1%	1% to .1%	79.5	.422	.110
2 W	**ESS-2A** (RWR71)	20	WW	.1Ω-12.1K	1%	1% to .1%	155.5	.812	.187
2 W	**CP-2**	400/800	WW	.1Ω-2.4K	10%	5%	65	.688	.250x.250
2-1/4 W	**G-3-80** (RW80)	20	WW	.1Ω-10.4K	1%	3% to .05%	80	.422	.110
2.5 W (25°C)	**TAQW**	−400-8000	CF	1M-1G	—	5%, 10%, 15%, 20%	12.5KV	2.55	.275
2-1/2 W	**RS-2C**	20	WW	.1Ω-32.3K	1%	5% to .05%	138	.500	.218
2.5 W (125°C)	**ROX-1½**	200/100/50	MO	1.5K-7500M	—	1%, 2%, 5%, 10%	11KV	1.550	.270
3 W	**ESS-2B** (RWR89)	20	WW	.1Ω-4.12K	1%	1% to .1%	112	.560	.187
3 W	**RS-2B** (RW79)	20	WW	.1Ω-6.49K	1%	5% to .1%	140	.560	.187
3 W	**LVR-3**	70-250***	WW	.005Ω-.1Ω	1%	3%, 5%, 10%	—	.560	.205
3 W	**CP-3**	400/800	WW	.1Ω-7.5K	10%	5%	150	.875	.313x.313
3 W	**HLW-3**	30/90	WW	.1Ω-6K	5%	To 1%	180	.438	.203
3 W (25°C)	**TARW**	−400-8000	CF	1M-1G	—	5%, 10%, 15%, 20%	15KV	3.05	.275
3 W (125°C)	**ROX-2**	200/100/50	MO	2K-10G	—	1%, 2%, 5%, 10%	15KV	2.050	.270
3-1/4 W	**CW-2C**	30/90	WW	.1Ω-15K	5%	3%	150	.500	.218
3-3/4 W	**CW-2B**	30/90	WW	.1Ω-11K	5%	3%	140	.560	.187
3-3/4 W	**RS-2B**	20	WW	.1Ω-24.5K	1%	5% to .05%	157	.560	.187

*Hermetically Sealed. **Flat Radial Lead Package. ***TC shown for values of .01Ω-.1Ω.

NOTES: (1) Military power ratings are shown for RN, RNC, RL, RLR metal film resistors. Note that CMF metal film resistors can be rated higher for commercial use...see catalog. (2) Where 20 PPM is specified on wirewound resistors, it applies to 10 ohms and up. 1-9.9 ohms = 50 PPM, 1 ohm = 90 PPM. (3) MF (Metal Film), OF (Oxide Film), MO (Metal Oxide), CF (Carbon Film), WW (Wirewound). (4) Other values available, consult factory. (5) On HL and CW resistors, standard tolerance is 10% below 1 ohm.

DALE® RESISTOR SELECTION GUIDE

POWER (1)	TYPE	TC (PPM) (2)	ELE-MENT (3)	VALUE RANGE (4)	STD. TOL. (5)	TOL. AVAIL.	MAX. WORKING VOLTAGE	PACKAGE	
								LENGTH	DIA.
4 W (25°C)	**FHV-2**	200/100/50	MO	20K-10G	—	1%, 2%, 5%, 10%	7.5KV	1.020x.520**	
5 W	**CP-5**	400/800	WW	.1Ω-8.5K	10%	5%	200	.875	.344x.375
5 W	**LVR-5**	70-350***	WW	.005Ω-.1Ω	1%	3%, 5% & 10%	—	.925	.330
5 W	**CW-5-2**	30/90	WW	.1Ω-30K	5%	3%	265	.875	.250
5 W	**RS-5**	20	WW	.1Ω-95.2K	1%	5%-.05%	360	.875	.312
5 W	**RS-5-69** (RW74)	20	WW	.1Ω-24.3K	1%	5%-.1%	350	.875	.312
5 W	**ERH-5** (RER60)	50/20	WW	.1Ω-3.32K	1%	.1% to 5%	160	.600	—
5 W	**ESS-5** (RWR74)	20	WW	.1Ω-12.1K	1%	1% to .1%	250	.875	.312
5 W	**RH-5** (RE60G)	50/20	WW	.1Ω-3.32K	1%	5% to .25%	160	.600	—
5 W (125°C)	**ROX-3**	200/100/50	MO	3K-15G	—	1%, 2%, 5%, 10%	22.5KV	3.050	.270
5 W (25°C)	**FHV-3**	200/100/50	MO	30K-10G	—	1%, 2%, 5%, 10%	3.5KV	2.070x.750**	
5-1/4 W	**HLW-5**	30/90	WW	.1Ω-15K	5%	To 1%	320	.625	.250
5-1/2 W	**CW-2**	30/90	WW	.1Ω-22K	5%	3%	235	.625	.250
6 W (125°C)	**ROX-4**	200/100/50	MO	4K-20G	—	1%, 2%, 5%, 10%	30KV	4.050	.270
6-1/2 W	**CW-5**	30/90	WW	.1Ω-45K	5%	3%	365	.875	.312
7 W	**RS-7**	20	WW	.1Ω-154K	1%	5% to .05%	504	1.218	.312
7 W	**CP-7**	400/800	WW	.1Ω-18K	10%	5%	350	1.406	.344x.375
7 W	**EGS-10-80** (RWR84)	20	WW	.1Ω-12.4K	1%	1% to .1%	295	.875	.312
7-1/2 W	**RH-5**	50/20	WW	.1Ω-24.5K	1%	5% to .25%	160	.600	—
8 W	**HLW-6**	30/90	WW	.1Ω-25K	5%	To 1%	250	1	.312
9 W	**CW-7**	30/90	WW	.1Ω-75K	5%	3%	520	1.218	.312
10 W	**ERH-10** (RER65)	50/20	WW	.1Ω-5.62K	1%	.1% to 5%	265	.750	—
10 W	**ESS-10** (RWR78)	20	WW	.1Ω-39.2K	1%	1% to .1%	650	1.780	.375
10 W	**CP-10**	400/800	WW	.1Ω-30K	10%	5%	540	1.875	.344x.375
10 W	**LVR-10**	****	WW	.01Ω-.800Ω	1%	3%, 5% & 10%	—	1.828	.392
10 W	**RS-10**	20	WW	.1Ω-273K	1%	5% to .05%	858	1.780	.375
10 W	**RS-10-38** (RW78)	20	WW	.1Ω-71.5K	1%	5% to .1%	846	1.780	.375
10 W	**RH-10** (RE65G)	50/20	WW	.1Ω-5.62K	1%	5% to .25%	265	.750	—
10 W	**HLM-10**	30/90	WW	.1Ω-15K	5%	To 1%	300	1.312	—
10 W (25°C)	**DJU**	−400-8000	CF	20Ω-100G	—	3%, 5%, 10%, 15%	25KV	4.500	.750
12 W	**HL-12**	30/90	WW	.1Ω-70K	5%	To 1%	500	1.750	.313
12 W	**HLW-12**	30/90	WW	.1Ω-70K	5%	To 1%	500	1.750	.312
12-1/2 W	**RH-10**	50/20	WW	.008Ω-47.1K	1%	5% to .25%	265	.750	—
13 W	**CW-10**	30/90	WW	.1Ω-130K	5%	3%	875	1.781	.375
15 W	**CP-15**	400/800	WW	.1Ω-30K	10%	5%	670	1.875	.50x.50
20 W	**ERH-25** (RER70)	50/20	WW	.1Ω-12.1K	1%	5% to .1%	550	1.062	—
20 W	**CP-20**	400/800	WW	.25Ω-30K	10%	5%	770	2.50	.50x.50
20 W	**HL-20**	30/90	WW	.1Ω-120K	5%	To 1%	880	2	.438
20 W	**HLW-20**	30/90	WW	.1Ω-120K	5%	To 1%	880	2	.438
20 W	**HLM-20**	30/90	WW	.1Ω-65K	5%	To 1%	1000	2.625	—
20 W (25°C)	**DPW**	−400-8000	CF	20Ω-100G	—	3%, 5%, 10%, 15%	35KV	6.500	1.125
22 W	**CP-22**	400/800	WW	.25Ω-30K	10%	5%	815	2.50	.50x.50
25 W	**HL-25**	30/90	WW	.1Ω-155K	5%	To 1%	1300	2	.563
25 W	**RH-25** (RE70)	50/20	WW	.01Ω-95.2K	1%	5% to .25%	550	1.062	—
30 W	**ERH-50** (RER75)	50/20	WW	.1Ω-39.2K	1%	5% to .1%	1250	1.968	—
30 W	**HL-24**	30/90	WW	.1Ω-55K	5%	To 1%	800	2.50	—
30 W (25°C)	**DPX**	−400-8000	CF	30Ω-100G	—	3%, 5%, 10%, 15%	65KV	10.500	1.125
35 W	**HLZ-33**	90/180	WW	.05Ω-1.9Ω	10%	5%	—	2	.563
35 W (25°C)	**DZW**	−400-8000	CF	20Ω-100G	—	3%, 5%, 10%, 15%	40KV	6.500	2.000
40 W	**HL-35**	30/90	WW	.1Ω-135K	5%	To 1%	1400	3.250	—
50 W	**HL-50**	30/90	WW	.1Ω-385K	5%	To 1%	1900	4	.563
50 W	**RH-50** (RE75)	50/20	WW	.01Ω-273K	1%	5% to .25%	1250	1.969	—
55 W	**HL-55**	30/90	WW	.1Ω-300K	5%	To 1%	1800	4.750	—
60 W (25°C)	**DVY**	−400-8000	CF	35Ω-100G	—	3%, 5%, 10%, 15%	90KV	14.500	1.500
90 W	**HLZ-90**	90/180	WW	.15Ω-5.7Ω	10%	5%	—	4	.563
95 W	**HL-95**	30/90	WW	.1Ω-550K	5%	To 1%	2600	7.250	—
100 W	**HL-100**	30/90	WW	.1Ω-870K	5%	To 1%	2500	6.50	.750

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DALE® RESISTOR SELECTION GUIDE

POWER (1)	TYPE	TC (PPM) (2)	ELE-MENT (3)	VALUE RANGE (4)	STD. TOL. (5)	TOL. AVAIL.	MAX. WORKING VOLTAGE	PACKAGE	
								LENGTH	DIA.
100 W	**RH-100** (RE77)	50/20	WW	.1Ω-50K	1%	5% to .25%	1900	3.50	—
100 W (25°C)	**DZZ**	−400-8000	CF	30Ω-100G	—	3%, 5%, 10%, 15%	125KV	18.500	2.000
165 W	**HLZ-165**	90/180	WW	.36Ω-13Ω	10%	5%	—	6.50	.750
175 W	**HL-175**	30/90	WW	.1Ω-1.7M	5%	To 1%	5200	8.50	1.125
225 W	**HL-225**	30/90	WW	.1Ω-2.1M	5%	To 1%	6100	10.50	1.125
250 W	**RH-250** (RE80)	50/20	WW	.1Ω-75K	1%	5% to .25%	2300	4.50	—
300 W	**HLZ-300**	90/180	WW	.23Ω-25Ω	10%	5%	—	8.50	1.125
1000 W	Special designs to handle up to 1000 watts are available on custom order.								

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For more information, contact your Dale Representative or the appropriate factory listed below:

ELEMENT TYPE	FACTORY TO CONTACT
WW (Wirewound)	**Dale Electronics, Inc.,** 2064 12th Avenue, Columbus, NE 68601. Phone 402-564-3131
MF (Metal Film)	**Dale Electronics, Inc.,** 2300 Riverside Blvd., Norfolk, NE 68701. Phone 402-371-0080
CF (Carbon Film) **MO** (Metal Oxide) **OF** (Oxide Film)	**Dale Electronics, Inc.,** P.O. Box 1179, Robbinsville, NC 28771. Phone 704-479-6451

RESISTOR CATALOG

All resistors in this guide are described in Dale's comprehensive new full line catalog. For a free copy, write on your letterhead to: Dale Electronics, Inc., Dept. 860, 2064 12th Avenue, Columbus, NE 68601.

In addition to the resistors shown, many non-standard versions are available or can be engineered to match your needs.

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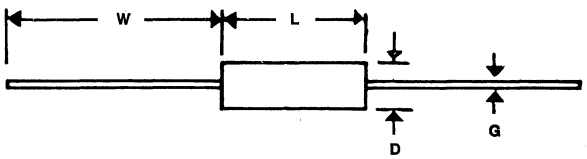
MATERIALS

Core: High Alumina Ceramic
Element: Nickel/Chromium, Nickel/Copper & Other Special Alloys
End Caps: Stainless Steel
Leads: Tinned Copperweld, Tinned Copper
Coating: High Temperature Silicone Compound



ELECTRO COMP STYLE	WATTAGE	MAX. WORKING VOLTAGE	MAX. RESISTANCE IN OHMS	DIMENSIONS IN (MM) INCHES DIMENSIONS (IN MM) L ±(1.6) .060	D ±(0.8) .030	(W) W	(G) G
ECP-1A	1.0	50	10K	(10.3) .410	(2.4) .090	(38) 1.500	(.5) .020
ECP-1B	1.1	62	12K	(13.5) .530	(2.4) .090	(38) 1.500	(.5) .020
ECP-1C	1.0	28	5K	(8.4) .330	(2.4) .090	(38) 1.500	(.5) .020
ECP-2	1.5	72	10K	(9.8) .390	(4.8) .190	(38) 1.500	(.8) .030
ECP-2A	3.0	135	22K	(14.2) .560	(4.8) .190	(38) 1.500	(.8) .030
ECP-2B	3.25	185	42K	(20.6) .810	(4.8) .190	(38) 1.500	(.8) .030
ECP-2C	3.0	138	32K	(12.7) .500	(6.4) .250	(38) 1.500	(.8) .030
ECP-2D	2.5	135	20K	(12.7) .500	(4.8) .190	(38) 1.500	(.8) .030
ECP-3	4.0	210	45K	(15.9) .630	(6.4) .250	(38) 1.500	(.8) .030
ECP-5	5.0	325	90K	(23.0) .410	(8.7) .340	(38) 1.500	(1.0) .040
ECP-6	6.0	360	95K	(26.2) 1.03	(8.7) .340	(38) 1.500	(1.0) .040
ECP-7	7.0	360	100K	(31.3) 1.23	(8.7) .340	(38) 1.500	(1.0) .040
ECP-10	10.0	800	250K	(46.9) 1.85	(10.3) .410	(38) 1.500	(1.0) .040

Prompt deliveries from inventory

PRECISON POWER RESISTORS

CHASSIS MOUNT ALUMINUM—FINNED HEAT SINK 5 through 250 Watts

Chassis Mount, EC units are designed for maximum heat dissipation by mounting solidly to metal chassis surface for maximum heat transfer. They are outstanding for their high power dissipation with precision tolerances in minimum physical sizes.

ELECTRICAL SPECIFICATIONS

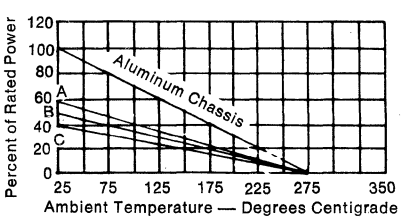
- Resistance Range — .05 ohms to 275K ohms.
- Tolerance — 5%, 3%, 1%, .5%, .25%, .05%.
- Temperature Coefficient — ±20 PPM to 90 PPM

GENERAL SPECIFICATIONS

- Lower hot spot ratings due to exclusive complete encapsulation of element within anodized auminum body.
- Welded construction throughout assures long stable load life.
- Heavy spade lug type leads on 5 through 70 watt sizes, threaded heavy stud terminals on 100 through 250 watts.
- 1000 VAC minimum dielectric strength on 5W and 10W; 2500 VAC on 25W, 50W and 100W; 5500 VAC on all others.
- Temperature Range — −55°C to +275°C.
- Eight standard sizes.

DERATING CURVES

Temperature of −55°C to +275°C. Derating is required for reduced chassis mounting area and high ambient temperature.
Curves: A—When mounted on proper aluminum Chassis: 4x6x2x.040 aluminum chassis = EC5, EC10; 5x7x2x.040 aluminum chassis = EC25; 12x12x.059 aluminum panel = EC50, EC100; 12x12x.125 aluminum panel = EC110, EC180, and EC250; B—Unmounted EC5, EC10; C—Unmounted EC25, EC100 and EC110; D—Unmounted EC50, EC180 and EC250.

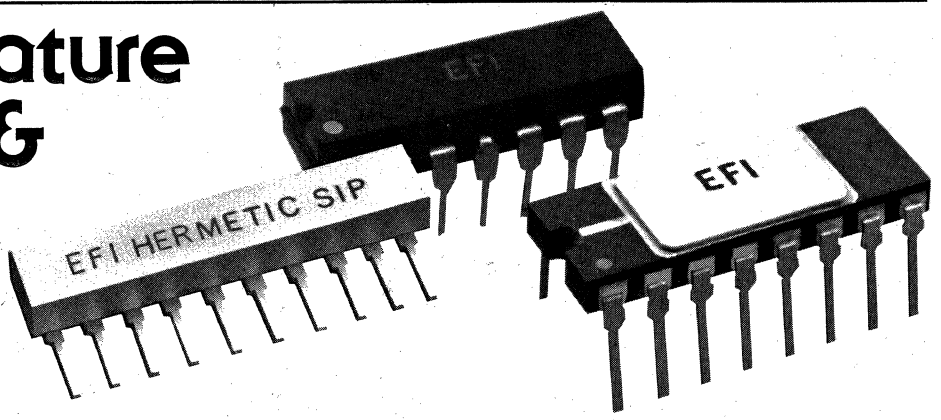


DIMENSIONS TABLE

EC TYPE	MIL-R 18546	COM. WATTS	MAX. RES.	A	Aa	B	C	D	E	F	G	H	J	K	L	M	N	P	NO. MTG. SCREW SIZE
EC5	RE60	5	20K	.444	—	.490	.600	1.125	.334	.646	.317	.075	.145	.078	.093	.078	.050	—	2-#2
EC10	RE65	10	30K	.562	—	.625	.750	1.375	.438	.812	.406	.100	.203	.093	.093	.094	.086	—	2-#2
EC25	RE70	25	75K	.719	—	.781	1.062	1.938	.500	1.094	.563	.094	.250	.171	.125	.125	.086	—	2-#2
EC50	RE75	50	200K	1.563	—	.844	1.968	2.781	.625	1.156	.625	.094	.281	.196	.125	.125	.086	—	2-#4
EC100	—	70	275K	2.625	—	.844	2.968	3.781	.625	1.156	.625	.094	.281	.196	.125	.125	.086	—	2-#4
TOL.	—	—	—	±.005	—	±.005	±.031	±.063	±.031	±.031	±.031	±.016	±.016	±.01	±.005	±.016	±.005	—	—
EC110	RE77	100	50K	2.750	—	2.250	3.500	5.478	1.800	2.813	1.750	.188	.800	.375	.188	.250	thd 12/24	—	2-#8
EC180	—	180	50K	2.770	—	2.500	3.500	5.478	2.125	3.000	2.188	.250	.950	.375	.188	.200	thd 12/24	—	2-#8
EC250	RE80	250	45K	3.875	3.000	2.500	4.500	7.000	2.125	3.000	2.188	.250	1.000	.312	.188	.200	thd ¼/20	.875	4-#8
TOL.	—	—	—	±.01	±.01	±.01	±.094	±.094	REF.	±.031	±.031	±.016	REF.	±.031	±.010	REF.	—	±.01	—

COMPLETE LINE OF RESISTORS, CERAMIC, HIGH FREQUENCY, HIGH VOLTAGE, PRECISION AND WIREWOUND

Microminiature Resistors & Networks



RESISTOR NETWORKS

PACKAGE TYPE	PINS/LEADS/ TERMINALS	RESISTANCE RANGES	DISSIPATION	TOLERANCES	NETWORK TYPES/CONFIGURATION
SIP	2—10	20Ω—1MΩ	125mW/Res.	Absolute: ±1% to ±0.05% Ratio: ±0.1% to ±0.005%	Common connection to all resistors (S1) Series connection (S2)
Hermetically sealed SIP	10	20Ω—1MΩ	100mW/Res. 1.0W/Pkg.		Common connection (S1) Series connection (S2)
Molded DIP (P) Epoxy-coated DIP (E) Hermetic DIP (C)	8, 14, 16 4—24 even # 8, 14, 16, 18, 24	20Ω—1MΩ 20Ω—1MΩ	125mW/Res. 1.2W/Pkg.		Common connection (D1) Series connection (D2) Single resistor connection (D4)
TRIM-PAK® * Laser-Trimmable DIP	8, 14, 16, 18, 24	20Ω—1MΩ	125mW/Res. 1.2W/Pkg.	Absolute: ±1% to ±0.05% Ratio: ±0.1% to ±0.005%	Common connection (D1) Series connection (D2) Single resistor connection (D4)
Hermetically sealed Chip-carrier	16, 18, 20, 28 32, 42, 64	20Ω—1MΩ	100mW/Res. 1.0W/Pkg.	Same as TRIM-PAK	Single-layer (epoxy sealed) Multi-layer (epoxy or alloy sealed)
Flip-chip	14, 16, 24 (other on request)	20Ω—1MΩ	125mW/Res. 1.0W/Pkg.	Same as SIP & DIP, above	Common connection (D1) Series connection (D2) Single resistor connection (D4)

*Patent Pending

LADDER NETWORKS

PACKAGE TYPE	MODEL NO.	CONFIGURATION	RESOLUTION	ACCURACY	OPERATING TEMPERATURE RANGE	MAXIMUM CUMULATIVE ERROR
16-pin ceramic DIP	D355	R-2R	10-bit or 12-bit	± ½ LSB	0 to 70°C or −55°C to +125°C	12 Bits: ±0.012% 10 Bits: ±0.05%
24-pin hermetically sealed DIP	D350 D351	BCD	8, 10, or 12-bit	± ½ LSB	0 to 70°C or −55°C to +125°C	12 Bits: ±0.012% (±0.03%)**
14-pin hermetically sealed DIP	D352 D353	BCD				10 Bits: ±0.05% (±0.12%)**
14-lead hermetically sealed flatpack	F352 F353	Binary				8 Bits: ±0.2%
16-pin hermetic chip carrier	C355	R-2R	10-bit or 12-bit	± ½ LSB	0 to 70°C or −55°C to +125°C	12 Bits: ±0.012% 10 Bits: ±.05%
24-pin hermetic chip carrier	C350	BCD	8, 10 or 12-bit	± ½ LSB	0 to 70°C or −55°C to +125°C	12 Bits: ±0.012% 10 Bits: ±0.05% 8 Bits: ±0.2%

**D351 only.

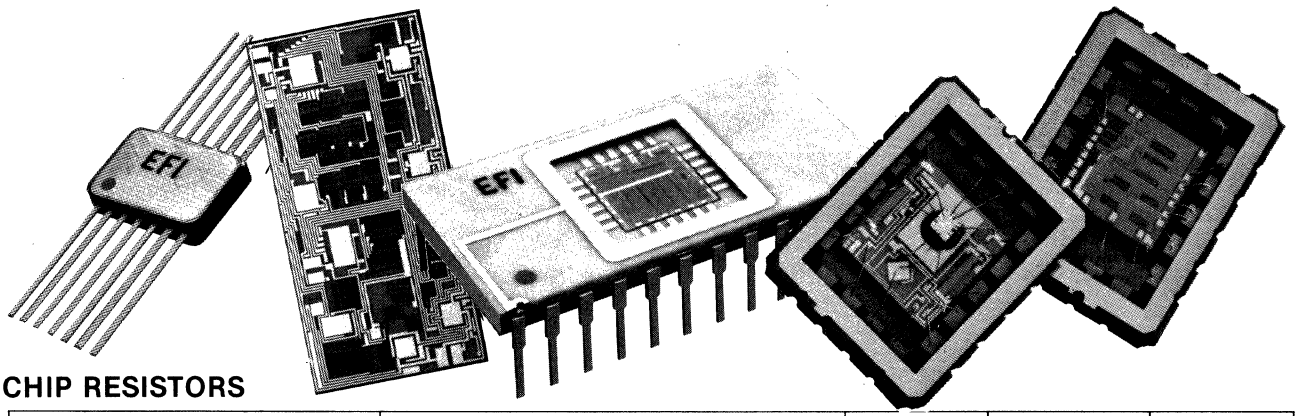
METALLIZED CERAMIC SUBSTRATES (Conductor-only and Resistor-conductor)

SUBSTRATE	METALLIZATION	RESISTORS*
Composition: 99.5% Al_2O_3 Surface Finish: 2—4 μin. Typ. 1—2 μin. (polished) Size: .1″ × .1″ thru 4.5″ × 3.75″ Thickness: .010″ — .025″ Dimensional Tolerances: T — ±.002%, ±.001″ L — ±.003″ W — ±.003″ Camber: .004″/in. Dielectric Constant: 9.8 typ. @ 25°C—1MHz Loss Factor: .0004 typ @ 25°C—10GHz	**SPUTTERED** Ni/Cr, Ni, Au; Cr, Ni, Au; Cr, Au; TaW; Mo, Ni, Au; Cr, Cu, Au; Cr, Cu; Ti-W; Ti Other combinations of above metals. **ELECTROPLATED** Au: 100 μin. (Std.) — 300 μin. 24K: High ductility Cu: 100 μin.—300 μin. Resistivity: 10 ohms/square-200 ohms/square or 400 ohms/square	Range: to 1M Absolute Tolerance: to 0.05% Ratio Tolerance: to 0.01% Absolute TCR: ±50 ppm, ±25 ppm Ratio Tracking 100R/R**: 1 ppm/°C 1000R/R: 3 ppm/°C Time Stability Absolute: 0.05%/1000 hrs. @ 125°C Ratio: 0.005%/1000 hrs. @ 125°C Frequency: to >18 GHz

*For resistor-conductor pattern. **R > 1000 ohms

ELECTRO-FILMS INCORPORATED

111 GILBANE STREET, WARWICK CENTRAL INDUSTRIAL PARK, WARWICK, RI 02886



CHIP RESISTORS

CHIP SIZE (±.003")**				TERMINATIONS				TOLERANCE	STABILITY	TCR
Type	Length	Width	Thickness	Width	Length	Resistance	Power*			
1.	.040"	.020"	.010"	.007"	.015"	20Ω— 24KΩ	15— 30mW	Standard: 5% and 1%	0.05%/1000 hrs. @ 125°C (Dependent on range)	Standard: ±50 PPM/°C
2.	.030"	.030"	.010"	.004"	.006"	250Ω— 40KΩ	18— 35mW			
3.	.050"	.050"	.010"	.0075"	.045"	20Ω— 125KΩ	50—100mW	Special: .5% — .1% & tighter		Special: ±25 PPM/°C ±10 PPM/°C
4.	.100"	.050"	.010"	.015"	.045"	40Ω— 400KΩ	85—175mW			
5.	.100"	.100"	.010"	.015"	.095"	20Ω—1000KΩ	200—400mW			
6.	.045"	.030"	.010"	.010"	.025"	40Ω— 59KΩ	30— 60mW			

SUBSTRATES	METALLIZATION
Composition — 99.5% Al_2O_3 Surface — 3—4 microinches (Standard) Thickness — .010" ±.002" (Standard) ±.001" (Special)	Resistive Material: Cr/Ni/X, 100—200Å (R.F. Sputtered) Conductor Base: Nickel — 5—8 μin. (R.F. Sputtered) Terminations: A. Gold — 100 μin. (Electroplated) B. Nickel & Solder (62/32/2) Microwave versions available.
Passivation: Optional, thermo-plastic recommended for solder applications.	

* When bonded to substrate, value dependent, @ 125°C. ** All sizes available in center tapped versions.

Surface Mounted Resistor Networks

RATIO TOLERANCES TO 0.01%
ANY COMBINATION OF RESISTOR VALUES FROM 20Ω TO 250 KΩ

HERMETIC CHIP CARRIERS — standard JEDEC hermetic chip carries to full MIL STD 883B specifications. Available with from 16 to 64 terminals.

WRAP-AROUND CHIP RESISTORS — several sizes available for faceup surface mounting, permitting customer trim after mounting.

FLIP CHIPS — solder bumped; coated, multi-resistor substrates for face down attachment. Suitable for reflow soldering assembly. Low cost and fast production in custom networks.

VERSA-CHIP — New low-cost, surface-mounted packaging design for precision resistor networks. Provides pin-for-pin equivalency with chip carriers, and versatility for many alternate configurations. Laser-trimmable by customer after mounting.

Microwave Components

METALIZED PLATES — metalized on 1 or 2 sides; as fired or polished substrates, in house laser hole drilling and contouring, through hole metalization, and patterned edges. Metalization — see metalized ceramic substrates.

MICROWAVE ATTENUATOR CHIPS — (3rd Quarter) attenuation of 1, 2, 3, 4, 5, 6, 8, 10, 16, and 20 dB; frequency to 18 GHz.

LANGE COUPLERS — Fabricated to customer design to 0.4 MIL ±0.00005 MIL spacing.

Other New Products

R.C. NETWORKS — RC Networks are now available in standard SIP and DIP packages with tight tolerance RC time constants.

SILICON CHIP RESISTORS — (3rd Quarter) Standard and center-tapped chip resistors to compliment EFI's alumina-substrate chip resistors, TAW or NiCr, passivated.

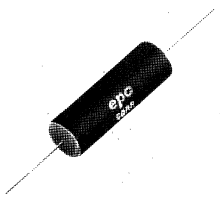
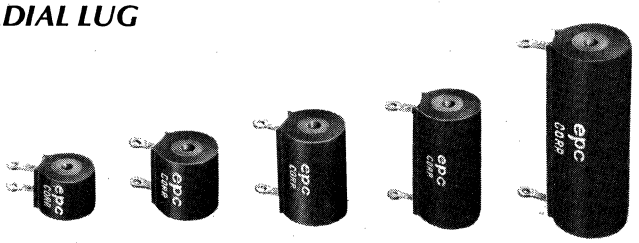
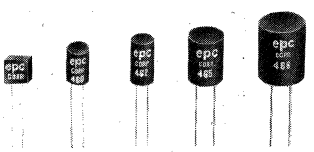
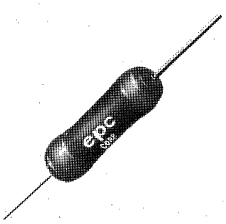
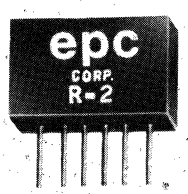
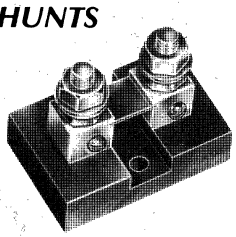
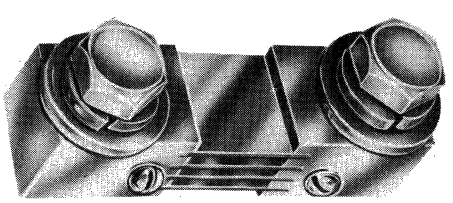
ELECTRO-FILMS INCORPORATED

111 GILBANE ST., WARWICK CENTRAL INDUSTRIAL PARK, WARWICK, RI 02886

epc CORPORATION

MANUFACTURERS OF PRECISION WIRE-WOUND RESISTORS ● RESISTOR NETWORKS

CURRENT SHUNTS AND HIGH VOLTAGE DIVIDERS ● NO ORDER TOO SMALL OR LARGE

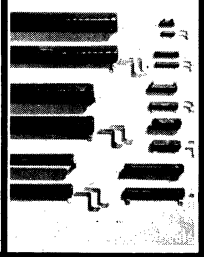
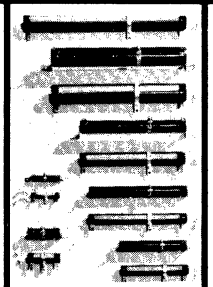
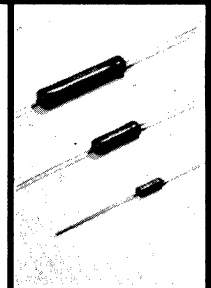
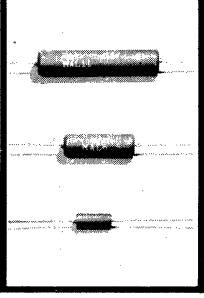
EPC DEVICES	DESCRIPTION	Mil Equiv. MIL	Mil Equiv. EPC	CONDENSED SPECIFICATIONS
TYPE CA 	Encapsulated precision wire-wound resistors offering exceptional resistance stability, T.C. 5 ppm std. and low thermal EMF's. Designed to meet MIL-R-93/MIL-R-39005. Group encapsulization, Radial-lug four terminal and special physical configurations available. ***Request CA Brochure***	RBR-08 RBR-16 RBR-17 RBR-18 RBR-19 RBR-56 RBR-55 RBR-54 RBR-53 RBR-52 RBR-71 RBR-70	610 630 640 650 660 680 690 710 750 760 460 465	Power: .02 to 2.5W Range: 1Ω to 20MΩ depending on size Tolerance: .005%, .01%, .025%, .05%, .1% and 1% Temp. Coef.: 5 PPM/°C std. on values over 100Ω Stability: ±35ppm/YR
RADIAL LUG 				**PRINTED CIRCUIT** 
TYPE SP 	Silicone coated precision wire-wound power resistors, offering exceptional stability and performance under severe environmental conditions of MIL-R-26/MIL-R-39007. Also available utilizing Beryllium oxide cores. For greater power-size ratio and stability. ***Request SP Bulletin***	RWR-70 RWR-69 RWR-70 RWR-74 RWR-55 RWR-78 RWR-68 RWR-56	SP-1 SP-2A SP-5 SP-6 SP-7A SP-10A SP-10B SP-12	Power: .25W to 12.5W Range: .1Ω to 275KΩ depending on size Tolerance: 1% is std. Available to .01% Temp. Coef.: 20 PPM/°C. Slightly higher for lower values. Special T.C.'s available
NETWORKS 	*RC NETWORKS OUR SPECIALITY* Resistor networks to customer specification utilizing ultra precision wire-wound, metal film, carbon film, or wire-wound power resistors. All networks assembled on printed circuit boards. ***FAST DELIVERY ON PROTOTYPE AND LARGE ORDERS***			Power: .1W to 10W Range: .1Ω to 5MΩ Nominal Resistance Tolerance: To ±.005% D.C. W-W Resistance Ratio Tolerance: To .001% D.C. W-W Long Term Stability: .001% Response Time: 100MS
LIGHTWEIGHT SHUNTS 	Standard D.C. current shunts from .001Ω to 1Ω. Accuracy ±.25%, available to .01%. Also external portable and switchboard shunts for use with D.C. Ammeters. 1 to 200 amp. with a 50MV or 100MV drop. Accuracy ±1%. ***SPECIAL OEM CURRENT SHUNT RANGING FOR PANEL METERS***			**METER SHUNTS** 

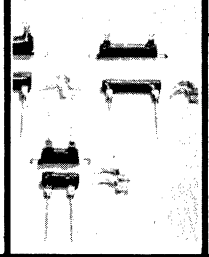
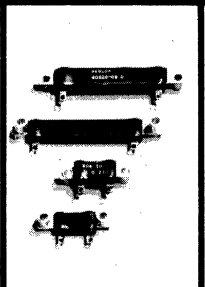
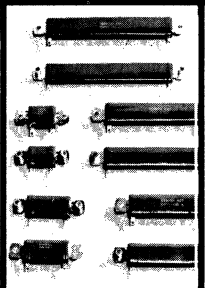
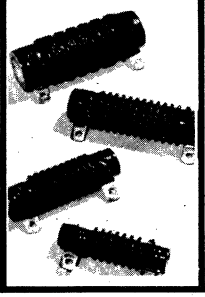
ELECTRONIC PRECISION COMPONENTS CORPORATION

11 SANDFORD BLVD. ● MOUNT VERNON, N.Y. 10550 ● TELEPHONE: (914) 664-2333

E-SYSTEMS INC.
Memcor Division

WIRE WOUND RESISTORS

TYPE		Power Rating (Watts)	Max. Res. (Ohms)	Core Size (Inch.)
FR VITREOUS ENAMEL FIXED TUBULAR WITH TABS		5	25K	1 x 5/16
		10	50K	1 3/4 x 5/16
		20	100K	2 x 7/16
		25	100K	2 x 9/16
		50	250K	4 x 9/16
		100	100K	6 1/2 x 3/4
		160	100K	8 1/2 x 1 1/8
		200	100K	10 1/2 x 1 1/8
AR VITREOUS ENAMEL ADJUSTABLE TUBULAR WITH TABS		10	10K	1 3/4 x 5/16
		25	25K	2 x 9/16
		50	50K	4 x 9/16
		75	50K	6 x 9/16
		100	100K	6 1/2 x 3/4
		160	100K	8 1/2 x 1 1/8
		200	100K	10 1/2 x 1 1/8
VL VITREOUS ENAMEL AXIAL LEADS		3	10K	7/32 x 17/32
		5	25K	5/16 x 1 1/64
		10	50K	3/8 x 1 25/32
ML MOLDED SILICONE AXIAL LEADS		1	2500	.125 x .437
		2	3500	.205 x .590
		3	10K	.242 x .525
		6.5	80.6K	.375 x .917
		11	200K	.375 x 1.828

TYPE		Power Rating (Watts)	Max. Res. (Ohms)	Core Size (Inch.)
FR W/LEADS VITREOUS ENAMEL FIXED TUBULAR		5-8	25K	1 x 5/16
		10-12	50K	1 3/4 x 5/16
		20	100K	2 x 7/16
MZ VITREOUS ENAMEL MIDGET OVALS WITH TABS		10	5000	3/8 x 5/32
		20	25K	3/8 x 5/32
ZR VITREOUS ENAMEL OVALS TAB TERMINAL		30	10K	5/16 x 1
		40	15K	5/16 x 1
		55	25K	5/16 x 1
RR VITREOUS ENAMEL EDGEWOUND WITH TABS		40	1.8	2 x 9/16
		90	3	4 x 9/16
		100	2.5	3 1/2 x 3/4
		160	5.5	6 x 3/4
		150	6.0	5 x 1
		300	13	8 1/2 x 1 1/8
		500	36	10 1/2 x 1 5/8
		750	40	12 x 2 1/2
		1500	100	20 x 2 1/2

MEMCOR Components represent the cumulative design and production knowledge gained during 30 years experience in the industry.

Let MEMCOR sales engineers aid you with your special design and application requirements.

For price, quality, and delivery look to MEMCOR Components. Immediate delivery on stock value resistors. Typical 3-5 week delivery on other standard values and special requirements. These products are available from MEMCOR's Nationwide Authorized Distributor Network.

Write for FREE Catalog.

E-SYSTEMS
Memcor Division

DEPT. EM
1320 FLAXMILL ROAD
HUNTINGTON, INDIANA 46750
Telephone: (219) 356-4300
TWX: 810-333-1530

PRECISION WIREWOUND RESISTORS

GENERAL RESISTANCE
A PRIME TECHNOLOGY COMPANY

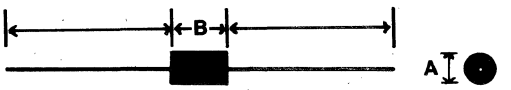
1,500,000 resistors in stock — all manufactured to meet the most exacting standards of accuracy, stability and reliability.

General Resistance has been engaged in the development and manufacture of precision wirewound resistors for over 30 years. The widest possible range of form factors is available, including axial and PC mounting types, in resistance values and accuracies to meet virtually any requirement.

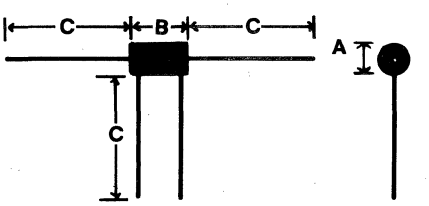
"Standard values" are normally available from stock. And *any* resistance value from 1Ω to 1,100,000Ω, as well as accuracies other than the "standard" ±0.1%, ±0.025% and ±0.01%, are available. .

All General Resistance resistors are manufactured to the exacting standards typified by military specifications such as MIL-R-93/ MIL-R-39005 (RB and RBR styles).

ECONISTOR, MINI-OHM, AND MAXI-OHM

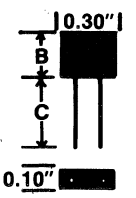


CURRISTOR

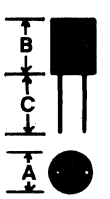


Type		Basic Resistance Range	Standard Accuracies	Stability	Tempco	Power Δ Rating ±0.1%@ +85°C	Max. Voltage	A Dia.	B Length	C Length of Wire	D† Wire Gauge
ECONISTOR (Axial-Leads)	8E16	1Ω to 1.1 Meg	±0.01% ±0.025% ±0.1% (others available)	±35ppm/ year	±5ppm/ °C max. −55°C to +125°C (others available)	8E16, 0.33W	200VDC or AC pk.	1/4" 6.4 mm	1/2" 12.7 mm	1-1/2" typ. 38 mm	22 AWG 0.6 mm
	8E24					8E24, 0.40W		1/4" 6.4 mm	3/4" 19.1 mm	1-1/2" typ. 38 mm	20 AWG 0.8 mm
SQUARISTOR (PC Mounting)	GR102	1Ω to 100K				0.30W	150VDC or AC pk.	N/A	0.32" 8.1 mm	1" typ. 25 mm	22 AWG 0.6 mm
MAXI-OHM (Axial-Leads)	12E32	1Ω to 3.5M				12E32, 0.75W	600VDC or AC pk.	3/8" 9.5 mm	1" 25.4 mm	1-1/2" typ. 38 mm	20 AWG 0.8 mm
	16E32	1Ω to 5M				16E32, 1.00W		1/2" 12.7 mm	1" 25.4 mm	1-1/2" typ. 38 mm	20 AWG 0.8 mm
PLUGISTOR (PC Mounting)	8P13	1Ω to 200K				0.30W	150VDC or AC pk.	1/4" 6.4 mm	13/32" 10.3 mm	1" typ. 25mm	22 AWG 0.6 mm
MINI-OHM (Axial Leads)	5E10	1Ω to 80K		±50ppm/ year		0.2W	175VDC or AC pk.	5/32" 4 mm	5/16" 0.5 mm	1-1/2" typ. 38 mm	24 AWG 0.4 mm
CURRISTOR	8C24	0.01Ω to 100Ω			±10ppm/ °C std. (others available)	0.50W*		1/4" 6.4 mm	3/4" 19.1 mm	1" 25 mm	22 or 20 AWG 0.6 or 0.8 mm
	12C20					0.75W*		3/8" 9.5 mm	5/8" 15.9 mm	1" 25 mm	20 AWG 0.8 mm
	16C32					1.50W*		1/2" 12.7 mm	1" 25.4 mm	1" 25 mm	20 AWG or Terminals
	16C64					2.50W*		1/2" 12.7 mm	2" 51 mm	1" 25 mm	20 AWG or Terminals
	32C64					6.00W*		1" 25.4 mm	2" 51 mm	N/A	Terminals

SQUARISTOR



PLUGISTOR



ΔFor other tolerances consult factory

*Power ratings for Curristor are at + 100°C

†All leads are tinned copper

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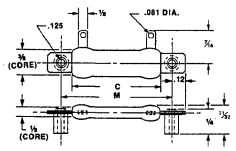
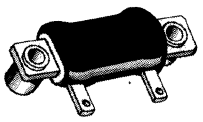
MINIATURE OVAL



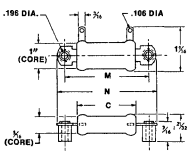


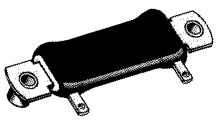
TYPE	WATT	C	M
FVOT-10	10	¾	1
FVOT-15	15	1	1¼
FVOT-20	20	2	2 5/16

NOTE: FVOT = VITREOUS
FSOT = SILICONE

Miniature oval resistors, by their basic design, are ideally suited for applications where space is limited and the mounting surface can be utilized for heat dissipation purposes. Resistors can be easily stacked into compact units. Standard tolerance is ±5% for 1 ohm and greater and ±10% for less than 1 ohm. Ayrton-Perry type non-inductive winding is available.

STANDARD OVAL



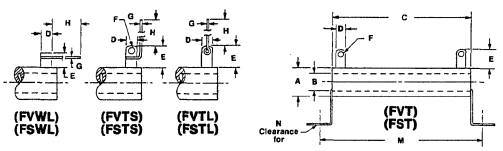


TYPE	WATT	C	M	N
FVOT-30	30	1¼	2	2½
FVOT-40	40	2	2¾	3¼
FVOT-55	55	3½	4¼	4¾
FVOT-65	70	4¾	5½	6
FVOT-75	95	6	6¾	7¼

NOTE: FVOT = VITREOUS
FSOT = SILICONE

Standard oval resistors, like the miniature ovals are easily stacked and utilize the mounting surface as a heat-sink. When stacking two or more parts, the individual resistors should be de-rated. Standard tolerance is ±5% for 1 ohm and greater and ± 10% for less than 1 ohm. Ayrton-Perry type non-inductive winding is available.

FIXED

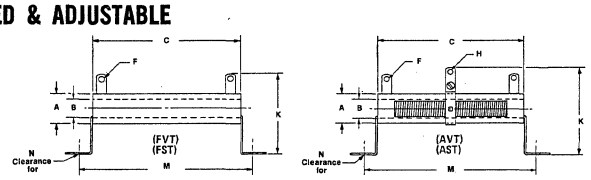


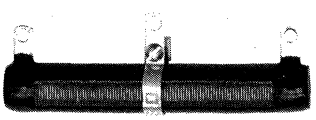
TYPE	WATT	CORE A	CORE B	CORE C	TERMINAL D	TERMINAL E	TERMINAL F	LEADS G	LEADS H	MOUNTING M	MOUNTING N
FVT-5	5	5/16	3/16	1	3/16	7/16	.104	—	—	1 7/16	6-32
FVTL-5	5	5/16	3/16	1	3/16	7/16	—	.032	2	1 7/16	6-32
FVTS-5	5	5/16	3/16	1	3/16	7/16	.104	.032	2	1 7/16	6-32
FVWL-5	8	5/16	3/16	1	1/8	1/4	—	.032	2	1 7/16	6-32
FVT-10	12	5/16	3/16	1¾	3/16	7/16	.104	—	—	2 3/16	6-32
FVTL-10	12	5/16	3/16	1¾	3/16	7/16	—	.032	2	2 3/16	6-32
FVTS-10	12	5/16	3/16	1¾	3/16	7/16	.104	.032	2	2 3/16	6-32
FVWL-10	12	5/16	3/16	1¾	1/8	1/4	—	.032	2	2 3/16	6-32
FVT-20	20	7/16	1/4	2	3/16	7/16	.104	—	—	2½	6-32
FVTL-20	20	7/16	1/4	2	3/16	7/16	—	.040	2	2½	6-32
FVTS-20	20	7/16	1/4	2	3/16	7/16	.104	.040	2	2½	6-32
FVWL-20	20	7/16	1/4	2	1/8	1/4	—	.040	2	2½	6-32

NOTE: The above chart applies to both vitreous and silicone coated resistors. The "type" nomenclature shown is for vitreous coating. When ordering coating substitute the letter "S" for the letter "V" in the type.
EXAMPLE: FVT = VITREOUS FST = SILICONE

Huntington Electric's 5-20 watt tubular resistors are offered in a variety of styles to meet your specific applications. The 5-12 watt units are also available with a 3/16" male quick-connect terminal. All units are available with Ayrton-Perry type non-inductive winding on request. Standard tolerance is ±5% for 1 ohm and greater and ±10% for less than 1 ohm. For other specific options, consult factory.

FIXED & ADJUSTABLE

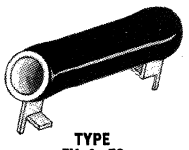




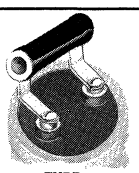
TYPE	Watt	CORE A	CORE B	CORE C	TERM F	ADJ. BAND H	MOUNTING K	MOUNTING M	MOUNTING N
FVT-10 AVT-10	12	5/16	3/16	1¾	.104	.104	13/16 7/8	2 3/16	8-32
FVT-25 AVT-25	25	5/16	5/16	2	.166	.173	1 3/16 1 1/16	2¾	8-32
FVT-50 AVT-50	50	5/16	5/16	4	.166	.173	1 3/16 1 1/16	4¾	8-32
FVT-75 AVT-75	75	5/16	5/16	6	.166	.173	1 3/16 1 1/16	6¾	9-32
FVT-100 AVT-100	100	¾	½	6½	.166	.173	2 3/32 2 5/16	7⅜	8-32
FVT-160 AVT-160	175	1⅛	¾	8½	.196	.166	2 1/16 2 13/16	9⅜	8-32
FVT-200 AVT-200	225	1⅛	¾	10½	.196	.166	2 1/16 2 13/16	11⅜	8-32

NOTE: FVT = VITREOUS COATED FST = SILICONE COATED
AVT = VITREOUS COATED ADJUSTABLE AST = SILICONE COATED ADJUSTABLE

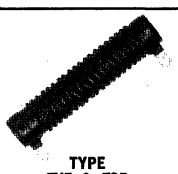
Huntington Electric's 12-225 watt wirewound resistors, like all of our other sizes and types, feature all welded construction utilizing high quality ceramic cores, resistance wire, terminal materials and vitreous enamel or silicon coatings. A variety of optional features, including quick-connect terminals, non-inductive windings and multiple taps, along with special sizes, terminal configurations and resistance tolerances, are available. Consult factory for details. Standard tolerances for fixed resistors are ±5% for 1 ohm and greater and ±10% for less than 1 ohm. ±10% is standard for adjustable units.



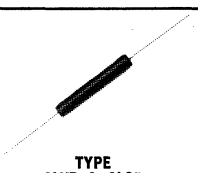
TYPE FV & FS DIRECT P.C. BOARD MOUNTING



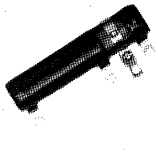
TYPE CMV & CMS CAPACITOR MOUNTING



TYPE FVE & FSE SMALL SIZE HIGH WATTAGE



TYPE ALVR & ALSR MINIATURE CIRCUITS



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  - — Ratio tracking to ±0.5 ppm/°C
  - — Absolute tolerance to 0.05%
  - — Absolute TCR to ±10 ppm/°C
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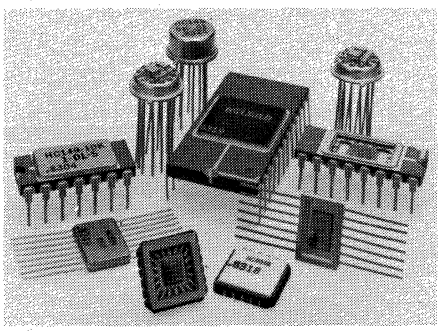
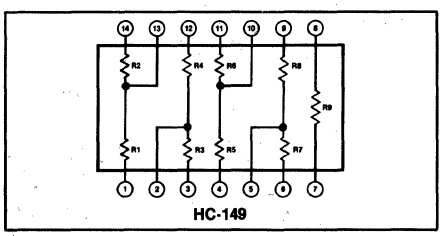


A SAMPLING OF PACKAGED NETWORKS

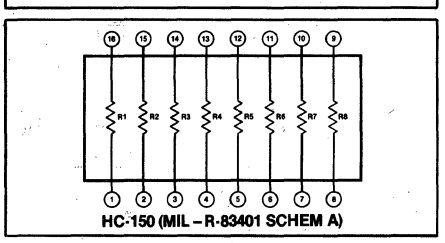
SERIES → / PARAMETERS	HC-149 Quad Divider Network (Equal R's)	HC-150 8 Equal Isolated Resistors	HC-170 12 Equal Isolated Resistors	HC-180 Binary Weighted Divider
Resistance Range	10K-100KΩ	2K-100KΩ	2K-100KΩ	5K-100KΩ
Tolerance Absolute	Standard: ±5%			Custom: To 0.05%
Ratio	Standard: ±0.01%			Custom: To 0.005%
Thermal Stability Absolute (TCR) Standard	±25ppm/°C			±25ppm/°C
Custom	To ±10ppm/°C			To ±5ppm/°C
Tracking (TCRT) Standard	±5ppm/°C			±5ppm/°C
Custom	To 0.5ppm/°C			To ±1ppm/°C
Power Dissipation Package Total	1W max.	1W max.	1.5W max.	1W max.
LCC, JEDEC LCC, DIP, Flatpak	500mW max.	500mW max.	1W max.	—
Per Resistor	100mW, max.	100mW, max.	80mW, max.	50mW, max.
Package[1] Styles	14-Lead, DIP or Flatpak; 20-Lead JEDEC LCC	16-Lead DIP, or Flatpak; 20-Lead JEDEC LCC	24-Lead DIP, or Flatpak; 28-Lead JEDEC LCC	14-Lead DIP, or Flatpak; 20-Lead JEDEC LCC

NOTES:

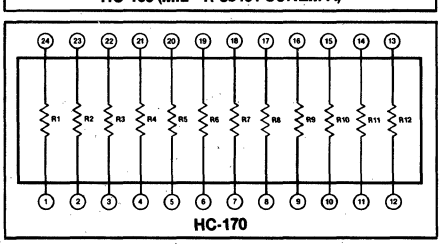
1. **LCC denotes leadless chip carrier packages that are available in JEDEC and non-JEDEC versions.**



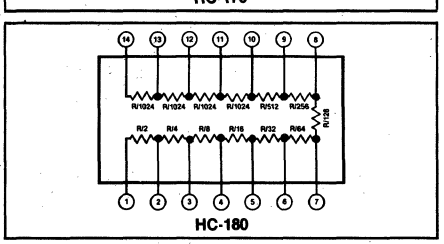
HC-149



HC-150 (MIL – R-83401 SCHEM A)



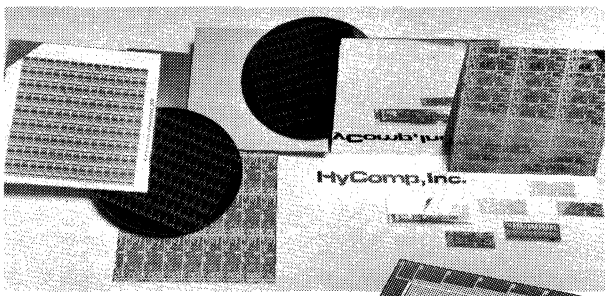
HC-170

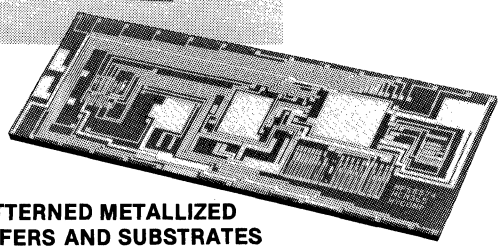


HC-180

Metallized **WAFERS & SUBSTRATES**

With or without pattern





METALLIZED WAFERS

SUBSTRATE CHARACTERISTICS	SUBSTRATE MATERIALS*			
	Silicon	Ceramic	Glass	Units
Formulation	100% Pure	99.6% Alumina	Corning 7059	—
Dimensions Length x Width	Standard: 2 x 2 to 3 x 3 Optional: To 4 x 4			Inch
Thickness	0.012	0.010-0.025	0.022	Inch
Finish (As-Fired)	NA	4-6, 2-3 opt.	NA	μinch
Surfaces Coated	1 or 2	1 or 2	1 or 2	—
DEPOSITIONS	**METALLIZATION**			
Resistance Layer Material	Nichrome (Vacuum-deposited on substrate)			
Thickness	Typically 100-200Å			
Diffusion Barrier Material	Nickel (Vacuum-deposited on Nichrome)			
Thickness	Typically 1000-3000Å			
Bonding Layer Material	High ductility 24K gold (Vacuum-deposited on Nickel)			
Thickness	Typically 1200Å; Electroplated to a minumum of 40 microinches, a maximum to customer specification			

*** Sapphire and Berrylia substrates are available on request.**

PATTERNED METALLIZED WAFERS AND SUBSTRATES

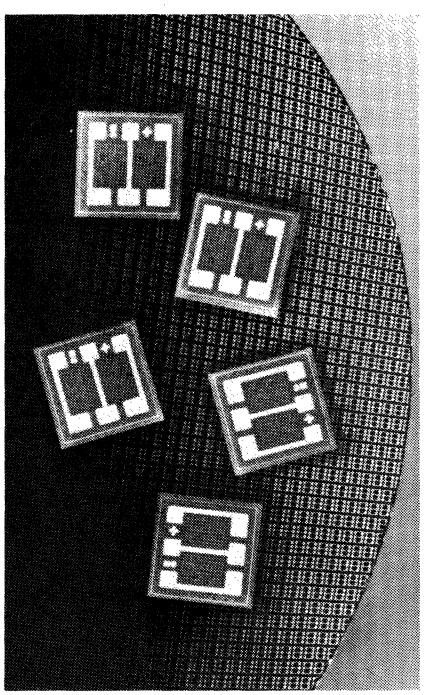
PATTERN PARAMETER	PARAMETER RANGE
MECHANICAL	
Lines and Spaces	Standard: Down to 1 mil Optional: Down to 0.25 mil
Form Factor	Wafers or individual substrates
Bonding Methods	HyComp's standard gold bonds are compatible with ultrasonic, thermo-compression ball and wedge, and thermosonic bonding techniques.
ELECTRICAL	
Sheet Resistivity	50 to 300 Ohms per square
Absolute TCR	10 to 50ppm/°C
Levels of Fabrication	HyComp will attach active or passive devices on request.

Nichrome **CHIP RESISTORS**

STANDARD CHIP RESISTOR PRODUCTS

SERIES	HC30CT		HC20C		HC20BC
PARAMETERS					
Package	Top-Contact Center-Tapped		Top-Contact Non-Tapped		Top and Back Contact Non-Tapped
Substrate	Silicon	Ceramic	Silicon	Ceramic	Silicon
Resistance[1]	10Ω-1.2MΩ		10Ω-1.2MΩ	10Ω-510KΩ	10Ω-1.2MΩ
Tolerance Absolute	0.1%, 0.5%, 1%, 2%, 5%, 10%, 20%				1, 2, 5, 10, 20%
Ratio	0.1%, 0.05% 0.025%, 0.01%		—		—
Temperature TCR	± 10ppm/°C typ. ± 50ppm/°C max.				± 25ppm/°C typ. ± 50ppm/°C max.
TCRT	± 1ppm/°C typ. ± 2ppm/°C max.		—		—
Dimensions (L x W) Thickness	30 x 30 mils 10 ± 3 mils		20 x 20 mils 10 ± 3 mils		20 x 20 mils 10 ± 3 mils
Power, max.	250mW		250mW	100mW	100mW

1. Available in standard RETMA values. Other values available on request.



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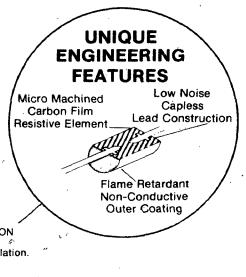
5%, 2% AND 1% CARBON FILM RESISTORS

FUSE ACTION — NON-FLAMMABLE



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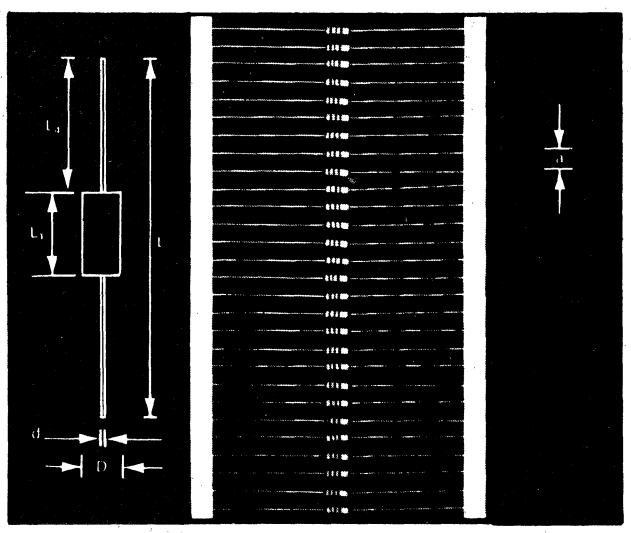
- △ Capless Design
- △ Meets MIL Specifications
- △ Extremely Long Life
- △ Produced And Checked By Automatic Equipment
- △ Failure Rate Less Than 10^8/Hour (MTTF More Than 10^8)
- △ Solderability as per MIL-STD-202
- △ Insulation Resistance Higher Than 10^9 Ohms
- △ Terminal Strength > 8 Lbs.
- △ Equivalents: MIL R-10509, MIL R-39, MIL R-11
- △ Color Code: MIL-STD-129
- △ Available With Weldable Leads
- △ Available in Bulk Pack or Taped and Reeled

TYPE	A	b	a	L_1	L_4	d	D	L
UPM ¼ W (INCHES)	3.35-0.039	0.236	0.197 ± 0.08	0.236 + 0.039	1.457 ± 0.039	0.024	0.091 ± 0.08	$3.15 \begin{smallmatrix}+0.118\\-0.079\end{smallmatrix}$
UPM ¼ W (MM)	85-1	6	5 ± 0.2	6 + 1	37 ± 1	0.6	2.3 ± 0.2	$80 \begin{smallmatrix}+3\\-2\end{smallmatrix}$
UPM ½ W (INCHES)	3.35-0.039	0.236	0.197 ± 0.08	0.315 + 0.039	1.457 ± 0.039	0.027	0.111 ± 0.08	$3.15 \begin{smallmatrix}+0.118\\-0.079\end{smallmatrix}$
UPM ½ W (MM)	85-1	6	5 ± 0.2	8 + 1	36 ± 1	0.7	2.8 ± 0.2	$80 \begin{smallmatrix}+3\\-2\end{smallmatrix}$



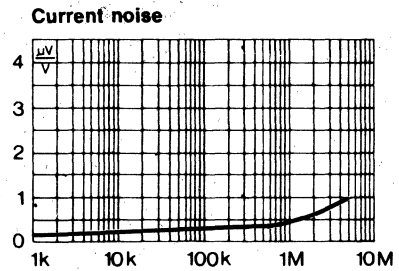
INCLUDE RESISTANCE RANGES

Wattage	Tolerance	Range
¼	5%	4.7Ω — 1 MegΩ
	2%	10Ω — 300KΩ
½	5%	4.7Ω — 4.7 MegΩ
	2%	10Ω — 1 MegΩ

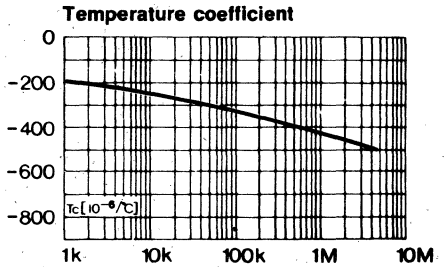
MIL R-11 EQUIVALENT	MIL R-10509 EQUIVALENT
RC 07 and RC 12	RN 65 cat. b,d
RC 20 and RC 22	RN 70 cat. b,d

	MAX. Δ RES.
Humidity (Steady State)	± 1.00%
Life	± 1.00
Short Time Overload	± 0.50
After Soldering	± 0.25
Thermal Shock	± 0.25
Twist	± 0.25
Vibration	± 0.25

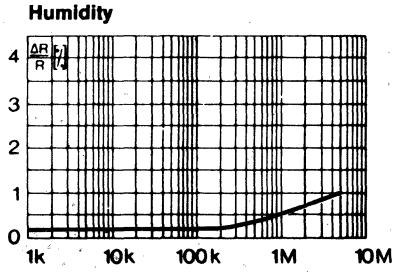
Current noise



Temperature coefficient



Humidity



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IEI-ISKRA

• Ceramic Caps, Discs, Feed Thru • Ferrites • Meters • Motors, fractional H.P. • Semiconductors • Switches • Speakers • Trimmer Pots

THICK FILM RESISTOR NETWORKS

SERIES SC, DB

Standard resistor networks are on 96% aluminium oxide Al_2O_3 ceramic substrates using methods of screen printing and firing of thick film resistor networks. Resistors are laser calibrated. They are produced in Single-in-line (SIL) and Dual-in-line (DIL) pin versions. Surface protection is of epoxy resin guaranteeing excellent climatic characteristics.

FEATURES

△ Low Profile
△ Standard Profile and Size
△ High Reliability
△ Wide Resistance Range
△ Non-inductive Resistor
△ Low Assembly Costs

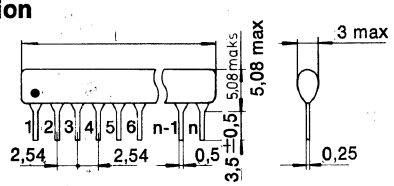
PERFORMANCE DATA

	$\Delta R/R_{max}$
Life 1,000 h/P_n at 70°C	±1%
Temperature cycling 5 cycles −55°C to +125°C	±0.5%
Temperature exposure 1,000 hours at +125°C	±1%
Humidity steady state 56 days/40°C/95% relative humidity	±1%
Short-term overload 2.5 × U_n/5 s	±0.5%
Resistance to soldering heat 260°C/10 s	±0.5%
Vibration 20 g/10 Hz — 2000 Hz	±0.5%

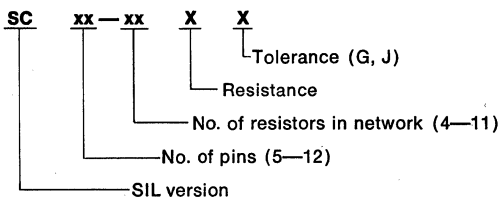
TECHNICAL DATA

Maximum operating voltage for individual resistor	100 Vdc or √PR, whichever is less
Temperature coefficient	±250 × 10^{-6}/K standard ±100 × 10^{-6}/K on special request
Resistance range	10 Ω to 1 MΩ, Series E12
Resistance tolerance	±2% (G) ±5% (J)
Climatic category	55/125/56

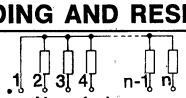
SIL version



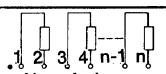
Type designation



LOADING AND RESISTOR CONNECTIONS



No. of pins n
No. of resistors n—1

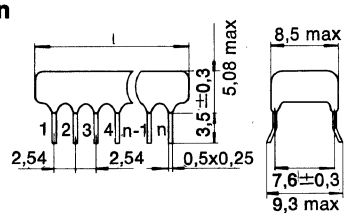


No. of pins n
No. of resistors n/2

Loading per resistor at 70°C	
100 mW	150 mW

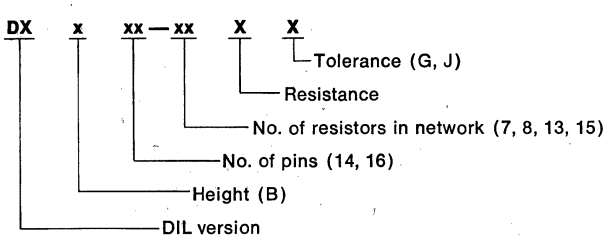
No. of pins	5	6	7	8	9	10	11	12
Length l (mm)	13	15,5	18,0	20,5	23,0	25,5	28,0	31,0

DIL version

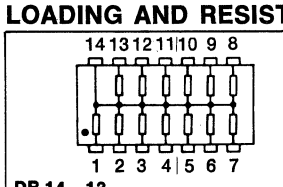


l (mm) = 18,8 max — DB 14—13, DB 14—7
l (mm) = 22,6 max — DB16—15, DB 16—8

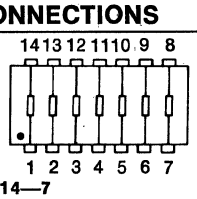
Type designation



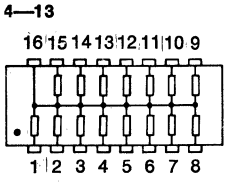
LOADING AND RESISTOR CONNECTIONS



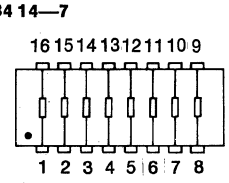
DB 14—13



DB4 14—7



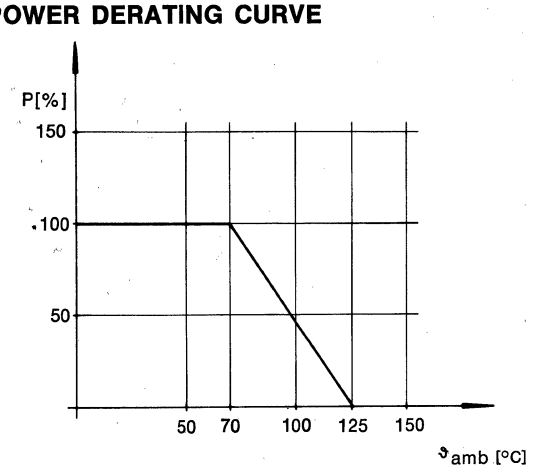
DB 16—15



DB 16—8

Loading per resistor at 70°C	
125 mW	250 mW

POWER DERATING CURVE



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INTEROHM RESISTORS by International C

RESISTOR	Type	Power Rating @ 70°C	Resistance Tolerance	Resistance Range	Voltage Rating	Temperature Coefficient
Carbon Film	CF 25	0.25W	±2%, ±5%	1.0 ohm — 10 megohms	250V	From 200 PPM/°C
	CF 50	0.50W	±2%, ±5%	1.0 ohm — 10 megohms	350V	From 200 PPM/°C
Metal Film	MF 25	0.25W	±1%, ±2%, ±5%	1 ohm — 1.0 megohm	250V	100 PPM/°C
	MF 50	0.50W	±1%, ±2%, ±5%	1 ohm — 1.0 megohm	350V	100 PPM/°C
Metal Oxide (Flame Proof)	MO-1	1.0W	±2%, ±5%, ±10%	0.5 ohm — 100K ohms	350V	350 PPM/°C
	MO-2	2.0W	±2%, ±5%, ±10%,	0.5 ohm — 100K ohms	350V	350 PPM/°C

RESISTOR NETWORKS — SIP

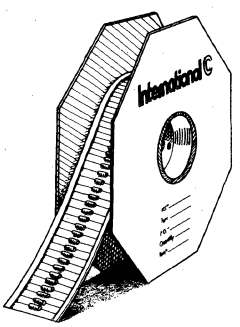
Pins	5-14
Resistance Range	22 ohms—2.2 megohms
Resistance Tolerance	±2%, ±5%, ±10%, ±20%
Element Power Rating	0.125W @70°C
Package Power Rating	0.35W — 1W @70°C
Temperature Coefficient	±150 PPM/°C, ±300 PPM/°C
Maximum Voltage	200V
Operating Temperature	−55°C to +130°C

ZERO OHM JUMPERS

1/4W Size Insulated Construction

PACKAGING

- Tape & Reel
- Magazine Pack
- Cut & Form (to specification)
- Bulk (100 Bag)



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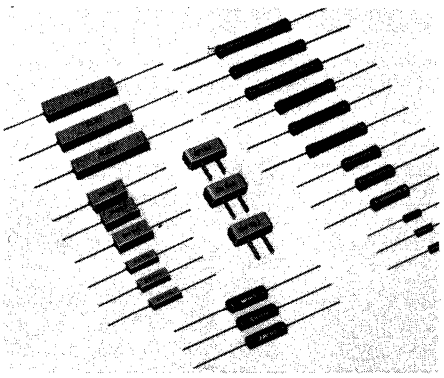
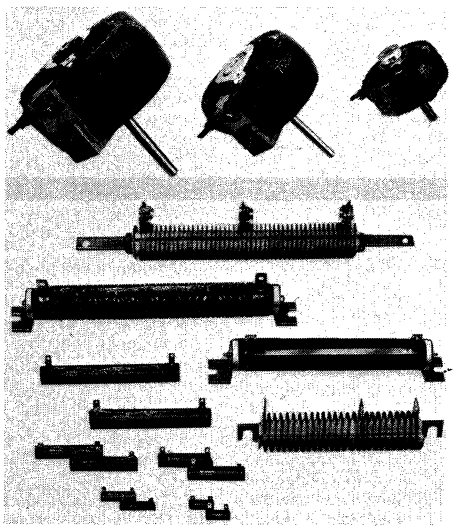
CARBON & METAL FILM RESISTORS
Fuse Action — Non Flammable (NF)

WIRE WOUND POWER RESISTORS
1W — 1 KW

Type	Series
Carbon Film FR — (NF) 5% & 2% ¼W — 2W	UPM
Metal Film ⅛W — 1W 5% — .1% • 150 — 25 PPM	RN
Metal Oxide Film (NF) ¼W — low • .5% — 5%	RSN
Wire Wound (NF) 5% Resin Coated • 1W — 40W	KN
Wire Wound "Bathtub" (NF) Cement Sealed 2 — 40W 5%	SQ
Fuse Action Resistors ¼W — 2W	PRN





POWER RESISTORS:

WW Enamel Coated
5W — 600W 1Ω — 200 KΩ Series Q

WW "Corn Cob"
120W — 600W .2Ω — 20Ω Series OR

Ribbon Wound
400W — 1 KW .033Ω — 1.6Ω Series CLA

SEMI-FIXED VARIABLE RESISTORS:

1 Resistance Range 100Ω — 2 MΩ
2 Standard Tolerance ≤500Ω ±30%
>500Ω ±20%, ≥500 KΩ ±30%
3 Standard Curve: B Curve
4 Rated Power 0.1W, 0.25W

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JULIE RESEARCH LABORATORIES INCORPORATED

PRECISION WIREWOUND RESISTORS

PRECISION RESISTORS FOR EVERY APPLICATION

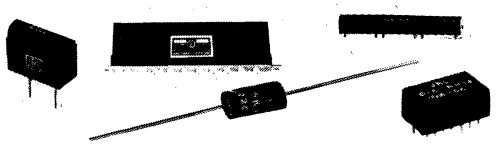
Precision Resistors for every application imaginable; high quality, low priced precision resistors are available for your every design need and at delivery schedules (1-2 weeks) even distributors can't beat!! JULIE RESEARCH resistors are guaranteed for a lifetime performance in almost every value, tolerance and stability.

Available as individual, ratio or network assemblies, these expertly manufactured and trimmed resistors assist you in eliminating countless hours of Production Test time from your design. In addition, the use of these very stable resistors contribute to reliable design and reduced component count. Specify a Julie Resistor. Better yet, call us and we will assist in helping you get the best price-performance unit your application and budget will allow.

JUST A FEW OF THE PROVEN APPLICATIONS FOR THESE LOW REACTANCE HIGH PERFORMANCE RESISTORS ARE:

- Transducer Calibrating Networks
- Current Metering
- Gyro Torquing
- AC and DC Precision Bridge Elements
- Amplifier Summing Elements
- D/A Converters
- Reference Divider
- Precision Multiplier
- Resistive Divider Networks
- Shunting
- AC or DC Ratio
- High Performance MIL Spec
- Zener Trimming Networks

RESISTOR STYLES



SPECIFICATIONS

Precision wirewound resistor accuracy and stability available in standard DIP styles.

Range: 100Ω to 100 KΩ per resistor.
Ratio Accuracy: To .001% for ratio 1:1.
Stability: Network .002% for standard ranges.
Temperature Coefficient: 1 ppm/°C to 20 ppm/°C.
Delivery: 3-4 weeks.
Custom designs available — contact factory for other package styles.

SPECIFICATIONS

Range: Individual Resistors, 0.1 ohm to 5 megohms. Ratio Sets, 1:1 to 10^6:1 depending on total resistance required.
Accuracy: Standard accuracy of resistors, 0.005% for values from 1000 ohms to 5 megohm. Standard accuracy of ratio sets, 0.0025% for ratios near 1:1. Accuracies from 0.002% to 0.1% are available (at corresponding prices) on special order.
Stability: Resistors, 0.002% per year for standard ranges.
Accuracy Over Military Temperature Range: ±0.02% from −45°C to +85°C.
Matching Over Military Temperature Range: ±0.005% from −45°C to +85°C.
Retrace Over Military Environmental Conditions: 0.002%.
Temperature Coefficient: Resistors, 5 ppm/°C standard. (Available as low as 1.0 ppm/°C). Ratio sets, 2.5 ppm/°C standard. (Available as low as 0.7 ppm/°C).
Note: Temperature Coefficient can be altered, in manufacture, over wide ranges.
Thermal Transients: All thermal-induced transient effects, e.g.: self-heating, Seebeck and Peltier effects, are less than 0.0015% at rated power dissipation. Self-heating and time constants of thermal transients are reduced to 10% of normal values in air.
Current Capability: To 2 amperes.
Voltage: Between Terminals, 300 volts maximum, Terminals to Case, 500 volts maximum.

SPECIFICATIONS

Range: Individual Resistors, 1 ohm to 10 megohms. Ratios, 1:1 to 10^6:1, depending on total resistance required.
Accuracy: Standard accuracy of resistors, 0.01%, for values from 100 ohms to 5 megohm. Standard accuracy of ratios, 0.005%, for ratios near 1:1. Intermediate accuracies of 0.05% and up and higher accuracies to .0025% are available on special order.
Stability: Resistors 0.003% per year for standard ranges.
Accuracy Over Military Temperature Range: 0.02% from −30°C to +85°C.
Retrace Over Military Environmental Conditions: 0.003%.
Temperature Coefficient: Resistors, 5 ppm/°C standard, (available as low as 1.0 ppm/°C). Ratios, 2.5 ppm/°C standard, (available as low as 0.7 ppm/°C).
Note: Temperature Coefficient can be altered, in manufacture, over over wide ranges.

SPECIFICATIONS

Range: Individual Resistors, 1 ohm to 100 ohms.
Accuracy: Standard accuracy of resistors, 0.01%, for values from 1.0 ohm to 100 ohms. (R_1xG) .005% (CH).
Stability: Resistors 0.003% per year for standard ranges.
Accuracy Over Military Temperature Range: 0.02% fom −30°C to +85°C.
Retrace Over Military Environmental Conditions: 0.003%.
Temperature Coefficient: Resistors, 5 ppm/°C standard, (available as low as 2.5 ppm/°C).
Note: Temperature Coefficient can be altered, in manufacture, over wide ranges.
Voltage and Power Ratings: See chart.
Construction: See charts.
Group Encapsulation: Special techniquies permit group encapsulation of high-accuracy units on a high-yield basis, enabling better accuracies at competitive costs. (See JRL Bulletin B-11.)

HIGH LOAD-LIFE STABILITY, PRECISION NETWORKS

Type	Construction Dual In-Line	Resistor Configuration	Dimensions (Inches) L x W x H	Max Res Per Resistor	Max Volt Per Resistor	Max Power Per Resistor
RNX-14	14 pin	3 max.	.740 x .39 x .43	100K	125V	1/10W
RNX-16	16 pin	4 max.	.840 x .39 x .43	100K	125V	1/10W

LOWEST, LOW REACTANCE OIL FILLED AND ENCAPSULATED THA-H, CH, HCH, RESISTORS AXIAL WIRE LEAD CONSTRUCTION

Style	Size Inches	Size MM	AWG Leads	Max. Res.	Volt	Power	MIL R-93
H-32	3/8 x 1/2	9.5 x 12.7	20	250 K	250	1/2 W	—
H-33	3/8 x 3/4	9.5 x 19.1	20	350 K	450	1/2 W	RB 53
H-34	3/8 x 1	9.5 x 25.4	20	500 K	500	1/2 W	RB 52
H-42	1/2 x 1/2	12.7 x 12.7	18	750 K	250	1/2 W	—
H-44	1/2 x 1	12.7 x 25.4	18	2 Meg	500	1 W	RB 57
H-46	1/2 x 1/2	12.7 x 38.1	18	3 Meg	750	1 1/2	RB 58
H-48	1/2 x 2	12.7 x 50.8	18	5 Meg	1000	2 W	RB 59
HCH-32	3/8 x 1/2	9.5 x 12.7	20	150 K	—	3/4 W*	—
HCH-33	3/8 x 3/4	9.5 x 19.1	20	250 K	—	1 W*	—
HCH-34	3/8 x 1	9.5 x 25.4	20	350 K	—	1.5 W*	—
HCH-35	3/8 x 1 1/4	9.5 x 31.8	20	500 K	—	1.8 W*	—
HCH-42	1/2 x 1/2	12.7 x 12.7	18	375 K	—	1.5 W*	—
HCH-44	1/2 x 1	12.7 x 25.4	18	750 K	—	3 W*	—
HCH-46	1/2 x 1 1/2	12.7 x 38.1	18	1 M	—	4.5 W*	—
HCH-48	1/2 x 2	12.7 x 50.8	18	1.5 M	—	6 W*	—
CH-32	3/8 x 1/2	9.5 x 12.7	20	300 K	—	3/4*	—
CH-33	3/8 x 3/4	9.5 x 19.1	20	500 K	—	1 W*	—
CH-34	3/8 x 1	9.5 x 25.4	20	700 K	—	1.5*	—
CH-35	3/8 x 1 1/4	9.5 x 31.8	20	1 Meg	—	1.8*	—
CH-42	1/2 x 1/2	12.7 x 12.7	18	750 K	—	1.5*	—
CH-44	1/2 x 1	12.7 x 25.4	18	1.5 M	—	3.0*	—
CH-46	1/2 x 1 1/2	12.7 x 38.1	18	2 M	—	4.5*	—
CH-48	1/2 x 2	12.7 x 50.8	18	5 M	—	6 W*	—
THA-36	3/8 x 1/2	9.5 x 12.7	18	1 M	100	—	RB 53
THA-38	3/8 x 3/4	9.5 x 19.1	18	1 M	100	—	RB 53

* When mounted on heat sink.

SUPER ACCURATE, SUPER STABLE ENCAPSULATED, MINIATURE PRECISION R, XG, RS, L, GL RESISTORS

TYPE R AND C — AXIAL WIRE LEAD-CONSTRUCTION

C21X	3/16 x 3/8		24	100 K	125	1/10 W	
R-22	1/4 x 9/16	6.4 x 14.3	22	500 K	125	1/8 W	—
R-23	1/4 x 3/4	6.4 x 19.1	22	750 K	125	1/4 W	RB 54
R-24	5/16 x 1	7.9 x 25.4	22	1 Meg	350	1/4 W	—
R-32	3/8 x 1/2	9.5 x 12.7	22	750 K	125	1/4 W	—
R-33	3/8 x 3/4	9.5 x 19.1	20	1 Meg	125	1/3 W	RB 53
R-34	3/8 x 1	9.5 x 25.4	20	1.5 Meg	250	1/2 W	RB 52
R-35	3/8 x 1 1/4	9.5 x 31.8	20	2 Meg	250	3/8 W	—
R-42	1/2 x 1/2	12.7 x 12.7	18	1.5 Meg	125	1/2 W	—
R-44	1/2 x 1	12.7 x 25.4	18	4 Meg	250	1 W	RB 57
R-46	1/2 x 1 1/2	12.7 x 38.1	18	7.5 Meg	250	1 1/2 W	RB 58
R-48	1/2 x 2	12.7 x 50.8	18	10 Meg.	250	2 W	RB 59

TYPE L AND RB — RADIAL LUG CONSTRUCTION

L-10A	5/8 x 9/16	15.9 x 14.3	Solder Lug	1.5 Meg	125	1/2 W	RB 16
L-HB	5/8 x 1 1/4	15.9 x 31.8	Solder Lug	4 Meg	250	1 W	RB 18
RB-19	1 x 2 1/32	25.4 x 51.6	Solder Lug	10 Meg	350	2 W	RB 19
RB-17	1/2 x 1	12.7 x 25.4	Solder Lug	1.5 Meg	125	3/4 W	RB 17

TYPE XG — RADIAL WIRE LEAD CONSTRUCTION

R-32XG	3/8 x 9/16	9.5 x 14.3	22	500 K	125	1/4 W	—
R-42XG	1/2 x 9/16	12.7 x 14.3	20	1 Meg	125	1/2 W	—
R-44XG	1/2 x 1 5/32	12.7 x 29.3	20	3.5 Meg	250	1 W	—
R-46XG	1/2 x 1 3/8	12.7 x 34.9	20	5 Meg	250	1 1/2 W	—
R-48XG	1/2 x 2 1/16	12.7 x 52.4	20	10 Meg	250	2 W	—
R-52XG	5/8 x 19/32	15.9 x 15.1	20	1 Meg	125	3/4 W	—

TYPE RS — TOP HAT CONSTRUCTION

RS-36	11/32 x 1/2	10.3 x 12.7	22	750 K	125	1/4 W	—
RS-26	7/32 x 1/2	7.1 x 12.7	22	250 K	125	1/8 W	—

LOW OHM, LONG TERM STABILITY, OIL FILLED AND ENCAPSULATED 4-TERMINAL CH46-T4, R-46-T4, R46xG-T4 AXIAL AND RADIAL CONSTRUCTION

Style	Size	MM	AWG Leads	Max. Res.	Current	Power
R-46T4	1/2 x 1 1/2	12.7 x 38.1	18	100 Ohms	2 Amps	1 1/2 W
R-46XG-T4	1/2 x 1 1/2	12.7 x 38.1	20	100 Ohms	2 Amps	1 1/2 W
CH-46T4	1/2 x 1 1/2	12.7 x 38.1	18	100 Ohms	2 Amps	3 W*
CH-4814	1/2 x 2	12.7 x 50.8	18	100 Ohms	4 Amps	6 W*

* When mounted on heat sink.

JULIE RESEARCH LABORATORIES, INC. • 211 W. 61 ST., NEW YORK, N.Y. 10023 • (212) 245-2727 • TWX: 710-581-5138

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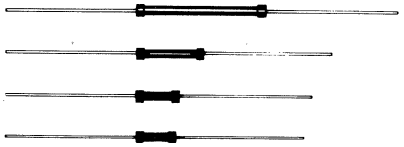
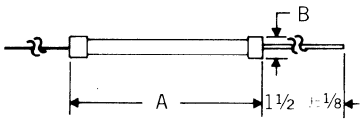
K&M electronics·inc

HIGH VOLTAGE
- PRECISION RESISTORS
- DIODE ARRAY

SERIES I RESISTORS
PRECISION HIGH OHMAGE HIGH VOLTAGE RESISTORS



FEATURES
- Tinned copper leads .020" or .032" standard. Other lead materials available
- Conformal epoxy coated
- Glass overglaze for vacuum applications



NOTES
- Voltage coefficient is dependent on resistance value. Typically less than 5 PPM/V in mid resistance values
- Burn in and other preconditioning options available
- Tolerance to ½% on request

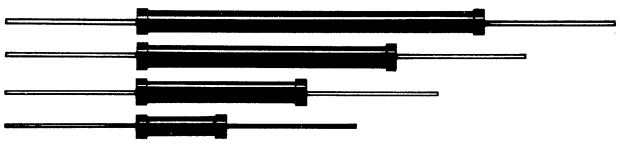
TYPES —

Type	Resistance Ohms Min	Resistance Ohms Max	Power at 70°C Watts	Maximum Operating Voltage	Tolerance at 25 VDC	Max Surface Temp.	Dimensions Max Inches A	Dimensions Max Inches B
KO1040	1 Meg	5K Meg	.75	2000V	1, 2 & 5%	220°C	.460	.145
KO1243	1 Meg	10K Meg	1.0	2500V	1, 2 & 5%	220°C	.500	.170
KO1268	1 Meg	20K Meg	1.5	5000V	1, 2 & 5%	220°C	.750	.170
KO1213	1 Meg	100K Meg	2.0	10,000V	1, 2 & 5%	220°C	1.500	.170

TEMPERATURE COEFFICIENT —

Temperature Coefficient +25°C to +125°C	KO1040 Megohms	KO1243 Megohms	KO1268 Megohms	KO1213 Megohms
±100 PPM/°C	1-100	1-100	1-200	1-400
±200 PPM/°C	100-3K	100-3K	200-6K	400-15K
±1000 PPM/°C	3K-5K	3K-10K	6K-20K	15K-100K

SERIES II RESISTORS
PRECISION HIGH OHMAGE HIGH VOLTAGE POWER RESISTORS



FEATURES
- Tinned copper leads .020" or .032" standard. Other lead materials available
- Conformal epoxy coated

NOTES
- Voltage coefficient is dependent on resistance value. Typically less than 5 PPM/V in mid resistance values
- Burn in and other preconditioning options available
- Tolerance to ½% on request

TYPES —

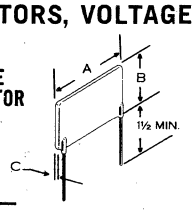
Type	Ohms Resistance Min	Ohms Resistance Max	Power at 70°C Watts	Maximum Operating Voltage	Tolerance at 25 VDC	Max Surface Temp.	Dimensions Max Inches A	Dimensions Max Inches B
KO2510	1 Meg	5K Meg	4	8,000V	1, 2 & 5%	220°C	1.125	.325
KO2520	1 Meg	10K Meg	7	16,000V	1, 2 & 5%	220°C	2.125	.325
KO2530	1 Meg	15K Meg	10	24,000V	1, 2 & 5%	220°C	3.125	.325
KO2540	1 Meg	20K Meg	12	32,000V	1, 2 & 5%	220°C	4.125	.325

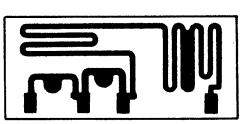
TEMPERATURE COEFFICIENT —

Temperature Coefficient +25°C to +125°C	KO2510 Megohms	KO2520 Megohms	KO2530 Megohms	KO2540 Megohms
±100 PPM/°C	1-500	1-1000	1-1500	1-2000
±200 PPM/°C	500-5K	1000-10K	1500-15K	2000-20K

SERIES III RESISTORS
PRECISION HIGH OHMAGE HIGH VOLTAGE FLAT RESISTORS, VOLTAGE DIVIDERS AND NETWORKS

SINGLE RESISTOR





TYPICAL VOLTAGE DIVIDER NETWORK

TYPES —

Type	Resistance Ohms Min	Resistance Ohms Max	Max Power @ 70°C	Max Operating Voltage	Max Surface Temp.	Dimensions Max Inches A	Dimensions Max Inches B	Dimensions Max Inches C
KF315	1 Meg	5K Meg	2	12,000V	150°C	1.550	.350	.110
KF510	1 Meg	5K Meg	2	10,000V	150°C	1.050	.550	.110
KF520	1 Meg	5K Meg	4	20,000V	150°C	2.050	.550	.110
KF1020	1 Meg	10K Meg	6	30,000V	150°C	2.050	1.050	.110

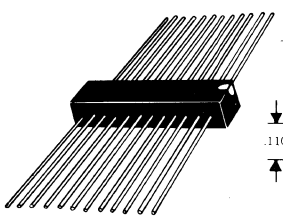
FEATURES
- Tolerances: 1%, 2%, 5%, 10%, 15%
- Conformal epoxy coated
- .032 tinned copper leads or nickel ribbon leads for welding
- Available without leads with solderable termination pads
- VCR less than 5 PPM/V
- Voltage dividers and networks designed to your specifications resistor ratios to 10,000:1 (size dependent).
- TCR tracking 25 PPM/°C
- Ratios to 1%

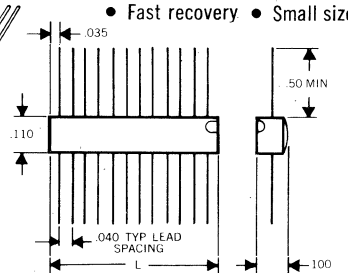
TEMPERATURE COEFFICIENT —

Temperature Coefficient +25°C to +125°C	KF315 Megohms	KF510 Megohms	KF520 Megohms	KF1020 Megohms
±100 PPM/°C	1-500	1-500	1-500	1-1000
±250 PPM/°C	500-5,000	500-5,000	500-5,000	1,000-10,000

MINIATURE HIGH VOLTAGE DIODE ARRAY

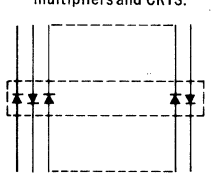
FEATURES
- Low reverse leakage current
- Fast recovery • Small sizes





MECHANICAL
- Lead Diameter .015 max
- Lead Material—Silver
- Encapsulant—Epoxy

APPLICATIONS
- Typical applications are power supplies which generate the high voltage required for image intensifiers photomultipliers and CRTS.



SPECIFICATIONS:

K & M Part No.	No. of Diodes	DIM L
107-031-12	12	.510
107-032-10	10	.430
107-033- 8	8	.350
107-034- 6	6	.270
107-035- 4	4	.190
107-036- 2	2	.110

ELECTRICAL
- PIV = 1200 VDC
- IR @ 23°C 500 VDC 10 nano amps Max
- Junction Capacitance @ 23° Max 0.35 pf Max @ 500 VDC
- Recovery Time @ 23°C 1.5 micro Sec. @ If = 10 ma
- Recovery Time @ 23°C 0.5 micro Sec. .040 Max
- Operating Temp +55°C to −54°C
- Storage Temp +85°C to −70°C

K&M electronics·inc MINIATURE HIGH VOLTAGE POWER SUPPLIES & COMPONENTS
123 Interstate Drive • West Springfield • Mass • 01089 • (413) 781-1350 • TWX 710-350-6463

EEM PRODUCT SELECTION GUIDES

Use the EEM Product Selection Guides. There are 34 Guides in this edition of EEM. See page 2 (A•2, B•2, C•2, D•2) of each volume to locate the Product Selection Guides that pertain to your needs.

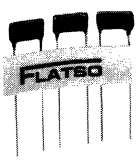
THICK AND THIN FILM ELECTRONIC COMPONENTS

DIP RESISTOR NETWORKS
MIL-R-83401

Thick film epoxy molded DIP resistor networks are available in both Commercial and M-83401 Mil-approved configurations. 14 and 16 Pin, A and B Schematics in standard resistance values are available from stock. Custom designed circuits for your unique requirements are a specialty.

RESISTOR NETWORKS

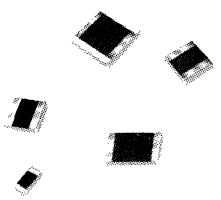
LCC resistor networks offer the designer, format compatibility between resistor networks and semiconductor devices. Custom circuits can be developed for up to 8 resistors in a .350" x .350" package. These circuits offer resistor values up to 500K ohm, TCs as low as 100ppm/°C and package power dissapations to .4 watts. Tolerances to 1% and ratio matching to .5% are available. These devices are suitable for use over the temperature range of −55°C to +125°C.



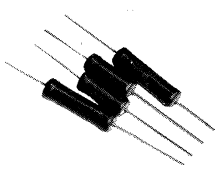
KDI Electronics offers seven "FLATSO" resistors with voltage ratings to 20 KV and power ratings from .25 watts to 5 watts. Resistance values from 50Ω to 5,000 Meg and temperature coefficients to ±100 PPM/°C are available depending on value. Custom Flatso Networks and non-standard values will be quoted upon request.

THICK FILM CHIP RESISTORS

A complete line of Thick Film Chip Resistors are available in eight sizes. These chips feature boths single-sided and wrap-around terminations. They are available with platinum gold, gold, and solder coated terminations. The resistance range is from 5.1 ohms to 4 megohms. Also available are extended range values to 500 megohms. Tolerances from 1% to 20% are standard as are temperature coefficients from 100 PPM/°C to 250 PPM/°C. Power capabilities range from 50 mW to 0.5 Watts. These chip resistors offer high rel design and construction and environmental testing is available.



HIGH VOLTAGE

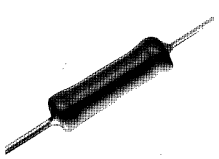


Axial lead thick film resistors for both high voltage and high resistance can be supplied in voltage ratings to 40 KV and resistance values to 1,000 Meg. Fired at over 900°C, these resistors are unmatched in performance with proven load life stability.

HIGH VOLTAGE. THICK FILM NETWORKS

Voltage dividers and other networks are available with ratings up to 60 KV. Divider Networks have tolerances to 1% with TC tracking to 25 PPM/°C. They can be manufactured with a resistance range from 10 ohm to 1,000 megohm. These networks are available in leaded and unleaded styles, in both standard and custom configurations.

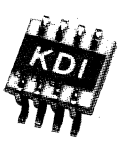
METAL FILM



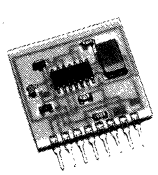
Conformal coated high precision metal film resistors offer superior stability and reliability at a reasonable cost. Features include: small size, impervious to moisture, low noise, low T.C. and resistance range of 10 ohms to 70 Megohms. Surpasses MIL-R-10509 and MIL-R-55182. In-plant testing facilities as well as matched networks are available. Standard T.C.: ±10, ±25, ±50, and ±100 ppm/°C.

"SO" RESISTOR NETWORKS

In order to gain the maximum benefit from the use of "SO" packaged semi-conductors, a compatable format for resistor networks is desirable. KDI offers a resistor network packaged to fit the "SOIC 8" footprint. General specifications for these custom networks include; resistance range up to 500K ohms, package power to .4 watts, up to 8 resistors, tolerance to 1% and ratio matching to .5%. These devices are suitable for operation over the temperature range of −55°C to +125°C.



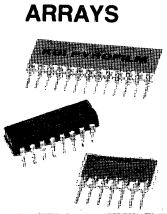
THICK FILM HYBRID CIRCUITS



Custom Thick Film Hybrid circuits are produced using any type of surface mountable semiconductor and chip component. Both Single-in-Line and Dual-in-Line styles are available and custom packaging formats can be accommodated also. Circuits can utilize any combination of semiconductors, capacitors, resistors and chip inductors. Full functional and parametric testing is available as well as any required environmental tests. All the features of Thick Film resistor networks, such as tight tolerances and ratio tracking, as well as low TC are inherent in hybrid circuits.

CHIPLESS™ RESISTOR/ CAPACITOR NETWORKS AND CAPACITOR ARRAYS

These standard and custom circuits are available in both Dual-in-Line and Single-in-Line formats and offer cost effective alternatives to discrete designs. These circuits and arrays utilize our Thick Film Capacitor technology and therefore require no "add on" chips. Capacitor elements are available with NPO or X7R characteristics. Values range up to several thousand picofarads with tolerances to 5% and matching to 2.5%. Resistor elements range from 10 ohms to 10 meg ohm with tolerance to 0.5%, TC to 100 ppm and matching to 0.1%.



FOR ADDITIONAL INFORMATION AND CATALOG, WRITE OR CALL TOLL FREE 800-221-0357

KDI ELECTRONICS, INC.
Pyrofilm & Engelmann Divisions

60 S. JEFFERSON ROAD, WHIPPANY, N.J. 07981•(201) 887-8100•TWX (710) 986-7220•FAX (201) 887-4645•800-221-0357

KELVIN

Precision Wire-wound Resistors, Power Resistors & Resistor Networks

Kelvin is a pioneer in the field of very high stability, close tolerance, precision wire-wound resistors. Resistors shown represent only part of the broad Kelvin line. Complete catalog data is available on request.

HIGH RELIABILITY "HRL" SERIES

Kelvin's "HRL" Series was generated after years of experience on the Polaris, Gemini, Apollo and other important high reliability missile and space programs. Kelvin has combined the many and varied parameters of these programs into a single resistor series, designed to meet the stringent high reliability requirements of many of today's military and commercial systems.

Kelvin's reliability goal, through the design and controls of the "HRL" Series resistor and the use of acceptance inspection procedures, was to produce precision wire-wound resistors having failure rates better than .0005%/1000 hours at a 90% confidence level. Present level is .00064%/1000 hours at a 60% confidence level.

All "HRL" resistors have a documented history. This includes traceability from the spool analysis of the resistance wire, through each phase of the production operation to the finished product. Each resistor is screened to eliminate INFANT MORTALITY. This consists of a 100 hour burn in at full rated power at 125°C and a short time overload at twice the rated power. Other tests are conducted as outlined in Bulletin HR 02449, which presents the complete procedure and methods approach for production of "HRL" resistors.

KELVIN TYPE	WATTAGE*	RESISTANCE MAXIMUM**	DIA. ± .015	LENGTH ± .032	MAXIMUM VOLTS	LEAD DIA.	MIL-R-39005
HRL-20	.08	25K	.187	.375	150 V	#22	
HRL-991	.125	150K	.250	.312	150 V	#22	RBR-71
HRL-1009	.125	316K	.250	.295	150 V	#22	RBR-75
HRL-1097	.125	90K	.193†	.500	150 V	#22	RBR-74
HRL-417	.125	220K	.250	.343	150 V	#20	RBR-56
HRL-467	.150	332K	.250	.500	200 V	#20	RBR-55
HRL-334	.200	500K	.375	.500	300 V	#20	
HRL-812	.250	562K	.250	.750	300 V	#20	RBR-54
HRL-815	.333	1.1 meg	.375	.750	300 V	#20	RBR-53
HRL-1100	.500	600K	.312	.812	300 V	#20	RBR-76
HRL-254	.500	1.21 meg	.375	1.000	600 V	#20	RBR-52
HRL-27	.750	6.42 meg	.500	1.000	600 V	#20	RBR-57

† ± .010 Tolerance

SUB-MINIATURE TYPES

TOLERANCES: 1% through .005% available on most types and resistance values.

TEMPERATURE COEFFICIENT: ±20 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.

COMBINATION AXIAL-RADIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.
315-PAR	.05	100K	.080	.375	100	#24
303-PAR	.05	100K	.125	.250	100	#24
162-PAR	.10	200K	.125	.375	100	#22
158-PAR	.15	700K	.187	.375	100	#22

AXIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. 1/64	LENGTH 1/32	MAX. VOLTS	LEAD DIA.
EP-00	.05	100K	.080	.375	100	#24
1788-P	.04	50K	.100	.225	75	#24
460-P	.06	100K	.100	.281	100	#24
301-P	.05	175K	.125	.250	100	#24
EP-01	.10	200K	.125	.375	100	#22
470-P	.10	500K	.160	.500	100	#24
EP-20	.15	700K	.187	.375	200	#22
304-P	.15	500K	.250	.250	100	#22
430-P	.15	600K	.250	.312	100	#20
417-P	.20	700K	.250	.343	100	#20

PRINTED CIRCUIT TYPES

TOLERANCES: 1% through .005% available on most types and resistance values.

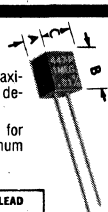
TEMPERATURE COEFFICIENT: ±20 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.



HIGH DENSITY PACKAGING

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	SIZE ±.020			MAX. VOLTS	LEAD DIA.	LEAD SPACING
			A	B	C			
446-P	.250	2 Meg.	.140"	.270"	.500"	100	#20	.250
447-P	.125	1 Meg.	.140"	.270"	.250"	100	#20	.125

STANDARD PRINTED CIRCUIT

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.	LEAD SPACING
252-P	.15	375K	.250	.250	100	#22	.150
176-P	.15	450K	.250	.312	100	#22	.150
178-P	.20	650K	.250	.400	200	#22	.150
277-P	.20	700K	.250	.437	200	#22	.150
471-P	.25	750K	.250	.500	300	#22	.150
177-P	.30	850K	.312	.500	400	#22	.200
179-P	.30	1.1M	.375	.500	400	#22	.200
155-P	.50	3.0M	.500	.625	400	#20	.250

HIGH STABILITY SERIES

LONG TERM STABILITY: .003% resistance change per year maximum under conditions involving normal equipment and room temperature variations.

TOLERANCES: 1% through .005% available on most types and resistance values.

TEMPERATURE COEFFICIENT: ±10 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.

AXIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX**	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.
OA	.15	560K	.187	.375	300	#22
OB	.25	1.2 Meg.	.250	.500	300	#22
OC	.33	2.2 Meg.	.250	.750	400	#22
OD	.33	2.4 Meg.	.375	.500	300	#20
OE	.50	3.6 Meg.	.375	.828	400	#20
OF	.60	5.2 Meg.	.375	1.000	400	#20
OG	.50	4.0 Meg.	.500	.500	400	#20
OH	.60	6.4 Meg.	.500	.625	400	#20
OJ	1.00	8.0 Meg.	.500	1.000	800	#20
OK	1.50	10.0 Meg.	.500	1.500	900	#20
OL	1.75	10.5 Meg.	.500	1.750	900	#20
OM	2.00	13.0 Meg.	.500	2.000	1200	#20

STANDARD TYPES

TOLERANCES: 1% through .005% available on most types and resistance values.

TEMPERATURE COEFFICIENT: ±20 ppm/°C standard.

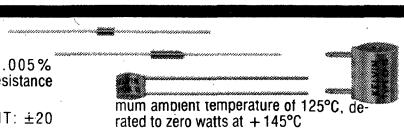
T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.

*All Lug Types available with #20 gauge radial leads (except EP-22) by specifying letter "R" after type number.



LUG and RADIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. 1/32	LENGTH 1/32	MAX. VOLTS	TERMINAL TYPE*	MOUNTING HOLE
EP-22	.10	350K	.312	.250	100	#24 x 2" (Wire Lead)	#2
346-P	.25	1.0M	.375	.440	150	Lug	#4
264-P	.33	1.5M	.375	.500	300	Lug	#4
EP-09	.50	4.0M	.500	.500	400	Lug	#6
263-P	.50	4.0M	.625	.500	400	Lug	#6
EP-15	.60	5.0M	.500	.625	400	Lug	#6
EP-16	1.00	6.5M	.500	1.000	800	Lug	#6
EP-30	1.50	10.0M	.500	1.500	900	Lug	#6

AXIAL-WIRE LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.
EP-21	.25	1.5 Meg.	.250	.500	400	#22
467-P	.25	1.5 Meg.	.250	.500	400	#20
EP-23	.33	2.75 Meg.	.250	.750	400	#22
812-P	.33	2.75 Meg.	.250	.750	400	#20
363-P	.40	3.0 Meg.	.250	1.000	400	#22
334-P	.33	3.0 Meg.	.375	.500	300	#20
815-P	.50	4.5 Meg.	.375	.750	600	#20
EP-24	.50	4.5 Meg.	.375	.828	600	#20
EP-25	.50	5.0 Meg.	.500	.500	400	#20
254-P	.60	6.5 Meg.	.375	1.000	800	#20
EP-26	.60	8.0 Meg.	.500	.625	400	#20
EP-27	1.00	10.0 Meg.	.500	1.000	800	#20
EP-28	1.50	12.0 Meg.	.500	1.500	900	#20
366-P	1.75	13.0 Meg.	.500	1.750	900	#20
EP-29	2.00	15.0 Meg.	.500	2.000	1200	#20

CATALOG #763 COVERS ALL PRODUCTS SHOWN ON THIS PAGE

KELVIN 5919 NOBLE AVENUE, VAN NUYS, CALIFORNIA 91411 TELEPHONE (818) 782-6662

FAST RISE TIME APPLICATIONS

"RT" style resistors provide exceptionally high frequency performance, in addition to the other recognized advantages of wire-wound resistors. "RT" resistors can be supplied with rise times as low as 100 nanoseconds (from 10% to 90% of peak pulse amplitude at 100 KC), depending on resistance values and physical configurations. See Catalog #763

TOLERANCES: 1% through .005% available on most types and resistance values.

TEMPERATURE COEFFICIENT: ±20 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.

AXIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. .1/64	LENGTH .1/32	MAX. VOLTS	LEAD DIA.
RTA	15	560 K	187	.375	300	#22
RTB	25	1.2 Meg	250	500	400	#22
RTC	33	2.2 Meg	250	750	400	#22
RTD	33	2.4 Meg	375	500	300	#20
RTE	50	3.6 Meg	375	.828	400	#20
RTF	60	5.2 Meg	375	1.000	400	#20
RTG	50	4.0 Meg	500	500	400	#20
RTH	60	6.4 Meg	500	.625	400	#20
RTJ	100	8.0 Meg	500	1.000	800	#20
RTK	150	10.0 Meg	500	1.500	900	#20
RTL	175	10.5 Meg	500	1.750	900	#20
RTM	200	13.0 Meg	500	2.000	1200	#20

SERIES KM MOLDED, POWER RESISTORS

Series KM are general purpose, reliable power resistors designed to be used where heat sinks are not available or not desired. These resistors are extremely stable for their size as compared to film types. Series KM are considered to have the lowest dollar per watt cost of precision resistors. Send for Bulletin K-1.

TOLERANCES:

KM025, KM050, KM100—.1% thru 5%
KM200 thru KM1000—.05% thru 5%

TEMPERATURE COEFFICIENT:
(Per Degree Centigrade)

±20 PPM (170 ohms and above)
±30 PPM (10 to 170 ohms)
±50 PPM (1 to 9.99 ohms)
Below one ohm—contact factory

T.C.s to 5 PPM/°C available depending on size and value.

NON-INDUCTIVE STYLES: Reduce resistance values by approximately 50%; derate maximum working voltage by 30%. Add "N" to part number. Example: KMN025.

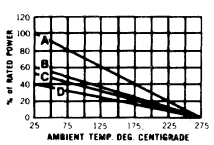
KELVIN PART NUMBER	WATTAGE @ 25° C	DC Working Voltage	Maximum Resistance	SIZE and TOLERANCES Length	Diameter	Lead Length (±0.125)	Lead Diameter (AWG)	Equivalent Military Styles MIL-R-26E
KM025	0.40	35	2.5K	0.250±.015	0.078±.015	1.5 in.	24	
KM050	0.75	50	3.9K	0.312±.015	0.078±.015	1.5 in.	24	
KM100	1.0	75	7.3K	0.422±.015	0.093±.015	1.5 in.	24	RW70
KM200	2.0	200	12K	0.490±.015	0.150±.015	1.5 in.	22	
KM250	2.5	200	16K	0.500±.031	0.218±.015	1.5 in.	20	
KM300	3.0	150	18K	0.560±.031	0.187±.015	1.5 in.	20	RW79
KM350	4.0	200	29K	0.625±.031	0.250±.015	2.0 in.	18	
KM500	5.0	400	62K	0.875±.031	0.312±.031	2.0 in.	18	RW74
KM700	7.0	600	98K	1.218±.031	0.312±.031	2.0 in.	18	
KM1000	10.0	1000	16K	1.780±.031	0.375±.031	2.0 in.	18	RW78

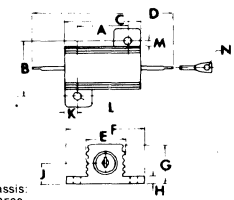
SERIES KC CHASSIS MOUNT POWER RESISTORS

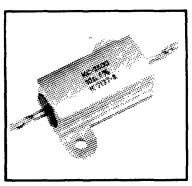
DERATING CURVES

Derating is required for reduced chassis mounting area and high ambient temperatures

Curves:







A — When mounted on proper aluminum chassis:
48 sq. inches 0.040 aluminum for KC500 and KC1000
70 sq. inches 0.040 aluminum for KC2500
144 sq. inches 0.040 aluminum for KC5000

B — Unmounted KC500 and KC1000
C — Unmounted KC2500
D — Unmounted KC5000

Designed to provide maximum heat dissipation through heat sink and finned case configuration. Ideally suited where large amounts of power must be dissipated and small size is important. Capable of maintaining their precision tolerance in wattage ratings up to 50 watts. Send for Bulletin K-3.

TOLERANCES: 0.05% through 5.0%.

TEMPERATURE COEFFICIENT:
(Per Degree Centigrade)

TC	KC500	KC1000	KC2500	KC5000
±50PPM	1 Ω to 9.9 Ω	1 Ω to 9.9 Ω	1 Ω to 9.9 Ω	1 Ω to 9.9 Ω
±30PPM	10 Ω to 25 Ω	10 Ω to 99 Ω	10 Ω to 170 Ω	10 Ω to 500 Ω
±20PPM	26 Ω to 20K	100 Ω to 30K	171 Ω to 75K	501 Ω to 200K

Below one ohm—contact factory.

T.C.s to 5 PPM/°C available depending on size and value.

NON-INDUCTIVE STYLES: Reduce resistance values by approximately 50%; derate maximum working voltage by 30%. Add "N" to part number. Example: KCN500.

KELVIN PART NUMBER	Watts	DC Working Voltage	Max. Res.	SIZE and TOLERANCES A ±.005	B ±.005	C ±.031	D ±.062	E ±.015	F ±.015	G ±.015	H ±.010	J ±.010	K ±.10	L ±.005	M ±.015	N ±.005	Mtg. Screw Size	MIL-R-18546
KC500	7.0	165	20K	0.444	0.490	0.600	1.125	0.334	0.646	0.320	0.065	0.133	0.078	0.093	0.078	0.050	#2	RE60
KC1000	12	275	30K	0.562	0.625	0.750	1.375	0.425	0.812	0.400	0.075	0.190	0.093	0.093	0.093	0.086	#2	RE65
KC2500	25	560	75K	0.719	0.781	1.062	1.938	0.525	1.080	0.550	0.088	0.280	0.171	0.125	0.115	0.086	#4	RE70
KC5000	50	1300	200K	1.563	0.844	1.968	2.781	0.615	1.150	0.615	0.085	0.307	0.203	0.125	0.115	0.086	#4	RE75

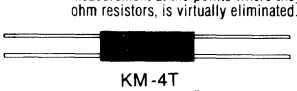
SERIES KM-4T & KC-4T POWER RESISTORS

KELVIN FOUR TERMINAL POWER RESISTORS provide low resistance and close tolerance capabilities to users who require accurate measurements in tightly designed circuits. The two voltage (sense) leads will yield a very precise measurement at the points where they join the current leads. Lead resistance, which plays a predominant role in low ohm resistors, is virtually eliminated.

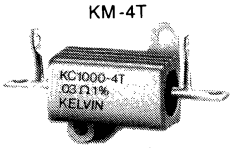
GENERAL FEATURES

TOLERANCES:	1% through 10%
RESISTANCE RANGE:	.001 ohms and up
TEMPERATURE COEFFICIENT:	.1Ω to 1Ω ±90 PPM/°C .05Ω to <.1Ω ± 150 PPM/°C Below .05 ohm—Check Factory
TEMPERATURE RANGE:	−55°C to +275°C
DIELECTRIC STRENGTH:	1000 VRMS all styles except KC5000-4T at 2500 VRMS
LEADS:	Tinned copperweld

See KM & KC Series this page for additional specifications.



KM-4T



KC-4T

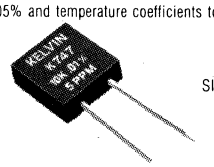
KELVIN PART NUMBER	WATTAGE RATING	DC WORKING VOLTAGE	MINIMUM RESISTANCE IN OHMS 10%	5%	3%	1%
KM300-4T	3W	150	.003	.005	.01	.02
KM500-4T	5W	400	.002	.003	.0075	.015
KC1000-4T	12W	275	.003	.005	.01	.02
KC2500-4T	25W	560	.002	.003	.0075	.015
KC5000-4T	50W	1300	.001	.002	.005	.01

K747 WIREWOUND RESISTOR

Lead Size:	#22 (.025) solder-coated brass
Lead Spacing ℄ to ℄:	.150" (±.010)
Wattage:	.3 watts
Voltage:	200 volts
Resistance Range:	.5Ω to 400K
Resistance Tolerance:	1% thru .005%
Temperature Coefficient:	±5 PPM standard (0–85°C)
TC Tracking:	±3PPM/°C Typical—Available to ±1PPM/°C (Value dependent)
Stability:	25PPM/year
Rise Time:	25 nanoseconds (value dependent)
Noise:	Not measureable on commercially available equipment
Environmental:	Exceeds all requirements of MIL-R-39005

Designed specifically to interchange with film resistors of same physical configuration. Performance characteristics show the K747 series to be superior in almost all instances. Send for Bulletin K747.

For closer tolerances to .005% and temperature coefficients to 1 PPM (0 to 60°C referenced to 25°C), request Bulletin K746.



SIZE: 320±.020 H,
.295±.010 L,
.100±.015 W.
Or .100±.010W (specify K746)

Kelvin pioneered the close tolerance, close temperature coefficient and excellent long term stability wire-wound resistor. State-of-the-art manufacturing techniques and superior testing capabilities yield the ultimate in quality at a competitive price. Please contact your nearest Kelvin representative or the factory direct for further details.

KELVIN 5919 NOBLE AVENUE, VAN NUYS, CALIFORNIA 91411 (818) 782-6662, TELEX: 651417

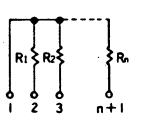
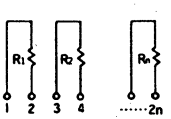
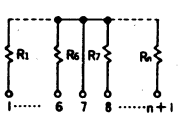
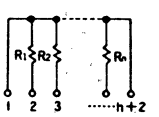
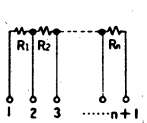
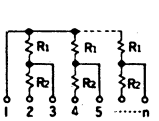
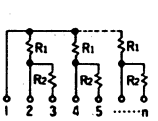
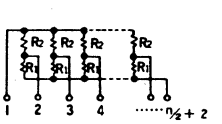
KOA SPEER ELECTRONICS, INC.

You Can't Resist KOA!

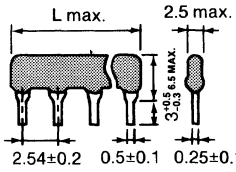
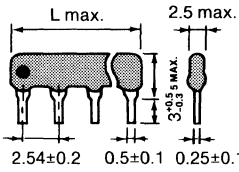
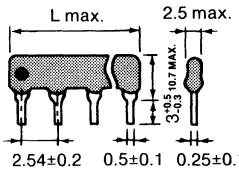
Fixed Resistors

Parameter	Metal Film					Low Power		Carbon Film	
	Precision	Semi-Precision	Ultra Precision	MIL	Multi-Rated				
Type Designation	MF	ML	H	RN	SN2C	MO	SPR	CF	RDS2
Wattage	1/8-1	1/8-1/2	1/10-1/2	1/8-1/4	1/8-1/4	1-3	1-5	1/8-1	1/8-1/4
Temp. Coefficient	25-100	200	5-25	50 & 100	50 & 100	200	150-600	—	—
Resist. Toler. (%)	0.5 & 1.0	2.0 & 5.0	0.05-1.0	0.5 & 1.0	1.0	2.0 & 5.0	2.0 & 5.0	2.0 & 5.0	2.0 & 5.0
Oper. Temp. Range	−55/+155°C	−55/+155°C	−55/+155°C	−55/+165°C	−55/+155°C	−55/+225°C	−55/+200°C	−55/+155°C	−55/+155°C
Short Time Overload (%)	0.3	0.5	0.06	0.05(C) 0.1(D)	0.05	0.5	1.0	0.4	0.2
Temp. Cycling	0.3	0.5	0.04	0.1	0.15	0.5	1.0	0.5	.15
Load Life (%)	1.0	1.5	0.3	0.5(C) 1.0(D)	1.0	2.0	3.0	2.0	1.5
Moisture Resistance	1.0	1.5	0.4	0.3(C) 1.0(D)	1.0	2.0	3.0	2.0	1.0
Voltage Coefficient	5ppm/V	10ppm/V	5ppm/V	5ppm/V	5ppm/V	10ppm/V	10ppm/V	15ppm/V	15ppm/V
Failure Rate/1000 Hrs.	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-3}$	$<10^{-3}$	$<10^{-4}$	$<10^{-4}$
Marking	Clr. Band (5)	Clr. Band (4)	Alpha	Alpha	Clr. Band (5)	Clr. Band (4)	Clr. & Alpha	Clr. Band (4)	Clr. Band (4)

Resistor Networks

CIRCUIT SYMBOL		NON MARKING	S	C	D
CIRCUIT CONSTRUCTION		 $R_1=R_2\cdots=Rn$ (n=3 to 13)	 $R_1=R_2\cdots+Rn$ (n=2 to 7)	 $R_1=R_2\cdots+Rn$ (n=4 to 12)	 $R_1=R_2\cdots=Rn$ (n=3 to 12)
MARKING	RKC	10KΩJ	[4]S10KΩJ	10KΩJ	10KΩJ
	RKL	103J	S103J	C103J	D103J
	RKH	103J	[4]S103J	[6]C103J	[6]D103J
CIRCUIT SYMBOL		**A**	**T**	**E**	**R**
CIRCUIT CONSTRUCTION		 $R_1=R_2\cdots=Rn$ (n=3 to 13)	 (n=4 to 12)	 (n=4 to 12)	 (n=6 to 18)
MARKING	RKC	[8]A103J	[8]T472/103J	[8]E472/103J	[8]R221/331J
	RKL	A103J	T472/103J	E472/103J	R221/331J
	RKH	[8]A103J	[8]T472/103J	[8]E472/103J	[8]R221/331J

SEE OUR AD IN CAPACITORS SECTION

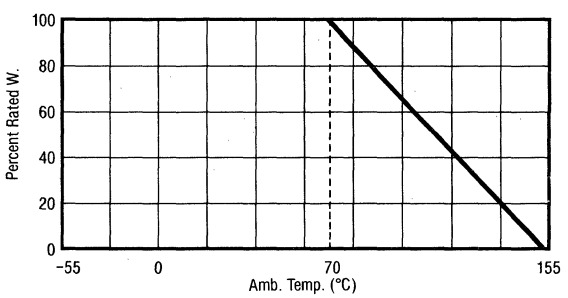
TYPE	RKC		RKL	RKH
DIMENSIONS				
NO. of pins	L (mm)	L (mm)	L (mm)	L (mm)
4	10.8	10.16	—	10.8
5	13.2	12.7	12.7	13.2
6	15.8	15.24	15.24	15.8
7	18.3	17.78	17.78	18.3
8	20.9	20.32	20.32	20.9
9	23.4	22.86	22.86	23.4
10	25.9	25.4	25.4	25.9
11	28.5	—	27.94	—
12	31.0	—	—	—
13	33.6	—	—	—
14	36.1	—	—	—

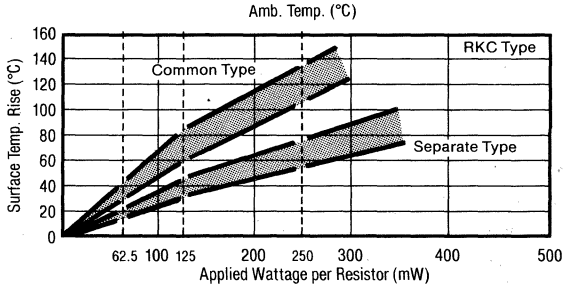
Thick Film Resistor Networks

	CIRCUIT	ONE ELEMENT	MAX. POWER IN ONE PACKAGE 4 PIN	5 PIN	6 PIN	7 PIN	8 PIN	9 PIN	10 PIN	11 PIN	12 PIN	13 PIN	14 PIN	MAX. WORKING V.	MAX. OVERLOAD V.	RATING AMBIENT TEMP.	RESISTANCE RANGE	RESISTANCE TOLERANCE G SERIES
RKC POWER RATING (W)	Bn	0.125	0.375	0.5	0.625	0.75	0.875	1	1.05	1.15	1.25	1.35	1.45	200V	280V	70°C	22Ω~ 10MΩ	G – J
	nA											—						
	nR		—		—		—		—		—	1.35	—					
	BnC																	
	nE																	
	nT																	
	BnD			0.375	0.5	0.625	0.75	0.875	1	1.125	1.25	—	1.45					
	BnS	0.25	0.5	—	0.75	—	1	—	1.05	—								
RKL POWER RATING (W)	Bn	0.1	—	0.4		0.6	0.7	0.8	0.84	0.92	—			150V	200V	70°C	22Ω~ 1MΩ	G – J
	nA																	
	nR																	
	BnC				—		—		—									
	nE																	
	nT																	
	BnD			0.3	0.4	0.5	0.6	0.7	0.8	0.9								
	BnS	0.11		—	0.33	—	0.44	—	0.55	—								
RKH POWER RATING (W)	Bn	0.25	0.525	0.7	0.875	1.05	1.25	1.4	1.5	—	—			250V	350V	70°C	56Ω~ 10MΩ	G – J
	nA																	
	nR		—															
	BnC				—		—		—									
	nE																	
	nT																	
	BnD				0.875		1.25		1.5									
	BnS	0.5	0.7	—	1.05	—	1.4	—										

Characteristics

Requirements			Characteristics
Max. Resistance Changes	Operating Temp. Range		-55°C ~ +155°C
	Temp. Coefficient		±200ppm/°C
	Short Time Overload		±(0.5%+0.05Ω)
	Insulation Resistance		Over 10^4MΩ
	Dielectric Withstanding V.		±(0.5%+0.05Ω)
	Terminal Strength	Pull Test	±(0.5%+0.05Ω)
		Bend Test	3 Cycle and Over
	Resistance to Soldering Heat		±(0.5%+0.05Ω)
	Solderability		Over ¾
	Life (at Elevated Ambient Temp.)		±(3 %+0.05Ω)
	Temperature Cycling		±(0.5%+0.05Ω)
	Moisture Resistance		±(1%+0.05Ω)≦100KΩ
	Load Life		±2% >100KΩ
Resistance To Solvents	Solvents	Freon TE Tri-chloroethylene 1-1-1 Tri-chloroethylene	No evidence of mechanical damage

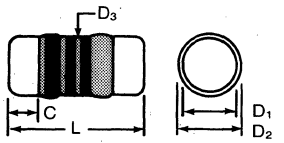




SEE OUR AD IN CAPACITORS SECTION

MELF

Appearance – Dimension



Coating Color: RD – Ivory, RN – Blue, CC – Brown

Style	Dimension mm				
	L	C	D_1	D_2	D_3
RD41B2B	3.5±0.2	0.5min.	1.45±0.1	1.55max.	0.1max.
RN41C2B					
CC12					
RD41B2E	5.9±0.2	0.5min.	2.2±0.1	$2.2^{+0.2}_{-0.1}$	0.15max.
RN41C2E					
CC25					

Rating

Style	Power Rating	Max. Working V.	Max. Overload V.	Tolerance	Resistance Range	Rating Ambient Temp.
RD41B2B	0.125W	200V	400V	J (E 24)	2.2Ω~ 1MΩ	70°C
RN41C2B		150V	300V	F (E 96)	10 Ω~510KΩ	
RD41B2E	0.25W	300V	600V	J (E 24)	1 Ω~ 2.2MΩ	
RN41C2E		250V	500V	F (E 96)	10 Ω~510KΩ	

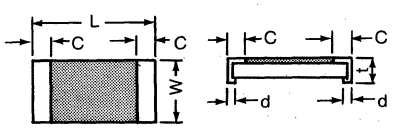
Style	Max. Current	Resistance	Rating Ambient Temp.
CC12	2A	less than 10mΩ	70°C
CC25	5A		

Characteristics

Requirements		Characteristics						
		RD						RN41C2E
Operating Temp. Range		-55~155°C						
Temp. Coefficient (ppm/°C)		Style / T.C.R.	+350~0	0~-450	0~-700	0~-1000	0~-1300	±50
		RD41B2B	2.2Ω~10Ω	11Ω~47KΩ	51KΩ~100KΩ	110KΩ~330KΩ	360KΩ~1MΩ	
		RD41B2E	1Ω~2Ω	2.2Ω~100KΩ	110KΩ~330KΩ	360KΩ~1MΩ	1.1MΩ~2.2MΩ	
	Short Time Overload	±(1%+0.05Ω)						±(0.5%+0.05Ω)
	Resistance to Soldering Heat	±(1%+0.05Ω)						±(0.5%+0.05Ω)
	Temperature Cycling	±(1%+0.05Ω)						±(0.5%+0.05Ω)
	Moisture Resistance	±5%						±(1 %+0.05Ω)
	Load Life	±2%						±(1 %+0.05Ω)
	Resistance to Solvents	No evidence of mechanical damage.						

RM Flat Chip Resistor

Appearance – Dimension



Style	Dimension mm				
	L	W	C	d	t
RM73B2B	$3.2^{+0.05}_{-0.25}$	$1.6^{+0.05}_{-0.15}$	0.5±0.3	0.15±0.15	0.57±0.08
RM73B2A	2±0.2	1.25±0.2	0.35±0.2	0~0.25	0.45±0.1

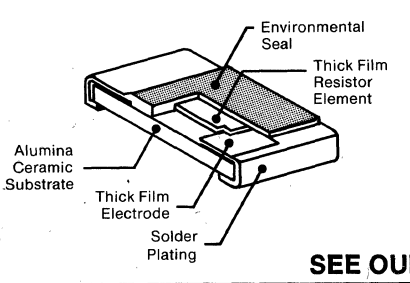
Rating

Style	Power Rating	Max. Working V.	Max. Overload V.	Operating Temp. Range	Resistance Range	Resistance Tolerance
RM73B2B	0.125W	200V	400V	-55°C~125°C	10Ω~1MΩ	G-J
RM73B2A	0.1W	150V	300V	-55°C~125°C		

Style	Current Rating	Max. Surge Current	Resistance	Operating Temp. Range
RM73B2B-Z RM73B2A-Z	2A	10A	50mΩ	-55°C~125°C

Characteristics — Structure – Material

Requirements	Characteristics
Temp. Coefficient	±250 ppm/°C
Terminal Strength	±(1%+0.1Ω)
	over.1kg/mm²
Resistance to Soldering Heat	±(1%+0.05Ω)
Short Time Overload	±(2%+0.05Ω)
Intermittent Overload	±(2%+0.01Ω)
Temperature Cycling	±(1%+0.2Ω)
Load Life	±(3%+0.1Ω)
Moisture Resistance	±(3%+0.1Ω)
Electrode Solderability	95%



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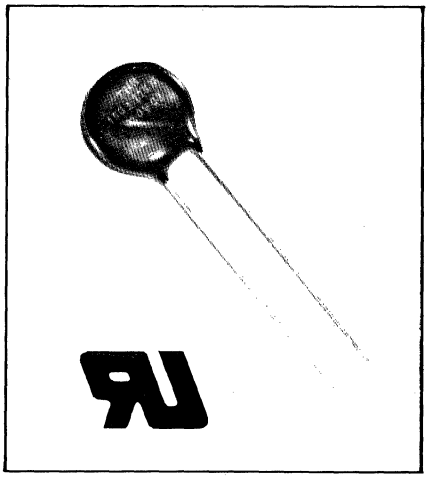
HIGH PERFORMANCE METAL OXIDE VARISTORS

Applications:

- Telephone Relays
- Telephone Solid State Circuits
- Communication Equipment
- Relay Coils
- Traffic Controllers
- Computer Equipment
- Railroad Circuitry
- Numerical Control
- Test Equipment
- Instrumentation
- Solid State Motor Control
- Television
- Copier Machines
- Calculators
- Contact Arc Suppression
- Solid State Relays/Timers
- Power Supplies
- Solid State Security Systems
- Medical Equipment
- Fire Alarms



Specifications:

Operating ambient temperature	−40°C ~ +85°C (−40°F ~ +185°F)
Operating varistor surface temperature	+115°C max. (+239°F max.)
Storage temperature range	−50°C ~ +125°C (−58°F ~ +257°F)
Max. varistor temperature coefficient	−0.05% /C
UL recognition	Standard #1414, File #E65426 #1449, File #E95427
Insulation resistance	Over 1,000 Megaohms
Hipot encapsulation	2500 VDC for 1 minute
Impulse response time	0.05 μ seconds or less

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- Metal Oxide Varistors
- Switching Power Supply Capacitors

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K
kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L
LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microforad
MHz megahertz
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOSIGT metal-oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM nuclear instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLL phased lock loop
PPI plan position indicator
PROM programmable read only memory
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

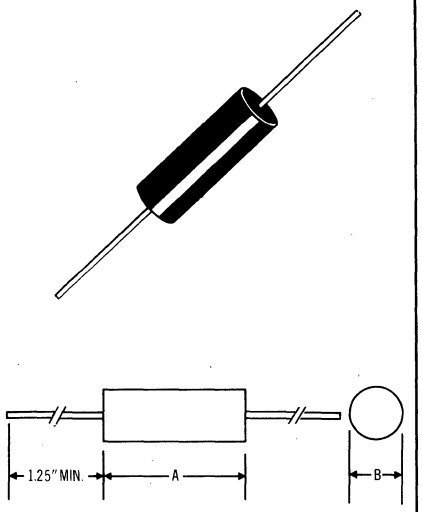
Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

ULTRA PRECISION / FASTEST DELIVERY MEISSNER

ULTRA PRECISION WIREWOUND RESISTORS

STYLE	MIL R 93 STYLE	WATTAGE	NOMINAL DIMENSIONS A ± .062	NOMINAL DIMENSIONS B ± .062	MAX OHMS
AX-01		.1	.188	.093	75 K
AX-1		.1	.250	.125	150 K
AX-1A		.1	.312	.150	175 K
AX-2		.2	.375	.150	200 K
AX-2F		.2	.375	.187	250 K
AX-4	RB 56	.25	.312	.250	400 K
AX-5	RB 55	.33	.500	.250	500 K
AX-6		.33	.625	.250	650 K
AX-7	RB 54	.5	.750	.250	1 MEG
AX-8	RB 53	.75	.750	.375	2 MEG
AX-9	RB 52	1.0	1.000	.375	3 MEG
AX-10	RB 57	1.25	1.000	.500	5 MEG
AX-11	RB 58	1.5	1.500	.500	7.5 MEG
AX-12	RB 59	2.0	2.000	.500	10 MEG

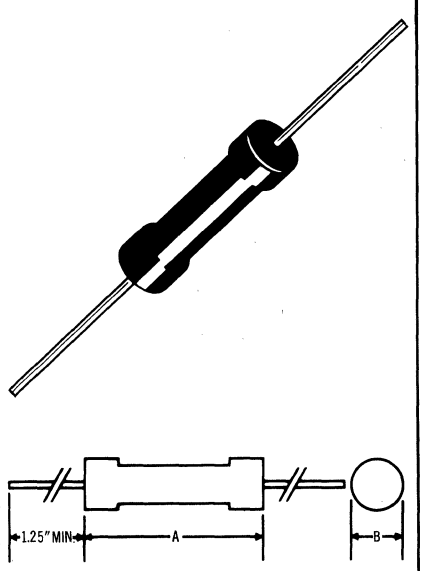


SPECIFICATIONS

TOLERANCE: .1% to .001%
WATTAGE: .1 Watt to 2.0 Watts
STABILITY: .0005% per year
TEMPERATURE COEFFICIENT: ±2 ppm/°C above 10 Ω
±15 ppm/°C below 10 Ω
WINDINGS: Non inductive
CONSTRUCTION: Encapsulated Epoxy
ADDITIONAL FEATURES: Tracking T.C. ±.5 ppm/°C. Shunts as low as .001 Ω. Special T.C. 0 to +6000 ppm/°C. Low capacitance ±1 pF Hermetic sealing available

SILICONE COATED POWER WIREWOUND RESISTORS

STYLE	MIL R 26 TYPE	WATTAGE RATING U 275°C	WATTAGE RATING V 350°C	NOMINAL DIMENSIONS A ± .062	NOMINAL DIMENSIONS B ± .031	MAX OHMS
MI-1A	RW 70	1.0	1.25	.406	.094	10 K
MI-1B		1.1	1.3	.531	.094	15 K
MI-2		4.0	5.5	.625	.250	47 K
MI-2A		3.0	3.75	.812	.188	42 K
MI-2B	RW 79	3.0	3.75	.560	.188	24 K
MI-2C	RW 69	3.0	3.75	.500	.218	32 K
MI-5	RW 74	5.0	6.5	.875	.312	95 K
MI-7		7.0	9.0	1.185	.312	154 K
MI-10	RW 78	10.0	13.0	1.780	.375	273 K



SPECIFICATIONS

TOLERANCE: 5%, 1% closer tolerances available to .05%
WATTAGE: 1 Watt to 13 Watts
STANDARD RESISTANCE VALUES: From .1 Ω to maximum values as stated in table. Values as low as .001 Ω and 4 terminal construction available
COATING: Special silicone coating withstands moisture, salt water immersion and cleaning solvents. It will withstand operation from −65°C up to 400°C
LEADS: Tinned copperweld. Length 1.25" minimum
TEMPERATURE COEFFICIENT: ±20 ppm/°C 500 Ω up
CONSTRUCTION: Welded Terminations
ADDITIONAL FEATURES: Non inductive windings. Other sizes and wattages. Special Temperature Coefficients up to +6000 ppm/°C

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INDUSTRIAL/CONSUMER GROUP

Mepco/ Electra Series	Category	Body Type	Resistance Range (ohms)	Tolerance Range (±%)	Temperature Coefficient Range (PPM/°C)	Power Range @ 70°C (watts)	Max. Voltage Range (watts)
SPACE MISER®	GENERAL PURPOSE	METAL FILM Conformal-Coated	.22Ω-5.1 Meg 10Ω-5.1 Meg	5% 1%	±100 ±100	⅓ ⅓	200 200
CR	GENERAL PURPOSE	CARBON FILM Conformal-Coated	1Ω-1 Meg	5%	−200 to +500, ±300	¼ ½	250-350
SFR	GENERAL PURPOSE	METAL FILM Conformal-Coated	1Ω-10 Meg	1%-2% 5%	±200 and ±100	¼ ½	250-350
SPR	STANDARD PRECISION	METAL FILM Conformal-Coated	10Ω-250 Meg	0.5%-1.0%	±50 to ±150	¼-1	350-500
UPR & MATCHED SETS	ULTRA PRECISION	METAL FILM Conformal-Coated	51.1Ω-499K	.025%-1%	±2 to ±25	@ 85°C 1/20 ⅛-¼, ⅓	200-300
MIL Style	**MIL Specs**	**INDUSTRIAL/STANDARD MILITARY**					
RL	MIL-R-22684	METAL FILM Conformal-Coated	4.3Ω-470K	2% 5%	±100	¼-½	250-350
RN	MIL-R-10509	METAL FILM Conformal-Coated	10Ω-4M	0.1%-1%	±25 to ±100	1/10-½	200-350
		ESTABLISHED RELIABILITY (MIL)					
RLR	MIL-R-39017	METAL FILM Conformal-Coated	4.2Ω-1.33M	1%-2%	±100	¼-½	250-350
RNC	MIL-R-55182	METAL FILM Conformal-Coated	10Ω-3.01M	0.1%-1%	±25 to ±100	@ +125°C 1/20-¼	200-300
RNR Hermetic	MIL-R-55182	METAL FILM Hermetic Seal	10Ω-1M	0.1%-1%	±25 to ±50	@ +125°C 1/10-½	200-350

SMD® RESISTORS

Columbia Road, Morristown, NJ 07960 (201) 539-2000 TWX: 710-986-7437 Telex: 136461

SERIES 9C COMMERCIAL CHIP RESISTORS

Mepco/ Electra Series	Resistance Range	Tolerance	Temperature Coefficient (ppm/°C)	Power Rating (70°C)	Maximum Voltage	Dimensions (mm)		
						Length	Width	Thickness
9C1206	10Ω-10MΩ	±1% ±5% ±10%	±100 ±200	⅛ Watt	200V (R.M.S.)	3.2 ±0.15	1.6 ±0.15	0.6 ±10

SERIES RM ESTABLISHED RELIABILITY CHIP RESISTORS (MIL-R-55342)

Mil-Part Part Number Style	Resistance Range	Tolerance	Temperature Coefficient (ppm/°C)	Power Rating (70°C)	Maximum Voltage	Dimensions (Inches)		
						Length	Width	Thickness
M55342/6 RM0705	100Ω-500Ω 100Ω-1MΩ 100Ω-1MΩ	±1% ±5% ±10%	±100 ±300 ±300	100mw	50VDC	.075 +.025 −.005	.050 +.010 −.005	.010 Min. .040 Max.
M55342/3 RM1005	100Ω-500KΩ 100Ω-1MΩ 100Ω-1MΩ	±1% ±5% ±10%	±100 ±300 ±300	100mw	40VDC	.100 +.025 −.005	.050 +.010 −.005	.010 Min. .040 Max.
M55342/4 RM1505	100Ω-1MΩ 100Ω-1MΩ 100Ω-1MΩ	±1% ±5% ±10%	±100 ±300 ±300	150mw	40VDC	.150 +.025 −.005	.050 +.010 −.005	.010 Min. .040 Max.

SERIES 9B PRECISION MELF RESISTORS

Mepco/ Electra Series	Resistance Range	Tolerance	Temperature Coefficient (ppm/°C)	Power Rating (70°C)	Maximum Voltage	Dimensions (Inches)	
						Length	Dia.
9B1406	.22-10M	.15-5%	15, 25, 50	.25W	200V	.142 Max.	.055 Max.

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NETWORKS

Columbia Road, Morristown, NJ 07960 (201) 539-2000 TWX: 710-986-7437 Telex: 136461

SERIES 9S FIXED RESISTOR NETWORKS SINGLE IN LINE PACKAGE

Mepco/Electra Series	Resistance Range	Tolerance	Temperature Coefficient (ppm/°C)	Circuits Available	Pin Styles Available
9S06, 08, 10	22Ω-1MΩ	±2% ±1%*	±200 ±100*	Terminator Pull Up/Pull Down	6, 8, and 10 Single in Line
9S06, 08, 10	22Ω-1MΩ	±2% ±1%* ±5%*	±200	Dual Terminator Circuit	6, 8, and 10 Single in Line

SERIES RZ040, RZ050, RZ060, RZ070, RZ080, RZ090, RZ030 MILITARY RESISTOR NETWORKS

Military Part Number	Resistance Range	Tolerance	Temperature Coefficient (ppm/°C)	Circuits Available	Pin Styles Available
M83401 RZ040, 050, 060	14.7Ω-1MΩ	±1% ±2% ±5%	±100 ±300	Terminator Pull Up	6, 8, 10 Pin High Profile
M83401 RZ070, 080, 090	10Ω-1MΩ	±1% ±2% ±5%	±100 ±300	Terminator Pull Up	6, 8, 10 Pin Low Profile
M8340103 RZ030	100Ω-100KΩ	±1% ±2% ±5%	±100 ±300	Terminator Pull Up	14 Pin Flat Pack

10K AND 100K ECL TERMINATORS

Mepco/Electra Series	Standard Resistance Values	Tolerance	Temperature Coefficient (ppm/°C)	Circuits Available	Capacitors	Pin Styles Available
9N08	68Ω, 100Ω,** 150Ω	±5%	±200	For 10K	.01μf Z5U 25VDC	8 Pin Single in Line
9N10	50Ω, 68Ω,** 100Ω	±5%	±200	For 100K	.01μf Z5U 25VDC	10 Pin Single in Line

* These characteristics available upon request. ** Others available upon request.

NON-LINEAR RESISTORS

Columbia Road, Morristown, NJ 07960 (201) 539-2000 TWX: 710-986-7437 Telex: 136461

PTC/NTC THERMISTORS

Mepco/ Electra Series	Category	Body Type	Resistance Range	Tolerance	Temperature Coefficient Range (ppm/°C)	Power Range @ 70°C (watts)	Ma. Voltage Range (volts)
NTC	Non Linear	Conformal Coated Disc	15Ω-330KΩ	±5% ±10% ±20%	8%-98%/°C	¼-1	N.A.
PTC			30Ω-250Ω		5%-75%/°C	N.A.	15-265V

VOLTAGE DEPENDENT RESISTORS (ZnO VARISTORS)

Mepco/ Electra Series	Style & Size Range Inches (mm)	R.M.S. Working Voltage	Temperature Coefficient @ 1mA. +25°C to +85°C	Max. Avg. Dissipation (Including Transients)	Max. Non-Repetitive Transient Current
592-593- 594-595	.276 — .630 O.D. (7 — 16) O.D.	30 — 460 All Types	−0.065%/K All Types	100mW — 600mW	250A — 4500A

For information on Mepco/Electra's CAPACITORS/POTENTIOMETERS/MILITARY COMPONENTS, **A**•1124-1126, **B**•1008-1009 and **A**•2029.

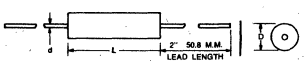
MICRO-OHM CORPORATION
4900 SANTA ANITA AVENUE, EL MONTE, CA 91731
(818) 442-3310 / (213) 686-0535 • TWX: 910-587-3425

QUALITY PRECISION RESISTORS
WIREWOUND

AXIAL LEAD

Series 100

Tolerances: .001% to 1%
T.Cs: 1 PPM to 6000 PPM
Windings: Non-inductive

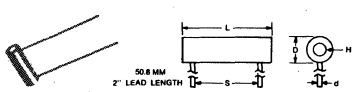


MO Style	Mil R-83 Equiv.	Length (L) Inch ±.032	Length (L) mm ±.81	Diameter (D) Inch ±.015	Diameter (D) mm ±.30	Lead (d) AWG	Lead (d) mm	Com'l Wattage	Max. Voltage DC	Max. Resistance (.0004 Wire)
133		.500	12.70	.200	5.08	22	.64	.30	300	600K
139		.700	17.78	.200	5.08	22	.64	.40	300	1.2M
144		.250	6.35	.250	6.35	22	.64	.25	150	400K
115		.312	7.92	.250	6.35	22	.64	.25	200	1M
156	RB56	.375	9.52	.250	6.35	20	.81	.25	200	700K
143	RB55	.500	12.70	.250	6.35	20	.81	.30	300	900K
137	RB54	.750	19.05	.250	6.35	20	.81	.50	300	1.2M
136		.610	15.49	.375	9.52	20	.81	.50	400	3M
132	RB53	.750	19.05	.375	9.52	20	.81	.66	500	3M
138	RB52	1.00	25.40	.375	9.52	20	.81	1.0	750	5M
134		.500	12.70	.500	12.70	20	.81	.66	300	3M
170		.625	15.88	.500	12.70	20	.81	.75	400	3M
146	RB57	1.00	25.40	.500	12.70	20	.81	1.5	750	7M
180	RB58	1.50	38.10	.500	12.70	20	.81	2.0	1000	15M
190	RB59	2.00	50.80	.500	12.70	20	.81	2.5	1200	20M
SUBMINIATURES										
140		.250	6.35	.125	3.18	24	.51	.10	100	150K
112		.375	9.52	.125	3.18	24	.51	.125	200	125K
113		.312	7.92	.160	4.06	22	.64	.15	150	300K
150		.500	12.70	.160	4.06	22	.64	.20	200	400K
114		.312	7.92	.187	4.75	22	.64	.20	200	300K
135		.375	9.52	.187	4.75	22	.64	.25	300	300K
160		.625	15.88	.187	4.75	20	.81	.30	300	600K
MICRO-MINIATURES										
XP101		.375	9.52	.050	1.27	30	.25	.02	50	10K
100		.110	2.79	.070	1.78	30	.25	.03	50	11K
105		.155	3.94	.075	1.91	30	.25	.04	50	11K
110		.200	5.08	.093	2.36	28	.32	.05	75	30K
130		.312	7.92	.093	2.36	28	.32	.06	100	60K
142		.185	4.70	.120	3.05	28	.32	.06	100	30K
141		.180	4.06	.125	3.18	28	.32	.06	100	30K

RADIAL LEAD

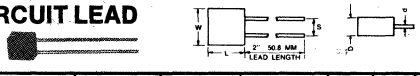
Series 200 & 600 (Lugs)

Tolerances: .001% to 1%
T.Cs: 1 PPM to 6000 PPM
Windings: Non-inductive



MO Style	Mil R-93 Equiv.	Length (L) Inch ± .032	Length (L) mm ± .81	Dia. (D) Inch ± 0.15	Dia. (D) mm ± .38	Lead (d) AWG	Lead (d) mm	Lead Spacing (S) Inch ± .032	Lead Spacing (S) mm ± .81	Mounting Hole (H) Inch ± .010	Mounting Hole (H) mm ± .35	Com'l Wattage	Max. Voltage DC	Max. Resistance (.0006 Wire)
221		.490	12.45	.365	9.27	24	.51	.390	9.91	.140	3.56	.50	300	2.5M
211		.325	8.26	.375	9.52	24	.51	.245	6.22	.120	3.05	.50	300	1.5M
226		1.000	25.40	.375	9.52	20	.81	.855	21.72	.089	2.26	1.00	600	5M
222		.668	17.48	.420	10.69	20	.81	.555	14.10	None		1.00	600	3M
236		1.125	28.59	.435	11.05	20	.81	.960	24.38	None		1.25	600	5M
220	RB17	1.000	25.40	.500	12.70	20	.81	.845	21.46	.140	3.56	1.00	600	10M
228	RB73	2.000	50.80	.500	12.70	20	.81	1.750	44.45	.140	3.56	2.00	1200	20M
227	RB08	.500	12.70	.550	13.97	20	.81	.235	5.97	.140	3.56	.50	300	1M
224	RB16	.612	15.54	.550	13.97	20	.81	.475	12.06	.140	3.56	.50	300	12M
230	RB18	1.250	31.75	.750	19.05	20	.81	1.125	28.59	.140	3.56	2.00	600	20M
SUBMINIATURES														
225		.500	12.70	.160	4.06	24	.51	.385	9.78	None		.20	200	500K
202		.250	6.35	.312	7.92	24	.32	.180	4.57	.089	2.26	.25	200	500K
243		.500	12.70	.250	6.35	22	.64	.290	7.37	None		.25	300	300K
MICRO-MINIATURES														
206		.200	5.08	.105	2.67	30	.25	.100	2.54	None		.30	100	30K
210		.250	6.35	.100	2.54	28	.32	.200	5.08	None		.05	100	30K
205		.165	4.19	.075	1.90	30	.25	.150	5.81	None		.04	50	11K

PRINTED CIRCUIT LEAD



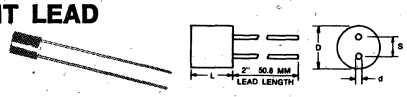
RECTANGULAR

MO Style	Length (L) Inch ± .032	Length (L) mm ± .81	Width (W) Inch ± .015	Width (W) mm ± .38	Depth (D) Inch ± .015	Depth (D) mm ± .38	Lead (d) AWG	Lead (d) mm	Lead Spacing (S) Inch ± .0-0	Lead Spacing (S) mm ± .25	Com'l Wattage	Max. Voltage DC	Max. Resistance (.0006 Wire)
450	.250	6.35	.250	6.35	.125	3.18	20	.81	.125	3.18	.125	100	1M
460	.250	6.35	.500	12.70	.125	3.18	20	.81	.250	6.35	.250	100	2M

PRINTED CIRCUIT LEAD

Series 400

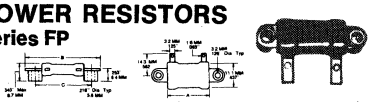
Tolerances: .001% to 1%
T.Cs: 1 PPM to 6000 PPM
Windings: Non-inductive



MO Style	Mil R-93 Equiv.	Length (L) Inch ±.032	Length (L) mm ±.81	Diameter (D) Inch ±.032	Diameter (D) mm ±.81	Lead (d) AWG	Lead (d) mm	Lead Spacing (S) Inch ±.010	Lead Spacing (S) mm ±.25	Com'l Wattage	Max. Voltage DC	Max. Resistance (.0006 Wire)
440		.250	6.35	.125	3.18	24	.51	.050	1.27	.10	100	120K
412		.375	9.52	.125	3.18	24	.51	.050	1.27	.125	200	55K
413		.312	7.92	.160	4.06	24	.51	.080	2.03	.15	150	300K
414		.312	7.92	.187	4.75	22	.64	.100	2.54	.20	200	300K
435		.375	9.52	.187	4.75	22	.64	.100	2.54	.25	300	300K
415	RB71	.312	7.92	.250	6.35	22	.64	.200	5.08	.25	300	500K
416		.375	9.52	.250	6.35	22	.64	.200	5.08	.25	300	800K
443		.500	12.70	.250	6.35	22	.64	.125	3.18	.30	300	1M
437		.750	19.05	.250	6.35	22	.64	.125	3.18	.50	300	1M
417	RB70	.500	12.70	.375	9.52	20	.81	.200	5.08	.50	300	1.5M
436		.610	15.49	.375	9.52	20	.81	.250	6.35	.50	450	3M
438		1.00	2.54	.375	9.52	20	.81	.250	6.35	1.00	750	5M
434		.500	12.70	.500	12.70	20	.81	.300	7.62	.50	300	3M
MICRO-MINIATURES												
405		.155	3.94	.075	1.91	30	.25	.030	.76	.04	50	11K
430		.312	7.92	.093	2.36	28	.32	.040	1.02	.05	100	50K
401		.175	4.44	.105	2.67	28	.32	.040	1.02	.05	75	30K
442		.185	4.70	.120	3.05	28	.32	.050	1.27	.05	100	30K
441		.160	4.06	.125	3.18	28	.32	.050	1.27	.05	100	30K

POWER RESISTORS

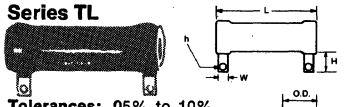
Series FP



Tolerances: .05% to 10%
T.Cs: PPM/°C Resistance
20 10Ω & over
30 1Ω — 10Ω
90 under 1Ω

MO Style	Core Length (A) Inch ±.032	Core Length (A) mm ±.01	Length Inch Hdwe. (D) Inch ±.015	Length Inch Hdwe. (D) mm ±.38	Mtg. Hole Spacing (C) Inch ±.015	Mtg. Hole Spacing (C) mm ±.38	Wattage Rating	Maximum Working Voltage	Resistance Range (Ohms)
FP-10	.750	19.05	1.218	30.94	1.00	25.4	10	300	.1-15K
FP-20	2.062	52.37	2.625	66.68	2.313	58.75	20	1000	.1-15K

Series TL



Tolerances: .05% to 10%
T.Cs: 90 PPM to 20 PPM
depending on value

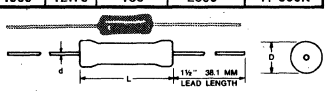
TERMINAL DIMENSIONS

M.O. Series	TL-5 Inch	TL-5 mm	TL-10 25 & 30 Inch	TL-10 25 & 30 mm	TL-60 & 100 Inch	TL-60 & 100 mm
Width (W)	.125	3.2	.187	4.8	.250	6.4
Height (H)	.250	6.4	.406	10.3	.750	19.1
Hole Dia. (h)	.062	1.57	.093	2.4	.154	3.9

No. Style	Length (L) Inch ±.062	Length (L) mm ±1.57	Diameter O.D. Inch ±.032	Diameter O.D. mm ±.81	Diameter I.D. Inch ±.032	Diameter I.D. mm ±.81	Wattage Rating	Maximum Working Voltage	Resistance Range (Ohms)
TL-6	1.00	25.40	.250	6.35	.156	3.96	5	230	.1-12K
TL-10	1.00	25.40	.438	11.12	.312	7.92	10	400	.1-22K
TL-25	2.00	50.80	.563	14.30	.312	7.92	25	1300	.1-100K
TL-50	4.00	101.60	.563	14.30	.312	7.92	50	1900	.1-250K
TL-60	4.00	101.60	.750	19.05	.500	12.70	60	2100	.1-350K
TL-100	6.50	165.10	.750	19.05	.500	12.70	100	2500	.1-550K

Series R

Tolerances: .05% to 10%
T.Cs: 90 PPM to 20 PPM
depending on value



MO Style	Mil R-26 Equiv.	Length (L) Inch ± .032	Length (L) mm ± .81	Diameter (D) Inch ± .032	Diameter (D) mm ± .81	Lead (d) AWG	Lead (d) mm	Wattage U	Wattage V	Max. Working Voltage U	Max. Working Voltage V	Resistance Ranges (ohms) .05% .1% .25%	Resistance Ranges (ohms) .5% 1% 3% 5%
R-¼		.250	6.35	.078	1.98	24	.51	.40		20		10-950	.1-3.4K
R-½		.312	7.92	.078	1.98	24	.51	.75		29		10-1.3K	.1-4.9K
R-1A	RW70	.406	10.31	.093	2.36	22	.64	1.00		52		1-2.7K	.1-10.4K
R-1		.531	13.49	.093	2.36	22	.64	1.10		62		1-4.0K	.1-15K
R-2½	RW69	.500	12.70	.210	5.33	20	.81	2.50	3.25	138	157	1-8.6K	.01-32.2K
R-3A	RW79	.562	14.27	.210	5.33	20	.81	3.00	3.75	135	148	1-6.5K	.01-34.5K
R-3		.812	20.62	.210	5.33	20	1.02	3.25	4.75	185	220	1-11.4K	.01-42.1K
R-4		.625	15.88	.300	7.62	18	1.02	4.00	5.50	210	250	1-12.7K	.01-47.1K
R-5	RW67 RW74	.875	22.22	.300	7.62	18	1.02	5.00	6.50	330	376	.5-24.5K	.01-91.0K
R-7		1.218	30.94	.375	9.52	18	1.02	7.00	9.00	504	576	.5-41.4K	.01-154K
R-10	RW68 RW78	1.780	45.21	.375	9.52	18	1.02	10.00	13.00	799	911	.5-71.3K	.01-265K

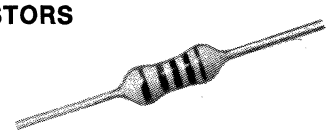
MICRO-OHM CORPORATION
4900 SANTA ANITA AVENUE, EL MONTE, CA 91731
(818) 442-3310 / (213) 686-0535 • TWX: 910-587-3425

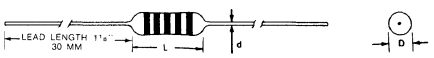
QUALITY PRECISION RESISTORS

METAL FILM RESISTORS

Type RN 55 & 50

T.C.s: 25, 50 & 100 PPM
Tolerances: 0.1% to 1%





Mil Equiv.	MO Style	Length (L) Inch ±.039	Length (L) mm ±1.0	Diameter (D) Inch ±.02	Diameter (D) mm ±0.5	Lead(d) Tin Cu. AWG	Lead(d) Tin Cu. mm	Watt. @ 70°C	Max. Working Volt.	Max. Overload Volt.	Resistance Range (Ω)
RN55	RN25	.25	6.4	.09	2.3	22	0.5	¼	250	500	1-10 Meg.
RN50	RN12	.150	3.8	.062	1.6	24	0.4	⅛	150	300	10-1 Meg.

- Exceeds Mil-R-10509 qualification
- T.C. 25, 50 & 100 PPM
- EIA Standard Color Coding
- .5% & 1% Tolerances
- Economical
- Low Noise
- Excellent high frequency characteristics
- Excellent Resistance Stability & Repeatability
- Packaging: Bulk, Strip Pack, or Tape & Reel

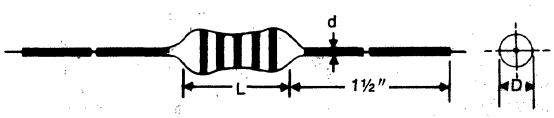
Vacuum-deposited nickel-chrome alloy is deposited on high purity ceramic cores. A multiple epoxy coating protects all resistors against adverse environmental conditions. Performance characteristics exceed all requirements of Mil-R-10509F. These stable and inexpensive resistors are recommended for use whenever miniature circuits are required for sophisticated electronic equipment.

CHARACTERISTICS

Requirements	Characteristics	Test Method JIS.C. 5202	Test Method Mil-R. 10509E
Operating Temp. Range	−55°C − +155°C	−	−
Temp. Coefficient (PPM/°C)	C, D,	5. 2. A	4. 6. 12
Short Time Overload	±(0.5% +0.05r)	5. 6 A	4. 6. 6
Insulation Resistance	Over 10^4M	5. 6 A	4. 6. 9
Dielectric Withstanding V	±(0.5% +0.05r)	5. 7 A	4. 6. 8
Effect of Soldering	±(0.5% +0.05r)	6.4. 350°C 3S	4. 6. 10
Temperature Cycling	±(0.5% +0.05r)	7. 4.	4. 6. 4
Low Temp. Operation	±(0.5% +0.05r)		4. 6. 5
Terminal Strength	±(0.5% +0.05r)	6. 1.	4. 6. 7
Moisture Resistance	±(1% +0.5r)	7.9. 1000 Hrs.	Mil-R 22684B 4. 6. 10
Load Life	±(1% +0.5r)	7.10 1000 Hrs.	4. 6. 13
Storage	±(0.2% +0.05r)	±(0.2% +0.05)	Shelved for one year in a room of Normal Temp. and Humidity.

HIGH STABILITY LINEAR POSITIVE TEMPERATURE RESISTOR

Type LPTC-25 Metal Film



Max. Power Rating @ 70°C	L ±.020	D ±.020	d
¼W	.250	.090	22 ga.

CONTINUED IN NEXT COLUMN

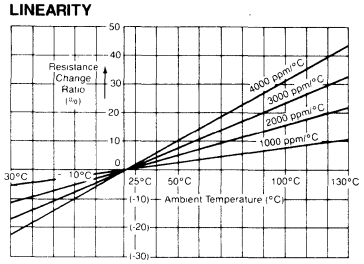
Type LPTC-25 Metal Film (continued)

Resistance Range: 10 ohm — 20K ohm (T1 and T2)
10 ohm — 1K ohm (T3 and T4)
Resistance Tolerance: ±2% (G) and ±5% (J)
Resistance Temperature Coefficient:
T1 (+2500 PPM) T3 (+3500 PPM)
T2 (+3000 PPM) T4 (+4000 PPM)
Features: a) Linear resistance change vs. temperature, which cannot be obtained in a semiconductor or thermister
b) Positive temperature coefficient
Application: Temperature compensation, temperature indication, temperature control, temperature protection and liquid level detection.
Markings: First two bands are significant digits, third band the multiplier, and the fourth and fifth bands are first two digits of T.C.R.

SPECIFICATIONS

Part No.	Rated Watt. (70°C)	Resistance Range	Temp. Coefficient PPM/°C	Res. Value	Res. Tole.	T.C.R. Tole.	Dimensions (mm) L	Dimensions (mm) D	Dimensions (mm) d
LPTC25	0.25W (¼W)	5Ω ~ +15KΩ	T1 = 2,500 T2 = 3,000 T3 = 3,500 T4 = 4,000	E−24	±2% ±5%	±10%	6.3 ±0.5	2.3 ±0.5 −0.3	0.6 ±0.05

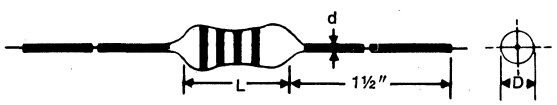
LINEARITY



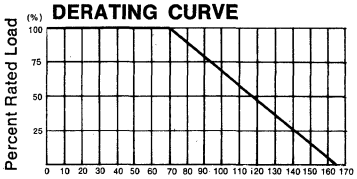
SPECIFICATIONS FOR MG SERIES METAL GLAZE RESISTORS

This high resistance component has been developed to be used as a precision or power resistor for X-ray equipment, measuring equipment and statistic electric equipment. It has high reliability in its shelf life, T.C.R. and other characteristics.

CHARACTERISTICS:
T.C.R.: 100 PPM
Load life: 3000 Hrs. ±1%
Anti moisture load life: ±1% after 250 Hrs. at 40°C 90-95% RH
Voltage coefficient: 0.00002 — 0.0005% /V
Shelf life: ±1% after 10,000 Hrs. at room temp.
Max. Temperature: 220°C
Temperature range: −55°C — +165°C



DERATING CURVE



Style	Rated Wattage (W)	Max. Working Voltage (KV)	Pulse Voltage (KV)	Resistance Range	Dimensions (inches) D ±.04	Dimensions (inches) L ±.06	Dimensions (inches) d ±.004
MG-25	0.25	0.10	0.30	1 Meg- 100 Meg	.09	.256	.025
MG-50	0.50	0.25	0.70	1 Meg- 200 Meg	.126	.393	.028
MG-1	1.0	1.00	1.00	1 Meg-1000 Meg	.165	.472	.032
MG-2	2.0	5.00	7.50	1 Meg-2000 Meg	.217	.630	.032

Resistance Tolerance: F = ±1%, G = ±2%, J = ±5%. Markings: EIA color coding system or Digital marking.

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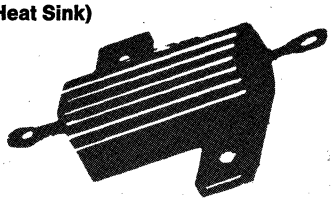
QUALITY PRECISION WIREWOUND RESISTORS

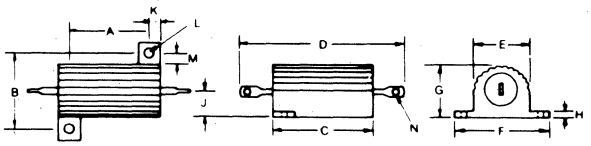
POWER WIREWOUND RESISTORS SERIES HS

(Heat Sink)



Tolerances: .05% to 10%
T.Cs: PPM/°C Resistance
20 10Ω & over
30 1Ω — 10Ω
90 under 1Ω

C = 50 watt units



POWER RATINGS

Micro-Ohm HS Resistor ratings are based on the following requirements:
1. 275°C Maximum internal hotspot temperature.
2. 1% Maximum △ R in 1000 hour load life for all models.

ELECTRICAL SPECIFICATIONS

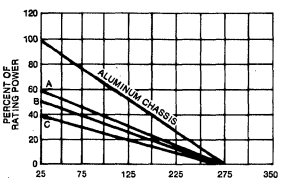
1. 4 Models, 5, 10, 25 & 50 watts.
2. Resistance Range: .05 ohms to 200K ohms.
3. Tolerances: .05% to 10%.
4. Temperature coefficient 20PPM to 90PPM.
5. 1000 VAC Minimum Dielectric Strength.
6. Non-inductive types available.

FEATURES

- Aluminum-Finned Heat Sink Case.
- Molded Construction.
- Complete Welded Construction.
- Screw Mounts on Chassis.
- High Stability at Conventional Power Ratings.
- Heavy spade lug type leads.

DERATING

Micro-Ohm HS Resistors have an operating temperature range of −55°C to +275°C. Derating is required for reduced chassis mounting area and for high ambient temp. Curves A, B & C below apply to operation of unmounted resistors.



AMBIENT TEMPERATURE DEG. CENTIGRADE
A = 5 and 10 watt units **B** = 25 watt units **C** = 50 watt units

MO Style	Mil-R 18546	Com'l Watt	Maximum Working Voltage	Max. Res.	A		B		C		D		E		F	
					Inch ±.005	mm ±.013	Inch ±.005	mm ±.013	Inch ±0.32	mm ±.81	Inch ±.062	mm ±1.57	Inch ±.015	mm ±.38	Inch ±.015	mm ±.38
HS5	RE60	5	160	20K	.44	11.28	.490	12.45	.600	15.24	1.125	28.58	.334	8.48	.646	16.41
HS10	RE65	10	265	30K	.562	14.27	.625	15.88	.750	19.05	1.375	34.93	.438	11.13	.812	20.62
HS25	RE70	25	550	75K	.719	18.26	.781	19.84	1.062	26.97	1.938	49.23	.500	12.70	1.094	27.29
HS50	RE75	50	1250	200K	1.563	39.70	.844	21.44	1.968	49.99	2.781	70.64	.625	15.88	1.156	29.36

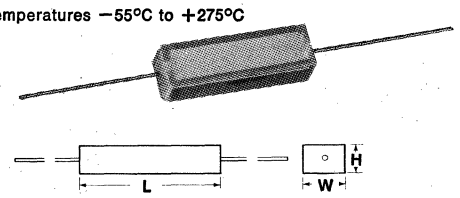
MO Style	G		H		J		K		L		M		N		Mounting Hole Size
	Inch ±.015	mm ±.38	Inch ±.010	mm ±.25	Inch ±.010	mm ±.25	Inch ±.010	mm ±.25	Inch ±.005	mm ±.013	Inch ±.015	mm ±.38	Inch ±.005	mm ±.013	
HS5	.317	8.05	.075	1.91	.145	3.68	.078	1.98	.093	2.36	.078	1.98	.050	1.27	#2
HS10	.406	10.31	.100	2.54	203	5.16	.093	2.36	.093	2.36	.094	2.39	.086	2.18	#2
HS25	.563	14.30	.094	2.39	.250	6.35	.171	4.34	.125	3.18	.125	3.18	.086	2.18	#2
HS50	.625	15.88	.094	2.39	.281	7.14	.196	4.98	.125	3.18	.125	3.18	.086	2.18	#4

For Non-inductive types add letter N after style number.

BATHTUB TYPE RESISTORS

CW SERIES

√ Economical
√ 1 watt to 50 watt
√ 5 & 10% Tolerances
√ Fireproof
√ Operating temperatures −55°C to +275°C



CONSTRUCTION

Premium grade resistance wire is wound on a woven fiberglass core. Tinned copper terminals are tightly crimped or welded (depending on resistance value) to the banded core. The wound unit is potted in a high quality Steatite Ceramic case using a high temperature, high thermal conducting inorganic potting compound. This results in a completely fireproof inorganic package, highly resistant to solvents and impervious to moisture.

Stand off or feet type available in sizes 3 Watt and larger. Specify by inserting letter "F" after type number. Example: CW5F

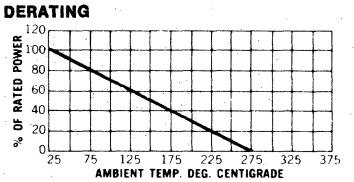
- Temperature coefficients (Typical) Below 1Ω 0 ±800 ppm; Over 1Ω 0 ±400 ppm
- Applicable specification to EIA Standard RS-344 Type
- Fuse type available
- Terminal strength: 5 lbs minimum
- Non-Inductive types available

CW SERIES - AXIAL LEAD

Type	Wattage	DIMENSIONS (Inches) Length (L)	Width (W)	Height (H)	Lead (d)	Maximum Working Voltage	Resistance Range (Ω)
CW1	1	.594	.219	.250	.032	60	.01-.27
CW2	2	.688	.250	.250	.032	65	.01-.35
CW3	3	.875	.312	.312	.032	150	.01-10K
CW5	5	.875	.375	.375	.032	200	.01-10K
CW7	7	1.406	.375	.343	.032	350	.01-27K
CW10	10	1.875	.375	.343	.032	540	.01-30K
CW15	15	1.875	.500	.500	.036	670	.01-30K
CW20	20	1.875	.500	.500	.036	740	.01-40K
CW25	25	2.531	.625	.625	.036	890	.01-40K
*CW50F	50	3.500	.500	.500	.040	940	.01-45K

* Available with stand off feet only.

DERATING



HOW TO ORDER:

CW5 — 10 ohms — 5%
5% — TOLERANCE
10 ohms — RESISTANCE VALUE
CW5 — TYPE & WATTAGE

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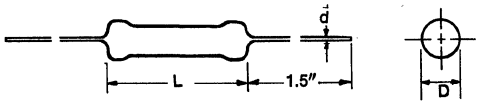
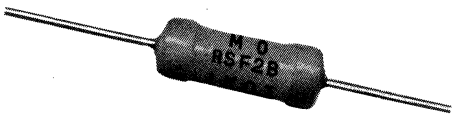
QUALITY PRECISION RESISTORS

FLAME-PROOF METAL OXIDE POWER RESISTORS



Style	Dimension (inches) L ±.02	D ±.02	d (nominal)
RSF-½B	.35	.12	.028
RSF-1B	.46	.16	.028
RSF-2B	.61	.23	.032
RSF-3B	.98	.33	.032
RSF-5B	1.60	.33	.032



Style	Power Rating @ 70°C	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Resistance Range	Resistance Tolerance
RSF-½B	0.5W	250V	400V	500V	0.2 -100 KΩ	
RSF-1B	1W	500V	1,000V	700V	0.2 -100 KΩ	
RSF-2B	2W	500V	1,000V	700V	0.2 -120 KΩ	G*
RSF-3B	3W	750V	1,000V	1,000V	0.2 -150 KΩ	J
RSF-5B	5W	750V	1,000V	1,500V	0.47-240 KΩ	

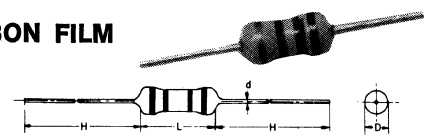
* G 5.1Ω and over

CHARACTERISTICS

Requirements		Characteristics	Test Method JIS C 5202	Test Method MIL-R-22684B
Operating Temperature Range		−55°C to +275°C		
Temperature Coefficient (ppm C)		±200	5.2	4 6 11
Max. Resistance Change	Short Time Overload	±(0.5% +0.05Ω)	5.5	4 6 5
	Effect of Soldering	±(0.5% +0.05Ω)	6.4 350°C 3 sec	4 6 9
	Temperature Cycling	±(0.5% +0.05Ω)	7.4 −55°C/85°C	4 6 3
	Moisture Resistance	±5%	7.9 1,000 hr	4 6 10
	Load Life	±5%	7.10 1,000 hr	4 6 12
Dielectric Withstanding Voltage		±(0.5% +0.05Ω)	5.7	4 6 7
Insulation Resistance		over 10^4 MΩ	5.6	4 6 8
Non-Combustibility		The resistor shall withstand Overload test in accordance with Article UL492, 213 without producing a fire hazard.		
Resistance to Solvents		The resistor shall withstand Solvents test in accordance with Article MIL-STD-202 E 215 without producing any mechanical or electrical damage.		

DEPOSIT CARBON FILM

Fixed Resistors
Type
M 50, 25, 12

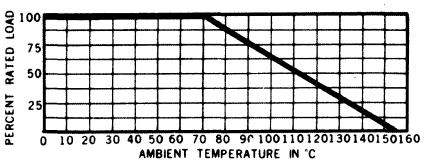


- Size equal to carbon composition resistor.
- Greater reliability and stability.
- Greater economy.
- 2% and 5% resistance tolerances.
- Conformal multilayer epoxy coating.
- Welded cap and lead construction.
- EIA standard color coding.
- Packaging — Bulk, strip pack or tape & reeled.

SPECIFICATIONS

Type	M-50	M-25	M-12
Wattage Rating at 70°C	0.5W	0.25W	0.125W
Max. Working Voltage	350V	250V	150V
Max. Over Load Voltage	700V	500V	300V
Resistance Tolerance	±2% (G), ±5% (J)	±2% (G) ±5% (J)	±5% (J)
Resistance Range 5%	1Ω to 10 MΩ	1Ω to 13 MΩ	1Ω to 5 MΩ
2%	10Ω to 910K	10Ω to 910K	51Ω to 220K
Temperatuge Range	−55°C to +155°C	−55°C to +155°C	−55° to +155°C

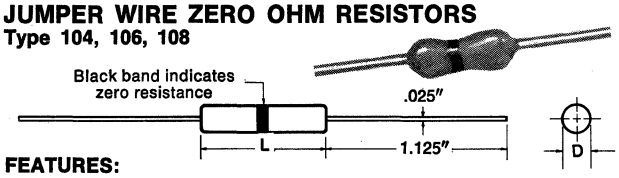
DERATING CURVES



Type	Body Length (L) inch	mm	Body Diameter (D) inch	mm	Leadwire Length (H) inch	mm	Leadwire Diameter (d) inch	mm	Net Weight
M-50	.350 ±.020	8.9 ±0.5	.146 ±.008	3.7 ±0.2	1.125 ±.1	30 ±3	.031±.001	0.8 ±0.03	500 grms (1.1 lb.)
M-25	.245 +.020 −.010	6.7 max.	.098 max.	2.5 max.	1.125 ±.1	30 ±3	.024 ±.005	0.6 ±0.05	200 grms (.44 lb.)
M-12	.160 +.020 −.010	4.6 max.	.068 max.	1.7 max.	1.125 ±.1	30 ±3	.020 ±.005	0.5 ±0.05	135 grms (.30 lb.)

JUMPER WIRE ZERO OHM RESISTORS

Type 104, 106, 108



FEATURES:

- Sizes equal to ⅛, ¼ and ½W carbon film
- Economical
- Straight-through zero ohm continuity
- Conformal multilayer epoxy coating
- Welded cap and lead construction
- Packing: Tape & reeled or bulk

Type	Equivalent Wattage	Body Inch Length (L) ±.010	Body Inch Diameter (D) +.005
104	⅛	.150	.080
106	¼	.245	.085
108	½	.500	.095

SPECIFICATIONS:

Maximum Resistance: 0.0025 ohm
Lead Material: Leads are copperclad steel with 30/70 solder coatings to allow both welding and soldering operations.
Body material: Epoxy coated metal body
Minimum Insulation Resistance: Dry, 10,000 megohm; Wet, 100 megohm
Minimum Dielectric Withstanding Voltage: Atmospheric, 500V RMS; Reduced, 325V RMS
Insulation Flammability: Resistor insulation is self extinguishing within 10 seconds after externally applied flame is removed.
Current Rating: 25 amps at 25°C, derating to 0 amps at 150°C
Reel Capacity: 5000 pcs

APPLICATIONS

Jumper wires or crossovers, as they are sometimes called, are basically interconnection devices between points on a PC board.
Generally they are used for the following reasons:

- Inability to connect two points on a PC board due to other circuit paths which must be crossed over.
- An after-the-fact design change that requires new point connections.
- Circuit tuning by changing point connections.

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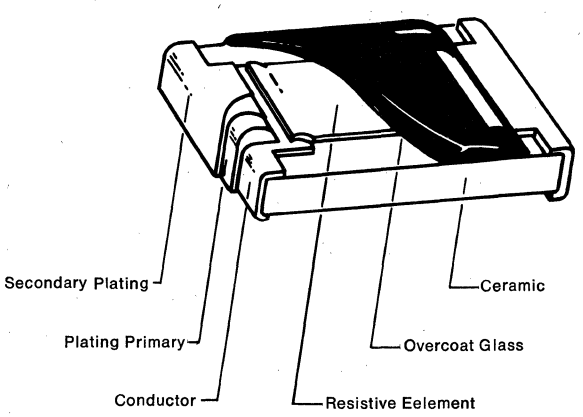
RECTANGULAR TYPE CHIP FIXED RESISTORS

RC SERIES
Thick Film

CONSTRUCTION AND MATERIAL



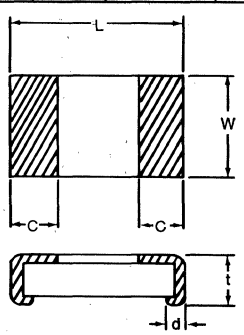
TYPE CODE

RC 315 — 104 J R B

- RC: Series name: Rectangular type chip resistors
- 315: Type No.
- 104: Resistance value (10 x $10^4\Omega$)
- J: Tolerance: (G = ±2%, J = ± 5%, K = ±10%)
- R: R = Stamped on the back S = Stamped on the surface (RC110 and RC310 are not marked)
- B: Packaging code: B = Bulk T = Taping

RATINGS AND DIMENSIONS

Type No.	Rated Wattage	Max. Working Voltage	Max. Overload Voltage	Resistance Range	Resistance Tolerance	Operating Temperature Range
RC110	1/32W	50V	100V	10Ω – 2.2 MΩ	K, M	−55 ~ +125°C
RC210	1/16W	150V	200V	10Ω – 2.2 MΩ	G, J, K	−55 ~ +125°C
RC310	1/10W	150V	200V	10Ω – 2.2 MΩ	J, K	−55 ~ +125°C
RC315	1/8W	200V	400V	10Ω – 2.2 MΩ	G, J, K	−55 ~ +125°C



(mm)

Type	L	W	c	d	t
RC110	2.0 ±0.2	0.67 ±0.2	0.4 ±0.2	under 0.4	0.45 ±0.08
RC210	2.0 +0.2 −0.1	1.25 +0.05 −0.25	0.4 ±0.2	under 0.4	0.45 ±0.08
RC310	2.75 ±0.2	1.0 ±0.2	0.5 ±0.2	under 0.5	0.45 ±0.08
RC315	3.10 ±0.15	1.55 ±0.15	0.5 ±0.2	under 0.5	0.55 ±0.1

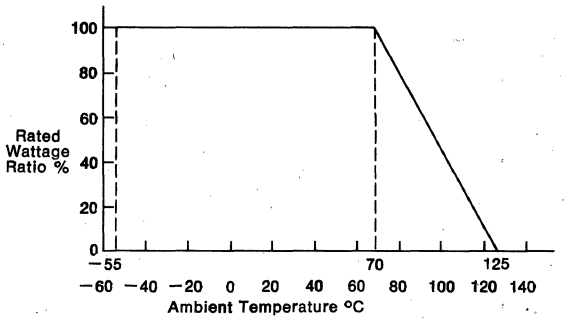
STANDARD RESISTANCE VALUE

Standard resistance values are E-12 series shown below. E-24 series and jumper chip are also available on request.

1.0	1.2	1.5	1.8	2.2	2.7	3.3	3.9	4.7	5.6	6.8	8.2

RATED WATTAGE

Rated Wattage is specified at ambient temperature of 70C°.



RATED VOLTAGE

Rated voltage shall be the AC or DC voltage corresponding to the rated wattage, and it shall be obtained by the following formula, however, if voltage obtained exceeds the Max. voltage shown in the table (item 3-1), the figure in the table shall be the Max.

$E = \sqrt{P \cdot R}$

E : Rated Voltage (V) P : Rated Wattage (W) R : Nominal Value (Ω)

PERFORMANCE SPECIFICATIONS

(Test method: JIS C-5202)

No.	Item	Characteristics	Test Method
1	Resistance Value	Resistance value must be within the specified tolerance.	To be measured at the voltage specified below. Nominal Resistance Value (Ω) / Max. Voltage (V) under 100Ω: 0.3 100Ω and over to under 1 KΩ: 1 1 KΩ and over to under 10 KΩ: 3 10 KΩ and over to under 100 KΩ: 10 100 KΩ and over to under 1 MΩ: 30 1 MΩ and over: 50
2	Temperature Coefficient	Nominal Value Ω / TCR PPM/°C under 1 KΩ: −100 ~ +600 1 KΩ and over to under 100 KΩ: −200 ~ +200 100KΩ and over: −600 ~ +100	Measure ohmic value in the room temperature and also measure the value at the room temperature plus 100°C, and obtain by the following formula. $\frac{R - R_o}{R_o} \times \frac{1}{t - t_o} \times 10^6$ (PPM/°C) R : Resistance value at room temperature (t_o) R : Resistance value at test temperature ($t = t_o + 100$)
3	Voltage Coefficient	Under 100 PPM/V, however, ohmic value change shall be within 2% in case of voltage coefficient exceeds the above.	Application Range: Over 1KΩ $\frac{R_1 - R_2}{R_2} \times \frac{1}{E_1 - E_2} \times 10^6$ (PPM/V) R_1 : Resistance value at rated voltage (E_1) R_2 : Resistance value at rated voltage at 1/10 times of rated voltage (E_2)
4	Short-Time Overload	Under ±(2.0% +0.1Ω) With no damage in the appearance.	2.5 times rated voltage or max. overload voltage, whichever smaller, shall be applied for 5 seconds.
5	Intermittent Overload	Under ±(5% +0.1Ω) With no damage in the appearance.	2.5 times rated voltage or max. overload voltage, whichever smaller, shall be tested 10,000 times for 1 second "ON" and 25 seconds "OFF".
6	Dielectric Voltage	Under ±(0.5% +0.1Ω) With no evidence of burning and insulation breakage.	AC500V shall be applied for 1 minute between substrate and termination.
7	Insulation Resistance	Over 1,000 Meg Ω	Measured by insulation resistance meter between substrate and termination.
8	Terminal Strength (Warping)	Under ±(1% +0.1Ω)	° Put the resistor on the test circuit board.

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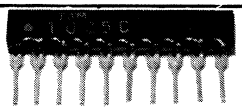
QUALITY PRECISION RESISTORS



THICK FILM RESISTOR NETWORKS
Single-In-Line SIP Resistors

INTRODUCTION

These conformal coated single-in-line (SIP) resistor networks are designed to meet a variety of application requirements in a compact, highly reliable package.

All SIP networks are quality tested for both resistance and tolerance before shipping.

Applications for resistor networks include: pull up and pull down resistors, TTL & ECL line terminating resistors. LED current limiting resistors and telecommunication networks.

PERFORMANCE SPECIFICATIONS

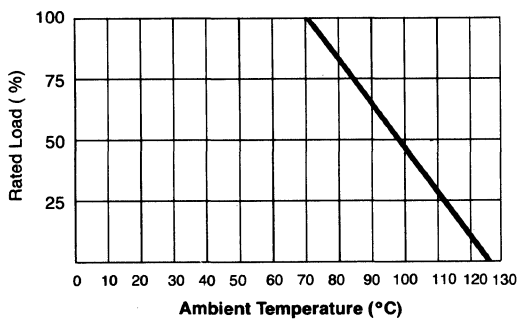
Temperature Coefficient: ±300 PPM Std., ±100 PPM avail.
TCR Tracking: 50 PPM Max.
Operating Temperature: −30°C to +125°C
Thermal Shock: ±5% Max.
Moisture Resistance: ±5% Max.
Terminal Strength: ±25% Max.

FEATURES

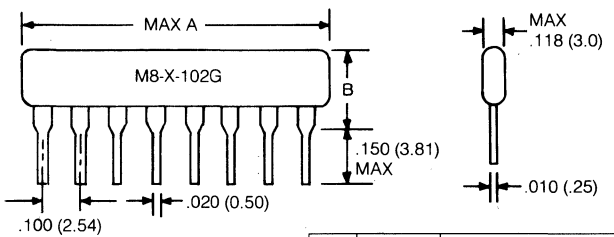
- Substrate Material — 96% alumina provides superior thermal properties and cooler operation.
- Resistors and Conductors — thick film materials with proven reliable performance.
- Lead Pull Strength: 5 lbs.
- Lead Material: Tinned plated copper alloy.
- Provides high electrical conductivity and thermal transfer.
- Encapsulation: Conformal coating ensure reliable performance.

Resistance to Soldering Heat: ±1.0% Max.
Load Life (1000) hours): ±3.0% Max.
Temperature Cycling: ±1.0% Max.
Shock and Vibration: ±.25% Max.
Solvent Resistance: Resists industrial cleaning agents per MIL-STD-202E
Lead Solderability: Meets MIL-STD-202 Method 208

DERATING CURVE



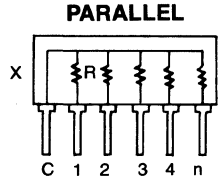
DIMENSIONS



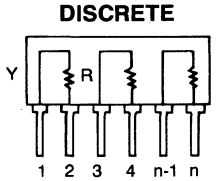
NO. PINS	NO. ELEMENTS X	Y	Z	DIMENSIONS — LENGTH (A) Low in.(mm)	Med. in.(mm)	High in.(mm)
4	3	—	3	.398 (10.1)	.433 (10.1)	—
5	4	—	4	.500 (12.7)	.531 (13.5)	—
6	5	3	5	.598 (15.2)	.630 (16.0)	—
7	6	—	6	.697 (17.7)	.728 (18.5)	.728 (18.5)
8	7	4	7	.799 (20.3)	.827 (21.0)	.827 (21.0)
9	8	—	8	.898 (22.8)	.925 (23.5)	.925 (23.5)
10	9	5	9	1.00 (25.4)	1.04 (26.5)	—
11	10	—	10	1.10 (27.9)	1.14 (29.0)	—
12	11	6	11	1.20 (30.4)	1.24 (31.5)	—
13	12	—	12	1.30 (33.0)	1.34 (34.0)	—
14	13	7	13	1.40 (35.5)	1.44 (36.5)	—
HEIGHT (B)				.197 (5.0)	.315 (8.0)	.433 (11.0)

STANDARD CIRCUITS

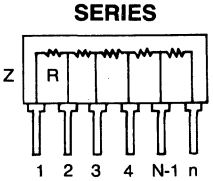
PARALLEL



DISCRETE



SERIES



POWER RATING — CIRCUITS X Y & Z

Profile	Rated Wattage @ 70°C	Max. Operating Voltage
Low	.125W	50V
Medium	.125W	125V
High	.250W	250V

Remark: Rated Wattage per package
= Number of Elements × Rated Wattage of Elements × 0.8

STANDARD RESISTANCE (Ω)

33	220	1K	5.6K	47K
47	270	1.2K	6.0K	68K
56	330	1.5K	6.8K	82K
68	390	1.8K	8.2K	100K
82	470	2.2K	10K	220K
100	510	2.7K	12K	390K
120	560	3.3K	15K	470K
150	680	3.9K	22K	680K
180	820	4.7K	33K	1M

PART NUMBERING

M 8 X 102 G

SINGLE IN-LINE RESISTOR NETWORK
L = Low profile
M = Medium profile
H = High profile

NO. OF PINS

CIRCUIT TYPE
X = Parallel Y = Discrete
Z = Series

RESISTANCE CODE
First two digits are significant.
Last digit specifies number of zeros.

RESISTANCE TOLERANCE
G = ±2% J = ±5% K = ±10% M = ±20%

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

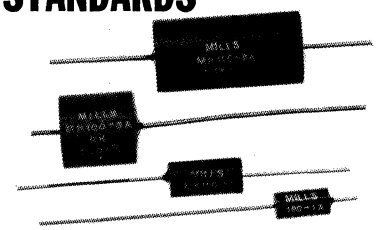
TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 85/86 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1166, **B**•1012, **C**•1028, **D**•1016
ASCII Code ..... **D**•1087
Batteries, Product Selection Guide ..... **D**•1413
Batteries & Fuel Cells, Characteristics ..... **D**•1430
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide ..... **A**•1003
Circuit Boards (Printed) Product Selection Guide ..... **C**•1099
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1205
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1863
Connectors, Miniglossary ..... **C**•1129
Connectors, Terminals, & Sockets, Product Selection Guide ..... **C**•1105
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Gude ..... **A**•1309
Delay Lines, Product Selection Guide ..... **A**•1459
Discrete Semiconductors, Product Selection Guide ..... **A**•2067
Displays, Readouts, Lamps, & Lights, Product Selection Guide ..... **B**•1015
EBCDIC Code ..... **D**•1092
Encapsulation, Miniglossary ..... **C**•1086
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide .. **C**•1623
Filters, Product Selection Guide ..... **A**•1583
Instruments, Graphic Recording Product Selection Guide ..... **D**•1401
Instruments, Panel Meters, Product Selection Guide ..... **D**•1329
Instruments, Test & Measuring Product Selection Guide ..... **D**•1175
Interconnection Systems, Product Selection Guide ..... **C**•1699
Keyboards & Keypads, Product Selection Guide ..... **B**•1705
Logofinder & Trademark Directories ..... **B**•901
Microwave Components, Product Selection Guide ..... **A**•1701
Military Qualified Products Lists ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1129
Opto Semiconductors, Miniglossary ..... **B**•1214
Oscilloscopes, Product Selection Guide ..... **D**•1385
Panel Hardware, Product Selection Guide ..... **C**•1589
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide ..... **A**•1991
Power Supplies, Miniglossary ..... **D**•1462
Power Supplies, AC, Product Selection Guide ..... **D**•1877
Power Supplies, DC, Product Selection Guide ..... **D**•1447
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide .... **B**•1225
Relay Contact Forms ..... **B**•1317
Relays, Electromechanical, Miniglossary ..... **B**•1308
Relays, Product Selection Guide ..... **B**•1261
Resistor Color Codes ..... **A**•1828
Resistors, Product Selection Guide ..... **A**•1785
Servo Components, Miniglossary ..... **D**•1985
Solenoids, Product Selection Guide ..... **B**•1463
Switches, Product Selection Guide ..... **B**•1477
Thermal Components, Product Selection Guide ..... **B**•1741
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1744
Thyristors/High Power Diodes, Miniglossary ..... **A**•2076
Transducers & Encoders, Product Selection Guide ..... **B**•1777
Transformers, Product Selection Guide ..... **A**•2099
Wire & Cable, Product Selection Guide ..... **C**•1743
Wire Gauges—Diameter, Area, Copper Weight ..... **C**•1844

PRECISION WIREWOUND RESISTORS

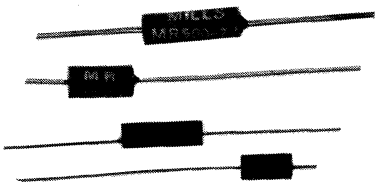
STANDARDS



Part No.	Watt	Max. R	Dia.	Length	Lead
MR100-1	.15	100K	.187	.375	#22
MR100-2	.25	1.5M	.250	.500	#22
MR100-3	.30	2.75M	.250	.750	#22
MR100-4	.35	3.0M	.375	.625	#20
MR100-5	.50	4.0M	.375	.828	#20
MR100-6	.50	5.0M	.50	.50	#20

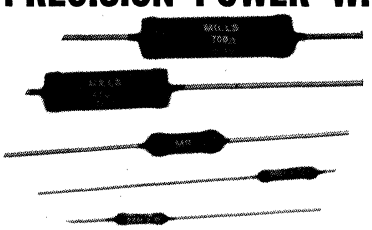
- Lead Configuration:
  "A" after Part No. 1 Axial Leads
  "R" for Radial Leads
  "L" for Lugs
- For high speed applications (minimum distributed L and C) specify MR200 Series.
- For high stability applications specify MR300 Series.
- Tolerance: .005% and up; to .002% in some cases.
- Metric sizes available, ask for our Metric Flyer.

MINIATURE PARTS



Part No.	Watt	Max. R	Dia.	Length	Lead
MR500-1	.04	100K	.080	.210	#20
MR500-2	.05	125K	.080	.375	#24
MR500-3	.04	100K	.125	.125	#24
MR500-4	.05	125K	.100	.210	#24
MR500-5	.10	125K	.125	.187	#24
MR500-6	.10	125K	.125	.250	

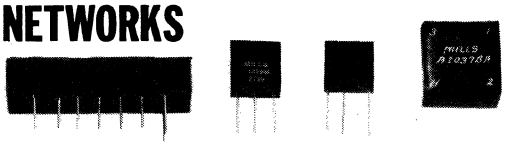
PRECISION POWER WIREWOUND RESISTORS



Part No.	Watt	Max. R	Dia.	Length	Lead
MRP-½-A	½	4.9K	.093	.343	#24
MRP-1-A	1	10.4K	.093	.406	#24
MRP-3-A	3	18K	.187	.562	#20
MRP-5-A	5	90K	.312	1.032	#18
MRP-10-A	10	370K	.344	1.719	#18

- To 10 watts.
- Silicone covered for maximum heat transfer.
- Tolerance: 5%, 1% standard, available to .05%.
- Ask for our Precision Power Flyer.

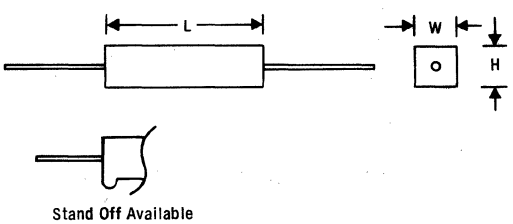
NETWORKS



- Any configuration you desire.
- Matched 2, 3 or 4 Network configurations available in standard sizes.
- Standard R, 2R, 4R types, etc. available.
- Tolerances: To .005%, closer in some cases;
  Temperature Coefficient tracking to 1 PPM; Ratio matches to .001%.
- Ask for our Network Flyer.

FIBERGLASS CORE WIREWOUND RESISTORS

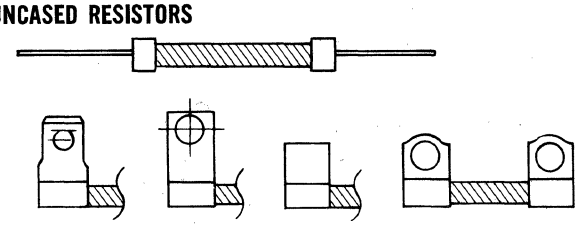
CERAMIC-CEMENT ENCASED RESISTORS



Stand Off Available

Part No.	Watt	Dimensions W	H	L	Leads
MRW-5	5	⅜	⅜	⅞	#20
MRW-7	7	⅜	⅜	1⅜	#20
MRW-10	10	⅜	⅜	1⅞	#20
MRW-15	15	½	½	1⅞	#18
MRW-20	20	½	½	2½	#18
MRW-25	25	⅝	⅝	2½	#18

UNCASED RESISTORS



ELECTRICAL SPECIFICATIONS

Tolerance ±10%, ±5" available
Wattage to 20 watts
Positive temperature coefficient parts are available

MECHANICAL INFORMATION

Variety of terminals available
Tin plated steel or brass lug terminal material
Axial leads — tinned copper or copperweld
Core is silicone impregnated fiberglass
Most dimensions per your requirements

MILLS RESISTOR COMPANY, INC.

3840 CATALINA STREET
LOS ALAMITOS, CA 90720
(213) 598-2454

7000 FRANKLIN BLVD.
SUITE 1070
SACRAMENTO, CA 95823
(916) 422-5461

CUSTOM BUILT OR STANDARD.....
..... MRC MEETS YOUR EXACT SPECS

MRC MILWAUKEE RESISTOR CORPORATION
704 W. VIRGINIA ST. • MILWAUKEE, WI 53204 • (414) 271-9900

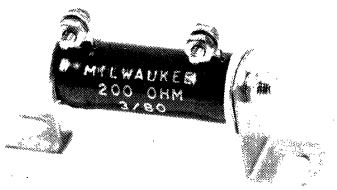
Custom Roundwire Power Resistors

ALTHOUGH MILWAUKEE RESISTOR ALSO MANUFACTURES INDUSTRY **STANDARD** VITREOUS ENAMEL RESISTORS, OUR SPECIALTY IS SOLVING DESIGN PROBLEMS THROUGH CUSTOM INNOVATION. SOME OF THE CUSTOM POSSIBILITIES ARE SHOWN ON THIS PAGE.

AVAILABLE WATTAGE RATINGS by core size.
Ratings based on 325°C above 25°C ambient.

Watts	Core Size O.D.xI.D.xL.	Ohmic Range Fixed † Min Ω	Fixed † Max Ω	Adjustable † Min Ω	Adjustable † Max Ω	Part No.*
8 (5) †	5/16X3/16X1	.70	13.5K	N.A.	N.A.	5-16-Ω
12 (10)†	5/16X3/16X1 3/4	.12	66K	0.27	15.2K	5-28-Ω
11 (8)	7/16X5/16X1	6.15	3.1K	N.A.	N.A.	7-16-Ω
15 (10)	7/16X5/16X1 1/2	.19	21K	N.A.	N.A.	7-24-Ω
20 (15)†	7/16X5/16X2	.11	63K	N.A.	N.A.	7-32-Ω
26	7/16X5/16X3	.11	110K	N.A.	N.A.	7-48-Ω
25 (20)†	9/16X5/16X2	.22	35K	0.47	28K	9-32-Ω
31 (25)	9/16X5/16X2 1/2	.11	55K	0.68	40K	9-40-Ω
50 (35)†	9/16X5/16X4	.21	119K	1.31	78K	9-64-Ω
75	9/16X5/16X6	.33	207K	2.15	128K	9-96-Ω
24	3/4X1/2X1 1/2	.33	13K	N.A.	N.A.	12-24-Ω
30 (25)	3/4X1/2X2	.28	29K	0.62	26K	12-32-Ω
45 (35)	3/4X1/2X3	.18	63K	1.17	59K	12-48-Ω
51 (40)	3/4X1/2X3 1/2	.22	83K	1.44	79K	12-56-Ω
61 (45)	3/4X1/2X4	.27	97K	1.72	93K	12-64-Ω
65 (50)	3/4X1/2X4 1/2	.31	122K	2.0	117K	12-72-Ω
75 (60)	3/4X1/2X5	.35	134K	2.27	129K	12-80-Ω
90	3/4X1/2X6	.43	172K	2.82	167K	12-96-Ω
100†	3/4X1/2X6 1/2	.47	186K	3.1	181K	12-104-Ω
52	1X3/4X3	.15	43K	0.49	38K	16-48-Ω
70	1X3/4X4	.12	72K	0.75	66K	16-64-Ω
85	1X3/4X5	.16	106K	1.02	99K	16-80-Ω
105	1X3/4X6	.20	134K	1.29	127K	16-96-Ω
40 (33)	1 1/8X3/4X2	.48	7.9K	N.A.	N.A.	18-32-Ω
80	1 1/8X3/4X4	.12	53K	0.77	48K	18-64-Ω
95	1 1/8X3/4X5	.17	83K	1.07	79K	18-80-Ω
120	1 1/8X3/4X6	.21	106K	1.37	100K	18-96-Ω
130(115)	1 1/8X3/4X6 1/2	.23	119K	1.51	114K	18-104-Ω
160	1 1/8X3/4X8	.31	160K	1.96	154K	18-128-Ω
175(160) †	1 1/8X3/4X8 1/2	.32	169K	2.11	163K	18-136-Ω
225†	1 1/8X3/4X10 1/2	.41	214K	2.71	208K	18-168-Ω
235	1 1/8X3/4X11 1/4	.45	239K	2.94	230K	18-180-Ω
251	1 1/8X3/4X12	.48	259K	3.16	250K	18-192-Ω
220	1 5/8X1 1/8X8 1/2	.41	100K	2.69	98K	26-136-Ω
275	1 5/8X1 1/8X10 1/2	.55	131K	3.54	129K	26-168-Ω
300	1 5/8X1 1/8X11 3/4	.62	151K	4.10	149K	26-188-Ω
500‡	2 1/2X1 3/4X12	.98	58K	6.4	58K	40-192-Ω C
750‡	2 1/2X1 3/4X15	1.30	75K	8.4	75K	40-240-Ω C
1000‡	2 1/2X1 3/4X20	1.80	105K	11.6	104K	40-320-Ω C
850‡	3 1/4X1 3/4X15	1.65	50K	10.8	50K	52-240-Ω C
1150‡	3 1/4X1 3/4X20	2.30	69K	15.0	69K	52-320-Ω C

- Wattages shown in parenthesis are Navy ratings per Mil-R-15109.
† Resistors shown are standard wattages
*Add "A" after part number for adjustable types.
†For resistance values outside the limits shown, consult M.R.C.
‡ Cement coating standard — Silicone available.
- Unable to find what you need above? The same cores can be wound with ribbon wire for higher wattage capability



M.R.C. can build a resistor to your specifications on any of the basic cores shown here. (If these do not suit your need, contact M.R.C. for engineering assistance, as 32 additional cores are also available.)

When contemplating a custom resistor, consider the following options to meet your exact requirement(s):

- **SPECIAL APPLICATIONS**
- **SIZE LIMITATIONS**
- **MIL–R–15109**

SPECIAL TOLERANCE–
- Resistance tolerance to ±1% can be manufactured in many cases.

SPECIAL COATINGS–
- Silicone
- Cement
- Sand & Cement

SPECIAL TAPS–
- Taps can be provided to your specifications.

SPECIAL T.C.–
- Temperature coefficient to 20 ppm/°C.

SPECIAL WINDINGS–
- Ayrton-Perry (Non-inductive, round wire only)
- Bilfilar (Non-inductive)

SPECIAL TERMINALS–
- Single and double ¼" quick-connect
- Metal sleeve ferrule
- Live-bracket

HARDWARE–
- Terminal hardware
- L–Bracket mounting
- Spring clip mounting
- Vertical mounting hardware

LOAD BANKS–
- M.R.C. will custom design and build load banks to your requirements.

CUSTOM BUILT or STANDARD.....
.....MRC MEETS YOUR EXACT SPECS

MRC MILWAUKEE RESISTOR CORPORATION
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UNIQUE HI-OHM RIBWOUNDS .....
.....SAVE SPACE

MRC MILWAUKEE RESISTOR CORPORATION
704 W. VIRGINIA ST. • MILWAUKEE, WI 53204 • (414) 271-9900

Vitreous Enamel Ribwound Resistors

APPLICATIONS

Particularly useful where high energy is to be dissipated in the lower ohmic ranges. Due to its ability to operate at higher temperatures and dissipate greater heat, the ribwound resistor is almost one-half the physical size of the equivalently rated round-wire style resistor. Ribwound wattage ratings are based on a temperature rise of 375°C above an ambient of 40°C. They may be mounted with spring clips (thru 1 1/8" dia.); thrubolt mounting hardware, individual or multiple-stacked bracket assemblies or live-bracket mountings.

BASIC CONSTRUCTION

Crimped ribbon resistance wire is edge-wound and then locked to the ceramic core with vitreous enamel. Resistance wire is spot-welded to the terminal bands. Ribwound resistors can be furnished in fixed, adjustable, or tapped styles and are also available with cement coating.

OHMS	OHMS	OHMS
0.1	1.0	6.0
0.15	1.25	8.0
0.2	1.5	10.0
0.25	2.0	12.0
0.4	2.5	15.0
0.5	3.0	20.0
0.6	4.0	25.0
0.75	5.0	33.0

Many 300 watt units are stocked in both fixed and adjustable styles. Listed are the more popular 300 watt ohmic values. All other wattage ratings and styles are made to order.

HI–OHM RIBS
Exclusively from M.R.C.

You may note on the adjacent chart that maximum ohmic values shown for each wattage are three or more times that normally available.

This development is the result of the installation of precision rib winding machines designed and manufactured by M.R.C.

Unique in the industry, these precision machines produce a winding with extreme uniformity, as close inspection of M.R.C. ribwound resistors will reveal. The uniform winding allows turns to be applied much closer to each other and consequently significantly higher resistances are achieved.

This means that lower ohmic value round wire power resistors may feasibly be replaced by HI–OHM RIBS with a significant saving in size. (For a given wattage rating, ribwounds are considerably smaller physically.)

WATTS	CORE SIZE	OHMIC RANGE#		PART NUMBER	
	O.D. X I.D. X L.	FIXED	ADJ.	FIXED	ADJ.
40	$^{9}/_{16}$X$^{5}/_{16}$X2	.010-9.4	N.A.	9-32-Ω R	USE SAME PART NUMBER BUT SUBSTITUTE "AR" FOR "R".
50	$^{3}/_{4}$X$^{1}/_{2}$X2	.010-6.1	N.A.	12-32-Ω R	
60	$^{3}/_{4}$X$^{1}/_{2}$X2$^{1}/_{2}$	.010-12.2	N.A.	12-40-Ω R	
75	$^{3}/_{4}$X$^{1}/_{2}$X3	.010-18.3	N.A.	12-48-Ω R	
90	$^{9}/_{16}$X$^{5}/_{16}$X4	.016-28.0	.014-25.0	9-64-Ω R	
100	$^{3}/_{4}$X$^{1}/_{2}$X3$^{1}/_{2}$	.013-24.0	.011-20.0	12-56-Ω R	
110	$^{3}/_{4}$X$^{1}/_{2}$X4	.016-30.0	.014-26.0	12-64-Ω R	
120 (110)	$^{3}/_{4}$X$^{1}/_{2}$X4$^{1}/_{2}$	.020-36.0	.018-32.0	12-72-Ω R	
135	$^{3}/_{4}$X$^{1}/_{2}$X5	.022-42.0	.020-39.0	12-80-Ω R	
150	$1^{1}/_{8}$X$^{3}/_{4}$X4	.023-44.0	.020-39.0	18-64-Ω R	
160	$^{3}/_{4}$X$^{1}/_{2}$X6	.029-55.0	.027-51.0	12-96-Ω R	
160 (155)	$1^{1}/_{8}$X$^{3}/_{4}$X4$^{1}/_{4}$	.025-49.0	.022-43.0	18-68-Ω R	
175	$1^{1}/_{8}$X$^{3}/_{4}$X4$^{1}/_{2}$	.027-53.0	.024-48.0	18-72-Ω R	
180	$^{3}/_{4}$X$^{1}/_{2}$X6$^{1}/_{2}$	.032-61.0	.030-57.0	12-104-ΩR	
220	$1^{1}/_{8}$X$^{3}/_{4}$X6	.041-80.0	.038-74.0	18-96-Ω R	
225 (220)	$1^{1}/_{8}$X$^{3}/_{4}$X6$^{1}/_{8}$	.040-82.0	.035-77.0	18-98-Ω R	
240 (240)	$1^{1}/_{8}$X$^{3}/_{4}$X6$^{1}/_{2}$	.041-89.0	.038-83.0	18-104-Ω R	
300 (300)†	$1^{1}/_{8}$X$^{3}/_{4}$X8$^{1}/_{2}$	.057-125	.055-119	18-136-Ω R	
375	$1^{1}/_{8}$X$^{3}/_{4}$X10$^{1}/_{2}$	.074-161	.071-155	18-168-Ω R	
400	$1^{1}/_{8}$X$^{3}/_{4}$X11$^{1}/_{4}$	.080-174	.077-168	18-180-Ω R	
400 (400)	$1^{5}/_{8}$X$1^{1}/_{8}$X8$^{1}/_{2}$	.066-159	.062-149	26-136-Ω R	
420	$1^{1}/_{8}$X$^{3}/_{4}$X11$^{3}/_{4}$	.084-183	.081-177	18-188-Ω R	
500 (500)	$1^{5}/_{8}$X$1^{1}/_{8}$X10$^{1}/_{2}$	.087-200	.083-200	26-168-Ω R	
550 (550)	$1^{5}/_{8}$X$1^{1}/_{8}$X11$^{3}/_{4}$	.100-240	.096-230	26-188-Ω R	
750‡	$2^{1}/_{2}$X$1^{3}/_{4}$X12	.140-166	.130-157	40-192-Ω RC	
1000‡	$2^{1}/_{2}$X$1^{3}/_{4}$X15	.183-210	.176-200	40-240-Ω RC	
1500‡	$2^{1}/_{2}$X$1^{3}/_{4}$X20	.250-300	.240-290	40-320-Ω RC	
2000‡	$3^{1}/_{4}$X$1^{3}/_{4}$X20	.300-390	.290-380	52-320-Ω RC	

 # Standard resistance tolerance is ±10% - closer on request.
† Stock wattage - see stock list this page.
‡ Cement coating is standard rather than vitreous enamel.
Wattages in parenthesis are Navy ratings per Mil-R-15109, Form EW.

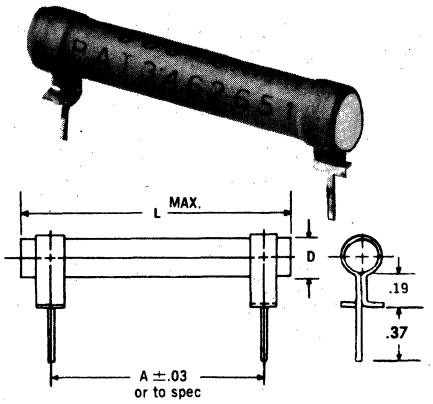
UNIQUE HI-OHM RIBWOUNDS .....
.....SAVE SPACE

MRC MILWAUKEE RESISTOR CORPORATION
DEPT. EM, 704 W. VIRGINIA ST. MILWAUKEE, WI 53204 414-271-9900

MILWAUKEE RESISTOR CORPORATION
704 W. VIRGINIA ST. MILWAUKEE, WI. 53204 414-271-9900

ON TIME DELIVERIES.....
.....DATE GUARANTEED when required

PCB Printed Circuit Board Resistors*



FIXED PCB'S

WATTS	L	A	D	MAX. OHMS
3	1	0.6	13/64	20,000
5	1 1/4	0.9	13/64	38,000
7	1 5/8	1.3	13/64	69,000
10	2.1	1.7	13/64	86,000
15	2.1	1.7	5/16	85,000
20	2 1/2	2.2	5/16	113,000

ADJUSTABLE PCB'S

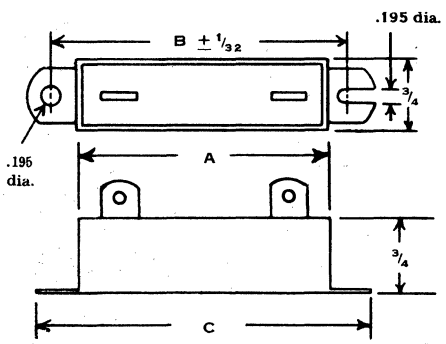
WATTS	L	A	D	MAX. OHMS
15	2.1	1.7	5/16	2,000 ‡
20	2 1/2	2.2	5/16	3,000 ‡

‡=FOR HIGHER OHMS, CONSULT FACTORY

FEATURES

- Built-in standoff keeps board cool.
- Mounting feet prevent rocking.
- Power ratings 3 to 20 watts.
- Complete OHM range.
- One-piece, welded terminals
- Rectangular leads .020 x .040 in.
- Silicon base coating. Vitreous enamel coating available.
- Standard tolerance ±5%.
- 20 PPM upon request.

* Patent #3,462,651

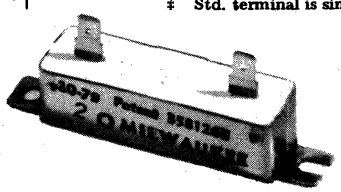


TERMINALS TO CUSTOMER SPECIFICATIONS—Screw Lug, Quick-Connect.

WATTS Ratings at 275°C rise showing benefit of mounting flush for full heat sink.††		DIMENSIONS			PART NUMBER
Without Heat Sink	With Heat Sink	A	B	C	(Specify Terminal)
20	45	1	1 7/16	1 7/8	12M16-Ω †
40	70	2 1/2	3	3 3/8	12M40-Ω ‡
50	100	3 11/16	4 1/8	4 9/16	12M59-Ω ‡

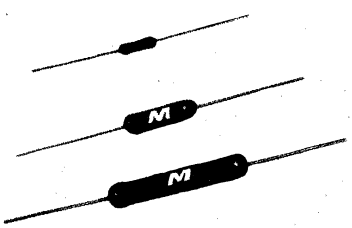
†† Ratings based on mounting on steel panel 10" x 10" x .040"; (heat transfer to heat sink is improved by the use of thermal conductive grease or epoxy).
† Std. terminal is 3/16" wide with hole, Type AB.
‡ Std. terminal is single quick connect, Type H.

Metal Case



High Heat Sink—flush mounting dissipates heat.
20 to 100 Watts — higher on Specials
Quick Connect or Screw Terminals
Save: Space -First Cost- Assembly Cost
Patent #3,581,266
WRITE FOR ADDITIONAL INFORMATION

Axials



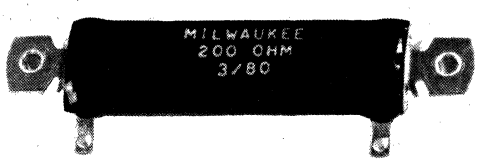
APPLICATIONS

- Electronic Circuitry
- Printed Circuits
- Radio, Television and Sound Reproduction
- Miniature Controls

FEATURES

- Rugged yet small.
- Highly stable.
- Matched expansion in core caps and coating for temperature stability.
- Standard 5% tolerance over 1 ohm, available in close tolerances on request.
- Wattage ratings based on 325°C rise at 25°C ambient.
- Standard Sizes—3, 6.5, 11 watts.
- Leads Hot Tin Dipped.

Ovals



OVAL RESISTORS are for use where space saving is desired and where the use of the 'Heat Sink' function of the metal chassis, rack or panel may be employed. Resistance tolerance of ±5% is standard except on low resistance and multi-tapped units. COATINGS of vitreous enamel or silicone base are offered.

OVALS are available in regular or miniature sizes; an original development of MILWAUKEE Resistor.

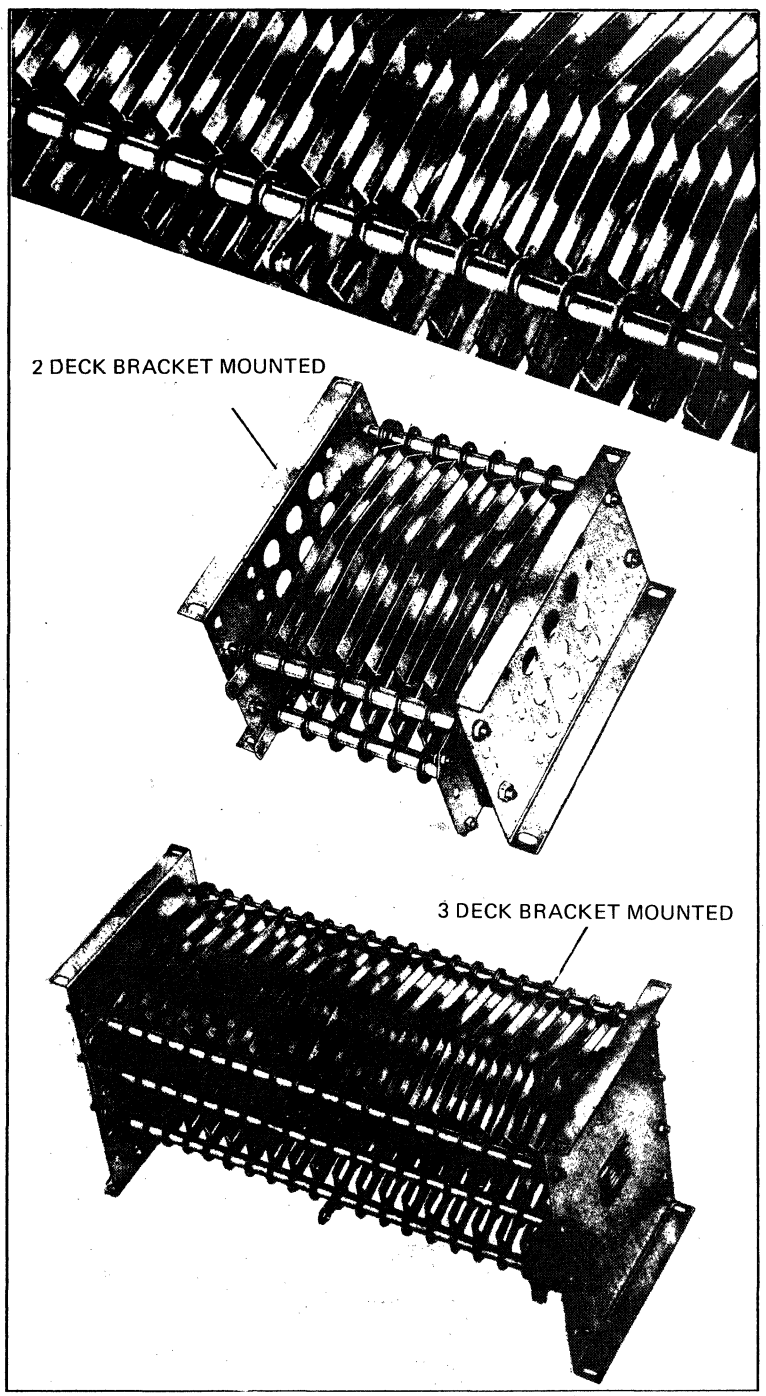
MRC MILWAUKEE RESISTOR CORPORATION
704 W. VIRGINIA ST. • MILWAUKEE, WI 53204 • (414) 271-9900

EXCLUSIVE PATENTED*, PRE-FORMED.....
.....GRID ELIMINATES WARPING PROBLEMS

Grid Resistors *

For High Current and High Power Circuits

COMPUTER AIDED DESIGN – All Milwaukee Grids are designed for the specific application involved at no extra cost. Without the constraints of standard resistance and current ratings, Milwaukee can offer a grid for your exact need, often at a considerable saving in cost.



APPLICATIONS WHERE RUGGED MILWAUKEE GRIDS ARE IN USE.....

- Motor Starting
- Speed Control
- Braking
- Power Systems
- Heaters
- Crane Controls
- Dummy Loads
- Grounding Resistors
- Feedback Resistors

* Patent 3,212,045

MRC MILWAUKEE RESISTOR CORPORATION
DEPT. EM, 704 W. VIRGINIA ST. MILWAUKEE, WI 53204 414-271-9900

EXCLUSIVE, PATENTED*, PRE-FORMED .....
.....GRID ELIMINATES WARPING PROBLEMS

EDGEWOUND RESISTORS .....
..... HIGH POWER TO WEIGHT RATIO

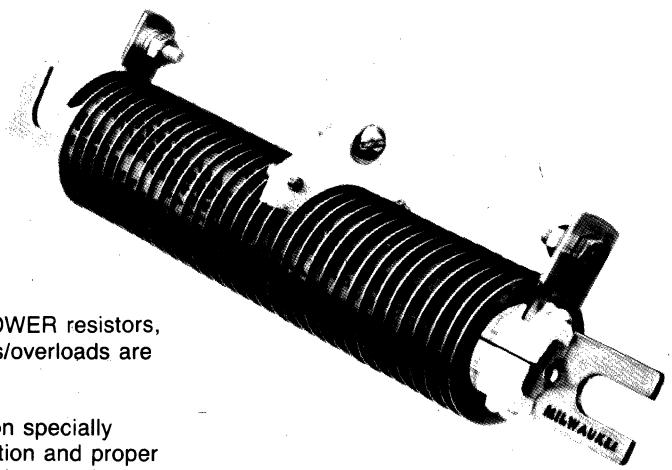
MRC MILWAUKEE RESISTOR CORPORATION
704 W. VIRGINIA ST. • MILWAUKEE, WI 53204 • (414) 271-9900

Edgewound Power Resistors

EDGE-POWER

New **EDGE-POWER** resistors complement Milwaukee Resistor's roundwire, ribwound and grid resistors which have been the industry's workhorse of electrical power dissipation for many years.

A continuous range of resistor types are now available for your high current applications. EDGE-POWER falls naturally between MRC's ribwound and grid resistors and allows full design versatility from one source.



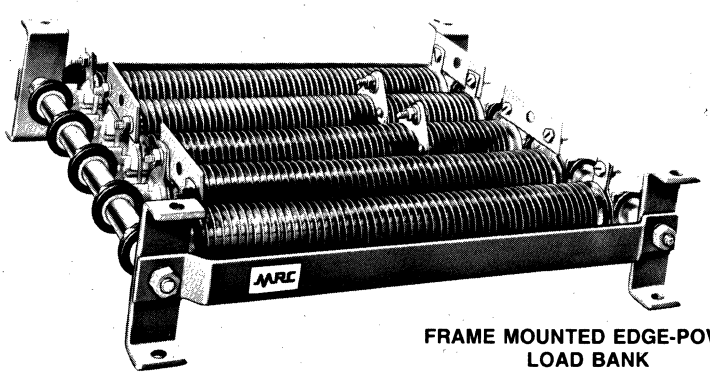
HIGH CAPACITY
GOOD WEIGHT/WATTAGE RATIO

Because of the open coil construction of EDGE-POWER resistors, heat dissipation is efficient, and reasonable surges/overloads are easily accommodated.

The heavy duty resistance-alloy coil is supported on specially designed porcelain insulators which provide insulation and proper turn-to-turn spacing. The end-slot/side-slot support bar provides versatility in mounting and adapts easily to many existing installations.

Movable tap terminals are available as an option. Terminal hardware for cable attachment is provided as a standard item on all terminals and taps.

Frame mounted load banks (as shown below) can be furnished with taps and jumpers to meet your circuit specifications (series, parallel or combination). Your load bank inquiries are invited.



FRAME MOUNTED EDGE-POWER LOAD BANK

Typical Applications of EDGE-POWER resistors include motor control (starting, plugging, speed control and braking), load dumping, ballast, current limiting, and voltage dropping. Edgewound resistors are commonly found in:

- Overhead Cranes
- Locomotives
- Lift Trucks
- Arc and Spot Welders
- Battery Lines / Chargers
- Plating Baths
- Elevators
- Power Supplies
- Many Industrial Controls

CUSTOM BUILT or STANDARD.....
.....MRC MEETS YOUR EXACT SPECS

MRC MILWAUKEE RESISTOR CORPORATION

MOTOR CONTROL .....
.... LOAD DUMPING, CURRENT LIMITING

MRC MILWAUKEE RESISTOR CORPORATION
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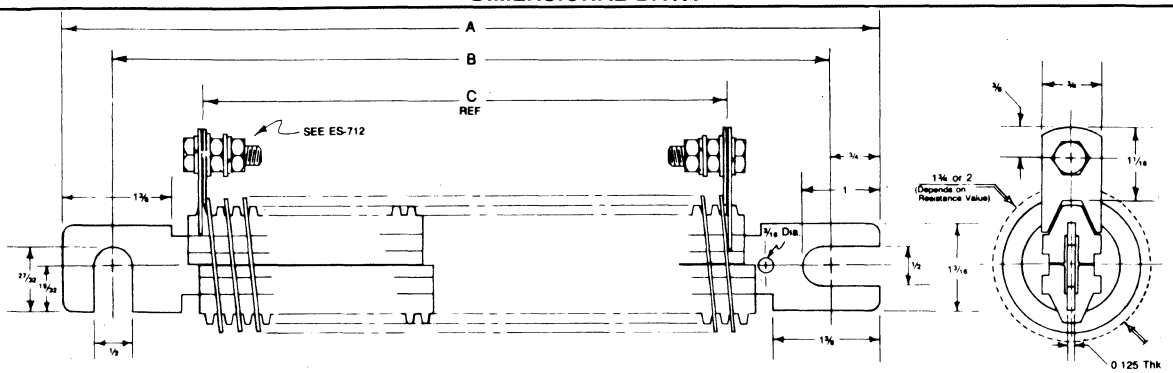
Edgewound Power Resistors

DIMENSIONAL DATA

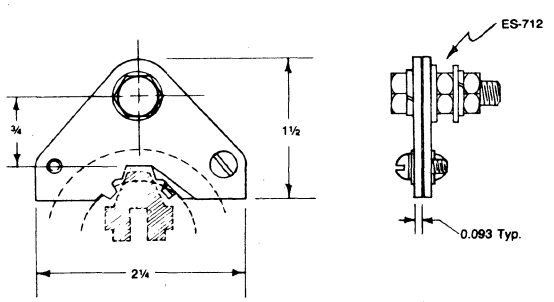


FORM 3			FORM 4			FORM 5			FORM 6			FORM 7			FORM 8		
600 WATT			800 WATT			1,000 WATT			1,200 WATT			1,400 WATT			1,600 WATT		
A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
12¼	11	8¼	15¼	14	11¼	18¼	17	14¼	21¼	20	17¼	24¼	23	20¼	27¼	26	23¼

Wattage rating based on 375°C rise above an ambient of 40°C

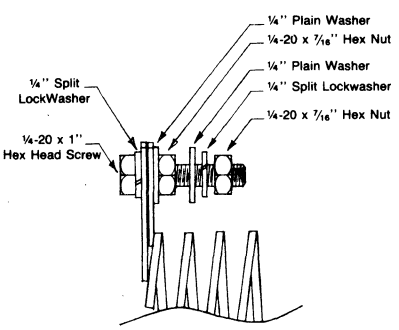
- Six lengths and 29 current ratings are available.
- Resistance elements are continuously wound from resistance alloy ribbon.
- End terminals are brazed permanently to the resistance element for reliable electrical connection.
- The resistance coil is edge-mounted on captivated porcelain insulators which maintain turn-to-turn spacing and provide isolation from the support bar.
- Support bar utilizes side-slot/end-slot design for mounting versatility.
- Movable tap terminals are available — See part number Z-5698 below.
- See ES-712 below for terminal hardware detail.
- See Bulletin 19B for available current ratings, resistance values and part numbers.

MOVABLE TAP TERMINAL



Part Number Z-5698

ES-712



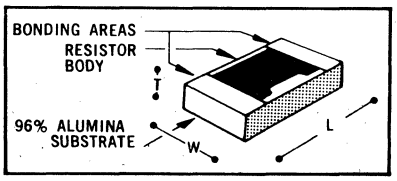
Standard Terminal Hardware

CUSTOM BUILT or STANDARD.....
.....MRC MEETS YOUR EXACT SPECS

MRC MILWAUKEE RESISTOR CORPORATION

PRECISION THICK/THIN FILM CHIP RESISTORS

MINI-SYSTEMS, INC
20 David Road, P.O. Box 69, North Attleboro, MA 02761
TELEPHONE: (617) 695-0203 • TWX NO. 710-348-0564



MINI-SYSTEMS, INC., thick/thin film chip resistor components are ideally suited for the fabrication of microelectronic circuits where tight resistance tolerance, wide range of resistance values, or short production runs make the conventional screening and firing of thick/thin film resistance networks too costly. MINI-SYSTEMS, INC., chip resistors are made from a carefully engineered selection of materials. Geometries are mechanically precise and uniform. Careful testing and inspection result in the highest quality resistors.

STANDARD "MSR" SERIES

- Sizes Available: .035″ x .035″ up to .661″ x .494″.
- PDIS Rating (25°C free air): 40 mW to 15 W.
- Resistors manufactured with palladium silver or platinum gold.
- Tolerances available: ±.5%, 1%, 2%, 5%, 10%, and 20% for most resistance values.
- All types available in untinned versions for conductive epoxy attachment.
- Hi-Rel screening available on all resistor types.
- Backside metalization available upon request.
- "Flip-Chip" resistors are solder tinned (SN-62).
- Wire bond resistors have gold metalization optimized for wire bonding.
- Sandwich metalization standard on all wrap-around resistors.

***Wrap-Around Terminations**

WA-	Size (L x W)	PDIS Rating 25°C (Milliwatts)	Ohmic Range
10	.040 x .037	35	1Ω to 75MΩ
4	.057 x .052	250	1Ω to 100MΩ
13	.083 x .052	400	1Ω to 100MΩ
9	.110 x .052	500	1Ω to 100MΩ
7	.110 x .102	1000	1Ω to 100MΩ
24	.160 x .052	600	1Ω to 100MΩ

* Other standard sizes available.
Write for free literature with detailed resistor chart.

ESTABLISHED RELIABILITY QPL MIL-R-55342 CHIP RESISTORS FOR ALL CRITICAL APPLICATIONS

- Sizes 55342/1 through /6
- Terminations Available: S, R, W, T, U
- Tolerances Available: F, G, J, K
- Meet or exceed Characteristic K
- Delivery: Typically 4 weeks ARO

NEW LOW COST "JR" SERIES COMPUTER/INDUSTRIAL GRADE WRAP AROUND CHIP RESISTOR

TYPE #JR13 — .075(L) x .050(W) x .017(T)

- Resistance Range: 10Ω to 10MΩ to standard EIA/MIL/IEC resistance decade values.
- PDIS Rating (25°C free air): 200 milliwatts.
- Untinned for either epoxy or solder attachment.
- Delivery typically 2 weeks ARO.

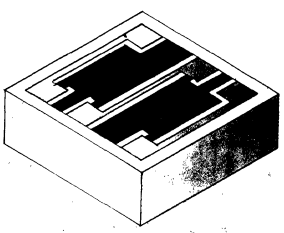
THIN FILM

MSTF-2 SERIES
(.020″ x .020″)

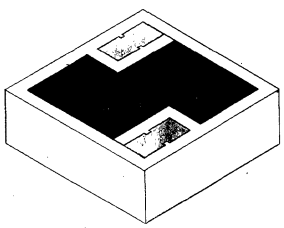
MSTF-3 SERIES
(.030″ x .030″)

MSTF-4 SERIES
(.040″ x .040″)

CUSTOM NETWORKS



MSTF-3 FORMAT A



MSTF-3 FORMAT B

- Nichrome or Tantalum Nitride
- Choice of Substrates:
  a) Oxidized Silicon — .010″ ±.003″ Oxide Thickness — 10,000 Å min.
  b) Ceramic, 99.6% — .010″ ±.001″
- Values range through the RETMA Series from 1Ω up to 10 megohm, depending on chip size.
- Tolerances: ±20%, 10%, 5%, 2%, 1%, 0.5% and 0.1% for most values.
- Backside gold available (3,000 Å typ.) on request.
- MSTF-3 series includes standard center tap dual resistor pattern.
- Visual requirements designed to meet MIL-STD-883 Method 2010.6 with full lot traceability of material and processing.
- Bond pad size: .005″ x .005″ minimum. Bond pad conductor material: Gold (20,000 Å typ.) standard. Bondable with normal wire bonding methods, such as thermocompression, thermosonic, or ultrasonic.
- Nichrome resistors passivated with silicon dioxide (5,000 Å typ.) for moisture protection and reliability. TCR (absolute) can be provided from 0-25 ppm. Special TCR's available on request.
- Noise: −30 to −35 dB typical for most values.
- Stability: 0.05% max. 0.02% typical. ± .003% typical Ratio. (After 1000 hours @ + 125°C.)
- Trimmable: Designed for later active trimming with Xenon or YAG Laser.
- Chip or Packaged

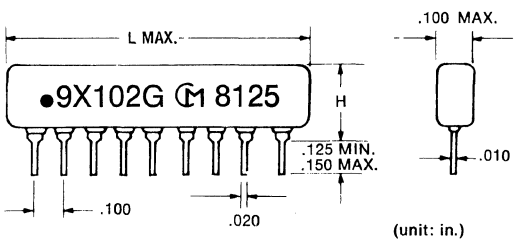
FOR ANY CUSTOM REQUIREMENTS, CONTACT FACTORY

THICK/THIN MULTILAYER SUBSTRATES/ HYBRID MICROCIRCUITS

MINI-SYSTEMS, INC. has the latest materials technology processing capabilities for thick film multilayer substrates/monolithic thick film substrates, and custom resistor networks coupled with complete facilities for hybrid assembly, packaging, and testing. Fully automatic wire bonders and fully automatic laser trim systems give substantial production quantity capabilities.

sip resistor networks

MURATA ERIE NORTH AMERICA, INC.



⅛ Watt H = .200
⅛ Watt H = .250
¼ Watt H = .336 (Except RSC___Y—.250)

X-CIRCUIT

No. Pins	No. of Elements	L
4	3	0.395
5	4	0.495
6	5	0.595
7	6	0.695
8	7	0.795
9	8	0.895
10	9	1.024
11	10	1.100
12	11	1.200
13	12	1.300

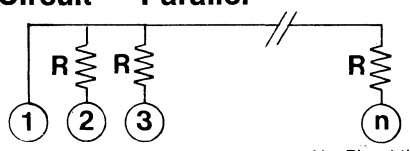
Y-CIRCUIT

No. Pins	No. of Elements	L
6	3	0.595
8	4	0.795
10	5	1.024
12	6	1.200

Z-CIRCUIT

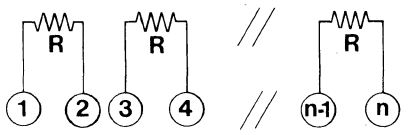
No. Pins	No. of Elements	L
6	8	0.595
8	12	0.795
9	14	0.895
10	16	1.024

X-Circuit — Parallel



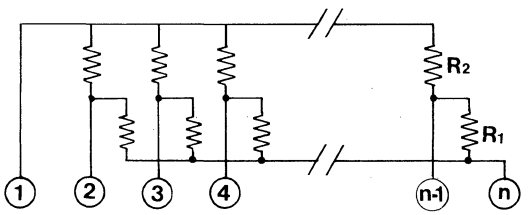
12 Elements Max. N = Pins 4 through 13

Y-Circuit — Discrete



6 Elements Max. N = 6, 8, 10 and 12 Pins

Z-Circuit — Double Termination



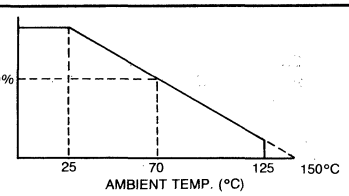
16 Elements Max. N = 6, 8, 9 and 10 Pins

SPECIFICATIONS

Electrical

Temp. Range:	−55°C to +125°C
Resistance Range:	47Ω to 750KΩ (22Ω to 1MΩ available on special request)
Resistance Tolerance:	±2% (G), ±5% (J), ±10% (K), ±20% (M)
Temp. Coefficient:	±200 ppm/°C max. (±100 ppm/°C max. on special order)
Power:	RSC-125 mW max./resistor or 1.5W max./package (whichever is smaller) RSH-250 mW max/resistor or 2.5W max./package (whichever is smaller)

Power Derating Characteristics:



Mechanical

Substrate Material:	Alumina
Resistor Material:	Cermet, thick film
Lead Pull Strength:	2 lbs.
Lead Material:	Tinned Copper Alloy

STANDARD RESISTANCES

Res. (ohms)	Code	Res. (ohms)	Code	Res. (ohms)	Code	Res. (ohms)	Code
100	101	1K	102	10K	103	100K	104
150	151	1.5K	152	15K	153	150K	154
220	221	2.2K	222	22K	223	220K	224
330	331	3.3K	332	33K	333	330K	334
470	471	4.7K	472	47K	473	470K	474
680	681	6.8K	682	68K	683	680K	684

TYPICAL RESISTANCE COMBINATIONS*

R_1/R_2	R_1/R_2	R_1/R_2
160/240	330/390	330/390
180/390	330/470	1.5K/3.3K
220/330	330/680	3K/6.2K

*** Note 1:** In addition to $R_1 = R_2$ resistance combinations, the typical resistor combinations shown in the chart are available on special order.
2: RC networks also available. Contact Murata Erie for technical details.

MARKING: Pin 1 Location, No. of Pins, Circuit Type, Res. Value, Tolerance, 4 = RSH ¼W only

PART NUMBERING SYSTEM

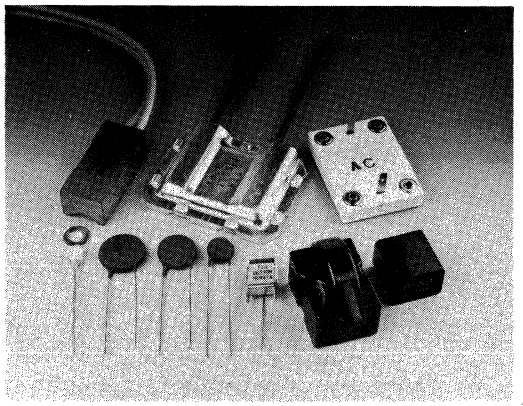
RSC 6 X 102 G

- **RSC** — SINGLE IN-LINE RESISTOR NETWORK; RSC = ⅛W; RSH = ¼W
- **6** — NO. OF PINS
- **X** — CIRCUIT TYPE; X = Parallel; Y = Discrete; Z = Double Termination
- **102** — RESISTANCE CODE; First two digits are significant. Last indicates number of zeros.
- **G** — RESISTANCE TOLERANCE; G = ±2%, J = ±5%, K = ±10%, M = ±20%

MURATA ERIE NORTH AMERICA, INC. 1148 Franklin Rd., S.E., Marietta, Georgia 30067 Tel: (404) 952-9777 Telex: 54-2329 TWX: 810-766-1531

posistor® positive temperature coefficient resistors

MURATA ERIE NORTH AMERICA, INC.

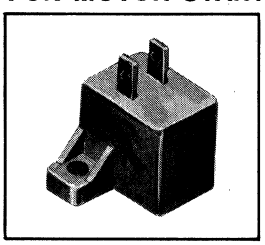


Murata Erie Posistors are basically positive temperature coefficient resistors with a very well defined resistance-temperature "knee" and the unique ability to "switch" relatively large amounts of power. They may also be used as self-regulating heating devices at useful power levels and as control devices for high power heaters. Applications include temperature sensing, over temperature and over current protection and motor starting to name a few.

Products utilizing Positors are extremely safe and reliable and offer all of the design, manufacturing, repair and sales advantages of solid state technology.

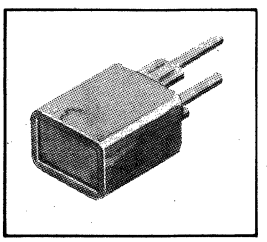
- Compact
- Reduced component count
- Extremely reliable
- "Stepless" temperature control
- Simple repair or replacement
- Long term reliability
- Shock and vibration immunity
- Nonflammable case and insulation available
- No electrical or acoustical noise
- No electrical contacts

FOR MOTOR STARTING



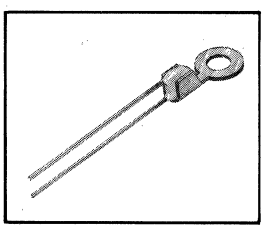
Provides a smooth, solid state electronic starting device for single phase motors utilizing a split-phase starting winding or for PSC motors as a direct replacement for starting capacitors and switches.

FOR DEGAUSING



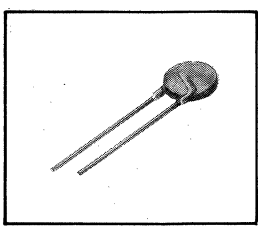
Used in series with CRT degausing coils, the Posistor functions as an automatic switch that goes to a high resistance state in a fixed time period after power is applied, effectively eliminating the current that flows through the degausing coil.

FOR SEMICONDUCTOR OVERLOAD PROTECTION



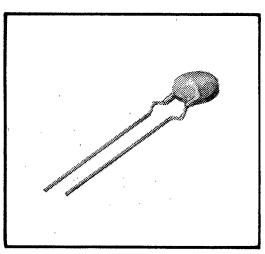
Senses the case temperature of high power semiconductors and appropriately reduces the power dissipation when dangerous power or current levels are reached by switching to a high resistance state and reducing base bias current.

FOR TRANSFORMER PROTECTION



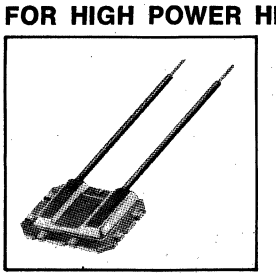
These devices are connected mechanically to the transformer core and electrically in series with the transformer primary. If core temperature exceeds temperature specs, the Posistor switches to a high resistance state and limits input current. It resets automatically when temperature returns to normal.

FOR CIRCUIT PROTECTION



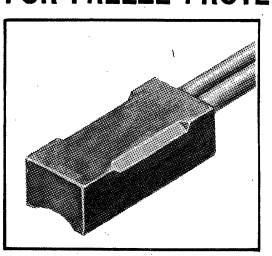
Provides overcurrent protection in a variety of applications. When connected in series with the protected device, Posistors limit the circuit current to a predetermined value — above that value they switch to a high resistance state and limit the current to a safe level.

FOR HIGH POWER HEATING



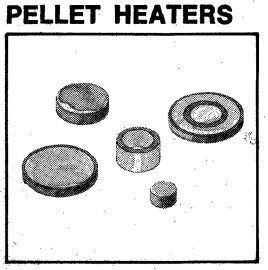
Posistors for heating are self-temperature regulating with fast thermal response and power ratings to 170 watts.

FOR FREEZE PROTECTION



Designed for water filled pipe freeze-protection. Self-temperature regulating. As temperature decreases the Posistor power dissipation increases creating more heat that is conducted to the pipe (approximately 25 watts @ −20°C).

PELLET HEATERS

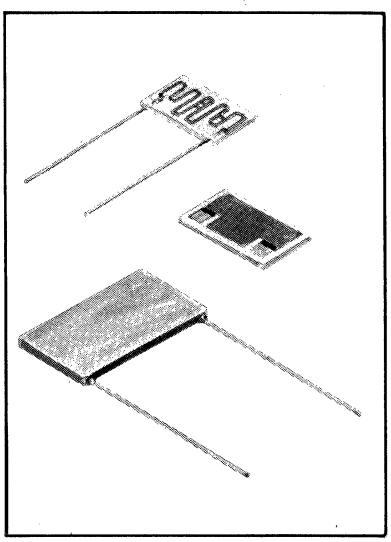


Basic Posistor elements are available in a variety of shapes and electrical characteristics to meet custom application requirements.

MURATA ERIE NORTH AMERICA, INC. 1148 Franklin Rd., S.E. Marietta, Georgia 30067 Tel: (404) 952-9777 Telex: 54-2329 TWX: 810-766-1531

high voltage resistors

MURATA ERIE NORTH AMERICA, INC.



HV resistors

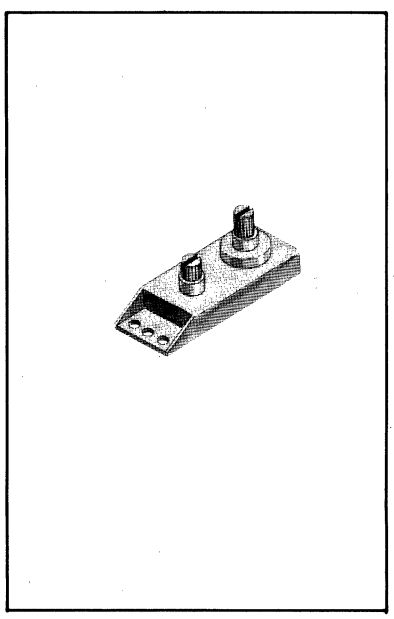
Murata Erie's line of high voltage resistors are designed to replace high voltage carbon film resistors and feature an extremely rigid alumina substrate with a deposited *thick film* resistance element for maximum electrical and mechanical stability.

Three models are offered — the *P Series* is for subassemblies that will be encapsulated in epoxy resin after assembly, the *D Series* which is supplied completely encapsulated and the *F Series* which is supplied encapsulated but without leads.

Murata Erie's application engineers are available to aid in the selection of exactly the right high voltage resistor to meet specific application requirements.

SPECIFICATIONS

Voltage Range	10 to 35 KV
Resistance Range	1 to 5000 Megohms
Power Rating	3 to 5 Watts at −70°C
Operating Temperature Range	−25°C to +130°C
Temperature Coefficient	±150 ppm/°C
Tolerance	±2% to ±20%



focus adjusting resistors

Murata Erie's focus adjusting resistors are designed to meet the stringent demands of high voltage CRT power supply applications. They are offered in a variety of configurations including those with integral capacitors and multiple taps such that most application requirements can be easily met.

TYPICAL CHARACTERISTICS

Item	Condition	Performance
Rated Power	Ambient Temperature: −20°C to +70°C	3W Max.
Temperature Coefficient	Ambient Temperature: −20°C to +120°C	±300 ppm/°C
Voltage Coefficient	Impressed Voltage: 1/10 Rated Voltage (to rated Voltage)	±3 ppm/Volt
Load Life	Ambient Temperature: 70°C; Impressed Voltage: Rated Voltage; Impressed Time: 1000 hours (90 minutes ON, 30 minutes OFF)	△R ≦ ±5% △N ≦ ±3%
Humidity Characteristics	Ambient Temperature: 40°C; Relative Humidity: 95%; Shelf Time: 1000 hours	△R ≦ ±5% △N ≦ ±3%
Thermal Shock Characteristics	1 cycle is −30°C (1 hour) to +130°C (1 hour) — Repeat 10 cycles	△R ≦ ±3% △N ≦ ±2%
Withstanding Voltage	Impressed Voltage: 1½ Rated Voltage; Impressed Time: 1 minute	△R ≦ ±3% No failure

△R denotes variation of resistance value. △N denotes variation of tapped resistance ratio.

MURATA ERIE NORTH AMERICA, INC. 1148 Franklin Rd., S.E., Marietta, Georgia 30067 Tel: (404) 952-9777 Telex: 54-2329 TWX: 810-766-1531

NIC COMPONENTS CORPORATION FIXED RESISTORS

RESISTORS GENERAL SPECIFICATIONS AND PRODUCT LIST

I. PRODUCTS LIST

Type	Series Number	Power Rating @70° C	Maximum Working Voltage	Resistance Range	Resistance Tolerance	Temperature Coefficient (ppm/° C)
Carbon Film	NCF16	0.16W	200V	10 ~ 1MΩ	±2, ±5%	+350—450 ~ 0—1300
Carbon Film	NCF25	0.25W	300V	1.0 ~ 10MΩ	±2, ±5%	+350—450 ~ 0—1300
Carbon Film	NCF50	0.50W	350V	1.0 ~ 10MΩ	±2, ±5%	+350—450 ~ 0—1300
Carbon Film	NCF1W	1W	500V	1.0 ~ 5.1MΩ	±2, ±5%	+350—450 ~ 0—1300
Metal Oxide Film	NMO1W	1W	350V	1.0 ~ 100KΩ	±2, ±5%	±350
Metal Oxide Film	NMO2W	2W	350V	1.0 ~ 100KΩ	±2, ±5%	±350
Metal Oxide Film	NMO3W	3W	500V	1.0 ~ 100KΩ	±2, ±5%	±350
Metal Oxide Film	NMO5W	5W	750V	5.1 ~ 240KΩ	±2, ±5%	±350
Metal Oxide Film	NMO7W	7W	750V	5.1 ~ 240KΩ	±2, ±5%	±350
Metal Film	NMR25	0.25W	250V	10 ~ 1MΩ	±0.5, ±1, ±2%	±25, ±50, ±100
Metal Film	NMR50	0.5W	350V	10 ~ 1MΩ	±0.5, ±1, ±2%	±25, ±50, ±100
Metal Film	NMR1W	1W	500V	20 ~ 1MΩ	±0.5, ±1, ±2%	±25, ±50, ±100
ZERO OHM	NZ025	JUMPER TYPE INSULATED RESISTORS				

Note: Higher and lower resistance values are available upon request.

II. GENERAL SPECIFICATIONS

A. ELECTRICAL CHARACTERISTICS

1. POWER
The power rating is the maximum power which can be applied to the resistor continuously at the specified ambient temperature.

2. RATED WORKING VOLTAGE
The rated working voltage is the maximum DC voltage or RMS value of AC voltage which can be applied to the resistor at the specified ambient temperature, and will be calculated by the following formula:

$$\text{RATED WORKING VOLTAGE} = \sqrt{\text{POWER RATING (W)} \times \text{NOM. RESISTANCE } (\Omega)}$$

However, the resistor can not be used over the specified MAXIMUM WORKING VOLTAGE.

3. MAXIMUM WORKING VOLTAGE
The maximum working voltage is the maximum limit of DC voltage or RMS value of AC voltage which can be applied to the resistor at the specified ambient temperature.

4. OVERLOAD VOLTAGE
The overload voltage is 2.5 times of rated working voltage which can be applied on the resistor in a period of 5 seconds at the specified ambient temperature. However, the resistor can not be used over the specified MAXIMUM OVERLOAD VOLTAGE even for a short period.

5. PULSE LOAD VOLTAGE
The pulse load voltage is the maximum pulse voltage specified in JIS C5202, 5.11 which can be applied on the resistor at the specified ambient temperature, and will be calculated by the following formula:

$$E_P = \text{POWER RATING (W)} \times \text{RESISTANCE } (\Omega) \frac{1}{t \times f} \quad (t\text{: time of pulse, f: test frequency})$$

However, the resistor can not be used over the specified MAXIMUM PULSE VOLTAGE.

B. MECHANICAL CHARACTERISTICS

1. LEAD PULL TEST
The lead wire shall withstand steady pull of the following weight applied axially to the lead wire for the minimum period of 10 seconds without any breakage or damage:

Nom. Lead Diameter	0.4ϕmm	0.5ϕmm	0.6ϕmm	0.7ϕmm	0.8ϕmm & over
Steady Weight	1.0Kgs.	1.0Kgs.	1.5Kgs.	2.0Kgs.	2.5Kgs.

2. LEAD BEND TEST
The lead wire shall withstand minimum 4 bends of 90° rotation without any breakage or damage, when the resistor is placed in a vertical position and is applied with a weight of 0.5Kgs for 0.4—0.5ϕmm or 1.1Kgs for 0.6ϕmm and over lead wire.

3. SOLDERABILITY
The lead wire is immersed into 10% methanol or isopropyl alcohol of rosin by weight for a period of 2±0.5 seconds. Then, it shall be dipped into molten solder (60% Sn & 40% Pb) melted at 230±5°C for a period of 5±1 seconds approximately 1.5mm from the body of the resistor. A new adhering coating of solder shall cover minimum 95% of the surface being dipped into solder.

4. RESISTANCE TO CLEANING SOLVENTS
Color coating or marking shall remain legible after cleaning by solvents such as isopropyl alcohol, trichloroethylene, freon TF/TAC, xyliene etc., in form of liquid or gas.

NIC COMPONENTS CORP. 238 Route 109, Farmingdale, New York 11735 • (516) 694-0060 • (800) 645-9333, 9222
NORTH AMERICAN OPERATIONS NIPPON INDUSTRIES COMPANY LTD.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

RESISTORS

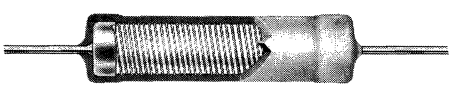
INDUSTRY'S FINEST RESISTORS

MIL-R-39007
ESTABLISHED RELIABILITY
FAILURE RATES M, P, AND R
.01%/1000 HRS.
RESISTANCE TOLERANCE ±1%
TEMPERATURE COEFFICIENT
±20 PPM/°C MAX. 10Ω AND HIGHER
±50 PPM/°C MAX. 1Ω TO 10Ω
±90 PPM/°C MAX. .1Ω TO 1Ω

SAGE SILICONE COATED fixed wire-wound units are not ordinary power resistors. They provide remarkable miniaturization vs. required wattage performance. Sage has pioneered the area of power handling capacity combined with precision and stability features ordinarily associated with Mil-R-93 resistors.

TYPE S: CONSTRUCTION

Showing ceramic core, space single layer winding, welded to stainless steel cap, and multiple layer coating.
Copperweld leads 60/40 Hot Solder Dip. Lead Length 2" ±1/16* is supplied on all sizes unless otherwise specified on purchase order.



* Except 250S and 500S Styles, which are 1½" minimum.

TYPE SB & NSB: HIGH WATTAGE COMMERCIAL BERYLLIA CORE RESISTORS

Standard Solderable Leads	Rated Watts G	Rated Watts V	Approx. Grams Weight
250SB	1	1.5	.18
500SB	1.5	2	.28
1000SB	2.25	2.75	.32
1200SB	3.5	4.5	1.0
1240SB	4	5	1.1
1250SB	4.5	6	1.2
1300SB	6	8	1.8
1500SB	7	9	3.6
1600SB	9	12	4.2
1700SB	14	18	7.3

TYPE S RESISTOR ITEM DESCRIPTION

Sage Part Number identification consists of a combination of numerals and letters according to the following guide. This is the nomenclature ordinarily marked on resistors and it fully serves the purpose of purchased item description except for limited cases of special testing. Note that grouping of characters is not constant, but varies to fit descriptive need of a given part.

STYLE DESIGNATION

1500 S/NS B 2740 1

- 1 — ±% tolerance
- 2740 — Nominal Value, Ohms (decimal symbol, as required, is used in both nominal value and tolerance)
- B — if applicable — Core Material and Process Classification: Blank entry indicates regular steatite core, commercial processing; A = alumina core, commercial processing; B = beryllia core, commercial processing; P = alumina core, High Rel processing; M = beryllia core, High Rel processing
- S/NS — S = single layer wound; NS = non-inductively wound
- 1500 — Body type, size, lead details per catalog chart

TYPE DESIGNATIONS

MIL STYLE	DETAIL SPEC. NO.	SAGE STYLE	MIL WATTS @ 25°C	AVAILABLE RESISTANCE RANGE
RWR80S RWR80W	/8E /8E	1009SM 1007SM	2	.10Ω to 2.67K
RWR81S RWR81W	/9C /9C	259SM 257SM	1	.10Ω to 1.0K
RWR89S RWR89W	/11C /11C	1249SM 1247SM	3	.10Ω to 4.12K
RWR84S RWR84W	/10C /10C	1509SM 1507SM	7	.10Ω to 12.4K
RWR71S RWR71W	/5D /5D	1259SP 1257SP	2	.10Ω to 16.2K
RWR74S RWR74W	/6C /6C	1509SP 1507SP	5	.10Ω to 12.1K
RWR78S RWR78W	/7C /7C	1709SP 1707SP	10	.10Ω to 39.2K

EXAMPLE PART DESIGNATION:

RWR-74 S 49R9 F R

- RWR-74 — Body Style
- S — Terminals: S — Solderable; W — Weldable; N — Non-inductive
- 49R9 — Nominal res., Ω. Three significant digits plus fourth indicating number of zeroes. Below 100Ω. R-decimal and following digits are significant.
- F — Tolerance ±1%
- R — Life failure rate

MIL-R-26E TYPE DESIGNATIONS

MIL STYLE	SAGE STYLE	MIL WATTS	DEFINED OHMIC RANGE: Single layer wound .00175 min. wire dia.	DEFINED OHMIC RANGE: .001 min. wire dia.
RW55V	1900S	7	.1—5100	
RW56V	1950S	14	.1—9100	
RW67V	1550S	6.5	.1—3600	.1—8200
RW68V	1700S	11	.1—8200	.1—20K
RW69V	1200S	3	.1—910	.1—2K

EXAMPLE: RW69 V 471

- RW69 — Body Style
- V — Characteristic, V only (350°C max.)
- 471 — Nominal resistance, Ω. Two significant digits plus third indicating number of zeros. Below 10ΩR = decimal and last digit is signifcant.

TOLERANCE: ±5% for values 1Ω and up; ±10% below 1Ω.
TC: ±260 ppm/°C 20Ω and up; 400 ppm/°C below 20Ω.

MIL STYLE	SAGE STYLE	MIL WATTS	VOLTAGE Max.	DEFINED OHMIC RANGE: Min.	DEFINED OHMIC RANGE: Max. for .001" wire (Navy)	DEFINED OHMIC RANGE: Max. for .0008" wire (all other)
RW70U	1000S	1	—	.1	1210	3160
RW74U	1500S	5	300	.1	12100	38300
RW78U	1700S	10	720	.1	40200	90900
RW79U	1240S	3	135	.1	3570	10500
RW80U	1000SB	2	—	.1	1240	3160
RW81U	250SB	1	25	.1	649	—

EXAMPLE: RW70 U 49R9 F

- RW70 — Body Style
- U — Characteristic, U only (275°C max.)
- 49R9 — Nominal resistance, Ω. Three significant digits plus four indicating number of zeros. Below 100ΩR decimal and following digits are significant.
- F — Tolerance ±% F = 1.0% B = .1% D = .5%

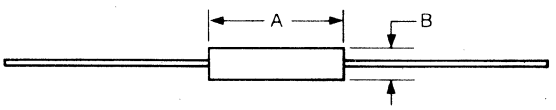
TC: ±30 ppm/°C 10Ω and above/±50 ppm/°C 1Ω to 10Ω/±90 ppm/°C below 1Ω.

SAGE BODY STYLE NO.	WATTAGE DATA (25°C AMBIENT) IND. STD.	SAGE CAPABILITY CHAR. G OR U 275°C	SAGE CAPABILITY CHAR. V 350°C	PHYSICAL DATA LEAD WIRE AWG NO.	PHYSICAL DATA BODY LENGTH INCHES	PHYSICAL DATA BODY DIAMETER INCHES	BODY DIELECTRIC STRENGTH VOLT rms	STD. RESISTANCE RANGE REGULAR WINDING MIN.	STD. RESISTANCE RANGE REGULAR WINDING MAX.	STD. RESISTANCE RANGE NON-INDUCTIVE MIN.	STD. RESISTANCE RANGE NON-INDUCTIVE MAX.
100S	1	1.2	1.7	24-.020	.400 Nom.*	.094±.031	500	0.1	8400	10	3000
200S	2	2.1	3	24-.020	.400 Nom.*	.125±.031	500	0.1	11,000	10	3900
250S	.25	.6	1	24-.020	.250±.031	.078±.016	500	0.1	3800	10	1350
300S	3	3	3.6	24-.020	.400 Nom.*	.187±.031	500	0.1	15,000	10	5300
500S	.5	.9	1.2	24-.020	.312±.031	.078±.016	500	0.1	5000	10	1750
1000S	1	1.2	1.7	24-.020	.406±.031	.094±.031	750	0.1	8400	10	3000
1100S	2	2.3	3.4	20-.032	.500±.062	.125±.031	1000	0.1	15,000	10	5500
1200S	2, 3	3	4	20-.032	.500±.062	.187±.031	1000	0.1	20,000	10	7000
1240S	3	3.2	4.2	20-.032	.562±.062	.187±.031	1000	0.1	24,000	10	8400
1250S	2, 3	3.5	5	20-.032	.812±.062	.187±.031	1000	0.1	40,000	10	14,000
1300S	3	4.2	5.5	18-.040	.625±.062	.250±.031	1000	0.1	30,000	10	10,500
1400S	3, 4	4.3	5.6	18-.040	.750±.062	.250±.031	1000	0.1	42,000	10	15,000
1500S	5	5.3	7.5	18-.040	.875±.062	.312±.031	1000	0.1	71,000	10	25,000
1550S	5	6	8	18-.040	1.000±.062	.312±.031	1000	0.1	88,000	10	31,000
1600S	7	7	9	18-.040	1.219±.062	.312±.031	1000	0.1	114,000	10	40,000
1700S	10	10	12	18-.040	1.781±.062	.375±.031	1000	0.1	230,000	10	80,000
1900S	7	10	12	18-.040	1.375±.062	.431±.031	1000	0.1	210,000	10	73,000
1950S	10	11	15	18-.040	1.437±.062	.431±.031	1000	0.1	314,000	10	110,000

* Clean lead to clean lead = .450 Max.

OHMITE® Series 44 OHMICONE® 5% Tolerance
MIL-R-26 Axial Lead Resistors

IN ACCORDANCE WITH RW-67V — RW-68V — RW-69V



DIMENSIONS: Inches (mm)

Ohmite Series	41J___	42J___	43J___	45J___	40J___
MIL-R-26 Designation	None	None	RW69V___	RW67V___	RW68V___
Wattage	1	2	3	5	10
(A) Max. Lgth.	.437" (11.1mm)	.406" (10.3mm)	.563" (14.3mm)	.937" (23.8mm)	1.843" (46.8mm)
(B) Max. Dia.	.125" (3.2mm)	.219" (5.6mm)	.250" (6.4mm)	.343" (8.7mm)	.406" (10.3mm)
Lead 1½"	22 GA	20 GA	20 GA	18 GA	18 GA

conformal silicone ceramic axial lead wirewound resistors

Series 44 *Ohmicone*® conformal silicone ceramic power resistors are designed for a wide range of commercial, industrial and communications equipment and systems. Resistors feature low, stable T.C.; all welded construction; and operation under high temperature conditions.

ELECTRICAL:

Tolerance: ±5%.

Temperature Coefficient: <1Ω — ±90 ppm/°C; 1 to 10Ω — 0 ±50 ppm/°C; 10Ω & greater — 0±20 ppm/°C.

Dielectric Withstanding Voltage: 1000 VAC for 3-5-10 Watt sizes, 500 VAC for 2 Watt and 250 VAC for 1 Watt size.

Overload, Short Time: 10X rated wattage for 5 seconds (5W and larger); 5X rated wattage for 5 seconds (3W and smaller).

Wattage: 1, 2, 3, 5, and 10 Watt sizes.

Inductance: Varies with no. of turns and wire size. Standard units have single layer winding.

Non-inductive (ARYTON-PERRY) windings available.

MATERIALS:

Core: Ceramic, resistant to thermal shock and wide variations in temperature.

Resistance Element: High grade resistance alloy wire, single layer winding. Leads and resistance elements welded to metal end caps.

Coating: High performance conformal silicone ceramic.

Leads: Solder coated.

DERATING

Wattage is based on 25°C Free Air Rating. For high temperature operation, derate linearly from 100% @ +25°C to 0% @ 275°C.

	CATALOG NUMBERS						CATALOG NUMBERS						CATALOG NUMBERS				
			RW69	RW67	RW68				RW69	RW67	RW68				RW69	RW67	RW68
OHMS	1 Watt	2 Watts	3 Watts	5 Watts	10 Watts	OHMS	1 Watt	2 Watts	3 Watts	5 Watts	10 Watts	OHMS	1 Watt	2 Watts	3 Watts	5 Watts	10 Watts
.1	41JR10	42JR10	43JR10	45JR10	40JR10	56.0	41J56R	42J56R	43J56R	(45J56R)	(40J56R)	1000	41J1K0	42J1K0	43J1K0	(45J1K0)	40J1K0
.15	41JR15	42JR15	43JR15	45JR15	40JR15	62.0	41J62R	42J62R	(43J62R)	(45J62R)	40J62R	1100	41J1K1	(42J1K1)	43J1K1	(45J1K1)	40J1K1
.2	41JR20	42JR20	43JR20	45JR20	40JR20	68.0	41J68R	42J68R	43J68R	45J68R	40J68R	1200	41J1K2	—	43J1K2	(45J1K2)	40J1K2
.3	41JR30	42JR30	43JR30	45JR30	40JR30	75.0	41J75R	42J75R	(43J75R)	45J75R	40J75R	1500	41J1K5	42J1K5	43J1K5	(45J1K5)	40J1K5
.4	41JR40	42JR40	43JR40	45JR40	40JR40	82.0	41J82R	42J82R	43J82R	45J82R	40J82R	1800	41J1K8	—	43J1K8	(45J1K8)	(40J1K8)
.5	41JR50	42JR50	43JR50	45JR50	40JR50	100	41J100	42J100	43J100	45J100	40J100	2000	41J2K0	—	43J2K0	45J2K0	40J2K0
.75	41JR75	42JR75	43JR75	45JR75	40JR75	120	41J120	42J120	43J120	(45J120)	40J120	2200	41J2K2	—	43J2K2	45J2K2	40J2K2
1.0	41J1R0	42J1R0	43J1R0	45J1R0	40J1R0	125	(41J125)	(42J125)	(43J125)	45J125	40J125	2500	41J2K5	—	43J2K5	(45J2K5)	40J2K5
1.5	41J1R5	42J1R5	43J1R5	45J1R5	40J1R5	150	41J150	42J150	43J150	45J150	40J150	2700	(41J2K7)	—	43J2K7	(45J2K7)	(40J2K7)
2.0	41J2R0	42J2R0	43J2R0	45J2R0	40J2R0	180	41J180	42J180	43J180	(45J180)	40J180	3000	41J3K0	42J3K0	43J3K0	45J3K0	40J3K0
2.2	41J2R2	42J2R2	43J2R2	45J2R2	40J2R2	200	41J200	42J200	43J200	45J200	40J200	3300	—	—	43J3K3	45J3K3	40J3K3
3.0	41J3R0	42J3R0	43J3R0	45J3R0	40J3R0	220	41J220	42J220	43J220	(45J220)	(40J220)	3500	—	—	(43J3K5)	(45J3K5)	(40J3K5)
4.0	41J4R0	42J4R0	43J4R0	(45J4R0)	40J4R0	225	(41J225)	(42J225)	43J225	(45J225)	40J225	3900	—	—	43J3K9	45J3K9	40J3K9
5.0	41J5R0	42J5R0	43J5R0	45J5R0	40J5R0	250	41J250	42J250	43J250	45J250	40J250	4000	—	—	(43J4K0)	(45J4K0)	(40J4K0)
7.5	41J7R5	42J7R5	43J7R5	45J7R5	40J7R5	270	41J270	42J270	43J270	45J270	40J270	4500	—	—	43J4K5	(45J4K5)	(40J4K5)
10.0	41J10R	42J10R	43J10R	45J10R	40J10R	300	41J300	42J300	43J300	45J300	40J300	4700	—	—	43J4K7	(45J4K7)	40J4K7
12.0	41J12R	42J12R	43J12R	45J12R	40J12R	330	41J330	42J330	43J330	45J330	40J330	5000	—	—	43J5K0	(45J5K0)	40J5K0
15.0	41J15R	42J15R	43J15R	45J15R	40J15R	350	(41J350)	42J350	(43J350)	(45J350)	(40J350)	6000	—	—	43J6K0	(45J6K0)	40J6K0
18.0	41J18R	42J18R	43J18R	(45J18R)	40J18R	390	41J390	42J390	43J390	45J390	40J390	6800	—	—	43J6K8	(45J6K8)	40J6K8
20.0	41J20R	42J20R	43J20R	(45J20R)	40J20R	400	41J400	42J400	43J400	45J400	40J400	7000	—	—	(43J7K0)	(45J7K0)	40J7K0
22.0	41J22R	42J22R	43J22R	(45J22R)	40J22R	450	(41J450)	(42J450)	(43J450)	45J450	40J450	7500	—	—	43J7K5	45J7K5	40J7K5
25.0	41J25R	42J25R	43J25R	45J25R	40J25R	470	41J470	42J470	43J470	45J470	40J470	8000	—	—	43J8K0	(45J8K0)	(40J8K0)
27.0	41J27R	42J27R	43J27R	45J27R	(40J27R)	500	41J500	42J500	43J500	45J500	40J500	9000	—	—	43J9K0	(45J9K0)	(40J9K0)
30.0	41J30R	42J30R	43J30R	45J30R	40J30R	560	(41J560)	42J560	43J560	(45J560)	40J560	10,000	—	—	43J10K	45J10K	40J10K
33.0	41J33R	(42J33R)	43J33R	45J33R	(40J33R)	600	41J600	42J600	43J600	45J600	40J600						
35.0	41J35R	(42J35R)	(43J35R)	(45J35R)	(40J35R)	680	41J680	42J680	43J680	45J680	(40J680)						
39.0	41J39R	42J39R	43J39R	45J39R	40J39R	750	41J750	42J750	43J750	45J750	40J750						
40.0	41J40R	42J40R	(43J40R)	45J40R	40J40R	800	41J800	42J800	43J800	(45J800)	40J800						
47.0	41J47R	42J47R	43J47R	(45J47R)	40J47R	820	41J820	42J820	43J820	(45J820)	40J820						
50.0	41J50R	42J50R	43J50R	45J50R	40J50R	900	41J900	(42J900)	43J900	(45J900)	40J900						

Please Note**. The values listed are those normally maintained in stock. The other values in the E 24 sequence are also available as special items.

OHMITE MFG. CO., a NORTH AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, Illinois 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

OHMITE® Series 22 5% Tolerance

conformal *Vitreous Enameled* axial lead wirewound resistors

FEATURES

- **Rugged Vitreous Enamel Coating Withstands Severe Humidity and Temperature Cycling**
- **Economical**
- **All Welded Construction**
- **Ideal for Machine Insertion**

Advanced conformal vitreous enamel coating protects resistors, even in environments of high heat. These rugged, economical wirewound resistors are recommended for industrial applications where quality construction and reliable operation are prime specifying parameters.

The items listed in the chart are standard stock items. Other values and wattages are also available in accordance with the following applications.

SPECIFICATIONS

Tolerance: ±5% std. ±1% to ±10% available.

Temperature Coefficient:
0 ±30 ppm/°C 10 ohms and above
0 ±50 ppm/°C 1 to 9.99 ohms
0 ±90 ppm/°C below 1 ohm.

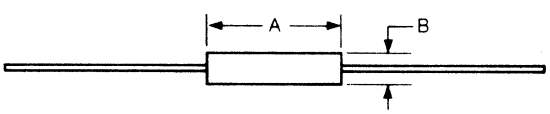
Dielectric Withstanding Voltage:
1000 VAC. (500 VAC for 1 watt type.)

Overload: 10X rated wattage for 5 sec. for 5 watt size and larger. 5X rated wattage for 5 sec. under 5 watt size.

Inductance: Standard units have single layer inductive winding. Low inductance windings available.

Core: Steatite ceramic.

Coating: Conformal vitreous enamel.



Watts	Type	Resistance Range Min.-Max.	Body Dimensions				Leads 1.5" (38.1mm) Ga.
			Max. Lgth.—A		Max. Dia.—B		
			In.	MM	In.	MM	
1	221	.1—6.1K	.406	10.3	.156	4.0	22
2	222	.1—8.7K	.406	10.3	.219	5.6	20
3	223	.1—22K	.562	14.3	.250	6.4	20
5	225	.1—54K	1.000	25.4	.250	6.4	20
6	226	.1—89K	1.031	26.2	.343	8.7	20
7	227	.1—118K	1.250	31.8	.343	8.7	20
10	220	.1—190K	1.797	45.6	.343	8.7	20
12.5	220P	.1—21K	1.812	46.0	.406	10.3	18

Resistance Ohms	Catalog Numbers				
	1 Watt	3 Watt	5 Watt	7 Watt	10 Watt
1.0	21J1R0	23J1R0	25J1R0	27J1R0	20J1R0
1.5	21J1R5	23J1R5	25J1R5	(27J1R5)	20J1R5
2.0	21J2R0	23J2R0	25J2R0	(27J2R0)	20J2R0
2.2	21J2R2	23J2R2	25J2R2	(27J2R2)	20J2R2
3.0	21J3R0	23J3R0	25J3R0	27J3R0	20J3R0
4.0	21J4R0	23J4R0	25J4R0	(27J4R0)	20J4R0
5.0	21J5R0	23J5R0	25J5R0	27J5R0	20J5R0
7.5	21J7R5	23J7R5	25J7R5	(27J7R5)	20J7R5
10.0	21J10R	23J10R	25J10R	27J10R	20J10R
12.0	21J12R	23J12R	25J12R	(27J12R)	20J12R
15.0	21J15R	23J15R	25J15R	27J15R	20J15R
18.0	21J18R	23J18R	25J18R	(27J18R)	20J18R
20.0	21J20R	23J20R	25J20R	(27J20R)	20J20R
22.0	21J22R	23J22R	25J22R	27J22R	20J22R
25.0	21J25R	23J25R	25J25R	(27J25R)	20J25R
27.0	21J27R	23J27R	25J27R	(27J27R)	20J27R
30.0	21J30R	23J30R	25J30R	(27J30R)	20J30R
33.0	21J33R	23J33R	25J33R	(27J33R)	20J33R
35.0	21J35R	23J35R	25J35R	(27J35R)	20J35R
39.0	21J39R	23J39R	25J39R	(27J39R)	(20J39R)
40.0	21J40R	23J40R	25J40R	27J40R	20J40R
47.0	21J47R	23J47R	25J47R	(27J47R)	20J47R
50.0	21J50R	23J50R	25J50R	27J50R	20J50R
56.0	21J56R	23J56R	25J56R	(27J56R)	20J56R
62.0	21J62R	23J62R	25J62R	(27J62R)	(20J62R)
68.0	21J68R	23J68R	25J68R	(27J68R)	
75.0	21J75R	23J75R	25J75R	27J75R	20J75R
82.0	21J82R	23J82R	25J82R	(27J82R)	20J82R
100	21J100	23J100	25J100	27J100	20J100
120	21J120	23J120	5J120	(27J120)	(20J120)
125	(21J125)	23J125	25J125	(27J125)	20J125
150	21J150	23J150	25J150	(27J150)	20J150
180	21J180	23J180	25J180	27J180	20J180
200	(21J200)	23J200	25J200	27J200	20J200
220	(21J220)	23J220	25J220	(27J220)	20J220
225	21J225	23J225	25J225	(27J225)	(20J225)
250	21J250	23J250	25J250	(27J250)	20J250
270	21J270	23J270	25J270	(27J270)	(20J270)
300	21J300	23J300	25J300	(27J300)	20J300
330	21J330	23J330	25J330	(27J330)	20J330
350	21J350	(23J350)	25J350	(27J350)	20J350
390	21J390	23J390	25J390	(27J390)	(20J390)
400	21J400	23J400	25J400	(27J400)	20J400
450	21J450	23J450	25J450	(27J450)	20J450
470	21J470	23J470	25J470	(27J470)	20J470
500	21J500	23J500	25J500	27J500	20J500
560	21J560	23J560	25J560	(27J560)	20J560
600	21J600	23J600	25J600	27J600	20J600
680	21J680	23J680	25J680	(27J680)	20J680
750	21J750	23J750	25J750	(27J750)	20J750
800	21J800	23J800	25J800	(27J800)	20J800
820	21J820	23J820	(25J820	(27J820)	20J820
900	21J900	23J900	25J900	(27J900)	20J900
1000	(21J1K0)	23J1K0	25J1K0	(27J1K0)	20J1K0
1100	(21J1K1)	23J1K1	25J1K1	(27J1K1)	(20J1K1)
1200	(21J1K2)	23J1K2	25J1K2	27J1K2	20J1K2
1500	(21J1K5)	23J1K5	25J1K5	(27J1K5)	(20J1K5)
1800	(21J1K8)	(23J1K8)	(25J1K8)	(27J1K8)	(20J1K8)
2000	(21J2K0)	23J2K0	25J2K0	(27J2K0)	20J2K0
2200	(21J2K2)	23J2K2	25J2K2	(27J2K2)	20J2K2
2500	(21J2K5)	23J2K5	25J2K5	(27J2K5)	20J2K5
2700	(21J2K7)	23J2K7	(25J2K7)	(27J2K7)	20J2K7
3000	(21J3K0)	23J3K0	25J3K0	(27J3K0)	20J3K0
3300		23J3K3	25J3K3	(27J3K3)	20J3K3
3500		23J3K5	25J3K5	(27J3K5)	20J3K5
3900		23J3K9	25J3K9	(27J3K9)	20J3K9
4000		23J4K0	25J4K0	(27J4K0)	20J4K0
4500		23J4K5	25J4K5	(27J4K5)	20J4K5
4700		23J4K7	25J4K7	(27J4K7)	20J4K7
5000		23J5K0	25J5K0	(27J5K0)	20J5K0
6000		23J6K0	25J6K0	(27J6K0)	20J6K0
6800		23J6K8	25J6K8	(27J6K8)	(20J6K8)
7000		23J7K0	25J7K0	(27J7K0)	20J7K0
7500		23J7K5	25J7K5	(27J7K5)	20J7K5
8000		23J8K0	25J8K0	(27J8K0)	(20J8K0)
9000		23J9K0	(25J9K0)	(27J9K0)	(20J9K0)
10,000		23J10K	25J10K	27J10K	20J10K
12,000			25J12K	(27J12K)	20J12K
13,000				(27J13K)	20J13K
15,000			25J15K	(27J15K)	20J15K
17,000				(27J17K)	(20J17K)
20,000			25J20K	27J20K	20J20K
22,000			25J22K	(27J22K)	20J22K
25,000			25J25K	(27J25K)	20J25K
30,000					20J30K
33,000					(20J33K)
35,000					20J35K
40,000					20J40K
50,000					20J50K

OHMITE MFG. CO., a NORTH AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, Illinois 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

OHMITE® Series 80 OHMICONE® 1% Tolerance

MIL-R-26 Axial Lead Resistors

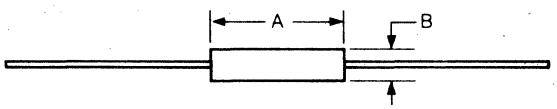
conformal *Ohmicone*® precision resistors

IN ACCORDANCE WITH RW70U — RW74U — RW78U — RW79U. SERIES 80 RESISTORS ARE DESIGNED FOR HIGH STABILITY, PRECISION POWER APPLICATIONS.

LOW TEMPERATURE COEFFICIENT, 20 PPM/°C FOR 10 OHMS AND ABOVE.

DIELECTRIC WITHSTANDING VOLTAGE 1000 VAC

1% TOLERANCE STANDARD, LOWER TOLERANCES AVAILABLE ON SPECIAL ORDER.



SPECIFICATIONS

Tolerance: ± 1% std.

Temperature Coefficient:
±20 ppm/°C 10 ohms and above
±50 ppm/°C 1 to 9.99 ohms
±90 ppm/°C below 1 ohm

Dielectric Withstanding Voltage: 1000 VAC for 3-5-10 Watt sizes, 500 VAC for 1 Watt size.

Overload: 10X rated wattage for 5 sec. for 5 Watt size and larger. 5X rated wattage for 5 sec. under 5 Watt size.

Stability: Load life delta R of 0.5% for 2000 hours.

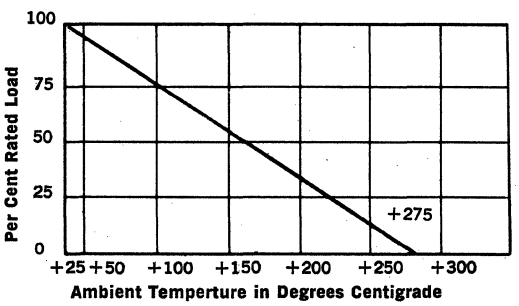
Inductance: Standard units have single layer inductive winding.

Core: Steatite ceramic.

Coating: Silicone ceramic.

DERATING

Wattage ratings are based on 25°C Free Air Rating. For higher ambient temperatures, use derating chart.



DIMENSIONS: Inches (mm)

Ohmite Series	81F___	83F___	85F___	80F___
MIL-R-26 Designations	RW70U___F	RW79U___F	RW74U___F	RW78U___F
Wattage	1	3	5	10
(A) Max. Lgth.	.437" (11.1mm)	.597" (15.2mm)	.937" (23.8mm)	1.842" (46.8mm)
(B) Max. Dia.	.125" (3.2mm)	.218" (5.5mm)	.343" (8.7mm)	.406" (10.3mm)
Leads 1½"	22 GA	20 GA	18 GA	18 GA

	CATALOG NUMBERS					CATALOG NUMBERS					CATALOG NUMBERS					CATALOG NUMBERS			
	1 Watt	3 Watts	5 Watts	10 Watts		1 Watt	3 Watts	5 Watts	10 Watts		1 Watt	3 Watts	5 Watts	10 Watts		1 Watt	3 Watts	5 Watts	10 Watts
OHMS	RW70U	RW79U	RW74U	RW78U	OHMS	RW70U	RW79U	RW74U	RW78U	OHMS	RW70U	RW79U	RW74U	RW78U	OHMS	RW70U	RW79U	RW74U	RW78U
.100	81FR10	83FR10	85FR10	80FR10	20.0	81F20R	83F20R	85F20R	80F20R	301	81F301	83F301	85F301	80F301	4750		83F4K75	85F4K75	80F4K75
.121		83FR121	85FR121	80FR121	22.1	81F22R1	83F22R1	85F22R1	80F22R1	332	81F332	83F332	85F332	80F332	4870		83F4K87	85F4K87	80F4K87
.150	81FR15	83FR15	85FR15	80FR15	24.3		83F24R3	85F24R3	80F24R3	365		83F365	85F365	80F365	4990		83F4K99	85F4K99	80F4K99
.200	81FR20	83FR20	85FR20	80FR20	24.9	81F24R9	83F24R9	85F24R9	80F24R9	374		83F374	85F374	80F374	5110		83F5K11	85F5K11	80F5K11
.221		83FR221	85FR221	80FR221	27.4	81F27R4	83F27R4	85F27R4	80F27R4	383		83F383	85F383		5620		83F5K62	85F5K62	80F5K62
.249		83FR249	85FR249	80FR249	30.1	81F30R1	83F30R1	85F30R1	80F30R1	392	81F392	83F392	85F392		6040		83F6K04	85F6K04	80F6K04
.274		83FR274	85FR274	80FR274	33.2	81F33R2	83F33R2	85F33R2	80F33R2	402	81F402	83F402	85F402	80F402	6190		83F6K19	85F6K19	80F6K19
.392	81FR392	83FR392	85FR392	80FR392	34.8	81F34R8	83F34R8	85F34R8	80F34R8	432		83F432	85F432	80F432	6650		83F6K65	85F6K65	80F6K65
.475		83FR475	85FR475	80FR475	39.2	81F39R2	83F39R2	85F39R2	80F39R2	453	81F453	83F453	85F453	80F453	6810		83F6K81	85F6K81	80F6K81
.499	81FR499	83FR499	85FR499	80FR499	40.2	81F40R2	83F40R2	85F40R2	80F40R2	475	81F475	83F475	85F475	80F475	6980		83F6K98	85F6K98	80F6K98
.681		83FR681	85FR681	80FR681	43.2		83F43R2	85F43R2	80F43R2	499	81F499	83F499	85F499	80F499	8060		83F8K06	85F8K06	80F8K06
.750	81FR75	83FR75	85FR75	80FR75	47.5	81F47R5	83F47R5	85F47R5	80F47R5	511		83F511	85F511	80F511	10,000		83F10K	85F10K	80F10K
.825		83FR825	85FR325	80FR825	49.9	81F49R9	83F49R9	85F49R9	80F49R9	562	81F562	83F562	85F562	80F562	15,000		83F15K	85F15K	80F15K
1.00	81F1R0	83F1R0	85F1R0	80F1R0	51.1		83F51R1	85F51R1	80F51R1	604	81F604	83F604	85F604	80F604	20,000		83F20K	85F20K	80F20K
1.10		83F1R1	85F1R1	80F1R1	56.2	81F56R2	83F56R2	85F56R2	80F56R2	619		83F619	85F619	80F619	20,500		83F20K5		
1.21		83F1R21	85F1R21	80F1R21	59.0		83F59R	85F59R	80F59R	681	81F681	83F681	85F681	80F681	22,100			85F22K1	80F22K1
1.43		83F1R43	85F1R43	80F1R43	60.4		83F60R4	85F60R4	80F60R4	715		83F715	85F715	80F715	23,700			85F23K7	80F23K7
1.50	81F1R5	83F1R5	85F1R5	80F1R5	61.9	81F61R9	83F61R9	85F61R9	80F61R9	750	81F750	83F750	85F750	80F750	24,900			85F24K9	80F24K9
1.82		83F1R82	85F1R82	80F1R82	68.1	81F68R1	83F68R1	85F68R1	80F68R1	806	81F806	83F806	85F806	80F806	25,500			85F25K5	80F25K5
2.00	81F2R0	83F2R0	85F2R0	80F2R0	75.0	81F75R	83F75R	85F75R	80F75R	825	81F825	83F825	85F825	80F825	27,400			85F27K4	80F27K4
2.49		83F2R49	85F2R49	80F2R49	82.5	81F82R5	83F82R5	85F82R5	80F82R5	909	81F909	83F909	85F909	80F909	30,100			85F30K1	80F30K1
2.74		83F2R74	85F2R74	80F2R74	88.7		83F88R7	85F88R7	80F88R7	1000	81F1K0	83F1K0	85F1K0	80F1K0	34,000			85F34K	80F34K
3.01	81F3R01	83F3R01	85F3R01	80F3R01	90.9		83F90R9	85F90R9	80F90R9	1180	81F1K18	83F1K18	85F1K18	80F1K18	36,500			85F36K5	80F36K5
3.32		83F3R32	85F3R32	80F3R32	100	81F100	83F100	85F100	80F100	1300		83F1K3	85F1K3	80F1K3	40,200			85F40K2	80F40K2
4.02	81F4R02	83F4R02	85F4R02	80F4R02	115		83F115	85F115	80F115	1470		83F1K47	85F1K47	80F1K47	43,200			85F43K2	80F43K2
4.53		83F4R53	85F4R53	80F4R53	121	81F121	83F121	85F121	80F121	1500	81F1K5	83F1K5	85F1K5	80F1K5	47,500			85F47K5	80F47K5
4.99	81F4R99	83F4R99	85F4R99	80F4R99	130		83F130	85F130	80F130	1620		83F1K62	85F1K62	80F1K62	49,900			85F49K9	80F49K9
5.11		83F5R11	85F5R11	80F5R11	150	81F150	83F150	85F150	80F150	1780		83F1K78	85F1K78	80F1K78	51,100			85F51K1	80F51K1
6.19		83F6R19	85F6R19	80F6R19	162		83F162	85F162	80F162	2000	81F2K0	83F2K0	85F2K0	80F2K0	80,600			85F80K6	80F80K6
6.81		83F6R81	85F6R81	80F6R81	169		83F169	85F169	80F169	2210	81F2K21	83F2K21	85F2K21	80F2K21	82,500				80F82K5
7.50	81F7R5	83F7R5	85F7R5	80F7R5	174		83F174	85F174	80F174	2260		83F2K26	85F2K26	80F2K26	90,900				80F90K9
8.06		83F8R06	85F8R06	80F8R06	178		83F178	85F178	80F178	2430		83F2K43	85F2K43	80F2K43	100,000				80F100K
9.09		83F9R09	85F9R09	80F9R09	182	81F182	83F182	85F182	80F182	2490	81F2K49	83F2K49	85F2K49	80F2K49	150,000				80F150K
10.0	81F10R	83F10R	85F10R	80F10R	200	81F200	83F200	85F200	80F200	2740	81F2K74	83F2K74	85F2K74	80F2K74	174,000				80F174K
11.0		83F11R	85F11R	80F11R	205		83F205	85F205	80F205	2940		83F2K94	85F2K94	80F2K94	200,000				80F200K
12.1	81F12R1	83F12R1	85F12R1	80F12R1	215		83F215	85F215	80F215	3010	81F3K01	83F3K01	85F3K01	80F3K01					
13.0		83F13R	85F13R	80F13R	221	81F221	83F221	85F221	80F221	3160		83F3K16	85F3K16	80F3K16					
14.0		83F14R	85F14R	80F14R	249	81F249	83F249	85F249	80F249	3320		83F3K32	85F3K32	80F3K32					
15.0	81F15R	83F15R	85F15R	80F15R	255		83F255	85F255	80F255	3480		83F3K48	85F3K48	80F3K48					
18.2	81F18R2	83F18R2	85F18R2	80F18R2	274	81F274	83F274	85F274	80F274	4020		83F4K02	85F4K02	80F4K02					

Please Note**. The values listed are those normally maintained in stock. Any of the other values in Table III of MIL-R-26/5B may also be obtained as a special item.

OHMITE MFG. CO., a NORTH AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, Illinois 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

OHMITE® Type 995 MOLDED Axial Lead Vitreous Enameled Resistors

FEATURES

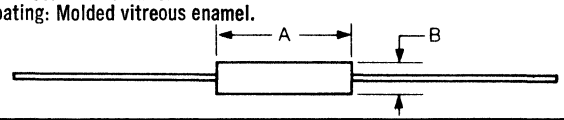
- **Unique Molded Construction Provides Consistent Shape & Size**
- **Exceeds MIL-R-26 Moisture Requirements**
- **Endures Heat Up to 1500 F**
- **All Welded Construction**
- **Ideal for Machine Insertion and High Density Circuits**

Series 99 molded vitreous wirewound resistors are high performance components designed for precision instrumentation, medical equipment and other applications demanding high reliability and stable operation. MIL-R-26 approved units are available for Military Application.

The items listed below are standard stock items. In addition items in accordance with the specifications shown are available on special order.

SPECIFICATIONS

Tolerance: ±5% std. ±.25% to ±10% available. 2 ohm minimum for tolerances closer than ±1%.
Temperature Coefficient: 0 ± 30 ppm/°C 10 ohms and above
0 ±100 ppm/°C 1 to 10 ohms 0 ±200 ppm/°C below 1 ohm.
Dielectric Withstanding Voltage: 1000 VAC. 500 VAC for 1 watt size.
Overload: 10X rated wattage for 5 sec. for 5 watt size and larger. 5X rated wattage for 5 sec. under 5 watt size.
Wattage Rating: May be increased by using metal mounting clips as a heat sink.
Inductance: Standard units have single layer inductive winding. Non-inductive (Aryton Perry or limited inductance) windings available.
Core: Steatite ceramic.
Coating: Molded vitreous enamel.



Watts	Type	Resistance Range Min.-Max.	Body Dimensions Max. Lgth.—A In.	Body Dimensions Max. Lgth.—A MM	Body Dimensions Max. Dia.—B In.	Body Dimensions Max. Dia.—B MM	Leads 1.5" (38.1mm) Ga.
1.5	995-1A	.1—6.65K	.437	11.1	.140	3.6	24
2.25	995-2A	.1—6.49K	.390	9.9	.219	5.6	20
3.25	995-3A	.1—22.1K	.562	14.3	.234	5.9	20
5	995-5B	.1—53.6K	.953	24.2	.234	5.9	20
6.5	995-5A	.1—80.6K	.937	23.8	.343	8.7	20
9	995-7A	.1—118K	1.233	31.3	.343	8.7	20
11	995-10A	.1—187K	1.796	45.6	.343	8.7	20
15	995-15A	.1—243K	2.015	51.2	.425	10.8	20

	1½ WATT .422" x .125" Dia. Style 995-1A Avg. Wt., .0009 lb.		2¼ WATT .375" x .188" Dia. Style 995-2A Avg. Wt., .0018 lb.		3¼ WATT .547" x .203" Dia. Style 995-3A Avg. Wt., .003 lb.		5 WATT .938" x .203" Dia. Style 995-5B Avg. Wt., .004 lb.		11 WATT 1.781" x .312" Dia. Style 995-10A Avg. Wt., .015 lb.	
Ohms	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.
1.0	4030	91J1R0	3860	92J1R0	4330	93J1R0	4530	95J1R0	4730	90J1R0
1.1	4031	91J1R1	(3861)	92J1R1	(4331)	93J1R1	(4531)	95J1R1	(4731)	90J1R1
1.2	4032	91J1R2	3862	92J1R2	4332	93J1R2	(4532)	95J1R2	4732	90J1R2
1.3	4033	91J1R3	3863	92J1R3	(4333)	93J1R3	(4533)	95J1R3	(4733)	90J1R3
1.5	4034	91J1R5	3864	92J1R5	4334	93J1R5	4534	94J1R5	4734	90J1R5
1.6	4035	91J1R6	(3865)	92J1R6	(4335)	93J1R6	(4535)	95J1R6	(4735)	90J1R6
1.8	4036	91J1R8	(3866)	92J1R8	4336	93J1R8	(4536)	95J1R8	4736	90J1R8
2.0	4037	91J2R0	3867	92J2R0	4337	93J2R0	4537	95J2R0	4737	90J2R0
2.2	4038	91J2R2	3868	92J2R2	4338	93J2R2	4538	95J2R2	4738	90J2R2
2.4	4039	91J2R4	3869	92J2R4	4339	93J2R4	4539	95J2R4	4739	90J2R4
2.7	4041	91J2R7	(3871)	92J2R7	4341	93J2R7	4541	95J2R7	(4741)	90J2R7
3.0	4042	91J3R0	3872	92J3R0	4342	93J3R0	4542	95J3R0	4742	90J3R0
3.3	4043	91J3R3	3873	92J3R3	4343	93J3R3	4543	95J3R3	4743	90J3R3
3.6	4044	91J3R6	(3874)	92J3R6	(4344)	93J3R6	(4544)	95J3R6	(4744)	90J3R6
3.9	4045	91J3R9	(3875)	92J3R9	4345	93J3R9	4545	95J3R9	(4745)	90J3R9
4.0	4046	91J4R0	3876	92J4R0	4346	93J4R0	4546	95J4R0	4746	90J4R0
4.3	4047	91J4R3	(3877)	92J4R3	(4347)	93J4R3	(4547)	95J4R3	(4747)	90J4R3
4.7	4048	91J4R7	3878	92J4R7	4348	93J4R7	4548	95J4R7	4748	90J4R7
5.0	4049	91J5R0	3879	92J5R0	4349	93J5R0	4549	95J5R0	4749	90J5R0
5.1	(4050)	91J5R1	(3880)	92J5R1	4350	93J5R1	(4550)	95J5R1	(4750)	90J5R1
5.6	4051	91J5R6	3881	92J5R6	4351	93J5R6	4551	95J5R6	4751	90J5R6
6.2	4053	91J6R2	3883	92J6R2	4353	93J6R2	4553	95J6R2	4753	90J6R2
6.8	4054	91J6R8	3884	92J6R8	4354	93J6R8	4554	95J6R8	4754	90J6R8
7.5	4056	91J7R5	3886	92J7R5	4356	93J7R5	4556	95J7R5	4756	90J7R5
8.2	(4058)	91J8R2	3888	92J8R2	4358	93J8R2	4558	95J8R2	4758	90J8R2
9.1	(4060)	91J9R1	(3890)	92J9R1	(4360)	93J9R1	4560	95J9R1	(4760)	90J9R1
10	4061	91J10R	3891	92J10R	4361	93J10R	4561	95J10R	4761	90J10R
11	(4062)	91J11R	(3892)	92J11R	(4362)	93J11R	(4562)	95J11R	4762	90J11R
12	4063	91J12R	3893	92J12R	4363	93J12R	4563	95J12R	4763	90J12R
13	(4064)	91J13R	(3894)	92J13R	(4364)	93J13R	(4564)	95J13R	(4764)	90J13R
15	(4065)	91J15R	3895	92J15R	4365	93J15R	4565	95J15R	4765	90J15R
16	4066	91J16R	(3896)	92J16R	(4366)	93J16R	4566	95J16R	4766	90J16R
18	4067	91J18R	3897	92J18R	4367	93J18R	4567	95J18R	4767	90J18R
20	4068	91J20R	3898	92J20R	4568	93J20R	4568	95J20R	4768	90J20R
22	4069	91J22R	3899	92J22R	4369	93J22R	4569	95J22R	4769	90J22R
24	(4070)	91J24R	(3900)	92J24R	(4370)	93J24R	4570	95J24R	4770	90J24R
25	4071	91J25R	(3901)	92J25R	4371	93J25R	4571	95J25R	4771	90J25R
27	4072	91J27R	3902	92J27R	4372	93J27R	4572	95J27R	4772	90J27R
30	4073	91J30R	3903	92J30R	4373	93J30R	4573	95J30R	4773	90J30R
33	4074	91J33R	(3904)	92J33R	4374	93J33R	4574	95J33R	4774	90J33R
35	(4074A)	91J35R	(3905)	92J35R	4374A	93J35R	4574A	95J35R	4774A	90J35R
36	4075	91J36R	(3906)	92J36R	(4375)	93J36R	4575	95J36R	4775	90J36R
39	4076	91J39R	3907	92J39R	4376	93J39R	4576	95J39R	4776	90J39R
40	(4077)	91J40R	(3908)	92J40R	(4377)	93J40R	4577	95J40R	4777	90J40R
43	(4078)	91J43R	(3909)	92J43R	4378	93J43R	4578	95J43R	(4778)	90J43R
47	4079	91J47R	3910	92J47R	4378	93J47R	4579	95J47R	4779	90J47R
50	4080	91J50R	3911	92J50R	4380	93J50R	4580	95J50R	4780	90J50R
51	4081	91J51R	3912	92J51R	4381	93J51R	4581	95J51R	(4781)	90J51R
56	4082	91J56R	(3913)	92J56R	4382	93J56R	4582	95J56R	4782	90J56R
62	4084	91J62R	(3915)	92J62R	4384	93J62R	4584	95J62R	4784	90J62R
68	4085	91J68R	3916	92J68R	4385	93J68R	4585	95J68R	4785	90J68R
75	4087	91J75R	3918	92J75R	4387	93J75R	4587	95J75R	4787	90J75R
82	4089	91J82R	(3920)	92J82R	4389	93J82R	4589	95J82R	4789	90J82R
91	4091	91J91R	3922	92J91R	4391	93J91R	4591	95J91R	4791	90J91R
100	4092	91J100	3923	92J100	4392	93J100	4592	95J100	4792	90J100
110	(4093)	91J110	(3924)	92J110	4393	93J110	4593	95J110	(4793)	90J110
120	4094	91J120	3925	92J120	4394	93J120	4594	95J120	4794	90J120
130	(4095)	91J130	3926	92J130	4395	93J130	4595	95J130	4795	90J130
150	4096	91J150	3927	92J150	4396	93J150	4596	95J150	4796	90J150
160	(4097)	91J160	3928	92J160	4397	93J160	4597	95J160	4797	90J160
180	4098	91J180	3929	92J180	4398	93J180	4598	95J180	4798	90J180
200	4099	91J200	3930	92J200	4399	93J200	4599	95J200	4799	90J200
220	4100	91J220	3931	92J220	4400	93J220	4600	95J200	4800	90J220
240	4101	91J240	(3932)	92J240	4401	93J240	4601	95J240	4801	90J240
250	4102	91J250	3933	92J250	4402	93J250	4602	95J250	4802	90J250
270	4103	91J270	3934	92J270	4403	93J270	4603	95J270	4803	90J270
300	4104	91J300	3935	92J300	4404	93J300	4604	95J300	4804	90J300
330	4105	91J330	3936	92J330	4405	93J330	4605	95J330	4805	90J330
350	(4105A)	91J350	3937	92J350	4405A	93J350	4605A	95J350	4805A	90J350
360	4106	91J360	3938	92J360	4406	93J360	4606	95J360	(4806)	90J360
390	4107	91J390	3939	92J390	4407	93J390	4607	95J390	4807	90J390
400	4108	91J400	3940	92J400	4408	93J400	4608	95J400	4808	90J400
430	4109	91J430	3941	92J430	4409	93J430	4609	95J430	4809	90J430

Ohms	1½ WATT .422" x .125" Dia. Style 995-1A Avg. Wt., .0009 lb. Old Cat. No.	1½ WATT .422" x .125" Dia. Style 995-1A Avg. Wt., .0009 lb. New Cat. No.	2¼ WATT .375" x .188" Dia. Style 995-2A Avg. Wt., .0018 lb. Old Cat. No.	2¼ WATT .375" x .188" Dia. Style 995-2A Avg. Wt., .0018 lb. New Cat. No.	3¼ WATT .547" x .203" Dia. Style 995-3A Avg. Wt., .003 lb. Old Cat. No.	3¼ WATT .547" x .203" Dia. Style 995-3A Avg. Wt., .003 lb. New Cat. No.	5 WATT .938" x .203" Dia. Style 995-5B Avg. Wt., .004 lb. Old Cat. No.	5 WATT .938" x .203" Dia. Style 995-5B Avg. Wt., .004 lb. New Cat. No.	11 WATT 1.781" x .312" Dia. Style 995-10A Avg. Wt., .015 lb. Old Cat. No.	11 WATT 1.781" x .312" Dia. Style 995-10A Avg. Wt., .015 lb. New Cat. No.
450	4109A	91J450	(3942)	92J450	4409A	93J450	4609A	95J450	(4809A)	90J450
470	4110	91J470	3943	92J470	4410	93J470	4610	95J470	4810	90J470
500	4111	91J500	3944	92J500	4411	93J500	4611	95J500	4811	90J500
510	4112	91J510	3945	92J510	4412	93J510	4612	95J510	(4812)	90J510
560	4113	91J560	3946	92J560	4413	93J560	4613	95J560	4813	90J560
600	4114	91J600	3947	92J600	4414	93J600	4614	95J600	4814	90J600
620	4115	91J620	3948	92J620	4415	93J620	(4615)	95J620	(4815)	90J620
680	(4116)	91J680	3949	92J680	4416	93J680	4616	95J680	4816	90J680
700	4117	91J700	(3950)	92J700	4417	93J700	4617	95J700	(4817)	90J700
750	4118	91J750	3951	92J750	4418	93J750	4618	95J750	4818	90J750
800	4119	91J800	(3952)	92J800	4419	93J800	4619	95J800	4819	90J800
820	4120	91J820	3953	92J820	4420	93J820	4620	95J820	4820	90J820
900	(4121)	91J900	(3954)	92J900	4421	93J900	(4621)	95J900	(4821)	90J900
910	4122	91J910	(3955)	92J910	4422	93J910	(4622)	95J910	(4822)	90J910
1000	4123	91J1K0	3956	92J1K0	4423	93J1K0	4623	95J1K0	4823	90J1K0
1100	(4124)	91J1K1	3957	92J1K1	(4424)	93J1K1	(4624)	95J1K1	4824	90J1K1
1200	4125	91J1K2	3958	92J1K2	4425	93J1K2	4625	95J1K2	4825	90J1K2
1300	4126	91J1K3	(3959)	92J1K3	4426	93J1K3	(4626)	95J1K3	4826	90J1K3
1400	4126A	91J1K4	(3960)	92J1K4	(4426A)	93J1K4	(4626A)	95J1K4	4826A	90J1K4
1500	4127	91J1K5	3961	92J1K5	4427	93J1K5	4627	95J1K5	4827	90J1K5
1600	(4128)	91J1K6	(3962)	92J1K6	4428	93J1K6	4628	95J1K6	4828	90J1K6
1800	4129	91J1K8	(3963)	92J1K8	4429	93J1K8	4629	95J1K8	4829	90J1K8
2000	4130	91J2K0	3964	92J2K0	4430	93J2K0	4630	95J2K0	4830	90J2K0
2200	4131	91J2K2	3965	92J2K2	4431	93J2K2	4631	95J2K2	4831	90J2K2
2400	4132	91J2K4	(3966)	92J2K4	4432	93J2K4	4632	95J2K4	(4832)	90J2K4
2500	4133	91J2K5	3967	92J2K5	4433	93J2K5	4633	95J2K5	4833	90J2K5
2700	(4134)	91J2K7	(3968)	92J2K7	4434	93J2K7	4634	95J2K7	4834	90J2K7
3000	4135	91J3K0	3969	92J3K0	4435	93J3K0	4635	95J3K0	4835	90J3K0
3300					4436	93J3K3	4636	95J3K3	4836	90J3K3
3500					4436A	93J3K5	4636A	95J3K5	4836A	90J3K5
3600					4437	93J3K6	4637	95J3K6	4837	90J3K6
3900					4438	93J3K9	4638	95J3K9	4838	90J3K9
4000					4439	93J4K0	4639	95J4K0	4839	90J4K0
4300					(4440)	93J4K3	(4640)	95J4K3	4840	90J4K3
4500					4440A	93J4K5	4640A	95J4K5	4840A	90J4K5
4700					4441	93J4K7	4641	95J4K7	4841	90J4K7
5000					4442	93J5K0	4642	95J5K0	4842	90J5K0
5100					4443	93J5K1	4643	95J5K1	4843	90J5K1
5600					4444	93J5K6	4644	95J5K6	4844	90J5K6
6000					4445	93J6K0	4645	95J6K0	4845	90J6K0
6200					4446	93J6K2	4646	95J6K2	4846	90J6K2
6800					4447	93J6K8	4647	95J6K8	4847	90J6K8
7000					4448	93J7K0	4648	95J7K0	(4848)	90J7K0
7500					4449	93J7K5	4649	95J7K5	4849	90J7K5
8000					4450	93J8K0	4650	95J8K0	4850	90J8K0
8200					4451	93J8K2	4651	95J8K2	4851	90J8K2
9000					(4452)	93J9K0	4652	95J9K0	4852	90J9K0
9100					(4453)	93J9K1	(4653)	95J9K1	4853	90J9K1
10000					4454	93J10K	4654	95J10K	4854	90J10K
11000							4655	95J11K	(4855)	90J11K
12000							4656	95J12K	4856	90J12K
13000							(4657)	95J13K	4857	90J13K
14000							(4657A)	95J14K	(4857B)	90J14K
15000							4658	95J15K	4858	90J15K
16000							4659	95J16K	(4859A)	90J16K
17000							4659B	95J17K	(4859C)	90J17K
18000							4660	95J18K	4860	90J18K
20000							4661	95J20K	4861	90J20K
22000							4662	95J22K	(4862)	90J22K
24000							4663	95J24K	(4863)	90J24K
25000							4664	95J25K	4864	90J25K
27000									4865	90J27K
30000									4866	90J32K
33000									4867	90J33K
35000									4867A	90J35K
36000									(4868)	90J36K
39000									4869	90J39K
40000									4870	90J40K
43000									4871	90J43K
45000									(4871A)	90J45K
47000									4872	90J47K
50000									4873	90J50K
51000									4874	90J51K

OHMITE MFG. CO., a NORTH AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, Illinois 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

OHMITE® Type 200 Brown Devil® Fixed Resistors

***Brown Devil*®** (Type 200) resistors, are vitreous enameled, wirewound units long famous for ruggedness and durability in small power resistors. With the emphasis toward miniaturization and the current industry trend toward high operating temperatures, Ohmite has been able to increase the ratings on two Brown Devil sizes. The 5 watt size is now rated 8 watts and the 10 watt size is now rated 12 watts. The 20 watt unit retains the same rating.

Available on special order in 3 watt size and in values other than those listed as standard. Also available on special order with radial leads for P-C board mounting.

Standard resistance tolerance is ±5% for values 1 ohm or higher; ±10% for values below 1 ohm. Tinned leads 1½" long: 3 and 5¼ watt, 20 AWG; 8, 12 and 20 watt, 18 AWG.

DIMENSIONS & WEIGHTS

Rating	5¼W	8W	12W	20W
Core Dimen.	⅝x¼D	1x5/16D	1¾x5/16D	2x7/16D
Weight (lbs.)	.005	.01	.015	.03

Ohms	5¼ WATT Old Cat. No.	5¼ WATT New Cat. No.	8 WATT Old Cat. No.	8 WATT New Cat. No.	12 WATT Old Cat. No.	12 WATT New Cat. No.	20 WATT Old Cat. No.	20 WATT New Cat. No.
0.5					1700A	B12JR50	1800A	B20JR50
1.0	2822	B5J1R0	1500	B8J1R0	1701	B12J1R0	1802A	B20J1R0
1.1	(2823)	B5J1R1						
1.2	(2824)	B5J1R2						
1.3	(2825)	B5J1R3						
1.5	2826	B5J1R5	1500B	B8J1R5	1704	B12J1R5		
1.6	(2827)	B5J1R6						
1.8	2828	B5J1R8						
2.0	2829	B5J2R0	1501	B8J2R0	1705	B12J2R0	1802B	B20J2R0
2.2	2830	B5J2R2						
2.4	2831	B5J2R4						
2.7	(2832)	B5J2R7						
3.0	2833	B5J3R0	1502	B8J3R0	1706	B12J3R0	1802C	B20J3R0
3.3	2834	B5J3R3						
3.6	(2835)	B5J3R6						
3.9	2836	B5J3R9						
4.0			1503	B8J4R0	1707	B12J4R0	1802D	B20J4R0
4.3	2837	B5J4R3						
4.7	2838	B5J4R7						
5.0			1504	B8J5R0	1708	B12J5R0	1803	B20J5R0
5.1	2839	B5J5R1						
5.6	(2840)	B5J5R6						
6.2	2841	B5J6R2						
6.8	(2842)	B5J6R8						
7.5	2843	B5J7R5	1505	B8J7R5	1709	B12J7R5		
8.2	2844	B5J8R2						
9.1	(2845)	B5J9R1						
10	2846	B5J10R	1506	B8J10R	1710	B12J10R	1804	B20J10R
11	(2847)	B5J11R						
12	2848	B5J12R	1507	B8J12R	1711	B12J12R		
13	(2849)	B5J13R						
15	2850	B5J15R	1508	B8J15R	1712	B12J15R		
16	(2851)	B5J16R						
18	2852	B5J18R						
20	2853	B5J20R	1509	B8J20R	1713	B12J20R		
22	2854	B5J22R						
24	2855	B5J24R						
25			1510	B8J25R	1714	B12J25R	1805	B20J25R
27	2856	B5J27R						
30	2857	B5J30R	1511	B8J30R	1715	B12J30R		
33	2858	B5J33R						
35			1512	B8J35R	1716	B12J35R		
36	2859	B5J36R						
39	2860	B5J39R						
40			1513	B8J40R	1717	B12J40R		B20J40R
43	2861	B5J43R						
47	2862	B5J47R						
50			1514	B8J50R	1718	B12J50R	1806	B20J50R
51	2863	B5J51R						
56	2864	B5J56R						
62	2865	B5J62R						
68	2866	B5J68R						
75	2867	B5J75R	1515	B8J75R	1719	B12J75R	1807	B20J75R
82	2868	B5J82R						
91	2869	B5J91R						
100	2870	B5J100	1516	B8J100	1720	B12J100	1808	B20J100
110	(2871)	B5J110						
120	2872	B5J120						
125			1517	B8J125	1721	B12J125		B20J125
130	2873	B5J130						
150	2874	B5J150	1518	B8J150	1722	B12F150	1809	B20J150
160	2875	B5J160						
180	2876	B5J180						
200	2877	B5J200	1519	B8J200	1723	B12J200	1810	B20J200
220	2878	B5J220						
225			1520	B8J225	1724	B12J225		
240	2879	B5J240						
250			1521	B8J250	1725	B12J250	1811	B20J250
270	2880	B5J270						
300	2881	B5J300	1522	B8J300	1726	B12J300	1812	B20J300
330	2882	B5J330						
350			1523	B8J350	1727	B12J350	1813	B20J350
360	2883	B5J360						
390	2884	B5J390						
400			1524	B8J400	1728	B12J400	1814	B20J400
430	2885	B5J430						
450			1525	B8J450	1729	B12J450		
470	2886	B5J470						

Ohms	5¼ WATT Old Cat. No.	5¼ WATT New Cat. No.	8 WATT Old Cat. No.	8 WATT New Cat. No.	12 WATT Old Cat. No.	12 WATT New Cat. No.	20 WATT Old Cat. No.	20 WATT New Cat. No.
500			1526	B8J500	1730	B12J500	1815	B20J500
510	2887	B5J510						
560	2888	B5J560						
600			1527	B8J600	1731	B12J600		
620	2889	B5J620						
650							1816	B20J650
680	2890	B5J680						
700			1528	B8J700	1732	B12J700	1817	B20J700
750	2891	B5J750	(1529)	B8J750	1733	B12J750	1818	B20J750
800			1530	B8J800	1734	B12J800	1819	B20J800
820	2892	B5J820						
900			1531	B8J900	1735	B12J900	(1820A)	B20J900
910	2893	B5J910						
1000	2894	B5J1K0	1532	B8J1K0	1736	B12J1K0	1821	B20J1K0
1100	(2895)	B5J1K1	(1533)	B8J1K1	(1737)	B12J1K1		
1200	2896	B5J1K2	1534	B8J1K2	1738	B12J1K2	1822	B20J1K2
1250			1535	B8J1K25	1739	B12J1K25	1823	B20J1K25
1300	2897	B5J1K3						
1500	2898	B5J1K5	1536	B8J1K5	1740	B12J1K5	1824	B20J1K5
1600	(2899)	B5J1K6						
1750			1537	B8J1K75	1741	B12J1K75	1825	B20J1K75
1800	2900	B5J1K8						
2000	2901	B5J2K0	1538	B8J2K0	1742	B12J1K0	1827	B20J1K0
2200	2902	B5J2K2						
2250			1539	B8J2K25	1743	B12J2K25	(1828)	B20J2K25
2400	2903	B5J2K4						
2500			1540	B8J2K5	1744	B12J2K5	1830	B20J2K5
2700	2904	B5J2K7						
2750							1831	B20J2K75
3000	2905	B5J3K0	1541	B8J3K0	1745	B12J3K0	1832	B20J3K0
3300	2906	B5J3K3						
3500			1542	B8J3K5	1746	B12J3K5	1833	B20J3K5
3600	2907	B5J3K6						
3900	2908	B5J3K9						
4000			1543	B8J4K0	1747	B12J4K0	1834	B20J4K0
4300	(2909)	B5J4K3						
4500			1544	B8J4K5	1748	B12J4K5	1835	B20J4K5
4700	2910	B5J4K7						
5000			1545	B8J5K0	1749	B12J5K0	1836	B20J5K0
5100	2911	B5J5K1						
5600	2912	B5J5K6						
6000			1546	B8J6K0	1750	B12J6K0	1837	B20J6K0
6200	2913	B5J6K2						
6800	2914	B5J6K8						
7000			1547	B8J7K0	1751	B12J7K0	1838	B20J7K0
7500	2915	B5J7K5	1548	B8J7K5	1752	B12J7K5	1839	B20J7K5
8000			1549	B8J8K0	1753	B12J8K0	1840	B20J8K0
8200	2916	B5J8K2						
8500					(1754)	B12J8K5		
9000			1550	B8J9K0	(1754A)	B12J9K0	(1840A)	B20J9K0
9100	(2917)	B5J9K1						
10K	2918	B5J10K	1551	B8J10K	1755	B12J10K	1841	B20J10K
11K	(2919)	B5J11K			(1756)	B12J11K		
12K	2920	B5J12K			1757	B12J12K		
12.5K			1552	B8J12K5	1758	B12J12K5	1842	B20J12K5
13K	2921	B5J13K						
13.5K					(1759)	B12J13K5		
15K	2922	B5J15K	1553	B8J15K	1761	B12J15K	1843	B20J15K
16K	2923	B5J16K			(1762)	B12J16K		
17.5K			(1554)	B8J17K5	(1763)	B12J17K5		
18K	2924	B5J18K			1764	B12J18K		
20K	2925	B5J20K	1555	B8J20K	1765	B12J20K	1844	B20J20K
22.5K			(1556)	B8J22K5	1766	B12J22K5		
25K			1557	B8J25K	1767	B12J25K	1845	B20J25K
30K					1768	B12J30K	1846	B20J30K
35K					1769	B12J35K	(1847)	B20J35K
40K					1770	B12J40K	1848	B20J40K
45K					1771	B12J45K	(1849)	B20J45K
50K					1772	B12J50K	1850	B20J50K
55K							(1851)	B20J55K
60K							(1852)	B20J60K
65K							(1853)	B20J65K
70K							(1854)	B20J70K
75K							(1855)	B20J75K
80K							1856	B20J80K
85K							(1857)	B20J85K
90K							(1858)	B20J90K
95K							(1859)	B20J95K
100K							1860	B20J100K

OHMITE MFG. CO., a NORTH AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, IL 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

OHMITE® Type 270 Vitreous Enameled Fixed Resistors

These lug type resistors are wire-wound on high quality ceramic cores, protected and insulated by Ohmite vitreous enamel — the time-proved standard covering that is the best conductor of heat for a material which must also be a good electrical insulator.

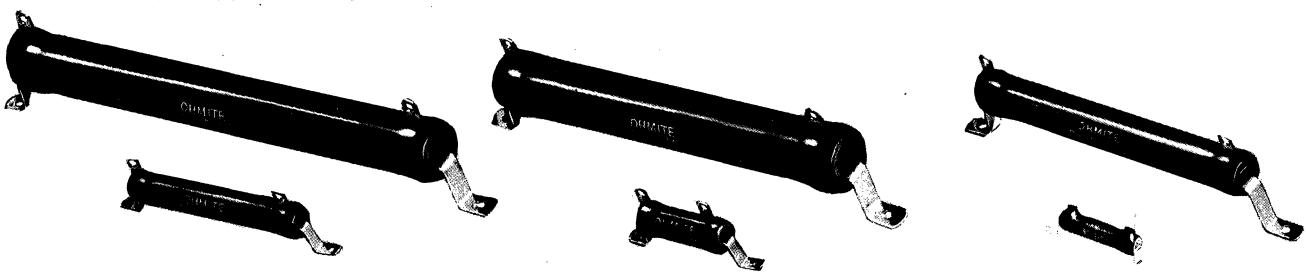
Resistance tolerance is ±5% for values 1 ohm or higher; ±10% below 1 ohm.

Wattage ratings are for use in free air. When resistors are mounted in closed spaces or where the circulation of air is restricted, they should not be used at more than one-half rating. Currents and voltages for reduced ratings can be obtained by multiplying full rating by the following factors: 75% load = .86, 66% = .81, 50% = .71, 33% = .57, 25% = .50.

Higher wattage resistors are available on a custom manufactured basis. Call for information.

These items are also available on special order, with non-inductive windings, (Aryton Perry).

The resistors listed below are standard stock items only. The 270 resistors are also available, on special order, in wattages from 3 through 1,000 with many intermediate values. Resistance values can also be supplied to meet your specific requirements. Contact our field representatives or our application engineers for assistance.



12 WATT Free air rating to 5600 Ohms Core: 1-3/4" x 5/16" Mtg. Ctr: 2 3/16" — Av. Wt. .02 lb. Std. Mtg. Brkt.: Cat. No. 5			Ohms Res.	25 WATT Free air rating to 12,000 Ohms. Core: 2" x 9/16" Mtg. Ctr: 2¾" — Av. Wt. .05 lb. Std. Mtg. Brkt.: No. 9		50 WATT Free air rating to 25,000 Ohms. Core: 4" x 9/16" Mtg. Ctr: 4¾" — Av. Wt. .09 lb. Std. Mtg. Brkt.: No. 9		100 WATT Free air rating to 60,000 Ohms. Core: 6½" x ¾" Mtg. Ctr: 7⅜" — Av. Wt. .20 lb. Std. Mtg. Brkt.: No. 12		175 WATT Free air rating for All Values Core: 8½" x 1⅛" Mtg. Ctr: 9⅜" — Av. Wt. .50 lb. Std. Mtg. Brkt.: No. 18		225 WATT Free air rating for All Values Core: 10½" x 1⅛" Mtg. Ctr: 11⅜" — Av. Wt. .62 lb. Std. Mtg. Brkt.: No. 18	
Resist. Ohms	Catalog Numbers Old	New		Catalog Numbers Old	New	Catalog Numbers Old	New	Catalog Numbers Old	New	Catalog Numbers Old	New	Catalog Numbers Old	New
.51	3723	L12JR51											
1.0	3730	L12J1R0	1	0200J	L25J1R0	0400J	L50J1R0	0600C	L100J1R0	0700C	L175J1R0	0900C	L225J1R0
1.5	3734	L12J1R5	2	0200K	L25J2R0	0400K	L50J2R0	0600D	L100J2R0	0700D	L175J2R0	0900D	L225J2R0
2.2	3738	L12J2R2	3	0200	L25J3R0	0400L	L50J3R0	0600E	L100J3R0	0700E	L175J3R0	0900E	L225J3R0
3.3	3742	L12J3R3	4	0200N	L25J4R0	0400N	L50J4R0	0600F	L100J4R0	0700F	L175J4R0	0900F	L225J4R0
4.7	3746	L12J4R7	5	0200A	L25J5R0	0400A	L50J5R0	0600A	L100J5R0	0700A	L175J5R0	0900A	L225J5R0
6.8	3750	L12J6R8	10	0200B	L25J10R	0400B	L50J10R	0600B	L100J10R	0700B	L175J10R	0900B	L225J10R
10	3754	L12J10R	15	0200R	L25J15R								
12	3756	L12J12R	25	0200C	L25J25R	0400C	L50J25R	0601	L100J25R	0701	L175J25R	0901	L225J25R
15	3758	L12J15R	50	0200D	L25J50R	0400D	L50J50R	0602	L100J50R	0702	L175J50R	0902	L225J50R
18	3760	L12J18R	75	0200E	L25J75R	0400E	L50J75R	0603	L100J75R	0703	L175J75R	0903	L225J75R
22	3762	L12J22R											
27	3764	L12J27R	100	0200F	L25J100	0400F	L50J100	0604	L100J100	0704	L175J100	0904	L225J100
33	3766	L12J33R	125					0604B	L100J125	0704B	L175J125		
39	3768	L12J39R	150	0200G	L25J150	0400G	L50J150	0605	L100J150	0705	L175J150	0905	L225J150
47	3770	L12J47R	200	0200H	L25J200	0400H	L50J200						
56	3772	L12J56R	250	0201	L25J250	0401	L50J250	0606	L100J250	0706	L175J250	0906	L225J250
68	3774	L12J68R	500	0202	L25J500	0402	L50J500	0607	L100J500	0707	L175J500	0907	L225J500
82	3776	L12J82R	750	0203	L25J750	0403	L50J750	0608	L100J750	(0708)	L175J750	0908	L225J750
100	3778	L12J100	800	0204	L25J800	0404	L50J800						
120	3780	L12J120	1,000	0205	L25J1K0	0405	L50J1K0	0609	L100J1K0	0709	L175J1K0	0909	L225J1K0
150	3782	L12J150	1,500	0206	L25J1K5	0406	L50J1K5	0610	L100J1K5	0710	L175J1K5	0910	L225J1K5
180	3784	L12J180											
220	3786	L12J220	2,000	0207	L25J2K0	0407	L50J2K0	0611	L100J2K0	0711	L175J2K0	0911	L225J2K0
270	3788	L12J270	2,500	0208	L25J2K5	0408	L50J2K5	0612	L100J2K5	0712	L175J2K5	0912	L225J2K5
330	3790	L12J330	3,000	0209	L25J3K0	0409	L50J3K0	0613	L100J3K0	0713	L175J3K0	0913	L225J3K0
390	3792	L12J390	3,500	0210	L25J3K5								
470	3794	L12J470	4,000	0211	L25J4K0	0410	L50J4K0						
560	3796	L12J560	5,000	0212	L25J5K0	0411	L50J5K0	0614	L100J5K0	0714	L175J5K0	0914	L225J5K0
680	3798	L12J680	6,000	0213	L25J6K0								
820	3800	L12J820	7,500	0214	L25J7K5	0412	L50J7K5	0615	L100J7K5	0715	L175J7K5	0915	L225J7K5
1,000	3802	L12J1K0	8,000			0413	L50J8K0						
1,200	3804	L12J1K2	10,000	0215	L25J10K	0414	L50J10K	0616	L100J10K	0716	L175J10K	0916	L225J10K
1,500	3806	L12J1K5											
1,800	3808	L12J1K8	12,000	0216	L25J12K	0415	L50J12K						
2,200	3810	L12J2K2	15,000	0217	L25J15K	0416	L50J15K	0617	L100J15K	0717	L175J15K	0917	L225J15K
2,700	3812	L12J2K7	20,000	0218	L25J20K	0417	L50J20K	0618	L100J20K	0718	L175J20K	0918	L225J20K
3,300	3814	L12J3K3	25,000	0219	L25J25K	0418	L50J25K	0619	L100J25K	0719	L175J25K	0919	L225J25K
3,900	3816	L12J3K9	30,000	0220	L25J30K			0620	L100J30K	0720	L175J30K	0920	L225J30K
4,700	3818	L12J4K7	35,000	0221	L25J35K	0419	L50J35K						
5,600	3820	L12J5K6	40,000	0222	L25J40K			(0621)	L100J40K	0721	L175J40K	0921	L225J40K
6,800	3822	L12J6K8	50,000	0224	L25J50K	0420	L50J50K	0622	L100J50K	0722	L175J50K	0922	L225J50K
8,200	3824	L12J8K2	60,000	0225	L25J60K			0623	L100J60K	0723	L175J60K	0923	L225J60K
10,000	3826	L12J10K	70,000	0226	L25J70K								
12,000	3828	L12J12K	75,000			0421	L50J75K	0624	L100J75K	0724	L175J75K	0924	L225J75K
15,000	3830	L12J15K	80,000	0227	L25J80K								
18,000	3832	L12J18K	100,000	0229	L25J100K	0422	L50J100K	0625	L100J100K	0725	L175J100K	0925	L225J100K
22,000	3834	L12J22K	125,000			0423	L50J125K						
27,000	3836	L12J27K	150,000			0424	L50J150K						
33,000	3838	L12J33K											
39,000	3840	L12J39K	175,000			0425	L50J175K						
47,000	3842	L12J47K	200,000			0426	L50J200K						
51,000	3843	L12J51K	250,000			0428	L50J250K						

OHMITE MFG. CO., a NORTH AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, IL 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

OHMITE® Dividohm® Type 210 Adjustable Vitreous Enameled Resistors

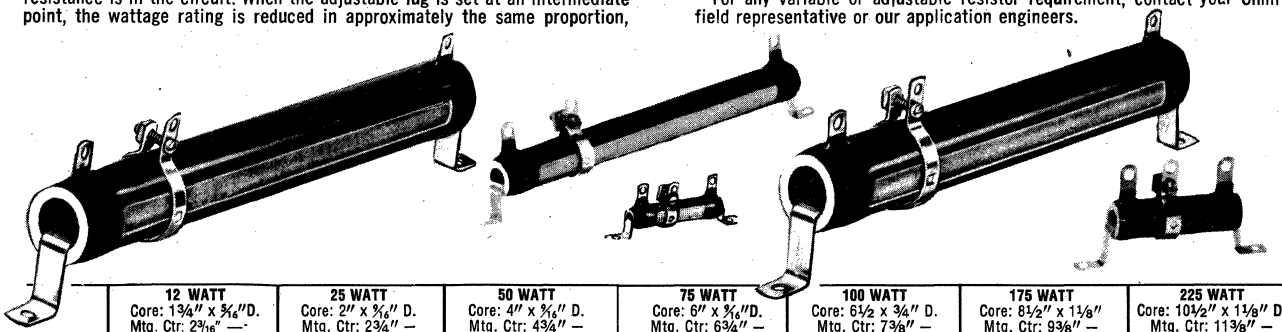
Dividohm resistors make ideal voltage dividers for original equipment and replacement in transmitters, rectifiers and other apparatus. Such tapped "bleeders" are made by using one or more adjustable lugs, as required. ***Dividohm*** are also handy for obtaining odd resistance values, for adjusting circuits, and for use on equipment which must be set to meet various line voltages.

Dividohm resistors are vitreous enameled resistors on which a narrow strip has been left uncovered to expose a portion of each turn. Contact to any wire in this strip is made by an embossed contact on the adjustable lug (supplied).

WATT RATING: The stated wattage rating applies only when the entire resistance is in the circuit. When the adjustable lug is set at an intermediate point, the wattage rating is reduced in approximately the same proportion, i.e., if the lug is set at half the resistance, the wattage is reduced by one-half. A safe rule to follow is to make sure that the maximum rated current is not exceeded. This should be carefully checked particularly if the resistor will be used as a voltage divider with several adjustable lugs. Resistance tolerance is ±10% for the total resistance value.

The items listed in the chart below, are those items that have proven to be the most popular based on usage. "Dividohm" style resistors are available on special order in resistance values other than those shown and in a wattage range of 12 Watts through 1000 Watts. In addition to the vitreous enamel standard coating, these items are also available with an Ohmicone silicone ceramic coating.

For any variable or adjustable resistor requirement, contact your Ohmite field representative or our application engineers.



	12 WATT Core: 1¾" x 3/16" D. Mtg. Ctr: 2 3/16" — Av. Wt. .02 lb. Std. Mtg. Brkt.* No. 5		25 WATT Core: 2" x 3/16" D. Mtg. Ctr: 2¾" — Av. Wt. .05 lb. Std. Mtg. Brkt.* No. 9		50 WATT Core: 4" x 3/16" D. Mtg. Ctr: 4¾" — Av. Wt. .09 lb. Std. Mtg. Brkt.* No. 9		75 WATT Core: 6" x 3/16" D. Mtg. Ctr: 6¾" — Av. Wt. .15 lb. Std. Mtg. Brkt.* No. 9		100 WATT Core: 6½ x ¾" D. Mtg. Ctr: 7⅜" — Av. Wt. .20 lb. Std. Mtg. Brkt.* No. 12		175 WATT Core: 8½" x 1⅛" Mtg. Ctr: 9⅜" — Av. Wt. .50 lb. Std. Mtg. Brkt.* No. 18		225 WATT Core: 10½" x 1⅛" D. Mtg. Ctr: 11⅜" — Av. Wt. .62 lb. Std. Mtg. Brkt.* No. 18	
Resist. Ohms	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.
1	1001	D12K1R0	0360	D25K1R0	0560A	D50K1R0	0769A	D75K1R0	0956A	D100K1R0	1156A	D175K1R0	1356A	D225K1R0
2	1002	D12K2R0	0360B	D25K2R0	0560B	D50K2R0	0769B	D75K2R0	0956B	D100K2R0	1156B	D175K2R0	1356B	D225K2R0
3	1003	D12K3R0	0361	D25K3R0	0560C	D50K3R0	0769C	D75K3R0	0956C	D100K3R0	1156C	D175K3R0	1356C	D225K3R0
4					0560D	D50K4R0	(0769D)	D75K4R0	0956D	D100K4R0	1156D	D175K4R0	1356D	D225K4R0
5	1004	D12K5R0	0362	D25K5R0	0560	D50K5R0	0769	D75K5R0	0956	D100K5R0	1156	D175K5R0	1358	D225K5R0
7.5	1005	D12K7R5	0362B	D25K7R5										
10	1006	D12K10R	0363	D25K10R	0561	D50K10R	0770	D75K10R	0957	D100K10R	1157	D175K10R	1357	D225K10R
15	1007	D12K15R	0364	D25K15R			0771	D75K15R						
20	1008	D12K20R	0364B	D25K20R										
25	1009	D12K25R	0365	D25K25R	0562	D50K25R	0772	D75K25R	0958	D100K25R	1158	D175K25R	1358	D225K25R
50	1010	D12K50R	0366	D25K50R	0563	D50K50R	0773	D75K50R	0959	D100K50R	1159	D175K50R	1359	D225K50R
75	1011	D12K75R	0367	D25K75R	0564	D50K75R								
100	1012	D12K100	0368	D25K100	0565	D50K100	0774	D75K100	0960	D100K100	1160	D175K100	1360	D225K100
150	1013	D12K150	0369	D25K150	0566	D50K150								
200	1014	D12K200	0370	D25K200	0567	D50K200	0774B	D75K200						
250	1015	D12K250	0371	D25K250	0568	D50K250	0775	D75K250	0960B	D100K250	1160B	D175K250	1360B	D225K250
300	1016	D12K300	0371B	D25K300	0568B	D50K300	0775B	D75K300						
350	(1017)	D12K350												
400	1018	D12K400	0371C	D25K400	0568C	D50K400	0775C	D75K400						
500	1019	D12K500	0372	D25K500	0569	D50K500	0776	D75K500	0961	D100K500	1161	D175K500	1361	D225K500
600	(1020)	D12K600												
750	1021	D12K750	0373	D25K750	0570	D50K750	0777	D75K750						
800	(1022)	D12K800	0374	D25K800	0571	D50K800	(0777B)	D75K800						
1000	1023	D12K1K0	0375	D25K1K0	0572	D50K1K0	0778	D75K1K0	0962	D100K1K0	1162	D175K1K0	1362	D225K1K0
1250	1024	D12K1K25	0375B	D25K1K25	0572B	D50K1K25	0778B)	D75K1K25						
1500	1025	D12K1K5	0376	D25K1K5	0573	D50K1K5	(0779)	D75K1K5	0962B	D100K1K5	1162B	D175K1K5	1362B	D225K1K5
2000	1026	D12K2K0	0377	D25K2K0	0574	D50K2K0	(0780)	D75K2K0						
2250	(1027)	D12K2K25	0377B	D25K2K25	(0574B)	D50K2K25	(0780B)	D75K2K25						
2500	1028	D12K2K5	0378	D25K2K5	0575	D50K2K5	(0781)	D75K2K5	0963	D100K2K5	1163	D175K2K5	1363	D225K2K5
3000	1029	D12K3K0	0379	D25K3K0	0576	D50K3K0	(0781B)	D75K3K0						
3500	(1030)	D12K3K5	0380	D25K3K5	0576B	D50K3K5	(0782)	D75K3K5						
4000	1031	D12K4K0	(0381)	D25K4K0	0577	D50K4K0	(0782B)	D75K4K0						
4500	(1032)	D12K4K5	0381B	D25K4K5	(0577B)	D50K4K5	(0782C)	D75K4K5						
5000	1033	D12K5K0	0382	D25K5K0	0578	D50K5K0	(0783)	D75K5K0	0964	D100K5K0	1164	D175K5K0	1364	D225K5K0
6000	1034	D12K6K0	0383	D25K6K0	(0578B)	D50K6K0	(0783B)	D75K6K0						
7000	1035	D12K7K0	0383B	D25K7K0	0578C	D50K7K0	(0783C)	D75K7K0						
7500	1036	D12K7K5	0384	D25K7K5	0579	D50K7K5	(0784)	D75K7K5						
8000	(1037)	D12K8K0	(0384B)	D25K8K0	(0580)	D50K8K0	(0784B)	D75K8K0						
8500	(1038)	D12K8K5												
9000	(1039)	D12K9K0	(0384C)	D25K9K0	0580B	D50K9K0	(0784C)	D75K9K0						
10000	1040	D12K10K	0385	D25K10K	0581	D50K10K	(0785)	D75K10K	0965	D100K10K	1165	D175K10K	1365	D225K10K
12000			(0386)	D25K12K	(0582)	D50K12K	0785B	D75K12K						
15000			0387	D25K15K	0583	D50K15K	(0786)	D75K15K	(0966)	D100K15K	(1166)	D175K15K	1366	D225K15K
20000			0388	D25K20K	0584	D50K20K	0787	D75K20K	(0967)	D100K20K	(1167)	D175K20K	1367	D225K20K
25000			0389	D25K25K	0585	D50K25K	(0788)	D75K25K	(0968)	D100K25K	(1168)	D175K25K	1368	D225K25K
30000					0586	D50K30K	(0789)	D75K30K	(0969)	D100K30K	(1169)	D175K30K	(1369)	D225K30K
35000							0790	D75K35K						
40000					0587	D50K40K	(0791)	D75K40K	(0970)	D100K40K	(1170)	D175K40K	(1370)	D225K40K
45000							(0792)	D75K45K						
50000					0588	D50K50K	(0793)	D75K50K	0971	D100K50K	(1171)	D175K50K	1371	D225K50K
60000					(0589)	D50K60K	(0794)	D75K60K						
75000									(0972)	D100K75K	(1172)	D175K75K	1372	D225K75K
80000					(0590)	D50K80K	(0795)	D75K80K						
100000					0591	D50K100K	(0796)	D75K100K	0973	D100K100K	(1173)	D175K100K	1373	D225K100K

Adjustable Lugs

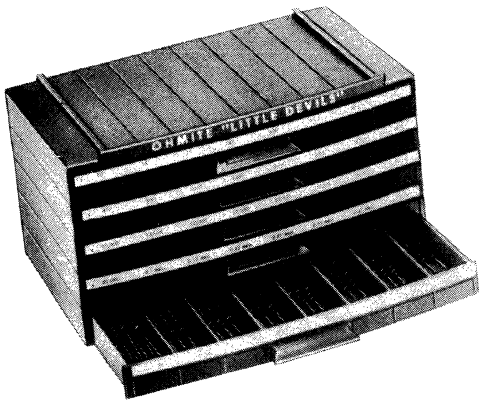
One "Screw Driver Type Adjustable Lug" is supplied with each unit. Lugs with a silver contact button can be ordered from the table below. MOVING THE LUGS: Lugs always should be loosened completely before moving and not moved except while the current is off in order to protect the exposed wire from mechanical or electrical injury and to protect the operator from dangerous voltages.

DOUBLE THUMB SCREW ADJUSTABLE LUG

This adjustable lug, which is illustrated at left, features two advantages — ease of adjustment and less chance of damaging the resistance wire while moving lugs. Available for 1⅛" cores. Catalog No. **2160**

STANDARD					With SILVER CONTACT BUTTONS				
	Screw Driver Type		Bakelite Knob Type			Screw Driver Type		Bakelite Knob Type	
Core Diam. Inches	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	Core Diam. Inches	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.
5/16	2115	1058	—	—	5/16	2116	2161	—	—
9/16	2121	0358	2122	0359	9/16	2123	2164	2124	2165
¾	2125	1958	2126	1959	¾	2127	2166	2128	2167
1⅛	2133	2158	2134	2159	1⅛	2135	2170	2136	2171

OHMITE® Cabinet Resistor Assortments



Perfect for R & D and prototype labs.
All popular values included.
8 wattage sizes to choose from.
Contents clearly marked on front of each drawer segment.

Always have the right style, wattage, and resistance value on hand. Thwart Murphey's Law which states; "The resistance value needed will not be available."

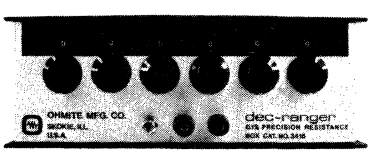
Ohmite cabinet assortments come in four different resistor styles and 8 different wattages. The resistors used to make up these assortments are the most popular resistance values as determined by national usage.

The handy compact plastic cabinets are packed in accordance with the tables below, which state the quantities, number of values, and the resistance range of each assortment. Each drawer segment is individually labeled. Dovetail tops and bottoms of each cabinet facilitate stacking. Individual cabinet dimensions are: 9″ long by 4¾″ high by 5¼″ deep.

For specific information regarding any of the cabinet assortments, ask your Ohmite Distributor for the latest cabinet brochure.

Style of Resistor	Watts	Cat. No.	Tolerance	Quantity	No. of Values	No. of Cab. in Assortment	Resistance Range
WIREWOUND							
Conformal Vitreous Enamel	1	CAB-221	5%	167	40	1	1Ω - 3KΩ
Conformal Vitreous Enamel	3	CAB-223	5%	325	71	2	1Ω - 10KΩ
Conformal Vitreous Enamel	5	CAB-225	5%	357	77	2	1Ω - 25KΩ
Conformal Vitreous Enamel	10	CAB-220	5%	185	40	1	1Ω - 50KΩ
Conformal Ohmicone®	1	CAB-441	5%	120	40	1	.1Ω - 3KΩ
Conformal Ohmicone®	3	CAB-443	5%	120	40	1	.1Ω - 5KΩ
Conformal Ohmicone®	5	CAB-445	5%	120	40	1	.1Ω - 10KΩ
Conformal Ohmicone®	10	CAB-440	5%	120	40	1	.1Ω - 15KΩ
LITTLE DEVIL®							
Carbon Composition	⅛	CAB-21	5%	500	80	2	2.7Ω - 22 MEGΩ
Carbon Composition	⅛	CAB-45	5%	1000	160	4	2.7Ω - 22 MEGΩ
Carbon Composition	¼	CAB-54	5%	124	37	1	47Ω - 10MΩ
Carbon Composition	¼	CAB-525	5%	800	80	2	2.7Ω - 22MΩ
Carbon Composition	¼	CAB-46	5%	1500	160	4	2.7Ω - 22MΩ
Carbon Composition	½	CAB-510	5%	120	40	1	10Ω - 10MΩ
Carbon Composition	½	CAB-526	5%	800	80	2	2.7Ω - 22MΩ
Carbon Composition	½	CAB-47	5%	1500	160	4	2.7Ω - 22MΩ
Carbon Composition	1	CAB-52	5%	100	40	1	10Ω - 10MΩ
Carbon Composition	1	CAB-527	5%	480	80	2	2.7Ω - 22MΩ
Carbon Composition	1	CAB-48	5%	900	160	4	2.7Ω - 22MΩ
Carbon Composition	2	CAB-53	5%	100	40	1	10Ω - 10MΩ
LITTLE REBEL®							
Carbon Film	⅛	CAB-5F	5%	150	31	1	10Ω to 22MΩ
Carbon Film	⅛	CAB-22F	5%	500	52	2	10Ω to 22MΩ
Carbon Film	⅛	CAB-34F	5%	1000	104	3	10Ω to 22MΩ
Carbon Film	¼	CAB-6F	5%	150	36	1	1Ω to 1MΩ
Carbon Film	¼	CAB-23F	5%	500	75	2	1Ω to 1MΩ
Carbon Film	¼	CAB-43F	5%	1500	137	4	1Ω to 1MΩ
Carbon Film	½	CAB-7F	5%	150	36	1	1Ω to 1MΩ
Carbon Film	½	CAB-24F	5%	500	75	2	1Ω to 1MΩ
Carbon Film	½	CAB-44F	5%	1500	137	4	1Ω to 1MΩ
METAL DEVIL®							
Metal Film	¼	CAB-8M	1%	250	40	1	10Ω to 301KΩ
Metal Film	¼	CAB-28M	1%	500	80	2	10Ω to 301KΩ
Metal Film	¼	CAB-31M	1%	1000	120	3	10Ω to 301KΩ
Metal Film	½	CAB-9M	1%	250	40	1	10Ω to 1MΩ
Metal Film	½	CAB-29M	1%	500	80	2	10Ω to 1MΩ
Metal Film	½	CAB-32M	1%	1000	120	3	10Ω to 1MΩ

DEC-RANGER



0.1% ACCURACY PRECISION DECADE RESISTANCE BOX NO. 3416

SPECIFICATIONS:
ACCURACY: ±0.1% (PLUS 0.03Ω MAXIMUM CONTACT AND CIRCUIT RESISTANCE)
NUMBER OF DECADES: 6
SELECTION: ROTARY TAP SWITCHES, CONTINUOUS ROTATION IN EITHER DIRECTION
READ OUT: DIGITAL, IN LINE, THROUGH "WINDOWS" IN PANEL
SWITCH LIFE: IN EXCESS OF 50,000 OPERATIONS
DIMENSIONS: 10½″ LONG x 3¾″ HIGH x 4⅝″ DEEP
RANGE: 1Ω — 1,111,110Ω IN 1Ω STEPS

CAP-RANGER®

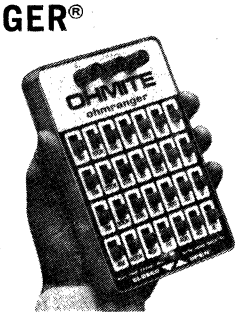
ECONOMICAL, PORTABLE CAPACITANCE SELECTOR

100 picofarads to 11.111 microfarads in 100 picofarad steps with ±2% accuracy. Three binding posts, one to ground the metal case. Compact size. Big performance. Simple operation. Solves your troubleshooting, breadboarding and circuit design problems using simple sliding switches. Dimensions 4″ x 6″ x 1″.
Catalog No. 3430A

OHM-RANGER®

ECONOMICAL, PORTABLE RESISTANCE SELECTOR

- **Over 11 million ohms in one-ohm increments**
- **1% accuracy***
- **Easy slide switch operation**
- **Handy slimline size**
- **Rugged metal construction**

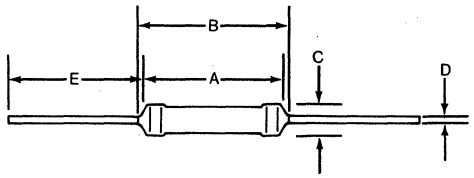


1 to 11,111,110 ohms, in one-ohm steps — with accuracy assured by half-watt 1% tolerance resistors! Has three binding posts, one to ground case. Small enough to take anywhere in your pocket, the handy easy-to-use OHM-RANGER is ideal for lab use, schools and service technicians. Dimensions 4″ x 6″ x 1″.
* 10 ohms and above
Catalog No. 3420

OHMITE MFG. CO., a NORTH AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, IL 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

OHMITE® PowrFilm™ Resistors

Dimensions



Type	A Max Length	B Clean Lead To Clean Lead	C Max Diameter	D Lead Dia.	E Lead Length
PF1	.394" (10mm)	.433" (11mm)	.154" (3.9mm)	.024" (.6mm)	1.5" (38mm)
PF2	.657" (17mm)	.704" (18mm)	.205" (5.2mm)	.024" (.6mm)	1.5" (38mm)

OHMS	Catalog Number 1.6 WATTS (70°C)	2.5 WATTS (70°C)	OHMS	Catalog Number 1.6 WATTS (70°C)	2.5 WATTS (70°C)	OHMS	Catalog Number 1.6 WATTS (70°C)	2.5 WATTS (70°C)	OHMS	Catalog Number 1.6 WATTS (70°C)	2.5 WATTS (70°C)
2.2	PF1J2R2	PF2J2R2	62	PF1J62R	PF2J62R	1800	PF1J1K8	PF2J1K8	51K	PF1J51K	PF2J51K
2.4	PF1J2R4	PF2J2R4	68	PF1J68R	PF2J68R	2000	PF1J2K0	PF2J2K0	56K	PF1J56K	PF2J56K
2.7	PF1J2R7	PF2J2R7	75	PF1J75R	PF2J75R	2200	PF1J2K2	PF2J2K2	62K	PF1J62K	PF2J62K
3.0	PF1J3R0	PF2J3R0	82	PF1J82R	PF2J82R	2400	PF1J2K4	PF2J2K4	68K	PF1J68K	PF2J68K
3.3	PF1J3R3	PF2J3R3	91	PF1J91R	PF2J91R	2700	PF1J2K7	PF2J2K7	75K	PF1J75K	PF2J75K
3.6	PF1J3R6	PF2J3R6	100	PF1J100	PF2J100	3000	PF1J3K0	PF2J3K0	82K	PF1J82K	PF2J82K
3.9	PF1J3R9	PF2J3R9	110	PF1J110	PF2J110	3300	PF1J3K3	PF2J3K3	91K	PF1J91K	PF2J91K
4.3	PF1J4R3	PF2J4R3	120	PF1J120	PF2J120	3600	PF1J3K6	PF2J3K6	100K	PF1J100K	PF2J100K
4.7	PF1J4R7	PF2J4R7	130	PF1J130	PF2J130	3900	PF1J3K9	PF2J3K9	110K	PF1J110K	PF2J110K
5.1	PF1J5R1	PF2J5R1	150	PF1J150	PF2J150	4300	PF1J4K3	PF2J4K3	120K	PF1J120K	PF2J120K
5.6	PF1J5R6	PF2J5R6	160	PF1J160	PF2J160	4700	PF1J4K7	PF2J4K7	130K	PF1J130K	PF2J130K
6.2	PF1J6R2	PF2J6R2	180	PF1J180	PF2J180	5100	PF1J5K1	PF2J5K1	150K	PF1J150K	PF2J150K
6.8	PF1J6R8	PF2J6R8	200	PF1J200	PF2J200	5600	PF1J5K6	PF2J5K6	160K	PF1J160K	PF2J160K
7.5	PF1J7R5	PF2J7R5	220	PF1J220	PF2J220	6200	PF1J6K2	PF2J6K2	180K	PF1J180K	PF2J180K
8.2	PF1J8R2	PF2J8R2	240	PF1J240	PF2J240	6800	PF1J6K8	PF2J6K8	200K	PF1J200K	PF2J200K
9.1	PF1J9R1	PF2J9R1	270	PF1J270	PF2J270	7500	PF1J7K5	PF2J7K5	220K	PF1J220K	PF2J220K
10	PF1J10R	PF2J10R	300	PF1J300	PF2J300	8200	PF1J8K2	PF2J8K2	240K	PF1J240K	PF2J240K
11	PF1J11R	PF2J11R	330	PF1J330	PF2J330	9100	PF1J9K1	PF2J9K1	270K	PF1J270K	PF2J270K
12	PF1J12R	PF2J12R	360	PF1J360	PF2J360	10K	PF1J10K	PF2J10K	300K	PF1J300K	PF2J300K
13	PF1J13R	PF2J13R	390	PF1J390	PF2J390	11K	PF1J11K	PF2J11K	330K	PF1J330K	PF2J330K
15	PF1J15R	PF2J15R	430	PF1J430	PF2J430	12K	PF1J12K	PF2J12K	360K	PF1J360K	PF2J360K
16	PF1J16R	PF2J16R	470	PF1J470	PF2J470	13K	PF1J13K	PF2J13K	390K	PF1J390K	PF2J390K
18	PF1J18R	PF2J18R	510	PF1J510	PF2J510	15K	PF1J15K	PF2J15K	430K	PF1J430K	PF2J430K
20	PF1J20R	PF2J20R	560	PF1J560	PF2J560	16K	PF1J16K	PF2J16K	470K	PF1J470K	PF2J470K
22	PF1J22R	PF2J22R	620	PF1J620	PF2J620	18K	PF1J18K	PF2J18K	510K	PF1J510K	PF2J510K
24	PF1J24R	PF2J24R	680	PF1J680	PF2J680	20K	PF1J20K	PF2J20K	560K	PF1J560K	PF2J560K
27	PF1J27R	PF2J27R	750	PF1J750	PF2J750	22K	PF1J22K	PF2J22K	620K	PF1J620K	PF2J620K
30	PF1J30R	PF2J30R	820	PF1J820	PF2J820	24K	PF1J24K	PF2J24K	680K	PF1J680K	PF2J680K
33	PF1J33R	PF2J33R	910	PF1J910	PF2J910	27K	PF1J27K	PF2J27K	750K	PF1J750K	PF2J750K
36	PF1J36R	PF2J36R	1000	PF1J1K0	PF2J1K0	30K	PF1J30K	PF2J30K	820K	PF1J820K	PF2J820K
39	PF1J39R	PF2J39R	1100	PF1J1K1	PF2J1K1	33K	PF1J33K	PF2J33K	910K	PF1J910K	PF2J910K
43	PF1J43R	PF2J43R	1200	PF1J1K2	PF2J1K2	36K	PF1J36K	PF2J36K	1 MEG	PF1J1M0	PF2J1M0
47	PF1J47R	PF2J47R	1300	PF1J1K3	PF2J1K3	39K	PF1J39K	PF2J39K			
51	PF1J51R	PF2J51R	1500	PF1J1K5	PF2J1K5	43K	PF1J43K	PF2J43K			
56	PF1J56R	PF2J56R	1600	PF1J1K6	PF2J1K6	47K	PF1J47K	PF2J47K			

Performance Specifications

Series Number	PF1 WATTS	PF1 OHMS	PF2 WATTS	PF2 OHMS
Power At 25°C Ambient	2.0 1.5	≤ 27K > 27K	3 2.4	≤ 51K > 51K
Power At 70°C Ambient	1.6 1.2	≤ 27K > 27K	2.5 2.0	≤ 51K > 51K
Max Voltage	500V		750V	
Resistance Range	2.2 OHMS to 1 MEGOHM		2.2 OHMS to 1 MEGOHM	
Resistance Tolerance	±5%		±5%	
Operating Range	−55°C To 200°C		−55°C To 200°C	
Overload Capacity	6.25 X Rated Watts for 5 Sec (500 V Max)		6.25 X Rated Watts for 5 Sec (750 V Max)	

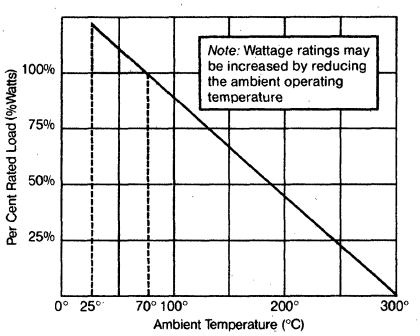
	PF1 Max Value	PF1 Typical Value R≤ 27KΩ	PF1 Typical Value R> 27KΩ	PF2 Max Value	PF2 Typical Value R≤ 51KΩ	PF2 Typical Value R> 51KΩ
Stability After:						
1000 HR Max Load	5%	2.5%	5%	5%	2.5%	5%
Environmental Tests	3%	0.5%	1%	3%	0.5%	1%
Soldering	1%	0.1%	0.1%	1%	0.1%	0.1%
Temperature Coefficient:						
Less Than 10 OHMS	0 ± 350 PPM/°C			0 ± 350 PPM/°C		
10 OHMS And Over	0 ± 250 PPM/°C			0 ± 250 PPM/°C		
Dielectric Withstanding:	Min 500V (R.M.S.)			Min 500V (R.M.S.)		
Max Body Temperature At Rated Load (Hot Spot)	300°C			300°C		

Power Rating

The power rating for *PowrFilm*™ resistors is dependent on the maximum power that can be dissipated continuously at a specified ambient temperature.

The nominal wattage ratings given for *PowrFilm* resistors are based on an ambient operating temperature of 70°C.

PowrFilm resistors can be operated at ambient temperatures other than 70°C in accordance with the Load Vs. Temperature curve shown.



Load Vs Temperature

Application Information

Construction

A homogenous film of metal alloy is deposited on a high grade ceramic body. The alloy is cut in a helix to increase and adjust the resistance. Tinned leads of copper-clad steel are welded to the end caps which are force fitted to the ceramic body.

Coated with a red non-flammable coating of silicon lacquer for environmental and electrical protection, the resistor will withstand 500V (R.M.S.) and is resistant to most of the commonly used cleaning solvents conforming to MIL-STD-202E, method 215 and IEC 68-2-45.

Inductance

The *PowrFilm* resistor is fundamentally non-inductive. Any reactance would be capacitive (dominated by the end cap to end cap capacitance) and would be extremely small.

Mounting

The body "hot spot" temperature at maximum dissipation and ambient temperature is 300°C and must be considered in relation to other nearby components and materials.

Weight

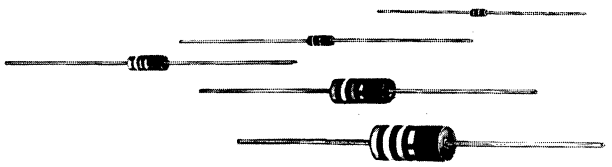
The PF1 resistor has a net weight of 4.4 lbs. per 5,000 pieces (reel).

The PF2 resistor has a net weight of 3 lbs. per 1,500 pieces (reel).

OHMITE® Little Devil® Molded Composition Resistors 5% Tolerance

Color Coder

CATALOG NO. 5190



Little Devils, Ohmite's famous molded composition resistors, find broad use in commercial and military applications. The 1/8, 1/4, 1/2, 1 and 2-watt sizes, which conform respectively to Styles RC05, RC07, RC20, RC32 and RC42 of MIL-R-11, meet all the stringent requirements of this military specification. All sizes available satisfy a wide range of design and service needs.

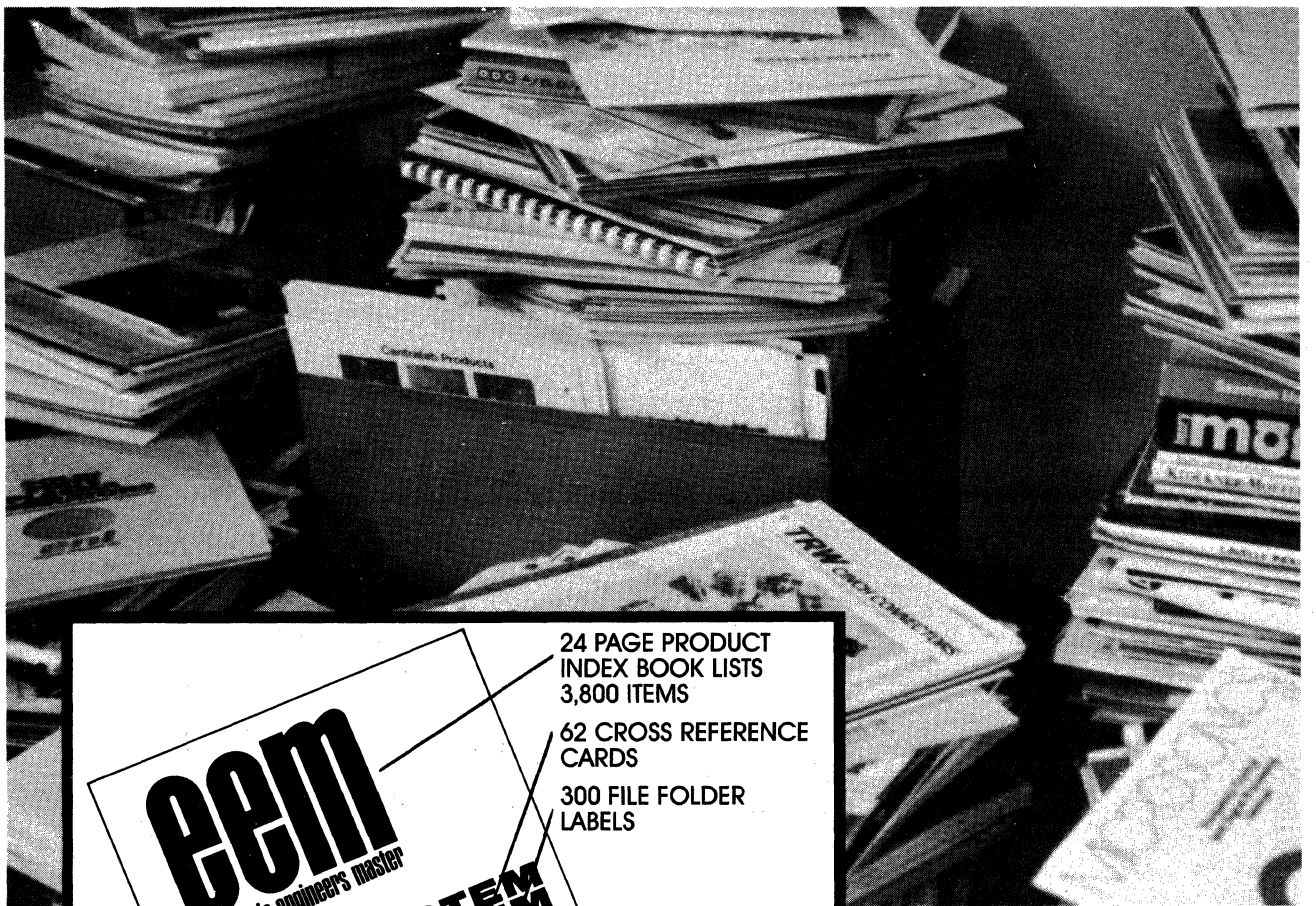
Little Devils have molded insulation for high dielectric strength. Noted advantages of these units are great stability, low noise level, low voltage coefficient, high insulation breakdown voltage and rapid heat dissipation. They may be used at full rated wattage at 70°C (158°F) ambient temperature.

Little Devils are available from stock in standard EIA resistance values in the tolerances and resistance ranges shown in the price table. Ratings for maximum continuous RMS voltage drop are high: 150 volts for 1/8 watt units, 250 volts for 1/4 watt, 350 volts for 1/2 watt, 500 volts for 1 watt, and 500 volts for 2 watt units.

SPECIFICATIONS

Watts	Length	Diameter	Leads	Mil-R-11
1/8	.145	.062	.015 x 1	RC05
1/4	.250	.090	.025 x 1 1/2	RC07
1/2	.391	.141	.033 x 1 1/2	RC20
1	.563	.219	.041 x 1 1/2	RC32
2	.688	.313	.046 x 1 1/2	RC42

Catalog Number						Catalog Number						Catalog Number					
Resist. (Ohms)	1/8 Watt	1/4 Watt	1/2 Watt	1 Watt	2 Watt	Resist. (Ohms)	1/8 Watt	1/4 Watt	1/2 Watt	1 Watt	2 Watt	Resist. (Ohms)	1/8 Watt	1/4 Watt	1/2 Watt	1 Watt	2 Watt
1			0E10G5			300	0B3015	0C3015	0E3015	0G3015	0H3015	82000	0B8235	0C8235	0E8235	0G8235	0H8235
1.1			0E11G5			330	0B3315	0C3315	0E3315	0G3315	0H3315	91000	0B9135	0C9135	0E9135	0G9135	0H9135
1.2			0E12G5			360	0B3615	0C3615	0E3615	0G3615	0H3615	0.1 MEG	0B1045	0C1045	0E1045	0G1045	0H1045
1.3			0E13G5			390	0B3915	0C3915	0E3915	0G3915	0H3915	0.11 MEG	0B1145	0C1145	0E1145	0G1145	0H1145
1.5			0E15G5			430	0B4315	0C4315	0E4315	0G4315	0H4315	0.12 MEG	0B1245	0C1245	0E1245	0G1245	0H1245
1.6			0E16G5			470	0B4715	0C4715	0E4715	0G4715	0H4715	0.13 MEG	0B1345	0C1345	0E1345	0G1345	0H1345
1.8			0E18G5			510	0B5115	0C5115	0E5115	0G5115	0H5115	0.15 MEG	0B1545	0C1545	0E1545	0G1545	0H1545
2.0			0E20G5			560	0B5615	0C5615	0E5615	0G5615	0H5615	0.16 MEG	0B1645	0C1645	0E1645	0G1645	0H1645
2.2			0E22G5			620	0B6215	0C6215	0E6215	0G6215	0H6215	0.18 MEG	0B1845	0C1845	0E1845	0G1845	0H1845
2.4			0E24G5			680	0B6815	0C6815	0E6815	0G6815	0H6815	0.20 MEG	0B2045	0C2045	0E2045	0G2045	0H2045
2.7	0B27G5	0C27G5	0E27G5	0G27G5		750	0B7515	0C7515	0E7515	0G7515	0H7515	0.22 MEG	0B2245	0C2245	0E2245	0G2245	0H2245
3.0	0B30G5	0C30G5	0E30G5	0G30G5		820	0B8215	0C8215	0E8215	0G8215	0H8215	0.24 MEG	0B2445	0C2445	0E2445	0G2445	0H2445
3.3	0B33G5	0C33G5	0E33G5	0G33G5		910	0B9115	0C9115	0E9115	0G9115	0H9115	0.27 MEG	0B2745	0C2745	0E2745	0G2745	0H2745
3.6	0B36G5	0C36G5	0E36G5	0G36G5		1000	0B1025	0C1025	0E1025	0G1025	0H1025	0.30 MEG	0B3045	0C3045	0E3045	0G3045	0H3045
3.9	0B39G5	0C39G5	0E39G5	0G39G5		1100	0B1125	0C1125	0E1125	0G1125	0H1125	0.33 MEG	0B3345	0C3345	0E3345	0G3345	0H3345
4.3	0B43G5	0C43G5	0E43G5	0G43G5		1200	0B1225	0C1225	0E1225	0G1225	0H1225	0.36 MEG	0B3645	0C3645	0E3645	0G3645	0H3645
4.7	0B47G5	0C47G5	0E47G5	0G47G5		1300	0B1325	0C1325	0E1325	0G1325	0H1325	0.39 MEG	0B3945	0C3945	0E3945	0G3945	0H3945
5.1	0B51G5	0C51G5	0E51G5	0G51G5		1500	0B1525	0C1525	0E1525	0G1525	0H1525	0.43 MEG	0B4345	0C4345	0E4345	0G4345	0H4345
5.6	0B56G5	0C56G5	0E56G5	0G56G5		1600	0B1625	0C1625	0E1625	0G1625	0H1625	0.47 MEG	0B4745	0C4745	0E4745	0G4745	0H4745
6.2	0B62G5	0C62G5	0E62G5	0G62G5		1800	0B1825	0C1825	0E1825	0G1825	0H1825	0.51 MEG	0B5145	0C5145	0E5145	0G5145	0H5145
6.8	0B68G5	0C68G5	0E68G5	0G68G5		2000	0B2025	0C2025	0E2025	0G2025	0H2025	0.56 MEG	0B5645	0C5645	0E5645	0G5645	0H5645
7.5	0B75G5	0C75G5	0E75G5	0G75G5		2200	0B2225	0C2225	0E2225	0G2225	0H2225	0.62 MEG	0B6245	0C6245	0E6245	0G6245	0H6245
8.2	0B82G5	0C82G5	0E82G5	0G82G5		2400	0B2425	0C2425	0E2425	0G2425	0H2425	0.68 MEG	0B6845	0C6845	0E6845	0G6845	0H6845
9.1	0B91G5	0C91G5	0E91G5	0G91G5		2700	0B2725	0C2725	0E2725	0G2725	0H2725	0.75 MEG	0B7545	0C7545	0E7545	0G7545	0H7545
10	0B1005	0C1005	0E1005	0G1005	0H1005	3000	0B3025	0C3025	0E3025	0G3025	0H3025	0.82 MEG	0B8245	0C8245	0E8245	0G8245	0H8245
11	0B1105	0C1105	0E1105	0G1105	0H1105	3300	0B3325	0C3325	0E3325	0G3325	0H3325	0.91 MEG	0B9145	0C9145	0E9145	0G9145	0H9145
12	0B1205	0C1205	0E1205	0G1205	0H1205	3600	0B3625	0C3625	0E3625	0G3625	0H3625	1.0 MEG	0B1055	0C1055	0E1055	0G1055	0H1055
13	0B1305	0C1305	0E1305	0G1305	0H1305	3900	0B3925	0C3925	0E3925	0G3925	0H3925	1.1 MEG	0B1155	0C1155	0E1155	0G1155	0H1155
15	0B1505	0C1505	0E1505	0G1505	0H1505	4300	0B4325	0C4325	0E4325	0G4325	0H4325	1.2 MEG	0B1255	0C1255	0E1255	0G1255	0H1255
16	0B1605	0C1605	0E1605	0G1605	0H1605	4700	0B4725	0C4725	0E4725	0G4725	0H4725	1.3 MEG	0B1355	0C1355	0E1355	0G1355	0H1355
18	0B1805	0C1805	0E1805	0G1805	0H1805	5100	0B5125	0C5125	0E5125	0G5125	0H5125	1.5 MEG	0B1555	0C1555	0E1555	0G1555	0H1555
20	0B2005	0C2005	0E2005	0G2005	0H2005	5600	0B5625	0C5625	0E5625	0G5625	0H5625	1.6 MEG	0B1655	0C1655	0E1655	0G1655	0H1655
22	0B2205	0C2205	0E2205	0G2205	0H2205	6200	0B6225	0C6225	0E6225	0G6225	0H6225	1.8 MEG	0B1855	0C1855	0E1855	0G1855	0H1855
24	0B2405	0C2405	0E2405	0G2405	0H2405	6800	0B6825	0C6825	0E6825	0G6825	0H6825	2.0 MEG	0B2055	0C2055	0E2055	0G2055	0H2055
27	0B2705	0C2705	0E2705	0G2705	0H2705	7500	0B7525	0C7525	0E7525	0G7525	0H7525	2.2 MEG	0B2255	0C2255	0E2255	0G2255	0H2255
30	0B3005	0C3005	0E3005	0G3005	0H3005	8200	0B8225	0C8225	0E8225	0G8225	0H8225	2.4 MEG	0B2455	0C2455	0E2455	0G2455	0H2455
33	0B3305	0C3305	0E3305	0G3305	0H3305	9100	0B9125	0C9125	0E9125	0G9125	0H9125	2.7 MEG	0B2755	0C2755	0E2755	0G2755	0H2755
36	0B3605	0C3605	0E3605	0G3605	0H3605	10000	0B1035	0C1035	0E1035	0G1035	0H1035	3.0 MEG	0B3055	0C3055	0E3055	0G3055	0H3055
39	0B3905	0C3905	0E3905	0G3905	0H3905	11000	0B1135	0C1135	0E1135	0G1135	0H1135	3.3 MEG	0B3355	0C3355	0E3355	0G3355	0H3355
43	0B4305	0C4305	0E4305	0G4305	0H4305	12000	0B1235	0C1235	0E1235	0G1235	0H1235	3.6 MEG	0B3655	0C3655	0E3655	0G3655	0H3655
47	0B4705	0C4705	0E4705	0G4705	0H4705	13000	0B1335	0C1335	0E1335	0G1335	0H1335	3.9 MEG	0B3955	0C3955	0E3955	0G3955	0H3955
51	0B5105	0C5105	0E5105	0G5105	0H5105	15000	0B1535	0C1535	0E1535	0G1535	0H1535	4.3 MEG	0B4355	0C4355	0E4355	0G4355	0H4355
56	0B5605	0C5605	0E5605	0G5605	0H5605	16000	0B1635	0C1635	0E1635	0G1635	0H1635	4.7 MEG	0B4755	0C4755	0E4755	0G4755	0H4755
62	0B6205	0C6205	0E6205	0G6205	0H6205	18000	0B1835	0C1835	0E1835	0G1835	0H1835	5.1 MEG	0B5155	0C5155	0E5155	0G5155	0H5155
68	0B6805	0C6805	0E6805	0G6805	0H6805	20000	0B2035	0C2035	0E2035	0G2035	0H2035	5.6 MEG	0B5655	0C5655	0E5655	0G5655	0H5655
75	0B7505	0C7505	0E7505	0G7505	0H7505	22000	0B2235	0C2235	0E2235	0G2235	0H2235	6.2 MEG	0B6255	0C6255	0E6255	0G6255	0H6255
82	0B8205	0C8205	0E8205	0G8205	0H8205	24000	0B2435	0C2435	0E2435	0G2435	0H2435	6.8 MEG	0B6855	0C6855	0E6855	0G6855	0H6855
91	0B9105	0C9105	0E9105	0G9105	0H9105	27000	0B2735	0C2735	0E2735	0G2735	0H2735	7.5 MEG	0B7555	0C7555	0E7555	0G7555	0H7555
100	0B1015	0C1015	0E1015	0G1015	0H1015	30000	0B3035	0C3035	0E3035	0G3035	0H3035	8.2 MEG	0B8255	0C8255	0E8255	0G8255	0H8255
110	0B1115	0C1115	0E1115	0G1115	0H1115	33000	0B3335	0C3335	0E3335	0G3335	0H3335	9.1 MEG	0B9155	0C9155	0E9155	0G9155	0H9155
120	0B1215	0C1215	0E1215	0G1215	0H1215	36000	0B3635	0C3635	0E3635	0G3635	0H3635	10.0 MEG	0B1065	0C1065	0E1065	0G1065	0H1065
130	0B1315	0C1315	0E1315	0G1315	0H1315	39000	0B3935	0C3935	0E3935	0G3935	0H3935	11.0 MEG	0B1165	0C1165	0E1165	0G1165	0H1165
150	0B1515	0C1515	0E1515	0G1515	0H1515	43000	0B4335	0C4335	0E4335	0G4335	0H4335	12.0 MEG	0B1265	0C1265	0E1265	0G1265	0H1265
160	0B1615	0C1615	0E1615	0G1615	0H1615	47000	0B4735	0C4735	0E4735	0G4735	0H4735	13.0 MEG	0B1365	0C1365	0E1365	0G1365	0H1365
180	0B1815	0C1815	0E1815	0G1815	0H1815	51000	0B5135	0C5135	0E5135	0G5135	0H5135	15.0 MEG	0B1565	0C1565	0E1565	0G1565	0H1565
200	0B2015	0C2015	0E2015	0G2015	0H2015	56000	0B5635	0C5635	0E5635	0G5635	0H5635	16.0 MEG	0B1665	0C1665	0E1665	0G1665	0H1665
220	0B2215	0C2215	0E2215	0G2215	0H2215	62000	0B6235	0C6235	0E6235	0G6235	0H6235	18.0 MEG	0B1865	0C1865	0E1865	0G1865	0H1865
240	0B2415	0C2415	0E2415	0G2415	0H2415	68000	0B6835	0C6835	0E6835	0G6835	0H6835	20.0 MEG	0B2065	0C2065	0E2065	0G2065	0H2065
270	0B2715	0C2715	0E2715	0G2715	0H2715	75000	0B7535	0C7535	0E7535	0G7535	0H7535	22.0 MEG	0B2265	0C2265	0E2265	0G2265	0H2265



24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS

62 CROSS REFERENCE CARDS

300 FILE FOLDER LABELS

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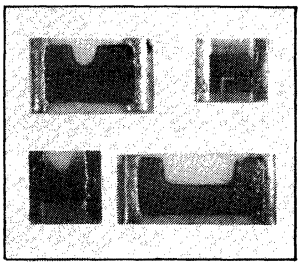
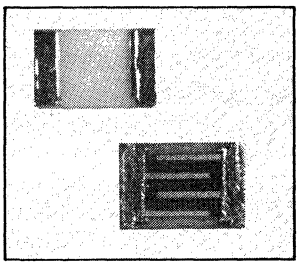
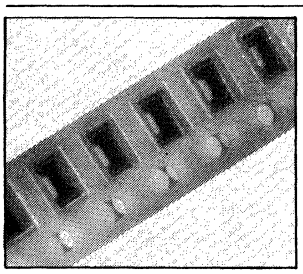
OHMTEK Surface Mount Resistors Chips/Networks



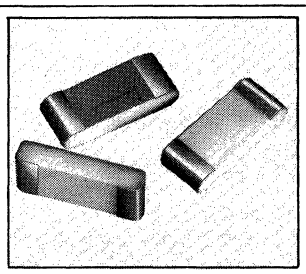
CERMET WRAPAROUND CHIP RESISTORS DESIGNED TO MEET MIL-R-55342, CHARACTERISTIC "K"
Resistance range 10 ohms - 1 megohm, tolerances 1 thru 10% in the following popular sizes (mils) 50x40, 50x50, 50x75, 50x100, 50x150, 100x100. Solder coated with nickel barrier and glass overcoat.



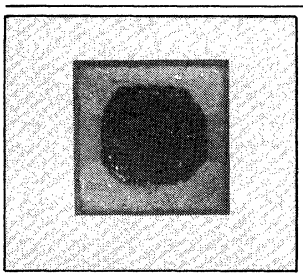
PRECISION THIN FILM WRAPAROUND CHIP RESISTORS DESIGNED TO MEET MIL-R-55342, CHARACTERISTIC "H"
Resistance range 10 ohms - 200k ohms, size 50x75 mils; tolerances 0.1, 0.5, 1, 2, 5%. Ideal for high frequency, low noise, and tight TCR applications requiring good stability.



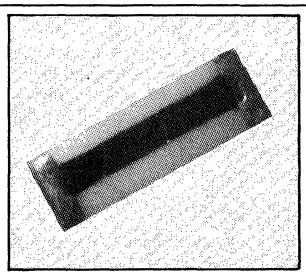
GENERAL PURPOSE CERMET WRAPAROUND CHIP RESISTORS
Economically priced industrial grade features standard 1206 case size (1.6x3.2 mm) Resistance range 10 ohms -10 megohms; tolerances 2, 5, 10, 20%. Bulk or tape and reel packaging.



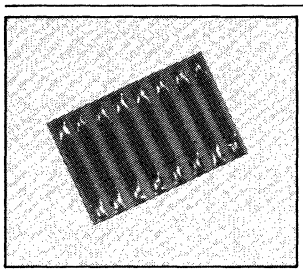
ULTRA-LOW VALUE WRAPAROUND CHIP RESISTORS
Resistance range 0.1 ohm - 10 ohms; tolerances 1, 2, 3, 5, 10%; size 60x150 mils; solder coated with nickel barrier.



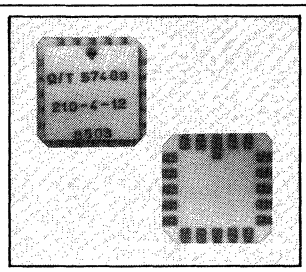
GOLD TOPSIDE CERMET CHIP RESISTORS
Cermet thick film chip with gold-wire-bondable terminations; sizes 50x50 and 35x35 mils standard; resistance range 10 ohms - 5 megohms; tolerances 1, 2, 5, 10%.



FLIP-CHIP CERMET RESISTORS
Cermet one-sided resistors for low cost reflow applications; sizes 50x75, 50x100, 50x150 mils; resistance range 10 ohms - 100 megohms; tolerances 2, 5, 10, 20%.



WRAPAROUND OR FLIP-CHIP RESISTOR NETWORK
Standard "A" and "B" schematics available with 50-mil pad spacing; 100 ohms to 1 megohm. Cermet resistance elements with pre-tinned nickel barrier layer conductors.



LEADLESS CHIP CARRIER CERMET NETWORK
Standard "A" and "B" schematics available in a 20 terminal, 50-mil center single-layer ceramic package with glazed overcoat or with ceramic cover; 100 ohms to 1 megohm; 1, 2, 5, 10% tolerances.

Features:
- All wraparound connections feature a thick or thin film adhesion layer covered with a leach-resistant nickel barrier layer and solder coated for 150°C applications.
- Ruthenium-based cermet thick film yields dependable performance and low cost.
- Abrasive and laser trimming available.
- Hi-Rel screening available on all resistor types with all Mil-Spec Qual testing in house.
- Special metalization and custom sizes available upon request.
- No inductance.
- Static free waffle pack packaging standard.
- Glass fired passivation as standard adds reliability and stability to the resistor elements.

Performance/Design Characteristics:
- Tolerances: ± 0.1% - 20%
- Resistance values: 1 ohm to 1 megohm
- TCR: Thin Film
  ± 50 ppm/°C (standard)
  Thick Film
  ± 100 ppm/°C (standard)
- Operating temperature range: -55°C to +150°C

ohmtek INC.
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NIAGARA FALLS, NY 14304
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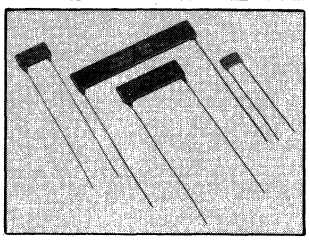
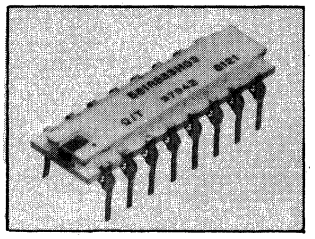
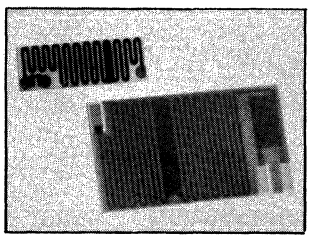
OHMTEK Cermet Resistors, Dividers and Networks



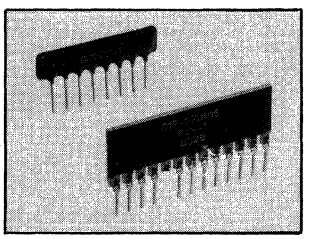
RADIAL LEAD RESISTORS
High voltage, low inductance applications; ¼, ½, 1, and 2 watt sizes; standard 10 ohms to 500 megohms 1%, 2%, 5%, 10% tolerances.



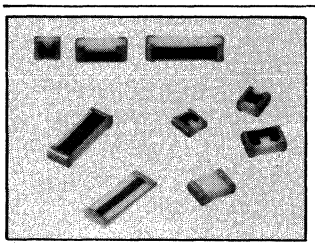
DUAL-IN-LINE
Resistor and R-C networks in standard DIL style "A" and "B" schematics; 100 ohms to 1 megohm; 1%, 5%, 10% tolerances. Testing to Group A of MIL-R-83401.



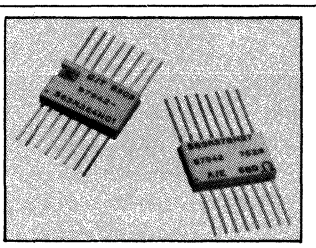
HIGH VOLTAGE DIVIDERS
Broad application to both military and commercial power supplies. Many standards to choose from, or custom made.



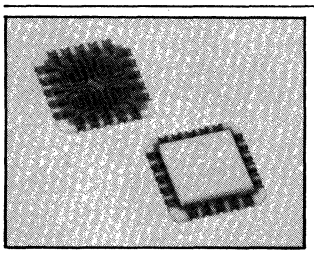
SINGLE-IN LINE CONFORMAL
Isolated resistors or common lead configurations. Low profile or high profile conserve P-C board space. Conformal epoxy coated or single-sided screened coatings.



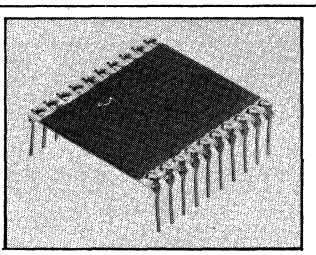
CHIP RESISTORS
General purpose solder-coated wraparounds and flipchips for reflow applications; gold topside terminations for wire bonding, ultra low to high megohm values; 1%, 2%, 5%, 10% tolerances.



FLAT PACKS
Application to high density packaging in airborne computers. Standard "A" and "B" schematics available as well as R-C networks tested to Group A of MIL-R-83401.



LEADLESS CHIP NETWORKS
Standard "A" or "B" schematic in single-layer ceramic with glazed overcoat or with ceramic cover; 100 ohms to 1 megohm; 1%, 5%, 10% tolerances.



CUSTOM NETWORKS
Custom sizes as well as networks including binary, R-2R, and decade configurations. Laser or abrasive trimmed as required to meet tolerancing demands.

Features:
- Standard circuits for military and commercial applications.
- Custom circuits to meet demanding or unique applications.
- Ruthenium-based screened films.
- Pt/Au or Pd/Ag terminations as required.
- Broad packaging sizes and styles – Standard DIL's, 3-13 pin SIL's, oversize .600 centers or greater DIL's.
- Rugged ceramic-based construction yields dependable performance and low cost.
- Discrete performance with space saving and greater reliability of networks.

Performance/Design Characteristics
- Tolerances: .1% – 20%.
- Resistance values: .1 ohm to 1 gigaohm.
- TCR's: 100 & 250 ppm standard; 50 ppm available.
- Operating temperature range: – 55° C to +125° C.
- Tracking: 10 to 25 ppm.
- Testing to full MIL-spec requirements available.

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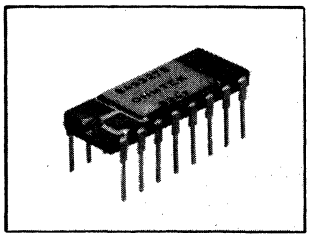
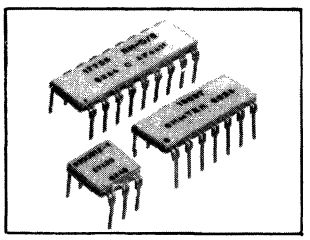
OHMTEK Precision Resistor Networks

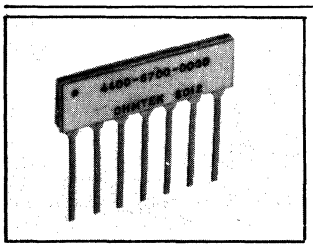
Wirewound Performance in Contemporary Packages



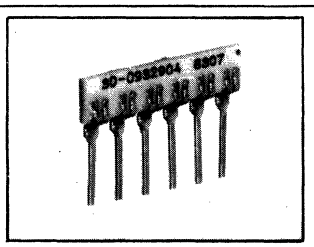
DUAL-IN-LINE HERMETIC
Meets Mil-R-83401 Characteristic "C" for military and other environmental extremes. Available 8, 14, 16 and 18 leads.



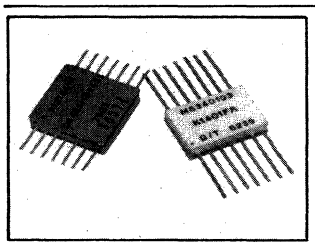
DUAL-IN-LINE CERAMIC SANDWICH
Meets Mil-R-83401 Characteristic "V". Packages of 4-22 leads in rugged monolithic inexpensive construction with highest precision in the industry.



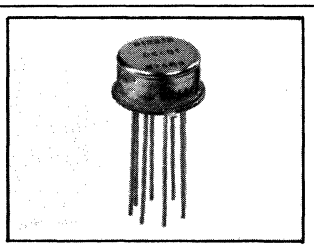
SINGLE-IN-LINE MIL-GRADE
Meets Mil-R-83401 Characteristic "V". 3-13 lead ceramic sandwich construction in high and low profile versions.



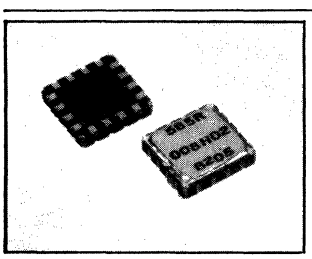
SINGLE-IN-LINE CONFORMAL
3-13 lead packages available. Designed for a wide range of tolerances and values at minimum cost.



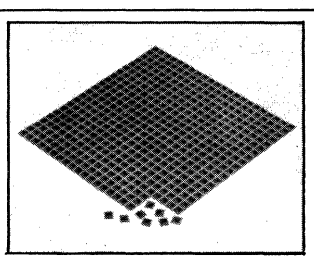
FLATPACKS
Hermetic or non-hermetic meet Mil-R-83401 Characteristic "C", "V" or "K". Available in 14 through 28 lead packages.



TO-STYLE HERMETIC
Available for custom precision applications requiring very low TCR and tight tracking.



LEADLESS CHIP CARRIERS
Hermetic or ceramic sandwich JEDEC packages. Standard and custom schematics available.



CHIP RESISTORS AND ARRAYS
Exceptional stability and reliability. Available in general purpose, 30-Mil square Mil-R-55342 characteristics and custom circuit arrays on ceramic or silicon.

Features:

- Standard circuits for military and commercial applications.
- Custom circuits as required for demanding applications.
- Nichrome or Tantalum based films optional.
- Wide packaging styles - standard hermetic or versatile custom pin counts with ceramic sandwich and conformal coated styles.
- Full Mil-spec screening available in-house.
- Rugged construction provides dependable performance at minimum cost.
- Network reliability greater than discrete resistor arrays.

Performance/Design Characteristics:

- Tolerances: .005% - 1%
- Resistance values: 10 ohms to 10 Megohm.
- Low TCR: 25 ppm/°C Std.
- Ultra low TCR: 10 and 5 ppm/°C available.
- Tracking less than 1 ppm.
- Operating temperature range: -55°C to +125°C
- Low noise: -35 db
- Stability: Δ R less than 200 ppm/70°C/ 10,000 hrs.

ohmtek INC.

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NIAGARA FALLS, NY 14304
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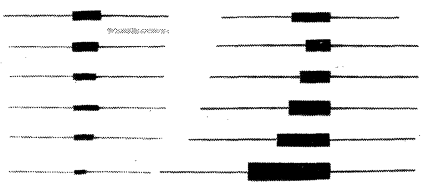
PRECISION POWER RESISTORS
Sub-Miniature Wire Wound
V-Coated for 350° C

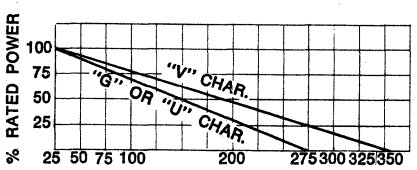


TYPE A MOLDED
.4 to 14 watts

TYPE B MOLDED
1 watt to 10 watts
Beryllium or Alumina Oxide Core

ELECTRICAL SPECIFICATIONS

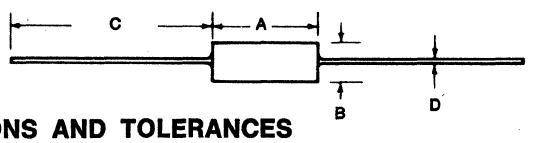
1. **Tolerances** — 5%, 3%, 1%, .5%, .25%, .1%, .05%, .02%.
2. **Dielectric Strength** — 500 VAC for 04A, 05A, 15A; B1, B3. Bal. 1000 VAC, circular foil wrap method or V-block.
3. Life — Maximum 0.5% resistance change after 1000 hour load life cycling 1½ hours on, ½ hour off, full load at 25°C).
4. Temperature Coefficient — Below 1 ohm = 90 PPM, Below 10 ohms = 50 PPM, Below 50 ohms = 30 PPM, All above = 20 PPM.



AMBIENT TEMP. DEG. CENTIGRADE

GENERAL SPECIFICATIONS

1. **Molded Type A** axial-lead resistors, molded for uniformity and minimum size for today's space age requirements.
2. Completely welded construction.
3. Meet or exceed requirements of Mil-R26, characteristic U.
4. Leads are tinned copperweld. Other materials available on request.
5. High temperature silicone molded coating.
6. **Molded Type B** beryllium oxide or alumina with power ratings 1.4 to 4 times higher than conventional ceramic resistors of the same size.

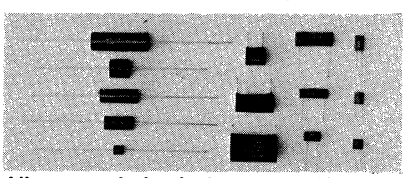


DIMENSIONS AND TOLERANCES

PRC Type	DIMENSIONS AND TOLERANCES A	B	C	D	Wattages G 275°	V 350°	Max. Res. Value	Working Voltage	MIL-R26 E Equiv.
04A	.250 ±.010	.090 ±.010	1.5	#24	.4	.75	3.4K	30	
05A	.330 ±.010	.110 ±.010	1.5	#24	.5	1.0	6K	50	
*15A	.412 ±.010	.115 ±.010	1.5	#24	1.25	2.0	7.5K	75	
20A	.550 ±.010	.115 ±.010	1.5	#24	1.25	2.0	10K	100	
S1A	.490 ±.010	.162 ±.010	1.5	#22	1.75	2.5	15K	150	
1A	.610 ±.010	.210 ±.010	1.5	#20	3.0	3.75	20K	200	
**N1A	.535 ±.010	.220 ±.010	1.5	#20	3.0	3.75	20K	200	
25A	.890 ±.010	.210 ±.010	1.5	#20	3.0	4.5	28K	200	
2A	.535 ±.010	.270 ±.010	2.0	#18	3.0	4.25	20K	200	
3A	.656 ±.010	.270 ±.010	2.0	#18	3.25	5.2	30K	200	
***5A	.900 ±.010	.312 ±.010	2.0	#18	5.5	7.5	75K	400	
7A	1.187 ±.010	.312 ±.010	2.0	#18	7.0	9.0	100K	600	
****10A	1.825 ±.010	.405 ±.010	2.0	#18	10.0	14.0	200K	1000	
B1	.250 ±.010	.090 ±.010	1.5	.020	1.0w	1.5w	3.4K	35	RW 81
B2	.325 ±.010	.090 ±.010	1.5	.020	1.5	2.0	4.9K	48	
B3	.412 ±.010	.115 ±.010	1.5	.020	2.25	3.0	10.4K	85	RW 80
B5	.610 ±.010	.210 ±.010	1.5	.032	4.0	5.0	24.5K	172	
B5C	.540 ±.010	.240 ±.010	2.0	.040	5.0	7.0	32.3K	260	
B6	.656 ±.010	.270 ±.010	2.0	.040	6.0	8.0	47.1K	300	
B10	.900 ±.010	.312 ±.010	2.0	.040	7.0	10.0	96 K	470	

* RW 70 ** RW 59/69/79 *** RW 57/67/74 **** RW 58/68/78
For Non-Inductive Winding add Suffix "N" to Callout.

MOLDED PRECISION WIRE WOUND RESISTORS



TYPE AP: AXIAL PRECISION
TYPE LP: LUG PRECISION
TYPE RP: RADIAL PRECISION
TYPE RPC: RECTANGULAR PRINTED CIRCUIT
TYPE PC: PRINTED CIRCUIT

All are non-inductively, reverse Pi wound at minimum wire tension for maximum long life stability. All production is aged before calibration for insurance of minimum long-term load-life drift. Due to advance winding techniques and design they have extremely low rise time characteristics approaching film type resistors. Through matching of materials, resistance changes from temperature expansion rates is eliminated. Zero voltage coefficient and low noise characteristics. Leads are solderable or weldable. TC of 15 PPM/°C standard. TC of 2 PPM/°C to 6000 PPM/°C available. All bridges and other instrumentation used in calibration are periodically checked against National Bureau Primary Standards. Designs exceed Mil-R-93 and Mil-R-9444. Distinct capabilities for: Special Networks; Matched Sets; Voltage Dividers; Molded and encapsulated Modules.

DIMENSIONS TABLE

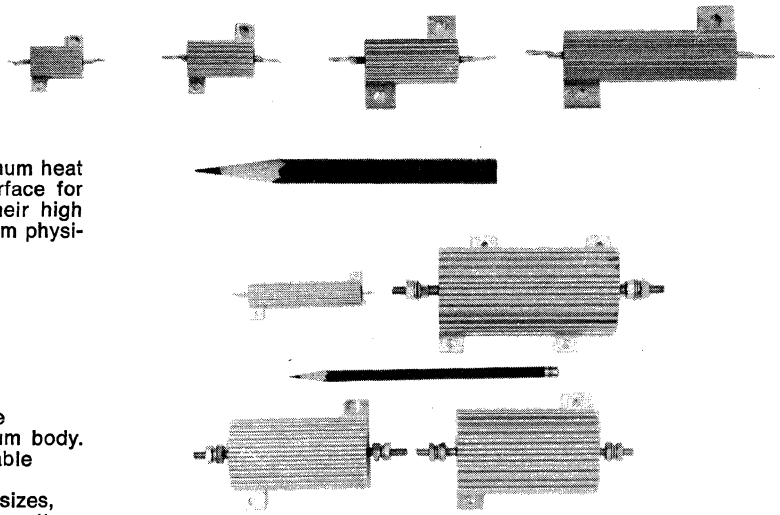
New Type		Comm. Watts	Max. Res.	Max. Dia.	Max. Length	Max. Volt.	Lead Spacing	Lead Gauge	Hole Size
118AP		.08	250K	.128	.263	100		#24	
122AP		.10	500K	.128	.380	100		#24	
130AP		.13	1.2M	.190	.300	100		#22	
134AP		.15	1.3M	.190	.380	100		#22	
142AP		.15	750K	.260	.260	150		#20	
152AP	RB56	.20	2.0M	.260	.385	100		#20	
156AP		.25	2.5M	.260	.510	150		#22	
160AP	RB55	.25	2.5M	.260	.510	150		#20	
164AP	RB54	.35	4.5M	.260	.760	300		#20	
168AP	RB53	.50	8.0M	.385	.760	400		#20	
172AP		.50	4.0M	.385	.510	300		#20	
176AP		.50	8.0M	.510	.510	400		#20	
180AP		.60	9.0M	.510	.635	400		#20	
184AP	RB52	.60	9.0M	.385	1.010	400		#20	
188AP	RB57	1.00	18.0M	.510	1.010	800		#20	
192AP	RB58	1.50	30.0M	.510	1.510	900		#20	
202RP		.25	500K	.260	.285	100	.200	#22	N.H.
214RP		.25	1.0M	.260	.447	150	.277	#22	#2
324LP	RB08	.50	4.0M	.510	.510	400	.325	Lug	#6
372LP	RB18	2.00	10.0M	.760	1.260	1000	1.000	Lug	#6
400RPC		.125	500K	.145 x .260	x .260	150	.125	#20	
500PC		.25	500K	.260	.320	150	.200	#22	
512PC		.20	700K	.260	.410	150	.150	#20	

PACIFIC RESISTOR CO.
18300 OXNARD STREET, TARZANA, CA 91356 • (818) 345-7811 - (213) 873-4574 • Inside CA: 800-835-3355 • Outside CA: 800-367-6677

PRECISION POWER RESISTORS
Aluminum-Finned Heat Sink

TYPE CH CHASSIS MOUNT
5 through 250 watts

TYPE BCH CHASSIS MOUNT
15 through 35 watts
Beryllium Oxide or Alumina Core

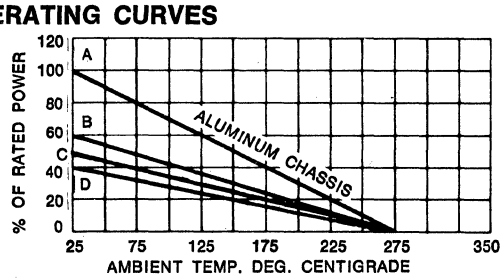


Chassis Mount, Type CH units are designed for maximum heat dissipation by mounting solidly to metal chassis surface for maximum heat transfer. They are outstanding for their high power dissipation with precision tolerances in minimum physical sizes.

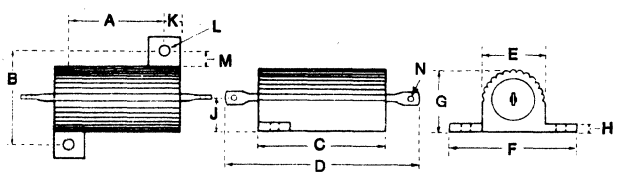
ELECTRICAL SPECIFICATIONS
1. Resistance Range — .05 ohms to 275K ohms.
2. Tolerance — 5%, 3%, 1%, .5%, .25%, .1%, .05%.
3. Temperature Coefficient — ±20 PPM to 90 PPM

GENERAL SPECIFICATIONS
1. Lower hot spot ratings due to exclusive complete encapsulation of element within anodized aluminum body.
2. Welded construction throughout assures long stable load life.
3. Heavy spade lug type leads on 5 through 70 watt sizes, threaded heavy stud terminals on 100 through 250 watts.
4. 1000 VAC minimum dielectric strength on 5CH, 10CH, B5CH and B10CH; 2500 VAC on 25CH, 50CH, 100CH, and B25CH; 5500 VAC on all others.
5. Temperature Range — −55°C to +275°C.
6. Eight standard sizes.

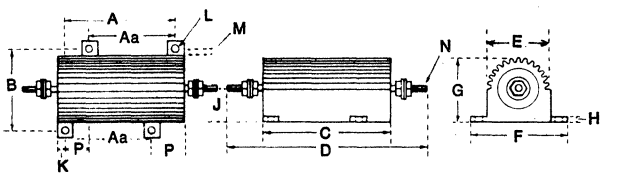
DERATING CURVES



Temp. of −55°C to +275°C. Derating is required for reduced chassis mounting area and high ambient temp.
Curves:
A — When mounted on proper alum.
Chassis:
4x6x2x.040 alum. chassis = 5CH & 10CH.
5x7x2x.040 alum. chassis = 25CH, B25CH, & B50CH.
12x12x.059 alum. panel = 50CH & 100CH.
12x12x.125 alum. panel = 110CH, 180CH, and 250CH.
B — Unmounted 5CH, 10CH, B5CH, B10CH.
C — Unmounted 25CH, 100CH, B25CH, and 110CH.
D — Unmounted 50CH, 180CH, and 250CH.



5CH, 10CH, 25CH, 50CH, 100CH, B5CH, B10CH, B25CH



110CH, 180CH, 250CH

Core Conductivity at 275°C (BTU-Ft / Ft²-Hr-°F)	
BERYLLIUM OXIDE (BeO)-64	
ALUMINUM OXIDE — 8	
STEATITE — 1.5	

DIMENSIONS TABLE

PRC Type	Mil-R 18546	Com. Watts	Max. Res.	A	Aa	B	C	D	E	F	G	H	J	K	L	M	N	P	No. Mtg. Screw Size
5CH	RE60	5	20K	.444	—	.490	.500	1.125	.334	.646	.317	.075	.145	.078	.093	.078	.050		2-#2
10CH	RE65	10	30K	.562	—	.625	.750	1.375	.438	.812	.406	.100	.203	.093	.093	.094	.086		2-#2
25CH	RE70	25	75K	.719	—	.781	1.062	1.938	.500	1.094	.563	.094	.250	.171	.125	.125	.086		2-#2
50CH	RE75	50	200K	1.563	—	.844	1.968	2.781	.625	1.156	.625	.094	.281	.196	.125	.125	.086		2-#4
100CH	—	70	275K	2.625	—	.844	2.968	3.781	.625	1.156	.625	.094	.281	.196	.125	.125	.086		2-#4
B5CH	RE60	15	20K	.444	—	.490	.600	1.125	.334	.646	.317	.075	.145	.078	.093	.078	.050		2-#2
B10CH	RE65	20	30K	.562	—	.625	.750	1.375	.438	.812	.406	.100	.203	.093	.093	.094	.086		2-#2
B25CH	RE70	35	75K	.719	—	.781	1.062	1.938	.500	1.094	.563	.094	.250	.171	.125	.125	.086		2-#2
TOL.	—	—	—	±.005	—	±.005	±.031	±.063	±.031	±.031	±.031	±.016	±.016	±.01	±.005	±.016	±.005 thd	—	—
110CH	RE77	100	50K	2.750	—	2.250	3.500	5.478	1.80	2.813	1.750	.188	.800	.375	.188	.250	12/24 thd		2-#8
180CH	—	180	50K	2.770	—	2.500	3.500	5.478	2.125	3.000	2.188	.250	.950	.375	.188	.200	12/24 thd		2-#8
250CH	RE80	250	45K	3.875	3.00	2.500	4.500	7.000	2.125	3.000	2.188	.250	1.00	.312	.188	.200	¼/20	.875	4-#8
TOL.	—	—	—	±.01	‡.01	±.01	±.094	±.094	REF.	±.031	±.031	±.016	REF.	±.031	±.010	REF.	—	±.01	—

‡ For Non-Inductive Winding add Suffix "N" to Callout.

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EEM PRODUCT SELECTION GUIDES

Use the EEM Product Selection Guides. There are 34 Guides in this edition of EEM. See page 2 (A•2, B•2, C•2, D•2) of each volume to locate the Product Selection Guides that pertain to your needs.

PRECISION RESISTIVE PRODUCTS, INC.
HIGHWAY 61 SOUTH, MEDIAPOLIS, IOWA 52637 (319) 394-9131 TWX 510 100 8039

PR-SERIES ULTRA PRECISION METAL FILM RESISTORS

- Low Temperature Coefficients
- Tight Tolerances • High Stability • Low Noise

DIMENSIONS

Style	Max. L.	Max. Dia.	CL to CL	Dim. A
PR1/10	.280	.102	.300	AWG #22
PR1/8	.400	.150	.450	AWG #22
PR1/4	.600	.200	.685	AWG #22

SPECIFICATIONS

Style	Resistance Range (Ohms)	Wattage Rating @ 85°C	Voltage Rating
PR1/10	10-500K	1/10	300
PR1/8	10-1M	1/8	400
PR1/4	10-1M	1/4	500

TYPICAL PERFORMANCE

	%ΔR
1000 Hr. Load Life 85°C	0.02
Humidity	0.04
Temperature Cycling	<0.01
Short Time Overload	<0.01
Dielectric Withstanding	<0.01
Noise	<−30dB
Insulation Resistance	>10000 M. Ohm
Shelf Life	<50 PPM/YR.

TEMPERATURE COEFFICIENTS

TC25 = 0 ±25 PPM/°C −20 to +85°C
TC20 = 0 ±20 PPM/°C −20 to +85°C
TC15 = 0 ±15 PPM/°C −20 to +85°C
TC10 = 0 ±10 PPM/°C −20 to +85°C
TC5 = 0 ± 5 PPM/°C −20 to +85°C

RESISTANCE TOLERANCES

±1.0%, ±0.5%, ±.25% & ±0.1%, ±0.5%, ±.02%, ±.01%

LEAD MATERIAL

OFHC with 60/40 Tin/Lead Coating

RL-SERIES ULTRA PRECISION METAL FILM RESISTORS

- Radial Leads • Small Size
- Low TC • High Stability

DIMENSIONS (INCHES)

H	Height	.365
L	Length	.260
W	Width	.140
LS	Lead Spacing Lead Gage #22	.150

SPECIFICATIONS

Style	Temperature Coefficient	Resistance Range (Ohms)	Standard Tolerance	Wattage @ 85°C
RL 1	20 PPM/°C 15 10 5	20 thru 100K	1%, 5%, .25%, .10%, .05%, & .02% .01%	.1
RL 3	20 PPM/°C 15 10 5	20 thru 100K	1%, .5%, .25%, .1% .05% & .02% .01%	.3

TEMPERATURE COEFFICIENTS

TC20 = 0 ±20 PPM/°C −20 to +85°C
TC15 = 0 ±15 PPM/°C −20 to +85°C
TC10 = 0 ±10 PPM/°C −20 to +85°C
TC5 = 0 ± 5 PPM/°C −20 to +85°C

TYPICAL ENVIRONMENTAL PERFORMANCE

	%ΔR
1000 Hr. Load Life	±0.02%
Humidity	±0.04%
Temperature Cycling	±0.01%
Short Time Overload	±0.01%
Insulation Resistance	>1000 Megohms
Noise Index	<−30dB
Voltage Coefficient	<0.05 PPM/Volt
1 Year Shelf Life	±50 PPM

MATCHED SETS AND NETWORKS

Customized resistance and temperature coefficient matching is available.

Resistance matching to .01% and T. C. tracking of 1 PPM/°C are standard.

Please consult the factory for details on your requirements.

GP-SERIES GENERAL PURPOSE PRECISION METAL FILM RESISTORS

- Economical • High Performance
- Very Stable • Low Noise

DIMENSIONS

Style	Max. L.	Max. Dia.	CL to CL	Dim. A
GP¼	.280	.102	.325	AWG #22
GP½	.400	.150	.450	AWG #22
GP¾	.600	.200	.685	AWG #22
GP1	.600	.200	.685	AWG #20

SPECIFICATIONS

PRP Style	Mil. Style	Resist. Range (Ohms)	Wattage Rating @ 70°C	Wattage Rating @ 125°C	Voltage Rating
GP¼	RN55	2.5—500K	¼	1/10	300
GP½	RN60	2.5—1 M	½	⅛	500
GP¾	RN65	10—1.5M	¾	¼	500
GP1	RN70	10—1.5M	1	½	500

TYPICAL PERFORMANCE

	%ΔR
Temperature Cycling	0.05
Low Temperature Operation	0.03
Terminal Strength, 5 Lb. Load	0.02
Resistance To Soldering Heat	0.02
Dielectric Withstanding Voltage	0.02
Short Time Overload	0.05
Moisture Resistance	0.20
1000 Hour Load Life @ 125°C	0.15

TEMPERATURE COEFFICIENTS

TC25 = 0 ±25 PPM/°C −20 to +85°C
TC50 = 0 ±50 PPM/°C −20 to +85°C
T100 = 0 ±100 PPM/°C −20 to +85°C
T250 = 0 ±250 PPM/°C −20 to +85°C

RESISTANCE TOLERANCES

±5.0%, ±2.0%, ±1.0%, ±0.5%, ±.25%, & ±0.1%

LEAD MATERIAL

OFHC with 60/40 Tin/Lead Coating

NOTE: The GP-Series of resistors is conformally coated and fully protected against moisture by a multi-paint coat system and a hard epoxy outer coating.

Marking is alpha-numeric and meets the most demanding marking requirements. Special marking is available upon request.

Consult the factory concerning failsafe, flameproof, and fusing requirements.

LCR¼-SERIES GENERAL PURPOSE METAL FILM RESISTORS

- Low Cost • Taped and Reel Package
- Color Band Marking • Exceeds Mil-R-22684B & Mil-R-10509F Performance Requirements

DIMENSIONS

Max. L	Max. Dia.	Lead L.	Lead Dia.
.270″	.098″	1¼″	.025

GENERAL SPECIFICATIONS

Resist. Tolerance	Resist. Range	Temp. Coef. of Resist.	Power Rating	Max. Volt.
1% 2% 5%	10Ω through 1M	50 & 100 PPM/°C	¼W (70°C)	250 VRMS

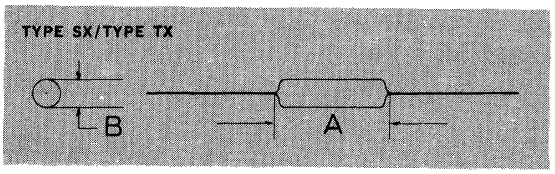
Performance Characteristics		PRP	Mil-R-22684B	Mil-R-10509F
Type No. (Style)		LCR¼	RL07	RN55D
Size: inch	Body Length	.270 Max.	.243 ±.038	.250 ±.031
	Body Diameter	.098 Max.	.090 ±.008	.109 ±.031
	Lead Diameter	.024 ±.002	0.23 ±.004	.025 ±.002
Power Rating		0.25W at 70°C 0.125W at 125°C	0.25W at 70°C 0.078W at 125°C	0.125W at 70°C 0.0625W at 25°C
Max. Rated Continuous Working Voltage		250V	250V	200V
Max. Ambient Temperature		165°C	150°C	165°C
TCR		±50 & ±100 PPM/°C	±200 PPM/°C	+200 −500 PPM/°C
Nominal Resistance Range		10Ω to 1MΩ	47Ω to 150kΩ	10Ω to 301kΩ
Standard Tolerances		1%, 2% & 5%	5% & 2%	1%
Dielectric Withstanding Voltage	ΔR	0.25%	0.5%	0.5%
Insulation Resistance		10,000 MΩ	1,000 MΩ	10,000 MΩ
Temperature Cycling	ΔR	0.25%	1.0%	0.5%
Short-Time Overload	ΔR	0.25%	0.5%	0.5%
Moisture Resistance	ΔR	0.5%	1.5%	1.5%
Load Life	ΔR	1.0%	2.0%	1.0%
Terminal Strength	ΔR	0.2%	0.5%	0.2%
Resistance to Soldering Heat	ΔR	0.5%	0.5%	0.5%
Shock	ΔR	0.2%	0.5%	0.5%
Vibration	ΔR	0.2%	0.5%	0.5%
Low Temperature Operation	ΔR	0.25%	0.5%	0.5%
Shelf Life	ΔR	0.2%	0.2%	N.A.

PRECISION

TYPE SX (SILICONE PROTECTION)
TYPE TX (ECONOMY LINE)

DESCRIPTION AND APPLICATION:

PRECISION continues a tradition with . . . low-priced resistors for critical applications . . . such as input voltage divider ratios of 10:1, 100:1 and 1000:1 with precise tolerances and TCR matching requirements . . . Which of these selections meet your needs exactly?



ELECTRICAL AND PHYSICAL SPECIFICATIONS

PRC Types				$P=\frac{E^2}{R}$	$E=\sqrt{PR}$	Body Dimensions ±.787mm (.031″)				1.5″L (Leads)†	Resistance (Ohms)		
TYPE SX		TYPE TX				(A) Length		(B) Diameter					
Inductive	Non-Inductive	Inductive	Non-Inductive	Max. Watts	Max. Volts	mm	(ins.)	mm	(ins.)	Max. Diam.	Min.	Max. Standard	Max. Special*
NEW SX030	—	TX030	—	.03W	25V	5.59	(.220″)	1.27	(.050″)	.020″	1.0	3K	5K
SX062	SX062N	TX062	TX062N	.04W	35V	6.86	(.270″)	2.03	(.080″)	.020″	1.0	17K	30K
SX063	SX063N	TX063	TX063N	.05W	50V	8.43	(.332″)	2.03	(.080″)	.020″	0.1	20K	50K
SX072	SX072N	TX072	TX072N	.06W	45V	6.86	(.270″)	2.29	(.090″)	.020″	0.1	25K	35K
SX073	SX073N	TX073	TX073N	.07W	65V	8.43	(.332″)	2.29	(.090″)	.020″	0.1	30K	65K
SX093	SX093N	TX093	TX093N	.1W	85V	8.43	(.332″)	2.92	(.115″)	.025″	0.1	35K	75K
SX094	SX094N	TX094	TX094N	.1W	100V	10.03	(.395″)	2.92	(.115″)	.025″	0.1	50K	100K
SX095	SX095N	TX095	TX095N	.125W	125V	11.61	(.457″)	2.92	(.115″)	.025″	0.1	60K	180K
SX105	SX105N	TX105	TX105N	.166W	165V	11.61	(.457″)	3.3	(.130″)	.025″	0.1	75K	210K
SX123	SX123N	TX123	TX123N	.166W	165V	8.43	(.332″)	3.68	(.145″)	.025″	0.1	40K	120K
SX106	SX106N	TX106	TX106N	.2W	200V	13.21	(.520″)	3.3	(.130″)	.025″	0.1	100K	280K
SX124	SX124N	TX124	TX124N	.2W	200V	10.03	(.395″)	3.68	(.145″)	.025″	0.1	50K	160K
SX143	SX143N	TX143	TX143N	.2W	200V	8.43	(.332″)	4.06	(.160″)	.028″	0.1	50K	130K
SX154	SX154N	TX154	TX154N	.25W	250V	10.03	(.395″)	4.47	(.176″)	.028″	0.1	100K	200K
SX155	SX155N	TX155	TX155N	.25W	250V	11.61	(.457″)	4.47	(.176″)	.028″	0.1	100K	300K
SX156	SX156N	TX156	TX156N	.33W	330V	13.21	(.520″)	4.47	(.176″)	.028″	0.1	140K	400K
SX174	SX174N	TX174	TX174N	.33W	330V	10.03	(.395″)	4.83	(.190″)	.028″	0.1	130K	220K
SX175	SX175N	TX175	TX175N	.33W	330V	11.61	(.457″)	4.83	(.190″)	.028″	0.1	135K	350K
SX158	SX158N	TX158	TX158N	.5W	500V	16.38	(.645″)	4.47	(.176″)	.028″	0.1	450K	600K
SX177	SX177N	TX177	TX177N	.5W	500V	14.78	(.582″)	4.83	(.190″)	.028″	0.1	400K	540K
SX185	SX185N	TX185	TX185N	.5W	500V	11.61	(.457″)	5.26	(.207″)	.028″	0.01*	135K	360K
SX186	SX186N	TX186	TX186N	.5W	500V	13.21	(.520″)	5.26	(.207″)	.028″	0.01*	150K	480K
SX188	SX188N	TX188	TX188N	.6W	600V	16.38	(.645″)	5.26	(.207″)	.028″	0.01*	450K	720K
SX2210	SX2210N	TX2210	TX2210N	.8W	800V	19.56	(.770″)	6.10	(.240″)	.032″	0.1	511K	1.1 MEG
SX3110	SX3110N	TX3110	TX3110N	1W	1000V	19.56	(.770″)	8.43	(.332″)	.032″	0.1	750K	1.6 MEG
SX2812	SX2812N	TX2812	TX2812N	1.25W	1000V	22.73	(.895″)	7.62	(.300″)	.032″	0.1	1 MEG	1.8 MEG
SX3114	SX3114N	TX3114	TX3114N	1.33W	1000V	25.91	(1.020″)	8.43	(.332″)	.032″	0.1	1.25 MEG	2 MEG
SX3712	SX3712N	TX3712	TX3712N	1.5W	1000V	22.73	(.895″)	11.1	(.437″)	.032″	0.25	1.5 MEG	2.5 MEG
SX3716	SX3716N	TX3716	TX3716N	2W	1250V	29.08	(1.145″)	11.1	(.437″)	.032″	0.5	2 MEG	3.5 MEG
SX3724	SX3724N	TX3724	TX3724N	3W	1250V	41.78	(1.645″)	11.1	(.437″)	.032″	0.5	3 MEG	5 MEG
SX3730	SX3730N	TX3730	TX3730N	5W	1500V	51.31	(2.020″)	11.1	(.437″)	.032″	0.5	4 MEG	6 MEG

* 0.01 ohm to 0.1 ohm and maximum special resistance values available in non-standard physical sizes — 0 + .062″
† Commercially pure copper (Electrolytic Tough Pitch/Oxygen-Free High Conductivity).

ENGINEERING DATA:

1 RESISTANCE RANGE AND TOLERANCE "Repeatable (part-to-part)"
Any ohmic value or decimal part of an ohm desired with tolerances to ±0.05%. Refer to type HR for closer resistance tolerances.

2 TEMPERATURE COEFFICIENT OF RESISTANCE (TCR)
Zero ±10ppm/°C. (Standard)
For specific TCR characteristics to ±1 ppm/°C refer to type HR. See type PT for Precision Positive (+) TCR characteristics to +6000 ppm/°C.

3 STABILITY VS. TIME CHARACTERISTICS "Low ΔR"
To ±0.005%/year at 25°C (no load).

4 POWER RATINGS VS. AMBIENT TEMPERATURE AND RESISTANCE TOLERANCE
(Full power ratings are based upon standard ±1% resistance tolerance. Derating is required for higher temperatures and closer resistance tolerances.)
Type SX: To +125°C.
Type TX: To + 85°C.

5 INDUCTANCE
The standard Type SX/TX resistors are inductively wound. Non-inductive resistors are available — add suffix letter "N" in part number.

6 TERMINALS
Solderable hot-tinned (63% Sn — 37% Pb) copper wire leads. Low thermal EMF, noise free construction.

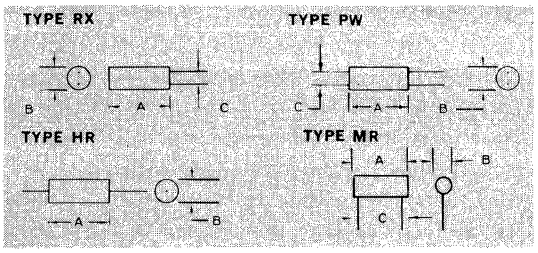
7 PROTECTIVE COATINGS
Type SX: New **solvent resistant** silicone-epoxy-seal.
Type TX: Commercial plastic conformal coating.

8 PURCHASING INFORMATION
Please specify: Quantity, type, resistance value, resistance tolerance and special features which may apply.

PRC PRECISION RESISTOR CO., INC.
10601 75th STREET NO. • LARGO, FL 33543 U.S.A. • TEL: (813) 541-5771 • TELEX: 821788

AXIAL LEAD TYPE HR
4-TERMINAL TYPE PW
PC AND RADIAL LEAD TYPES RX/MR

ULTRA



DESCRIPTION AND APPLICATION:

PRECISION'S ULTRA performance resistors represent exactly fifty years of specialization in the exclusive design and manufacture of precision resistance units. These ultra-high accuracy, ultra-time stability, low noise resistors are excellent for matched tolerances and TCR characteristics, as well as economical single or multiple secondary standards for critical commercial and military applications.

ELECTRICAL AND PHYSICAL SPECIFICATIONS

PRC Types	Meets or Exceeds Environmental Conditions of: MIL-R-39005	MIL-R-93	Max. Watts 1% Res. Tol.	Max. Volts	Body Dimensions ±.787mm (.031") (A) Length mm	(ins.)	(B) Diameter mm	(ins.)	Standard Space C	(ETP/OFHC)* Tinned Copper Leads Diam. Max.	Length† (±.125")	Resistance (Ohms) Min.	Max. Standard	Max. Special
PRINTED CIRCUIT														
RX378N	—	RB70	.5W	200V	12.7	(.500")	9.53	(.375")	.200"	.032"	1"	0.1	301K	500K
RX255N	RBR71	RB71	.25W	100V	7.92	(.312")	6.35	(.250")	.200"	.025"	1"	0.1	100K	150K
RX258N	—	—	.33W	300V	12.7	(.500")	6.35	(.250")	.200"	.025"	1"	0.1	250K	350K
RADIAL LEAD														
MR165N	RBR80	—	.2W	100V	8.26	(.325")	4.06	(.160")	.225"	.020"	1"	0.1	80K	120K
MR168N	RBR81	—	.2W	100V	12.7	(.500")	4.06	(.160")	.400"	.020"	1"	0.1	150K	250K
AXIAL LEAD														
NEW HR103	—	—	.1W	50V	5.08	(.200")	2.54	(.100")	—	.020"	1.5"	1.0	10K	20K
HR175N	—	—	.2W	100V	7.92	(.312")	3.96	(.156")	—	.020"	1.5"	0.1	80K	100K
HR186N	—	—	.2W	150V	9.53	(.375")	4.75	(.187")	—	.025"	1.5"	0.1	100K	150K
HR188N	RBR74	—	.25W	150V	12.7	(.500")	4.9	(.193")	—	.025"	1.5"	0.1	125K	200K
HR255N	RBR75	—	.25W	150V	7.49	(.295")	6.35	(.250")	—	.025"	1.5"	0.1	110K	316K
HR256N	RBR56	RB56	.25W	200V	9.53	(.375")	6.35	(.250")	—	.032"	1.5"	0.1	127K	200K
HR258N	RBR55	RB55	.33W	300V	12.7	(.500")	6.35	(.250")	—	.032"	1.5"	0.1	226K	500K
HR2512N	RBR54	RB54	.5W	300V	19.05	(.750")	6.35	(.250")	—	.032"	1.5"	0.1	511K	1 MEG
HR3114N	RBR76	—	.5W	300V	20.62	(.812")	7.92	(.312")	—	.032"	1.5"	0.1	600K	1.5 MEG
HR3712N	RBR53	RB53	.66W	300V	19.05	(.750")	9.53	(.375")	—	.032"	1.5"	0.1	750K	2 MEG
HR3716N	RBR52	RB52	1W	600V	25.4	(1.000")	9.53	(.375")	—	.032"	1.5"	0.1	1.5 MEG	3 MEG
HR5016N	RBR57	RB57	1.5W	600V	25.4	(1.000")	12.7	(.500")	—	.032"	1.5"	0.1	2 MEG	5 MEG
HR5024N	—	RB58	2W	900V	38.1	(1.500")	12.7	(.500")	—	.032"	1.5"	0.1	3.01 MEG	7.5 MEG
HR5032N	—	RB59	2.5W	1200V	50.8	(2.000")	12.7	(.500")	—	.032"	1.5"	0.1	5.11 MEG	10 MEG
4-TERMINAL														
PW½-AR	—	—	.5W	500V	15.88	(.625")	7.92	(.312")	.110"	.032"	1"	.005	100	500K
PW-AR	—	—	1W	1000V	19.05	(.750")	9.53	(.375")	.200"	.032"	1"	.005	100	750K
PW2-AR	—	—	2W	1000V	25.4	(1.000")	9.53	(.375")	.200"	.032"	1"	.01	100	1 MEG

* Commercially pure copper (Electrolytic Tough Pitch/Oxygen-Free High Conductivity). † 2" leads on MIL-Styles

ENGINEERING DATA:

1 RESISTANCE RANGE AND TOLERANCE "MIL Guidelines"

Standard: Any ohmic value or decimal part of an ohm desired with tolerances to ±0.01%. 10Ω min. res. (.01%).

Special: Higher or lower values beyond the standard limits with tolerances to ±0.005%. (Allow approx. +.001 ohm/inch for lead resistance on low value two-terminal designs: Lead resistance adder may be eliminated by using a four-terminal configuration). 100Ω min. res. (.005%). Type PW can also be supplied as two (2) resistor network for series/parallel circuits.

2 TEMPERATURE COEFFICIENT OF RESISTANCE (TCR)

Standard: Zero ±5 ppm/°C (100 ohms and above). **Zero ±15 ppm/°C** (values below 100 ohms).

Special: To ±1 ppm/°C. TCR matching to within 0.5 ppm/°C.

3 INDUCTANCE

Standard: Non-inductively wound with balanced reverse-pi winding.

4 STABILITY VS. TIME CHARACTERISTICS (No Load)

To ±0.001%/year at 25°C. 10% of tol. .01% tol. = .001% stability/yr.

5 POWER RATINGS VS. AMBIENT TEMPERATURE

These resistors are designed for full load operation providing the ambient temperature plus the temperature rise due to power dissipation does not exceed +125°C. (Derated to zero power at +145°C.)

6 VOLTAGE RATINGS (D.C. Voltage or Peak Voltage)

To calculate the safe operating voltage for any resistance value below the maximum listed, apply the formula $E = \sqrt{PR}$.

7 THERMAL EMF (With respect to copper)

Standard: < +2 microvolts per °C (100 ohms and above). < −3 microvolts per °C (values below 100 ohms).

Special: Construction and materials are available to minimize thermal electric effects.

8 PROTECTIVE ENCAPSULATION

Expansion — stress free base coat and epoxy seal.

9 MARKING (Identification)

Standard: PRC symbol, type, resistance value and tolerance.

Special: Military or custom marking.

10 SPECIAL TESTS

Qualification testing: Per MIL-Std-202 on a 100% or sample basis available.

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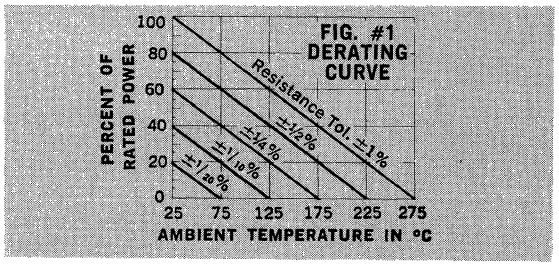
POWER

TYPE SM AXIAL LEAD

DESCRIPTION AND APPLICATION:

PRECISION'S TYPE SM sub-miniature precision power wirewound resistors are available in two and four terminal designs for commercial and military applications . . . such as precision current sensing in multi-range instrumentation. Popular resistance sets: Type SM186 0.9Ω and SM186-4 0.1Ω units used with Type SX154 90KΩ, 900Ω, 90Ω and 9 ohm resistors.



ELECTRICAL AND PHYSICAL SPECIFICATIONS

TWO (2) TERMINAL
ALL DRAWINGS
ILLUSTRATE ACTUAL SIZE

For higher resistance values (at max. rated voltage) decrease max. power rating ($P = E^2/R$)
For lower resistance values (at max. rated power) decrease max. voltage rating ($E = \sqrt{PR}$)
* Resist. values based upon max. power and max. voltage.

PRC Type	RW Styles MIL R-26	Max. Power Rating (Watts)	*Min. Allowable Resist. (Ohms)	*Resist. ($R = E^2/P$)	*Max. Allowable Resist. (Ohms)	Max. Voltage Rating	Body Dimensions ±.787mm (.031") Length mm	Length (ins.)	Diameter mm	Diameter (ins.)	1.5"L. Lead Diam. Tinned Copper
SM041	—	⅛W	1.0	5K	10K	25V	6.35	(.250")	1.52	(.060")	.020"
SM062	—	¼W	1.0	17K	30K	65V	6.35	(.250")	2.03	(.080")	.020"
SM063	—	½W	0.1	24K	50K	110V	7.92	(3.12")	2.03	(.080")	.020"
SM094	RW70	1W	0.1	40K	80K	200V	10.31	(.406")	2.92	(.115")	.025"
SM076	—	1⅛W	0.1	53K	180K	245V	12.7	(.500")	2.29	(.090")	.020"
SM156	—	1½W	0.1	90K	400K	375V	13.49	(.531")	4.47	(.176")	.028"
SM1711	—	2W	0.1	225K	900K	670V	20.62	(.812")	4.83	(.190")	.028"
SM186	RW69	3W	*0.025	80K	480K	500V	12.7	(.500")	5.26	(.207")	.028"
SM177	RW79	3W	0.1	80K	540K	500V	14.27	(.562")	4.83	(.190")	.028"
SM228	—	3W	*0.02	120K	720K	600V	15.88	(.625")	6.10	(.240")	.032"
SM2812	RW74	5W	*0.02	200K	1 MEG	1000V	22.23	(.875")	7.92	(.312")	.032"
SM3114	RW67	6½W	0.1	154K	1.5 MEG	1000V	25.4	(1.000")	7.92	(.312")	.032"
SM3726	RW78	10W	*0.07	156K	4 MEG	1250V	45.21	(1.780")	10.03	(.395")	.032"

* 0.02 ohm to 0.1 ohm and maximum resistance values available in non-standard physical sizes −0 +.062".
All low value 2-terminal designs are calibrated and tested at mid-point on lead unless otherwise specified.

CONSIDER THESE INNOVATIVE FEATURES:

1 WIDE RESISTANCE RANGE
"Widest in the industry" any ohmic value or decimal part of an ohm from 0.02 ohm to 4 megohms.

2 DEPENDABLE TOLERANCES
Small quantity lots, as well as, competitive high volume production quantities are accurately checked 100% to assure specified limits . . . ±1% (Std.), ±0.5%, ±0.25%, ±0.1% and ±0.05% resistance tolerances.

3 STABILITY VS. TEMPERATURE CHARACTERISTICS
Carefully selected materials/processes & quality control procedures insure low temperature (TCR) and power coefficients. **Standard:** Zero ±5 ppm/°C to zero ±20 ppm/°C. Special to ±2 ppm/°C.

4 HIGH VOLTAGE RATINGS
(D.C. Voltage or Peak Voltage)
Precision's high operating voltage winding patterns also eliminate dangerous crossovers and potential problems of standard mandrel style resistors. To calculate the safe operating voltage for any resistance value below the maximum listed, apply the formula $E = \sqrt{PR}$.

5 PRECISION POWER RATINGS
All (Std.) Type SM 1% tolerance resistors are designed for continuous full load operation at 25°C. Derate to zero power at +275°C. (Fig. #1)

6 SOLVENT RESISTANT COATING
All Type SM resistors are sealed in a tough solvent resistant—high temperature silicone coating . . . with indelible marking.

7 PURCHASING INFORMATION
Please Specify: Quantity, type, resistance value, resistance tolerance and special features which may apply. TCR characteristic together with temperature span of operation should be specified in behavior spec.

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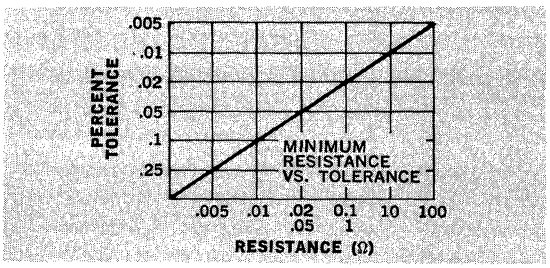
TYPE SM-(4) FOUR TERMINAL

SHUNTS

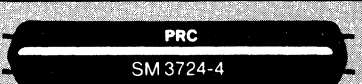


DESCRIPTION AND APPLICATION:

The four (4) terminal shunt/resistors illustrated on this page are specifically designed and constructed for applications requiring precise measurement and sensing of current by voltage drop methods or for use as precision voltage divider networks.

ELECTRICAL AND PHYSICAL SPECIFICATIONS

Precise low-value repeatability. Eliminates lead-out and contact resistance. "Single Joint" design makes lead identification academic.

PRC Type	Max. Power Rating	Body Dimensions ±.787mm (.031") Length mm	Length (ins.)	Diameter mm	Diameter (ins.)	Std. Space	1.5"L Std. Lead Diam. (±.001")	Min. Res. @ Max. Watts Ω	Min. Res. @ Max. Watts W	Min. Res.* @ Derated Power Ω	Min. Res.* @ Derated Power W	FOUR (4) TERMINAL ALL DRAWINGS ILLUSTRATE ACTUAL SIZE
NEW SM155-4	1¼W	13.21	(.520")	5.08	(.200")	.110"	.0285"	.015 @ 1¼W		.005 @ .5W		
SM186-4	2½W	16.5	(.650")	6.35	(.250")	.110"	.0285"	.025 @ 2½W		.005 @ .5W		
SM228-4	3W	19.69	(.775")	7.11	(.280")	.110"	.0285"	.03 @ 3W		.005 @ .5W		
SM2212-4	4W	26.04	(1.025")	7.11	(.280")	.110"	.0285"	.028 @ 4W		.005 @ .75W		
SM2812-4	5W	26.04	(1.025")	8.71	(.343")	.118"	.032"	.02 @ 5W		.005 @ 1.125W		
SM3724-4	7½W	45.72	(1.800")	11.10	(.437")	.243"	.032"	.03 @ 7½W		.005 @ 1.125W		

* Heavier current carrying capacity leads are available for low resistance — full power applications.

ENGINEERING DATA:

1 RESISTANCE RANGE AND TOLERANCE

Standard: Any ohmic value or decimal part of an ohm desired from 0.005 ohm to 100 ohms with tolerances to ±0.005% — see minimum resistance vs. tolerances graph above.

2 TEMPERATURE COEFFICIENT OF RESISTANCE

Zero ±15 ppm/°C

3 STABILITY VS. TIME CHARACTERISTICS

To ±0.001%/year @ 25°C e.g. 10% of tolerance ±0.01% = 0.001%/year.

4 SOLVENT RESISTANT COATING

. . . with indelible marking.

5 PRECISION POWER RATINGS

Minimum resistance values @ full power ratings are based upon ±1% resistance tolerances at 25°C. Derating is required for higher temperatures, closer tolerances and lower resistance values.

6 TERMINALS

Solderable "hot-tinned" copper wire leads act as an excellent wetting agent and provide long shelf life. Low EMF construction reduces thermal effects.

7 DC SHUNT APPLICATIONS

Example: To increase the range of a Milliammeter with an internal resistance of 27 ohms to read 500 milliamperes.

$$\text{Formula: } \frac{R^m \times I^m}{I - I^m} = \text{Shunt Resistance}$$

$$\text{Solution: } \frac{27 \times .001}{.500 - .001} = \frac{.027}{.499} \text{ or } .054\Omega \text{ shunt}$$

where: I^m = current of meter
I = current range desired
R^m = resistance of meter

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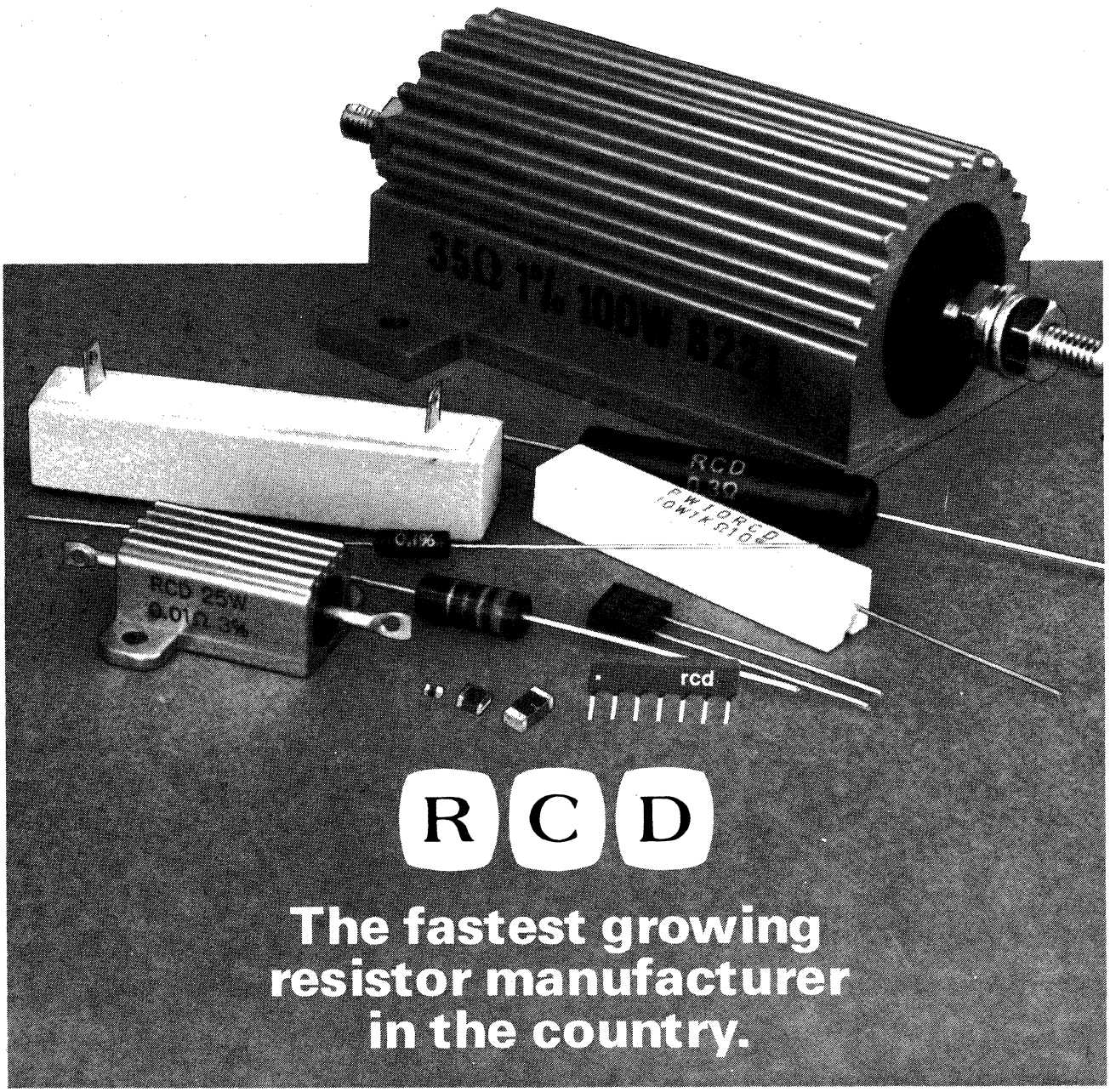
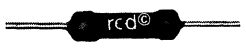
It's simple.

If we can't save you money on resistors, then we don't deserve your business.

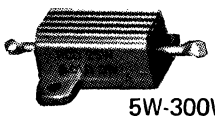


RCD Quick Reference Guide

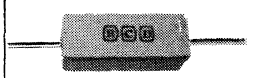
POWER WIREWOUND RESISTORS

Series 100* (STOCK)

¼W-20W

Silicone coated, all-welded, per MIL-R-26(RW), MIL-R-39007 (RWR). .001Ω to 300KΩ, tolerances to ±0.01%, TCR to 5PPM.
100X — non-inductive
100BEO — increased power
100R — radial leads
100F — flameproof coating

Series 600*

5W-300W

Silicone molded in an aluminum housing. High wattage capability with chassis mounting, per MIL-R-18546(RE), MIL-R-39009(RER). .005Ω to 200KΩ, tolerances to ±0.01%, TCR to 5PPM.
600X — non-inductive
600BEO — increased power

Series PW* (STOCK)

2W-50W

Low cost general purpose wirewounds. Ceramic encased, completely flameproof.
PWX — non-inductive
PWA — standoffs
PWR — radial leads
PWF — failsafe fusible
PWS — miniature sizes

Series RW

1W -3W

Low cost epoxy molded or conformal coated wirewounds offer savings over carbon comps. RW-1 (1-watt) is the size of a ½-W carbon comp. RW-2(2W) and RW-3(3W) are both the size of a 1W comp.
RWF — Flameproof fusible

Series ULV,LVF*

1W-25W

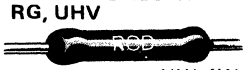
Series ULV utilizes a newly-developed manufacturing technique to obtain very low values (to 0.002Ω), with precision accuracy at lowest cost.
LVF — four terminal construct.

THICK FILM RESISTORS

Series RSF,BW (STOCK)

¼W-9W

METAL OXIDE RESISTORS
Flameproof, thick complex-oxide construction results in performance and size of wirewounds, at significant price reductions. Non-inductive, high-surge capability. 0.1Ω to 240K stocked. BW Series is fusible.

RG, UHV

¼W-4W

HIGH VOLTAGE/HIGH MEGOHM
Voltage capability to 50KV. Resitance to 10,000 Gig. Tolerances to 0.5%, TCR to 50PPM.

Series MG

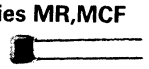
½W- 1W

SPACE SAVER RESISTORS—
Miniature resistors! ½-watt is ⅛W size, 1-watt is ¼-watt size. Improved dissipation due to thick cermet glaze. 6.2 ohm to 1 Meg, TCR to 50 PPM, tolerances to 1.0%.

Series MC, MCR

1/16-1.0W

THICK FILM CHIPS—12 SIZES
High-stability thick film chip resistors. 4.7Ω to 2000 Meg. Wrap-around termination available. Tolerances to 0.25%, TCR to 50PPM.

Series MR,MCF


WORLD'S SMALLEST!
Cermet micro-resistors offer highest performance in smallest possible size. Under 0.1" long! 4.7Ω to 8.2 Meg. Axial or radial leads.

DIP,SIP * (STOCK)

THIN FILM/THICK FILM—
RCD resistor networks offer premium performance per MIL-R-83401. SIP packages are 4 to 12 pin. DIP's are 14 or 16 pin. Variety of standard and custom configurations, hybrids available.

PRECISION WIREWOUND RESISTORS

Series SA,MA*

.1W-2W

Epoxy encapsulated, non-inductive precision bobbin wirewounds per MIL-R-93(RB), MIL-R-39005 (RBR). 0.1Ω to 25 Meg, tolerances to ±0.005%, TCR from ±1PPM to +6700PPM

Series PC*

.1W-1W

Same as Series SA, MA but feature radial leads for easy PCB insertion and space savings per MIL-R-93, MIL-R-39005. PC451 (rectangular) is direct low-cost replacement for ultra-precision films.

Series Q*

.1W-1W

Wirewound substitutes for precision metal film's RN55, RN60, RN65, RN70, RN75. Better stability, lower price. TCR as low as ±2PPM. Tolerances to ±0.01%.

THIN FILM RESISTORS

Series MF*

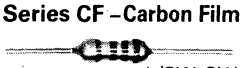
.1W-1W

Precision metal film per MIL-R-10509, RN55,60,65,70,75 and MIL-R-55182(RNR,RNC). 10Ω to 5.1 Meg, tolerances to ±0.05%. Outstanding TC's to 5PPM.

Series GP–Metal Film (STOCK)

.1W-1W

Commercial metal film with MIL-spec performance at half the price! Exceeds MIL-R-10509(RN),-22684 (RL),-39017(RLR). Values to 22.1 Meg, TC's to 25PPM, tolerances to ±0.5%.

Series CF–Carbon Film (STOCK)

1/8W-2W

General purpose carbon fim feature highest grade core for extended life stability and overload dissipation. 1ohm to 22 Meg, 7 standard sizes. Series CFF is flameproof.

TEMPERATURE SENSORS

LP 1/4

+150°C

Low cost metal film with linear positive TCR. 33Ω to 30K, tolerances to ±1.0%. Available in any T.C. up to +5000PPM (.5%/°C). Only ¼" long.

ATB,PTB,ATS,ATC *

+375°C

Precision wirewound, axial or radial. Interchangeable TCR, 1Ω to 1 Meg, tolerances to ±0.05%. Available in any T.C. up to +6720 PPM.

PTC,PTS *

+600°C

Ceramic encased RTD elements or stainless steel RTD probles. Platinum, Nickel, Nife elements stocked. Tolerances to +0.1%.

SPECIALTY PRODUCTS

FUSE RESISTORS

1/8W-10W

Standard and Custom fusing curves to provide precisely controlled circuit protection. Fusing time to 5μS at 0.1A and up.

SURGE RESISTORS *

1W-50W

Withstand high energy dissipation and absorb surges up to 75 joules with minor resistance shift Standard and Custom designs.

ZERO OHM (STOCK)

¼W

Insulated jumpers come in 1/4W size and are suited for automatic insertion. Resistance is .02 ohm or less. Chip jumpers available.

INDUCTORS

Series AL (STOCK)

Low cost color banded inductors per MIL-C15305. Special core results in high Q and SFR, low DCR. .22μH to 56000μH. Axial or radial leads. Shielded type available.

CUSTOM

RCD manufactures a series of custom coil products including toroids, transformers, and shielded chokes. RCD also offers custom Res/cap, Res/Diode hybrid networks and voltage dividers.

* Don't forget our **'SWIFT'** service (**S**hip **W**ith **I**n **F**ifty **T**wo hours) when you require fast delivery of a non-stock item!

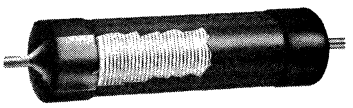
RCD Components Inc. • 330 Bedford Street, Manchester, NH 03101 • (603) 669-0054 Tlx: 943512

RCL·Shallcross
WIREWOUND RESISTORS

POWER

MIL-R-26, Type RW

T Series, Silicone Coated



GENERAL SPECIFICATIONS

Wattage Range: 25 styles to choose from ranging from .4 to 14 watts.

Resistance Values: From 0.1 ohm to maximum values as stated in table. For values below 0.1 ohm, use RCL-Shallcross Low Ω Metal Element Resistors.

Power Rating: Two power ratings, depending on operating temperature and stability requirements:

- Characteristic U: 275°C maximum hotspot temperature.
- Characteristic V: 350°C maximum hotspot temperature.

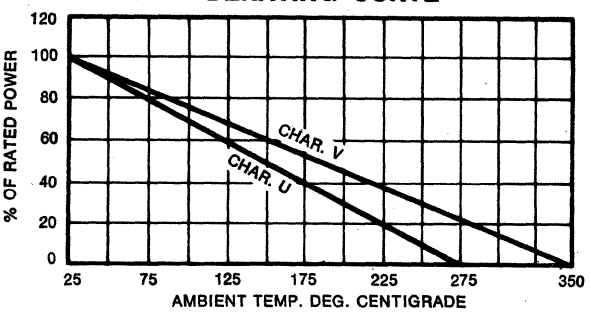
Derating: Wattage Ratings based on operation at 25°C. For higher ambient temperatures, derate per derating curve.

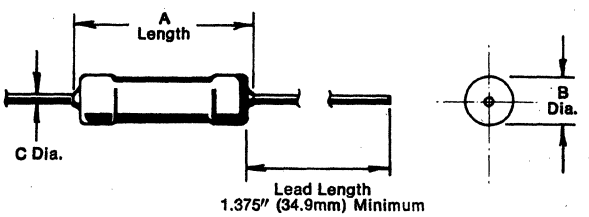
Tolerance: ±1.0% is standard. Closer tolerances are available.

Temperature Range: From −65°C to +275°C (Characteristic U) or +350°C (Characteristic V).

Temperature Coefficient of Resistance: Standard T.C.: ±20 PPM/°C = 500Ω and up, ±30 PPM/°C = 10Ω to 499Ω, ±50 PPM/°C = 1Ω to 9.99Ω, ±90 PPM/°C = 0.1Ω to 0.99Ω, ±400 PPM/°C = 0.025Ω to 0.099Ω, ±650 PPM/°C = 0.01Ω to 0.024Ω.

DERATING CURVE





ELECTRICAL AND DIMENSIONAL SPECIFICATIONS

Metric Dimensions

RCL[1] Style	MIL-R-26[1] Style	Wattage Rating U	Wattage Rating V	Dimensions Clean lead to clean lead Length A	Dimensions Clean lead to clean lead Diameter B	Resistance[2] RCL Style	Resistance[2] MIL-R-26 Style	Lead[2] Diam. C AWG	Dimensions Clean lead to clean lead Length A mm	Dimensions Clean lead to clean lead Diameter B mm	Lead Diam. mm
T-½-A	—	0.4		.220 ±.062	.078 ±.031	2K	—	#24	5.6 ±1.6	2.0 ±0.8	0.5
T½	—	0.75	—	.330 ±.062	.078 ±.031	4K		#24	8.4 ±1.6	2.0 ±0.8	0.5
T-½-A81	RW81	1.0	—	.250 ±.032	.085 ±.020	2K	1K	#24	6.4 ±0.8	2.2 ±0.8	0.5
T-1-80	RW80	2.0		.406 ±.032	.094 ±.032	10K	3.16K	#24	10.3 ±0.8	2.4 ±0.5	0.5
T-1A	—	1.0	1.25	.406 ±.062	.093 ±.032	6.5K	—	#24	10.3 ±1.6	2.4 ±0.8	0.5
T-1A-70	RW70	1.0		.406 ±.031	.094 ±.031	6.5K	3.16K	#24	10.3 ±0.8	2.4 ±0.8	0.5
T-1B	—	1.1	1.30	.530 ±.062	.093 ±.031	8.2K	—	#24	13.5 ±1.6	2.4 ±0.8	0.5
T-1C	—	1.0	—	.280 ±.062	.093 ±.031	3.4K	—	#24	7.1 ±1.6	2.4 ±0.8	0.5
T-2	—	1.5	—	.343 ±.062	.156 ±.031	8K	—	#20	8.7 ±1.6	4.0 ±0.8	0.8
T-2A	—	3.0	3.75	.500 ±.062	.187 ±.031	12K	—	#20	12.7 ±1.6	4.8 ±0.8	0.8
T-2A-69	RW69	—	3.00	.500 ±.063	.188 ±.063	18K	2K	#20	12.7 ±1.6	4.8 ±1.6	0.8
T-2B	—	3.0	3.75	.812 ±.062	.188 ±.031	34K	—	#20	20.0 ±1.6	4.8 ±0.8	0.8
T-2B-79	RW79	3.0		.560 ±.062	.187 ±.031	22K	10.5K	#20	14.2 ±1.6	4.8 ±0.8	0.8
T-2C	—	3.0	3.25	.500 ±.062	.250 ±.031	18K	—	#18	12.7 ±1.6	6.3 ±0.8	1.0
T-3	—	4.0	5.5	.625 ±.062	.250 ±.031	25K	—	#18	15.8 ±1.6	6.3 ±0.8	1.0
T-5	—	5.0	6.5	.875 ±.062	.312 ±.031	45K	—	#18	22.2 ±1.6	8.0 ±0.8	1.0
T-5-74	RW74	5.0	—	.875 ±.062	.312 ±.031	45K	38.3K	#18	22.2 ±1.6	8.0 ±0.8	1.0
T-6	—	6.0	7.5	1.00 ±.062	.312 ±.031	65K	—	#18	25.4 ±1.6	8.0 ±0.8	1.0
T-6-67	RW67	—	6.5	1.00 ±.094	.313 ±.063	65K	8.2K	#20	25.4 ±2.4	8.0 ±1.6	0.8
T-7	—	7.0	9.0	1.185 ±.062	.312 ±.031	75K	—	#18	30.0 ±1.6	8.0 ±0.8	1.0
T-7A-55	RW55	—	7.0	1.375 ±.094	.469 ±.094	120K	5.1K	#20	35.0 ±2.4	12.0 ±2.4	0.8
T-10	—	10.0	13.0	1.812 ±.062	.375 ±.031	150K	—	#18	46.0 ±1.6	9.5 ±0.8	1.0
T-10-78	RW78	10.0	—	1.780 ±.062	.375 ±.031	150K	90.9K	#18	45.2 ±1.6	9.5 ±0.8	1.0
T-10-68	RW68	—	11.0	1.875 +.063 −.125	.344 ±.094	150K	20K	#20	22.2 +1.6 −3.2	8.7 ±2.4	0.8
T-10-A-56	RW56	—	14.0	2.00 ±.094	.469 ±.094	200K	9.1K	#20	50.8 ±2.4	12.0 ±2.4	0.8

[1] Aryton Perry Winding available for non-inductive requirements. (Divide Max. Resistance Value by 2).
[2] Contact factory for lead diameter, ohmic values or temperature coefficients not listed as standard.

NON-INDUCTIVE WINDINGS, RADIAL LEADS, EXTENDED HEAT DISSIPATION and other SPECIAL FEATURES are available.

Call or write factory for complete information:

RCL·Shallcross
WIREWOUND RESISTORS

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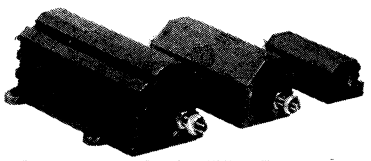
U.S. Hwy. 70 East, Smithfield, NC 27577 • (919) 934-5181

RCL·Shallcross
WIREWOUND RESISTORS

CHASSIS MOUNT POWER

MIL-R-18546, Type RE

AL Series, Aluminum Housed Chassis Mount



GENERAL SPECIFICATIONS

Wattage Range: 7 styles to choose from ranging from 5 to 250 watts.

Resistance Values: From 0.1 ohm to maximum values as stated in table.

Power Rating: 275°C maximum hotspot at 25°C ambient. 1% maximum ΔR in 1000 hour load life.

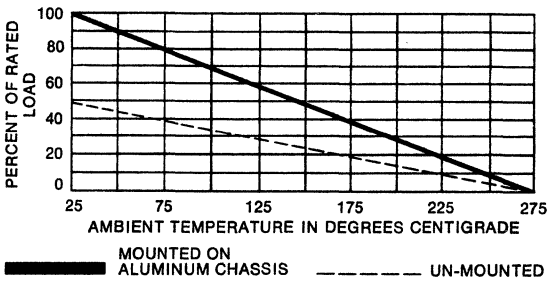
Derating: Wattage ratings based on operation at 25°C. For higher ambient temperatures, derate per derating curve.

Tolerance: ±1.0% is standard.

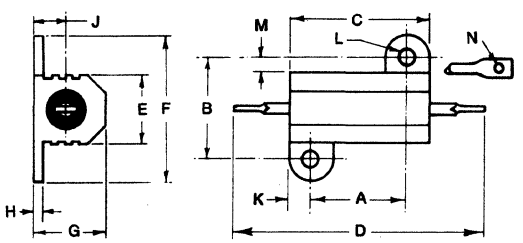
Temperature Range: From −55°C to +275°C.

Temperature Coefficient of Resistance: Standard T.C.: ±20 PPM/°C = 10Ω and up, ±50 PPM/°C = 1Ω to 9.99Ω, ±90 PPM/°C = below 1Ω.

WATTAGE VS. AMBIENT TEMP. DERATING

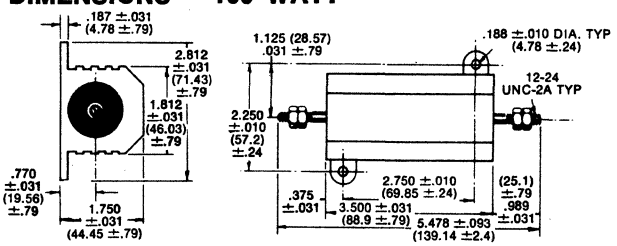


DIMENSIONS — 5 THRU 75 WATTS

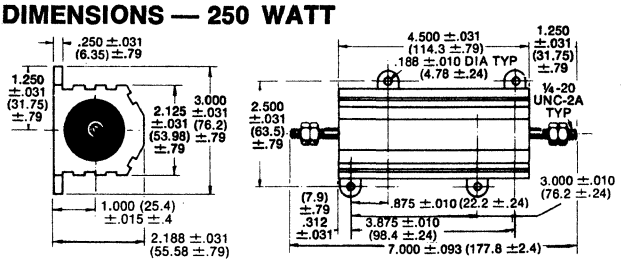


(METRIC DIMENSIONS ARE IN PARENTHESIS)

DIMENSIONS — 100 WATT



DIMENSIONS — 250 WATT



ELECTRICAL SPECIFICATIONS

RCL** Style	MIL Style	Power Rating (Watts)*		Resistance Range			Max. Weight
		RCL	MIL	Min.	Max.	Max. MIL	Grams
AL-5	RE-60G	5	5	.1	16K	3.32K	3
AL-10	RE-65G	10	10	.1	25K	5.62K	7
AL-25	RE-70G	25	20	.1	55K	12.1K	14
AL-50	RE-75G	50	30	.1	180K	39.2K	29
AL-75		75		.1	75K		120
AL-100	RE-77G †	100	75	.1	50K		400
AL-250	RE-80G †	250	120	.1	75K		800

* AL resistors have an operating temperature range of −55°C to +275°C. Derating is required for reduced chassis mounting area and or for high ambient temperatures.

** To order non-inductive styles add suffix N. (e.g.: ALN-5, RE-60N) (Divide Max. Res. Values by 2).

† For reference only

DIMENSIONAL SPECIFICATIONS

Style	A	B	C	D	E	F	G	H	J	K	L	M	N
Tol.	±.005	±.005	±.031	±.062	±.015	±.015	±.015	±.010	±.010	±.010	±.005	±.015	±.005
Tol. (metric)	±0.1	±0.1	±0.8	±1.6	±0.4	±0.4	±0.4	±0.25	±0.25	±0.25	±0.1	±0.1	±0.1
AL-5	.444 (11.28)	.490 (12.45)	.600 (15.24)	1.125 (28.58)	.334 (8.48)	.646 (16.41)	.320 (8.13)	.065 (1.65)	.140 (3.56)	.078 (1.98)	.093 (2.36)	.078 (1.98)	.050 (1.27)
AL-10	.562 (14.27)	.625 (15.88)	.750 (19.1)	1.375 (34.93)	.430 (10.92)	.800 (20.3)	.400 (10.2)	.075 (1.91)	.190 (4.83)	.093 (2.4)	.093 (2.4)	.102 (2.59)	.086 (2.18)
AL-25	.719 (18.26)	.781 (19.84)	1.062 (26.97)	1.938 (49.23)	.530 (13.46)	1.080 (27.43)	.560 (14.22)	.085 (2.16)	.260 (6.6)	.172 (4.37)	.125 (3.18)	.115 (2.92)	.086 (2.18)
AL-50	1.563 (39.7)	.844 (21.44)	1.968 (49.99)	2.781 (70.64)	.615 (15.62)	1.140 (28.96)	.615 (15.62)	.085 (2.16)	.300 (7.62)	.196 (4.97)	.125 (3.18)	.107 (2.71)	.086 (2.18)
Tol.	±.010	±.010	±.031	±.093	±.031	±.031	±.031	±.015	±.015	±.015	±.005	±.015	±.005
Tol. (metric)	±0.25	±0.25	±0.8	±2.4	±0.8	±0.8	±0.8	±0.4	±0.4	±0.4	±0.1	±0.4	±0.1
AL-75	2.125 (53.98)	1.500 (38.1)	2.500 (63.5)	3.750 (95.25)	1.125 (28.58)	1.875 (47.62)	1.125 (28.58)	.125 (3.18)	.625 (15.89)	.187 (4.75)	.172 (4.37)	.187 (4.75)	.095 (2.4)

NON-INDUCTIVE WINDINGS, SPECIAL LEADS and EXTENDED HEAT DISSIPATION versions are available.

Call or write factory for complete information:

RCL·Shallcross WIREWOUND RESISTORS

195 McGregor St., Manchester, NH 03102 • (603) 627-3831
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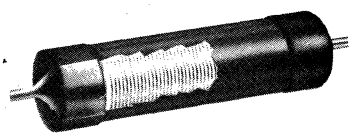
ESTABLISHED RELIABILITY POWER

RCL·Shallcross
WIREWOUND RESISTORS

MIL-R-39007, Type RWR, S Level PR Series, Silicone Coated



GENERAL SPECIFICATIONS

Wattage Range: 15 styles to choose from ranging from 1 to 15 watts.

Resistance Values: From 0.1 ohm to maximum values as stated in table.

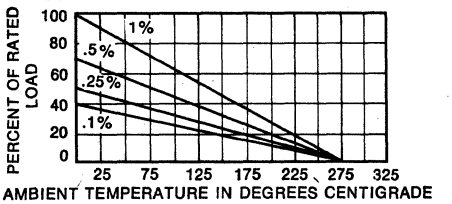
Power Rating: 275°C maximum hotspot at 25°C ambient.

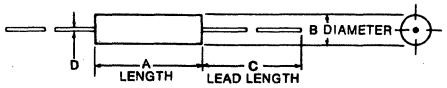
Tolerance: ±1.0% is standard. ±0.1%, ±0.25%, ±0.5%, ±3%, ±5% and ±10% are available.

Temperature Range: −55°C to +275°C.

Temperature Coefficient of Resistance: Standard T.C.: ±20 PPM/°C = 10Ω and up, ±50 PPM/°C = 1Ω to 10Ω, ±400 PPM/°C = 0.499Ω to 1Ω, ±650 PPM/°C = 0.1Ω to 0.499Ω.

WATTAGE VS. AMBIENT TEMP. DERATING





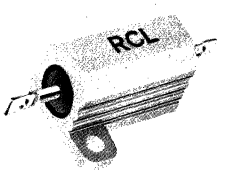
ELECTRICAL AND DIMENSIONAL SPECIFICATIONS

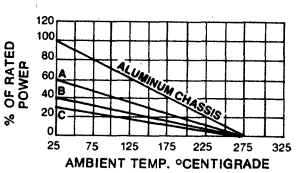
Shallcross Style	MIL-R-39007[1,2,3] Style	Power Rating (Watts) 275°	Resistance Value Min. Tol. 0.1%	Min. Tol. 1.0%	Max. All Tol.	Maximum Weight (Grams)	Dimensions A	B	C	D
PR13		6	10	0.1	10K	2.25	.625 ±.062	.250 ±.032	1.500	.040
PR17		5	10	0.1	7K	1.5	.500 ±.062	.218 ±.032	1.500	.040
PR33		15	10	0.1	80K	8.5	1.780 ±.062	.375 ±.032	1.500	.040
PR433	RWR78	10	0.499	0.1	80K	8.5	1.780 ±.062	.375 ±.032	1.500	.040
PR246	RWR84	7	0.499	0.1	25K	4.0	.875 ±.062	.312 ±.032	1.500	.040
PR446	RWR74	5	0.499	0.1	25K	4.0	.875 ±.062	.312 ±.032	1.500	.040
PR49	RWR80	2	0.499	0.1	3.16K	.35	.406 ±.032	.094 ±.032	1.500	.020
PR449		1	10	0.1	3.16K	.35	.406 ±.032	.094 ±.032	1.500	.020
PR60		10	10	0.1	45K	4.7	1.218 ±.062	.312 ±.032	1.500	.040
PR61	RWR89	4	0.499	0.1	4.12K	1.0	.560 ±.062	.187 ±.032	1.500	.032
PR261	RWR89	3	0.499	0.1	4.12K	1.0	.560 ±.062	.187 ±.032	1.500	.032
PR461		3	10	0.1	4.12K	1.0	.560 ±.062	.187 ±.032	1.500	.032
PR62		4.5	10	0.1	14K	1.25	.812 ±.062	.187 ±.032	1.500	.032
PR462	RWR71	3.25	0.499	0.1	16.2K	1.25	.812 ±.062	.187 ±.032	1.500	.032
PR66	RWR82	1.5	0.499	0.1	1.3K	.30	.312 ±.032	.085 ±.015	1.500	.020
PR68	RWR81	1	0.499	0.1	1K	.25	.250 ±.032	.085 ±.015	1.500	.020
PR268	RWR81	1	0.499	0.1	1K	.25	.250 ±.032	.085 ±.015	1.500	.020

[1] MIL-R-39007 Approved. To Life Failure Rate M, P, R, & S.
[2] Tolerances F (1%), D (.5%) and B (.1%) available at Life Failure Rate M, P, R, & S.
[3] Ayrton Perry Winding available for Non-Inductive requirements.

MIL-R-39009, Type RER, R Level

AL-ER Series, Aluminum Housed Chassis Mount





GENERAL SPECIFICATIONS

Wattage Range: 4 styles to choose from ranging from 5 to 50 watts.

Power Rating: 275°C maximum hotspot at 25°C ambient. 1% maximum ΔR in 2000 hour load life.

Derating: AL-ER chassis mount resistors have an operating temperature range of −55°C to +275°C. For higher ambient temperatures, use derating curve which applies to operation of unmounted resistors (A = AL5ER and AL10ER, B = AL25ER and C = AL50ER).

Tolerance: ±1% is standard.

Temperature Coefficient of Resistance: Standard T.C.: ±20 PPM/°C = 20Ω and up, ±50 PPM/°C = 1Ω to 19.6Ω, ±100 PPM/°C = below 1Ω.

Dimensional Specifications: Identical to AL Series on previous page.

ELECTRICAL SPECIFICATIONS

RCL Style Refer to Note #1	MIL-R-39009 Style	Power Rating* (Watts) RCL	MIL	Minimum Resistance	Maximum Resistance	Maximum Working Voltage	Maximum Weight (Grams)
ALN5 ER	RER-40	7.5	5	1.0Ω	1.65K	90.8	3.3
AL5 ER	RER-60	7.5	5	0.1Ω	3.32K	128.9	3.0
ALN10 ER	RER-45	12.5	10	1.0Ω	2.80K	167.3	8.8
AL10 ER	RER-65	12.5	10	0.1Ω	5.62K	237.1	8.0
ALN25 ER	RER-50	25.0	20	1.0Ω	6.04K	347.6	16.5
AL25 ER	RER-70	25.0	20	0.1Ω	12.1K	550.0	15.0
ALN50 ER	RER-55	50.0	30	1.0Ω	19.6K	766.8	35.0
AL50 ER	RER-75	50.0	30	0.1Ω	39.2K	1085.0	32.0

* Rating based on chassis mounting at +25°C ambient.

Call or write factory for complete information:

RCL·Shallcross
WIREWOUND RESISTORS

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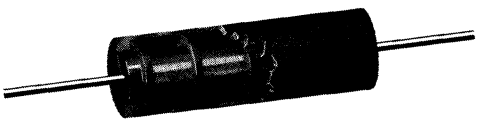
RCL Shallcross
WIREWOUND RESISTORS

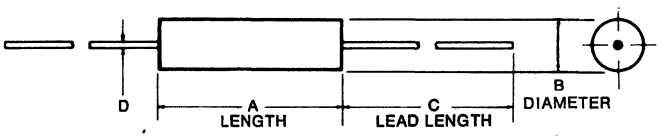
PRECISION

MIL-R-93, RB Type

VA, SP and 7000 Series, Axial Lead

ELECTRICAL AND DIMENSIONAL SPECIFICATIONS





Shallcross VA Style	MIL-R-93[2]	Dimensions A ±.032	B ±.015	C	D Awg.	Watts MIL 125°C	Watts Commercial[1] 85°C	Max. Volt. DC	Approx. Weight Grams	Max. Resistance
• 10	RB56	.343	.250	2.0	20	.125	.250	200	1.0	350K
• 11		.295	.250	1.5	22	.125	.250	150	.3	250K
• 12	RB55	.500	.250	2.0	20	.150	.300	300	1.0	525K
13		.625	.250	1.5	20	.200	.400	500	1.5	800K
• 14	RB54	.750	.250	2.0	20	.250	.500	300	2.0	850K
16		1.0	.250	1.5	20	.500	1.0	750	3.0	1.25Meg
19		.812	.312	1.5	20	.500	1.0	300	3.5	5.0Meg
30		.343	.375	1.5	20	.125	.250	300	2.0	1.0Meg
• 32		.500	.375	1.5	20	.250	.500	300	3.5	1.5Meg
• 34	RB53	.750	.375	2.0	20	.330	.660	500	4.5	2.0Meg
• 36	RB52	1.0	.375	2.0	20	.500	1.0	750	6.0	2.5Meg
38		1.5	.375	1.5	20	.750	1.500	1000	7.5	3.5Meg
39		2.0	.375	1.5	20	1.250	2.500	1200	10.0	4.0Meg
52		.500	.500	1.5	20	.330	.660	300	5.5	2.0Meg
• 54		.750	.500	1.5	20	.500	1.0	500	7.0	3.0Meg
• 56		1.0	.500	1.5	20	.750	1.5	750	8.5	4.0Meg
• 58		1.5	.500	1.5	20	1.0	2.0	1000	11.5	5.0Meg
• 59		2.0	.500	1.5	20	1.250	2.5	1200	12.5	10.0Meg
SP Style		SUBMINIATURES								
• 20		.250	.187	1.5	22	.100	.200	150	.3	125K
• 21		.375	.187	1.5	22	.125	.250	300	.3	200K
• 22		.500	.187	1.5	22	.150	.300	300	.3	300K
23		.625	.187	1.5	22	.175	.350	600	1.0	400K
26		1.0	.187	1.5	22	.250	.500	1000	1.5	500K
40		.500	.160	1.5	22	.100	.200	300	.3	500K
• 41		.250	.125	1.5	22	.050	.100	100	.2	125K
• 42		.375	.125	1.5	22	.065	.125	200	.2	200K
• 43		.500	.125	1.5	22	.075	.150	200	.3	300K
47		.187	.100	1.5	24	.025	.050	75	.1	50K
• 48		.312	.100	1.5	24	.030	.060	100	.1	100K
49		.437	.100	1.5	24	.040	.075	100	.2	150K
• 68		.250	.085	1.5	24	.020	.040	100	.1	50K
69		.375	.085	1.5	24	.025	.050	100	.1	100K

• Standard Style [1] Commercial ratings may be applied at 125°C provided 175°C max. operating temperature is permissible. [2] MIL-R-93 Approved. † For reference only

RCL Style	MIL-R-93 Style	Dia. ±.015	Lgth. ±.032	RCL Max. Watts	MIL Max. Watts	MIL Style Max. Res. 0.001 (.0254)	RCL Style 0.0005 (.0127)	Non-Inductive Winding	Lead Dia. AWG D	Metric Dimensions Dia. ±.4 mm	Lgth. ±.8 mm	Lead Dia. D mm
7002		.110	.220	.1			100K	NO	#24	2.8	5.6	0.5
7003		.100	.260	.05			150K	NO	#24	2.5	6.6	0.5
7004		.100	.300	.05			250K	YES	#24	2.5	7.6	0.5
7005		.125	.250	.1			300K	YES	#22	3.2	6.3	0.6
7006		.125	.3125	.1			350K	YES	#22	3.2	7.9	0.6
7007		.1875	.375	.125			700K	YES	#22	4.8	9.5	0.6
7008		.250	.250	.150			1Meg	YES	#22	6.3	6.3	0.6
7009	RB-56	.250	.343	.25	.125	127K	1.4Meg	YES	#20	6.3	8.7	0.8
7010	RB-55	.250	.500	.33	.15	226K	3Meg	YES	#20	6.3	12.7	0.8
7020	RB-54	.250	.750	.50	.25	511K	4.4Meg	YES	#20	6.3	19.0	0.8
7030	RB-53	.375	.750	.60	.33	750K	8Meg	YES	#20	9.5	19.0	0.8
7040	RB-52	.375	1.000	1.00	.50	1.5Meg	12Meg	YES	#20	9.5	25.4	0.8
7044		.500	.500	.50			7Meg	YES	#20	12.7	12.7	0.8
7045		.500	.625	.60			8Meg	YES	#20	12.7	15.9	0.8
7045A		.437	.625	.60			9Meg	YES	#20	11.1	15.9	0.8
7050	†RB-57	.500	1.00	1.25	.75	2Meg	14Meg	YES	#20	12.7	25.4	0.8
7050A		.437	1.00	1.25			13Meg	YES	#20	11.1	25.4	0.8
7060	†RB-58	.500	1.50	1.50	1.0	3Meg	20Meg	YES	#20	12.7	38.1	0.8
7070	†RB-59	.500	2.00	2.00	1.25	5Meg	30Meg	YES	#20	12.7	50.8	0.8

PC and 4000 Series Printed Circuit Board Style

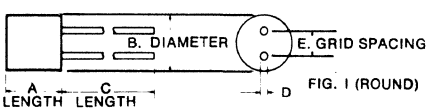


FIG. I (ROUND)

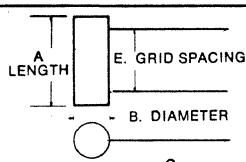
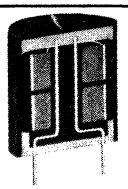


FIG. II (RADIAL)



ELECTRICAL AND DIMENSIONAL SPECIFICATIONS

Shallcross PC Style	PC Style MIL-R-93	Fig.	Dimensions A ±.032	B ±.015	C 1" Min.	D Awg.	E ±.010	Watts MIL 125°C	Watts Commercial[1] 85°C	Maximum Voltage DC	Approx. Weight Grams	Maximum Resistance
1		I	.250	.250	1.0	22	.200	.100	.200	150	.3	150K
3		I	.359	.265	1.0	22	.200	.125	.250	150	1.0	250K
4		I	.375	.375	1.0	20	.200	.250	.500	300	2.5	500K
8	RB71	I	.312	.250	1.0	22	.200	.125	.250	300	.3	150K
340		II	.500	.160	1.0	22	.406	.100	.200	300	.3	500K

[1] Commercial ratings may be applied at 125°C provided 175°C max. operating temperature is permissible.

RCL Style	MIL-R-93 Style	Fig. I Length (A)	Fig. I Diameter (B)	MIL Style Max. R Using .001 (25.4 μ)	RCL Style* Max. R Using .0006 (15.2 μ)	RCL Style** Max. Wattage	Standard Lead Spacing (±0.010)	Lead Diameter (AWG)	Metric Dimensions Length (mm)	Diameter (mm)	Standard Lead Spacing (mm ±0.25)	Lead Diameter (mm)
4060	RB-71	.312 ±.032	.250 ±.025	100K	500K	.250**	.200	#22	7.9 ±0.8	6.3 ±0.6	5.08	0.6
4061		.375 ±.032	.250 ±.025	160K	800K	.250	.200	#22	9.5 ±0.8	6.3 ±0.6	5.08	0.6
4062		.437 ±.032	.250 ±.025	160K	800K	.250	.200	#22	11.1 ±0.8	6.3 ±0.6	5.08	0.6
4063		.375 ±.032	.375 ±.015	185K	1Meg	.333	.200	#20	9.5 ±0.8	9.5 ±0.4	5.08	0.8
4064		.437 ±.032	.375 ±.015	250K	1.3Meg	.333	.200	#20	11.1 ±0.8	9.5 ±0.4	5.08	0.8
4065	RB-70	.500 ±.032	.375 ±.015	301K	1.5Meg	.333**	.200	#20	12.7 ±0.8	9.5 ±0.4	5.08	0.8
4066		.375 ±.032	.437 ±.015	450K	2Meg	.400	.300	#20	9.5 ±0.8	11.1 ±0.4	7.62	0.8
4067		.437 ±.032	.437 ±.015	600K	3Meg	.400	.300	#20	11.1 ±0.8	11.1 ±0.4	7.62	0.8
4068		.500 ±.032	.437 ±.015	700K	3.5Meg	.400	.300	#20	12.7 ±0.8	11.1 ±0.4	7.62	0.8

* Not applicable for MIL Styles (RB). ** Max. Wattage for MIL-R-93 Styles is 0.125 for RB-71 and 0.250 for RB-70.
Lead length 1½" (38.1 mm) Minimum. Tinned, weldable leads. RB-70 and RB-71, Lead length 1" ±⅛" (25.4 ±3.18 mm).

Call or write factory for complete information:

RCL Shallcross
WIREWOUND RESISTORS

195 McGregor St., Manchester, NH 03102 • (603) 627-3831
U.S. Hwy. 70 East, Smithfield, NC 27577 • (919) 934-5181

ESTABLISHED RELIABILITY PRECISION

RCL·Shallcross
WIREWOUND RESISTORS

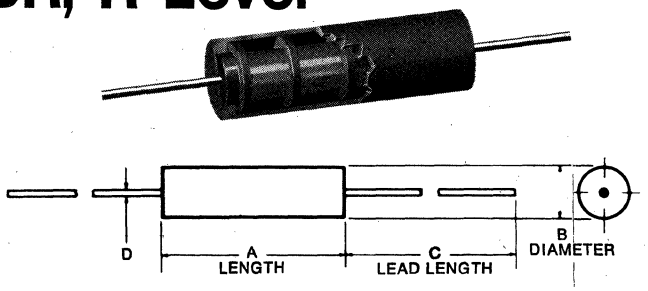
MIL-R-39005, Type RBR, R Level

HR Series

Mil Tolerance Range For HR & ER Series:

RBR	Value	Tol. Minimum
52, 53, 55, 56, & 71	≧ 10Ω ≧ 0.1Ω	±.01% ±1%
54	≧ 4.99Ω ≧ 0.1Ω	±.01% ±1%
80 & 81	≧ 1000Ω ≧ 100Ω ≧ 10Ω	±0.01% ±0.02% ±0.10%

±1.0% (F); ±0.1% (B); ±0.5% (D); ±0.05% (A); ±0.02% (Q); ±0.01% (T).



ELECTRICAL AND DIMENSIONAL SPECIFICATIONS

Shallcross HR Style	HR Style MIL-R-39005	Dimensions A ±.032	B ±.015	C Min.	D Awg.	Watts MIL 125°C	Watts Commercial [1] 85°C	Maximum DC Voltage	Approx. Weight Grams	Maximum Resistance
1		.250	.250	1.0	22	.100	.200	150	.3	150K
3		.359	.265	1.0	22	.125	.200	150	1.0	250K
4		.375	.375	1.0	20	.250	.500	300	2.5	500K
• 5 [2]		.500	.250	1.0	22	.250	.500	300	1.0	500K
6		.375	.250	1.0	22	.125	.250	300	1.0	300K
7		.500	.375	1.0	20	.330	.660	300	3.0	600K
• 8	RBR71 [3,4]	.312	.250	1.0	22	.125	.250	300	.3	150K
9		.750	.375	1.0	20	.500	1.0	600	4.5	1.0Meg
• 10	RBR56 [3,4]	.343	.250	1.5	20	.125	.250	200	1.0	350K
11	RBR75	.295	.250	1.5	22	.125	.250	150	.3	250K
• 12	RBR55 [3,4]	.500	.250	1.5	20	.150	.300	300	1.0	525K
13		.625	.250	1.5	20	.200	.400	500	1.5	800K
• 14	RBR54 [3,4]	.750	.250	1.5	20	.250	.500	500	2.0	850K
16		1.0	.250	1.5	20	.500	1.0	750	3.0	1.25Meg
19	RBR76	.812	.312	1.5	20	.500	1.0	500	3.5	5.0Meg
• 20		.250	.187	1.5	22	.100	.200	150	.3	125K
• 21		.375	.187	1.5	22	.125	.250	300	.3	200K
• 22	RBR74	.500	.187	1.5	22	.125	.300	300	.3	300K
23		.625	.187	1.5	22	.175	.350	600	1.0	400K
26		1.0	.187	1.5	22	.250	.500	1000	1.5	500K
30		.343	.375	1.5	20	.125	.250	300	2.0	1.0Meg
• 32		.500	.375	1.5	20	.250	.500	300	3.5	1.5Meg
• 34	RBR53 [3,4]	.750	.375	1.5	20	.330	.660	500	4.5	2.0Meg
• 36	RBR52 [3,4]	1.0	.375	1.5	20	.500	1.0	750	6.0	2.5Meg
38		1.50	.375	1.5	20	.750	1.5	1000	7.5	3.5Meg
39		2.00	.375	1.5	20	1.250	2.5	1200	10.0	4.0Meg
40		.500	.160	1.5	22	.100	.200	300	.3	500K
• 41		.250	.125	1.5	22	.050	.100	100	.2	125K
• 42		.375	.125	1.5	22	.065	.125	200	.2	200K
43		.500	.125	1.5	22	.075	.150	200	.3	300K
47		.187	.100	1.5	24	.025	.050	75	.1	50K
• 48		.312	.100	1.5	24	.030	.060	100	.1	100K
49		.437	.100	1.5	24	.040	.075	100	.2	150K
52		.500	.500	1.5	20	.330	.660	300	5.5	2.0Meg
54		.750	.500	1.5	20	.500	1.0	500	7.0	3.0Meg
• 56	RBR57	1.0	.500	1.5	20	.750	1.5	750	8.5	4.0Meg
• 68		.250	.085	1.5	24	.020	.040	100	.1	50K
69		.375	.085	1.5	24	.025	.050	100	.1	100K
340 [5]	RBR81	.500 Max.	.160 Max.	1.0	24	.100	.200	300	.55	175K
341 [5]	RBR80	.325 Max.	.160 Max.	1.0	24	.100	.200	150	.40	50K

• **Standard Style**....[1] Commercial ratings may be applied at 125°C max. provided 175°C max. operating temperature is permissible. [2] Printed Circuit Style — See previous page for dimension diagram. Standard grid spacing 200″. [3] Available in failure rate levels M, P and R. [4] MIL-R-39005 Approved. [5] Printed Circuit Style — See pevious page, Figure II for dimension diagram. Standard grid spacing for HR 340 is .400″ ±.005″ and for HR 341 is .225″ ±.005″.

2000 ER, 4000 ER & 7000 ER Series

FIG. "A" — AXIAL LEAD

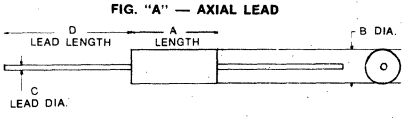


FIG "B" — PLUG-IN

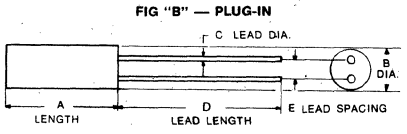
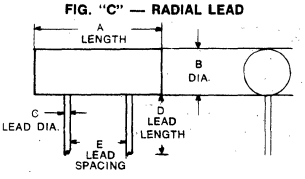


FIG. "C" — RADIAL LEAD



RCL Style	Military Style	MIL Resistance Range (Ohms)	Power Rating (Watts)	Fig.	Maximum Dimensions Length A	Diam. B	Lead Diam. C	Min. Lead Length D	Lead Spacing E ±0.005	Approx. Weight (Grams)	Style
7040-ER	RBR 52	0.1-1,200,000	0.5	A	1.020 (25.91)	0.39 (9.9)	0.034 (0.86)	1.5 (38.1)	N.A.	6.0	Axial
7030-ER	RBR 53	0.1-1,100,000	0.33	A	0.770 (19.6)	0.39 (9.9)	0.034 (0.86)	1.5 (38.1)	N.A.	4.5	Axial
7020-ER	RBR 54	0.1-562,000	0.25	A	0.770 (19.6)	0.265 (6.7)	0.034 (0.86)	1.5 (38.1)	N.A.	2.0	Axial
7010-ER	RBR 55	0.1-332,000	0.15	A	0.520 (13.21)	0.265 (6.7)	0.034 (0.86)	1.5 (38.1)	N.A.	1.0	Axial
7009-ER	RBR 56	0.1-220,000	0.125	A	0.364 (9.2)	0.265 (6.7)	0.034 (0.86)	1.5 (38.1)	N.A.	1.0	Axial
4060-ER	RBR 71	0.1-150,000	0.125	B	0.343 (8.7)	0.281 (7.1)	0.027 (0.69)	0.875 (22.2)	0.200 (5.1)*	0.3	Plug-In
R2407-ER	RBR 80	10.0-120,000	0.1	C	0.325 (8.3)	0.160 (4.06)	0.022 (0.56)	1.0 (25.4)	0.225 (5.7)	6.0	Radial
R2408-ER	RBR 81	10.0-250,000	0.1	C	0.50 (12.7)	0.160 (4.06)	0.022 (0.56)	1.0 (25.4)	0.400 (10.2)	6.0	Radial

(Metric dimensions in mm are in parenthesis) *±0.010 (±0.254)

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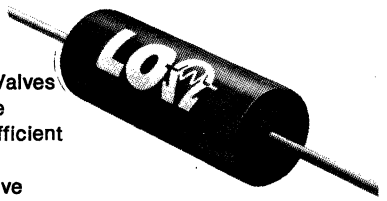
LO® Metal Element Resistors



GENERAL SPECIFICATIONS

Wattage Range: 3 and 5 watts.

Resistance Values: 0.005, 0.01, 0.015, 0.02, 0.025, 0.03, 0.04, 0.05, 0.07, 0.08, 0.1, 0.2 ohms.

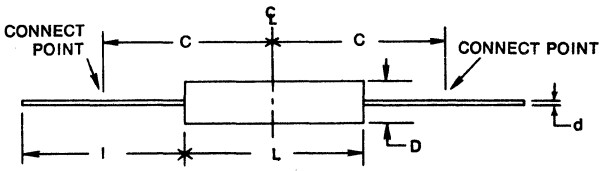
Derating: Lo Ω Metal Element Resistors are derated linearly from room temperature at full power to 0 power at 275°C.

Tolerance: 5% — All styles and values, 3% — All styles and values, 0.5% available above 0.005 ohms.

Construction: Tinned copper leads are welded directly to a low temperature coefficient of resistance element by a highly mechanized proprietary process. Resistors are encapsulated in a special formulated compound.

FEATURES

- Ultra Low Resistance Valves
- High Stability Over Life
- Low Temperature Coefficient of Resistance
- Inherently Non-Inductive

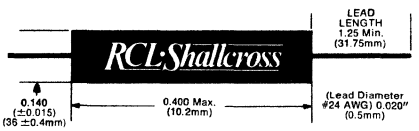


DIMENSION SPECIFICATIONS — Inches (Millimeters)

Style	L	D	C	l	d
LO-3	0.560 ±0.010 (14.224 ±0.254)	0.210 ±0.010 (5.334 ±0.254)	0.655 (16.64)	1.375 ±0.125 (34.925 ±3.175)	0.032 ±0.002 (0.813 ±0.051)
LO-5	0.920 ±0.010 (23.368 ±0.254)	0.330 ±0.010 (8.382 ±0.254)	0.835 (21.209)	1.250 ±0.125 (31.750 ±3.175)	0.040 ±0.002 (1.016 ±0.051)

Dual Function Fuse Resistors

A Dual Purpose Device That Acts As Both A Wirewound Resistor and Fuse



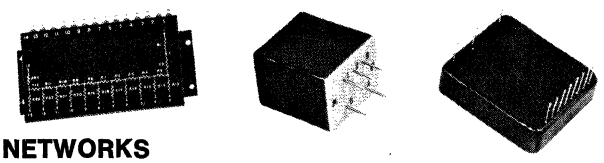
GENERAL SPECIFICATIONS

Resistance Range: 0.2Ω to 200Ω.
Resistance Tolerance: 10% is standard, 5% and 2% definition.
Operating Temperature: −55°C to +150°C
Temperature Coefficient: ±50 PPM/°C Max.

FEATURES

- Affords protection for semiconductor devices
- Eliminates fire hazard and circuit board damage to overheated components
- Eliminates unnecessary blowing due to transient conditions
- Reduces the number of discrete components required.

Discrete Resistor Networks and Matched Sets



NETWORKS

Network quality is determined by the qualities of its individual resistors and the packaging and mounting expertise of its assembler. RCL/Shallcross offers a unique background of experience, data, manufacturing and testing skills for its wirewound resistor networks. PARAMETERS: (1) Resistance ratios to .001%, (2) Resistor tolerances to ±.005% (at ambient), (3) Ratio tolerances as close as .01% (over a range of temperatures), (4) Stability to ±.001% per year.

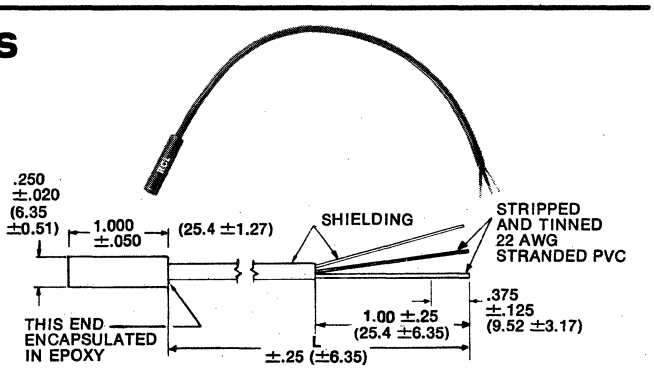
MATCHED SETS

Two or more resistors can be matched with relative tolerance much higher than each one's individual tolerance. Characteristics most often matched are: (1) DC Resistance at one or more temperatures, (2) AC and DC Voltage ratios, (3) Temperate Coefficients and (4) Phase Shifts. Principle advantages of matched sets are: (a) Very tight relative tolerances, (b) Lower cost than networks of comparable accuracy and (c) Flexibility in locating components during design and packaging. An engineering staff at RCL/Shallcross is ready to assist you in specifying your matched set requirements.

Molded Temperature Sensors

RCL offers a standard line of epoxy encapsulated sensing resistors for temperature compensating applications. The standard resistance tolerance ±5% with tighter tolerances available on special order. Cable lengths from 2.0" to 48.0" (50.80 to 1219.2 mm) are available with 6.0" (152.40 mm) standard. Operating temperature range is −55°C to +105°C. Repeatability of tempco within a given lot is ±100 PPM.

RCL Style	Resistance Range	PPM/°C Average Tempco 0°C — 100°C
TC35	10Ω — 50KΩ	3500 ±350
TC45	10Ω — 10KΩ	4500 ±450
TC55	10Ω — 5KΩ	5500 ±550



Call or write factory for complete information:

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Against this enviable background our engineers envision even greater challenges in solving future OEM and industrial resistor application problems. For prompt, practical answers to your requirements, send us your prints or specs.

AXIAL LEAD

No.	Watts	Resistance Min. Max.	Dimensions O.D. x Lgth.
3 AX	3	0.1- 10,000	¼ max. x 5/16
5 AX	5	0.1- 30,000	11/32 max. x 1 1/16
10 AX	10	0.1- 50,000	13/32 max. x 1 5/16

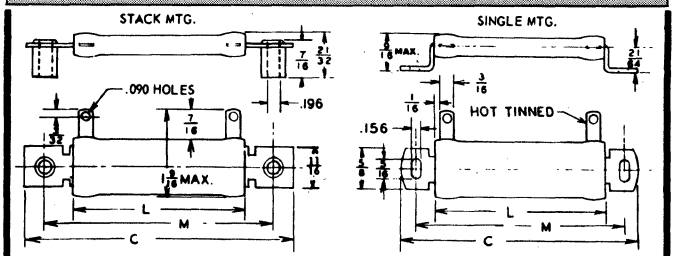
FIXED LUG

No.	Wattage	Resistance Min.-Max.	Max. Dimensions O.D. x Lgth.
1 M	5	0.1- 11,000	5/16 x 1
1¾ M	10	0.1- 50,000	5/16 x 1¾
2 E	20	0.25-100,000	7/16 x 2
2 B	25	0.25-100,000	5/16 x 2
4 B	50	0.5-175,000	5/16 x 4
6½ C	100	1.0-300,000	¾ x 6½
8½ R	160	1.0-300,000	1⅛ x 8½
10½ R	200	1.0-400,000	1⅛ x 10½

ADJUSTABLE

No.	Wattage	Resistance Min.-Max.	Max. Dimensions O.D. x Lgth.
1¾ MA	10	1.0- 10,000	5/16 x 1¾
2 BA	25	1.0- 25,000	5/16 x 2
4 BA	50	1.0-100,000	5/16 x 4
6 BA	75	1.0-100,000	5/16 x 6
6½ CA	100	1.0-100,000	¾ x 6½
8½ RA	160	1.0-100,000	1⅛ x 8½
10½ RA	200	1.0-100,000	1⅛ x 10½

FLAT OVAL



Watts* Free Air	Core—L	Min. Ohms	Max. Ohms	Mounting	C	M
30	1¼	0.1	10K	Single Stack	2⅛ 2½	1¾ 2
40	2	0.2	30K	Single Stack	2⅞ 3¼	2½ 2¾
55	3½	0.3	60K	Single Stack	4⅜ 4¾	4 4¼
65	4¾	0.4	85K	Single Stack	5⅝ 6	5¼ 5½
75	6	0.5	100K	Single Stack	6⅞ 7¼	6½ 6¾

* Ratings of flat oval resistors based on mounting on steel panel 10" x 10" x .040". When mounted on non-metallic surface, reduce wattage approximately 15%.

RIBBON-WOUND RESISTORS

Watts	Core Size D	Core Size L	Ohms Min. Res.	Ohms Max. Res.	Watts	Core Size D	Core Size L	Ohms Min. Res.	Ohms Max. Res.
400	1⅛	11¼	0.24	18.00	135	¾	5	0.06	4.25
375	1⅛	10½	0.22	16.50	105	¾	4	0.04	3.00
300	1⅛	8½	0.17	13.00	100	¾	3½	0.03	2.40
240	1⅛	6½	0.11	8.20	135	5/16	6	0.06	5.50
185	1⅛	5	0.09	6.40	105	5/16	5	0.05	3.65
180	¾	6½	0.08	6.00	90	5/16	4	0.04	2.75

Available with adjustable tap bands or with tapped windings.

NON-INDUCTIVE RESISTORS: for high frequency power circuits. Available in all fixed-lug types, 10 watts and larger. Standard tolerances: ±10%.

RESISTANCE TOLERANCES: Standard: ±5%, 1.0 ohm and over. Special: down to ±1%.

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RESNET® ULTRA PRECISION METAL FILM RESISTORS & NETWORKS

RESISTANCE TOLERANCES — 0.005% to 1%

TEMPERATURE COEFFICIENT — 1, 2, 5, or 10ppm/°C

FEATURES

- Long Term Stability: 25ppm/year
- Noise Factor: Below 30db
- Inductance: Approx. .05 microhenry
- Capacitance: Below 0.5 picofarad
- Voltage Coefficient: < 2ppm/volt
- Rise Time: Less than 1ns without ringing

PERFORMANCE MEETS OR EXCEEDS REQUIREMENTS OF MIL-R-55182

	S-50	S-100	X-100	S-120	S-300	S-302	C-200	C-202
Resistance Range and Wattage	1 ohm to 50K .125 watt	1 ohm to 150K .3 watt	1 ohm to 150K .3 watt	20 ohms to 200K .3 watt	50 ohms to 1 Meg. .5 watt	75 ohms to 1.5 Meg. .75 watt	1 ohm to 50K .100 watt	1 ohm to 200K .25 watt
Size	H .200 ± .020 L .295 ± .010 W .100 ± .010	H .320 ± .020 L .295 ± .010 W .100 ± .010	H .320 ± .020 L .295 ± .010 W .100 ± .010	H .320 ± .020 L .565 ± .020 W .150 ± .010	H .520 ± .020 L .565 ± .020 W .150 ± .010	H .520 ± .020 L .810 ± .010 W .150 ± .010	L .250 ± .10 D .125 ± .010	L .500 ± .020 D .250 ± .010
Lead Spacing	.150 ± .010	.150 ± .010	Center	.400 ± .020	.400 ± .020	.650 ± .020	Center	Center

CUSTOM RESISTOR NETWORKS

DUAL-IN-LINE (DIP)
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MATCHING & TRACKING
AS GOOD AS .005% I PPM/°C
PER CUSTOMER SPECIFICATIONS

Other Packages Available

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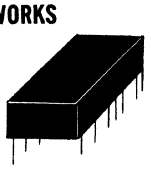
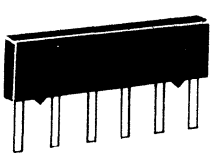
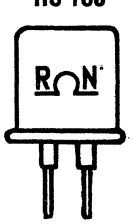
Packaging Capability



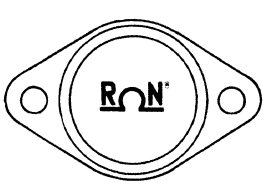


ULTRA-PRECISION HERMETIC SEAL METAL FILM HS-100



Resistance to 150K
Tolerance to .005%
TC to 1PPM/°C

PRECISION HERMETIC SEAL METAL FILM POWER RESISTOR P-300

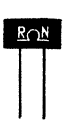
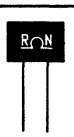
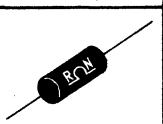
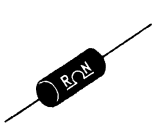


Power: 10 Watts (Heat Sink)
3 Watts (Free Air)
Tolerance to ±.01%
TC to 10ppm/°C
Standard TO-3 Package

FILMET®
NEW ECONOMY SERIES / HIGH PRECISION METAL FILM RESISTORS

COST COMPETITIVE WITH WIRE-WOUND

TC = 10ppm/°C Tolerance to .01%

STYLE	OUTLINE DWG.	MAX. DIMENSIONS	RESISTANCE RANGE
LC-50		H = .200 L = .320 W = .120 LS = .150	10Ω — 50K .125 Watt
LC-100		H = .345 L = .320 W = .120 LS = .150	10Ω — 150K .3 Watt
LC-200		L = .250 D = .125	10Ω — 50K .100 Watt
LC-202		L = .500 D = .250	10Ω — 200K .3 Watt

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(201) 887-2260 • TOLL FREE (800) 526-0704 EXCEPT N.J.

CARBORUNDUM® NON-INDUCTIVE POWER RESISTORS

Choose Type SP for great A-C power handling capability, whether it be at power frequency or many megahertz.

Choose Type A when high resistance is required in a high power non-inductive resistor.

Choose Type AS for its ability to absorb huge amounts of energy and for its non-inductive property at high voltage.

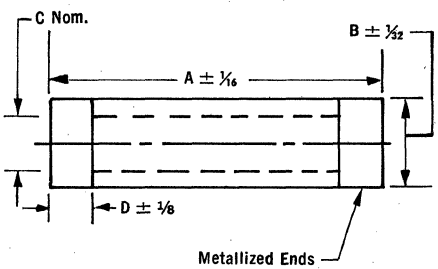
CHARACTERISTICS	Type SP	Type AS	Type A
Maximum Operating Temperature: °C	350	230 150*	230
Temperature Coefficient: Percent per degree C, −55°C to maximum rated temperature	±0.075	−0.075	−0.20
Voltage Coefficient: Maximum percent per kilovolt per inch active length (overall length less termination)	1.0	1.0	–
Short Time Overload: Maximum percent change after 5 cycles 10 times rated power, 5 seconds on, 90 seconds off	2.0	2.0	–
Moisture Resistance: Maximum percent change when tested per MIL-STD-202 method 103	2.5	2.5	2.5

*with epoxy insulation for use in oil

STANDARD SIZES

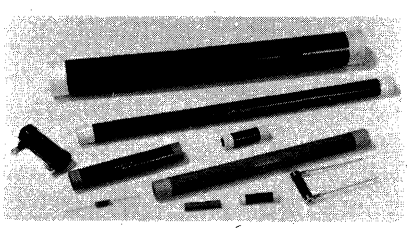
(Special sizes are also available: consult factory.)

Type	A	B	C (SP & AS)	C (A)	D
884 SP	2.0	0.50	0.22	—	0.25
885 SP, AS, & A	2.5	0.75	0.50	0	0.50
886 SP, AS, & A	5.0	0.75	0.50	0	0.62
887 SP, AS, & A	6.0	1.00	0.75	0.5	0.50
888 SP, AS, & A	8.0	1.00	0.75	0.5	0.88
889 SP, AS, & A	12.0	1.00	0.75	0.5	0.88
890 SP, AS, & A	18.0	1.00	0.75	0.5	0.88
891 SP	18.0	2.00	1.50	—	1.00
892 SP	24.0	2.00	1.50	—	1.00



SERIES 800 AND 1000

This general line is available in a wide variety of sizes and terminations. They retain the non-inductive and heavy load characteristics of all Carborundum ceramic resistors. These resistors can handle up to 1000 watts, 165 KJ and 165 KV in resistance values from 1 ohm to 1 megohm.



Parts are specified by the four or five character type number (for example 885SP, 888AS, 890A), the first two digits of the resistance, a single digit to indicate the power of ten multiplier, and a "J" for ±5%, a "K" for ±10%, or an "L" for ±20%. Where the resistance is less than ten ohms, the power of ten multiplier is not used, and an "R" replaces the decimal point. Thus R50 = 0.50 ohm, 7R5 = 7.5 ohm, 220 = 22.0 ohm, 152 = 1500 ohm, etc. *Type AS with a suffix letter to part number denotes optional construction: "D" for dielectric coating; "O" for oil application; "N" for No Arc terminal. Consult Customer Service for additional options and part number detail. A typical part number would be 886AS501KD. This represents a type AS resistor, 5" long x ¾" diameter, 500 ±10% ohms, with dielectric coating.

ELECTRICAL SPECIFICATIONS

Length and Diameter	Type	Resistance Available (ohms) Min.	to Max.	Average Power @ 40°C (watts)	Peak Energy (joules)	Peak Voltage (volts)
2" x ½"	884SP	1.0	200	22.5	250	1,000
2½" x ¾"	885SP	1.0	130	45	250	1,000
	885AS	6.0	1200	15	2,800	4,000
	885AS..D*	6.0	1200	15	2,800	8,000*
	885A	1500	220K	15	750	3,750
5" x ¾"	886SP	1.0	330	90	500	4,000
	886AS	15.0	3300	30	7,000	10,000
	886AS..D*	15.0	3300	30	7,000	20,000*
	886A	3900	390K	30	1,500	10,000
6" x 1"	887SP	1.0	330	150	1,600	4,000
	887AS	12.0	3300	50	13,000	15,000
	887AS..D*	12.0	3300	50	13,000	30,000*
	887A	3900	390K	50	6,000	12,000
6" x 1½"	1026AS	5.0	1200	70	37,000	15,000
	1026AS..D*	5.0	1200	70	37,000	30,000*
8" x 1"	888SP	1.0	390	190	2,100	6,000
	888AS	15.0	3900	75	16,500	22,500
	888AS..D*	15.0	3900	75	16,500	45,000*
	888A	4700	470K	60	7,500	15,000
8" x 1½"	1028AS	6.5	1875	100	46,000	22,500
	1028AS..D*	6.5	1875	100	46,000	45,000*
12" x 1"	889SP	1.0	680	275	3,200	10,000
	889AS	25.00	6800	100	27,000	37,500
	889AS..D*	25.00	6800	100	27,000	75,000*
	889A	8200	680K	90	12,500	25,000
12" x 1½"	1032AS	9.0	2500	150	75,000	37,500
	1032AS..D*	9.0	2500	150	75,000	75,000*
18" x 1"	890SP	1.0	1000	375	4,200	16,000
	890AS	40.0	10K	150	43,000	60,000
	890AS..D*	40.0	10K	150	43,000	120,000*
	890A	12K	1M	125	20,000	40,000
18" x 1½"	1038AS	15.0	3800	225	119,000	60,000
	1038AS..D*	15.0	3800	225	119,000	120,000*
18" x 2"	891SP	1.0	450	750	15,000	16,000
24" x 2"	892SP	1.0	600	1000	17,500	22,000
24" x 1½"	1044AS	20.0	4800	300	164,000	82,500
	1044AS..D*	20.0	4800	300	164,000	165,000*

Sohio Engineered Materials Company
Refractories Division, Electric Products Plant
Post Office Box 339, Niagara Falls, NY 14302
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SOHIO CARBORUNDUM

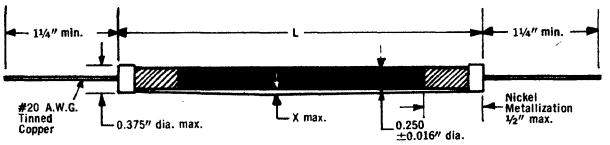
CARBORUNDUM® NON-INDUCTIVE POWER RESISTORS FOR SPECIAL PROBLEM SOLUTIONS

Series 102/104/106/109AS & SP Pencil-type Resistors

These ¼" diameter resistors are available in a variety of lengths. Pencil shaped resistors offer unique non-inductive and high-voltage properties in a compact, easily-wired configuration.

Type AS for high voltage and energy applications.

Type SP for high AC power handling capabilities.



Length	Type No.	Resistance Available (ohms) Min.	Resistance Available (ohms) Max.	Average Power @ 40°C (watts)	Peak Energy (joules)	Peak Voltage (volts)
2"	102AS	30	9,000	5	600	3,000
	102SP	1	700	15	50	1,000
4"	104AS	55	18,000	9	1,200	9,000
	104SP	2	1,500	25	95	3,600
6"	106AS	90	30,000	13	1,900	15,000
	106SP	3	2,400	36	155	5,000
9"	109AS	150	48,000	20	3,000	25,000
	109SP	4	3,800	55	250	8,800

TYPE 234 AND 231 RESISTORS

Carborundum type 234 and 231 resistors are a small size non-inductive bulk type resistor (there are no spirals or windings), capable of dissipating a full 10 watts of power (Type SP) or absorbing **275** Joules of energy (Type AS).

234 — ¼" x 1"
231 — 5/32" x ¾"

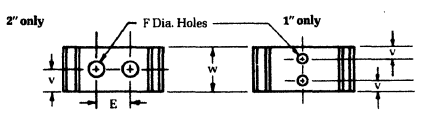
Specifications	234SP	234AS	231SP	231AS
Resistance, ohms ±5%, ±10%, ±20%	1-330	12-5000	1-1000	25-6250
Peak Voltage	500 Volts	2.5kv	375 Volts	1.5kv
Power at 40°C	10 Watts	3 Watts	2.5 Watts	1.5 Watts
Derate Linearly to 0 Watts at	350°C	230°C	350°C	230°C
Max operating temperature	350°C	230°C	350°C	230°C
Peak Energy	30 Joules	**275** Joules	15 Joules	75 Joules

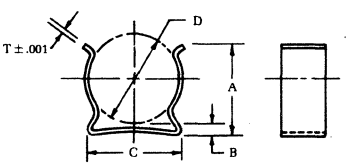
Characteristics	234SP	234AS	231SP	231AS
Short Time Oveload	5% max.	1% max.	3.5% max.	1% max.
• 10 Cycles of 1000% rated power • 5 sec. on, 90 sec. off				
Life test 1000hr rated power	5% max.	5% max.	5% max.	5% max.
Temperature Coefficient	±0.075% /°C	−0.075% /°C	±0.075% /°C	−0.075% /°C

Termination and Mounting

Electrical connection to the resistive bodies of resistors is made by flame-sprayed metal end bands. The standard metal is aluminum for type SP, nickel for types AS and A. Special terminations of brass or copper overspray or tinned ends are readily available specials. Add "B," "C," or "T" respectively to the part number to designate these special terminations.

In most cases, connections to the resistors may be made by stock clips such as these:





CLIPS DIMENSIONS

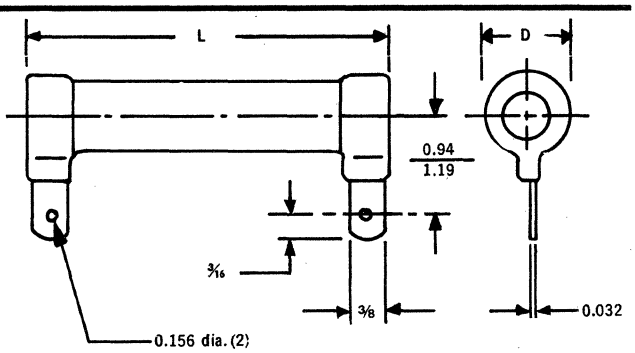
Stock No.	Size	Holes	A	B	C	D	E	F	T	V	W
35370	½"	1	0.620	0.090	0.560	0.500		0.093	0.020	0.188	0.375
35267	¾"	1	0.940	0.155	0.830	0.750		0.144	0.020	0.312	0.625
35268	1"	2	1.230	0.170	1.070	1.000		0.128	0.024	0.156	0.625
35371	1½"	2	1.650	0.100	1.650	1.500	0.925	0.103	0.032	0.250	0.500
35269	2"	2	2.375	0.544	1.080	2.000	0.375	0.125	0.043	0.375	0.750

Material: Beryllium Copper
Finish: Electro Tin Plate

TYPE AS EPOXY COATED STYLE

Carborundum Type AS High-Energy Ceramic Resistors are available with an epoxy coating which protects the resistors body from contaminants. It is especially useful where the resistor is employed in an application where it is not protected from a dirty ambient atmosphere or where it is immersed in a cooling or dielectric fluid. Energy level in oil should not exceed 300 joules/cc.

The overall length, L, of the coated resistor is approximately 0.25" longer than the uncoated part; the diameter, D, is approximately 0.30" greater. Coated resistors are also available with an axial mounted cab.



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SOHIO CARBORUNDUM

CARBORUNDUM® NON-INDUCTIVE POWER RESISTORS FOR SPECIAL PROBLEM SOLUTIONS

TYPE AS DISC AND WASHER STYLES

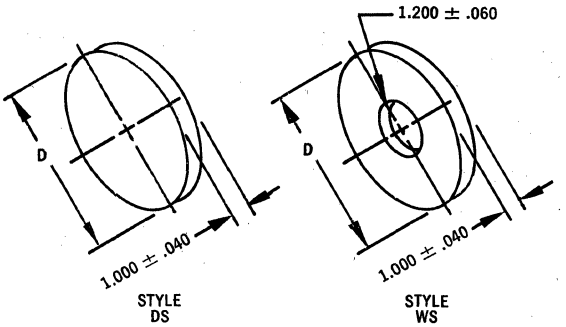
Carborundum Type AS Disc and Washer Ceramic Resistors are a bulk-type low resistance element, and therefore have the ability to absorb instantaneously great surges of energy with virtually zero inductance.

Maximum Peak Voltage: 5000 volts.

Maximum Temperature: 230°C.

Power Rating: In free air, parts will safely dissipate 2.5 watts per square inch of surface area at 40°C.

Temperature Coefficient of Resistance: −0.1%/°C to 0.0%/°C.



Style		Diameter "D" (inches)	Peak Energy (joules)	Available Resistances	
				Minimum	Maximum
911DS	Solid Disc	1.60 ± 0.06	9,000	1.6	100
912DS	Solid Disc	2.37 ± 0.06	21,000	0.7	90
913DS	Solid Disc	3.00 ± 0.08	33,000	0.5	56
914DS	Solid Disc	3.75 ± 0.08	52,500	0.3	36
913WS	Washer	3.00 ± 0.08	27,600	0.5	78
914WS	Washer	3.75 ± 0.08	47,000	0.3	40
915WS	Washer	4.37 ± 0.08	65,500	0.2	28
916WS	Washer	4.75 ± 0.08	79,500	0.2	24

CARBORUNDUM® VARISTORS

Standard varistors described below have a 10% tolerance on voltage. Also available: leadless discs and rods, voltages specified at intermediate values or at other currents, and voltage tolerances of ±15% and ±20%. Available at extra cost: voltage tolerances of ±5% and ±7%, color coding, and special coatings.

Standard rod varistors have a blue epoxy coating. Available at extra cost: formed leads for printed circuit board insertion.

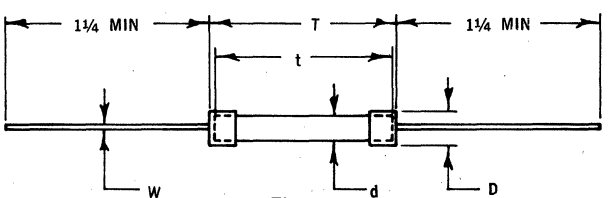


Figure 1

Standard disc varistors have a black flame-retardant PVC coating. Also available: Glyptal coating and kinked leads for printed circuit board insertion.

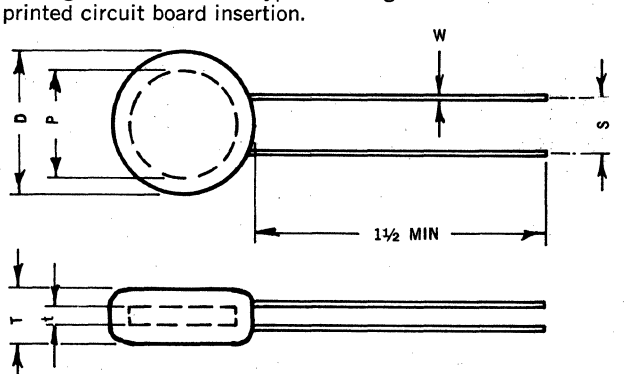


Figure 2

VOLTAGES AVAILABLE

	Carborundum Style Number	Volts ±10% at 1.0 MA	Volts at 1.0 MA Volts at .1 MA	Peak Voltage	Power Watts	d ±.030	t ±.030	D max.	T max.	w nom.	s nom.
ROD STYLES (Figure 1)	231BNR4-	100-750	2.1-1.7	800	0.750	0.156	0.625	0.250	0.812	0.032	—
	233BNR4-	68-710	2.1-1.7	800	1.000	0.250	0.625	0.375	0.812	0.032	—
	234BNR4-	135-1050	2.2-1.7	1500	1.500	0.250	1.000	0.375	1.188	0.032	—
	Carborundum Style Number	**Volts ±10% at 1.0 MA**	**Volts at 1.0 MA Volts at .1 MA**	**Peak Voltage**	**Power Watts**	**d ±.030**	**t ±.030**	**D max.**	**T max.**	**w nom.**	**s nom.**
DISC STYLES (Figure 2)	551BNR2-	9-88	2.4-1.8	100	0.250	0.250	0.062	0.400	0.350	0.020	0.125
	432BNR2-	6-90	2.9-1.7	100	0.500	0.500	0.062	0.650	0.350	0.032	0.250
	379BNR2-	12-180	2.9-1.7	200	0.500	0.500	0.125	0.650	0.400	0.032	0.250
	328BNR2-	2-80	3.0-1.7	100	0.750	0.750	0.062	0.900	0.350	0.032	0.375
	925BNR2-	12-160	2.4-1.7	150	0.750	0.750	0.100	0.900	0.380	0.032	0.375
	Carborundum Style Number	**Volts ±10% at 5.0 MA**	**Volts at 5.0 MA Volts at .5 MA**	**Peak Voltage**	**Power Watts**	**d ±.030**	**t ±.030**	**D max.**	**T max.**	**w nom.**	**s nom.**
	923BNR2-	13-150	2.2-1.7	150	1.500	1.000	0.100	1.150	0.380	0.040	0.375
	463BNR2-	10-190	2.2-1.7	200	1.500	1.000	0.125	1.150	0.400	0.040	0.375
	927BNR2-	9-140	2.7-1.9	150	2.250	1.250	0.100	1.400	0.380	0.040	0.375

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Refractories Division, Electric Products Plant
Post Office Box 339, Niagara Falls, NY 14302
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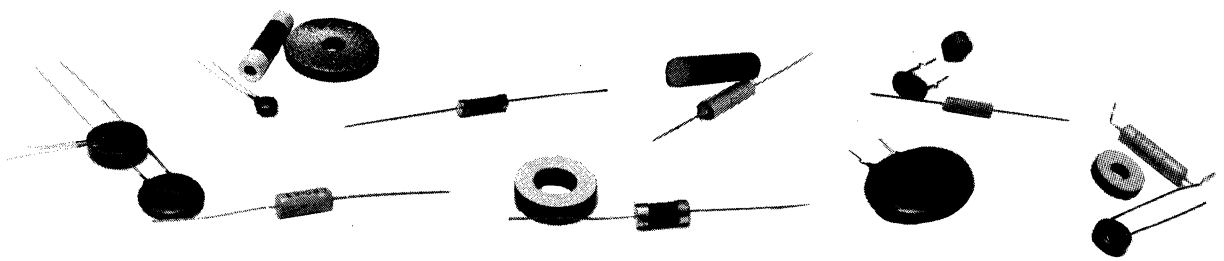
SOHIO CARBORUNDUM

CARBORUNDUM® VARISTORS



Carborundum silicon carbide varistors are voltage-dependent resistors which are offered in a wide variety of configurations, including discs, rods, and washers. In addition to the sizes shown on these pages, rods are available up to 18 inches in length, washers are available up to 3½ inches in diameter. Typical uses include limitation of peak discharges, spike suppression, stabilization of voltages, and generation of nonlinear functions.

Varistors are specified by the voltage measured across them, suitably toleranced, at some constant current. The slope of the voltage-current characteristic is most often given by the maximum voltage ratio for two specified currents.

In general the characteristic for a varistor may be approximated by the equation:

$$i = Ke^n$$

where i and e are instantaneous current and voltage respectively, K is a proportionality constant, and n is an exponent applicable in the range in which the varistor is used: most often it is between 3 and 5.

The silicon carbide varistor is a "forgiving" component. When hit by a voltage surge, the energy is absorbed throughout its body, not at a junction. A voltage surge beyond the design level causes substantial increase in current and energy absorption, but not a catastrophic failure.

SMALL DISC VARISTORS

Carborundum Part Number	Volts ±10% @ 1.0 ma.	Volts @ 1.0 ma. ÷ Volts @ 0.1 ma. (maximum)
432BNR2-406	6.8	2.70
432BNR2-407	8.2	2.60
432BNR2-408	10.0	2.50
432BNR2-409	12.0	2.35
432BNR2-410	15.0	2.20
432BNR2-411	18.0	2.10
432BNR2-412	22.0	2.00
432BNR2-413	27.0	1.90
432BNR2-414	33.0	1.84
432BNR2-416	47.0	1.80
432BNR2-418	68.0	1.76
432BNR2-420	100.0	1.72
379BNR2-410	15.0	2.50
379BNR2-412	22.0	2.40
379BNR2-414	33.0	2.30
379BNR2-415	39.0	2.20
379BNR2-416	47.0	2.10
379BNR2-417	56.0	2.00
379BNR2-418	68.0	1.95
379BNR2-419	82.0	1.90
379BNR2-420	100.0	1.84
379BNR2-421	120.0	1.78
379BNR2-422	150.0	1.74
379BNR2-423	180.0	1.70
328BNR2-400	2.2	3.60
328BNR2-401	2.7	3.40
328BNR2-402	3.3	3.20
328BNR2-403	3.9	3.00
328BNR2-404	4.7	2.80
328BNR2-405	5.6	2.60
328BNR2-406	6.8	2.50
328BNR2-407	8.2	2.40
328BNR2-408	10.0	2.30
328BNR2-409	12.0	2.20
328BNR2-410	15.0	2.10
328BNR2-411	18.0	2.00
328BNR2-412	22.0	1.95
328BNR2-413	27.0	1.90
328BNR2-414	33.0	1.85
328BNR2-416	47.0	1.76

LARGE DISC VARISTORS

Carborundum Part Number	Volts ±10% @ 5.0 ma.	Volts @ 5.0 ma. ÷ Volts @ 0.5 ma. (maximum)
463BNR2-410	15.0	2.40
463BNR2-412	22.0	2.20
463BNR2-414	33.0	2.10
463BNR2-415	39.0	2.02
463BNR2-416	47.0	1.98
463BNR2-417	56.0	1.94
463BNR2-418	68.0	1.90
463BNR2-419	82.0	1.86
463BNR2-420	100.0	1.82
463BNR2-421	120.0	1.78
463BNR2-422	150.0	1.74
463BNR2-423	180.0	1.70
927BNR2-408	10.0	2.90
927BNR2-409	12.0	2.80
927BNR2-410	15.0	2.70
927BNR2-411	18.0	2.60
927BNR2-412	22.0	2.50
927BNR2-413	27.0	2.40
927BNR2-414	33.0	2.30
927BNR2-416	47.0	2.20

ROD VARISTORS

Carborundum Part Number	Volts ±10% @ 1.0 ma.	Volts @ 1.0 ma. ÷ Volts @ 0.1 ma. (maximum)
233BNR4-417	56.0	2.50
233BNR4-418	68.0	2.40
233BNR4-419	82.0	2.30
233BNR4-420	100.0	2.20
233BNR4-421	120.0	2.10
233BNR4-422	150.0	2.00
233BNR4-423	180.0	1.90
233BNR4-424	220.0	1.82
233BNR4-425	270.0	1.78
233BNR4-426	330.0	1.76
233BNR4-428	470.0	1.74
233BNR4-430	680.0	1.70
234BNR4-426	330.0	2.00
234BNR4-427	390.0	1.90
234BNR4-428	470.0	1.80
234BNR4-429	560.0	1.77
234BNR4-430	680.0	1.74
234BNR4-431	820.0	1.70
234BNR4-432	1000.0	1.68

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SOHIO CARBORUNDUM

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A

AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire gauge

B

BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C

CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D

D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E

EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F

FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G

GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H

HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I

IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J

JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K

kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L

LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M

MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microforad
MHz megahertz
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOSIGT metal-oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N

NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM nuclear instrumentation module
NOR not OR
NTC negative temperature coefficient

O

OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P

PC printed circuit
PCB printed circuit board
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLL phased lock loop
PPI plan position indicator
PROM programmable read only memory
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q

QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R

RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S

SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T

TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U

UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V

VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W

WPS word processing software

Y

YIG yttrium iron garnet

Z

ZIF zero insertion force

Thick-Film Chip Resistors

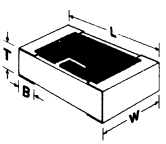
Chip resistors were State of the Art's first manufactured product, and in the years since we started production our resistor chip line has grown into the broadest range of thick film chip resistors offered anywhere. We offer lower values, higher values, closer tolerances, flatter temperature coefficients, smaller sizes, etc., etc.

RESISTOR PERFORMANCE

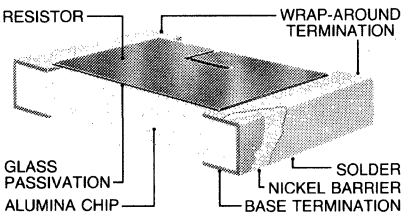
PERFORMANCE CHARACTERISTICS STANDARD PRODUCTION	MAX CHANGE IN RESISTANCE
RESISTANCE TO SOLDERING	0.5%
THERMAL SHOCK	0.5%
SHORT TIME OVERLOAD	0.5%
HIGH TEMPERATURE STORAGE	1.0%
LOAD LIFE (1000 hrs)	1.0%

SIZES AVAILABLE

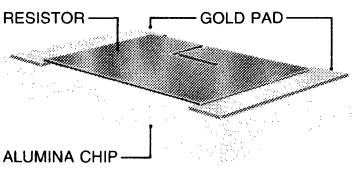
State of the Art offers fourteen standard resistor chip sizes, ranging from the extremely compact .030 x .020 inch chip to a 2-watt chip measuring .250 x .125 inch.



OTHER SIZES AVAILABLE
0703
1002
1507
CHECK WITH FACTORY FOR FULL DETAILS



STYLE C CONSTRUCTION



STYLE A CONSTRUCTION

TABLE I | MEASUREMENT IN INCHES / MEASUREMENT IN mm — 1mm = .03937 inch.

SIZE CODE	LENGTH (L)	WIDTH (W)	MAXIMUM THICKNESS (T)	END-BAND (B)	MAXIMUM POWER (mW)	MAXIMUM VOLTAGE
0302	.030±.005 .76 ±.13	.020±.005 .51 ±.13	.015 .38	.004- .015 .10 - .38	35	15
0402	.040±.005 1.02 ±.13	.020±.005 .51 ±.13	.020 .51	.007- .015 .18 - .38	50	30
0404	.035±.005 .89 ±.13	.035±.005 .89 ±.13	.020 .51	.006- .015 .15 - .38	35	25
0504	.050±.005 1.27 ±.13	.040±.005 1.02 ±.13	.020 .51	.007- .017 .18 - .43	125	40
0705	.075±.007 1.91 ±.18	.050±.005 1.27 ±.13	.020 .51	.007- .020 .18 - .51	200	50
1005	.100±.008 2.54 ±.21	.050±.005 1.27 ±.13	.020 .51	.010- .025 .25 - .64	250	75
1206	.120±.010 3.05 ±.25	.060±.005 1.50 ±.13	.025 .64	.010- .030 .25 - .76	250	200
1505	.150±.010 3.81 ±.25	.050±.005 1.27 ±.13	.020 .51	.010- .030 .25 - .76	330	100
1010	.100±.010 2.54 ±.25	.100±.010 2.54 ±.25	.020 .51	.010- .025 .25 - .64	500	75
2010	.200±.010 5.08 ±.25	.100±.010 2.54 ±.25	.030 .76	.020- .040 .51 -1.02	1000	125
2512	.250±.010 6.35 ±.25	.125±.010 3.18 ±.25	.030 .76	.030- .050 .76 -1.27	2000	150

PART NUMBERING SYSTEM

Our part numbering system is explained on the right. As an example, we show the part number of our standard production; passivated; 50 x 40-mil chip; with pretinned nickel barrier wrap-around terminations, 15 ohm ±5%. The part number is S0504CPX150J:

If in doubt about the proper codes, or if there is more information to be transmitted than the part number can carry, use plain language.

S 0504 CPX 150 J

SPECIAL TERMINATION
G - Gold **PS** - Platinum/silver **PG** - Platinum gold

TCR CERTIFICATION
05: 50 ppm/°C **10:** 100 ppm/°C **20:** 200 ppm/°C **30:** 300 ppm/°C

RESISTANCE TOLERANCE
M: 20% **K:** 10% **J:** 5% **G:** 2% **F:** 1% **D:** ½%

RESISTANCE VALUE
Use a three or four digit code. Four digits are used for 1% tolerance or lower, otherwise three digits are used. The first two or three digits represent significant figures and the last digit specifies the number of zeros to follow. The letter "R" shall be used to represent the decimal point when fractional values of an ohm are required; i.e., 1 ohm = 1R0; 4.7 ohms = 4R7; 16.9 ohms = 16R9, etc.

P: Passivated (glass)
X: Tinned NICKEL BARRIER
U: Untrimmed resistor

TERMINATION STYLE
A — Single surface for gold wire bonding
C — Wrap-around style
D — Metallized bottom side
E — Metallized bottom with one side wrap-around

SIZE CODE
See Table I for size code

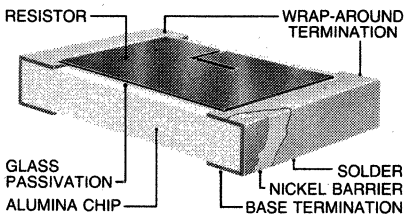
PREFIX
C — Commercial/industrial (please consult factory)
S — Standard production
H — High reliability testing

CALL TOLL FREE
800-458-3401*

State of the Art, Inc.
2470 FOX HILL ROAD, STATE COLLEGE, PA 16803-1797
*IN PA DIAL 814-355-8004, TELEX 866633, SOURCE CODE 56235

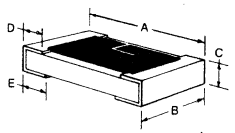
MIL-R-55342 Thick Film Chip Resistors

CHARACTERISTICS



TECHNICAL SPECIFICATIONS	TEMPERATURE CHARACTERISTICS K	M
RESISTANCE TEMPERATURE CHARACTERISTICS	0 ± 100	0 ± 300
MAXIMUM AMBIENT TEMP. FULL POWER	70°C	70°C
MAXIMUM TEMPERATURE ZERO WATTAGE	125°C	125°C
THERMAL SHOCK (max. % change)	± 0.50	± 0.50
LOW TEMP. OPERATION (max. % change)	± 0.25	± 0.50
SHORT TIME OVERLOAD (max. % change)	± 0.25	± 0.50
HIGH TEMPERATURE EXPOSURE (max. % change)	± 0.50	± 1.00
RESISTANCE TO BONDING EXPOSURE (max. % change)	± 0.25	± 0.25
MOISTURE RESISTANCE (max. % change)	± 0.50	± 0.50
LIFE, 2000 HOURS (max. % change)	± 0.50	± 2.00

DIMENSIONS



SIZE	RM0505	RM0705	RM1005	RM1505	RM2208
LENGTH A	.050 +.010 −.005	.075 +.010 −.005	.100 +.010 −.005	.150 +.010 −.005	.225 +.010 −.005
WIDTH B	.050 +.005 −.005	.050 +.005 −.005	.050 +.005 −.005	.050 +.005 −.005	.075 +.005 −.005
THICKNESS C	.015 +.007 −.000	.015 +.007 −.000	.015 +.007 −.000	.015 +.007 −.000	.025 +.007 −.000
TOP END BAND D	.010 ±.005	.015 ±.005	.015 ±.005	.015 ±.005	.015 ±.005
BOTTOM END BAND E	.015 ±.005	.015 ±.005	.015 ±.005	.015 ±.005	.015 ±.005

OUR MIL-R-55342 TERMINATIONS FEATURE NICKEL BARRIER

PRODUCTION TESTING

Inspection of Product for Delivery

Production testing of product for delivery consists of group A and group B inspections. Each production lot or batch of chip resistors must pass this screening before shipment can be authorized.

Each production batch must be subjected to and pass the group A screening listed below. Sub-group 2 sampling is in accordance with MIL-STD-105, general inspection level II.

Each production batch must also pass the group B tests below. Sampling is in accordance with MIL-STD-105, special inspection level S-4.

GROUP A — INSPECTION

SUBGROUP 1
THERMAL SHOCK
DC RESISTANCE
SUBGROUP 2
VISUAL and MECHANICAL INSPECTION

GROUP B — INSPECTION

SUBGROUP 1
RESISTANCE to BONDING EXPOSURE
RESISTANCE-TEMPERATURE CHARACTERISTICS
LOW-TEMPERATURE OPERATION
SHORT TIME OVERLOAD
SUBGROUP 2
ADHESION
SUBGROUP 3
SOLDERABILITY

PACKAGING

Resistors are packaged in anti-static waffle packs. Individual chips are not marked. Each package contains a noncorrosive label indicating source code, lot number, military part number, quantity, date code, resistance value and tolerance. Unit packages are heat sealed in water-vapor proof conductive bags in conformance with MIL-B-81705 (type I) and are labeled per MIL-STD-129.

PART NUMBERING SYSTEM

To order MIL-R-55342 thick film chip resistors, use part numbers as in the following example. A .075" x .050", 6800 ohm, ± 5% tolerance, ± 100 PPM, tinned, wrap-around resistor is properly indicated with part number: M55342/6—K682JRM, which has the code elements shown below.

M55342/6-K 682 J R M

LIFE FAILURE RATE DESIGNATION
M: 1% per 1000 hours **R:** 0.01% per 1000 hours
P: 0.1% per 1000 hours **S:** 0.001% per 1000 hours

TERMINATION MATERIAL
R: Pre-tinned, wrap-around style
(untinned is not available)

RESISTANCE TOLERANCE
F: ± 1% **G:** ± 2% **J:** ±5% **K:** ± 10%

RESISTANCE
Use a three or four digit code. Four digits are used for 1% tolerance, otherwise three digits are used. The first two or three digits represent significant figures and the last digit specifies the number of zeros to follow. The letter "**R**" shall be used to represent the decimal point when fractional values of an ohm are required.

TEMPERATURE CHARACTERISTICS
K: ± 100 PPM per °C **M:** ± 300 PPM per °C

SIZE
M55342/2: Style RM0505 (.050" x .050") — 50mW, 40v
M55342/6: Style RM0705 (.075" x .050") —100mW, 50v
M55342/3: Style RM1005 (.100" x .050") —100mW, 40v
M55342/4: Style RM1505 (.150" x .050") —150mW, 40v
M55342/5: Style RM2208 (.225" x .075") —225mW, 40v

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*IN PA DIAL 814-355-8004, TELEX 866633, SOURCE CODE 56235

Custom Networks

State of the Art produces a variety of custom conductor networks, resistor networks, and resistor capacitor networks in low and high volume. Most of our customers are in one of the following categories:

1) Hybrid firms
2) Non-hybrid manufacturers who, for one reason or another, can use a thick film circuit (as an example, a pulse transformer manufacturer who uses an RC network, but one that fits into a molded DIP package).
3) Thin-film houses that use thick-film substrates from time to time.

State of the Art can quote and manufacture from a complete network layout or from a schematic with size, component and output pad location requirements. Our design department will be glad to assist you in designing your network to achieve your lowest cost.

NETWORK CONSTRUCTION

SUBSTRATE: 96% Alumina std — 99% Alumina optional
THICKNESS: .025 inch std — .012 .015. 020 .040 inch optional
LINEAR TOOLING: Laser scribed, green scored, diamond saw cut
HOLE TOOLING: Laser drilled, green punched
CONDUCTORS: Silver, palladium silver, platinum silver, gold, platinum gold, etc. NICKEL BARRIER is available on some types of networks.
RESISTORS: Screened on substrate or thick film chip
PASSIVATION: Glass or silicone based
TINNING: Solder dip or solder paste
CAPACITORS: Screened on thick film or multilayer ceramic chip
COMPONENT MOUNTING: Conductive epoxy or solder reflow; Other components: consult factory

Surface Mount Resistor Networks

SLAMDIP

The SLAMDIP resistor network is the first of a series of surface mount resistor networks under development at SOTA*.

When State of the Art's "SLAMDIP" resistor network replaces individual chip resistors, you will save space and reduce your placement labor. Other benefits also surface, such as better tracking and lower board cost.

RESISTANCE VALUES

10 ohm — 1 Mohm, STANDARD
1 ohm — 100 Mohm, SPECIAL ORDER

TOLERANCE, TCR

1%, 100 ppm*
2%, 200 ppm
Also available: ½%, 5%

Not available in extreme low and high values

PART MARKING

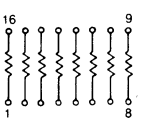
102 G A

SCHEMATIC CONFIGURATION
(See Configurations on right)

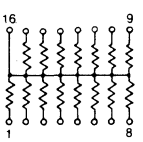
TOLERANCE
F — 1%; G — 2%; J — 5%

RESISTANCE VALUE
Leading digits significant; last digit specifies number of zeros to follow
(Ex. 102 = 1000 ohms)

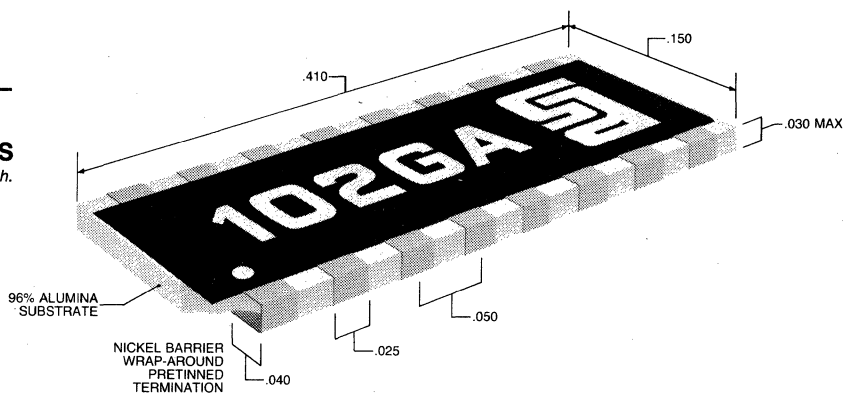
PIN #1 LOCATION



CONFIGURATION A
SLAMDIP 8
POWER RATING
Package 500 mW
Resistor 62 mW
Maximum Voltage: 100V



CONFIGURATION B
SLAMDIP 15
POWER RATING
Package 500 mW
Resistor 31 mW
Maximum Voltage: 50V



DIMENSIONS

NOTE: Dimensional Tolerance ± .005 inch.

PERFORMANCE CHARACTERISTICS

	MAXIMUM CHANGE IN RESISTANCE 100 PPM UNITS	200 PPM UNITS
LOW TEMPERATURE OPERATION	±0.25	±0.5
SHORT TIME OVERLOAD	±0.25	±0.5
MOISTURE RESISTANCE	±0.5	±0.5
THERMAL SHOCK	±0.5	±0.5
RESISTANCE TO SOLDERING HEAT	±0.25	±0.5
HIGH TEMPERATURE EXPOSURE	±0.5	±1.0
LIFE	±0.5	±2.0

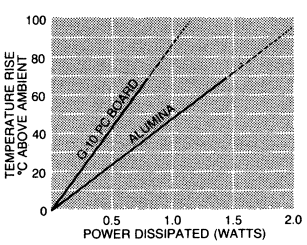
CUSTOM DESIGNS

State of the Art can offer a variety of custom network designs. Using our standard 8 resistor package, the values of individual resistance can be altered to suit the need; other resistance patterns can be applied — limited only by what can be put into the available space.

We can also produce other substrate designs. The length or width can be increased or decreased, the "lead" spacing can be changed, and we can put termination pads on all four sides. Please contact State of the Art's engineering department for information and quotations. Tooling for special networks is not expensive.

POWER RATINGS

We have rated the State of the Art "SLAMDIP" resistor network at a maximum of ½ watt per package. By this, we mean that at 70°C on a 2" x 2" G-10 PC board, the resistor film temperature would be limited to approximately 125°C. The performance on life test listed here will be met if the resistor package does not exceed 125°C. Reference to the power graph indicates that the arbitrary power rating of ½ watt could be either increased or decreased depending on the actual situation. Our engineering department has a wealth of information on the subject and will be happy to share it with you.



ALL RESISTORS
ENERGIZED SIMULTANEOUSLY
2 INCH X 2 INCH BOARD SZES

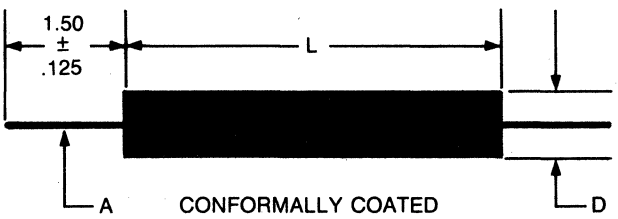
NOTE: At the time of publishing, we had a number of innovative surface mount resistor networks under development. Our SLAMDIP is only the first. Please Write or Call our sales office for up to date availability of other networks.

CALL TOLL FREE
800-458-3401*

State of the Art, Inc.
2470 FOX HILL ROAD, STATE COLLEGE, PA 16803-1797
*IN PA DIAL 814-355-8004, TELEX 866633, SOURCE CODE 56235

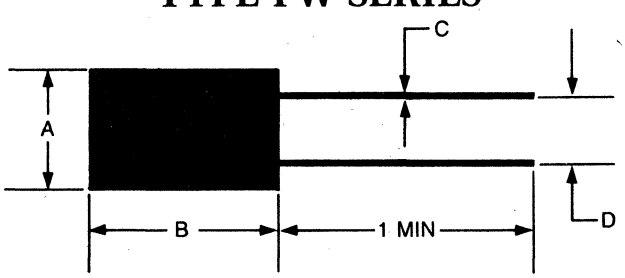
Demand Quality.

PRECISION METAL FILM RESISTORS



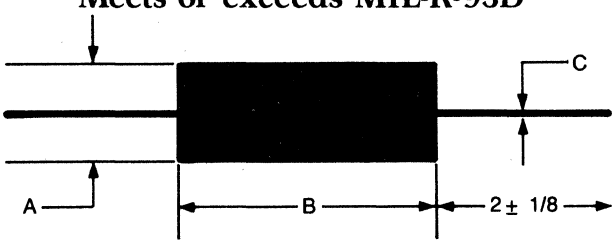
Tel Labs Style	Mil R	RR	W	VR	BL(L)	BD(D)	LD(A)
LA45	N/A	10-25K	1/40	100	.130 ±.005	.047 ±.005	.016(#26)
LA50	RNC50	10-200K	1/20	200	.150 ±.020	.070 ±.010	.016(#26)
LA55	RNC55	10-604K	1/10	200	.250 ±.020	.080 ±.015	.025(#22)
LA60	RNC60	10-1.0M	1/8	250	.375 ±.060	.100 ±.015	.025(#22)
LA65	RNC65	10-3.0M	1/4	300	.562 ±.031	.180 ±.015	.025(#22)
LA70	RNC70	10-4.02M	1/2	350	.640 ±.031	.210 ±.015	.032(#20)
LA75	RNC75	10-5M	1	750	1.000 ±.031	.340 ±.015	.032(#20)
LA80	N/A	10-10M	2	750	2.062 ±.031	.275 ±.015	.032(#20)

TYPE PW SERIES



Mil R93D Desig.	Tel Labs Style	A ± .015	B ± .032	C	D ± .015	MAX. VALUE Mil.	MAX. VALUE Comm.	WATTAGE Mil.	WATTAGE Comm.	MAX. V. Mil.	MAX. V. Comm.
RB71	PW1	.250	.312	.025	.200	100K	125K	.125W	.15W		300
	PW2	.250	.406	.025	.200		175K		.2W		600
RB70	PW20	.375	.500	.032	.200,.250	301K	375K	.250W	.33W	150	600
	PW40	.468	.625	.032	.250,.300		500K		.3W		600
	PW31	.500	.625	.032	.250,.300		1.75 Meg		.6W		600
	PW10	.406	1.250	.032	.250,.300		1.0 Meg		1.0W		1200
	PW50	.531	1.000	.032	.250,.300		3.0 Meg		1.0W		1200

TYPE SA EPOXY
Meets or exceeds MIL-R-93D



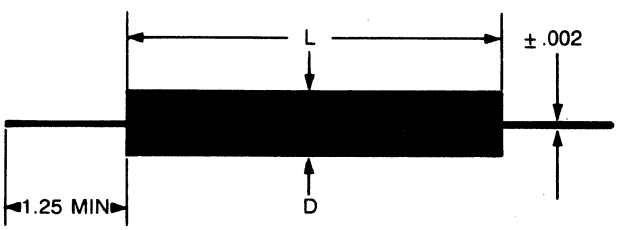
Tel Labs Style	Mil R93D Desig.	Diam. A ± .015	Length B ± .031	Lead Diam. C.	MAX. VALUE Mil.	MAX. VALUE Comm.	WATTAGE Mil.	WATTAGE Comm.	MAX. VOLTAGE Mil.	MAX. VOLTAGE Comm.
SA1	RB55	.250	.500	.032	226 K	1.1 Meg	.15W	.3W	400	400
SA2	RB54	.250	.750	.032	448 K	2 Meg	.25W	.4W	300	400
SA3	RB53	.375	.750	.032	750 K	8 Meg	.333W	.5W	300	400
SA4	RB52	.375	1.000	.032	1.5 Meg	10 Meg	.5W	.75W	600	800
SA5	RB57	.500	1.000	.032	2 Meg	16 Meg	.75W	1.0W	800	1000
SA6	RB58	.500	1.531	.032	3 Meg	24 Meg	1.0W	1.5W	900	1200
SA7	RB59	.500	2.031	.032	5.11 Meg	24 Meg	1.25W	2.0W	1200	1800
SA11		.250	.625	.032		400 K		.33W		800
SA13		.312	.937	.032		1.2 Meg		.5W		800
SA16	RB56	.250	.375	.032	127 K	205 K	.125W	.25W	200	200
SA19		.250	.250	.032		500 K		.2W		200
SA18		.500	.500	.032		3 Meg		.5W		500

SUBMINIATURES

Tel Labs Style	Diameter A ± .015	Length B ± .031	Lead Diam. C.	Maximum Value	Maximum Wattage	Maximum Voltage
SA9	.135	.312	.025	400K	.08W	100
SA10	.185	.500	.025	500K	.2W	100
SA20	.165	.500	.025	400K	.150W	100,200
SA21	.187	.375	.025	500K	.125W	100,200
SA22	.150	.400	.025	190K	.07W	100
SA24	.125	.250	.020	75K	.05W	100
SA25	.110	.300	.020	85K	.05W	100
SA26	.125	.375	.025	140K	.05W	100
SA29	.100	.300	.025	80K	.05W	100
SA30	.200	.405	.025	550K	.13W	100
SA31	.100	.220	.020	70K	.04W	100

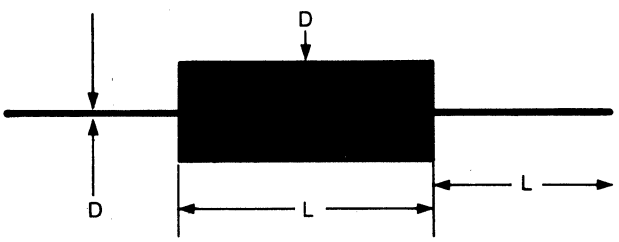
Specify Tel Labs.

TYPE EL SILICONE POWER
Meets or exceeds MIL-R-26



Tel Labs Style	Mil Desig RW	Wattage U 275°	Wattage V 350°	Dimensions — Inches Dia.	Dimensions — Inches LN	Max Res. .05% to .05%	Max Res. 1% to 5%	Lead Dia. IN.
EL¼		.5W	1.0W	.090±.031	.215±.031	500Ω	500Ω	.020
EL½		.75W	1.0W	.094±.031	.280±.031	1K	1.5K	.020
EL1A	RW70	1.0W	1.25W	.094±.031	.406±.031	2K	6K	.020
EL1B		1.0W	1.50W	.094±.031	.530±.031	4K	9K	.020
EL1C		1.0W	2.0W	.135±.031	.335±.031	2K	4.4K	.025
EL2F		2.5W	3.0W	.188±.031	.500±.062	4K	12K	.032
EL2H		2.5W	3.0W	.188±.031	.385±.062	2K	5.7K	.032
EL2G		2.5W	3.0W	.188±.031	.430±.062	2K	8K	.032
EL2B		3.0W	3.5W	.188±.031	.625±.062	8K	16K	.032
EL2A		3.25W	4.5W	.188±.031	.825±.062	10K	28K	.032
EL2E	RW59	2.5W	3.5W	.195±.031	.500±.062	8K	15.4K	.032
EL2E	RW69	2.5W	3.5W	.195±.031	.500±.062	8K	15.4K	.032
EL2I	RW79	3.0W	3.5W	.195±.031	.560±.062	8K	19K	.032
EL2D		3.0W	4.0W	.250±.031	.500±.062	7.5K	19K	.032,.040
EL2C		3.0W	4.0W	.250±.031	.562±.062	8K	22K	.032,.040
EL2		3.5W	4.5W	.250±.031	.625±.062	12K	31K	.032,.040
EL3		3.5W	5.0W	.295±.031	.500±.062	8.3K	23K	.032,.040
EL5	RW74	5.0W	7.0W	.290±.062	.925±.093	22K	56K	.032,.040
EL7		6.0W	8.0W	.290±.062	1.200±.093	35K	90K	.032,.040
EL5A	RW57	5.0W	6.5W	.350±.062	1.000±.093	35K	90K	.040
EL5A	RW67	5.0W	6.5W	.350±.062	1.000±.093	35K	90K	.040
EL7A		7.0W	9.0W	.350±.062	1.360±.093	45K	100K	.040
EL10A	RW58	10W	11W	.350±.062	1.815±.093	75K	175K	.040
EL10A	RW68	10W	11W	.350±.062	1.815±.093	75K	175K	.040
EL12	RW56	12W	14W	.469±.062	2.00±.093	90K	235K	.040

ULTRA LOW OHM POWER RESISTORS



Tel Labs Style	LENGTH	DIAMETER	Lead L	Lead D	Resistance Measurement Points from body
TL01	.406±.015	.094±.015	1.5 Min.	.025±.002	.375 each side
TL03	.560±.015	.210±.015	1.5 Min.	.032±.002	.375 each side
TL05	.920±.015	.330±.015	1.5 Min.	.040±.002	.375 each side

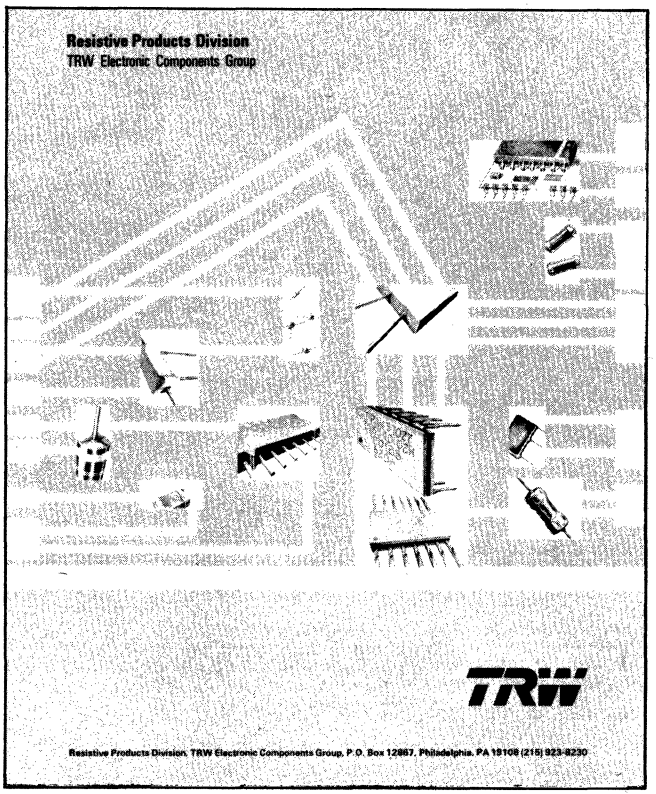
Send for our new catalog covering our complete line of fixed wire wound resistors.

Additional items include:
TYPE VR - Vitreous Coated
TYPE EH - Aluminum Housed
TYPE BL - Beryllium Oxide
TYPE PR - Subminiature Printed Circuit
TYPE Q81 - Special Temperature Compensation
TYPE Q239 – Special 4-Terminal Device

TEL LABS, inc.

154 Harvey Road, PO Box 375, Londonderry, N.H. 03053
TWX 710-220-1844 Tel. (603) 625-8994

RESISTIVE PRODUCTS DIVISION
TRW ELECTRONIC COMPONENTS GROUP



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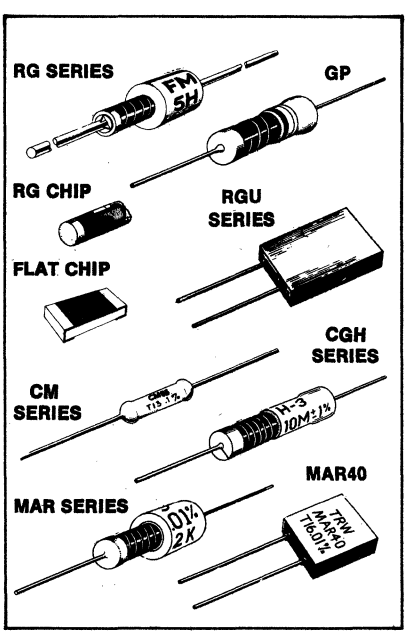
SEMI-PRECISION, PRECISION, ULTRA-PRECISION METAL FILM AND METAL GLAZE™ DISCRETES AND CHIPS



TRW has a discrete resistor for every application. High performance is attributable to TRW's proprietary Metal Glaze™ technology and metal film process, sustained over decades of manufacturing experience.

- General purpose metal film resistors, high stability—GP Series.
- Precision Metal Glaze™ resistors — RG Series.
- RG Series chip resistors.
- Precision high voltage thick film —CGH Series.
- CM Series—high reliability/stability, zero noise industrial precision metal film.
- Ultra precision metal film MAR Series and MAR matched sets.
- RGU series radial lead molded metal glaze resistors take up half the board area of comparably rated axial-lead resistors.

RG SERIES
SPECIFICATIONS
Resistance Values: 1Ω to 3 MΩ
Tolerance: ±.5, ±1, ±2, ±5%
Power Rating @ 70°C: ⅛W to 3W
Temperature Coefficient of Resistance: 25 to 200 ppm/°C

FLAT CHIP RESISTORS
SPECIFICATIONS
Resistance Range: 10Ω to 1 MΩ
Tolerance: ±5%
Power Rating: 0.125W @ 70°C
Temperature Coefficient: 200 ppm/°C

GP SERIES
SPECIFICATIONS
Resistance Values: 10Ω through 1.0 MΩ higher values available; consult factory.
Tolerance: ¼W application ±1%
½W application ±1%
Power Rating @ 70°C: ⅛ through 1 watt
Temperature Coefficient of Resistance: ±50.7 ±100 ppm

RG CHIP RESISTORS
SPECIFICATIONS
Resistance Range: 3Ω to 1 MΩ, plus zero-ohm jumpers
Tolerances: ±.5%, ±1%, ±2%, & ±5%
Rated Wattage: ⅛W @ 70°C
Temperature Coefficient: <100 ppm/°C for all tolerances*

RGU SERIES
SPECIFICATIONS
Resistance Range: 10Ω to 1 MΩ
Tolerance (E96, E24): ±1%, ±2%, ±5%
Power Rating: ½ watt at 70°C
Temperature Coefficient: ±50, ±100 ppm/°C

CGH SERIES
SPECIFICATIONS
Resistance Range: 100 KΩ to 500 MΩ
Tolerance: ±.5%, ±1%, ±2%, ±5%
Power Rating @ 70°C: ¼-5W
Temperature Coefficient: 50, 100 ppm/°C

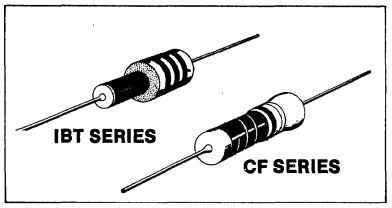
CM SERIES
SPECIFICATIONS
Resistance Range: 10-7.0 MΩ
Tolerance: ±.05%, ±.1%, ±.25%, ±.5% ±1.0%
Temperature Coefficient 5, 10, 15, 25 ppm/°C

MAR SERIES
SPECIFICATIONS
Resistance Range: 10Ω-3 MΩ
Tolerance: .01-5%
Power Rating @ 85°C: 1/20-¼ watt
Temperature Coefficient: 5, 10, 15 ppm/°C

MAR40 SERIES
SPECIFICATIONS
Resistance Range: 20Ω-250 KΩ
Tolerance: .005-1.0%
Power Rating @ 85°C: 0.3W
Temperature Coefficient: 2, 5, 10 ppm/°C

RESISTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, EASTERN SALES: P.O. Box 1860 Boone, NC 28607, Phone (704) 264-8861, TWX 510-936-3241, WESTERN SALES: 4222 S. Staples St., Corpus Christi, TX 78411, Phone (512) 992-7900, TWX 910-876-1400

GENERAL PURPOSE RESISTORS
CARBON FILM AND CARBON COMPOSITION



Over fifty years ago it was the skilled technical personnel at TRW that invented and volume produced the very first carbon resistor. Still the most widely used 5% resistors, the TRW standard CF and IBTs assure all the quality and reliability exhibited by TRW Resistive Products for six decades.

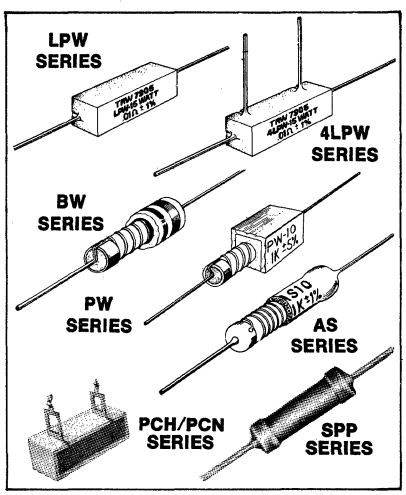
SPECIFICATIONS

Electrical Characteristics	IBT-¼	IBT-½	IBT-1
MIL-R-11 Style	RC07	RC20	RC32
Resistance Range	10Ω to 1 MΩ	10Ω to 22 MΩ	10Ω to 10 MΩ
Tolerance	±5% (Series E24)	±5% (Series E24)	±5% (Series E24)
Rated Power	0.25W @ 70°C	0.50W @ 70°C	1W @ 70°C
Max. Continuous Working Voltage	250V	350V	500V
Surface Temperature Rise	32°C @ 0.25W	50°C @ 0.5W	70°C @ 1W
Average Shunt Capacitance	0.15 pF	0.175 pF	0.30 pF
Dielectric Withstanding Voltage			
—Atmospheric Pressure	500V RMS, min.	700V RMS, min.	1000V RMS, min.
—At 87mm of Mercury	325V RMS, min.	450V RMS, min.	625V RMS, min.
Insulation Resistance—Dry	10^5 MΩ min.	10^5 MΩ min.	10^5 MΩ min.
Wet	10^3 MΩ min.	10^3 MΩ min.	10^3 MΩ min.

SPECIFICATIONS

Type	CF-⅛	CF-¼	CF-½	CF-1	CF-2
Resistance, Standard	1Ω to 1 MΩ	1Ω to 10 MΩ	1Ω to 10 MΩ	1Ω to 10 MΩ	1Ω to 10 MΩ
Tolerances, Standard	±5%	±5%	±5%	±5%	±5%
Power Rating	⅛ watt @ 70°C	¼ watt @ 70°C	½ watt @ 70°C	1 watt @ 70°C	2 watts @ 70°C
Maximum Continuous Working Voltage	150 volts	250 volts	350 volts	500 volts	500 volts
Minimum Insulating Resistance—Dry	100 MΩ	1000 MΩ	1000 MΩ	1000 MΩ	1000 MΩ
Minimum Dielectric Withstanding Voltage—Atmospheric	300 volts	500 volts	500 volts	500 volts	500 volts
Load Life—Typical △R Less Than	±3%	±3%	±3%	±3%	±3%

WIREWOUND RESISTORS
LOW AND HIGH POWER, PRECISION, FLAMEPROOF/FAILSAFE



TRW is one of the largest wirewound resistor manufacturers in the world and offers the proven best failsafe/flameproof resistor available. TRW's wirewound resistors feature smaller sizes for all applications: 2 Watts in a 1 Watt package, 1 Watt in a ½ Watt package with TCR's tailored per customer requirement. TRW wirewound resistors are molded, conformally coated, or encased in a flameproof ceramic housing with optional stand offs and alternate configurations to fit a wide variety of applications.

- General purpose low power molded BW series and flameproof/failsafe BWF series 1, 2 watts; ±2, ±5, ±10% from .05 to 2400Ω.
- General purpose power PW series.
- Semi-precision power AS series.
- Semi-precision power for pulse and surge applications—PPW series.
- Low resistance power LPW series.
- Current sensing 4 terminal 4 LPW series.
- High power PWW series.
- Temperature sensing BWG series.
- New semi-precision power (SPP) resistor is auto insertable, low noise, conformal coated, in 2, 3 and 5 watt sizes.

LPW SERIES, 4LPW SERIES
- 3 watts to 15 watts
- ±1%, ±2%, ±3%, ±5%, ±10% tolerance
- .01 ohm to 1.0 ohm

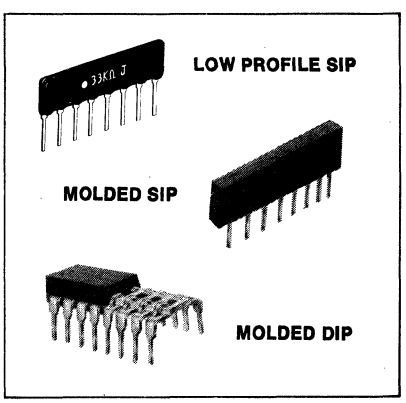
BW SERIES
- 1 watt, 2 watts
- ±2%, ±5%, ±10% tolerance
- 0.05 ohm to 2400 ohms
- TCs as low as ±150 ppm/°C

PW SERIES
- 3 watts to 50 watts
- ±10%, ±5% tolerance
- 0.18 ohms to 30k ohms
- TCs from 300 ppm/°C to +5500 ppm/°C

AS SERIES
- ½ watt to 10 watts
- ±5%, ±3%, ±1%, ±.5%, ±.25%, ±.1% tolerance
- 0.1 ohm to 175k ohms
- ±20 ppm/°C

PCN, PCH SERIES
- 5w to 15w
- ±10%, ±5% tolerance
- I ohm to 1200 ohms
- ±400 ppm/°C TC

CONFORMALLY COATED NETWORKS, MOLDED SIP's AND DIP's, LOW AND HIGH PROFILE, THICK AND THIN FILM



TRW's resistor networks exploit the same Non-Noble Glaze™ technology employed in our well known RG discretes. The conformally coated networks offer both significant cost and space savings. The molded networks are auto insertable and less susceptible to damage. Resistance values as low as 22Ω. Temperature coefficients as low as ±100ppm—°C for requirements of ±1%, ±2% or ±5%.

- 4-14 pin conformally coated SIP packages in 22Ω to 2.2 MΩ.
- Low profile (.200 in. max. ht.) SIP available in 5-11 pin conformally coated in 22Ω to 1 MΩ.
- Molded SIP Networks in 6-, 8-, and 10-pin .350 in. and 8- and 10-pin .195 in. 22Ω-1MΩ.
- Molded DIP Networks in 14- and 16-pin packages 22Ω to 1 MΩ.

THICK FILM CONFORMAL COATED SIP NETWORKS
SPECIFICATIONS
Resistance Range: 22Ω to 1.0 MΩ
Resistance Tolerance: ±2% and ±5%
Temperature Coefficient: ±200 ppm/°C

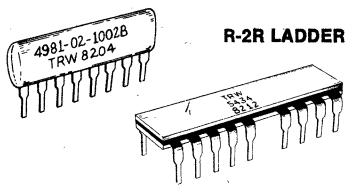
THICK FILM MOLDED SIP NETWORKS
SPECIFICATIONS
Resistance Range: 22Ω to 1 MΩ
Resistance Tolerance: ±2% and ±5%
Temperature Coefficient: ±150 ppm/°C
TC Tracking: 50 ppm/°C typical

THICK FILM MOLDED DIP NETWORKS
SPECIFICATIONS
Resistance Range: 22Ω to 1 MΩ
Resistance Tolerance: ±2% and ±5%
Temperature Coefficient: ±150 ppm/°C
TC Tracking: 50 ppm/°C typical

RESISTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, EASTERN SALES: P.O. Box 1860 Boone, NC 28607, Phone (704) 264-8861, TWX 510-936-3241, WESTERN SALES: 4222 S. Staples St., Corpus Christi, TX 78411, Phone (512) 992-7900, TWX 910-876-1400

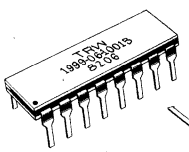
TANFILM PRODUCTS STANDARD AND CUSTOM CIRCUIT CONFIGURATIONS, PACKAGING

SIP NETWORKS

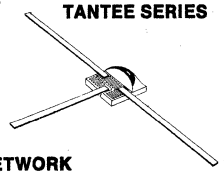


R-2R LADDER

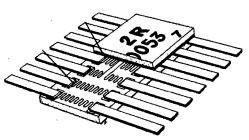
DIP RESISTOR NETWORKS



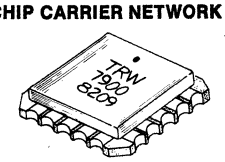
TANTEE SERIES



FLATPACK NETWORK



CHIP CARRIER NETWORK



TaNFilm® is the most cost effective way to achieve tight tolerance and tight tracking. TRW's TaNFilm products have the highest reliability/stability available due to the innate properties of TRW's unique materials technology. Network capabilities include TCR ±300 ppm to ±25 ppm°C with as low as 2 ppm°C tracking, ±.1% absolute tolerance, and ±.01% ratio tolerance. Ohmic values run from 20Ω to 200K per resistor. Custom circuit confirgurations, packages and substrates are available.

- SIP's up to 12 pins, low profile, 3 standard sizes, conformally coated.
- DIP's up to 20 pin standards with special mechanical and electrical configurations available, as well as R-2R ladder and flat-pack networks.
- Custom hybrid circuit packages.
- Miniature leadless chip carrier networks contain 20 pads with standard and custom schematics.

TaNFilm® CONFORMALLY COATED SIP NETWORKS

SPECIFICATIONS

Resistance Ranges:
49.9Ω to 50 KΩ
20Ω to 50 KΩ
20Ω to 100 KΩ
Higher resistance values available
Resistance Tolerances: ±.1%, ±.25%, ±.5%, ±1%, ±2%
Temperature Coefficient of Resistance: ±25 ppm/°C, ±50 ppm/°C, ±100 ppm/°C −100 ±50 ppm/°C
TCR Tracking: 5 ppm/°C
Temperature Range: −55°C to +150°C
Noise: Less than −25 dB
Power Rating @ 70°C:

	Wattage		
	Network		
Resistor	6 Pin	8 Pin	10 Pin
.12	.6	.84	1.08
.12	.36	.48	.60

TaNFilm® DIP RESISTOR NETWORKS

SPECIFICATIONS

MIL Qualified Resistance Values:
100Ω to 100 KΩ
100Ω to 70 KΩ
Higher and lower resistance values available
Resistance Tolerances: ±.1%, ±.25%, ±.5%, ±1%, ±2%
Temperature Coefficient of Resistance: ±50 ppm/°C, ±100 ppm/°C, ±300 ppm/°C, −100 ±25 ppm/°C
TCR Tracking: 5 ppm/°C, except Models 1987 & 1998 below 500Ω (20 ppm/°C)
Temperature Range: −55°C to +150°C
Power Rating @ 70°C:

	Wattage	
Model	Resistor	Network
1987	.1	1.3
1998	.1	1.5
1989	.2	1.4
1999	.2	1.6

TaNFilm® FLAT-PACK RESISTOR NETWORKS

SPECIFICATIONS

Mil Qualified Resistance Ranges:
49.9Ω to 121 KΩ
49.9Ω to 121 KΩ
Higher resistance values available
Resistance Tolerances: ±.1%, ±.25%, ±.5%, ±1%, ±2%
Temperature Coefficient of Resistance: ±25 ppm/°C, ±50 ppm/°C, ±100 ppm/°C, ±300 ppm/°C, −100 ±25 ppm/°C
TCR Tracking: Referenced to R1, is ±5 ppm/°C, except Model 8987 below 500 ohm, which is ±20 ppm/°C
Temperature Range: −55° to +150°C
Noise: Less than −25 dB
Power Ratings: .1 watt per resistor, .5 watt per network at 70°C; 1.0 watt per network at 25°C

TaNFilm® R-2R LADDER 12- BIT, 20-PIN DIP

SPECIFICATIONS

Ladder Resistance Values (R): 5K, 10K, 20K, 25K, 50K
Ladder Resistance Tolerance: ±5%

TaNFilm® SUBMINIATURE DUAL NETWORK TaNTee SERIES

SPECIFICATIONS

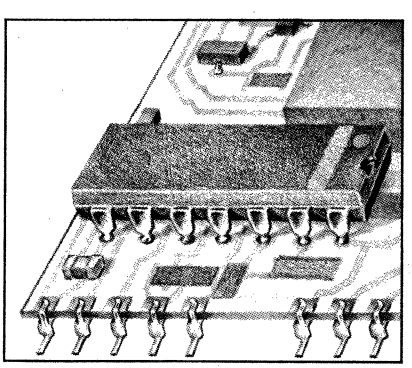
Resistance Range, each R: 10Ω to 10 KΩ
Power Rating: ¼W @ 85°C (sum of power in both resistors)
Resistor Tolerance:
Absolute Tolerance—±5% standard, ±1% available
Ratio Tolerance—To .1%

TaNFilm® CHIP CARRIER RESISTOR NETWORKS

SPECIFICATIONS

Resistance Values: 50Ω to 50 KΩ standard; up to 100 KΩ on special order
Resistance Tolerances: ±.1%, ±.25%, ±.5%, ±1%, ±2%
Temperature Coefficient of Resistance: ±25 ppm/°C, ±50 ppm/°C, ±100 ppm/°C, ±300 ppm/°C
TCR Tracking: 5 ppm/°C
Temperature Range: −55°C to +150°C
Noise: Less than −25 dB
Power Rating @ 70°C: .1W/resistor, .5W/network

CUSTOM HYBRID CIRCUITS



Custom thick film hybrid circuits utilize surface mount technology and are most applicable where size reduction and reliability are prime factors. Circuit miniaturization is due to higher density manufacturing techniques. Higher reliability is the result of fewer "component to board" interconnections and common thermal effects between components. Generally, outboard components (diodes, transistors, IC's, and capacitors) are surface mounted. Resistors and conductors are screen printed and fired at 900-1000 °C directly to the ceramic substrate.

Performance specifications are per customer requirements relative to specific applications. TRW will assist in design upon request. Both custom thick film substrates and complete hybrid circuit manufacture available.

TRW circuit features include:

- High conductivity, leach resistant copper conductors
- 10 ohm to 10M ohm/square resistors
- Stability characteristics and cost effectivity of TRW's proprietary Non-Noble Metal Glaze™ technology
- Precious metal elements also employed per customer application and requirements

CUSTOM THICK FILM CIRCUITS

- High reliability
- Major size reduction compared to discrete components
- Cost effective in volume quantities

ADDITIONAL FEATURES:

- Top Stamping — to customer specification; one 8-character line
- Missing Pins — removed external to SIP molded package, but within standoff profile
- TCR — ±150 ppm
- Ratio Matching — ±2% between specifed resistor pairs — ratios not to exceed 20:1

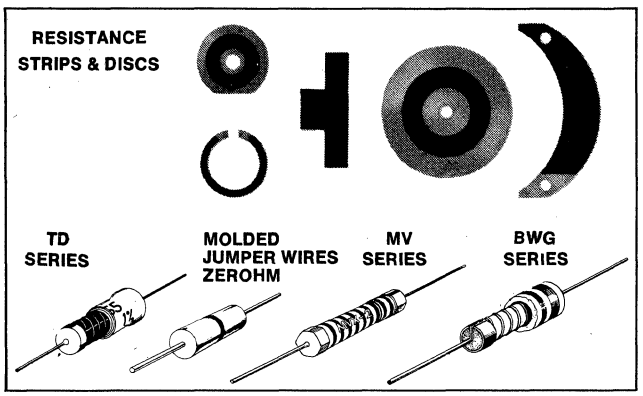
TRW will customize relative to specific application requirements.

CIRCUIT VARIATIONS:

Variations to standard circuits of both the .350-in. and .195-in. SIP are feasible, such as:

- Crossovers
- Modified common locations
- Missing resistors
- Multiple value resistances
- Open or shorted pins

SPECIAL PURPOSE RESISTORS AND RESISTIVE PRODUCTS TEMPERATURE SENSING DEVICES



Within the broad line of products available from TRW Resistive Products Division is also included standard and special resistance strips and discs, molded jumper wires or crossovers, and a wide range of high voltage, high temperature and temperature sensing resistors and elements for all applications.

- BWG Series wirewound temperature sensing resistors with TCs as high as +5500 ppm/°C
- Thin film TD Series temperature sensing element with superior linearity, close tolerance, and ultra miniature size
- MV Series high-voltage film resistors from 10K to 1000 megohm range
- Standard and special resistance strips and concentric disc resistors
- Straight-through wire conformal coated and molded crossover ¼ watt size supplied on lead tape and reel for automatic insertion

BWG SERIES

- Excellent linearity over wide temperature span
- Fast response time
- Small size
- Economical cost
- 1 watt, 2 watts
- ±5%, ±10% tolerance
- 0.1 ohm to 300 ohms
- TCs as high as +5500 ppm/°C

TD SERIES

- Proven metal film reliability
- Fast thermal response
- Positive temperature coefficient
- Superior linearity
- Ultra miniature

SPECIFICATIONS

Resistance Range at 25°C; TD50 - 100Ω to 2 KΩ, TD55 - 10Ω to 3 KΩ; TD60 - 10Ω-6 KΩ; TD65 -10Ω-10 KΩ

Temperature Coefficient: +5000 ±100 ppm/°C at 25°C; +6000 ±120 ppm/°C at 100°C

Tolerance at 25°C: ±.5%, ±1% or ±2%

MV SERIES

- ½ watt to 90 watts
- 10k to 1000 megohm range
- ±5%, ±10%, or ±20% tolerance

CONFORMAL COATED AND MOLDED JUMPER WIRES, ZEROHM

SPECIFICATIONS

Maximum Resistance: 0.01 ohm

Lead Material: Leads are copperclad steel with TRW's 30/70 solder alloy coating to allow both welding and soldering operations

Body Material: Electrical grade, high performance, molding compound

Minimum Insulation Resistance: Dry, 10,000 megohm; Wet, 100 megohm

Minimum Dielectric Withstanding Voltage: Atmospheric, 500V RMS; Reduced, 325V RMS

Insulation Flammability: Resistor insulation is self extinguishing within 10 seconds after externally applied flame is removed

Current Rating: 25 amps at 25°C, derating to 0 amps at 150°C

RESISTANCE STRIPS & DISCS

SPECIFICATIONS

ELEMENTS

TRW resistance strips consist of a high grade paper-base phenolic laminate with the resistance material permanently bonded to the surface. Disc resistors are simply die stamped from a resistance strip.

Strips can be supplied with a low-resistance colloidal silver contact coating over any portion of the surface where a low-resistance positive contact is desired. On discs, inner and outer rings of colloidal silver are applied to provide contact with coaxial line fixtures.

RESISTANCE VALUES

Strips are available with resistances from 19 ohms/square to 1.0 megohm/square. Standard disc values range from 5 ohms to 100,000 ohms.

TOLERANCE

Standard tolerance is ±20%. Special tolerances of ±15% and ±10% are available on special order.

VOLTAGE RATING

Maximum rated voltage is 500 volts per inch of current path.

SURFACE MOUNTABLE DEVICES

TRW has recently extended its broad line of resistive products to include a family of surface mountable devices. These products combine TRW's proprietary state of the art technologies with both standardized and custom configurations to meet the specifications of a wide variety of applications.

Currently available surface mountable designs include:

—Thick Film RG Power Chip Resistors
—Thick Film Non-noble Flat Chip Resistors
—Thin Film Chip Carrier Networks
—Surface Mountable Thick and Thin Film SIP and DIP Networks
—Flatpack Network and TaNTee Series Designs
—Semi Precision Power Wirewound Resistors

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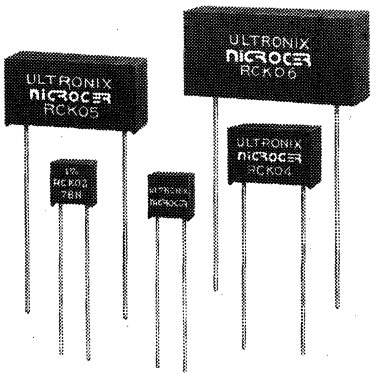


metal foil resistor MICROCER® process

very high precision and stability

MIL QUALIFICATION TO MIL-R-55182/9 (RNC90Y)

FEATURES

- VERY TIGHT TOLERANCES ±0.005% to ±1% – Matching to 0.002%
- VERY LOW TEMPERATURE COEFFICIENT*
  typical <±3 ppm/°C (−55° to +155°C) ± 1 ppm (0°C to + 60°C)
  tracking to 0.5 ppm/°C
- VERY HIGH STABILITY < 25 ppm/year or < *50 ppm/3 years (shelf life)*
- *NEGLIGIBLE RISE TIME approx. 1 X* 10^{-9} sec.

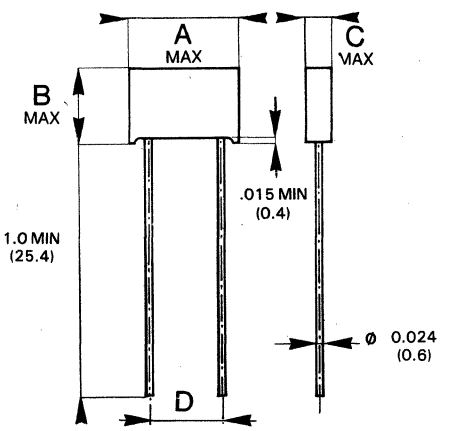
STANDARD ELECTRICAL SPECIFICATIONS

ULTRONIX TYPE	MIL TYPE	70° RATING	125°C RATING	MAX. WORKING VOLTAGE	RESISTANCE RANGE (OHMS)			
					±0.005%	±0.02% ±0.01%	±0.05%	±0.1%, ±0.2% ±0.5%, ±1%
RCK02A	RNC90Y**	0.6W	0.33W	300V	50Ω-200K	25Ω-200K	10Ω-200K	1Ω-200K
RCK04	–	1.0W	0.6W	350V	50Ω-400K	25Ω-400K	10Ω-400K	2Ω-400K
RCK05/05A	–	1.2W	0.9W	500V	150Ω-600K	75Ω-600K	30Ω-600K	3Ω-600K
RCK06	–	1.5W	1.2W	650V	200Ω-1M	100Ω-1M	40Ω-1M	4Ω-1M

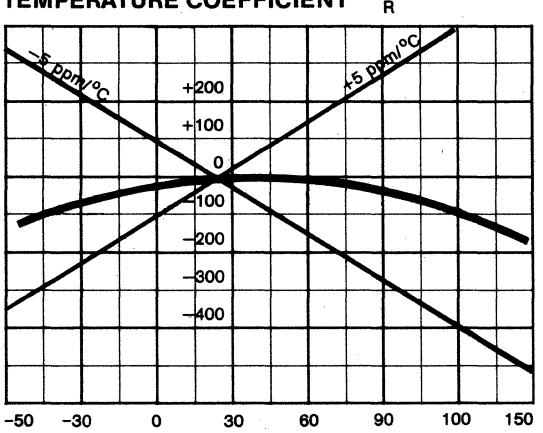
** CONSULT ULTRONIX FOR QPL MAX. AND MIN. VALUES

PHYSICAL CONFIGURATIONS

Type	Dim. A	Dim. B	Dim. C	Dim. D
RNC90Y	.320 (8.13)	.375 (9.52)	.120 (3.05)	.150 (3.81)
RCK02A	.312 (7.92)	.330 (8.38)	.115 (2.92)	.150 (3.81)
RCK04	.575 (14.6)	.413 (10.5)	.138 (3.5)	.400 (10.16)
RCK05	.890 (22.6)	.413 (10.5)	.138 (3.5)	.700 (17.78)
RCK05A	.890 (22.6)	.413 (10.5)	.138 (3.5)	.650 (16.51)
RCK06	1.200 (30.5)	.531 (13.5)	.256 (6.5)	.900 (22.86)



TEMPERATURE COEFFICIENT $\frac{\Delta R}{R}$ ppm



*The T.C. of RCK resistors is always better than ± 5 ppm/°C in the temperature range −55°C to +155°C.

More generally, the T.C. is positive towards the very low temperatures, typical values +2.2 ± 2 ppm/°C for −55°C to +25°C.

It is negative towards the high temperatures, typical value −1.8 ± 2 ppm/°C for +25°C to +125°C.

For temperature variations of about 20 to 30°C from the 25°C ambient temperature, the T.C. is very low.

In the temperature range 0°C to +60°C it can be reduced to a value below ± 1 ppm/°C.

For a group of resistors, T.C. matching can be made to better than ± 0.5 ppm/°C. Consult **ULTRONIX.**

Maximum T.C. spread may vary from the nominal T.C. spread for ohmic values less than 5 ohms. Consult **ULTRONIX.**

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Grand Junction
Colorado 81502

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metal foil resistor
nicrocer® process

SPECIFICATIONS

ELECTRICAL

RESISTANCE RANGE..... 1Ω to1M
RESISTANCE TOLERANCE..... ±0.005% to ±1%
POWER RATING..... 0.5W to 1.5W at 70°C depending on configuration
T.C. LIMIT..... ±5 ppm/°C
DIELECTRIC VOLTAGE..... 750 V RMS
INSULATION RESISTANCE..... > 10^6M
THERMAL RESISTANCE..... 0.14°C/mW
THERMO-ELECTRIC EFFECT..... 0.5 μV for 1°C of difference between leads

MECHANICAL

MECHANICAL..... insulated case
RESISTIVE ELEMENT..... nickel-chromium
TERMINAL LEADS..... tinned copper or UE6P weldable solderable type C MIL-STD 1276
UNIT WEIGHT..... 0.3—1—2—4g

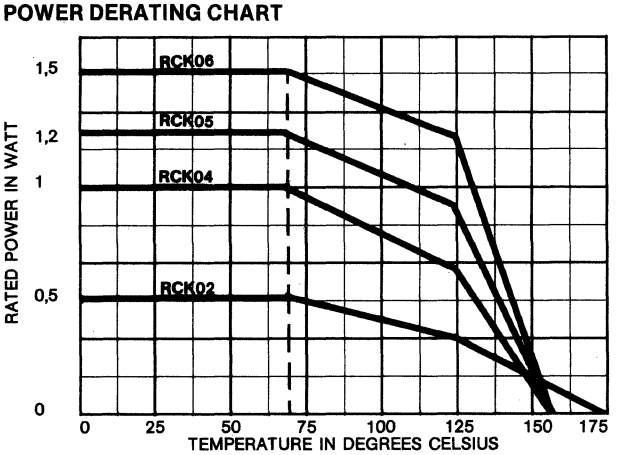
ENVIRONMENTAL

TEMPERATURE LIMITS..... −55°C +175°C

ENVIRONMENTAL PERFORMANCE SPECIFICATIONS

TESTS	REQUIREMENTS MIL-R-55182E	TYPICAL DRIFTS
OVERLOAD	±0.05%	±0.002%
TEMPERATURE CYCLING	±0.05%	±0.002
TERMINAL STRENGTH	±0.02%	±0.001%
RESISTANCE TO SOLDERING HEAT	±0.02%	±0.002%
VIBRATIONS (LIFE TEST)	±0.02%	±0.002%
MOISTURE RESISTANCE	±0.05% Insulation R. > 10^2MΩ	±0.003% Insulation R. > 10^4MΩ
LOAD LIFE	±0.05% ±0.05% @ 175°C	±0.005% ±0.01%
HIGH TEMPERATURE EXPOSURE	-	±0.005%
HUMIDITY (STEADY STATE) 56 DAYS	-	±0.003% Insulation R. > 10^4MΩ

POWER DERATING CHART

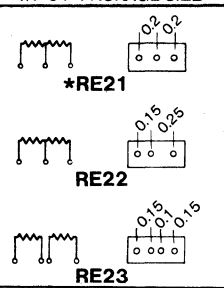


POWER DERATING

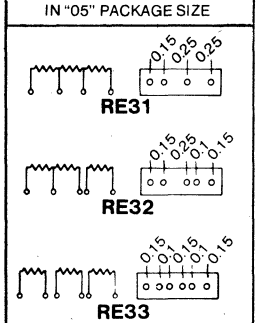
The power ratings listed in the tables are based upon achieving the specified stabilities at maximum ambient temperatures of 70°C. If a resistor is to be used at higher ambient temperature, the power should be derated linearly to zero per the chart. To insure maximum stability, this power curve should be derated by 25% for tolerances to 0.05%, by 50% for tolerances to 0.01% and by 75% for tolerances of 0.005%.

RESISTOR NETWORKS

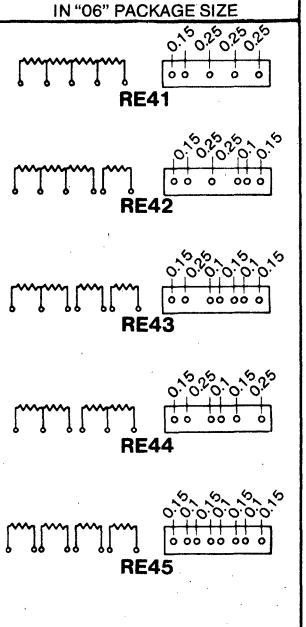
IN "04" PACKAGE SIZE



IN "05" PACKAGE SIZE



IN "06" PACKAGE SIZE



* Available in "02" Package, Lead Spacings of 0.1. Order RE11.

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wirewound resistors very high precision and stability

MIL QUALIFICATION TO MIL-R-39005 AND MIL-R-93

SPECIFICATIONS

MINIMUM VALUES
Generally 0.1Ω for 1% and 0.5% and 10Ω for 0.1% and tighter.

TOLERANCES (±)
Standards are 0.005%, 0.01%, 0.02%, 0.05%, 0.1%, 0.5% and 1% depending on style and value.

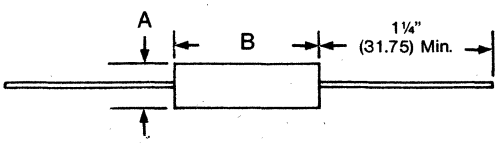
TEMPERATURE COEFFICIENTS
± 5 ppm/°C standard for 10Ω and above. Higher T.C.'s on low ohmic values.
±1 ppm/°C available. TC match to ±0.5 ppm/°C.
High T.C.'s up to + 6000 ppm/°C are available.

MILITARY QUALIFIED

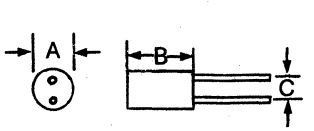
MIL STYLE		ULTRONIX TYPE	MAXIMUM VALUE Ω		POWER RATING AT 125°C (WATTS)	MAX. VOLTS	DIMENSIONS ± .020 (.51)			ϕ LEADS		
MIL-R 93	MIL-R 39005		MIL-R 93	MIL-R 39005			A	B	C	AWG	inch	mm
—	RBR74	185A	—	6.52K	0.125	300	.193 (4.90)	.500 (12.70)	—	22	.026	0.60
RB56	RBR75	202A	42K	150K	0.125	200	.250 (6.35)	.295 (7.49)	—	22	.026	0.60
RB56	RBR56	203A	42K	220K	0.125	200	.250 (6.35)	.343 (8.71)	—	20	.032	0.81
RB71	RBR71	203PA	100K	150K	0.125	150	.250 (6.35)	.320 (8.13)	.200 (5.08)	22	.026	0.60
RB55	RBR55	205A	80K	332K	0.15	400	.250 (6.35)	.500 (12.70)	—	20	.032	0.81
RB54	RBR54	207A	170K	562K	0.25	800	.250 (6.35)	.750 (19.05)	—	20	.032	0.81
—	RBR76	308A	—	3.344K	0.50	800	.312 (7.92)	.810 (20.57)	—	20	.032	0.81
RB53	RBR53	307A	320K	1.1M	0.33	800	.375 (9.53)	.750 (19.05)	—	20	.032	0.81
RB52	RBR52	310A	610K	1.21M	0.50	800	.375 (9.53)	1.00 (25.40)	—	20	.032	0.81
RB57	RBR57	510A	830K	1.37M	0.75	800	.500 (12.70)	1.00 (25.40)	—	20	.032	0.81

COMMERCIAL

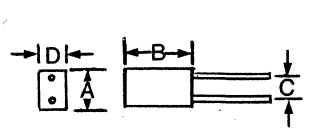
ULTRONIX TYPE	MAX. VALUE Ω	POWER RATING AT 125°C (WATTS)	MAX. VOLTS	DIMENSIONS ± .020 (.51)				ϕ LEADS		
				A	B	C	D	AWG	inch	mm
123A	111K	0.05	150	.100 (2.54)	.230 (5.84)	—	—	24	.020	.511
118A	192K	0.05	150	.130 (3.30)	.180 (4.57)	—	—	26	.016	.404
122A	199K	0.05	150	.123 (3.12)	.218 (5.54)	—	—	24	.020	.511
102A	334K	0.10	150	.110 (2.79)	.250 (6.35)	—	—	24	.020	.511
101A	410K	0.10	300	.130 (3.30)	.375 (9.53)	—	—	22	.026	0.60
101P	453K	0.12	150	.300 (7.62)	.320 (8.13)	.150 (3.81)	.110 (2.79)	22	.026	0.60
103A	633K	0.10	150	.150 (3.81)	.300 (7.62)	—	—	22	.026	0.60
102P	821K	0.12	150	.250 (6.35)	.250 (6.35)	.125 (3.18)	.125 (3.18)	22	.026	0.60
184A	817K	0.125	300	.187 (4.75)	.375 (9.53)	—	—	22	.026	0.60
185A	961K	0.125	300	.188 (4.78)	.500 (12.70)	—	—	22	.026	0.60
202A	968K	0.25	200	.250 (6.35)	.310 (7.87)	—	—	22	.026	0.60
203A	1.7M	0.25	200	.250 (6.35)	.343 (8.71)	—	—	20	.032	0.81
203PA	1.48M	0.25	150	.270 (6.86)	.320 (8.13)	.200 (5.08)	—	22	.026	0.60
205A	1.93M	0.33	400	.250 (6.35)	.500 (12.70)	—	—	20	.032	0.81
207A	3.0M	0.50	800	.250 (6.35)	.750 (19.05)	—	—	20	.032	0.81
308A	3.0M	0.60	800	.312 (7.92)	.810 (20.57)	—	—	20	.032	0.81
210A	4.10M	0.50	800	.250 (6.35)	1.00 (25.40)	—	—	20	.032	0.81
307A	5.63M	0.60	800	.375 (9.53)	.750 (19.05)	—	—	20	.032	0.81
310A	7.68M	1.00	800	.375 (9.53)	1.00 (25.40)	—	—	20	.032	0.81
510A	24M	1.25	800	.500 (12.70)	1.00 (25.40)	—	—	20	.032	0.81
515A	35M	1.50	1200	.500 (12.70)	1.50 (38.10)	—	—	20	.032	0.81
517A	43M	1.75	1200	.500 (12.70)	1.75 (44.45)	—	—	20	.032	0.81
520A	43M	2.00	1200	.500 (12.70)	2.00 (50.80)	—	—	20	.032	0.81



STYLES XXXA



STYLES XXX PA/PC



STYLES XXX P

wirewound resistors

axial leaded power

MIL QUALIFICATION TO MIL-R-39007 and MIL-R-26

ULTRONIX INC SIERRICE
P.O. Box 1090
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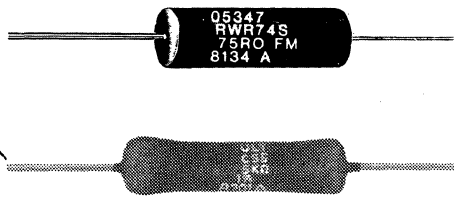
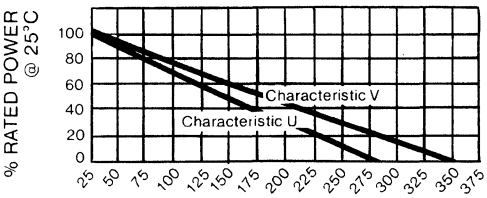
Colorado 81502

(303) 242-0810



POWER RATING

The chart below shows this operating for characteristic U resistors of 1% tolerance and characteristic V resistors of 3% and looser tolerance.



SPECIFICATIONS

MINIMUM RESISTANCE
0.1Ω for solenoid winding depending on tolerance
10Ω for non-inductive winding

TOLERANCES AVAILABLE
±0.1%, 0.25%, 0.5%, 1%, 3%, 5%, & 10%
Depending on style and value

TEMPERATURE COEFFICIENTS
Standard .1 to .499Ω +650 PPM/°C
.499 to 1.0Ω +400 PPM/°C
1.0 to 10Ω ±50 PPM/°C
>10Ω ±20 PPM/°C
Special to + 6000PPM/°C

NON INDUCTIVE WINDING-ADD PREFIX N
Divide maximum resistance by two.
Multiply maximum working voltage by 0.707
Where possible, specify maximum inductance or capacitance allowable at a specific frequency.

PRODUCT SELECTION			POWER RATING AT 25 C/MAXIMUM VALUE				DIMENSIONS						
							ϕ DIAMETER		LENGTH		ϕ LEAD		
ULTRONIX	MIL-R-26	MIL-R-39007	COMMERCIAL	MIL-R-26 CHAR U	MIL-R-26 CHAR V	MIL-R-39007	INCH	MM	INCH	MM	AWG	inch	mm
MS1	RW81	RWR81	1W/1.25K	1W/1K	—	1W/1.00K	.085±.020	2.16±0.51	.250±.031	6.35±0.79	24	.020	0.51
MS101	—	RWR82	1.5W/1.5K	—	—	1.5W/1.3K	.093 max	2.4 max	.343 max	8.7 max	24	.020	0.51
MS2	RW70	—	2W/3.16K	1W/3.16K	—	—	.094±.031	2.39±0.79	.406±.031	10.31±0.79	24	.020	0.51
MS2	RW80	RWR80	2W/3.16K	2W/2.67K	—	2W/3.16K	.094±.031	2.39±0.79	.406±.031	10.31±0.79	24	.020	0.51
MS25/CS3	RW69	—	3W/10K	—	3W/2K	—	.200±.031	5.08±0.79	.500±.062	12.70±1.57	20	.032	0.81
MS3/CS4	RW79	RWR89	3W/11K	3W/10.5K	—	3W/4.12K	.187±.031	4.75±0.79	.560±.062	14.22±1.57	20	.032	0.81
CS5	—	—	4W/20K	—	—	—	.200±.031	5.08±.079	.812±.062	20.62±1.57	20	.032	0.81
CS6	RW74	RWR74	5W/38K	5W/12.1K	—	5W/12.1K	.312±.031	7.92±0.79	.875±.062	22.22±1.57	18	.040	1.02
CS7	RW67	—	6.5W/45K	—	6.5W/8.2K	—	.312±.031	7.92±.079	1.000±.062	25.40±1.57	20	.032	1.02
CS6	—	RWR84	7W/38K	—	—	7W/12.4K	.312±.031	7.92±0.79	.875±.062	22.22±1.57	18	.040	1.02
CS8	—	—	8W/84K	—	—	—	.375±.031	9.52±0.79	1.375±.062	34.92±1.57	18	.040	1.02
CS10	RW78	RWR78	10W/115K	10W/39.2K	—	10W/39.2K	.375±.031	9.52±0.79	1.780±.062	45.21±1.57	18	.040	1.02
CS11	RW68	—	11W/115K	—	11W/20K	—	.375±.031	9.52±0.79	1.780±.062	45.21±1.57	18	.040	1.02

VERY LOW OHM, ULTRA PRECISION FOUR TERMINAL RESISTORS

STANDARD OHMIC VALUES & WATTAGES AVAILABLE

OHMIC VALUE	PRODUCT TYPE				
	FT1	FT2	FT3	FT5	FT7
.00167			3 watts		
.003		2 watts	3 watts		
.00455		2 watts	3 watts		
.005		2 watts	3 watts		
.010	1 watt	2 watts	3 watts		
.0139		2 watts	3 watts		
.025	1 watt	2 watts	3 watts		
.050	1 watt	2 watts			
1. - 35.				5 watts	7 watts

Derate to 0 at 175°C.

Ultronix manufactures a large variety of four-terminal resistors and networks for specialized applications. These are used in requirements of lower value where high precision and low temperature coefficient is required.

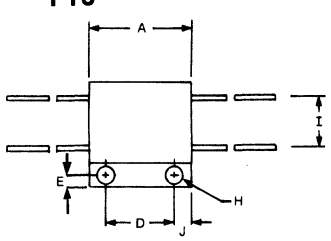
Tolerances available 1.0% or greater.

Temperature Coefficient for the FT1, FT2, and FT3 is 100 ppm/°C from +25°C to +125°C. FT5 and FT7. T.C. is 10 ppm/°C from +25°C to +125°C.

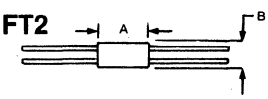
SPECIFICATIONS Dimensional Tolerances ±.02 (.508)

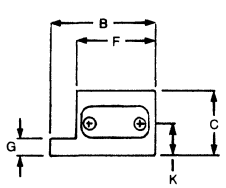
	A	B	C	D	E	F	G	H	I	J	K	LEAD LENGTH	ϕ LEADS AWG	inch	mm
FT1	.625 (15.87)	.312 (7.92)	—	—	—	—	—	—	.20 (5.08)	—	—	1.00 typ. (25.4)	18	.040	1.012
FT2	.750 (19.05)	.375 (9.52)	—	—	—	—	—	—	.20 (5.08)	—	—	1.00 typ. (25.4)	18	.040	1.012
FT3	.750 (19.05)	.780 (19.81)	.50 (12.7)	.50 (12.7)	.093 (2.36)	.590 (14.98)	.120 (3.05)	.120 (3.05)	.20 (5.08)	.125 (3.17)	.25 (6.35)	1.00 typ. (25.4)	16	.051	1.29
FT5	.625 (15.87)	.312 (7.92)	.450 (11.43)	.40 (10.16)	.112 (2.84)	—	—	.125 (3.17)	—	.112 (2.84)	.296 (7.51)	voltage 1.0 typ. (25.4) current 1.0 typ. (25.4)	voltage 26 current 20	voltage .016 current .032	voltage 0.404 current 0.813
FT7	1.000 (25.4)	.312 (7.92)	.450 (11.43)	.781 (19.83)	.110 (2.79)	—	—	.125 (3.17)	—	.110 (2.79)	.29 (7.36)	voltage 1.0 typ. (25.4) current 1.0 typ. (25.4)	voltage 26 current 20	voltage .016 current .032	voltage 0.404 current 0.813

FT3

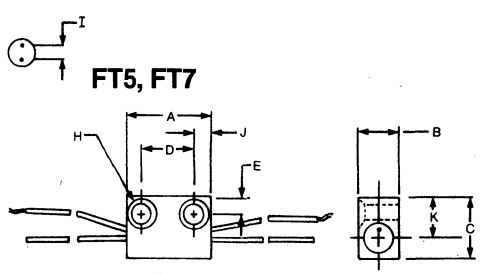


FT1, FT2





FT5, FT7



ULTRONIX SIERRICE

wirewound resistors

10 TO 50 WATTS

ALUMINUM HOUSED — CHASSIS MOUNT

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Grand Junction
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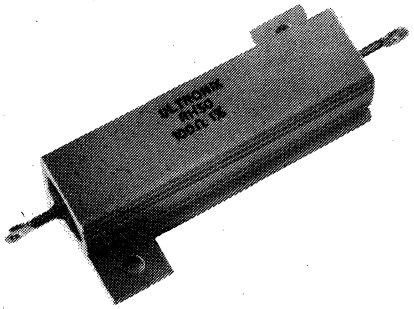
(303) 242-0810



The RH Series provides high dissipation, light weight and small volume, complete environmental protection, electrical insulation 10^7 MΩ, mechanical strength, easy mounting, high stability <0.05%/year, low temperature coefficient, low ohmic values.

Ultronix Type	Power Rating at 25°C	Max. Rated Voltage	Max. Value (ohms)	Minimum Value (ohms) vs. Tolerance						Length ±.02 (.5)	Height Max.
				0.1%	0.5%	1%	2%	5%	10%		
RH5	10W	160V	3.32K	9.4	1.2	0.6	0.3	0.1	0.01	.64 (16.3)	.35 (8.9)
RH10	12.5W	250V	5.62K	9.4	1.2	0.6	0.3	0.1	0.009	.75 (19)	.43 (11)
RH25	25W	550V	12.1K	2.8	0.15	0.06	0.03	0.015	0.0075	1.10 (28)	.59 (15)
RH50	50W	1285V	39.2K	2.8	0.15	0.06	0.03	0.015	0.0075	1.97 (50)	.59 (15)

Power Rating based on proper heat sinking: 413cm^2 for RH5 and RH10, 536cm^2 for RH25 and RH50

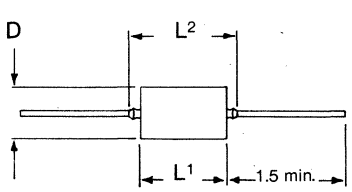
HERMETICALLY SEALED – ULTRA-HIGH STABILITY

- Accuracy to 25 ppm absolute
- Shelf life to 10 ppm/year
- Temperature coefficient to ±1 ppm/°C
- Zero voltage coefficient
- Noise free
- Low thermal EMF

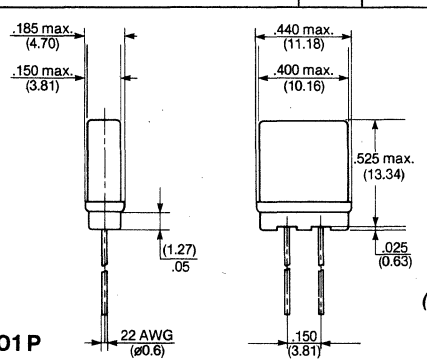
SPECIFICATIONS

Style	Max Value (Ω)	Power rating at 25° C* (W)	Max Volts	Dimensions						ϕ Leads		
				D ± .01 (.25)		L1 ± .02 (.51)		L2 ± .03 (.76)				
				inch	mm	inch	mm	inch	mm	AWG	inch	mm
HS185A	817 KΩ	0.125	300	.187	4.76	.500	12.70	.625	15.88	22	.026	.60
HS205A	1.93 MΩ	0.25	300	.250	6.35	.500	12.70	.562	14.27	20	.032	.81
HS207A	2.3 MΩ	0.4	600	.250	6.35	.750	19.05	.812	20.62	20	.032	.81
HS210A	4.10 MΩ	0.5	600	.250	6.35	1.000	25.40	1.063	27.00	20	.032	.81
HS307A	4.10 MΩ	0.6	600	.375	9.53	.750	19.05	.850	21.59	20	.032	.81
HS310A	5.63 MΩ	0.8	600	.375	9.53	1.000	25.40	1.160	29.46	20	.032	.81
HS510A	24 MΩ	1.	600	.500	12.70	1.000	25.40	1.160	29.46	20	.032	.81
HS520A	43 MΩ	1.8	900	.500	12.70	2.000	50.80	2.160	54.86	20	.032	.81
HS101P	450 KΩ	0.3 *	300	See HS101P drawing						22	.026	.60

*HS101P Power Rating is at 125°C



HSXXXA



HS101P

(Available without standoff)

P.O. Box 1090
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Colorado 81502

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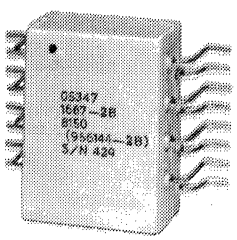
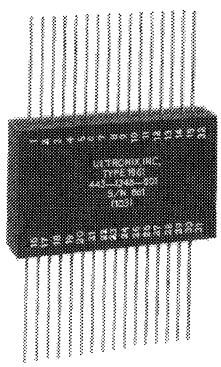
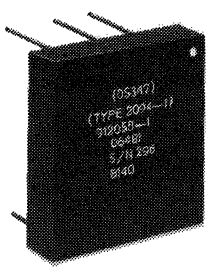
wirewound networks and custom requirements

CALL FOR OUR APPLICATIONS ENGINEERS TO ASSIST YOU WITH YOUR DESIGN REQUIREMENTS

CUSTOM DESIGNED NETWORKS AND MATCHED SETS







Network quality is determined by the precision of its individual resistors plus packaging and mounting techniques. **ULTRONIX** offers a unique background of experience, reliability, data, manufacturing and testing skills for wirewound resistor networks. For a sample of this ability, submit your next network requirement for evaluation by **ULTRONIX** engineers.

Matched resistor sets and custom designed networks are available from Ultronix for equipment design requiring close ratio matching and temperature tracking of resistors.

Our networks are used in a wide variety of applications such as communications satellites, precision instrumentation, aircraft controls, etc.

GENERAL SPECIFICATIONS AVAILABLE

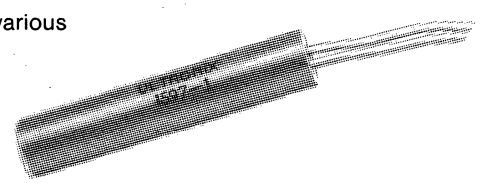
Ambient operating temperature range	−55°C to125°C
Resistances values	0.1 ohm to 40M ohm
Absolute resistor tolerances	to ±0.005%
Matched resistance ratios	to ±0.001%
Temperature coefficient match and tracking between resistors within	±1 ppm from 0°C to +85°C

Low reactance and rise times as low as 0.02 microseconds.
AC resistance match at frequence determined by user.

CUSTOM WIREWOUND TEMPERATURE SENSORS

Ultronix temperature sensors are available with temperature coefficients from −50 to +6000 PPM/°C. Various alloys and metals are used to obtain the required range of resistance change with temperature for trimming, tracking, compensation and matching. These units may be in metal housings such as brass, aluminum, or stainless steel, or molded in various epoxies or silicone.

TCR PPM/°C		TCR PPM/°C	
25°C to 125°C	-55°C to 25°C	25°C to 125°C	-55°C to 25°C
80 ± 20	80 ± 20	1400 ± 200	1500 ± 200
100 ± 20	100 ± 20	2600 ± 200	2600 ± 200
140 ± 30	140 ± 30	3000 ± 150	3000 ± 150
180 ± 30	180 ± 30	3200 ± 300	3200 ± 300
290 ± 30	290 ± 30	3500 ± 300	3500 ± 300
400 ± 40	380 ± 40	4500 ± 400	3900 ± 300
700 ± 200	700 ± 200	5000 ± 500	4000 ± 500
850 ± 80	850 ± 80	6000 ± 300	5000 ± 300
1000 ± 100	1000 ± 100		



The accompanying table lists standard TCR's for readily available alloys and metals. Most alloys show some non-linearity as can be noted by the TCR differences above and below 25°C. However, all alloys can be considered linear over narrow spectrums.

enameled wirewound power resistors

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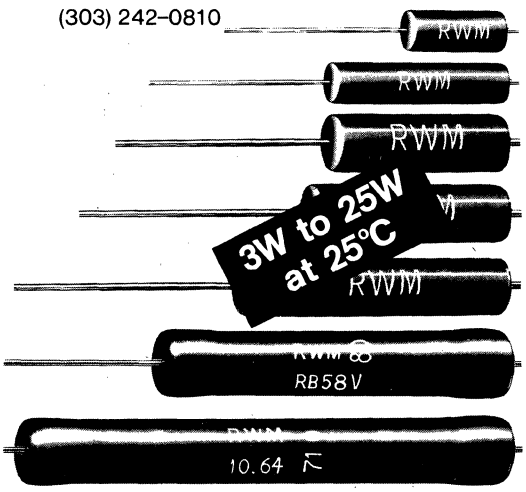
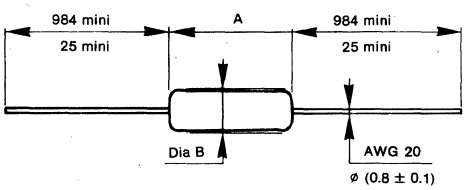


As a result of more than 40 years of experience and continuous improvements the RWM Series of resistors features proven reliability either in direct or alternating current.
The high quality of the RWM results primarily from the use of a proprietary Sfernice enamel fired at high temperature and which is free from any compound that would corrode the resistive wire.

- **HIGH SPECIFIC DISSIPATION**
- **HIGH RELIABILITY LEVEL**
  - **Fire proof**
  - **Excellent endurance**
  - **Conformal vitreous enamel**
  - **Great mechanical strength**
  - **Good environmental protection**
  - **All welded construction**
- **LOW OHMIC VALUES**

Table 1

Style	4 x 10	4 x 22	6 x 22	5 x 26	6 x 34	8 x 45	10 x 64
A	.472±.039 (12±1)	.870±.039 (22.1±1)	.854±.039 (21.7±1)	.972±.039 (24.7±1)	1.327±.039 (33.7±1)	1.764±.039 (44.8±1)	2.512±.039 (63.8±1)
Dia B	.216±.039 (5.5±1)	.216±.039 (5.5±1)	.291±.059 (7.4±1.5)	.291±.059 (7.4±1.5)	.291±.059 (7.4±1.5)	.370±.059 (9.4±1.5)	.370±.059 (9.4±1.5)
Weight: grams	1	2	2.5	3	4	8	14



inches
(mm)

FEATURES

Table 2

SFERNICE STYLES		4 x 10	4 x 22	6 x 22	5 x 26	6 x 34	8 x 45	10 x 64
MIL-R-26 E STYLES		RW 69	–	–	RW 67	–	RW 68	–
CECC 40201-001	(alternate marking)	RB 59	RB 61	RB 57	RB 57	RB 60	RB 58	–
BS - CECC 40201-002	(alternate marking)	JB	HB	KB	–	–	–	–
POWER RATING	Rated at 70°C	2.6 W	4.3 W	6 W	5.6 W	6.9 W	9.5 W	21 W
	at 25°C	3 W	5 W	7 W	6.5 W	8 W	11 W	25 W
	with surface temp. ≦ 400°C	5.5 W	7 W	10 W	10 W	12 W	20 W	25 W
OHMIC RANGE E 12	± 10%	.1 Ω < 1 Ω	.15 Ω < 1 Ω	.15 Ω < 1 Ω	.15 Ω < 1 Ω	.33 Ω < 1.5 Ω	.47 Ω < 1.8 Ω	.68 Ω < 3.3 Ω
IN RELATION TO TOLERANCE E 12	± 5%	1 Ω 6.8 KΩ	1 Ω 16 KΩ	1 Ω 27 KΩ	1 Ω 27 KΩ	1.5 Ω 36 KΩ	1.8 Ω 62 KΩ	3.3 Ω 100 KΩ
LIMITING ELEMENT VOLTAGE		120 V	300 V	350 V	350 V	500 V	650 V	800 V
CRITICAL RESISTANCE		4.8 KΩ	–	17.5 KΩ	18.8 KΩ	31 KΩ	38 KΩ	25.6 KΩ

MARKING

SFERNICE Trade mark, SFERNICE series and style, CEEC style, if applicable, (except for the smallest model due to lack of space 4 x 10 or RB 59), ohmic value (in Ω), resistance tolerance (in %), manufacturing date.

SPECIFICATIONS

Tolerance: ± 5% standard. ± 2% to ± 10% on request.
Temperature coefficient: + 75 ppm/ °C typical.
Dielectric withstanding voltage: 1000 V RMS.
Inductance: non inductive (Ayrton-Perry) winding available.

ORDERING PROCEDURE

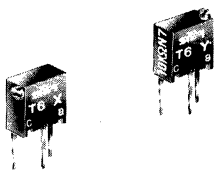
SERIES	STYLE	NON INDUCTIVE WINDING	OHMIC VALUE	TOLERANCE
RWM	8x45	NI	1.6 KΩ	±5%

1/4" ultra high precision multiturn trimmer

NICROCER® process

– fully sealed container military and professional grade –

P.O. Box 1090
Grand Junction
Colorado 81502
(303) 242-0810

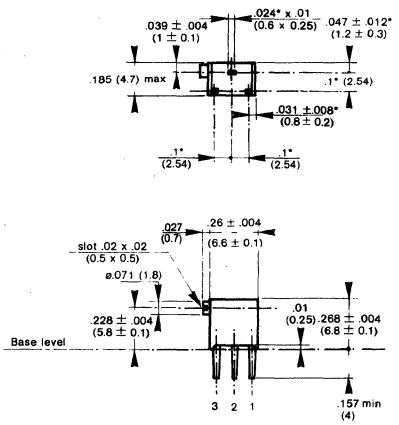


The nickel-chromium track specially developed by SFERNICE using the NICROCER® process for high-precision planar resistors, gives this trimmer a unique combination of performances:

- **VERY LOW TEMPERATURE COEFFICIENT: typical < ± 10 ppm/°C in the range – 55°C + 125°C**
- **VERY LOW CONTACT RESISTANCE VARIATION: typically 0.2Ω**
- **INFINITE RESOLUTION: TYPICAL ADJUSTMENT: < 0.1%**
- **NON-INDUCTIVE**
- **EXCELLENT OVERALL STABILITY**
- **FULLY SEALED CASE**

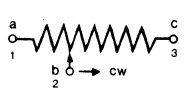
Two versions are available: TM6X side adjust
TM6Y top adjust

TM6 X

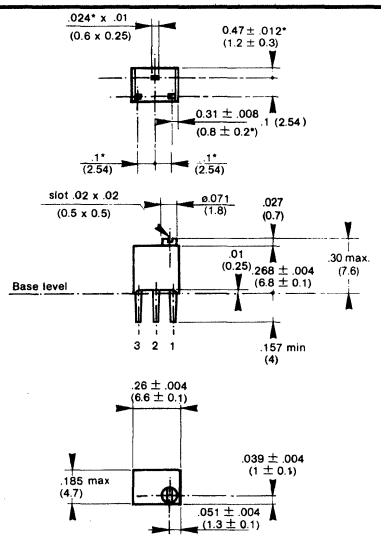


* To be measured at base level
Dimensions in inches (mm)

CIRCUIT DIAGRAM



TM6 Y



SPECIFICATIONS

MECHANICAL

ELECTRICAL TRAVEL... 15 turns ± 5 turns
OPERATING TORQUE... .14 to 1.4 oz inch max.
END STOP TORQUE... clutch action
UNIT WEIGHT... .02 oz max.
RESISTIVE ELEMENT... nickel chromium

ENVIRONMENTAL

TEMPERATURE RANGE... – 55°C + 155°C
SEALING... fully sealed case

ELECTRICAL

ELECTRICAL TRAVEL... 13 turns ± 2 turns
RESISTANCE RANGE... 20Ω to 5 KΩ
Standard series 1 - 2 - 5
TOLERANCE standard... ± 10%
on request... ± 5%
POWER RATING linear... 0.25W at +85°C
TYPICAL TEMP. COEFFICIENT... < 10 ppm/°C
INDUCTANCE... < 0.1 μH
SETTLING TIME... $1x10^{-9}$ sec.
FREQUENCY... > 100 MHz
RESOLUTION... infinite
ADJUSTMENT... 0.05% max.
LIMITING ELEMENT VOLTAGE... 250 V
MAX. CONTACT RESISTANCE VARIATION... 0.3% RN or 1Ω
DIELECTRIC STRENGTH (RMS)... 1000 V
END RESISTANCE (typical)... 2Ω for 20Ω and 50Ω, 5Ω ≧ 100Ω
INSULATION RESISTANCE (250 V DC)... 10^6 MΩ

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

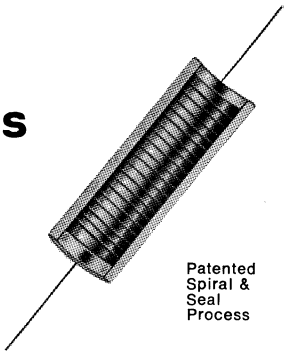
TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 85/86 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1166, **B**•1012, **C**•1028, **D**•1016
ASCII Code ..... **D**•1087
Batteries, Product Selection Guide ..... **D**•1413
Batteries & Fuel Cells, Characteristics ..... **D**•1430
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide ..... **A**•1003
Circuit Boards (Printed) Product Selection Guide ..... **C**•1099
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1205
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1863
Connectors, Miniglossary ..... **C**•1129
Connectors, Terminals, & Sockets, Product Selection Guide ..... **C**•1105
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Gude ..... **A**•1309
Delay Lines, Product Selection Guide ..... **A**•1459
Discrete Semiconductors, Product Selection Guide ..... **A**•2067
Displays, Readouts, Lamps, & Lights, Product Selection Guide ..... **B**•1015
EBCDIC Code ..... **D**•1092
Encapsulation, Miniglossary ..... **C**•1086
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide .. **C**•1623
Filters, Product Selection Guide ..... **A**•1583
Instruments, Graphic Recording Product Selection Guide ..... **D**•1401
Instruments, Panel Meters, Product Selection Guide ..... **D**•1329
Instruments, Test & Measuring Product Selection Guide ..... **D**•1175
Interconnection Systems, Product Selection Guide ..... **C**•1699
Keyboards & Keypads, Product Selection Guide ..... **B**•1705
Logofinder & Trademark Directories ..... **B**•901
Microwave Components, Product Selection Guide ..... **A**•1701
Military Qualified Products Lists ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1129
Opto Semiconductors, Miniglossary ..... **B**•1214
Oscilloscopes, Product Selection Guide ..... **D**•1385
Panel Hardware, Product Selection Guide ..... **C**•1589
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide ..... **A**•1991
Power Supplies, Miniglossary ..... **D**•1462
Power Supplies, AC, Product Selection Guide ..... **D**•1877
Power Supplies, DC, Product Selection Guide ..... **D**•1447
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide .... **B**•1225
Relay Contact Forms ..... **B**•1317
Relays, Electromechanical, Miniglossary ..... **B**•1308
Relays, Product Selection Guide ..... **B**•1261
Resistor Color Codes ..... **A**•1828
Resistors, Product Selection Guide ..... **A**•1785
Servo Components, Miniglossary ..... **D**•1985
Solenoids, Product Selection Guide ..... **B**•1463
Switches, Product Selection Guide ..... **B**•1477
Thermal Components, Product Selection Guide ..... **B**•1741
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1744
Thyristors/High Power Diodes, Miniglossary ..... **A**•2076
Transducers & Encoders, Product Selection Guide ..... **B**•1777
Transformers, Product Selection Guide ..... **A**•2099
Wire & Cable, Product Selection Guide ..... **C**•1743
Wire Gauges—Diameter, Area, Copper Weight ..... **C**•1844

VAMISTOR

Metal Film Resistors: Power 1/10 to 4 Watts



Patented Spiral & Seal Process

FEATURES:

- Parts exceed MIL-R-55182
- Special burn-in available
- Matched sets, both toler.
- Tolerances to .1% & TC to 10 PPM

QPL Pendings: RN80 G/B, RL42 TX, RL32, RL32 TX

VAMISTOR TYPES APPROVED PER MIL-R-55182

MILITARY TYPE	STYLE CHAR.	VAMISTOR STYLE	TC ppm/°C	RESISTANCE RANGE	BODY LENGTH	BODY DIAMETER	LEAD LENGTH	LEAD DIAMETER
RNC55	C	HS47-2B	50		.250	.109	1½	.025
RNR55	H	HR47-2B	50		±.031	±.031	±⅛	±.002
RNN55	E	HS47-2A	25	24.9 OHMS to 200K				
	J	HR47-2A	25		(6.35	(2.78	(38.1	(.635
(1/10 Watt)	K	HR47-2K	100		±.787)	±.787)	±3.18)	±.050)
RNC60	C	HS48-2B	50		.375	.125	1½	.025
RNR60	H	HR48-2B	50		±.062	+.040	±⅛	±.002
RNN60	E	HS48-2A	25	24.9 OHMS to 499K		−.031		
	J	HR48-2A	25		(9.52	(3.17+	(38.1	(.635
(⅛ Watt)	K	HR48-2K	100		±1.57)	1.02−.787)	±3.18)	±.050)
RNC65	C	HS55-2B	50		.625	.188	1½	.025
RNR65	H	HR55-2B	50		+.031	+.062	±⅛	±.002
RNN65	E	HS55-2A	25	24.9 OHMS to 1 MEG.	−.094	−.031		
	J	HR55-2A	25		(15.87		(38.1	(.635
(¼ Watt)	K	HR55-2K	100		+.787	(4.77+	±3.18)	±.050)
					−2.39)	1.57−.787)		
RNC70	C	HS52-2B	50		.750	.250	1½	.032
RNR70	H	HR52-2B	50		+.125	+.078	±⅛	±.002
RNN70	E	HS52-2A	25	24.9 OHMS to 1.5 MEG.	−.062	−.031		
	J	HR52-2A	25		(19.04		(38.1	(.813
(½ Watt)	K	HS52-2K	100		+3.17	(6.35+	±3.18)	±.050)
					−1.57)	1.98−.787)		
RNC75	E	HS50-2A	25		1.062	.375	1½	.032
RNR75	J	HR50-2A	25	24.9 OHMS to 2 MEG.	±.062	+.062	±⅛	±.002
						−.031		
					(26.97	(9.52+	(38.1	(.813
(1 Watt)					±1.57)	1.57−.787)	±3.18)	±.050)

Vamistor Resistors are also approved for MIL-R-10509. Consult factory.

(Metric Dimensions shown in parenthesis)

COMMERCIAL PARTS & EXTENDED RANGES

Parts are made on same production line as MIL-R-55182 and MIL-R-10509

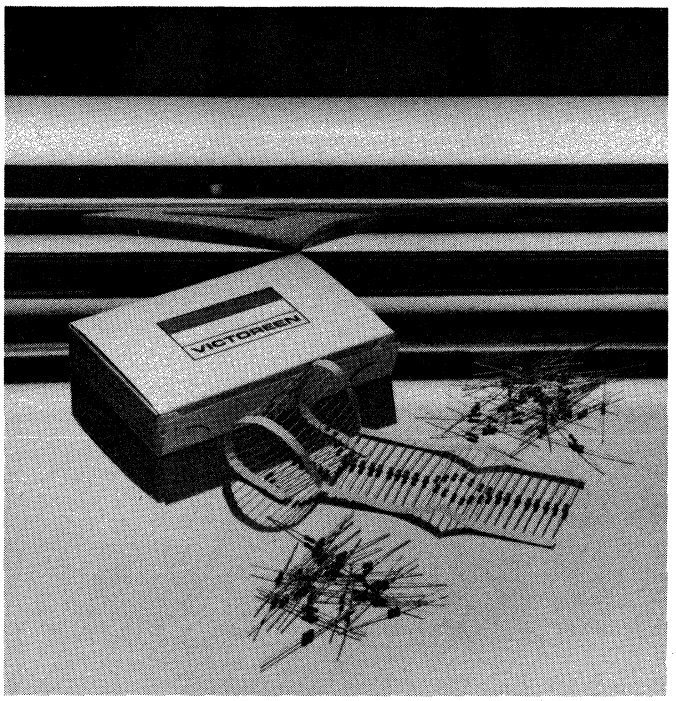
STYLE	WATTAGE @70°C	T.C. ppm/°C	RESISTANCE RANGES	BODY LENGTH	BODY DIAMETER	LEAD DIAMETER	LEAD LENGTH
HS47	⅛	25	24.9 OHMS to 200K	.250	.109	.025	1.5
		50					
VX55		100	10 OHMS to 5 MEG.				
HS48	¼	25	24.9 OHMS to 499K	.375	.125	.025	1.5
		50					
VX60		100	10 OHMS to 5 MEG.				
HS55	½	25	24.9 OHMS to 1.5 MEG.	.600	.188	.025	1.5
		50					
VX65		100	10 OHMS to 8 MEG.			.032	
HS52	1	25	24.9 OHMS to 2 MEG.	.750	.250	.032	1.5
		50					
VX70	½	100	10 OHMS to 10 MEG.	.600	.188		
HS50	2	25	24.9 OHMS to 3.5 MEG.	1.000	.300	.032	1.5
		50					
VX75	2	100	10 OHMS to 12 MEG.				
HS49	4	25	24.9 OHMS to 6 MEG.	2.100	.300	.032	1.5
		50					
VX80	4	100	10 OHMS to 15 MEG.				

All dimensions are in inches

VAMISTOR Corp.

SALES OFFICE:

115 Industrial Park, Sevierville, TN 37862 • (615) 453-0001 • TWX: 810-570-4931



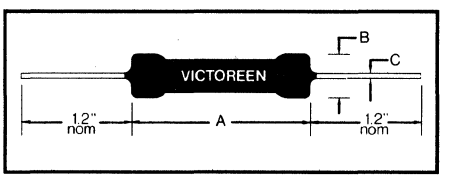
VICTOREEN Carbon & Metal Film Resistors

From general purpose thru extreme precision, Victoreen now offers low-priced Carbon and Metal Film Resistors.

In addition to our broad based stock, custom stocking plans are available to fit your needs.

CARBON FILM

- Wide resistance range: 1 ohm to 10M ohm
- Tolerances available: 2 & 5%
- Packaging variety: Bulk, Tape & Reel, Ammo Pack
- Cut and form leads available as required
- Custom stocking plans available
- Epoxy conformal coated

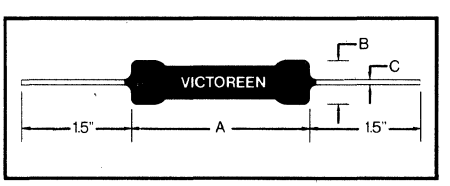


Dimensions (in inches)

Type	A Max Length	B Max O.D.	C Nominal
VCF-125	0.150	0.080	0.020
VCF-250	0.270	0.110	0.024
VCF-200	0.410	0.160	0.024
VCF-1000	0.512	0.189	0.028
VCF-2000	0.709	0.256	0.028

METAL FILM

- Wide Temperature Coefficient range: 25, 50, 100PPM/°C
- Tolerances available: 0.25%, 0.5%, 1%, 2%, 5%
- Packaging variety: Bulk, Tape & Reel, Ammo Pack
- Cut and form leads available as required
- Custom stocking plans available
- Epoxy conformal coated



Dimensions (in inches)

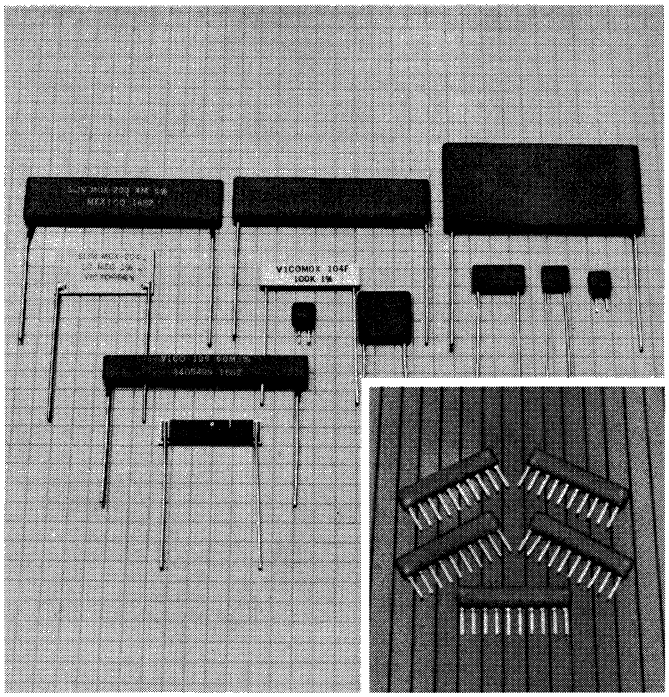
Type	A Max Length	B Max O.D.	C Nominal
VMF-50	0.150	0.078	0.018
VMF-55	0.275	0.105	0.024
VMF-60	0.400	0.155	0.028
VMF-65	0.490	0.175	0.028
VMF-70	0.700	0.235	0.032

Capabilities

Type	Resistance Range (Ohm)	Power Rating (@ 70°C)	Voltage Rating
VCF-125	1-1M	1/8W	200V
VCF-250	1-10M	1/4W	250V
VCF-500	1-10M	1/2W	350V
VCF-1000	1-10M	1W	500V
VCF-2000	1-10M	2W	500V
VMF-50	10-510K	1/8W	200V
VMF-55	10-1M	1/4W	250V
VMF-60	10-1M	1/2W	350V
VMF-65	10-1M	1W	500V
VMF-70	10-1M	2W	500V

VICTOREEN
Victoreen, Inc.
A Sheller-Globe Corporation Subsidiary
10101 Woodland Avenue
Cleveland, Ohio 44104
(216) 795-8200

VICTOREEN
Thick Film Flat Resistors S.I.P. and D.I.P. Networks

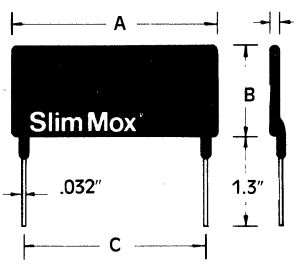


Slim-Mox Resistors are ideal for applications where high voltage/high impedance or high density packaging are benefits to the designer.

S.I.P. Networks are available from 47 ohm to 2.2 megs, with stocking plans to fit your needs. D.I.P. Networks are also available.

Slim-Mox

- Stocking values available
- Wide resistance range to 50,000 Meg ohm
- Voltage capability to 20 KV
- Power rating to 15 Watts
- Tolerances from 0.5 to 20%
- Epoxy conformal coated
- Resistor Dividers available



Dimensions (in inches)

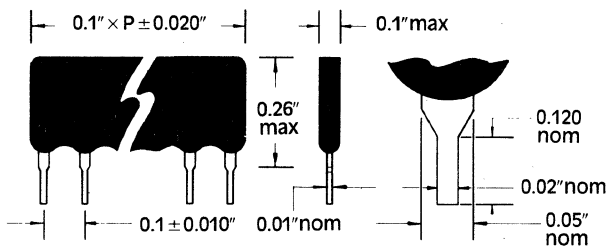
SLIM-MOX	A Max. Length	B Max. Height	C Nominal
SIL-2	0.30	0.30	0.1
101	0.33	0.34	0.2
102	0.58	0.34	0.4
104	1.08	0.34	0.9
108	2.08	0.34	1.9
202	0.58	0.59	0.4
204	1.08	0.59	0.9
208	2.08	0.59	1.9
308	2.08	0.84	1.9
404	1.08	1.09	0.9
408	2.08	1.09	1.9

Capabilities (Slim-Mox)

SLIM-MOX	Resistance Range (Ohm)	Power Rating (@ 25°C)	Voltage Rating
SIL-2	1K-100M	0.25W	1500V
101	1K-5000M	0.5W	2500V
102	1K-10,000M	1.0W	5000V
104	1K-50,000M	2.0W	10,000V
108	1K-50,000M	4.0W	20,000V
202	1K-30,000M	2.0W	5000V
204	1K-50,000M	4.0W	10,000V
208	1K-50,000M	8.0W	20,000V
308	1K-50,000M	10.0W	20,000V
404	1K-50,000M	8.0W	10,000V
408	1K-50,000M	15.0W	20,000V

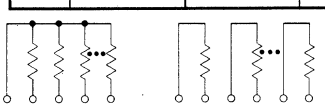
VNK-1V,2V

- Wide resistance range: 47 ohm to 2.2 Meg ohm
- Tolerances available: 2, 5, 10 & 20%
- Bulk package
- Custom stocking plans available
- Epoxy conformal coated
- 5 to 14 pin configurations available



Capabilities (S.I.P. Networks)

Code	Temperature Coefficient (PPM/°C)	Resistance Range (ohm)	Tolerance (%)
A	150	47-2.2M	2, 5
B	200	100-2.2M	5, 10, 20



Type 1V
Pin One Common

Type 2V
Isolated Elements

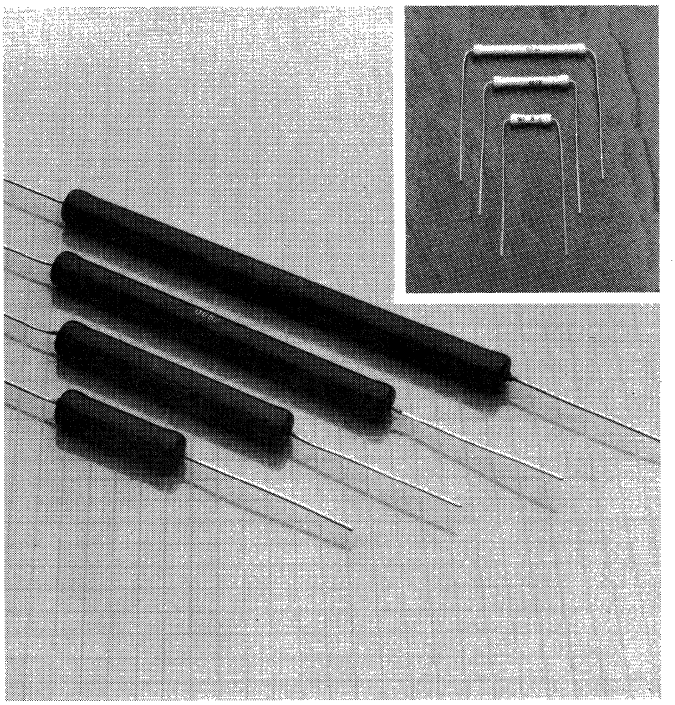
Victoreen, Inc.
A Sheller-Globe Corporation Subsidiary
10101 Woodland Avenue
Cleveland, Ohio 44104
(216) 795-8200

VICTOREEN

VICTOREEN

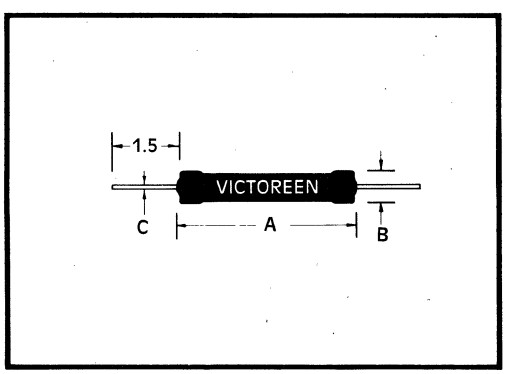
Thick Film Cylindrical Resistors

Victoreen's MOX series of high voltage, high resistance, high power resistors provide dependable product with high performance to size ratio.



Mini-Mox Maxi-Mox

- **Stocking values available**
- **Wide resistance range to 100,000 meg ohm**
- **Voltage capability to 37.5 KV**
- **Power rating to 10.0 Watts**
- **Tolerances from 0.5 to 15%**
- **Epoxy conformal coated**



Capabilities

Type	Resistance Range (ohm)	Power Rating (@ 25°C)	Voltage Rating
MOX-200	1M-1000M	.25W	500V
MOX-300	1M-1000M	.50W	1000V
MOX-400-24	10-25,000M	.75W	2500V
MOX-750-24	10-50,000M	1.00W	4000V
MOX-1125-24	10-75,000M	1.50W	6000V
MOX-1-13	10-80,000M	2.0W	7500V
MOX-2-13	20-85,000M	4.0W	15,000V
MOX-3-13	30-90,000M	6.0W	22,500V
MOX-4-13	40-95,000M	8.0W	30,000V
MOX-5-13	50-100,000M	10.0W	37,500V

Dimensions (in inches)

		A Max. Length	B Max. O.D.	C Nominal
MINI-MOX	200	0.275	0.105	0.024
	300	0.435	0.145	0.028
	400-24	0.500	0.150	0.020
	750-24	0.840	0.150	0.020
	1125-24	1.235	0.150	0.020
MAXI-MOX	1-13	1.140	0.345	0.032
	2-13	2.140	0.345	0.032
	3-13	3.140	0.345	0.032
	4-13	4.140	0.345	0.032
	5-13	5.140	0.345	0.032

HOW TO ORDER:

When ordering Victoreen Mox Resistors, specify—

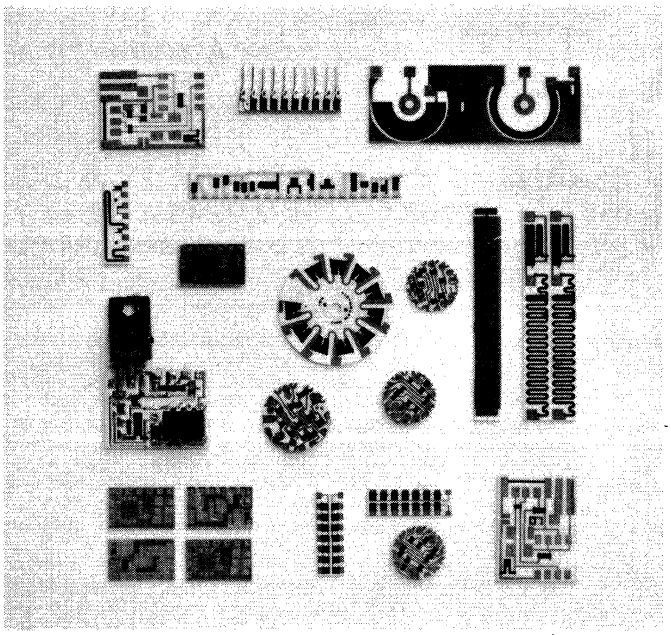
MOX-1125 -2 4 10M 1%

STYLE
LEAD
COATING
RESISTANCE
TOLERANCE

Victoreen, Inc.
A Sheller-Globe Corporation Subsidiary
10101 Woodland Avenue
Cleveland, Ohio 44104
(216) 795-8200

VICTOREEN

VICTOREEN
Micro Circuits



From Substrates To Hybrids

- Custom-Made
- Miniaturized Circuits
- Reliable Performance
- Flexible Design
- Quick Prototyping

Electrical Options

- Ratio Matching to ± .1%
- Absolute Tolerances to ± .1%
- Temperature Coefficient Tracking to ± 10PPM/°C
- Power Ratings of up to 50 Watts/In.^{2}

General Information

- **Resistance Range: .1 ohm to 50,000 Megohm**
- **Termination Materials: PdAg, PdAu, PtAg, PtAu, Ag, Au**
- **Minimum Line Resistance: .020 ohm/□**
- **Line Definition: .005" Min. line width .005" Min. spacing between adjacent lines**

Mechanical Options

- Any Size to a Preferred Maximum of 3" × 3"
- Electrical Crossovers, Multi-Layer Printing
- Double Sided Printing of Resistive and Conductive Paths
- Through Hole Plating on Internal Holes (vias)
- Wrap Around Plating

Victoreen, Inc.
A Sheller-Globe Corporation Subsidiary
10101 Woodland Avenue
Cleveland, Ohio 44104
(216) 795-8200

VICTOREEN

VISHAY RESISTIVE SYSTEMS GROUP

FIXED RESISTORS

Hermetically Sealed Resistors — Metrology and Laboratory Groups

Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 25°C	Max. Work. Voltage	Nominal Dimensions Inch (mm) Length x Diameter	Shelf-Life Stability (Max.ΔR)[3]	Load-Life Stability (Max.ΔR)[3]	Temperature Coefficient of Resistance
VHA412	5-100K >100K-250K	±0.001%	0.3W 0.2W	250	0.625 x 0.375 (15.88) x (9.53)	5ppm after 1 year and 10ppm after 3 years	0.002% 2000 hours 0.1W per chip @60°C	Nominal[2] / Standard Spread[2] 0°C to +25°C / +0.6ppm/°C ±1.5ppm/°C +25°C to +60°C / -0.6ppm/°C ±1.5ppm/°C -55°C to +25°C / +2.2ppm/°C ±2.0ppm/°C +25°C to +125°C / -1.8ppm/°C ±2.0ppm/°C
VHA414	5-200K >200K-500K	±0.001%	0.5W 0.3W	350	1.000 x 0.375 (25.4) x (9.53)			
VHA512*	5-300K >300K-750K	±0.001%	0.75W 0.4W	350	0.625 x (0.50) (15.88) x (12.70)			
VHA516-4*	5-400K >400K-1M	±0.001%	1.0W 0.5W	500	1.000 x 0.500 (25.4) x (12.7)			
VHA516-5*	5-500K >500K-1.25M	±0.001%	1.25W 0.6W	500	1.000 x 0.500 (25.4) x (12.7)			
VHA516-6*	5-600K >600K-1.5M	±0.001%	1.5W 0.7W	500	1.000 x 0.500 (25.4) x (12.7)			
VHA518-7*	5-700K >700K-1.75M	±0.001%	1.75W 0.8W	600	1.500 x 0.500 (38.1) x (12.7)			
VHA518-8*	5-800K >800K-2.0M	±0.001%	2.0W 0.9W	600	1.500 x 0.500 (38.1) x (12.7)			
VHA518-9*	5-900K >900K-2.25M	±0.001%	2.25W 1.0W	600	1.500 x 0.500 (38.1) x (12.7)			
VHA518-10*	5-1M >1M-2.5M	±0.001%	2.5W 1.1W	600	1.500 x 0.500 (38.1) x (12.7)			
VHA518-11*	5-1M >1M-3.3.M	±0.001%	2.5W 1.2W	600	1.500 x 0.500 (38.1) x (12.7)			
VHP202	5-100K >100K-250K	±0.001%	0.3W 0.2W	300	W x L x H (max) 0.195 x 0.445 x 0.430** (4.95) x (11.30) x (10.92) Lead Spacing 0.150 (3.81) nom. †			

Hermetically Sealed "0" TCR Resistor

Model Number	Resistance (Ohms)	Tolerance[1] @+25°C	Power at 70°C	Power at 125°C	Max. Work. Voltage	Nominal Dimensions Inch (mm) W x L x H	Shelf-Life Stability (2000h) (Max.ΔR)[3]	Load-Life Stability (Max.ΔR)[3]	Temperature Coefficient of Resistance
VHP100	100-150K	To ±0.005%	.3W	.15W	300V	W 0.185 ±.020 (4.70 ±0.51) L 0.435 ±.020 (11.05 ±0.51) H 0.430** ±.020 (10.92 ±0.51) Lead Spacing 0.150 (3.81) nom. †	5ppm after 1 year and 10ppm after 3 years	0.02% maxΔR 0.3W @ 70°C and 0.02% maxΔR 0.15W @ 125°C	-55°C to +125°C / <0.6ppm/°C

* Number of chips is designated after dash i.e., VHA516-4 (4 chips). The VHA500 series is also available in a four-terminal lead.
** .375H (9.53mm) available on special order † 0.200 (5.08mm) lead spacing available

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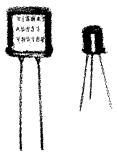
VISHAY RESISTIVE SYSTEMS GROUP

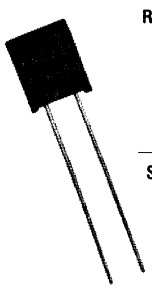
FIXED RESISTORS

Hermetically Sealed Resistors — Industrial and Aerospace Group



Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 70°C	Power at 125°C	Max. Work. Voltage	Maximum Dimensions Inch (mm) W x L x H	Shelf-Life Stability (Max.ΔR)[3]	Load-Life Stability (Max.ΔR)[3]	Temperature Coefficient of Resistance
VHS555[4]**	1-100K >100K-150K	±0.005%	0.6W 0.4W	0.3W 0.2W	300	0.195 x 0.445 x 0.430 (4.95) x (11.30) x (10.92) Lead spacing 0.150 (3.81) Nom.	5ppm after 1 year and 10ppm after 3 years	0.0025% 2000 hrs. 0.1W @ 60°C 0.015% 2000 hrs. 0.3W @ 125°C 0.01% 10,000 hrs. 0.05W @ 125°C	Standard Nominal[2] Spread[2] 0°C to +25°C +0.6ppm/°C ±1.5ppm/°C +25°C to +60°C -0.6ppm/°C ±1.5ppm/°C -55°C to +25°C +2.2ppm/°C ±2.0ppm/°C +25°C to +125°C -1.8ppm/°C ±2.0ppm/°C
VHS102	1-100K >100K-150K	±0.005%	0.6W 0.4W	0.3W 0.2W	300	0.195 x 0.445 x 0.430** (4.95) x (11.30) x (10.92) Lead spacing 0.150 (3.81) Nom.†			

Established Reliability Resistors — MIL Style RNC90Y (MIL-R-55182/9, Char. Y)



Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 70°C	Power at 125°C	Max. Work. Voltage	Nominal Dimensions Inch (mm) W x L x H	Shelf-Life Stability (Max.ΔR)[3]	Load-Life Stability (Max.ΔR)[3]	Temperature Coefficient of Resistance
RNC90Y[4]	4.99-121K	±0.005%	0.6W	0.3W	300	0.105 x 0.310 x 0.326 (2.67) x (7.87) x (8.28) Lead spacing 0.150 (3.81) Nom. Dim. Tol. ±0.010 (0.25)	25ppm after 1 year and 50ppm after 3 years	0.015% 2000 hrs. 0.3W @ 125°C	Standard Nominal[2] Spread[2] 0°C to +25°C +0.6ppm/°C ±1.5ppm/°C +25°C to +60°C -0.6ppm/°C ±1.5ppm/°C -55°C to +25°C +2.2ppm/°C ±2.0ppm/°C +25°C to +125°C -1.8ppm/°C ±2.0ppm/°C
S555	1-121K >100K-150K	±0.005%	0.6W	0.3W 0.2W	300	0.105 x 0.310 x 0.326 (2.67) x (7.87) x (8.28) Lead spacing 0.150 (3.80) Nom. Dim. Tol. ±0.010 (0.25)			

* Within the resistance range of 4.99Ω to 121KΩ, this unit contains an RNC90Y inside the hermetically-sealed unit.
** .375H (9.53mm) available on special order
† .200 (5.08mm) lead spacing available

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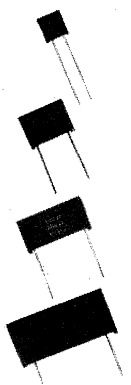
VISHAY RESISTIVE SYSTEMS GROUP

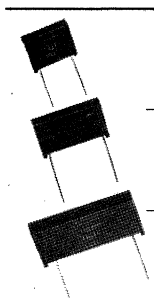
FIXED RESISTORS

Precision Resistors — High Performance Industrial & Aerospace Group



Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 70°C	Power at 125°C	Max. Work. Voltage	Nominal Dimensions Inch (mm) W x L x H	Shelf-Life Stability (Max.ΔR)[3]	Load-Life Stability (Max.ΔR)	Temperature Coefficient of Resistance
S102C™[4] (1 chip)	1-100K >100K-250K	±0.005%	0.6W 0.4W	0.3W 0.2W	300	0.105 x 0.302 x 0.326 (2.67) x (7.67) x (8.28) Dim. Tol. ±0.010 (0.25) Lead Spacing 0.150 (3.81) Nom.	25ppm after 1 year and 50ppm after 3 years	0.005% 2000 hrs. 0.1W per chip @70°C 0.015% 2000 hrs. 0.3W per chip @125°C 0.05% 10,000 hrs. 0.3W per chip @125°C	Nominal[2] / Standard Spread[2] 0°C to +25°C +0.6ppm/°C ±1.5ppm/°C +25°C to +60°C -0.6ppm/°C ±1.5ppm/°C -55°C to +25°C +2.2ppm/°C ±2.0ppm/°C +25°C to +125°C -1.8ppm/°C ±2.0ppm/°C
S104D (2 chips)	1-200K >200K-500K	±0.005%	1.0W 0.6W	0.5W 0.3W	350	0.160 x 0.575 x 0.530 max* (4.06) x (14.61) x (13.46) Lead Spacing 0.400 (10.16) Nom.			
S105D (3 chips)	1-300K >300K-750K	±0.005%	1.5W 0.8W	0.75W 0.4W	350	0.160 x 0.820 x 0.530 max* (4.06) x (20.83) x (13.46) Lead Spacing 0.650 (16.51) Nom.			
S106D (4 chips)	0.5-400K >400K-1M	±0.005%	2.0W 1.0W	1.0W 0.5W	500	0.260 x 1.190 x 0.530 max* (6.60) x (30.23) x (13.46) Lead Spacing 0.900 (22.86) Nom.			

Value Engineered and Standard Stock Precision Resistors



Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 70°C	Power at 125°C	Max. Work. Voltage	Nominal Dimensions Inch (mm) W x L x H	Shelf-Life Stability (Max.ΔR)[3]	Load-Life Stability (Max.ΔR)[3]	Temperature Coefficient of Resistance (Limits)
VSR4 (2 chips)	1-200K >200K-500K	.005%	0.5W 0.3W	0.4W 0.2W	350	0.160 x 0.575 x 0.530 max* (4.06) x (14.61) x (13.46) Lead Spacing 0.400 (10.16) Nom.	25ppm after 1 year	0.05% 2000 hrs. @125°C	0°C to +60°C ±4ppm/°C -55°C to +125°C ±8ppm/°C
VSR5 (3 chips)	1-300K >300K-750K	.005%	0.75W 0.4W	0.6W 0.3W	350	0.160 x 0.820 x 0.530 max* (4.06) x (20.83) x (13.46) Lead Spacing 0.650 (16.51) Nom.			
VSR6 (4 chips)	0.5-400K >400K-1M	.005%	1.0W 0.5W	0.8W 0.4W	500	0.260 x 1.190 x 0.530 max* (6.60) x (30.23) x (13.46) Lead Spacing 0.900 (22.86) Nom.			

* .413H (10.49mm) available on request

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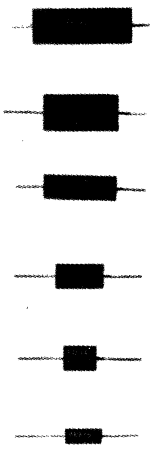
VISHAY RESISTIVE SYSTEMS GROUP

FIXED AXIAL LEAD RESISTORS

Value Engineered and Standard Stock Axial Lead Precision Resistors



Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 70°C	Power at 125°C	Max. Work. Voltage	Nominal Dimensions Inch (mm) D x L	Shelf-Life Stability (Max. ΔR)[3]	Load-Life Stability (Max.ΔR)[3]	Temperature Coefficient of Resistance (Limits)
VTA52 (RBR52)	5-750K 25-750K	±.1 ±.01	1.0W	.5W	300	.375 x 1.00 (9.53) x (25.4)	25ppm after 1 year	0.05% 2000 hrs. @ 125°C	0°C to +60°C ±4ppm/°C -55°C to +25°C ±8ppm/°C
VTA53 (RBR53)	5-500K 25-500K	±.1 ±.01	.66W	.33W	300	.375 x .750 (9.53) x (19.05)			
VTA54 (RBR54)	5-500K 25-500K	±.1 ±.01	.5W	.25W	300	.260 x .750 (6.60) x (19.05)			
(VTA55) (RBR55)	5-250K 25-250K	±.1 ±.01	.3W	.15W	300	.260 x .500 (6.60) x (12.70)			
VTA56 (RBR56)	5-250K 25-250K	±.1 ±.01	.25W	.125W	300	.260 x .356 (6.60) x (9.04)			
VMTA55 (RNC55)	5-30K 50-30K	±.1 ±.01	.2W	.1W	200	.120 x .270 (3.05) x (6.86)			
VMTA60 (RNC60)	5-30K 50-30K	±.1 ±.01	.25W	.125W	250	.125 x .375 (3.18) x (9.53)			
VMTB60 (RNC60)	5-60K 50-60K	±.1 ±.01	.25W	.125W	250	.160 x .375 (4.07) x (9.53)			
VSA100	5-250K 50-250K	±.1 ±.01	.6W	.3W	300	.305 (7.75) max T. .102 (3.60) max H. .250 (6.40) max			

CHIPS

Microchip (V5X5) and Minichip (V15X5) Resistors for Hybrid Microcircuits

Model Number	Resistance* (Ohms)	Trim Range	Tolerance[1] To	Power at 70°C	Max. Work. Voltage	Nominal Chip Dimensions Inch (mm) L x W x T	Shelf-Life Stability (Max.ΔR)[3]	Load-Life Stability (Max.ΔR)[3]	Nominal TCR[2]	Standard TCR Spread from Nominal[2]
V5X5	5-10K	0 To 1.2x the nominal prevalue	±0.02% or ±0.005%[5]	0.05W	40	0.050 x 0.050 x 0.020 (1.27) x (1.27) x (0.508)	0.005%/Yr. 0.0005%/Yr. Hermetically Packaged	0.05% 2000 Hrs. @70°C	0°C to +25°C	+0.6ppm/°C ±1.5ppm/°C
									+25°C to +60°C	-0.6ppm/°C ±1.5ppm/°C
V15X5	5-30K	0 To 1.3x the nominal prevalue	±0.02% or ±0.005%[5]	0.1W	40	0.150 x 0.050 x 0.020 (3.81) x (1.27) x (0.508)			-55°C to +25°C	+2.2ppm/°C ±2.0ppm/°C
									+25°C to +125°C	-1.8ppm/°C ±2.0ppm/°C

* Higher resistance ranges and larger size chips available

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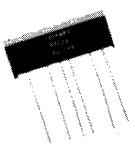
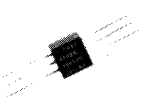
VISHAY RESISTIVE SYSTEMS GROUP

UNITIZED RESISTOR NETWORKS AND VOLTAGE DIVIDERS

	Model Number[9]	No. of Resistors	R. Value of Each Individual Resistor[10] (Ohms)	Tolerance Ratio Between Resistors at 25°C To	Maximum Dimensions (Excluding Leads) W x L x H x Inch (mm)	TCR Ratio Between Resistors (Tracking) (Ref. @ 25°C)
	300190 300191	2	50-250K	.005%	0.160 x 0.575 x .413 (4.06) x (14.61) x (10.49)	0° to +60°C -55°C to +125°C (Standard Spread) ±1.5ppm/°C ±2.0ppm/°C (Maximum Spread) ±2.5ppm/°C ±2.3ppm/°C (Available to) 0.5ppm/°C 0.5ppm/°C
	300192 300193 300194	3	50-250K	.005%	0.160 x 0.820 x .413 (4.06) x (20.83) x (10.49)	
	300195 300196 300197 300198 300199	4	50-250K	.005%	0.255 x 1.190 x .413 (6.48) x (30.23) x (10.49)	
	300210	3	50-250K	.005%	0.160 x 0.820 x .413 (4.06) x (20.83) x (10.49)	
	300211 300212	4	50-250K	.005%	0.255 x 1.190 x .413 (6.48) x (30.23) x (10.49)	
	300144	2	100-20K[11]	.005%	0.110 x 0.305 x 0.330 (2.79) x (7.75) x (8.38)	−55°C to +125°C (Maximum Spread) 1.0ppm/°C (Available to) 0.1ppm/°C
	300145	4	100-20K[11]	.005%	0.385 x 0.385 x 0.210 (9.779) x (9.779) x (5.334)	
	VSR144	2	Any value from 100Ω-20KΩ with some derating of power	.005%	0.110 x 0.305 x 0.330 (2.79) x (7.75) x (8.38)	To 3.0ppm/°C (absolute TCR to 5.0ppm/°C

Hermetically-Sealed Miniature Voltage Dividers

	Model Number[9]	No. of Chips	R. Value of Each Individual Resistor[10] (Ohms)	Tolerance Ratio Between Resistors at 25°C To	Maximum Dimensions (Excluding Leads) W x L x H x Inch (mm)	TCR Ratio Between Resistors (Tracking) (Ref. @ 25°C)
	VHD200	1*	100-20K	.005%	.195 x .445 x .430 (4.95) x (11.30) x (10.92)	To 0.1ppm/°C (absolute TCR to 0.6ppm/°C)
	VHD144	1*	Any value from 100Ω-20KΩ with some derating of power	.005%	.195 x .445 x .430 (4.95) x (11.30) x (10.92)	To 0.5ppm/°C (absolute TCR to 2.0ppm/°C)

* Two resistive elements on a common substrate.

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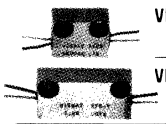
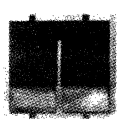
VISHAY RESISTIVE SYSTEMS GROUP

POWER RESISTORS AND PLATES

Precision Power Plate Resistors for Current Sensing and Power Surge Applications



Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 25°C	Max. Work. Voltage	Maximum Dimensions Inch (mm) W x L x H	Shelf-Life Stability/Yr. (Max.ΔR)[3]	Standard TCR Spread from Nominal
VPR-5	1-100K	.01%	5W	300	.450 x .630 x .315 (11.43) x (16.00) x (8.00)	25ppm	Above 10 ohms ± 5ppm/°C
VPR-7	1-100K	.01%	7W	300	.450 x 1.035 x .315 (11.43) x (26.29) x (8.00)		Below 10 ohms ± 10ppm/°C



Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 25°C[6]	Nominal Plate Dimensions Inch (mm) L x W x T	Shelf-Life Stability (Max.ΔR)[3]	Load-Life Stability (Max.ΔR)[3]	Resistance Element Area Sq. In. (mm)	Nominal TCR[2]
V3PR-300589	10-5K	± 0.005%[5]	3W in air; 10W on heat sink	1.000 x 1.000 x .025 (25.4) x (25.4) x (0.635)	25ppm after 1 year	0.03% 2000 hrs @ 125°C	1.00 (25.40)	± 2ppm/°C
V3PR-300586 (2 R's)	0.25	± 0.25%	25W*	1.600 x 1.700 x 0.025 (40.64) x (43.18) x (0.635)	25ppm after 1 year	0.03% 2000 hrs @ 125°C	0.98 (24.89)	± 10ppm/°C
V3PR-300338	0.5	± 0.25%	25W*					
V3PR-300571	1.0	± 0.25%	20W*	1.750 x 1.12 x 0.025 (44.45) x (28.45) x (0.635)			0.658 (16.71)	
V3PR-300572	2.0	± 0.25%	20W*	1.750 x 1.12 x 0.025 (44.45) x (28.45) x (0.635)			0.658 (16.71)	
V3PR-300610 (4 R's)[7]	2.0	± 0.25%	> 100W*	4.000 x 5.000 x 0.025 (101.6) x (127.0) x (0.635)			11.20 (284.48)	

* Power is 10W/sq. in. when a heat sink, which keeps the foil temperature below 100°C, is used.

Hermetically Sealed Precision Power and Current Sensing Resistors

Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 25°C*	Max. Work. Voltage	Nominal Plate Dimensions Inch (mm) H x L x W	Load-Life Stability (Max.ΔR)[3]	Shelf-Life Stability (Max.ΔR)[3]	Nominal TCR[2]
VHP-3	1-80K	± 0.01%	3W in air; 10 W on heat sink (3A max)	750	0.335 x 1.530 x 1.000 (8.51) x (38.86) x (25.4) (Standard TO-3 Case)	0.05% 2000 hrs @ 25°C	5ppm after 1 year	0°C to +25°C +0.6ppm/°C ± 1.5ppm/°C +25°C to +60°C -0.6ppm/°C ± 1.5ppm/°C -55°C to +25°C +2.2ppm/°C ± 2.0ppm/°C +25°C to +125°C -1.8ppm/°C ± 2.0ppm/°C
VHP-4**	1-500Ω	± 0.01%	3W in air; 10 W on heat sink (3A max)	750	0.375 x 1.530 x 1.000 (9.53) x (38.86) x (25.4)			

* Below 5 ohms, TCR is ± 15ppm/°C (-55°C to +125°C), ** 4 terminal model

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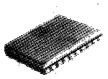
VISHAY RESISTIVE SYSTEMS GROUP

NETWORKS

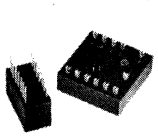
Hermetically Sealed Miniature Precision Resistor Networks in DIP, TO and Other Packages

	Model Number	Type Package	Max. No. of V5 x 5 (V15 x 5) Resistors	Max. R Value of each V5 x 5 (V15 x 5) Resistor	Tolerance Ratio Between Resistors @25°C To	Maximum Dimensions (Excluding leads) Inch (mm) H x D - pin circle	TCR Ratio Between Resistors (Ref. @25°C)
	1403	4 pin TO-18	5 (1)	10K (30K)	.0025%	0.200 x 0.212 - 0.100 (5.08) x (5.38) - (2.54)	
	1413	8 pin TO-5	9 (3)	10K (30K)	.0025%	0.200 x 0.370 - 0.200 (5.08) x (9.40) - (5.08)	
	1417	8 pin TO-5	12 (3)	10K (30K)	.0025%	0.200 x 0.362 - 0.230 (5.08) x (9.19) - (5.84)	
	1419	10 pin TO-5	12 (3)	10K (30K)	.0025%	0.200 x 0.362 - 0.230 (5.08) x (9.19) - (5.84)	
	1421	12 pin TO-8	49 (16)	10K (30K)	.0025%	0.200 x 0.602 - 0.400* (5.08) x (15.29) - (10.16)*	
	1422	16 pin TO-8	49 (16)	10K (30K)	.0025%	0.200 x 0.602 - 0.400* (5.08) x (15.29) - (10.16)*	0° to +60°C -55°C to +125°C (Standard Spread) ±1.5ppm/°C +2.0ppm/°C (Maximum Spread) ±2.5ppm/°C ±2.3ppm/°C (Available To) 0.5ppm/°C 0.5ppm/°C
						H x L x W - Lead Spacing	
	1442	8 pin DIP	12 (4)	10K (30K)	.0025%	0.100 x 0.528 x 0.320 - 0.300 (2.54) x (13.41) x (8.13) - (7.62)	
	**1445**	14 pin DIP	30 (10)	10K (30K)	.0025%	0.100 x 0.778 x 0.296 - 0.300 (2.54) x (19.76) x (7.52) - (7.62)	
	1446	16 pin DIP	36 (12)	10K (30K)	.0025%	0.100 x 0.810 x 0.298 - 0.300 (2.54) x (20.57) x (7.57) - (7.62)	
	1457	18 pin DIP	80 (25)	10K (30K)	.0025%	0.150 x 1.007 x 0.502 - 0.300 (3.81) x (25.58) x (12.7) - (7.62)	
	1460	20 pin 1" x 1" Plug-in	221 (73)	10K (30K)	.0025%	0.220 x 1.010 x 0.900 - 0.900 (5.59) x (25.65) x (22.86) - (22.86)	
	1476	30 pin 1" x 1" flat pack	225 (105)	10K (30K)	.0025%	0.125 x 1.148 x 0.950 - 0.05** (3.18) x (29.16) x (24.13) - (1.27)**	
	1485	16 pin leadless chip carrier	12 (4)	10K (30K)	.0025%	0.055 x 0.360 x 0.295 (1.40) x (9.14) x (7.49)	

* pin square ** axial lead pin spacing

STANDARD AND CUSTOM RESISTANCE NETWORKS

Binary Networks and BCD Ladders



Besides designing completely custom precision networks to your most demanding specifications, Vishay offers standard binary R-2R ladder networks in 4-bit to 16-bit configurations (voltage-fed) with resistance values from 1 ohm to 50KΩ; 2R to 100KΩ. Three basic package styles (nominal dimensions): **Profile 500,** 0.750" (19.05 mm) W x 0.500" (12.70 mm) H. **Profile 375,** 1.230" (31.24 mm) W x 0.365" (9.27 mm) H. Lengths dependent on number of bits: min. 0.700" (17.78 mm) for 4-bit Profile 500 to 2.14" (54.35 mm) for 16-bit ladder; min. 0.730" (18.54 mm) for Profile 375 to 2.59" (65.78 mm) for 15-bit package. **Profile 200,** 1.0" (25.4 mm) W x 1.0" (25.4 mm) L x 0.200" (5.08 mm) H only.

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VISHAY RESISTIVE SYSTEMS GROUP

VISHAY PRECISION WIREWOUND RESISTORS

AXIAL LEAD MILITARY TYPE – NON QPL

This series of resistors is designed to meet or exceed mil spec requirements.

MIL-R 39005 Size	VISHAY Type	POWER RATING @ 125°C	MAX Working Voltage	Dimensions			Resistance Range		
				Dia. D ± .010	Length L ± .010	Lead Dia. d ± .002	MIN		MAX
RBR74	VWA74	.200	150	.193	.500	.025	10Ω	to	1M
RBR56	VWA56	.175	150	.250	.350	.032	10Ω	to	1M
RBR55	VWA55	.250	200	.250	.500	.032	10Ω	to	1.5M
RBR54	VWA54	.330	300	.250	.750	.032	10Ω	to	3M
RBR75	VWA75	.175	150	.250	.295	.032	10Ω	to	1M
RBR52	VWA52	.600	600	.375	1.000	.032	10Ω	to	10M
RBR53	VWA53	.500	300	.375	.750	.032	10Ω	to	10M
RBR57	VWA57	1.000	600	.500	1.000	.032	10Ω	to	20M

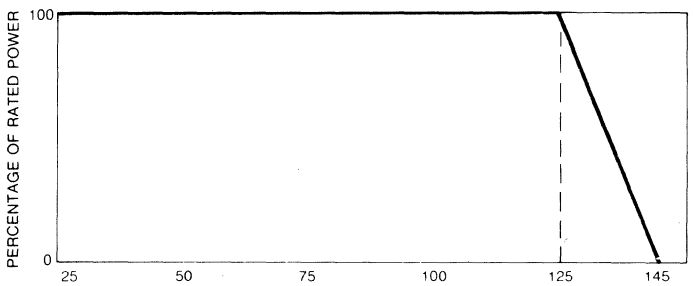
MIL-R 93 Size	VISHAY Type	POWER RATING @ 125°C	MAX Working Voltage	Dimensions			Resistance Range		
				Dia. D ± .010	Length L ± .010	Lead Dia. d ± .002	MIN		MAX
RB 70	VWA70	.400	400	.375	.500	.032	10Ω	to	7M
RB 58	VWA58	1.500	900	.500	1.500	.032	10Ω	to	25M
RB 59	VWA59	2.000	1000	.500	2.000	.032	10Ω	to	30M

RESISTANCE VS. TOLERANCE		
STYLE	VALUE	TOL
VWA 52, 58, 59, 70	≥ 100Ω	± .05%
	≥ 10Ω	± .10%
	≥ 0.1Ω	± .50%
VWA 53	≥ 10Ω	± .01%
55, 56, 57 & 75	≥ 0.1Ω	± 1.0%
VWA 54	≥ 4.99Ω	± .01%
	≥ 0.1Ω	± 1.0%
VWA 74	ALL	± 0.1%

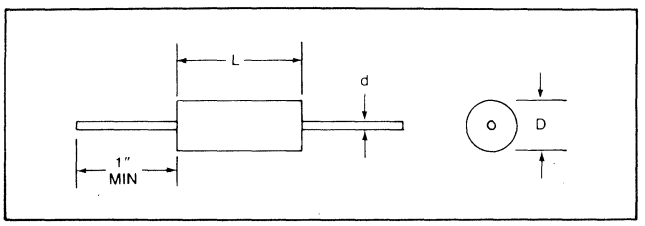
RESISTANCE VS. TEMPERATURE COEFFICIENT	
VALUE	STD TCR (–55°C to +125°C)
< 1Ω	± 90ppm/°C
1Ω < 10Ω	± 30ppm/°C
10Ω < 100Ω	± 15ppm/°C
100Ω & above*	± 10ppm/°C

*Available to ± 2.0ppm/°C

POWER DERATING CURVE



DIMENSIONAL OUTLINE



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VISHAY RESISTIVE SYSTEMS GROUP

VISHAY PRECISION WIREWOUND RESISTORS

AXIAL LEAD COMMERCIAL/INDUSTRIAL TYPE

Vishay Type #	Power Rating		Max. Working Voltage	Dimensions			Resistance Range	
	Watts	@*		Dia. D ± .010	Length L ± .010	Lead Dia. d ± .002	MIN	MAX
A0931	.025	A	75	.097	.312	.020	10Ω	150K
A0940	.030	A	75	.097	.406	.020	10Ω	200K
A1020	.030	A	150	.100	.200	.020	10Ω	150K
A1030	.040	A	200	.100	.300	.020	10Ω	150K
A1025	.030	A	75	.105	.250	.020	10Ω	100K
A1026	.040	A	75	.105	.250	.020	10Ω	150K
A1123	.045	B	70	.118	.236	.016	5Ω	100K
A1135	.070	B	80	.118	.354	.016	5Ω	200K
A1221	.040	A	100	.125	.215	.020	10Ω	150K
A1225	.050	A	100	.125	.250	.020	10Ω	225K
A1226	.050	A	100	.125	.250	.020	10Ω	200K
A1231	.050	A	200	.125	.312	.025	10Ω	300K
A1237	.080	A	100	.125	.375	.025	10Ω	300K
A1238	.080	A	100	.125	.375	.025	10Ω	350K
A1327	.100	A	150	.138	.276	.025	10Ω	125K
A1527	.100	A	100	.155	.270	.025	5Ω	300K
A1528	.100	A	100	.155	.270	.025	5Ω	450K
A1550	.125	A	150	.155	.500	.025	5Ω	600K
A1531	.100	A	300	.156	.310	.025	5Ω	500K
A1535	.100	A	300	.156	.350	.025	5Ω	500K
A1825	.100	A	300	.187	.250	.025	5Ω	600K
A1831	.100	A	300	.187	.312	.025	5Ω	500K
A1837	.080	B	150	.185	.374	.016	5Ω	400K
A1838	.150	A	150	.187	.375	.025	1Ω	600K
A1839	.125	A	200	.189	.374	.025	1Ω	600K
A1840	.150	A	150	.187	.375	.025	1Ω	750K
A1850	.200	A	200	.187	.500	.025	1Ω	1 Meg
A1862	.175	A	300	.187	.625	.025	1Ω	600K
A2347	.250	B	250	.236	.472	.020	2Ω	1.1 Meg
A2525	.150	A	200	.250	.250	.025	1Ω	600K
A2526	.150	A	200	.250	.250	.025	1Ω	600K
A2529	.175	A	300	.250	.295	.025	1Ω	1 Meg
A2535	.175	A	300	.250	.350	.025	1Ω	750K
A2536	.250	A	300	.250	.350	.032	10Ω	750K
A2537	.125	A	200	.250	.354	.032	1Ω	1 Meg
A2538	.200	B	250	.250	.378	.020	2Ω	650K
A2539	.200	A	300	.250	.375	.025	1Ω	1.5 Meg
A2550	.175	A	300	.250	.500	.025	1Ω	1.25 Meg
A2551	.250	A	300	.250	.500	.025	1Ω	2 Meg
A2552	.250	A	300	.250	.500	.032	10Ω	1.25 Meg
A2553	.150	A	250	.250	.500	.032	1Ω	1.5 Meg
A2559	.300	B	400	.250	.591	.020	5Ω	1.3 Meg
A2575	.330	A	400	.250	.750	.025	10Ω	1.5 Meg
A2576	.330	A	400	.250	.750	.032	10Ω	1.5 Meg
A2577	.300	A	300	.250	.750	.025	1Ω	3 Meg
A2578	.250	A	300	.250	.750	.032	1Ω	3 Meg
A25100	.400	A	400	.250	1.000	.025	1Ω	4 Meg

*See appropriate Power Derating Curve

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VISHAY RESISTIVE SYSTEMS GROUP

VISHAY PRECISION WIREWOUND RESISTORS

AXIAL LEAD COMMERCIAL/INDUSTRIAL TYPE

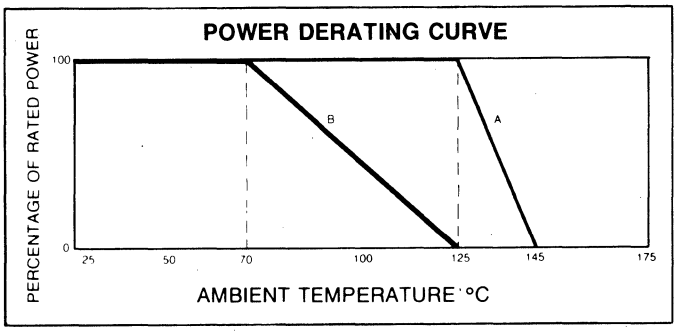
Vishay Type #	Power Rating		Max. Working Voltage	Dimensions			Resistance Range	
	Watts	@*		Dia. D ± .010	Length L ± .010	Lead Dia. d ± .002	MIN	MAX
A2955	.400	B	250	.295	.551	.032	1Ω	2 Meg
A3175	.450	A	400	.312	.750	.025	1Ω	1.5 Meg
A3181	.500	A	400	.312	.812	.025	1Ω	4 Meg
A3481	.600	A	400	.343	.812	.032	1Ω	5 Meg
A3750	.400	A	400	.375	.500	.032	1Ω	2 Meg
A3751	.400	A	400	.375	.500	.032	1Ω	7 Meg
A3762	.450	A	400	.375	.625	.032	1Ω	2 Meg
A3775	.500	A	400	.375	.750	.032	1Ω	3 Meg
A3776	.500	A	400	.375	.750	.032	1Ω	10 Meg
A37100	.600	A	600	.375	1.000	.032	1Ω	4 Meg
A37101	.500	A	600	.375	1.000	.032	1Ω	10 Meg
A37102	.600	A	600	.375	1.000	.032	1Ω	12 Meg
A4142	.400	B	400	.410	.429	.024	5Ω	2.5 Meg
A4165	.500	B	500	.410	.654	.024	5Ω	5 Meg
A5050	.500	A	400	.500	.500	.032	1Ω	10 Meg
A5062	.600	A	400	.500	.625	.032	1Ω	1.5 Meg
A5075	.750	A	400	.500	.750	.032	1Ω	2 Meg
A5076	.750	A	400	.500	.750	.032	1Ω	15 Meg
A50100	1.000	A	800	.500	1.000	.032	1Ω	6 Meg
A50101	1.000	A	800	.500	1.000	.032	1Ω	20 Meg
A50125	1.250	A	800	.500	1.250	.032	1Ω	10 Meg
A50150	1.500	A	900	.500	1.500	.032	1Ω	9 Meg
A50151	1.500	A	900	.500	1.500	.032	1Ω	25 Meg
A50200	2.000	A	1200	.500	2.000	.032	1Ω	10 Meg
A50201	2.000	A	1200	.500	2.000	.032	1Ω	30 Meg

*See appropriate Power Derating Curve

SPECIALS AVAILABLE:

- TCR to ±2ppm/°C
- Matched Sets
- Values beyond limit of table
- Non inductively wound – specify N

POWER DERATING CURVE

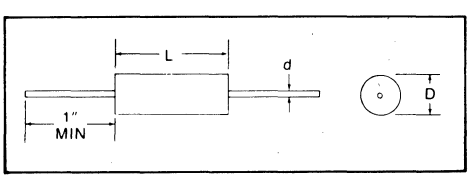


RESISTANCE VS. TCR	
VALUE	STD TC (0°C to 60°C)
<1Ω	±90ppm/°C
1Ω to <10Ω	±30ppm/°C
10Ω to <100Ω	±15ppm/°C
100Ω above*	±5ppm/°C

*Available to ±2.0ppm/°C

RESISTANCE VS. TOLERANCE	
VALUE	TOLERANCE
≥1000Ω	±.005%
≥5Ω	±.01%
≥.01Ω	±1.0%

DIMENSIONAL OUTLINE



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VISHAY RESISTIVE SYSTEMS GROUP

VISHAY PRECISION WIREWOUND RESISTORS

PRINTED CIRCUIT COMMERCIAL/INDUSTRIAL TYPE

CYLINDRICAL BODY STYLE

Vishay Type	Power Rating		Max Working Voltage	DIMENSIONS				Resistance Range	
	Watts	@*		Body Dia D ±	Body Length L ±	Lead Dia d ± .002	Lead Spacing S ±	MIN	MAX
P1530	.080	A	100	.155	.300	.020	.100	10Ω	300K
P1837	.130	A	150	.187	.375	.025	.100	10Ω	350K
P2525	.080	A	175	.250	.250	.020	.100	10Ω	300K
P2526	.200	B	175	.250	.250	.025	.150	0.1Ω	500K
P2527	.200	B	175	.250	.250	.025	.200	0.1Ω	500K
P2528	.100	A	200	.250	.280	.025	.150	10Ω	400K
P2531	.150	A	225	.250	.312	.025	.200	10Ω	500K
P2535	.200	B	250	.250	.350	.025	.150	0.1Ω	1 Meg
P2537	.200	A	250	.250	.375	.020	.150	10Ω	700K
P2538	.200	B	250	.250	.378	.020	.150	2Ω	650K
P2539	.200	B	250	.250	.378	.020	.200	2Ω	650K
P2550	.250	A	400	.250	.500	.025	.175	10Ω	1 Meg
P2551	.300	B	300	.250	.500	.025	.150	0.1Ω	1 Meg
P2559	.300	B	400	.250	.591	.020	.150	5Ω	1.3 Meg
P2560	.300	B	400	.250	.591	.020	.200	5Ω	1.3 Meg
P2733	.125	A	150	.276	.335	.025	.200	1Ω	800K
P3750	.330	B	400	.375	.500	.032	.250	0.1Ω	1 Meg
P3751	.400	B	400	.375	.500	.032	.200	0.1Ω	1 Meg
P3752	.300	A	400	.375	.500	.032	.200	1Ω	5 Meg
P3753	.400	A	400	.375	.500	.032	.200	10Ω	5 Meg
P4142	.400	B	400	.410	.429	.024	.300	5Ω	2.5 Meg
P4143	.400	B	400	.410	.429	.024	.400	5Ω	2.5 Meg
P4165	.500	B	500	.410	.654	.024	.300	5Ω	5 Meg
P4166	.500	B	500	.410	.654	.024	.400	5Ω	5 Meg
P5050	.400	B	400	.500	.500	.032	.300	0.1Ω	1.5 Meg
P5051	.500	A	400	.500	.500	.032	.400	10Ω	7 Meg

RECTANGULAR BODY STYLE

Vishay Type	Power Rating		Max Working Voltage	DIMENSIONS					Resistance Range	
	Watts	@*		Body Height H ±	Body Length L ±	Body Width W ±	Lead Dia d ± .002	Lead Spacing S ±	MIN	MAX
PR071	.030	A	50	.075	.175	.075	—	.125	10Ω	30K
PR252	.125	A	100	.250	.250	.125	.032	.125	10Ω	500K
PR253	.200	B	—	.250	.250	.125	.025	.125	10Ω	500K
PR293	.125	A	150	.295	.370	.146	.032	.200	1Ω	900K
PR312	.100	A	100	.315	.299	.114	.025	.150	1Ω	600K
PR3230	.300	B	—	.320	.300	.100	.025	.150	1Ω	500K
PR3231	.300	B	150	.328	.306	.110	.025	.150	1Ω	500K
PR5025	.250	A	150	.500	.250	.125	.032	.250	10Ω	1 Meg
PR5256	.500	B	—	.520	.565	.150	.025	.400	10Ω	1 Meg
PR5387	.700	B	—	.530	.875	.180	.025	.650	1Ω	1 Meg

*See appropriate Power Derating Curve

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VISHAY RESISTIVE SYSTEMS GROUP

VISHAY POWER WIREWOUND RESISTORS

Vishay Type	MIL-R-26 Equivalent	Power Rating		Max. Working Voltage	Dimensions			Resistance Range	
		Watts	@*		Dia. D ± .010	Length L ± .010	Lead Dia. d ± .002	MIN	MAX
AXIAL LEADS - SILICONE COATED									
W0723	RW-81	1.00	B	50	.079	.235	.024	.1Ω	2K
W0830	—	.40	B	50	.085	.300	.020	10Ω	3.5K
W0925	—	.30	B	05	.093	.250	.020	1Ω	4.5K
W0941	RW-70	1.00	B	100	.093	.410	.020	.1Ω	10K
W1031	—	.50	B	150	.109	.312	.020	.5Ω	7K
W1040	RW-70	1.00	B	100	.109	.406	.020	.1Ω	12K
W1135	RW-80	2.00	B	100	.118	.354	.024	.1Ω	4K
W1550	RW-69	2.50	B	200	.156	.500	.032	.1Ω	25K
W1555	RW-79	3.00	B	200	.157	.551	.032	.05Ω	15K
W1837	—	1.75	B	100	.187	.375	.032	.1Ω	14K
W1850	RW-69	2.50	B	200	.188	.500	.032	.01Ω	25K
W1856	RW-79	3.00	B	200	.188	.560	.032	.01Ω	30K
W1859	RW-79	3.00	B	200	.187	.594	.032	.1Ω	30K
W1963	—	4.00	B	200	.197	.630	.032	.01Ω	20K
W2553	—	3.20	B	200	.250	.532	.032	.1Ω	25K
W2562	—	4.00	B	200	.250	.625	.040	.01Ω	45K
W2767	RW-74	4.00	B	200	.275	.670	.040	.1Ω	50K
W2881	—	4.50	B	300	.281	.812	.040	.05Ω	70K
W30117	—	7.00	B	500	.300	1.175	.040	.05Ω	70K
W3187	RW-67,74	5.00	B	300	.312	.875	.040	.01Ω	90K
W31121	—	7.00	B	500	.312	1.218	.040	.01Ω	150K
W3487	—	5.20	B	300	.343	.875	.040	.05Ω	70K
W3590	RW-74	6.00	B	300	.354	.906	.032	.05Ω	60K
W35126	—	8.00	B	500	.354	1.260	.032	.1Ω	100K
W35185	RW-78	10.00	B	750	.354	1.850	.032	.1Ω	150K
W37100	RW-67	6.30	B	500	.375	1.000	.032	.05Ω	90K
W37178	RW-68,78	10.00	B	750	.375	1.780	.040	.01Ω	250K
W39181	RW-68	10.00	B	750	.390	1.812	.032	.05Ω	200K
W39182	RW-78	10.00	B	750	.390	1.812	.040	.05Ω	200K
W43137	RW-55	8.00	B	750	.437	1.375	.032	.05Ω	150K
W43200	RW-56	12.50	B	1000	.437	2.000	.032	.05Ω	250K
AXIAL LEADS - CONFORMAL COATED									
WM092	—	.50	A	50	.098	.236	.024	.1Ω	2K
WM113	—	1.00	A	100	.118	.335	.024	.1Ω	4K
WM175	—	1.50	A	200	.177	.551	.032	.05Ω	15K
WM196	—	2.00	A	200	.197	.630	.032	.01Ω	20K
WM199	—	2.50	A	250	.197	.906	.032	.05Ω	40K
WM359	—	3.00	A	300	.354	.906	.032	.05Ω	60K
WM3512	—	4.00	A	500	.354	1.260	.032	.1Ω	100K
WM3518	—	5.00	A	700	.354	1.850	.032	.1Ω	150K
AXIAL LEADS - EPOXY MOLDED									
WM092	—	.50	A	50	.094	.256	.024	.51Ω	2K
WM143	—	1.00	A	100	.146	.394	.024	.51Ω	4K
WM225	—	1.50	A	200	.220	.591	.032	.51Ω	15K

*See appropriate Power Derating Curve

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Phone: (713) 550-0568

Southwest Region Sales Office
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Fullerton, CA 92635
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Northwest Region Sales Office
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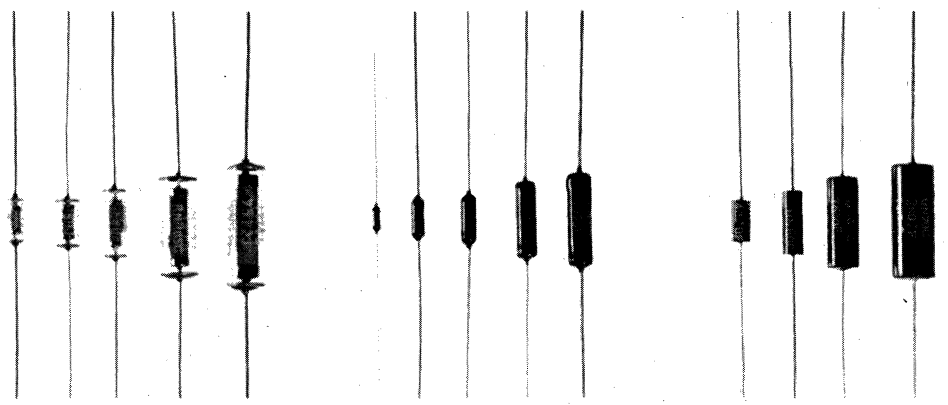
precision metal film resistors to MIL-R-55182



H Hermetic C Conformal M Molded

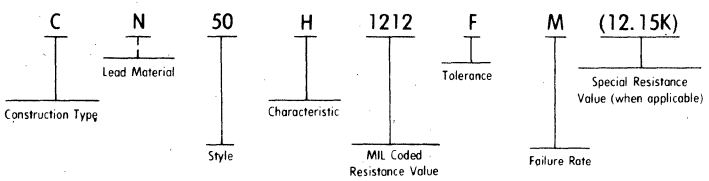
MIL-R-55182 APPROVED ITEMS

Mil Style	A Part No.	Charac-teristic	Resistance Range	Tolerance	Failure Rate	Mil Style	A Part No.	Charac-teristic	Resistance Range	Tolerance	Failure Rate
RNR RNC RNN 50	CC CC CN 50	K	10 Ω - 100K	F, D	M, P, R	RNR RNC RNN 60	MC MC MN 60	J	49.9 Ω - 499K	F, D, B	M, P
RNR RNC RNN 50	CC CC CN 50	H	49.9 Ω - 100K	F, D, B	M, P, R	RNR RNN 60	HN HN 60	C	10 Ω - 2.49M	F, D, B	M, P, R, S
RNR RNC RNN 50	CC CC CN 50	J	49.9 Ω - 100K	F, D, B	M, P, R	RNR/RNN 60	HN HN 60	E	10 Ω - 2.49M	F, D, B	M, P, R, S
RNR RNC RNN 55	CC CC CN 55	K	10 Ω - 301K	F, D	M, P, R	RNR/RNN 65	HN HN 65	K	24.9 Ω - 4.99M	F, D	M, P, R, S
RNR RNC RNN 55	CC CC CN 55	H	49.9 Ω - 200K	F, D, B	M, P, R	RNR RNN 65	HN HN 65	H	24.9 Ω - 4.99M	F, D, B	M, P, R, S
RNR/RNC RNN 55	CC CC CN 55	J	49.9 Ω - 200K	F, D, B	M, P, R	RNR RNN 65	HN HN 65	J	24.9 Ω - 4.99M	F, D, B	M, P, R, S
RNR/RNN 55	HN HN 55	C	10 Ω - 1.21M	F, D, B	M, P, R, S	RNR/RNN 65	HN HN 65	C	24.9 Ω - 4.99M	F, D, B	M, P, R, S
RNR/RNN 55	HN HN 55	E	10 Ω - 1.21M	F, D, B	M, P, R, S	RNR/RNN 65	HN HN 65	E	24.9 Ω - 4.99M	F, D, B	M, P, R, S
RNR/RNN 57	HN HN 57	C	49.9 Ω - 200K	F	M, P, R, S	RNR RNN 70	HN HN 70	K	24.9 Ω - 7.5M	F, D	M, P, R, S
RNR/RNN 57	HN HN 57	E	49.9 Ω - 200K	F	M, P, R, S	RNR RNN 70	HN HN 70	H	24.9 Ω - 7.5M	F, D, B	M, P, R, S
RNR/RNC RNN 60	MC MC MN 60	K	24.9 Ω - 499K	F, D	M, P	RNR RNN 70	HN HN 70	J	24.9 Ω - 7.5M	F, D, B	M, P, R, S
RNR/RNC RNN 60	MC MC MN 60	H	49.9 Ω - 499K	F, D, B	M, P	RNR RNN 70	HN HN 70	C	24.9 Ω - 7.5M	F, D, B	M, P, R, S
						RNR RNN 70	HN HN 70	E	24.9 Ω - 7.5M	F, D, B	M, P, R, S

NOTE: QPL 65 and 70 characteristics H, J, and K are available in hermetic construction only.

PART NUMBER INFORMATION

When ordering, specify military part number in accordance with MIL-R-55182 or MIL-R-10509 or Angstrohm part number as follows:



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VISHAY-ANGSTROHM

TEMPERATURE COEFFICIENT

D, K	± 100 PPM/°C Max.
C, H	± 50 PPM/°C Max.
E, J	± 25 PPM/°C Max.
W	± 20 PPM/° Max. Between −40 and +150°C
X	± 15 PPM/°C Max. Between −25 and +125°C
Y	± 10 PPM/°C Max. Between −15 and +105°C
Z	± 5 PPM/°C Max. Between 0 and + 75°C
(9)	Special; temperature range and Max. PPM/°C to be specified on order.

RESISTANCE VALUE
First three digits are significant. Fourth digit is number of zeros to follow. Must always be four digits. Use R to signify decimal when necessary. If more than three significant digits are required, round off and show exact value in parenthesis after failure rate code as shown by sample part number.

RESISTANCE TOLERANCE

F	± 1%
D	± .5%
C	± .25%
B	± .1%
(05)	± .05% (49.9 Ω min.)

FAILURE RATE

M	1% per 1000 hours.
P	.1% per 1000 hours.
R	.01% per 1000 hours.
S	.001% per 1000 hours.

CONSTRUCTION TYPE	LEAD MATERIALS	STYLE	POWER RATING @ 70°C	POWER RATING @ 125°C	MAXIMUM VOLTAGE
H Hermetic	— Optiopal solderable				
C Conformal	C Tinned copper	50	1/10W	1/20W	200V
M Molded	N Gold plated nickel	55	1/5 W	1/10W	200V
	D Tinned nickel	57	1/4 W	1/8 W	250V
	S Solder dipped nickel	60	1/4 W	1/8W	250 V
	X Other, as specified	65	1/2 W	1/4W	300V
		70	3/4 W	1/2 W	350V

ELECTRICAL PARAMETERS				STYLE	PHYSICAL PARAMETERS					
Characteristics Available	Minimum Resistance	Maximum Resistance	(1) Tolerances Available		Construction Types Available	Maximum Body Length	Maximum Body Diameter	Lead Materials Available	Lead Length	Lead Diameter
D, K	10 Ω	100K	F, D							
C, H	10 Ω	100K	F, D, C, B							
E, J	10 Ω	100K	All							
W	49.9 Ω	75K	All	50	C (2)	.195"	.070"	N, C, D, S	1.0"	.016"
X	75 Ω	50K	All							
Y	100 Ω	40K	All							
Z	200 Ω	30K	All							
D, K	10 Ω	1.21M	F, D							
C, H	10 Ω	1.21M	F, D, C, B		H (1)	.340"	.115"	N, S	1.5"	.025"
E, J	10 Ω	1.21M	All		C (2)	.300"	.098"	N, C, D, S	1.5"	.025"
W	49.9Ω	200K	All	55	M	.280"	.125"	N, C, D, S	1.5"	.025"
X	75 Ω	150K	All							
Y	100 Ω	100K	All							
Z	200 Ω	75K	All							
C	49.9 Ω	200K	F							
E	49.9 Ω	200K	F	57	H (3)	.340"	.152"	N, S	1.25"	.020"
D, K	10 Ω	2.49M	F, D							
C, H	10 Ω	2.49M	F, D, C, B		H (1)	.455"	.150"	N, S	1.5"	0.25"
E, J	10 Ω	2.49M	All		C	.340"	.110"	N, C, D, S	1.5"	.025"
W	49.9 Ω	400K	All	60	M (2)	.410"	.135"	N, C, D, S	1.5"	.025"
X	75 Ω	300K	All							
Y	100 Ω	200K	All							
Z	200 Ω	150K	All							
D, K	24.9 Ω	4.99M	F, D							
C, H	24.9 Ω	4.99M	F, D, C, B		H (1)	.665"	.240"	N, S	1.5"	.025"
E, J	24.9 Ω	4.99M	All	65	C	.535"	.140"	N, C, D, S	1.5"	.025"
W	49.9 Ω	700K	All		M	.610"	.215"	N, C, D, S	1.5"	.025"
X	75 Ω	550K	All							
Y	100 Ω	400K	All							
Z	200 Ω	275K	All							
D, K	24.9 Ω	7.5M	F, D							
C, H	24.9 Ω	7.5M	F, D, C, B							
E, J	24.9 Ω	7.5M	All		H (1)	.800"	.245"	N, S	1.5"	.032"
W	49.9 Ω	1M	All	70	C	.620"	.165"	N, C, D, S	1.5"	.032"
X	75 Ω	800K	All		M	.740"	.280"	N, C, D, S	1.5"	.032"
Y	100 Ω	600K	All							
Z	200 Ω	400K	All							

FOOTNOTES:
(1) Listed on QPL 55182 for Characteristics H, J, K, C, & E
(2) Listed on QPL 55182 for Characteristics H, J, & K
(3) Listed on QPL 55182 for Characteristics C & E

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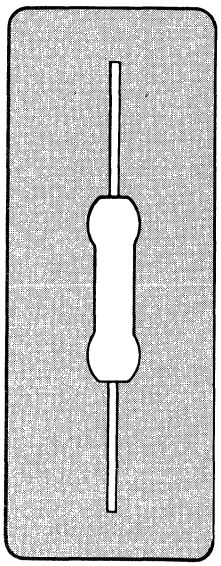
Ward Leonard Axial Lead Resistors



Application

These miniaturized, space-saving axial lead resistors find wide-spread application in computers, instruments, communication, and other electronic equipment. Axiohm® resistors meet the exacting requirements of printed circuit board and other automated equipment in addition to terminal board, point-to-point wiring, and mechanical connections.

Construction

Precision dimensioned ceramic cores are equipped with end caps and tinned axial leads for fast, easy soldering. Low TC alloy resistance wire is spot welded to end caps insuring a permanent low resistance bond. The cement, silicone, or vitreous enamel coating seals and protects the resistance wire.

Temperature Coefficient

Standard T.C. is ±180ppm/°C.

Resistance Tolerance

Standard ±5%. Closer tolerances on special order.

Optional Features

Non-Inductive Resistors — Specially designed axial lead resistors can be supplied for high frequency circuits. These resistors utilize the Ayrton-Perry method of winding in which two single layer windings run in opposite directions and cross at points 180° apart providing minimum inductance and distributed capacitance.

Controlled or Limited Inductance — Resistors are available with special single windings in which the winding is controlled not to exceed a specified inductance.

Reel Packs — Single or double adhesive tape for bulk packing resistors for automatic feeding in automated assembly line can be supplied.

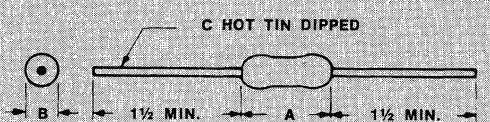
Ordering Information

1. Quantity
2. State watt rating, type coating (C = Cement, SX = Silicone, X = Vitreous enamel) and ohms. Example: A five watt cement coated axial lead resistor of 1,000 ohms would be ordered as 5C1000.
3. Resistance tolerance if other than standard ±5%.
4. Optional features
5. T.C. Other Than Standard

Axial Lead Resistors — Ratings and Sizes

Watt Rating at 325° C Temperature Rise, 25° C Ambient	Resistance Range in Ohms† Min.	Resistance Range in Ohms† Max.	Standard Resistance Tolerance	Dielectric Withstanding Voltage	Maximum Voltage Rating††	Dimensions (in inches) A ±1/16	B ±1/32	C B & S Gauge
1	0.1	7,500	±5%	500	100	13/32ⓘ	3/32	#24 (.020" dia.)
2	0.1	10,000	±5%	500	300	3/8	3/16	#20 (.032" dia.)
3	0.1	20,000	±5%	500	450	1/2	3/16	#20 (.032" dia.)
4	0.1	30,000	±5%	500	600	11/16	3/16	#20 (.032" dia.)
5	0.1	40,000	±5%	500	800	15/16	3/16	#20 (.032" dia.)
7	0.1	50,000	±5%	500	875	1	5/16	#20 (.032" dia.)
10	0.1	125,000	±5%	500	1600	1-3/4	5/16	#20 (.032" dia.)
12.5	0.1	175,000	±5%	500	1600	1-3/4	3/8	#20 (.032" dia.)

†Other resistance values on order.
††Voltage not to exceed $\sqrt{RxP}$
ⓘ±1/32.



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Fixed Tubular Resistors

Application

Fixed resistors introduce only one pre-determined amount of resistance into a circuit.

Construction

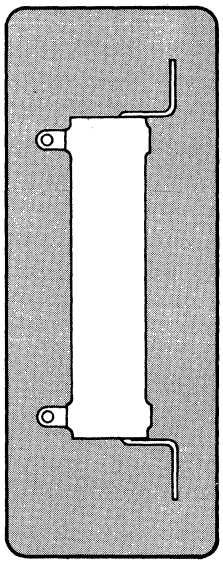
Standard fixed tubular resistors are single layer wound and furnished with two lug terminals that are pre-tinned for fast, easy soldering. They can be supplied with cement, silicone or vitreous enamel coatings.

Resistance Tolerance

±5% standard. Below one ohm ±10%.

Ordering Information

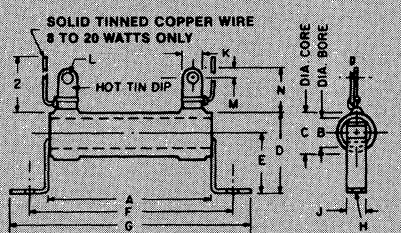
1. Quantity required.
2. Watt rating.
3. Type coating (FC = cement, FS = silicone, F = vitreous enamel).
4. Resistance value (in ohms).
   Example: A 10-watt cement coated fixed resistor of 500 ohms would be ordered as 10FC500.



Fixed Tubular Resistors — Lug Terminals

Watt Rating at 300° C Temperature Rise, 40° C Ambient	Resistance Range in Ohms† Min.	Max.	Standard Resistance Tolerance	Std. Lug Terminal Type No.	Mounting Bracket†† Type No.
8	0.5	12,000	±5%	225	829
10	0.5	28,000	±5%	225	829
12	0.5	36,000	±5%	225	829
15	0.5	40,000	±5%	225	835
20	0.5	62,000	±5%	225	835
25	0.5	70,000	±5%	219	813
30	0.5	77,000	±5%	219	826
35	0.5	115,000	±5%	219	813
50	0.5	185,000	±5%	219	813
70	0.5	275,000	±5%	219	814
100	0.5	450,000	±5%	219	814
130	0.5	500,000	±5%	252	815
160	0.5	650,000	±5%	252	815
180	0.5	750,000	±5%	252	815
225	0.5	900,000	±5%	252	815

†Other resistance values on order.
††Spring clip push-in type mounting brackets furnished only when specified on order.
Note: Maximum Voltage Ratings based on 495 R.M.S. (700 peak) volts per linear inch of core length. Voltage must not exceed $\sqrt{RxP}$

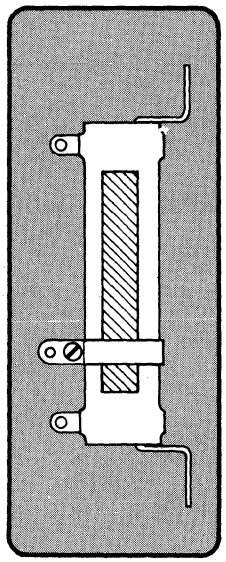


Dimensions — In Inches (Approximate)

Watt Rating	A	B	C	D	E	F	G	H dia.	J	K	L dia.	M	N
8	1	7/32	5/16	—	—	—	—	—	—	3/16	.089	1/8	7/16
10	1-1/2	7/32	5/16	—	—	—	—	—	—	3/16	.089	1/8	7/16
12	1-3/4	7/32	5/16	—	—	—	—	—	—	3/16	.089	1/8	7/16
15	1-1/2	5/16	7/16	—	—	—	—	—	—	3/16	.089	1/8	7/16
20	2	5/16	7/16	—	—	—	—	—	—	3/16	.089	1/8	7/16
25	2	25/64	9/16	1	21/32	2-5/8	3	.156	1/4	1/4	.144	5/32	9/16
30	2	29/64	5/8	1-1/16	11/16	2-5/8	3	.156	1/4	1/4	.144	5/32	9/16
35	3	25/64	9/16	1	21/32	3-5/8	4	.156	1/4	1/4	.144	5/32	9/16
50	4	25/64	9/16	1	21/32	4-5/8	5	.156	1/4	1/4	.144	5/32	9/16
70	4-1/2	17/32	3/4	1-5/8	13/16	5-1/4	6	.187	3/8	1/4	.144	5/32	9/16
100	6-1/2	17/32	3/4	1-5/8	13/16	7-1/4	8	.187	3/8	1/4	.144	5/32	9/16
130	6-1/2	3/4	1-1/8	1-15/16	1-5/16	7-1/4	8	.187	1/2	5/16	.169	5/32	5/8
160	7-1/2	3/4	1-1/8	1-15/16	1-5/16	8-1/4	9	.187	1/2	5/16	.169	5/32	5/8
180	8-1/2	3/4	1-1/8	1-15/16	1-5/16	9-1/4	10	.187	1/2	5/16	.169	5/32	5/8
225	10-1/2	3/4	1-1/8	1-15/16	1-5/16	11-1/4	12	.187	1/2	5/16	.169	5/32	5/8

Ward Leonard

Adjustable Tubular Resistors



Application

Ward Leonard Adjustohm® resistors are designed for use in electronic and other circuitry where resistance values must be adjusted from time to time or where intermediate resistance values are required.

Construction

Adjustable tubular resistors are manufactured to the same precise specifications as fixed tubular resistors. Each wire-wound resistor has a bare side, two lug terminals and one adjustable band.

Ordering Information

1. Quantity required 2. Watt rating
3. Type coating (AC=cement, AS=silicone, A=vitreous enamel)
4. Resistance value (in ohms)

Example: A 12 watt cement coated adjustable resistor of 1,000 ohms would be ordered as 12AC1000.

Adjustable Bands

Resistor Size (in Watts)	Band Cat. No.
12	609
30	612
50	612
70	612
130	615
180	615
225	615

NOTE: When adjustable contact band is positioned to obtain resistance required, the power rating must be lowered in proportion to the adjusted resistance to nominal. To determine power rating, use the following equation:

$$P_M = \frac{R_A}{R_N}$$

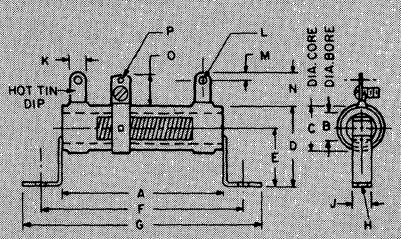
Where: P_M = Max. Power Rating (in Watts)
R_A = Resistance in Ohms (Adjusted)
R_N = Resistance in Ohms (Nominal)

Adjustable Tubular Resistors — Lug Terminals

Watt Rating at 300° C Temperature Rise	Resistance Range in Ohms† Min.	Max.	Standard Resistance Tolerance	Maximum Voltage Rating	Core and Length	Std. Lug Terminal Type No.	Adjustable Band Type No.	Mounting Bracket†† Type No.
12	1	8,000	+10%,-5%		Z1¾"	211	609Z	829
30	1	20,000	+10%,-5%	Ratings based on 495 R.M.S. (700 peak) volts per linear inch of core length. Voltage must not exceed $\sqrt{RxP}$	A2"	219	612A	826
50	1	40,000	+10%,-5%		T4"	219	612T	813
70	1	63,000	+10%,-5%		B4½"	219	612B	814
130	1	150,000	+10%,-5%		D6½"	252	615D	815
180	1	200,000	+10%,-5%		D8½"	252	615D	815
225	1	200,000	+10%,-5%		D10½"	252	615D	815

†Other resistance values on order. ††Spring clip push-in mounting brackets furnished only when specified on order.

Watt Rating	A	B	C	D	E	F	G	H dia.	J	K	L	M	N	O	P
12	1-3/4	7/32	5/16	7/16	9/32	2-1/8	2-7/16	.144	1/4	3/16	.089	1/8	7/16	9/16	.116
30	2	29/64	5/8	1-1/16	11/16	2-5/8	3	.156	1/4	1/4	.144	5/32	9/16	3/4	.144
50	4	25/64	9/16	1	21/32	4-5/8	5	.156	1/4	1/4	.144	5/32	9/16	3/4	.144
70	4-1/2	17/32	3/4	1-5/8	13/16	5-1/4	6	.187	3/8	1/4	.144	5/32	9/16	3/4	.144
130	6-1/2	3/4	1-1/8	1-15/16	1-5/16	7-1/4	8	.187	1/2	5/16	.169	5/32	5/8	25/32	.169
180	8-1/2	3/4	1-1/8	1-15/16	1-5/16	9-1/4	10	.187	1/2	5/16	.169	5/32	5/8	25/32	.169
225	10-1/2	3/4	1-1/8	1-15/16	1-5/16	11-1/4	12	.187	1/2	5/16	.169	5/32	5/8	25/32	.169



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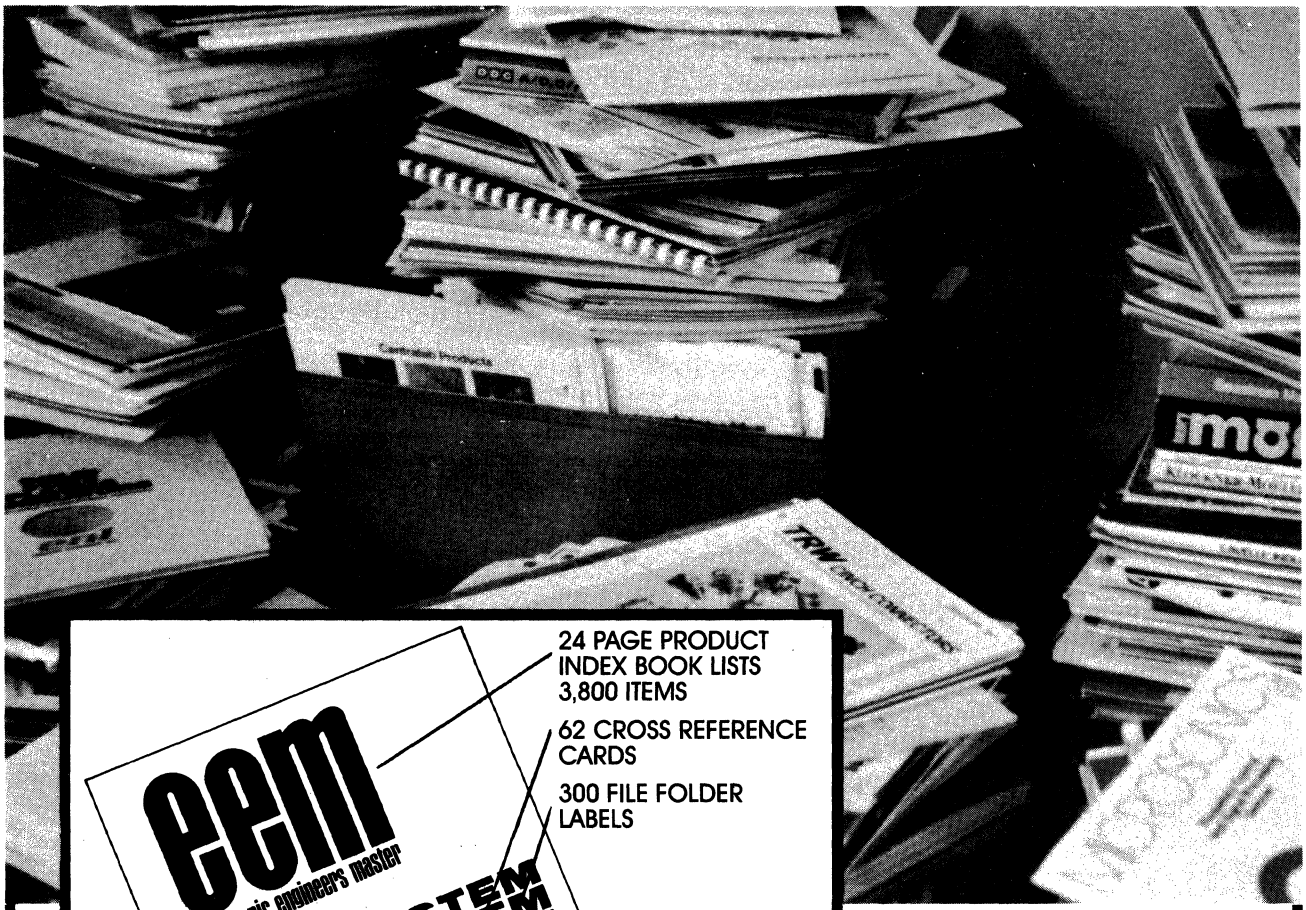

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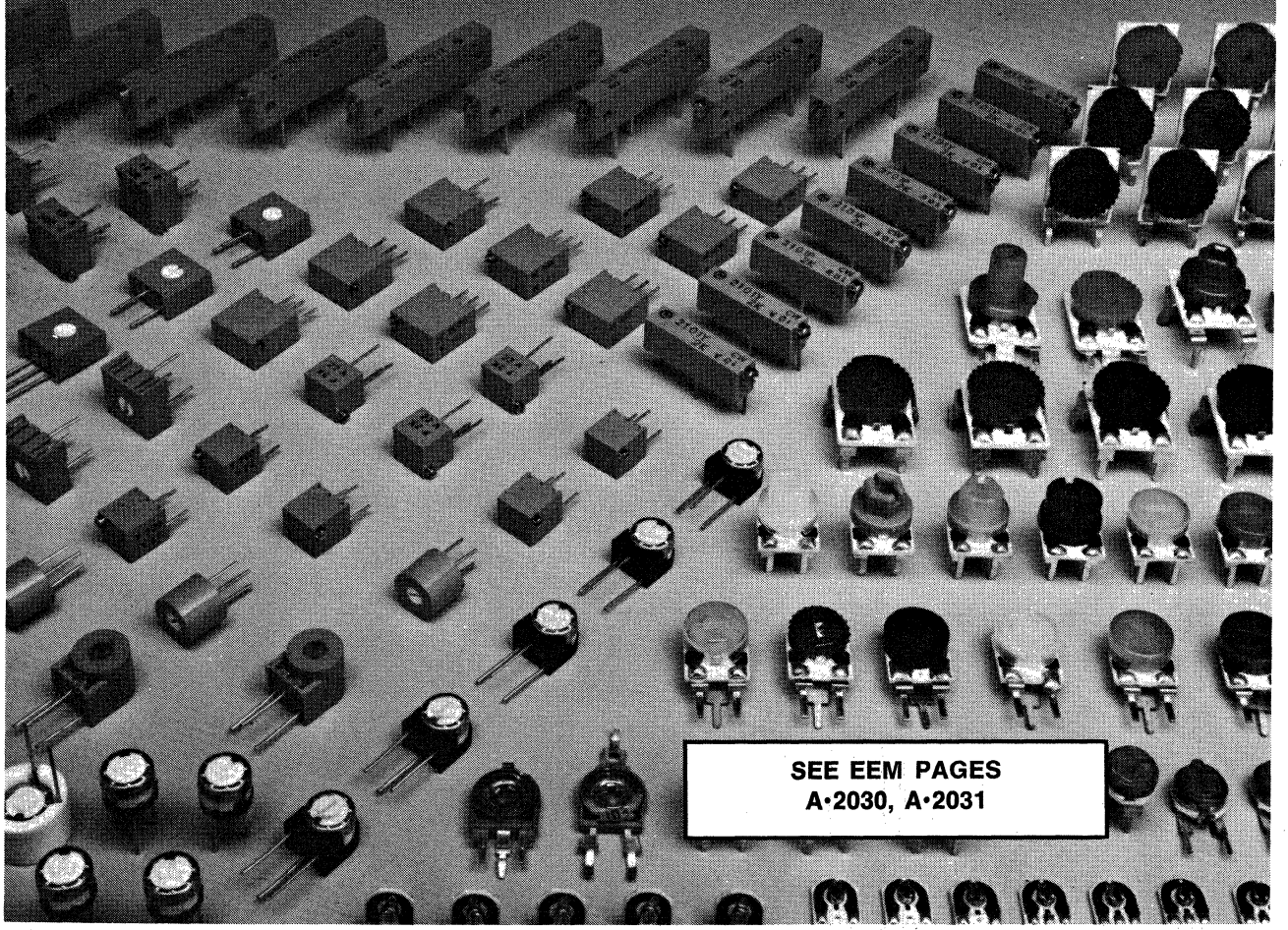


SEE EEM PAGES A•2030, A•2031

POTENTIOMETERS/RHEOSTATS†

Manufacturers	EEM Starting Page No.	Resistance Element Material						Features												Other Features
								Mechanical Adjustment						Mounting						
		Carbon Film	Carbon Comp.	Cermet	Conductive Plastic	Hybrid	Wirewound	Single Turn	Multiturn	Slider Motion	Nonlinear Tapers	High Power >5W	Precision	Linear Thru Panel	PC Board	Servo Adj.	Switch	Multisection	
Allen-Bradley	A•1994		•	•	•			•						•		•	•	•	
Bourns	A•2003				•	•	•	•	•				•	•		•			
	A•2004				•			•			•		•	•			•	•	
Cord Electronics	A•2009		•					•	•	•				•	•		•		
CTS Berne	A•2011			•				•							•				Slotted; shaft lock
Duncan Electronics	A•2012							•	•	•	•	•	•	•		•	•	•	
E-Systems	A•2015						•	•			•	•		•					Rheostats†
ETI	A•2016				•	•	•		•	•			•				•		Motor control
Hi-Tech	A•2019		•				•	•		•	•			•					
IEI-Iskra	A•2020	•		•				•						•	•				
JDK Controls	A•2021*				•			•			•		•			•	•		Gear heads
Mallory/Emhart	A•2022*						•	•	•	•	•			•			•		
Maurey Instrument	A•2023				•		•	•		•			•	•		•			Heavy duty
	A•2024				•		•			•									Light duty
	A•2025				•		•			•									
	A•2026				•			•					•	•		•			
	A•2027						•	•	•				•					•	Motorized
Ohmite Mfg.	A•2023						•					•		•					Rheostats†
	A•2033*		•					•						•				•	Shaft lock
Preh Electronic	A•2034	•	•				•	•		•	•			•	•		•	•	
Samarius	A•2035				•		•	•			•		•	•		•	•	•	
Shogyo	A•2037							•		•	•							•	
Spectrol	A•2041			•	•			•						•					
	A•2042			•	•		•	•	•				•	•		•			
Vernitech	A•2049				•			•	•				•	•		•			
VRN International	A•2054						•	•	•				•	•		•			

† A rheostat is a two-terminal variable resistor. When both ends of the resistance element and the slider contact (three terminals) are used, it's called a potentiometer. By tradition, nevertheless, power variable resistors are often referred to as rheostats, no matter how used.

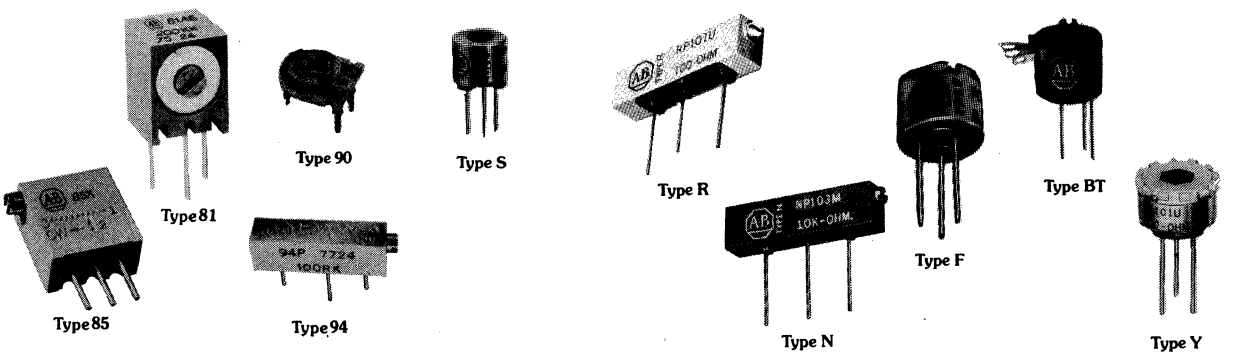
* Mil. Spec.

TRIMMERS

Manufacturers	EEM Starting Page No.	Resistance Element Material						Features								
								Mechanical Adjustment		Motion			Mounting			
		Carbon Film	Carbon Comp.	Cermet	Conductive Plastic	Metal Film	Wirewound	Single Turn	Multi-turn	Linear	Non-Linear	Precision	Thru Panel	PC Board	Multi-section	Other Features
Allen-Bradley	A•1993		•	•	•			•	•					•		
Bourns	A•1996			•			•		•					•		Industrial grade
	A•2000			•			•	•						•		Industrial grade
	A•2006			•									•	•	•	Attenuators
Cord Electronics	A•2009		•										•	•		
CTS Berne	A•2011			•				•						•		
Hi-Tech	A•2018			•				•	•				•	•		Open frame, surface mount
IEI-Iskra	A•2020	•		•						•				•		
Mepco//Electra	A•2029*			•				•	•					•		
Murata Erie	A•2030	•		•				•						•		
	A•2031			•					•			•		•		
Preh Electronic	A•2034	•	•					•		•	•		•	•		
Sangamo Components	A•2056													•		Plus resistor network
	A•2058			•				•	•					•		
	A•2059						•	•	•					•		
	A•2060*						•	•	•					•		
	A•2061*						•		•			•		•		
	A•2022			•				•	•					•		Low cost
Spectrol	A•2040			•				•	•					•		
	A•2041						•	•	•					•		
Ultronics	A•1965*					•			•	•		•		•		
Vishay	A•2051							•	•			•		•		
VRN International	A•2054			•			•	•	•					•		

* Mil. Spec.

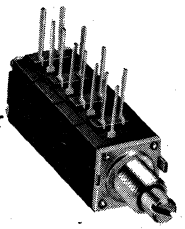
Types 81,85,90,94, S,N,R,F,BT,Y Trimming Potentiometers



SPECIFICATIONS

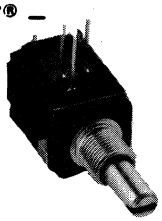
Type	Publication Number	Resistance Element and Adjustment Turns	Resistance Range and Tolerance	Power	Voltage Rating (RMS or DC)	Operating Temperature Range	Terminal Types	Case Dimensions in Inches (millimeters)	Enclosure
81	EC5731-2.1	Cermet Single Turn	10 Ohms to 1 Megohm ±10%, ±20%	0.5 Watt at 70°C	300V	−55°C to +125°C	Pin	0.25 (6,35) Diameter by 0.25 (6,35)	Immersion Sealed
85	EC5735-2.1	Cermet Multi-Turn	10 Ohms to 2 Megohms ±10%, ±20%	0.5 Watt at 70°C	300V	−55°C to +125°C		L 0.4 (10) H 0.42 (10,7) W 0.21 (5,3)	
90	EC5770-2.1	Cermet Single Turn	100 Ohms to 2 Megohms ±20%	0.5 Watt at 70°C 1.0 Watt at 40°C	200V	−55°C +125°C		L 0.466 (11,9) W 0.393 (10,0) D 0.228 (5,8)	Open Frame
94	EC5774-2.1	Cermet Multi-Turn	10 Ohms to 2 Megohms ±10%, ±20%	0.5 Watt at 70°C 0.75 Watt at 25°C	300V	−55°C +125°C		L 0.76 (19,3) H 0.45 (11,55) W 0.2 (5,08)	Immersion Sealed
S	EC5720-2.1	Cermet Single Turn	50 Ohms to 1 Megohm ±5%, ±10%	0.5 Watt at 85°C		−65°C +150°C		0.375 (9,52) Diameter by 0.375 (9,52)	
N	EC5815-2.1	Composition Multi-Turn	100 Ohms to 2.5 Megohms ±10%, ±20%	0.25 Watt at 70°C		−55°C to +100°C		L 1.250 (31,75) H 0.359 (9,13) W 0.250 (6,35)	
R	EC5820-2.1					−55°C to +125°C	Pin or Solder Lug		
F	EC5806-2.1	Composition Single Turn	100 Ohms to 5 Megohms ±10%, ±20%	0.25 Watt at 70°C		−55°C to +120°C	Pin or Solder Lug	0.500 (12,70) Diameter by 0.531 (13,49)	
BT	EC5920-2.1			Consult Factory		−40°C to +120°C	Front: 3 Lugs Rear: 3 Pins or Front: 2 Pins Rear: 2 Pins	0.500 (12,70) Diameter by 0.535 (13,59)	Dust and Splash Resistant
Y	EC5828-2.1			0.25 Watt at 50°C	350V	−55°C to +100°C	Pin or Solder Lug	0.500 (12,70) Diameter by 0.359 (9,13)	Dust and Splash Resistant

Series 70 MOD POT® – Modular design innovated by Allen-Bradley offers almost unlimited combinations: single, dual, triple or quadruple sections. Options include PC or solder lug terminals, variety of switches, vernier drives, concentric shafts, hot-molded composition, cermet or conductive plastic resistance elements.

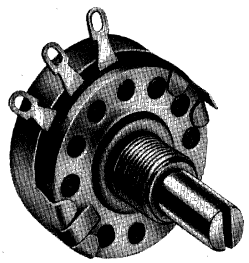


Series 72 MOD POT® – Similar to Series 70, except the bushing and shaft are non-metallic. Available in single or dual combination only.

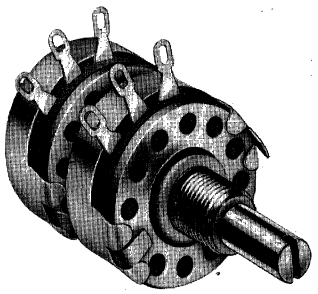
Series 73 MOD POT® – Similar to Series 70, except the bushing is of a more economical design. Available in single, dual, triple or quadruple sections.



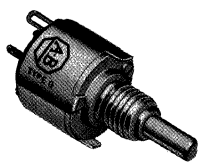
Type J (RV4 and 2RV7) – Standard of the industry for quality. Hot-molded composition, 50 ohms to 5 megs, ±10% and ±20% (special values to 1000 megs available), 2.25W at 70°C, single, dual, triple sections available. Switch for single or dual sections.



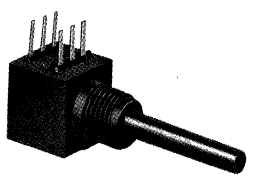
Type EJ – Extra long life version of the Type J with rotational life exceeding one million rotations, single or dual configurations. Slip clutch available.



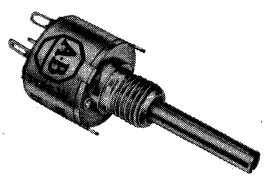
Type G (RV6) – Hot-molded composition, 100 ohms to 5 megs, ±10% and ±20%, 0.5W at 70° C, single section available with or without SPST switch.



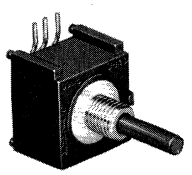
Type M – Miniature conductive plastic. 100 ohms to 1 meg., ±20%, 0.1W at 40° C, single and dual sections available. Switches optional. 5 terminal options. Non-metallic case, bushing and shaft.



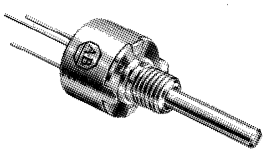
Type W (RV6) – Hot-molded composition, 100 ohms to 5 megs, ±10% and ±20%, 0.5W at 70° C, single section.



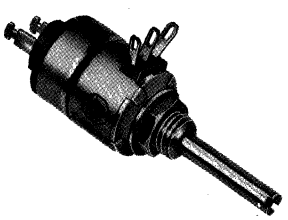
Type 2000 – Designed cost-effective in conductive plastic. 250 ohms to 1 meg, ±20%, 0.5W at 70° C single section. 3 terminal options. Sealed for board washing. Non-metallic case and shaft. Choice of bushing.



Type WP – Pin-terminal version of Type W. Suited for printed circuit board mounting.



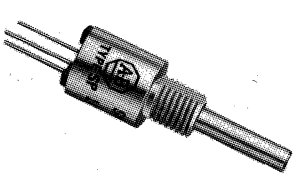
Type WR – Radial-lead version of Type W. Available with or without switch. Switch versions offer contacts that close at start of clockwise rotation (TYPE WRS) or with switch with contacts that close at start of counter-clockwise rotation (TYPE WRH).



Standard options for most types include linear and non-linear tapers, a variety of shafts, bushings, shaft endings, shaft lengths, and hardware.

Types J and the multi-section MOD POT® with composition tracks are well suited for attenuator applications.

Type SP – Cermet, 50 ohms to 1 meg, ±10%, 1.0W at 70° C, single section. Only 3/8 inch diameter.



Conductive Plastic, Cermet and Hot-Molded Carbon Composition Panel Potentiometers

SPECIFICATIONS

Type	Publication Number	Resistance Element	Resistance Range and Tolerance	Power Rating (Linear Taper)	Voltage Rating (RMS or DC)	Operating Temperature Range	Number of Sections Available	Case Dimensions in Inches (millimeters)	Enclosure
Series 70	EC5570-2.1	Cermet	100 Ohms to 5 Megohms ±10%	2.0 Watts @ 70° C	350V	−55° C to +150° C	1, 2, 3 or 4	0.625 (15,88) Square Lug terminals: 0.594 (15,08) Deep Pin terminals: 0.625 (15,88) Deep (Single Section)	Dust and Splash Resistant
		Hot-Molded Composition	50 Ohms to 10 Megohms ±10%, ±20%	1.0 Watt @ 70° C		−55° C to +120° C			
		Conductive Plastic	100 Ohms to 1 Megohm ±10%, ±20%	0.5 Watt @ 70° C					
Series 72	EC5670-2.1	Cermet	100 Ohms to 5 Megohms ±10%	1.0 Watt @ 70° C		−55° C to +100° C	1 or 2		
		Hot-Molded Composition	50 Ohms to 10 Megohms ±10%, ±20%	0.5 Watt @ 70° C					
		Conductive Plastic	100 Ohms to 1 Megohm ±10%, ±20%	0.25 Watt @ 70° C					
Series 73	EC5670-2.1	Cermet	100 Ohms to 5 Megohms ±10%	2.0 Watts @ 70° C		−55° C to +120° C	1, 2, 3 or 4		
		Hot-Molded Composition	50 Ohms to 10 Megohms ±10%, ±20%	1.0 Watt @ 70° C					
		Conductive Plastic	100 Ohms to 1 Megohm ±10%, ±20%	0.5 Watt @ 70° C					
J(RV4 and 2RV7)	EC5607-2.1	Hot-Molded Composition	50 Ohms to 5 Megohms ±10%, ±20%	2.25 Watts @ 70° C	500V	−55° C to +120° C	1, 2 or 3	0.625 (15,88) Deep by 1.156 (29,36) Diameter (Single Section) [1]	
EJ	EC5620-2.1			2.25 Watts @ 70° C			1 or 2		
G(RV6)	EC5605-2.1		100 Ohms to 5 Megohms ±10%, ±20%	0.5 Watt @ 70° C	350V	−55° C to +120° C	1	For G and W: 0.469 (11,91) Deep For WR: 0.422 (10.72) Deep by 0.500 (12.70) Diameter Above dimensions for types G and WR do not include the available switch option [1]	Immersion Sealed
W(RV6)	EC5612-2.1			0.5 Watt @ 70° C		−55° C to +120° C	1		
WR	EC5650-2.1			0.5 Watt @ 70° C					Dust and Splash Resistant
SP	EC5640-2.1	Cermet	50 Ohms to 1 Megohm ±10% (5% available)	1.0 Watt @ 70° C	300V	−65° C to +150° C		0.438 (11,11) Deep by 0.375 (9,52) Diameter	Immersion Sealed
M	EC5610-2.1	Conductive Plastic	100 Ohms to 1 Megohm ±20%	0.1 Watt @ 40° C	90V	−25° C to +100° C	1 or 2	0.394 (10,0) Cubed All Versions	Dust and Splash Resistant
2000	EC5680-2.1		250 Ohms to 1 Megohm ±20%	0.5 Watt @ 70° C	350V	−55° C to +125° C	1	0.625 (15,88) Square	Sealed for Board Washing

[1] All depth dimensions are maximum.

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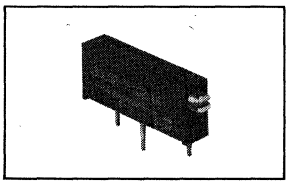
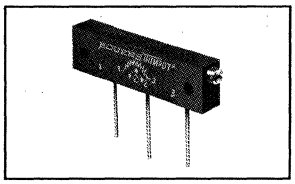
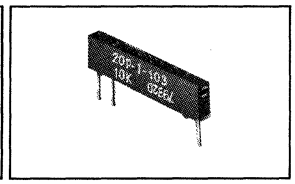
BOURNS® RECTANGULAR MULTITURN TRIMMING POTENTIOMETERS

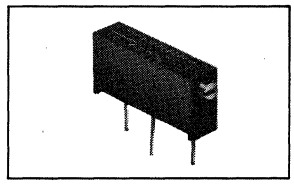
TRIMPOT® TRIMMING POTENTIOMETERS

3005P	**3057**	**20**	**3006**
3/4" long, 0.16" wide, 0.31" high Industrial grade	1-1/4" long, 0.19" wide, 0.315" high Industrial & Military grade (RT12, RTR12)	0.787" long, 0.080" wide, 0.185" high Industrial grade SIP type	3/4" long, 0.19" wide, 0.25" high Industrial grade









	Wirewound		Cermet	
Resistance Range	10 to 50,000 ohms	10 to 50,000 ohms	10 ohms to 5 megohms	10 ohms to 2 megohms
Resistance Tolerance*	±10% standard	±5% standard	±10% standard	±10% standard
Contact Resistance Variation	N/A	N/A	1.0% or 1 ohm (whichever is greater)	1.0% or 1 ohm (whichever is greater)
Adjustability	Within resolution	Within resolution	0.01% V.R.	0.01% V.R.
Insulation Resistance 500 VDC	100 megohms minimum	1000 megohms minimum	100 megohms minimum	100 megohms minimum
Power Rating	1.0 watt @ 40°C	1.0 watt @ 70°C	0.25 watt @ 70°C (250 volt maximum)	0.75 watt @ 70°C (400 volt maximum)
Temperature Range	−65°C to +125°C	−55°C to +150°C	−55°C to +125°C	−55°C to +125°C
Temperature Coefficient	±50ppm/°C maximum	±50ppm/°C maximum	±100ppm/°C maximum (50 ohms and up)	±100ppm/°C maximum
Seal Test	85°C FLUORINERT**	85°C FLUORINERT** (pin styles only)	85°C FLUORINERT**	85°C FLUORINERT**
Load Life (1000 hrs.)	1.0 watt @ 40°C	1.0 watt @ 70°C	0.25 watt @ 70°C	0.75 watt @ 70°C
Mechanical Life	200 cycles	200 cycles	200 cycles	200 cycles
Electrical Adjustment	20 turns nominal	22 turns nominal	15 turns nominal	15 turns nominal
Mechanical Stops	Wiper idles	Wiper idles	Wiper idles	Wiper idles
Terminals	1 PC pin style (shown)	2 PC pin styles 1 solder lug 1 flexible leads	1 PC pin style (shown)	3 PC pin styles

*Closer tolerances available.

**Fluorinert is a registered trademark of 3M Company.

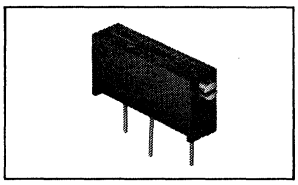
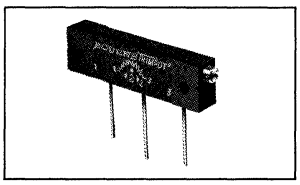
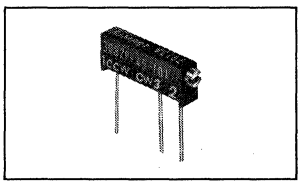
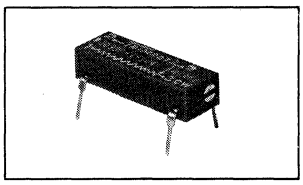
Specifications subject to change without notice.

(continued on next page)

BOURNS®

BOURNS® RECTANGULAR MULTITURN TRIMMING POTENTIOMETERS (continued)

TRIMPOT® TRIMMING POTENTIOMETERS

3009	**3059**	**3082**	**3099**
3/4" long, 0.19" wide, 0.35" high Industrial grade	1-1/4" long, 0.19" wide, 0.315" high Industrial & Military grade (RJ12, RJR12)	1/2" long, 0.10" wide, 0.15" high Industrial & Military grade (RJR28)	3/4" long, 0.25" wide, 0.19" high Industrial & Military grade (RJR32) DIP style
			

Cermet

10 ohms to 2 megohms	10 ohms to 2 megohms	10 ohms to 2 megohms	10 ohms to 5 megohms
±10% standard	±10% standard	±10% standard	±10% standard
1.0% or 1 ohm (whichever is greater)	1.0% or 1 ohm (whichever is greater)	3.0% or 3 ohms (whichever is greater)	1.0% or 1 ohm (whichever is greater)
0.01% V.R.	0.01% V.R.	0.03% V.R.	0.01% V.R.
100 megohms minimum	1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum
0.75 watt @ 70°C (400 volt maximum)	1.0 watt @ 70°C (400 volt maximum)	0.6 watt @ 25°C (300 volt maximum)	1.0 watt @ 70°C (400 volt maximum)
−55°C to +125°C	−55°C to +150°C	−65°C to +150°C	−55°C to +150°C
±100ppm/°C maximum	±100ppm/°C maximum	±100ppm/°C maximum	±100ppm/°C maximum
85°C FLUORINERT**	85°C FLUORINERT** (pin styles only)	85°C FLUORINERT**	85°C FLUORINERT**
0.75 watt @ 70°C	1.0 watt @ 70°C	0.6 watt @ 25°C	1.0 watt @ 70°C
200 cycles	200 cycles	200 cycles	200 cycles
15 turns nominal	22 turns nominal	10 turns nominal	20 turns nominal
Wiper idles	Wiper idles	Wiper idles	Wiper idles
2 PC pin styles	2 PC pin styles 1 solder lug 1 flexible leads	1 PC pin style (shown)	1 PC pin style (shown)

*Closer tolerances available.

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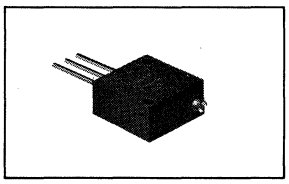
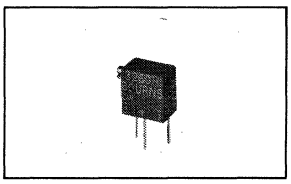
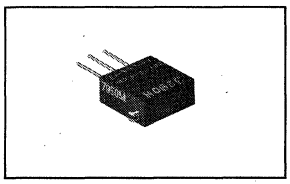
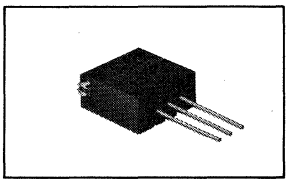
Specifications subject to change without notice. 5

BOURNS®

BOURNS® SQUARE MULTITURN TRIMMING POTENTIOMETERS

TRIMPOT® TRIMMING POTENTIOMETERS

	3250	**3260**	**3290**	**3252**
	1/2" square 0.23" thick maximum Industrial & Military grade (RT22, RTR22)	1/4" square 0.185" thick maximum Industrial & Military grade (RT26)	3/8" square 0.16" thick maximum Industrial & Military grade (RT24, RTR24)	1/2" square 0.23" thick maximum Industrial & Military grade (RJ22)
				
	Wirewound			**Cermet**
Resistance Range	10 to 50,000 ohms	10 to 25,000 ohms	10 to 25,000 ohms	10 ohms to 2 megohms
Resistance Tolerance*	±5% standard	±5% standard	±5% standard	±10% standard
Contact Resistance Variation	N/A	N/A	N/A	2.0% or 2 ohms (whichever is greater)
Adjustability	Within resolution	Within resolution	Within resolution	0.01% V.R.
Insulation Resistance 500 VDC	1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum
Power Rating	1.0 watt @ 70°C	0.25 watt @ 85°C	1.0 watt @ 70°C	1.0 watt @ 70°C (400 volt maximum)
Temperature Range	−65°C to +150°C	−65°C to +150°C	−65°C to +150°C	−65°C to +150°C
Temperature Coefficient	±50ppm/°C maximum	±50ppm/°C maximum	±50ppm/°C maximum	±100ppm/°C maximum
Seal Test	85°C FLUORINERT** (pin styles only)	85°C FLUORINERT**	85°C FLUORINERT**	85°C FLUORINERT** (pin styles only)
Load Life (1000 hrs.)	1.0 watt @ 70°C	0.25 watt @ 85°C	1.0 watt @ 70°C	1.0 watt @ 70°C
Mechanical Life	200 cycles	200 cycles	200 cycles	200 cycles
Electrical Adjustment	25 turns nominal	11 turns nominal	25 turns nominal	22 turns nominal
Mechanical Stops	Wiper idles	Wiper idles	Wiper idles	Wiper idles
Terminals	3 PC pin styles 1 flexible leads	2 PC pin styles	3 PC pin styles	3 PC pin styles 1 flexible leads

*Closer tolerances available.

**Fluorinert is a registered trademark of 3M Company.

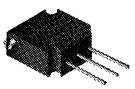
Specifications subject to change without notice.

(continued on next page)

BOURNS®

BOURNS® SQUARE MULTITURN TRIMMING POTENTIOMETERS (continued)

TRIMPOT® TRIMMING POTENTIOMETERS

3262	**3266**	**3292**	**3296**	**3299**
1/4" square 0.185" thick maximum Industrial & Military grade (RJ26, RJR26)	1/4" square 0.185" thick maximum Industrial grade	3/8" square 0.16" thick maximum Industrial & Military grade (RJ24, RJR24)	3/8" square 0.202" thick maximum Industrial grade	3/8" square 0.25" thick maximum Industrial grade
				
Cermet				
10 ohms to 1 megohm	10 to 500,000 ohms	10 ohms to 1 megohm	10 ohms to 5 megohms	10 ohms to 5 megohms
±10% standard	±10% standard (no optional tolerance)	±10% standard	±10% standard	±10% standard
3.0% or 3 ohms (whichever is greater)	3.0% or 3 ohms (whichever is greater)	3.0% or 3 ohms (whichever is greater)	3.0% or 3 ohms (whichever is greater)	3.0% or 3 ohms (whichever is greater)
0.02% V.R.	0.02% V.R.	0.01% V.R.	0.01% V.R.	0.01% V.R.
1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum
0.25 watt @ 85°C (300 volt maximum)	0.25 watt @ 85°C (300 volt maximum)	0.5 watt @ 85°C (400 volt maximum)	0.5 watt @ 70°C (300 volt maximum)	0.5 watt @ 70°C (300 volt maximum)
−65°C to +150°C	−55°C to +125°C	−65°C to +150°C	−55°C to +125°C	−55°C to +125°C
±100ppm/°C maximum	±100ppm/°C maximum	±100ppm/°C maximum	±100ppm/°C maximum	±100ppm/°C maximum
85°C FLUORINERT**	85°C FLUORINERT**	85°C FLUORINERT** (pin styles only)	85°C FLUORINERT**	85°C FLUORINERT**
0.25 watt @ 85°C	0.25 watt @ 85°C	0.5 watt @ 85°C	0.5 watt @ 70°C	0.5 watt @ 70°C
200 cycles	200 cycles	200 cycles	200 cycles	200 cycles
12 turns nominal	12 turns nominal	22 turns nominal	25 turns nominal	25 turns nominal
Wiper idles	Wiper idles	Wiper idles	Wiper idles	Wiper idles
3 PC pin styles	2 PC pin styles	3 PC pin styles 1 flexible leads	5 PC pin styles	5 PC pin styles

*Closer tolerances available.

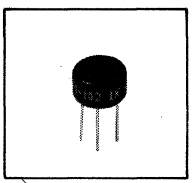
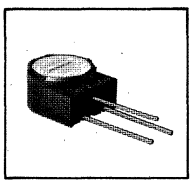
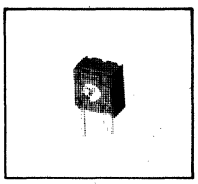
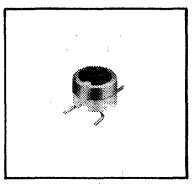
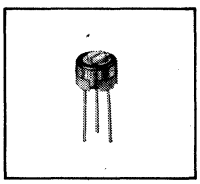
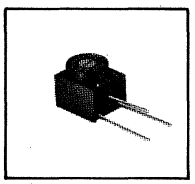
**Fluorinert is a registered trademark of 3M Company.

Specifications subject to change without notice. 7

BOURNS®

BOURNS® SINGLE-TURN TRIMMING POTENTIOMETERS

TRIMPOT® and ⊨® TRIMMING POTENTIOMETERS

3305	3345	3323	3325	3329	3339
5/16" diameter 0.195" high max. (top adjustment) Industrial grade Sealed	1/2" diameter 0.25" high max. (top adjustment) Industrial grade	1/4" square 0.22" high max. (top adjustment) Industrial grade	1/4" diameter 0.23" high max. (top adjustment) Surface Mounted Trimmer (SMT) Industrial grade	1/4" diameter 0.25" high max. (top adjustment) Industrial & Military grade (RJ50, RJR50)	5/16" diameter 0.26" high max. (top adjustment) Industrial grade
					
Wirewound	**Wirewound**	**Cermet**	**Cermet**	**Cermet**	**Cermet**
10 to 25,000 ohms	10 to 50,000 ohms	20 ohms to 2 megohms	10 ohms to 1 megohm	10 ohms to 1 megohm	10 ohms to 1 megohm
±5% standard	±5% standard	±20% standard	±10% standard	±10% standard	±10% standard
N/A	N/A	1.0% or 3 ohms (whichever is greater)	3.0% or 3 ohms (whichever is greater)	3.0% or 3 ohms (whichever is greater)	3.0% or 3 ohms (whichever is greater)
Within resolution	Within resolution	0.05% V.R.	0.05% V.R.	0.05% V.R.	0.03% V.R.
500 megohms minimum	1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum
0.5watt @ 70°C	1.0watt @ 70°C	0.5watt @ 70°C (300 volt max.)	0.5watt @ 85°C (300 volt max.)	0.5watt @ 85°C (300 volt max.)	0.5watt @ 85°C (300 volt max.)
-55°C to +125°C	−55°C to +150°C	−55°C to +125°C	−55°C to +150°C (operating) +215°C/3 mins (processing)	−55°C to +150°C	−55°C to +150°C
±70ppm/°C maximum (200 ohms up)	±50ppm/°C maximum (100 ohms up)	±100ppm/°C maximum	±100ppm/°C maximum	±100ppm/°C maximum	±100ppm/°C maximum
Dustproof, splashproof ①	85°C FLUORINERT**	85°C FLUORINERT**	85°C FLUORINERT**	85°C FLUORINERT**	85°C FLUORINERT**
0.5 watt @ 70°C	1.0 watt @ 70°C	0.5 watt @ 70°C	0.5 watt @ 85°C	0.5 watt @ 85°C	0.5 watt @ 85°C
200 cycles	200 cycles	200 cycles	200 cycles	200 cycles	200 cycles
280° nominal	300° nominal	240° nominal	240° nominal	240° nominal	4 turns nominal
300° nominal	310° nominal	275° nominal	260° nominal	260° nominal	Wiper idles
2 PC pin styles	2 PC pin styles 2 thumbwheel types	5 PC pin styles	1 top-adjust style 2 side-adjust styles	5 PC pin styles	3 PC pin styles

Resistance Range		
Resistance Tolerance		
Contact Resistance Variation		
Adjustability		
Insulation Resistance 500 VDC		
Power Rating		
Temperature Range		
Temperature Coefficient		
Seal Test		
Load Life (1000 hours)		
Mechanical Life		
Adjust Angle		
Mech Angle		
Terminals		

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*Closer tolerances available.

**Fluorinert is a registered trademark of 3M Company.

① Performance not guaranteed after exposure to printed circuit board cleaning procedures.

Specifications subject to change without notice.

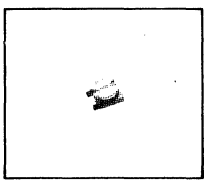
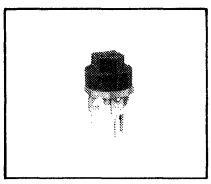
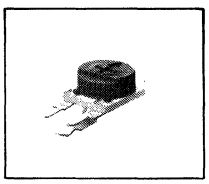
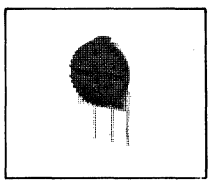
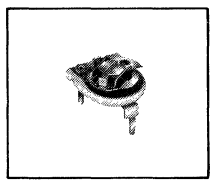
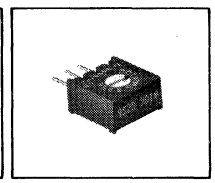
(continued on next page)

BOURNS®

BOURNS® SINGLE-TURN TRIMMING POTENTIOMETERS (continued)

TRIMPOT® and ⊒® TRIMMING POTENTIOMETERS

3304	3306	3309	3352	3359	3386
4mm diameter 2.5mm high max. Surface Mounted Trimmer (SMT) Industrial grade	6mm diameter 9.1mm high max. (top and side adjustment) Industrial grade	9mm diameter 13mm high max. (top and side adjustment) Industrial grade	3/8" diameter 0.39" high max. (side adjustment)	3/8" diameter 0.5" high max. (side adjustment) Industrial grade	3/8" square 0.2" thick max. Industrial grade

Cermet

500 ohms to 1 megohm	100 ohms to 1 megohm	100 ohms to 2 megohms	10 ohms to 5 megohms	10 ohms to 2 megohms	10 ohms to 2 megohms
±25% standard	±25% standard	±25% standard	±20% standard	±20% standard	±10% standard
5% maximum	3% maximum	3% maximum	1.0% or 1 ohm (whichever is greater)	2.0% or 3 ohms (whichever is greater)	1.0% or 1 ohm (whichever is greater
N/A	N/A	N/A	0.1% V.R.	0.1% V.R.	0.05% V.R.
N/A	N/A	N/A	10 megohms minimum	N/A	1,000 megohms minimum
0.1watt @ 70°C (20 volt max.)	0.3watt @ 70°C (100 volt max.)	0.5watt @ 70°C (350 volt max.)	0.75watt @ 40°C (250 volt max.)	0.75watt @ 40°C (250 volt max.)	0.5watt @ 85°C (300 volt max.)
−20°C to +70°C	−20°C to +70°C	−20°C to +70°C	-55°C to +125°C	−65°C to +125°C	−55°C to +125°C
±250ppm/°C nominal	±200ppm/°C maximum	±200ppm/°C (<500k) ±300ppm/°C (≥500k)	±100ppm/°C maximum (1K and up)	±100ppm/°C maximum	±100ppm/°C maximum
N/A	Dust resistant, splash resistant ①	Dust resistant, splash resistant ①	No ①	No ①	85°C FLUORINERT**
0.1watt @ 70°C	0.3 watt @ 70°C	0.5watt @ 70°C	0.5 watt @ 85°C	0.5 watt @ 70°C	0.5 watt @ 85°C
20 cycles	N/A	N/A	200 cycles	500 cycles	200 cycles
230° nominal	160° nominal	220° nominal	205° nominal	230° nominal	280° nominal
N/A	N/A	N/A	225° nominal	270° nominal	310° nominal
Solderable pads	Solderable pins	Solderable pins	7 PC pin styles	2 PC pin styles	12 PC pin styles

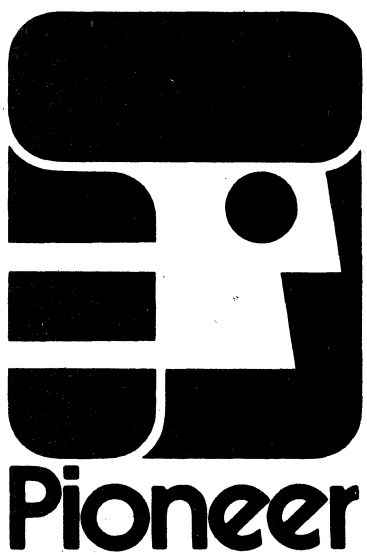
*Closer tolerances available.

**Fluorinert is a registered trademark of 3M Company.

① Performance not guaranteed after exposure to printed circuit board cleaning procedures.

Specifications subject to change without notice. 9

BOURNS® TRIMMERS
PANEL CONTROLS
RESISTOR NETWORKS
PRECISION POTENTIOMETERS
IN STOCK FROM



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BOURNS®

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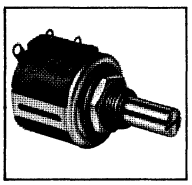
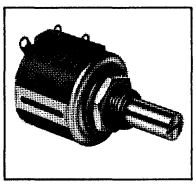
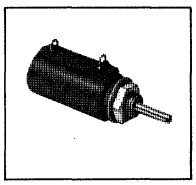
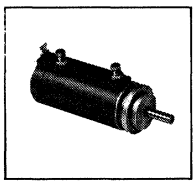
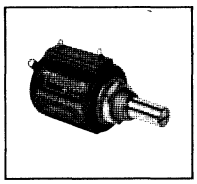
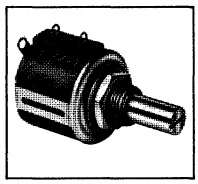
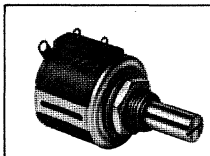
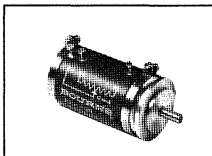
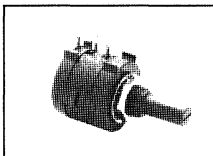
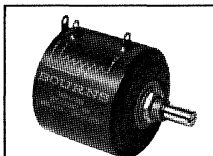
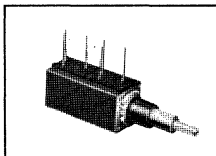
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 • TEL (714) 781-5050

BOURNS® MULTITURN PRECISION POTENTIOMETERS

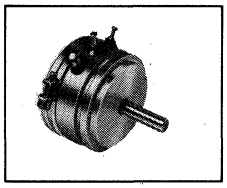
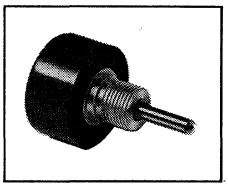
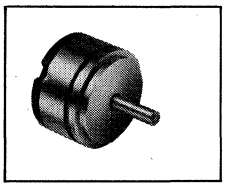
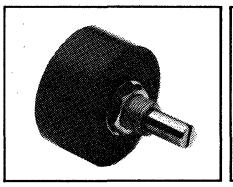
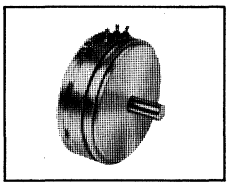
	3543 3-Turn Wirewound	**3545** 5-Turn Wirewound	**3700/3701** 10-Turn Wirewound/Hybrid	**3750/3751** 10-Turn Wirewound/Hybrid	**3500/3501** 10-Turn Wirewound/Hybrid	**3540** 10-Turn Wirewound
						
Resistance	20 to 50k ohms	50 to 50k ohms	**3700** 100 to 100k ohms **3701** 1k to 50k ohms	**3750** 100 to 100k ohms **3751** 1k to 50k ohms	**3500** 50 to 200k ohms **3501** 1k to 100k ohms	100 to 100k ohms
Power Rating @ 70°C	1.0 watt	1.5 watts	1.0 watt	1.0 watt	2.0 watts	2.0 watts
Independent Linearity	±0.25%	±0.25%	±0.25%	±0.25%	**3500** ±0.2% **3501** ±0.25%	±0.25%
Rotational Life	0.3x10⁶ revolutions	0.5x10⁶ revolutions	**3700** 1x10⁶ revolutions **3701** 4x10⁶ revolutions	**3750** 1x10⁶ revolutions **3751** 4x10⁶ revolutions	**3500** 2x10⁶ revolutions **3501** 4x10⁶ revolutions	1x10⁶ revolutions
Size	7/8" diameter x 3/4"	7/8" diameter x 3/4"	1/2" diameter x 1"	1/2" diameter x 1"	7/8" diameter x 1"	7/8" diameter x 3/4"

	3541 10-Turn Hybrid	**3550/3551** 10-Turn Wirewound/Hybrid	**3590** 10-Turn Wirewound	**3400** 10-Turn Wirewound	**83/84** 10-Turn Wirewound/Hybrid
					
Resistance	1k to 100k ohms	**3550** 100 to 200k ohms **3551** 1k to 100k ohms	200 to 100k ohms	100 to 500k ohms	**Wirewound** 200 to 100k ohms **Hybrid** 1k to 100k ohms
Power Rating @ 70°C	2.0 watts	**3550** 2.5 watts **3551** 2.0 watts	2.0 watts @ 40°C 0 watts @ 125°C	5.0 watts @ 40°C	1.0 watt
Independent Linearity	±0.25%	±0.2%	±0.25%	±0.15%	±0.25%
Rotational Life	4x10⁶ revolutions	**3550** 2x10⁶ revolutions **3551** 4x10⁶ revolutions	1x10⁶ revolutions	2x10⁶ revolutions	**Wirewound** 1x10⁶ revolutions **Hybrid** 4x10⁶ revolutions
Size	7/8" diameter x 3/4"	7/8" diameter x 1-9/16"	7/8" diameter x 3/4"	1-13/16" diameter x 1-3/4"	5/8" square x 3/4"

Specifications subject to change without notice. **11**

BOURNS®

BOURNS® SINGLE-TURN PRECISION POTENTIOMETERS

	6534 Conductive Plastic Servo Mount	**6637/6638** Conductive Plastic Bushing Mount	**6538** Conductive Plastic Servo Mount	**6657** Conductive Plastic Bushing Mount	**6574** Conductive Plastic Servo Mount
					
Resistance	1k to 100k ohms	1k to 100k ohms	1k to 100k ohms	1k to 100k ohms	1k to 100k ohms
Power Rating @ 70 °C	1.0 watt	1.0 watt	1.0 watt	1.5 watts	2.0 watts
Independent Linearity	±0.5%	±1.0%	±1.0%	±1.0%	±.25%
Rotational Life	25,000,000 shaft revolutions	10,000,000 shaft revolutions	20,000,000 shaft revolutions	10,000,000 shaft revolutions	25,000,000 shaft revolutions
Size	7/8" diameter x 15/32"	7/8" diameter x 7/16"	7/8" diameter x 15/32"	1-5/16" diameter x 5/8"	2" diameter x 3/5"

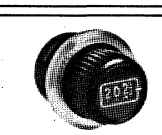
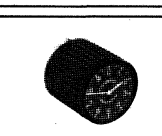
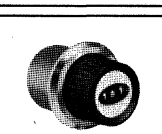
BOURNS® DIALS; PUSHBUTTON AND KNOBPOT® POTENTIOMETERS

PUSH-BUTTON POTENTIOMETERS

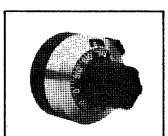
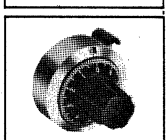
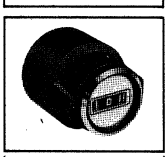
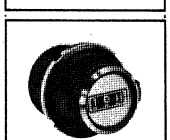
3680 Series
Cermet

Decades	Model	Resistance	Resolution
1	3681	10 to 10k ohms	10%
2	3682	100 ohms to 1 megohm	1.0%
3	3683	1k ohms to 1 megohm	0.1%
4	3684	10k ohms to 1 megohm	0.01%
5	3685	100k ohms to 1 megohm	0.001%

KNOBPOT® POTENTIOMETERS

		Resistance	Power Rating	Diameter
3600 Wirewound		100 to 100k ohms	1.5 watts @ 25°C	3/4"
3610 Wirewound		100 to 100k ohms	1.5 watts @ 25°C	7/8"
3640 Wirewound		100 to 100k ohms	2.5 watts @ 25°C	1-1/4"
3650 Wirewound		100 to 100k ohms	2.5 watts @ 25°C	1-1/4"

DIALS

H-507-6 7/8" diameter	
H-490 1" diameter	
CT23 1-1/16" diameter	
CT26 1-1/4" diameter	

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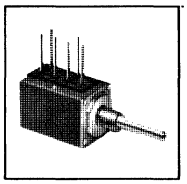
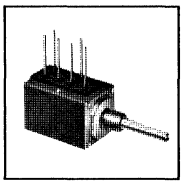
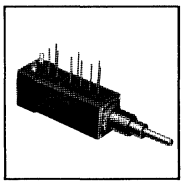
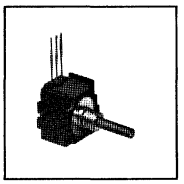
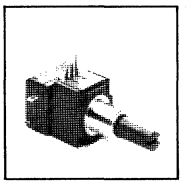
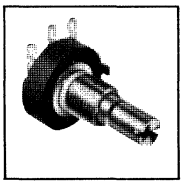
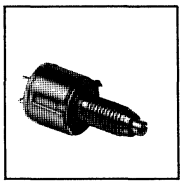
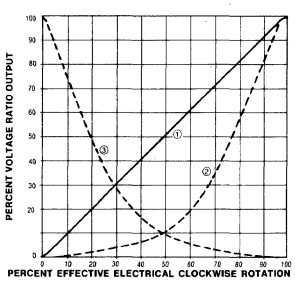
BOURNS®

BOURNS® PANEL CONTROLS

81/82	87/88	85/86*	91/92/93/ 94/95	97/98/99*	3851/3852	3862
						
•5/8" square •Modular construction •Single or multiple sections •Linear or audio tapers •Concentric or single shafts •Cermet •Conductive plastic	•5/8" square •Modular construction •Single or multiple sections •Semi-precision linear tapers •Concentric or single shafts •Cermet •Conductive plastic	•5/8" square •Modular construction •Multiple sections •DPST and DPDT rotary switches* •Concentric or single shafts •Cermet •Conductive plastic	•5/8" square •Modular construction •Single or dual sections •Linear or audio tapers •Single plastic shaft •Cermet •Conductive plastic	•5/8" square •Modular construction •DPST and DPDT rotary switches •Single shaft •Cermet •Conductive plastic	•3/4" diameter •1/4" depth •Single section •Linear or audio tapers •Single shaft •Cermet •Conductive plastic	•1/2" diameter •Rear terminals •Single section •Linear taper •1/8" diameter single shaft •Cermet

SWITCH TYPE

Type	Detent	Contacts
DPST	CW	Open/Closed
		Open/Open
		Closed/Closed
	CCW	Open/Closed
		Open/Open
		Closed/Closed
DPDT	CW	Open/Closed
	CCW	Open/Closed



RESISTANCE RANGES

Model	81/82 - 85/86 - All Model 90s				87/88
Element Type	CP		Cermet		CP/Cermet
Taper	Linear	Audio	Linear	Audio	Linear
Available Resistance Range	150 to 5 meg	1k to 5 meg	50 to 5 meg	1k to 5 meg	250 to 2.5 meg
Model	**3851**		**3852**		**3862**
Element Type	**CP**		**Cermet**		**Cermet**
Taper	Linear	Audio	Linear	Audio	Linear
Available Resistance Range	1k to 100k	1k to 2.5 meg	50 to 5 meg	1k to 2.5 meg	100 to 5 meg

Taper Code	Description	Linearity	Tol.	Fig. Ref.
A	Linear-Cermet	±5% Ind.	±10%	1
B	Linear-Conductive plastic	±5% Ind.	±20%	1
C	CW Audio-Cermet	N/A	±10%	2
D	CW Audio-Conductive plastic	N/A	±20%	2
E	Linear-Conductive plastic	±5% Ind.	±10%	1
F	CCW Audio-Cermet	N/A	±10%	3
G	CCW Audio-Conductive plastic	N/A	±20%	3
H	Linear-Cermet	±5% Ind.	±5%	1
L	Linear-Conductive plastic	±2% Z.B.Ⓐ	±5%	1
M	Linear-Cermet	±2.5% Z.B.Ⓐ	±3%	1
N	Linear-Conductive plastic	±1% Z.B.Ⓐ	±5%	1
P	Linear-Cermet	±1.5% Z.B.Ⓐ	±3%	1
S	CW Audio-Conductive plastic	N/A	±10%	2
T	CCW Audio-Conductive plastic	N/A	±10%	3

*Switch/potentiometer combinations only.
Ⓐ Zero base linearity.

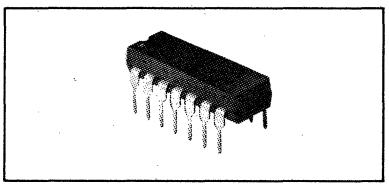
BOURNS®

BOURNS® ATTENUATORS

Bourns offers an extensive line of fixed, variable and switchable attenuators. All Bourns attenuators are available in both standard and custom configurations. Our Engineering Departments can custom design special attenuators for your special applications.

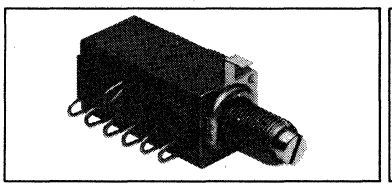
Fixed Attenuators

Models
4114R-033-001
O-Pad Configurations



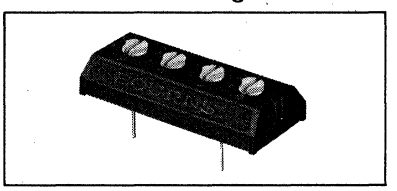
Variable Attenuator

Models 81/82, 91/92
Straight T-Pad



Switchable Attenuators

Model
3100
T and O-Pad Configurations



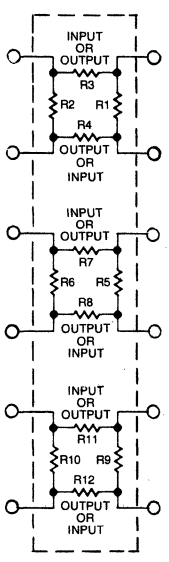
RESISTOR NETWORKS

Pre-assembled 14 pin DIPs contain balanced or unbalanced attenuator pads. Available in 1/2 dB steps to 36 dB

Features include temperature coefficient of ±100ppm/°C operating temperature −55°C to +125°C

Attenuation tolerance (dB) of ±1%

Flat response through 1MHz



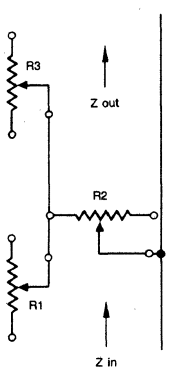
O-Pad

PRECISIONS/ CONTROLS

Thick film cermet elements achieve infinite resolutions and setting stability

Straight T is available with 10% to 20% impedance tolerances

Minimum attenuation loss 0.2 dB all models with flat response through complete audio range



Straight T-Pad

TRIMPOT

Bourns Model 3100 switchable attenuators incorporate both switching and attenuator network functions in a single integrated package resulting in reduced component count, assembly costs and PC board space

Sealed to avoid switch contamination and PCB cleaning procedures

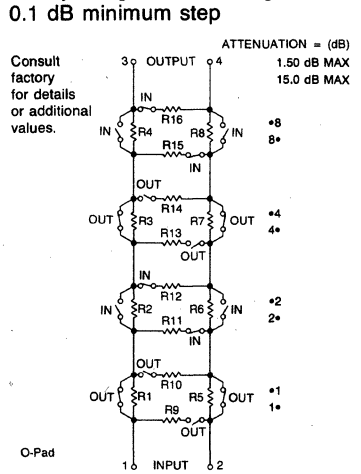
Precious metal switch contacts assure low insertion loss and long term operating stability

Impedance: 600 ohms ±2% (balanced or unbalanced)
75 ohms ±5% (unbalanced)

Standard attenuation ranges: 0-1.5, 0-15, and 0-24 dB

Binary Weighted Switching, 0.1 dB minimum step

Consult factory for details or additional values.



O-Pad

Specifications subject to change without notice.

BOURNS® TRIMMERS · PANEL CONTROLS RESISTOR NETWORKS PRECISION POTENTIOMETERS IN STOCK FROM

ELECTRONIC SUPPLY®
A DKM ELECTRONICS COMPANY

RIVERSIDE, CA
(714) 787-9220

TEMPE, AZ
(602) 258-4769

SAN DIEGO, CA
(619) 278-5020

BOURNS® TRIMMERS · PANEL CONTROLS RESISTOR NETWORKS PRECISION POTENTIOMETERS IN STOCK FROM

IDEAL INDUSTRIAL ELECTRONIC SUPPLY, INC.

EL PASO, TX
(915) 779-6647

BOURNS® TRIMMERS · PANEL CONTROLS RESISTOR NETWORKS PRECISION POTENTIOMETERS IN STOCK FROM

RS ELECTRONICS
A Subsidiary of Chelsea Industries

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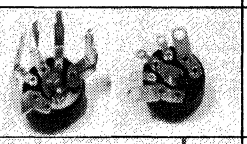
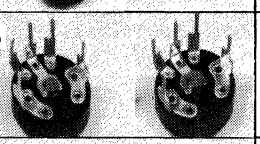
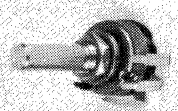
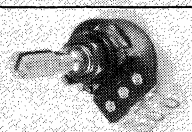
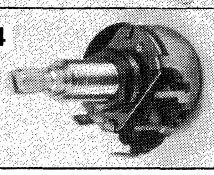
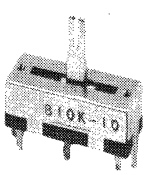
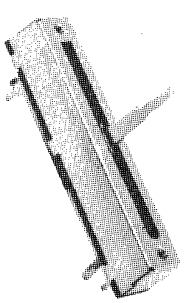
ROTARY SLIDE TRIMMING CARBON COMPOSITION

SERIES	DIAMETER IN/MM	RESISTANCE RANGE (KΩ)(+/−20%)	POWER RATING (WATTS)	SHAFT TYPE	SWITCH TYPE	SWITCH RATING	TERMINAL TYPE P-PCB, S-SOLDER	ANGLE OF ROTATION (+/−10%)
12 	½/12	.5-500	0.1	SQ	ROTARY SPST	12VDC/1A	P/S	230°
16 	⅝/16	.5-1000	0.1	N/A	ROTARY SPST	12VDC/1A	P/S	260°
17 	43/64/17	.5-1000	0.1	S,R,F	ROTARY SPST	12VDC/1A	P/S	260°
18 	21/32/16.8	.5-1000 AVAILABLE WITH DUAL ELEMENT	0.2	S,F,R	ROTARY SPST	125 VAC/1A	P/S	300°
24 	15/16/24	1-3000 AVAILABLE WITH DUAL ELEMENT AND DUAL ELEMENT WITH SWITCH.	0.5	S,F,R	ROTARY SPST SPST SPST DPST DPST DPDT PUSH-PUSH	125VAC/1A 125VAC/3A 250VAC/1A 125VAC/3A 125VAC/1A 125VAC/1A 125VAC/3A	P/S	300°

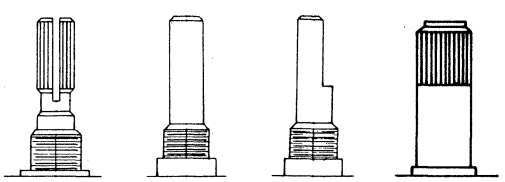
ROTARY POTS:
DETENTS–SERIES 18 AND 24
CENTER,11, 41

SLIDE POTS:
CENTER DETENTS-20, 30, 45, 60
11 DETENTS-30 21 DETENTS-45

SLIDE POTS	TRAVEL (MM)	TERMINAL TYPE P-PCB, S-SOLDER	DUAL AVAIL.
SV10	10	P	**YES**
SV20 	20	P	**YES**
		S	**YES**
SV30 	30	P	**YES**
		S	**YES**
SV45	45	P	**YES**
		S	**YES**
SV60	60	P	NO
		S	NO

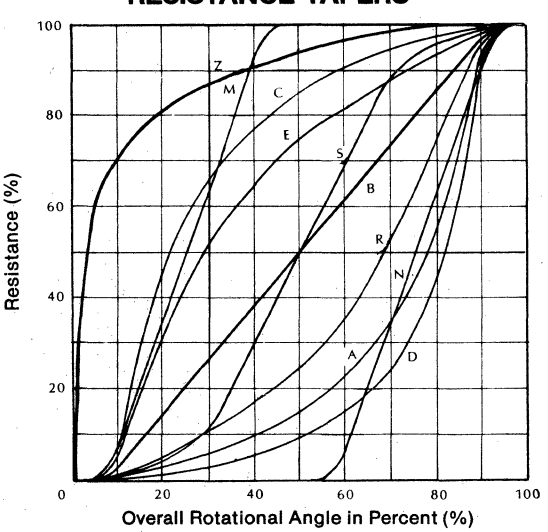
RESISTANCE RANGE: 500Ω-2MΩ

SHAFT TYPES



S R F SQ

RESISTANCE TAPERS



enclosures • capacitors • circuit boards • coils, chokes, inductors • connectors, electronic • sockets/ terminals • crystals • oscillators • crystal filters delay lines • panel hardware • displays • lamps/ lights • cooling equipment • filters • generators • multimeters • panel meters • oscilloscopes • gra phic recorders • interconnections • microwave components • motors/ drives • batteries • power supplies, dc • power supplies, ac • semiconductors • relays • solenoids • resistors • potentiometers/trimmers controls/rheostats • fiber optic components • switches • keyboards/keypads • transducers/en coders • transformers • wire & cable • enclosures capacitors • circuit boards • coils, chokes, induc tors • connectors, electronic • sockets/terminals

EEM PRODUCT SELECTION GUIDES

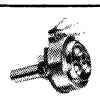
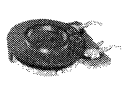
Use the EEM Product Selection Guides. There are 34 Guides in this edition of EEM. See page 2 (A•2, B•2, C•2, D•2) of each volume to locate the Product Selection Guides that pertain to your needs.

CTS® CORPORATION
BERNE DIVISION

INDUSTRIAL CERMET POTS & TRIMMERS

CTS Series	Description	Data Sheet	Resistance Range	CTS Series	Description	Data Sheet	Resistance Range
550R	Power: 2 @ 70°C Max. Temp: 175°C Resist. Tol: ±10% Dim.: ¾″ dia. Bushing: ⅜″ FMS Shaft: ⅞″ FMS x .250″ dia., slotted	3550 E	50Ω-1 MEGΩ	**375S**	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370″ dia. x .150″ .100″ lead spacing	3375	50Ω-1 MEGΩ
550S	Power: 2 @ 70°C Max. Temp: 175°C Resist. Tol: ±10% Dim.: ¾″ Dia. Bushing: ⅜″ FMS Shaft: 2″ FMS x .250″ dia.	3550 E	50Ω-1 MEGΩ	**375T**	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370″ dia. x 150″ .100″ lead spacing	3375	50Ω-1 MEGΩ
550LT	Power: 2 @ 70°C Max. Temp: 175°C Resist. Tol: ±10% Dim: ¾″ Dia. Bushing: ½″ FMS, Shaft: locking ⅝″ FMS x .250″ dia., slotted	3550 E	50Ω-1 MEGΩ	**375X**	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370″ dia. x .150″ .100″ lead spacing TO-5 lead spacing	3375	50Ω-1 MEGΩ
375E	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370″ dia. x .150″ .100″ lead spacing Cent. Term: .400″	3375	50Ω-1 MEGΩ	**375Y**	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370″ dia. x .150″ .100″ lead spacing TO-5 lead spacing	3375	50Ω-1 MEGΩ
375V	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .350″ dia. x .150″ .172″ lead spacing Cent. Term: .156″	3375	50Ω-1 MEGΩ	**375Z**	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370″ dia. x .150″ .100″ lead spacing TO-5 lead spacing	3375	50Ω-1 MEGΩ

INDUSTRIAL CARBON POTS & TRIMMERS

	CTS Series	Description	Resistance Range & Tol.	Power Rating (Watts)	Max. Op. Temp.	No. of Turns
	**VA-45** (Vernier Adjust)	15/16″ Panel Mount Shaft: ¼″ dia. x 1″ FMS. Slotted	100Ω-1 Meg ±10%	½ to 10K ⅓ Above 10K to 100K ¼ Above 100K @ 55°C	85°C	10¼
	U201	13/32″ Knob. Dia. Snap-in self-supporting mounting, parallel to PC board	100Ω-1 Meg ±20%	¼ to 5K @ 40°C ¼ 5K & Up @ 55°C	85°C 100°C	1
	**X201**	13/32″ Knob. Dia. Snap-in self-supporting mounting, perpendicular to PC board	100Ω-1 Meg ±20%	¼ to 5K @ 40°C ¼ 5K & Up @ 55°C	85°C 100°C	1
	U260	10 mm (.394″) Dia. Mounts horizontally, knob parallel to PC board	500Ω-1 Meg ±20%	.2 @ 55°C	100°C	1
	X260	10 mm (.394″) Dia. Mounts vertically, knob perpendicular to PC board	500Ω-1 Meg ±20%	.2 @ 55°C	100°C	1

ORDERING INFORMATION: Place orders using following address:
BERNE DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • TWX 810-323-1880
* In Indiana, dba CTS Electronics Corporation

SYSTRON DONNER
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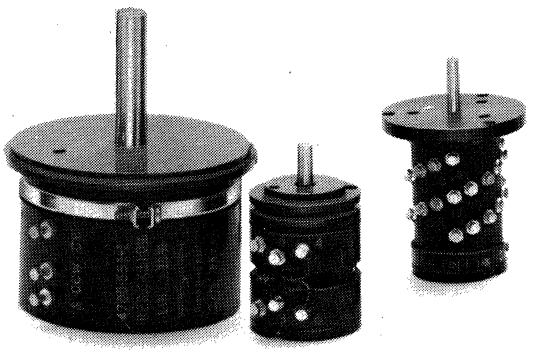
DUNCAN ELECTRONICS DIVISION

A complete selection of standard products is available for cost-effective solutions to a wide variety of potentiometric functions. DUNCAN ELECTRONICS is also prepared to respond to special requirements, and offers a host of new, innovative alternatives to position sensing applications.



PRECISION POTENTIOMETERS

A COMPLETE SELECTION OF WIREWOUND, HYBRID, AND CONDUCTIVE PLASTIC UNITS, INCLUDING COMMERCIAL AND INDUSTRIAL MODELS AND SPECIAL CAPABILITIES.

COMPARISON OF RESISTIVE CHARACTERISTICS

PARAMETER	RESISTIVE TECHNOLOGY		
	Wirewound	Hybrid	Conductive Plastic
Resistance Range	Full Range	Limited Range	Full Range
Std. Resistance Tolerance	± 3%	± 5%	± 10%
Effective Travel Range	Up To 10-Turns	Up To 10-Turns	360° Maximum
Temp. Coefficient of Resistance	± 20 PPM/°C	± 70 PPM/°C	– 300 PPM/°C
Power Dissipation	High	High	Moderate
Resolution	Finite	Infinite	Infinite
Adjustability/Setability	Fair	Good	Excellent
Linearity/Conformity	Very Good	Good	Excellent
Contact Resistance	Low	High	Moderately High
Rotational Life (Rev.)	2×10^8	10×10^6	50×10^6
Moisture Stability	Excellent	Good	Fair
Non-Linear Functions	Excellent	Good	Excellent
Rheostat Applications	Excellent	Poor	Fair
AC Circuit Applications	Poor	Fair	Excellent
Relative Cost	Low	Medium	High

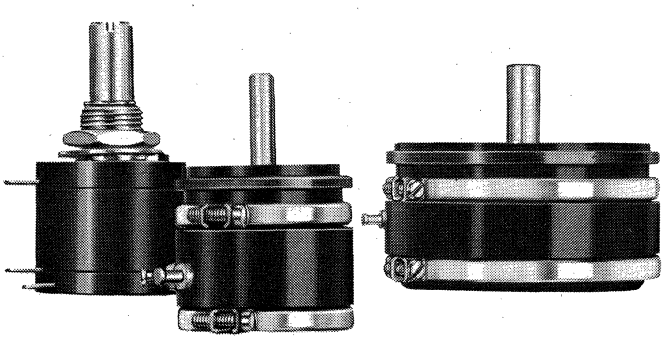
SINGLE TURN

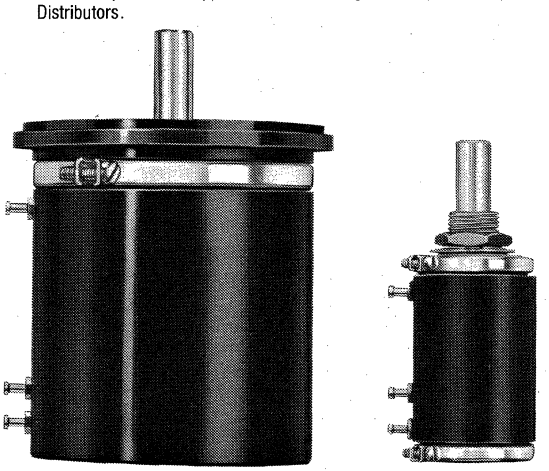
Element Type/ Series No.	Dia.	Resistance Range (Ω)	Linearity (%) Standard	Linearity (%) Best Practical	Max. Power @ 70°C (Watts)	Mounting Style
WIREWOUND						
1200	7/8"	15-75K	±0.5	±0.2	1.25	Servo/Bushing
(1230)[3]	7/8"	15-50K	±0.5	±0.25	1.25	(Bushing)
1300	1 1/16"	25-100K	±0.4	±0.15	2.0	Servo/Bushing
1500	1 7/16"	25-125K	±0.3	±0.12	3.0	Servo/Bushing
1600	1 3/4"	25-150K	±0.25	±0.09	4.0	Servo/Bushing
(1630)	1 3/4"	25-100K	±0.3	±0.15	4.0	(Bushing)
1700	2"	25-200K	±0.2	±0.08	5.0	Servo/Bushing
1800	3"	25-250K	±0.15	±0.05	7.0	Servo/Bushing
CONDUCTIVE						
1220	7/8"	400-75K	±0.5	±0.2	0.5	Servo/Bushing
1320	1 1/16"	500-100K	±0.4	±0.15	0.75	Servo/Bushing
1520	1 7/16"	500-125K	±0.3	±0.10	1.0	Servo/Bushing
1620	1 3/4"	500-150K	±0.25	±0.075	1.5	Servo/Bushing
1720	2"	600-200K	±0.2	±0.06	2.0	Servo/Bushing
1820	3"	750-300K	±0.15	±0.04	3.0	Servo/Bushing
HYBRID						
2200	7/8"	200-10K	±0.5	±0.25	1.25	Servo/Bushing
2230	7/8"	500-7K	±0.5	±0.3	1.25	(Bushing)
2300	1 1/16"	200-15K	±0.4	±0.2	2.0	Servo/Bushing
2500	1 7/16"	500-20K	±0.3	±0.15	3.0	Servo/Bushing
2600	1 3/4"	500-25K	±0.25	±0.12	4.0	Servo/Bushing
2630	1 3/4"	1K-17.5K	±0.5	±0.2	4.0	(Bushing)
2700	2"	500-30K	±0.2	±0.1	5.0	Servo/Bushing
2800	3"	750-50K	±0.15	±0.07	7.0	Servo/Bushing

MULTI-TURN

Element Type/ Series No.	Dia.	Resistance Range (Ω)	# of Turns	Linearity (%) Standard	Linearity (%) Best Practical	Max. Power @ 70°C (Watts)	Mounting Style
WIREWOUND							
3200	7/8"	3-250K	3/5/10	±0.5/ 0.35/0.25	±0.1/ 0.07/0.05	1.5/2.0/2.5	Servo/Bushing
(3233)	7/8"	10-200K	10	±0.25	±0.1	2.5	Bushing
(3250/M3250)	7/8"	10-150K	3/5/10	±0.5/ 0.5/0.25	±0.3/ 0.2/0.1	1.0/1.5/2.0	Bushing
3500	1 7/16"	5-500K	3/5/10	±0.25/ 0.2/0.15	±0.5/ 0.04/0.03	3.0/4.0/5.0	Servo
3600		5-600K	3/10	±0.35/0.25	±0.1/0.05	5.0/7.0	Bushing
3700	2"	5-830K	3/10	±0.2/0.1	±0.04/0.02	5.0/7.0	Servo/Bushing
HYBRID							
4200	7/8"	500-100K	3/5/10	±0.5/ 0.35/0.25	±0.15/ 0.1/0.075	1.5/2.0/2.5	Servo/Bushing
(4250/M4250)	7/8"	500-100K	10	±0.25	±0.15	2.0	Bushing
4500	1 7/16"	500-200K	3/5/10	±0.25/ 0.2/0.15	±0.075/ 0.06/0.05	3.0/4.0/5.0	Servo
4600	1 3/4"	1K-250K	3/10	±0.35/0.25	±0.15/0.08	5.0/7.0	Bushing
4700	2"	1K-250K	3/10	±0.2/0.1	±0.06/0.03	5.0/7.0	Servo/Bushing

NOTES: 1. All Wirewound models are manufactured to meet or exceed applicable characteristics of MIL-R-12934.
2. All Conductive Plastic and Hybrid models are manufactured to meet or exceed applicable characteristics of MIL-R-39023.
3. Models in parenthesis ( ) are available through authorized Duncan Distributors.





SYSTRON DONNER DUNCAN ELECTRONICS DIVISION
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2865 Fairview Road, Costa Mesa, CA 92626
(714) 545-8261 TWX 910-595-1128

POSITION SENSING PRODUCTS

SLIDELINE® CONTROLS

FOR INSTRUMENTATION AND AUDIO/BROADCAST APPLICATIONS:

Duncan 400 Slideline® Potentiometers provide an ideal, human-factored solution for instrumentation and audio/broadcast controls, combining unusually accurate electrical characteristics with a wide variety of output options, fingertip controls, and faceplate alternatives to meet exacting customer applications requirements.

Ideally suited for medical and process control equipment, or test/measurement apparatus, the 400 is capable of providing specific packaging or electrical characteristics without the special costs you might expect. The 400 can change its face and provide excellent accuracy in single or dual element configurations for the type of control you seek. Units are available with two individual wipers generating independent outputs for establishing high/low limits in monitoring instruments. For specs, infinite resolution, virtually noise-free operation and a reputation for failure-free performance (rated for 5 million traverses without degradation), is coupled with a 600Ω to 250KΩ resistance range (±20%; ±10% available) and linearities from ±2% to ±0.1%. Stroke is 2¾" or 4¼".

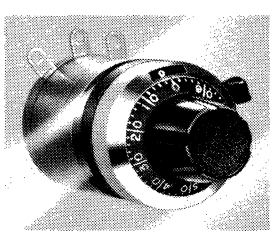
A normally open SPST or DPST "cue" switch function is available closing at the end of travel. As a result, valuable instrument panel space is saved and multiple functions provided.

TURNS-COUNTING DIALS

Duncan Turns-Counting Dials are especially designed to provide accurate, highly visible position readouts of multi-turn devices.

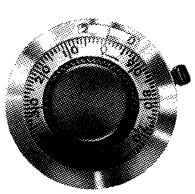
PERFECTLY DESIGNED FOR COMBINATIONS

Duncan Turns-Counting Dials are ideal for use with any Duncan Multi-turn Potentiometer, particularly the ⅞" dia., 10-turn 3250 series. Such combinations are suited for cost-effective instrumentation and system control applications.



3250 10-turn/Model 62 Dial Combination

Model 62, 15-turn



Model 82, 20-turn

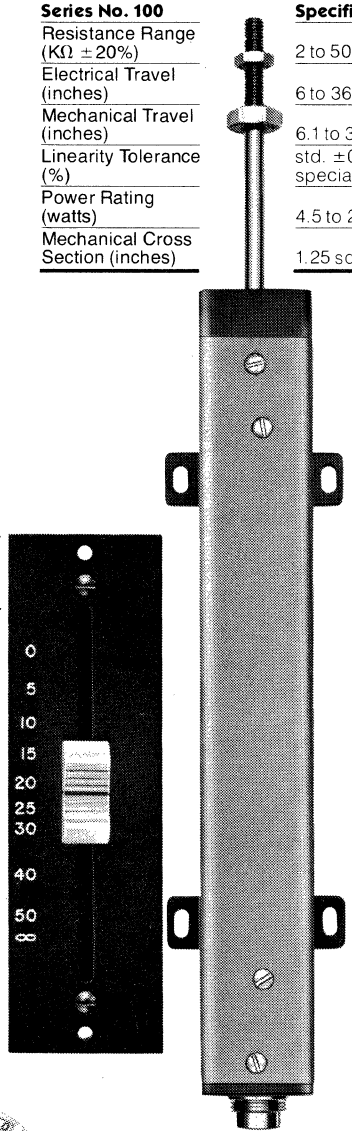
RECTILINEAR/*SERIES 100*

ACCURATE FEEDBACK AND INTERFACING CAPABILITIES IN A NEW SERIES

The new Duncan Series 100 Rectilinear Control is available in 7 different sizes.

Completely enclosed, the 100 offers an impressive array of linear motion/rectilinear capabilities and gives you a choice of 3 different interface connectors, linear and non-linear taper, and switch functions at the end of mechanical travel. They're perfect for use under unusual industrial or environmental conditions.

Series No. 100	Specifications
Resistance Range (KΩ ±20%)	2 to 500
Electrical Travel (inches)	6 to 36
Mechanical Travel (inches)	6.1 to 36.1
Linearity Tolerance (%)	std. ±0.5% special ±0.1%
Power Rating (watts)	4.5 to 27
Mechanical Cross Section (inches)	1.25 sq.



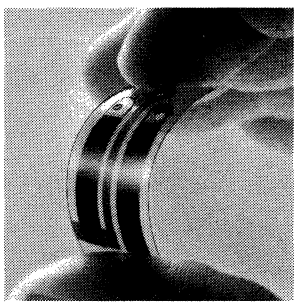
9600 Series

9800 Series

RESISTIVE ELEMENTS

A STANDARD PRODUCT APPROACH TO LOW-COST POSITION SENSING

Series 98E Elements are currently operating in hundreds of different systems. You'll find them in everything from airborne applications and instrumentation, to consumer appliances and automotive electronics.



If you want to design your own element, we'll help you. Before your first production quantity is required, you will have the satisfaction of testing and approving a design in ample time to meet your planned requirements.

TYPICAL SPECIFICATION RANGES	
Electrical Travel	up to 36" (900mm)
Resistance Range (Ω per square)	50 to 20K ±20%/±10%
Linearity	to ±0.05%
Power Rating	3 watts/square

INDUSTRIAL/AUTOMOTIVE SENSOR/ MODULES AND MINIATURE RETILINEARS

9800 Series Developed initially for demanding under hood environments, the 9800 Series now offers a complete selection of standard package/connector-interface styles. Characteristic extended life of 1 million full cycles, excellent linearity, stable materials, and integrally molded design are illustrative features of this innovative solution to demanding applications. Special configurations of this series are also available.

9600 Series Designed for a variety of miniature-sized, accurate position feedback applications, the Duncan 9600 Series Linear Position Sensor Module is ideally suited for use where reliability in a harsh operating environment is a primary consideration. Application uses include industrial, vehicular, appliance, machine tool, and robotics. The 9600 Series is available in three standard sizes and provides excellent long-life at 1,000,000 full cycles (5 million dither cycles); resistance, voltage and linearity characteristics.

SYSTRON DONNER DUNCAN ELECTRONICS DIVISION
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(714) 545-8261 TWX 910-595-1128

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K
kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L
LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microforad
MHz megahertz
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOSIGT metal-oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM nuclear instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLL phased lock loop
PPI plan position indicator
PROM programmable read only memory
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

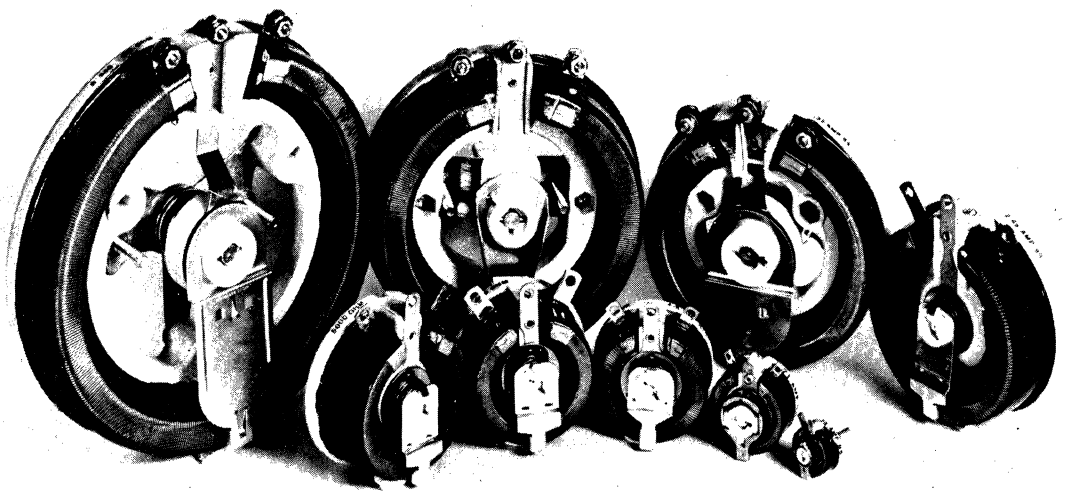
Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

E-SYSTEMS
Memcor Division

POWER RHEOSTATS

MEET THE MEMCOR FAMILY OF HIGH QUALITY WIRE-WOUND POWER RHEOSTATS



All MEMCOR Power Rheostats are vitreous enamel coated. The core and base are bonded together with vitreous enamel, thereby contributing markedly to the heat dissipation.

Standard tolerance: ±10%, ±5% available as a special.

TYPE	POWER (Watts)	RESISTANCE RANGE	DIAMETER	WEIGHT
R12½	12½ Watt	1 - 5000 Ohms	7/8"	.035 Lbs.
R25	25 Watt	1 - 5000 Ohms	1 1/16"	0.23 Lbs.
R50	50 Watt	0.5 - 10,000 Ohms	2 15/16"	0.45 Lbs.
R75	75 Watt	0.5 - 10,000 Ohms	2¾"	0.60 Lbs.
R100	100 Watt	0.5 - 10,000 Ohms	3⅛"	0.72 Lbs.
R150	150 Watt	0.5 - 10,000 Ohms	4"	1.50 Lbs.
R225	225 Watt	1 - 2500 Ohms	5"	2.18 Lbs.
R300	300 Watt	1 - 2500 Ohms	6"	3.0 Lbs.
R500	500 Watt	1 - 2500 Ohms	8"	3.75 Lbs.
R1000	1000 Watt	1 - 2000 Ohms	12"	10.0 Lbs.

Special Rheostats with Tapered Sections, Locking Devices, Off Positions, Tandem Mountings, Special Shafts on Bushing, and many other variations can be supplied.

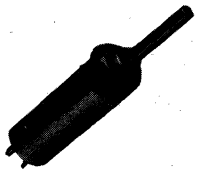
Write for FREE Catalog.

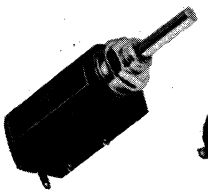
E-SYSTEMS
Memcor Division
DEPT. EM
1320 FLAXMILL ROAD
HUNTINGTON, INDIANA 46750
Telephone: (219) 356-4300
TWX: 810-333-1530

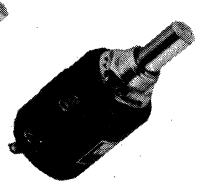
ETI SYSTEMS

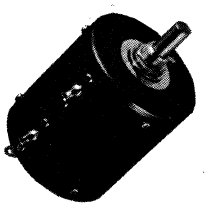
MULTI-TURN POTENTIOMETERS TURNS COUNTING DIALS

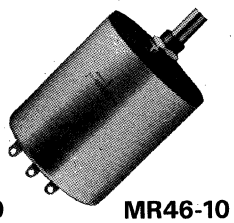
MW22-10


MW10-10


MW12-10


MW20-10


MW46-10


MR46-10

POTENTIOMETERS

Available in 3 or 5 turns on most models.

Non-Standard Options:
- —Shaft extensions.
- —Flatted shaft.
- —Increased tolerances on resistance and linearity.
- —Multi-gang, (on select pots).
- —Rear shaft extension.
- —Slipping clutch.
- —High torque.
- —Hybrid elements.

Contact factory for quotations.

Model	No. of Turns	Size Dia. x Length	Resistance Range	Resistance Tolerance	Linearity, Independent	Power Rating	Mechanical Life (Rev.)	Shaft Dia. †
MW22-10	10	.875 x .750	100Ω-100KΩ	±5%	±.25%	2 watts	500,000	¼″
MW10-10	10	.400 x 1.00	20Ω-100KΩ	±5%	<5K=±.4% >5K=±.25%	1.5 watts	200,000	⅛″
MW12-10	10	.500 x 1.00	20Ω-150KΩ	±3%	<5K=±.3% >5K=±.25%	1 watt	1,000,000	⅛″
MW20-10	10	.790 x 1.00	20Ω-200KΩ	±3%	±.25%	3 watts	2,000,000	¼″
MW46-10	10	1.812 x 2.00	5Ω-500KΩ	±3%	±.25%	5 watts	2,000,000	¼″
MW46-20	20	1.812 x 3.13	10Ω-1 Meg.	±3%	±.25%	10 watts	2,000,000	¼″
MR46-10	10	1.812 x 2.20	0.5Ω-500KΩ	±5%	±.25%	5 watts	2,000,000	¼″
MR46-20	20	1.812 x 3.74	10Ω-1 Meg.	±3%	±.25%	10 watts	2,000,000	¼″
SMR46	10	Same as MR46-10 except with limit switches at end. (Snap action)						
MO46-10	10	2.500 x 3.187	Same specs as MR46-10 except oil-filled.					

TURNS COUNTING DIALS

MG SERIES

MG22 SATIN
7/8″ Dia. Counts up to 20 turns. Over the center lock.
Black: MGA22
Gray: MGG22

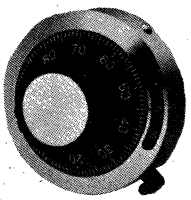
MB SERIES

MB25 SATIN
1″ Dia. Counts up to 10 turns. Over the center lock.
Black: MBA25

CA SERIES

CA20
7/8″ Dia. Counts up to 20 turns. Over the center lock.

MF SERIES

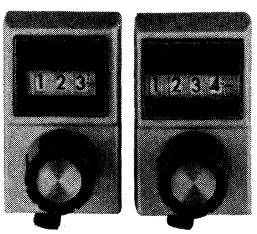


MF46 SATIN
1 13/16″ Dia. Counts up to 20 turns. Over the center lock.
Black: MFA46

MD SERIES

MD30
1 3/16″ Dia. Counts up to 10 turns.

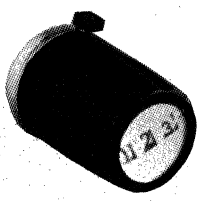
DB SERIES



DB10 1″x1.75″ DB100 1″x1.75″

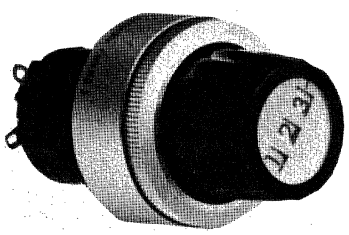
DB10=10 turns.
DB100=100 turns.
Both with over the center lock.
Available in satin or black.

DA SERIES



DA10
1″ Dia. Counts up to 10 turns.
With or without positive action brake.

COMBO® 3 POT/DIAL COMBINATION



Pre-assembled and phased to ±.25% absolute readout accuracy. Mounts in a 1.187″ dia. panel hole. Available with several potentiometers above.

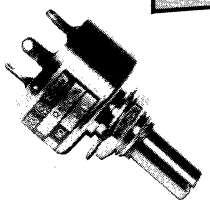
Standard shaft size for dials is 1/4″ diameter. Other shaft sizes available on all models.

SEE SECTION 3500, MOTORS & DRIVES, AND SECTION 2200, CONTROL SYSTEMS AND COMPONENTS.

ETI SYSTEMS
Dept. EM, 215 Via Del Norte, Oceanside, CA 92054
TEL: (619) 757-7770
TWX: 910-322-1396
Div: Polaris Enterprises, Inc.

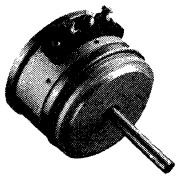
ETI SYSTEMS

SINGLE TURN POTENTIOMETERS



SW22D

SW22



SLNB45

SP30

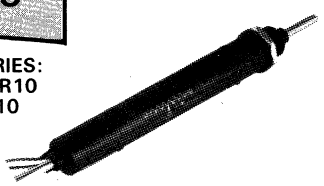
MODEL NO.	SIZE: DIA. x LENGTH	STD. Resistance Range and Tolerance	Std. Lin. (Ind)	Mechanical Rotation	Power Rating @40 C	Mech. Life Rev.	Element
SW22D	.875″ × .500″	10 – 10K ± 5%	±.5%	320° ± 5°	1 watt	1 MIL	Wirewound
SP22D	.875″ × .500″	1K – 20K ± 15%	±1.5%	320° ± 5°	1 watt	10 MIL	Conductive Plastic
SW22**	.875″ × .790″	10 – 10K ± 3%	±.5%	*Continuous	1 watt	1 MIL	Wirewound
SLNB45	1.625″ × 1.043″	100 – 50K ± 3%	±.25%	*Continuous	2 watt	2 MIL	Wirewound
SW45**	1.614″ × 1.043″	10 – 50K ± 3%	±.5%	*Continuous	2 watt	1 MIL	Wrwd & Cond Plastic
SP30**	1.08″ × .590″	1K – 10K ± 10%	±1%	*Continuous	75 watt	50 MIL	Conductive Plastic
SW80**	3.0″ × 1.043″	20 – 50K ± 3%	±.4%	*Continuous	3 watt	2 MIL	Wirewound
SP22AC	.875″ × 7.87″	1K – 10L ± 15%	±1.5%	*Continuous	5 watt	20 MIL	Conductive Plastic
SO30	1.26″ × .830″	50 – 10K ± 10%	±1%	*Continuous	1.5 watt	1 MIL	Wirewound

* Stops available. Non-standard mechanical and electrical rotation angles are available. ** Multi-gangs available.

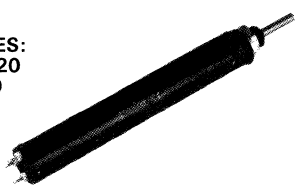
LINEAR MOTION POTENTIOMETERS

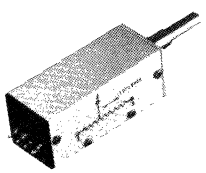
MODEL NO. *	Stroke	SIZE: Diameter x Length	Resistance Value	Mech. Stroke (Inch.)	Elect. Stroke (Inch.)	Shaft Dia. (Inch)
LWR10-	30	1/2 ″ × 3 3/8″	20 – 10K	1.260	1.181	.125
LWR10-	50	1/2″ × 4 3/16″	50 – 20K	2.047	1.986	.125
LWR10-	100	1/2″ × 6 1/8″	5 – 40K	4.015	3.937	.125
LO10-	30	1/2″ × 3 3/8″	10 – 10K	1.260	1.181	.125
LO10-	50	1/2″ × 4 3/16″	50 – 20K	2.047	1.968	.125
LO10-	100	1/2″ × 6 1/8″	50 – 40K	4.015	3.937	.125
LWR20-	50	.790″ × 5 5/16″	50 – 20K	2.087	1.968	3/16
LWR20-	100	.790″ × 7 1/4″	50 – 40K	4.055	3.937	3/16
LWR20-	200	.790″ × 11 1/4″	100 – 80K	7.992	7.874	3/16
LO20-	50	.790″ × 5 5/16″	50 – 20K	2.087	1.968	3/16
LO20-	100	.790″ × 7 1/4″	50 – 40K	4.055	3.937	3/16
LO20-	200	.790″ × 11 1/4″	100 – 80K	7.992	7.874	3/16
LW20-	15	.790 sq. × 2″	8 – 5K	.590	.590	3/16
LW20-	30	.790 sq. × 2 5/8″	15 – 10K	1.180	1.180	3/16
LW20-	50	.790 sq. × 3 3/8″	25 – 15K	1.968	1.968	3/16
LW20-	100	.790 sq. × 5 5/16″	50 – 30K	3.937	3.937	3/16
LCP20-	15	.790 sq. × 2″	500 – 10K	.590	.590	3/16
LCP20-	30	.790 sq. × 2 5/8″	500 – 10K	1.180	1.180	3/16
LCP20-	50	.790 sq. × 3 3/8″	1K – 10K	1.968	1.968	3/16
LCP20-	100	.790 sq. × 5 5/16″	2K – 20K	3.937	3.937	3/16
LH20-	50	.790 sq. × 3 3/8″	500 – 10K	1.968	1.968	3/16
LH20-	100	.790 × 5 5/16″	1K – 10K	3.937	3.937	3/16
LW30-	50	1 1/4″ sq. × 4 3/4″	25 – 20K	1.968	1.968	3/16
LW30-	100	1 1/4″ sq. × 6 3/4″	50 – 40K	3.937	3.937	3/16
LW50-	300	2″ sq. × 15 3/4″	200 – 50K	11.812	11.812	.250
LW50-	500	2″ sq. × 23 5/8″	500 – 150K	19.687	19.687	.250
LW50-	1000	2″ sq. × 47 1/4″	500 – 300K	39.375	39.375	.250
LCP8-	10	.287 sq. × 1.26″	1K – 5K	.472	.433	.078

SERIES: LWR10 LO10

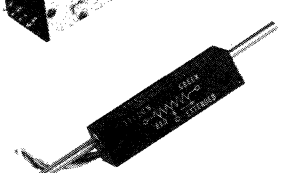


SERIES: LWR20 LO20





SERIES: LW20, LCP20, LH20

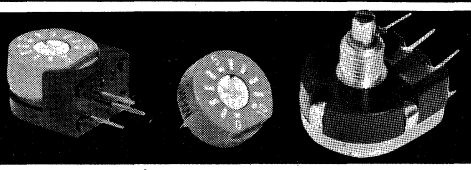


SERIES: LCP8-10 "Mini-Lini"

* LW = Wirewound, LCP = Conductive Plastic, LO = Oil Filed, (wirewound), LH = Hybrid. When ordering include stroke with model number. Example: LWR10 would be ordered as LWR10-30, or LWR10-50, or LWR10-100.

ETI SYSTEMS
DEPT. EM, 215 VIA DEL NORTE • OCEANSIDE, CA 92054
TEL: (619) 757-7770 • TWX: 910-322-1396
DIV: POLARIS ENTERPRISES, INC.

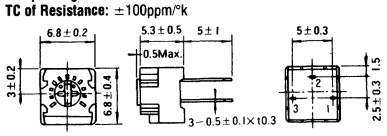
CERMET TRIMMERS



SINGLE TURN CERMET TRIMMERS

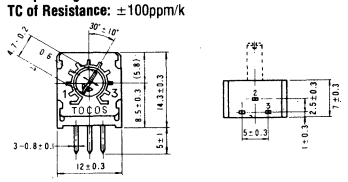
GF06 Series GF06P/W, GF06X/S, GF06UT/VT

Power Rating: 0.5W ± 70°C
Mechanical Travel: 250° ± 10°
Operating Torque: 200gm cm max
Temp. Range °C: −55°C To +125°C
TC of Resistance: ±100ppm/°k



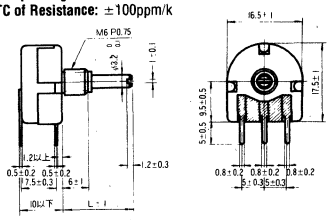
GF12 Series GF12P, GF12X,

Power Rating: 0.75W @ 70°C
Mechanical Travel: 300° ± 10°
Operating Torque: 350gm cm max
Temp. Range °C: −55°C — +125°C
TC of Resistance: ±100ppm/k



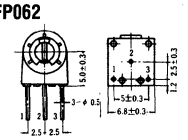
GF16 Series GF16, GFP16

Power Rating: 0.5W @ 70°C
Mechanical Travel: 260° ± 10°
Operating Torque: 20 — 200gm cm
Temp. Range °C: −55°C — +120°C
TC of Resistance: ±100ppm/k



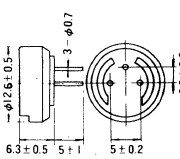
GFP06 Series GFP061, GFP062

Power Rating: 0.5W @ 70°C
Mechanical Travel: 250° ± 10
Operating Torque: 200gm cm max
Temp. Range °C: −55°C — +125°C
TC of Resistance: ±100ppm/k



G12 Series G12P, G12X/S

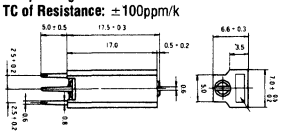
Power Rating: 0.75W @ 70°C
Mechanical Travel: 300° ± 10°
Operating Torque: 350gm cm max
Temp. Range °C: −55°C — +125°C
TC of Resistance: ±100ppm/k



MULTI TURN CERMET TRIMMERS

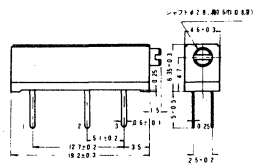
RJC07R Series Multi Turn

Power Rating: 0.75W @ 40°C
Mechanical Travel: 15 ± 3 turns
Operating Torque: 300gm cm max
Temp. Range °C: −55°C — +125°C
TC of Resistance: ±100ppm/k



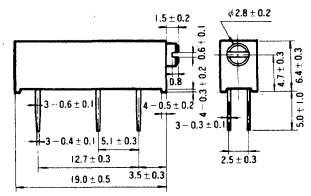
RJC094 Series
Multi Turn, Thin Film, Cermet, RJC094P/X

Power Rating: 0.75W @ 40°C
Mechanical Travel: 15 ± 3 turns
Operating Torque: 300gm cm max
Temp. Range °C: −55°C — +125°C
TC of Resistance: ±100ppm/k



RJC097 Series
Multi Turn, RJC097P/PK/PK2

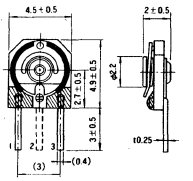
Power Rating: 0.7W @ 70°C
Mechanical Travel: 15 ± 3 turns
Operating Torque: 300gm cm max
Temp. Range °C: −55°C — +125°C
TC of Resistance: ±100ppm/k



OPEN FRAME TRIMMERS

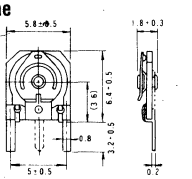
RGP04 Series
Open Frame, RGP043/46, RGP044/47

Power Rating: 0.1W @ 70°C
Mechanical Travel: 250°
Operating Torque: 200gm cm max
Temp. Range °C: −40°C — +100°C
TC of Resistance: ±250ppm/k



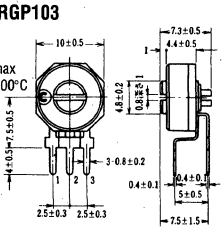
RGP05 Series Open Frame

Power Rating: 0.2W @ 70°C
Mechanical Travel: 300°
Operating Torque: 200gm cm max
Temp. Range °C: −40°C — +100°C
TC of Resistance: ±250ppm/k



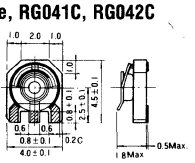
RGP10 Series
Open Frame, RGP102, RGP103

Power Rating: 0.5W @ 70°C
Mechanical Travel: 220° ± 10°
Operating Torque: 300gm cm max
Temp. Range °C: −40°C — +100°C
TC of Resistance: ±250ppm/k



RG04 Series Open Frame, RG041C, RG042C
Surface Mount

Power Rating: 0.1W @ 70°C
Mechanical Travel: 250°
Operating Torque: 200gm cm max
Temp. Range °C: −40°C — +100°C
TC of Resistance: ±250ppm/k

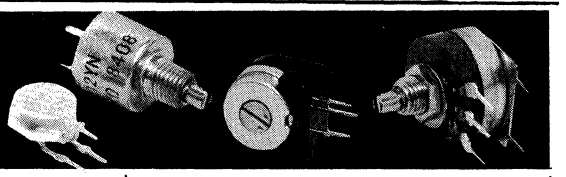


Type		Part No.	Resistance Range / Short Length mm.	Ω						KΩ								MΩ	
				10	20	50	100	200	500	1	2	5	10	20	50	100	200	500	1	2
Cermet Trim Pots	P.C.B.	GF06P, W, X, S	N/A																	
	P.C.B.	GFP061/062	N/A																	
	P.C.B.	RJC094P, X	N/A																	
	P.C.B.	RGP102	N/A																	
	P.C.B.	GF12P, X, S	5S, 10S																	
	P.M./P.C.B.	GF16/P16	10S																	
	P.C.B.	G12P, S, X	N/A																	
	P.C.B.	RJC07	N/A																	
	P.C.B.	RJC097	N/A																	
	P.C.B.	RGP043, 4, 6, 7	N/A																	
	P.C.B.	RGP050, 3, 4, 5	N/A																	
	S.M.D.	RG041C, 2C	N/A																	

Manufactured by:
Tokyo Cosmos Electric Co., LTD.

Sold in the US by: **Tocos America, Inc.**
A Subsidiary of Tokyo Cosmos Electric Co., Ltd.
565 West Golf Rd., Arlington Heights, ILL. 60005
Phone: (312) 310-8641 Telex: 11910 997-0078
Fax: (312) 490-0140 Answerback QUANTUM CI

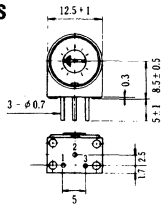
VARIABLE RESISTORS



WIRE WOUND VARIABLE RESISTORS

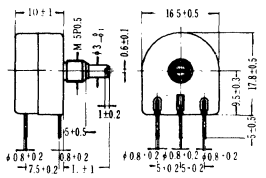
RA12 Series
Wire Wound, RA12P, RA12X/S

Power Rating: 0.5W ± 70°C
Mechanical Travel: 300° ± 10°
Operating Torque: 300gm cm max
Temp. Range °C: −55°C — −125°C
TC of Resistance: ±50ppm/k



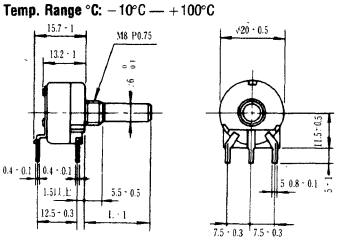
RA16 Series Wire Wound, RA16Y, RA16P

Power Rating: 0.5W
Mechanical Travel: 290° ± 5°
Temp. Range °C: −10°C — +100°C



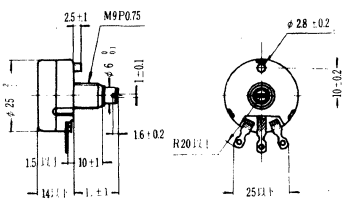
RA20 Series Wire Wound, RA20Y, RA20YP

Power Rating: 1.0, 0.5W
Mechanical Travel: 290° ± 5°
Temp. Range °C: −10°C — +100°C



RA25 Series Wire Wound, RA25Y

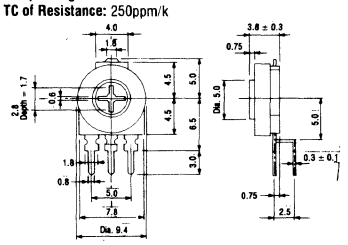
Power Rating: 1.2, 0.6W
Mechanical Travel: 290° ± 50
Temp. Range °C: −10°C — +100°C



CARBON VARIABLE RESISTORS

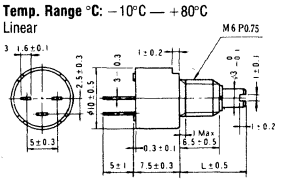
FF08 Series Carbon, FF083VZ

Power Rating: 0.2W @ 50°C
Mechanical Travel: 280° ± 10°
Operating Torque: 30 — 350GM cm max
Temp. Range °C: −30°C — +70°C
TC of Resistance: 250ppm/k



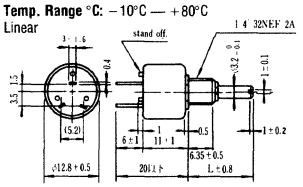
RV-102YN Series Carbon

Power Rating: 0.25W
Mechanical Travel: 300° ± 10°
Temp. Range °C: −10°C — +80°C
Linear



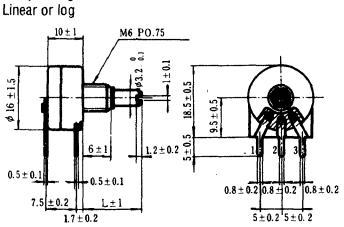
RV12YN Series Carbon

Power Rating: 0.5W
Mechanical Travel: 300° ± 10°
Temp. Range °C: −10°C — +80°C
Linear



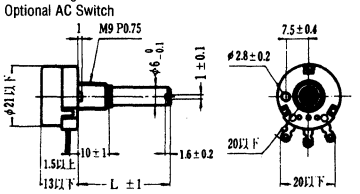
RV16YP Series Carbon

Power Rating: 0.125W
Temp. Range °C: −10°C — +80°C
Linear or log



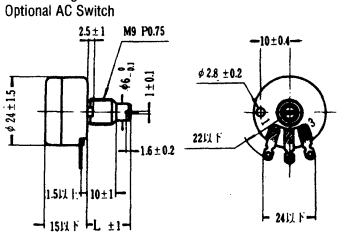
RV20N Series Carbon

Power Rating: 0.25W
Mechanical Travel: 290° ± 5°
Temp. Range °C: −10°C — +80°C
Linear or log
Optional AC Switch



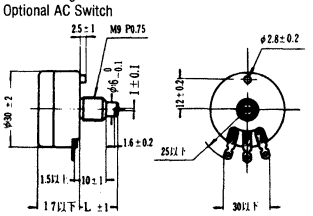
RV24YN Series Carbon

Power Rating: 0.4W
Mechanical Travel: 300° ± 5°
Temp. Range °C: −10°C — +80°C
Linear or log
Optional AC Switch



RV30YN Series Carbon

Power Rating: 1.0W
Mechanical Travel: 300° ± 5°
Temp. Range °C: −10°C — +80°C
Linear or log
Optional AC Switch



Type		Part No.	Resistance Range / Short Length mm.	Ω						KΩ									MΩ		
				10	20	50	100	200	500	1	2	5	10	20	50	100	200	500	1	2	
Carbon Variable Resistor	Panel Mt.	RV10YN	10S																		
	P.C.B.	RV16YP	10S																		
	Panel Mt. (SW.)	RV20YN	10S, 15S, 20S																		
	Panel Mt. (SW.)	RV24YN (ME)	15S, 20S																		
	Panel Mt.	RV30YN (ME)	15S, 20S																		
	P.C.B.	SMR16PA	N/A																		
	P.C.B.	FP08	N/A																		
	Panel Mt.	RV12YN	10S, 15S																		
Wire Wound Variable Resistors	P.M./P.C.B.	RA16Y, YP	10S																		
	P.M./P.C.B.	RA20Y, YP	10S, 15S																		
	Panel Mt.	RA25Y	15S, 20S																		
	P.C.B.	RA12P, X, S	N/A																		

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IEI-ISKRA

• Ceramic Caps, Discs, Feed Thru • Ferrites • Meters • Motors, fractional H.P. • Semiconductors • Switches • Speakers • Trimmer Pots

MINIATURE PRE-SET POTENTIOMETERS

For the requirements of modern electronic equipment ISKRA has designed a new series of trimmer potentiometers PNZ 10, which feature a number of improvements.

Some of them are:

△ Miniature rectangular design
△ Horizontal and vertical mounting
△ Three types of resistive layers:
carbon layer on phenolic
carbon layer on ceramic
cermet layer on ceramic
△ With hex slot suitable for automatic adjustment
△ Dual wiper design reduces contact resistance and electrical noise
△ Enclosed body protects against dust and short circuits
△ Non-inflammable plastic according to UL-94 — V0
Technical and electrical data and dimensions are given below

MINIATURE PRE-SET CARBON ON PERTINAX POTENTIOMETERS

PNZ 10, 10A, 11

Technical Data

Rated dissipation at 40°C	0.2 W
Resistance value range	100 Ω to 5 MΩ
Tolerance	±20%, ≤ 1 MΩ ±30%, > 1 MΩ
Resistance law	linear
Maximum voltage	200 Vdc
Temperature coefficient	±1000 × 10⁻⁶/K, ≤ 100 kΩ ±2000 × 10⁻⁶/K, > 100 kΩ
On special request only	± 500 × 10⁻⁶/K, ≤ 100 kΩ ±1000 × 10⁻⁶/K, > 100 kΩ
Climatic category	25/70/21
Climatic stability	IEC 190, DIN 41 450, group HSF

Mechanical Data

Angle of rotation	295° ±5° 360° continuous
Self-extinguishing plastic material according to UL-94	V0
Operating torque	4 to 20 mNm
End stop torque	≥ 50 mNm
Weight	0.8 g

MINIATURE PRE-SET CARBON ON CERAMIC POTENTIOMETERS

PNKZ 10, 10A, 11

Technical Data

Rated dissipation at 55°C	0.5 W
Resistance value range	100 Ω to 2.5 MΩ
Tolerance	+50%, −30%, < 100 Ω ±20%, 100 Ω to 1 MΩ ±30%, > 1 MΩ
Resistance law	linear
Maximum voltage	250 Vdc
Temperature coefficient	±500 × 10⁻⁶/K
On special request only	±100 × 10⁻⁶/K
Climatic category	40/90/56
Climatic stability	IEC 190, DIN 41 450, group GND

Mechanical Data

Angle of rotation	295° ±5° 360° continuous
Self-extinguishing plastic material according to UL-94	V0
Operating torque	4 to 20 mNm
End stop torque	≥ 50 mNm
Weight	1 g

MINIATURE PRE-SET CERMET POTENTIOMETERS

PNCZ 10, 10A, 11

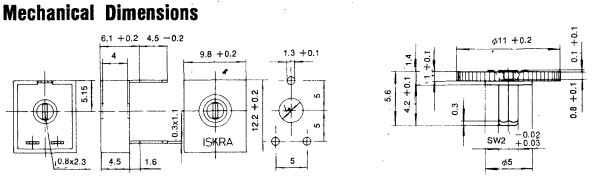
Technical Data

Rated dissipation at 85°C	0.5 W
Resistance value range	25 Ω to 5 MΩ
Tolerance	+50% −30%, < 100 Ω ±20%, 100 Ω to 1 MΩ ±30%, > 1 MΩ
Resistance law	linear
Maximum voltage	250 Vdc
Temperature coefficient	±200 × 10⁻⁶/K
On special request only	±100 × 10⁻⁶/K
Climatic category	55/125/56
Climatic stability	IEC 190, DIN 41 450, group GND

Mechanical Data

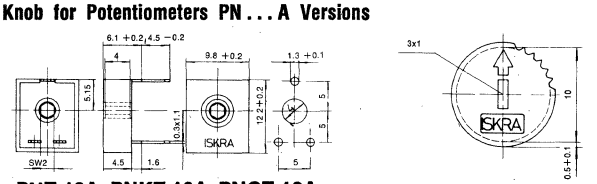
Angle of rotation	295° ±5° 360° continuous
Self-extinguishing plastic material according to UL-94	V0
Operating torque	4 to 20 mNm
End stop torque	≥ 50 mNm
Weight	1 g

Mechanical Dimensions

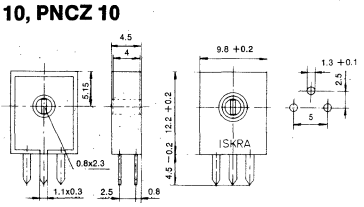


PNZ 10, PNKZ 10, PNCZ 10

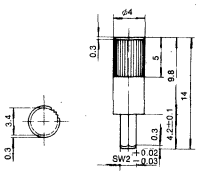
Knob for Potentiometers PN . . . A Versions



PNZ 10A, PNKZ 10A, PNCZ 10A



PNZ 11, PNKZ 11, PNCZ 11



Spindle for Potentiometers PN . . . A Versions

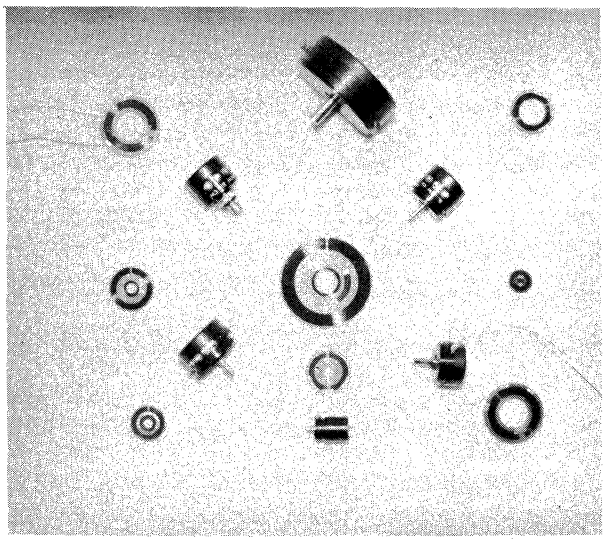
Color of protecting housing
PNZ type — black
PNKZ type — green
PNCZ type — red

ISKRA ELECTRONICS INC.
222 SHERWOOD AVE., FARMINGDALE, NY 11735 • (516) 753-0400

JDK Controls, Inc.

PRECISION CO-MOLDED CONDUCTIVE PLASTIC POTENTIOMETERS & ASSEMBLIES

JDK Controls manufactures one type of potentiometer element — co-molded conductive plastic — because to a serious user, there are very few reasons to use any other type of resistive element technology. In the JDK process, the termination and resist materials are molded under temperature to a plastic substrate. The result is a very hard, smooth surface which promotes ultra-long life and excellent electrical characteristics. This process is superior in reliability to other conductive plastic processes such as film and screening, as well as other element types including cermet, hybrid, and wirewound.



JDK FEATURES

- ULTRA-LONG ROTATIONAL LIFE
  50 Million Cycles — Minimum
- EXCELLENT OUTPUT SMOOTHNESS
  Always under .1%
- LINEAR AND NON-LINEAR
  Functions Available
- OUTSTANDING VALUE
  $\frac{\text{Unit Price}}{\text{Performance}}$
- 18 MONTH WARRANTY
  For most applications —
  because JDK believes in what it manufactures

QUALITY ASSURANCE

All JDK precision co-molded conductive plastic potentiometers are designed and manufactured to meet or exceed the requirements of:

MIL-R-39023A

Our Quality Assurance System meets the requirements of:

MIL-Q-9858A
MIL-I-45208A

MARKETS

JDK precision co-molded conductive plastic potentiometers are used in a variety of commercial, industrial, and military applications.

STANDARD ROTARY SINGLE-TURN SIZES

Model No.	Dia. Inches	Res. Range	Standard* Elect. Travel	Standard* Ind. Lin.	Mounting Styles
6005	.500	1K-50K	325°	1.0%	Servo/Bushing
6008	.750	1K-50K	340°	.5%	Servo/Bushing
6009	.875	1K-50K	340°	.5%	Servo/Bushing
6011	1.062	1K-50K	340°	.5%	Servo/Bushing
6015	1.437	1K-50K	340°	.5%	Servo/Bushing
6018	1.750	1K-50K	350°	.5%	Servo/Bushing
6020	2.000	1K-50K	350°	.5%	Servo/Bushing

* Specials Available

CUSTOM REQUIREMENTS AND ASSEMBLIES

JDK specializes in custom requirements for potentiometers in the sizes listed above as well as the following:

- ELEMENTS
  .578" to 3.0" outside diameter
  Rotor/Wiper assemblies available
- DC MOTOR POTENTIOMETER ASSEMBLIES
  16 or 22 mm
  Gearheads also available
- NEXT ASSEMBLIES
  JDK will add to its potentiometers —
  brackets, connectors, switches,
  wire harnesses, etc.

For a complete product catalog, call or write:

JDK Controls, Inc.
2630 Lavery Court, Suite F, Newbury Park, California 91320-1593 Telephone 805/499-7779

EMHART

ELECTRICAL/ELECTRONIC GROUP

MALLORY COMPONENTS DIVISION
INDIANAPOLIS, INDIANA
(317) 261-1361

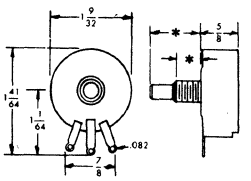
MALLORY

SPECIFICATION TABLE

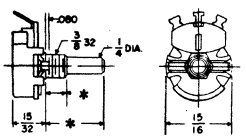
Watts	Style	Diameter	Depth	Standard Bushing	Standard Shaft Diameter	DEGREES OF ROTATION: Mechanical	Electrical W/Switch	Electrical W/O Switch	RESISTANCE ± 10%: Min. OHMS	Max. OHMS	LOCATING LUG RADIUS (3 and/or 9 o'clock): Radius
3	R	1 9/32	5/8	3/8-32	1/4	297	260	290	1	50K	17/32
4	M	1 5/8	9/16	3/8-32	1/4	294	245	275	1/2	100K	17/32
5	SC	3/4	7/16	1/4-32	1/8	305	—	275	1	25K	15/64
5	VW	3/4	7/16	3/8-32	1/4	305	—	275	1	25K	17/32
5	LW	15/16	15/32	3/8-32	1/4	300	—	280	3	25K	7/16
10	SCG	3/4	7/16	1/4-32	1/8	305	—	275	1	25K	15/64
10	VWG	3/4	7/16	3/8-32	1/4	305	—	275	1	25K	17/32
12 1/2	MG	1 5/8	9/16	3/8-32	1/4	294	245	275	1/2	100K	17/32

Standard Breakdown Voltage test 900 V RMS

The above data is only a guide. This listing of controls does not cover all possible configurations tooled. Please consult Mallory Components Engineering for further details and availability of deviations.



STYLE R AND QR



STYLE LW

*AS REQUIRED

OTHER WIREWOUND POTENTIOMETER FEATURES AVAILABLE ON SELECTED PRODUCT TYPES:
- nonlinear resistance tapers,
- ±5% resistance tolerance,
- multisection units,
- twist-tab mounting.

MALLORY MANUFACTURES A COMPLETE LINE OF "T", "L", and "LL" PAD ATTENUATORS.

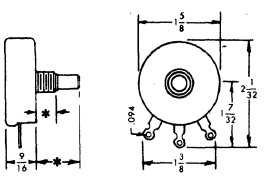
In addition to the many types of wire-wound controls carried as stock items, Mallory can supply custom made units tailored to your exact requirements. Specifying Mallory for your custom made control will assure exacting quality for either your prototype or production use.

POTENTIOMETER LINE SWITCHES AVAILABLE

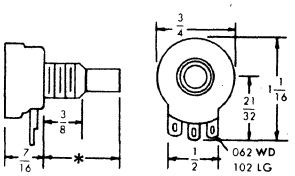
GRADE NAME	ACTION	TYPE	SIZE	RATING	AVAILABLE ON CONTROL	APPROVAL
OAC-1	Rotary	SPST	15/16"	6 A 125VAC 3 A 125VDC	M, R	UL & CSA
OAC-2	Rotary	DPST	15/16"	6 A 125VAC 6 A 125VDC (3 amps/circuit)	M, R	UL & CSA
OAC-3	Rotary	2XSPST	15/16"	3 amps 125AVC	M, R	UL & CSA
OAC-SPC	Rotary	SPST	15/16"	15A 10VDC	M, R	N.R.
OAC-4	Rotary	SPST	15/16"	5 amps 125VAC	M, R	UL & CSA
OAC-8 Auto-SPL	Rotary	SPST	15/16"	20 amps 15VDC	M, R	Automotive
OAC-5	Rotary	SPST	15/16"	5 amps 125VAC	M, R	UL & CSA
OAC-8	Rotary	SPST	15/16"	5 amps 125VAC	M, R	CSA
OAC-8 AUTO	Rotary	SPST	15/16"	15 amps 10V	M, R	UL & CSA
OAC-6	Rotary	SPST	15/16"	5 amps 125VAC		UL & CSA
OAC-8 AUTO	Rotary	SPST	15/16"	15 amps 20VDC 7.5 amps 10VDC	M, R	
OAC-9	Rotary	SPDT	15/16"	5 amps 125VAC	M, R	CSA
OPP-3	Push-Pull	SPST	15/16"	5 amps 125VAC 1 amp 125VDC	LW	UL & CSA
OPP-5	Push-Return	Momentary SPST	15/16"	1 amp 125VAC	LW	UL
PPS1	Push-Pull Side Mount	DPST (OAC-2) SPDT (OAC-3)				
PPS2	Push-Push Side Mount	DPST (OAC-2) SPDT (OAC-3)				
Dual Switches any pr. of OAC		Side Mounted Rotary switches may be used.				
MOAC-1	Rotary	SPST	1/2"	3 amps 125VAC	NO	UL
MOAC-3	Rotary	SPDT	1/2"	2 amps 125VAC	NO	UL

Most of the above switches are available separately for mounting on the customer's control, either by welding or tab mounting.

WIREWOUND POTENTIOMETERS



STYLE M, QM, MG, QMG



STYLE VW, QVW, VWG, QVWG

STYLE SC, QSC, SCG, QSCG
As Above But Smaller Shaft & Bushing Diameter

Indianapolis, Indiana;
Phone: (317) 261-1361

222 Dixon Road, Weston,
Ontario M9P 2M2, Canada;
Phone: (416) 244-4239
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1079 Parkinson Road, Woodstock,
Ontario N4S 7W8, Canada;
Phone: (519) 539-4891
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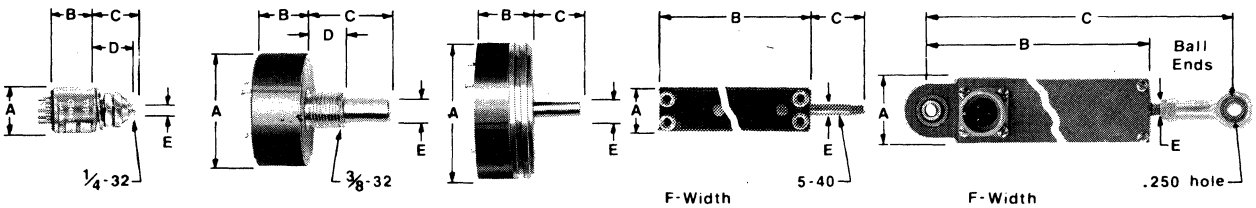
MAUREY INSTRUMENT CORP. Potentiometers

Rotary and Linear Motion Transducers

WIREWOUND These precision potentiometers were developed for military use over a period of 27 years. They are widely used in instrumentation and automation where precise electrical and mechanical requirements are specified. Low resistance tolerance and TCR; close electrical angle tolerance. Custom designs are available.

CONDUCTIVE PLASTIC Our raised molded track will withstand 200,000,000 cycles of high dynamic velocities (10″ per second). The infinite resolution and low noise make these units particularly suitable for servo feedback applications. 100 g shock, 100—20,000 Hz at 50 g. Impervious to most gases and oils.



	TRIMMER		BUSHING						SERVO**	LINEAR MOTION (LMA)			LINEAR MOTION (LMB)		
	Part No.	Type	A	B	C	D	E	F	OHMS Range	OHMS ± %	Lin. ± %	Elect. Travel	Mech. Travel	Watts @ 40°C	Torque OZ-IN
Wirewound	50-M123	TRIMMER	.50	.50	.50	.44	.125	—	50Ω-50K	5	3.0	325°	325°	2	1-8
	50-M125	BUSH'G	.50	.50	.62	.25	.125	—	50Ω-25K	5	1.0-0.5	325°	325°	2	0.5
	87-M44	SERVO**	.87	.68	.50	—	.125	—	100Ω-25K	5	1.0-0.2	353°	360°	2	0.1
	131-M3	BUSH'G	1.31	.50	.87	.38	.250	—	100Ω-50K	5	1.0-0.3	320°	330°	3	0.1
	200-M167	SERVO**	2.00	.80	.75	—	.250	—	100Ω-50K	5	1.0-0.1	356°	360°	5	0.5
	200-M493	BUSH'G	2.00	1.00	.87	.38	.250	—	100Ω-100K	5	1.0-0.4	320°	360°	4	0.6
	300-M74	SERVO**	3.00	.80	.75	—	.250	—	500Ω-100K	5	0.2-0.05	358°	360°	7	0.6
	M1326-1	LMA ‡	.50	2.00	.75	—	.125	.38	50Ω-20K	5	3.0-0.3	1.00″ ‡	1.10″	1	4*
	M1326-4	LMA ‡	.50	.500	.75	—	.125	.38	250Ω-50K	5	0.3-0.1	4.00″ ‡	4.10″	4	4*
	M1326-12	LMA ‡	.50	13.00	.75	—	.125	.38	5K-100K	5	0.1-0.05	12.0″ ‡	12.10″	12	4*
	M2028-5	LMB ‡	1.25	10.50	**13.20**	—	.250	.76	1K-100K	5	0.2-0.03	5.0″ ‡	5.25″	5	4*
	M2028-10	LMB ‡	1.25	15.80	**18.50**	—	.250	.76	2K-200K	5	0.1-0.02	10.0″ ‡	10.25″	10	4*
	M2028-15	LMB ‡	1.25	21.00	**23.70**	—	.250	.76	5K-200K	5	0.1-0.01	15.0″ ‡	15.25″	15	4*
Conductive Plastic	87-P82	BUSH'G	.87	.53	.87	.38	.250	—	500Ω-50K	20	2.0	340°	360°	1	1
	87-P83	SERVO**	.87	.59	.50	—	.125	—	500Ω-50K	10	0.5	340°	360°	1	0.5
	106-P249	SERVO**	1.06	.65	.50	—	.125	—	500Ω-100K	10	0.5	340°	360°	1.5	0.5
	112-P16	BUSH'G	1.12	.53	.87	.38	.250	—	500Ω-100K	20	2.0	340°	360°	1.5	1
	112-P19	SERVO**	1.12	.65	.50	—	.125	—	500Ω-100K	10	0.5	340°	360°	1.5	0.5
	200-P445	BUSH'G	2.00	.53	.87	.38	.250	—	1K-100K	20	1.0	340°	360°	3	1
	200-P446	SERVO**	2.00	.80	.75	—	.250	—	1K-100K	10	0.5	340°	360°	3	0.5
	P1613-1	LMA ‡	.50	2.00	.75	—	.125	.38	1K-5K	20	2.0	1.0″ ‡	1.1″	0.5	4*
	P1613-4	LMA ‡	.50	5.00	.75	—	.125	.38	4K-10K	20	0.5	4.0″ ‡	4.1″	2	4*
	P1991-5	LMB ‡	1.25	10.50	**13.20**	—	.250	.76	5K-20K	20	0.5	5.0″ ‡	5.25″	2.5	4*
	P1991-10	LMB ‡	1.25	15.80	**18.50**	—	.250	.76	10K-25K	20	0.5	10.0″ ‡	10.25″	5	4*
	P1991-15	LMB ‡	1.25	21.00	**23.70**	—	.250	.76	15K-50K	20	0.5	15.0″ ‡	15.25″	7	4*

* Frictional force in ounces shown for linear motion units.
** Servo dimensions to MIL-R12934C and MIL-R39023A. Custom deviations to the above units are available.
‡ Available travel in one inch increments.

MAUREY
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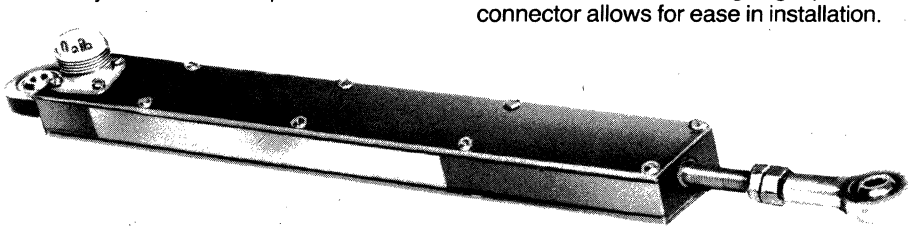
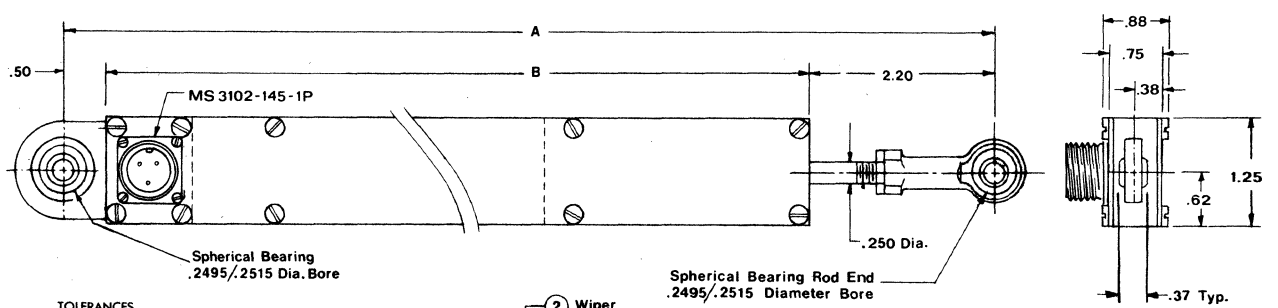
MAUREY INSTRUMENT CORP.

HEAVY DUTY LINEAR MOTION POTENTIOMETERS WIREWOUND AND CONDUCTIVE PLASTIC HDL

WIREWOUND M2028 This transducer combines the inherent accuracy and reliability of a wirewound potentiometer with the physical ruggedness required in industrial applications. They are used with hydraulic and mechanical actuators to measure and control linear motion. The self-aligning spherical ball ends and MS connector simplifies installation. High duty bearings give the ¼ inch shaft stability in the extended position.

CONDUCTIVE PLASTIC P1991 Where severe environmental conditions exist as in mills, factories and power generating plants, this linear motion transducer is practically indestructible. The unit is impervious to dust, oil and moisture. The molded, raised conductive track and graphite composition contacts provide for years of maintenance free service. As with the M2028, the self-aligning spherical ball ends and MS connector allows for ease in installation.





ELECTRICAL AND MECHANICAL CHARACTERISTICS

	M2028 WIREWOUND	P1991 CONDUCTIVE PLASTIC
Total Resistance (Ohms)	See Charts II & III	See Note 5
Total Resistance Tolerance	±5%	±20%
Theoretical Resolution	See Chart III	.001 inch
Independent Linearity	See Note 6	±0.5%
Theoretical Elect. Travel (inches)	See Chart I	See Chart I
Theoretical Elect. Travel Tolerance (inches)	±.010	±.025
Total Mechanical Travel (inches)	See Chart I	See Chart I
Temperature Coefficient	50 PPM/°C	500 PPM/°C
Operating Temperature Range	−55 to 125°C	−55° to 105°C
Power Rating (Watts at 40°C)	1 watt/inch	0.5 watt/inch
Dielectric Strength (Volts, RMS for 60 Sec)	750 volts, RMS	750 volts, RMS
Terminals	3	3
Taps	1/2 inch spacing	1/2 inch spacing
Tap Tolerance (inches)	±.010	±.030
Life Expectancy (Cycles at 60 in./min.)	500,000	50,000,000
Shaft Frictional Force	4 ounces	4 ounces
Weight (ounces)	See Chart I	See Chart I
Bearings	Nylon	Nylon

Notes:
1. Mating connector supplied.
2. Stainless steel shaft.
3. Anodized aluminum housing.
4. Terminals available on special request.
5. Ohms per inch for P1991: 500, 1K, 2K, 5K, 10K.
7. Independent linearity for M2028: (100% ÷ Total Turns x 2)
6. With modification, this type is available in strokes greater than 15 inches.

CHART I

Dash No.	Elect. Travel	Mech. Travel	A	B	Wt. Ozs.
−1	1.00	1.25	13.20	10.50	10
−2	2.00	2.25	13.20	10.50	10
−3	3.00	3.25	13.20	10.50	10
−4	4.00	4.25	13.20	10.50	10
−5	5.00	5.25	13.20	10.50	10
−6	6.00	6.25	18.50	15.80	15
−7	7.00	7.25	18.50	15.80	15
−8	8.00	8.25	18.50	15.80	15
−9	9.00	9.25	18.50	15.80	15
−10	10.00	10.25	18.50	15.80	15
−11	11.00	11.25	23.70	21.00	20
−12	12.00	12.25	23.70	21.00	20
−13	13.00	13.25	23.70	21.00	20
−14	14.00	14.25	23.70	21.00	20
−15	15.00	15.25	23.70	21.00	20

CHART II

DASH NO.	TOTAL RESISTANCE
102	1,000
202	2,000
502	5,000
103	10,000
203	20,000
503	50,000
104	100,000

CHART III

OHMS PER INCH	NUMBER OF TURNS PER INCH
500	270
1,000	370
2,000	415
2,500	450
5,000	550
10,000	660
20,000	1000

PART NUMBER DESIGNATION (EXAMPLE)
M2028-5-502
- M2028 — BASIC TYPE
- 5 — ELECTRICAL TRAVEL (5.00 INCHES)
- 502 — TOTAL RESISTANCE (5000 Ω)

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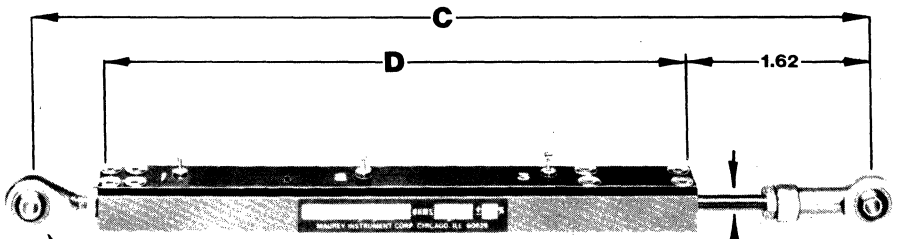
INSTRUMENT CORP.

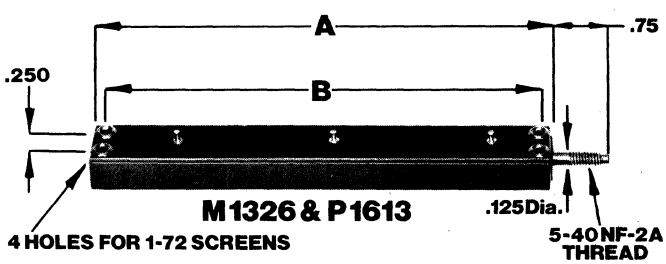
LIGHT DUTY LINEAR MOTION POTENTIOMETERS WIREWOUND AND CONDUCTIVE PLASTIC

LDL

WIREWOUND (M-Series) These miniature transducers combine the best electrical characteristics in the smallest size at the lowest cost. The units were designed for use in laboratory test equipment, light industrial applications and automation where great accuracy of electrical output is essential. The spherical ball ends add flexibility to mounting. These wirewound, linear motion potentiometers will meet the requirement in the majority of applications.

CONDUCTIVE PLASTIC (P-Series) Where long life in a hostile environment is required, these linear motion transducers with molded, raised tracks and graphite composition contacts have no equal. They are practically impervious to dust, water and oil. The high contact pressure resists the effects of severe vibration and shock. The units are being used in factories and mills where maintenance-free operation is essential.





Stroke (Inches)	M1326 / P1613		M2078 / P2080	
	A	B	C	D
1	2.00	1.800	5.12	3.00
2	3.00	2.800	6.12	4.00
3	4.00	3.800	7.12	5.00
4	5.00	4.800	8.12	6.00
5	6.00	5.800	9.12	7.00
6	7.00	6.800	10.12	8.00
7	8.00	7.800		
8	9.00	8.800		
9	10.00	9.800		
10	11.00	10.800		
11	12.00	11.800		
12	13.00	12.800		

Shaft shown in fully retracted position
Shaft is free to rotate. .
Body: ½ wide on terminal side x ⅜ deep.

ELECTRICAL AND MECHANICAL CHARACTERISTICS

	M1326 WIREWOUND	P1613 CONDUCTIVE PLASTIC	M2078 WIREWOUND	P2080 CONDUCTIVE PLASTIC
Total Resistance (Ohms)	25 Ω to 20K/inch	250 Ω to 10K/inch	25 Ω to 20K/inch	250 Ω to 10K/inch
Total Resistance Tolerance	±5%	±20%	±5%	±20%
Theoretical Resolution (inch)	.006 to .001	.001	.006 to .001	.001
Independent Linearity	±1.2% to ±0.1%	±2% to ±0.5%	±1.2% to ±0.1%	±2% to ±0.5%
Theoretical Electrical Travel (inches)	1.000 to 12.000	1.00 to 5.00	1.000 to 6.000	1.00 to 5.00
Theoretical Elect. Travel Tolerance (inches)	±.010	±.050	±.010	±.050
Total Mechanical Travel (inches)	1.10 to 12.10	1.10 to 5.10	1.10 to 6.11	1.10 to 5.10
Temperature Coefficient (PPM/°C)	50	500	50	500
Operating Temperature Range	−55°to125°C	−55°to105°C	−55°to125°C	−55°to105°C
Power Rating (Watts at 40°C)	1 watt/inch	0.5 watt/inch	1 watt/inch	0.5 watt/inch
Dielectric Strength (Volts, RMS for 60 Sec)	750	750	750	750
Terminals	3	3	3	3
Taps	4 taps/inch	4 taps/inch	4 taps/inch	4 taps/inch
Tap Tolerance (inches)	±.010	±.050	±.010	±.050
Life Expectancy (cycles at 60 in./min.)	500,000	50,000,000	500,000	50,000,000
Shaft Frictional Force (ounces, max.)	4 oz.	4 oz.	4 oz.	4 oz.
Bearings	Nylon	Nylon	Nylon	Nylon

Standard Resistance Values, Ohms / inch: 250Ω, 500Ω, 1K, 2K, 2.5K, 10K, 20K

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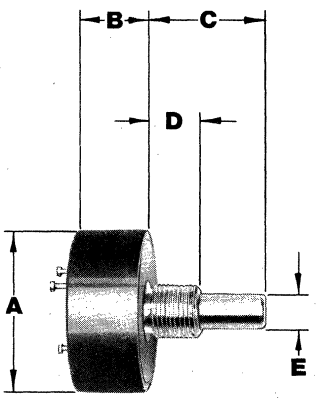
MAUREY INSTRUMENT CORP.

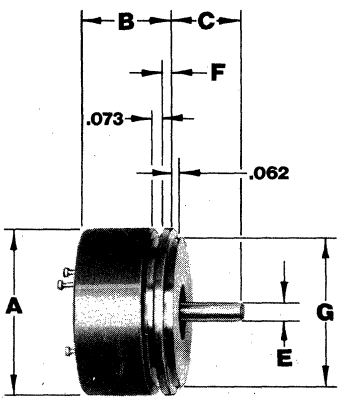
PRECISION CONDUCTIVE-PLASTIC SINGLE TURN POTENTIOMETERS

PST

These conductive plastic potentiometers have been specially designed for severe environmental conditions in mill-factory operations as well as in critical military applications. The molded, raised track maintains itself free from contamination of foreign particles, oil or water. The high gram pressure of the graphite composition contact on the raised track gives excellent resistance to contact bounce under punishing vibration or shock, as well as an exceptional rotational life. Such units are particularly suited for applications where trouble-free maintenance is required.



BUSHING



SERVO

	TYPE	A	B	C	D	E	F	G
87-P82	BUSHING	.87	.53	.87	.38	.250	—	—
87-P83	SERVO	.87	.59	.50	—	.125	.062	.750
106-P249	SERVO	1.06	.57	.50	—	.125	.062	.968
112-P16	BUSHING	1.12	.50	.87	.38	.250	—	—
112-P19	SERVO	1.12	.57	.50	—	.125	.062	1.000
143-P93	SERVO	1.43	.63	.50	—	.250	.093	1.312
200-P445	BUSHING	2.00	.50	.87	.38	.250	—	—
200-P446	SERVO	2.00	.75	.75	—	.250	.093	1.875

ELECTRICAL AND MECHANICAL CHARACTERISTICS

	87-P82 BUSHING	87-P83 SERVO	106-P249 SERVO	112-P16 BUSHING	112-P19 SERVO	143-P SERVO	200-P445 BUSHING	200-P446 SERVO
Total Resistance (Ohms)	500 Ω - 50K	500 Ω - 50K	500 Ω - 100K	500 Ω - 100K	500 Ω - 100K	1K - 100K	1K - 100K	1K - 100K
Total Resistance Tolerance	±20%	±10%	±10%	±20%	±10%	±10%	±20%	±10%
Theoretical Resolution	.001%	.001%	.001%	.001%	.001%	.001%	.001%	.001%
Independent Linearity	±2%	±0.5%	±0.5%	±2%	±0.5%	±0.5%	±2%	±0.5%
Theoretical Electrical Travel (Degrees)	340°	340°	340°	340°	340°	340°	340°	340°
Theoretical Elect. Travel Tolerance (Degrees)	±5°	±3°	±2°	±5°	±2°	±2°	±5°	±2°
Total Mechanical Travel (Degrees)	360°	360°	360°	360°	360°	360°	360°	360°
Temperature Coefficient (PPM/°C)	400	400	400	400	400	400	400	400
Operating Temperature Range (°C)	−55°to105°C	−55°to105°C	−55°to105°C	−55°to105°C	−55°to105°C	−55°to105°C	−55°to105°C	−55°to105°C
Power Rating (Watts at 40°C)	1	1	1.5	1.5	1.5	2	3	3
Dielectric Strength (Volts, RMS for 60 Sec)	1000	1000	1000	1000	1000	1000	1000	1000
Terminals, Standard	3	3	3	3	3	3	3	3
Taps, Maximum Available	4	4	6	6	6	9	9	9
Tap Tolerance	±5°	±3°	±2°	±5°	±2°	±2°	±5°	±2°
Life Expectancy (Revolutions at 500RPM)	20,000,000	100,000,000	100,000,000	20,000,000	100,000,000	100,000,000	20,000,000	100,000,000
Moment of Inertia (gm-cm^2)	0.2	0.2	0.2	0.2	0.2	1.5	1.5	1.5
Starting Torque (ounce-inches)	*0.6	0.5	0.5	*0.6	0.5	0.3	*0.6	0.3
Running Torque (ounce-inches)	*0.5	0.4	0.4	*0.5	0.4	0.2	*0.5	0.2
Weight (ounces)	0.5 oz.	0.6 oz.	0.6 oz.	0.6 oz.	0.6 oz.	1.7 oz.	2 oz.	4 oz.
*Stop Strength (pound-inches)	**2 lb.-in.	—	—	*2 lb.-in.	—	—	*3 lb.-in.	—
Bearings	Bronze	SS Ball B.	SS Ball B.	Bronze	SS Ball B.	SS Ball B.	Bronze	SS Ball B.

* Add one ounce-inch for O-ring seal

** For units with mechanical stops. Conforms to MIL - R - 39023 A

Standard Resistance Values Within Range Indicated.
500 Ω , 1K, 2K, 5K, 10K, 20K, 50K, 100K

MAUREY
INSTRUMENT CORPORATION
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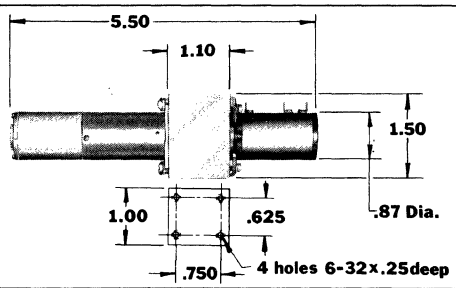
MAUREY INSTRUMENT CORP. MOTORIZED POTENTIOMETERS AND SWITCHES — MPS

General Description & Applications

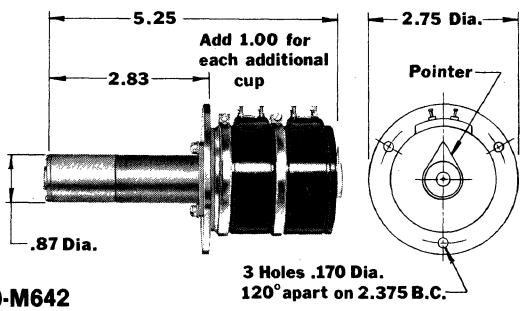
A family of single turn and multiturn, motor driven potentiometers and switches has been developed for industrial servo applications. They are used for such applications as variable speed controls on power generating sets, electrical-mechanical remote control, and readouts. They provide excellent accuracy at an economical price. These integrated motor-potentiometers are the result of years of Maurey experience in the manufacture of precision potentiometers and motor assemblies. The potentiometers, gear head, clutch, and motor are precisely matched to perform to exacting specifications. Motor-clutch-pot units are available in a wide range of specifications. A motor of selected speed and voltage may be matched with single, 3, 5, or 10 turn potentiometers, either wirewound or conductive plastic. When multiple voltages are required, single cups may be conveniently ganged with or without clutches. In addition, Maurey engineers can provide multi-tap potentiometers, special shafts and mountings, and a wide range of AC or DC motors to your specification.



87-H477

87-H477 DC Motorized Multiturn Potentiometer

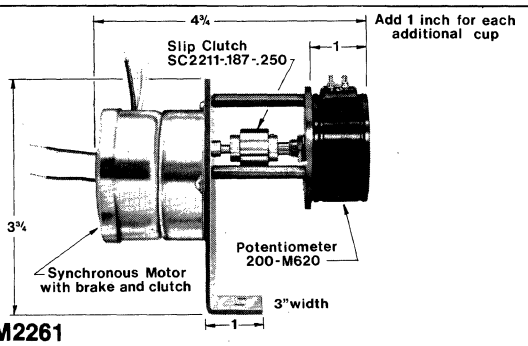
A compact, motor driven, 10 turn ⅞" diameter precision potentiometer. A slip clutch between the motor and the potentiometer protects the stops at the end of mechanical travel. The precision machined, square aluminum housing provides mounting holes for the device.
Sealed from dust and normal industrial environment.
Potentiometer independent linearity: ±0.25% or better
Power rating: 2.5 watts at 60°C
Resistances available: 500 Ω, 1K, 2K, 5K, 10K, 20K, 50K, 100K.



200-M642

200-M642 DC Motorized Single Turn Potentiometer

A versatile motor, switch, potentiometer assembly. This model may use multi-pole, single throw switch cups, and with up to six precision potentiometers of various resistance values. All components are easily assembled or changed. Proven design for factory or mill environments. A pointer indicates position of wiper or percentage of voltage. A mounting flange simplifies installation on a panel or bracket.
Potentiometers have 320°electrical angle, linearity: ±0.5%
Power: 5 watts at 85°C.
Resistances available: 100 Ω, 250 Ω, 500 Ω, 1K, 2K, 2.5K, 5K, 10K, 20K, 25K, 50K, 100K.



M2261

M2261 AC Motorized Single Turn Potentiometers

A compact AC motor driven wirewound potentiometer with mechanical stops. A slip clutch provides positive protection to the mechanical stops in the potentiometer. The slip clutch can be eliminated for continuous rotation potentiometers. Also available with single throw switches.
Potentiometer: ±0.5% independent linearity; 4 watts, standard resistances of 250, 500, 1K, 2K, 2.5K, 5K, 10K, 20K, 50K, 100K.
Motor: 115 Volts, A.C. 60 Hz; synchronous continuous duty with positive clutch and instantaneous brake; standard RPM: 1, 2, 4, 6, 10, 12, 30, 60.

Standard DC Motor Data:

Speed: (See chart)
Voltage: (See chart)
Current: (See chart)
Torque at 24 volts: 50 oz-in.
Break away voltage: 10 volts DC
Other requirements on request

Voltage VDC	ma	Speed RPM
12	49	6.0
24	50	16.0
28	51	21.2
35	53	24.5

Special Requirements

The types shown here are representative of a wide range of motor driven mechanisms manufactured by Maurey. AC or DC motors may be used. Single and multicup carbon, wirewound, or conductive plastic potentiometers may be specified, with or without slip clutches or switches. Write or phone for a solution to your requirement.

MAUREY
INSTRUMENT CORPORATION
4557 West 60th Street, Chicago, IL 60629 · PHONE (312) 581-4555 · TWX 910-221-6025

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

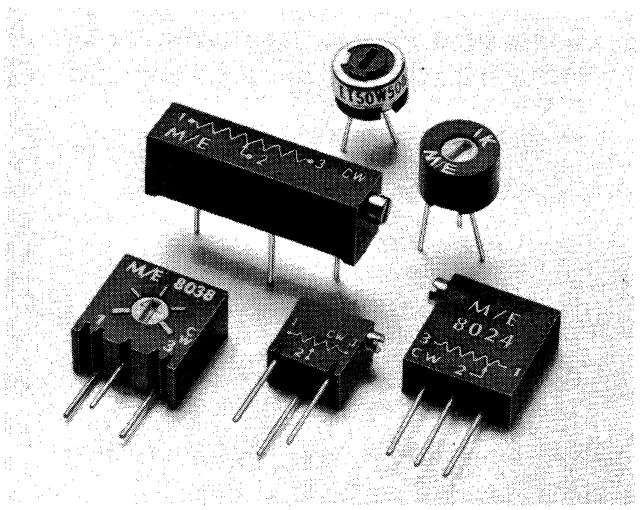
TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 85/86 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1166, **B**•1012, **C**•1028, **D**•1016
ASCII Code ..... **D**•1087
Batteries, Product Selection Guide ..... **D**•1413
Batteries & Fuel Cells, Characteristics ..... **D**•1430
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide ..... **A**•1003
Circuit Boards (Printed) Product Selection Guide ..... **C**•1099
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1205
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1863
Connectors, Miniglossary ..... **C**•1129
Connectors, Terminals, & Sockets, Product Selection Guide ..... **C**•1105
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Gude ..... **A**•1309
Delay Lines, Product Selection Guide ..... **A**•1459
Discrete Semiconductors, Product Selection Guide ..... **A**•2067
Displays, Readouts, Lamps, & Lights, Product Selection Guide ..... **B**•1015
EBCDIC Code ..... **D**•1092
Encapsulation, Miniglossary ..... **C**•1086
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide .. **C**•1623
Filters, Product Selection Guide ..... **A**•1583
Instruments, Graphic Recording Product Selection Guide ..... **D**•1401
Instruments, Panel Meters, Product Selection Guide ..... **D**•1329
Instruments, Test & Measuring Product Selection Guide ..... **D**•1175
Interconnection Systems, Product Selection Guide ..... **C**•1699
Keyboards & Keypads, Product Selection Guide ..... **B**•1705
Logofinder & Trademark Directories ..... **B**•901
Microwave Components, Product Selection Guide ..... **A**•1701
Military Qualified Products Lists ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1129
Opto Semiconductors, Miniglossary ..... **B**•1214
Oscilloscopes, Product Selection Guide ..... **D**•1385
Panel Hardware, Product Selection Guide ..... **C**•1589
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide ..... **A**•1991
Power Supplies, Miniglossary ..... **D**•1462
Power Supplies, AC, Product Selection Guide ..... **D**•1877
Power Supplies, DC, Product Selection Guide ..... **D**•1447
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide .... **B**•1225
Relay Contact Forms ..... **B**•1317
Relays, Electromechanical, Miniglossary ..... **B**•1308
Relays, Product Selection Guide ..... **B**•1261
Resistor Color Codes ..... **A**•1828
Resistors, Product Selection Guide ..... **A**•1785
Servo Components, Miniglossary ..... **D**•1985
Solenoids, Product Selection Guide ..... **B**•1463
Switches, Product Selection Guide ..... **B**•1477
Thermal Components, Product Selection Guide ..... **B**•1741
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1744
Thyristors/High Power Diodes, Miniglossary ..... **A**•2076
Transducers & Encoders, Product Selection Guide ..... **B**•1777
Transformers, Product Selection Guide ..... **A**•2099
Wire & Cable, Product Selection Guide ..... **C**•1743
Wire Gauges—Diameter, Area, Copper Weight ..... **C**•1844

Mepco//Electra
A NORTH AMERICAN PHILIPS COMPANY

Reliability across the board™



CERMET TRIMMER SPECIFICATIONS

Temperature Coefficient: ±100 ppm/°C, standard
Contact Resistance Variation (CRV): 3%
End Resistance: 1% maximum or 2Ω, whichever is greater.
Resolution: Essentially infinite.
Operating Range:
−25°C to +125°C for Models 8014, 8038.
−55°C to +125°C for Model 8035.
−65°C to +150°C for Models 8024, 8026, 8050.
Torque: 3 to 5 inch-ounces maximum, depending on model.
Sealed to allow wave solder and immersion cleaning.
Stops: Clutch at both ends for multiturn; positive at both ends for single turn models.

RESISTANCE VALUES AND CODES			
OHMS	**CODE**	**OHMS**	**CODE**
10	100	10K	103
20	200	20K	203
50	500	50K	503
100	101	100K	104
200	201	200K	204
500	501	500K	504
1K	102	1MEG	105
2K	202	2MEG	205
5K	502	5MEG	505

TRIMMERS

11468 Sorrento Valley Rd., San Diego, CA 92121 (619) 453-0332 TWX: 910-337-1120 Telex: 820534

INDUSTRIAL CERMET TRIMMERS

	8014	**8024**	**8026**	**8035**	**8038**
Description	¼" Round Single Turn	⅜" Square Multiturn	¼" Square Multiturn	¾" Rectangular Multiturn	⅜" Square Single Turn
Standard Resistances	100Ω to 1 MΩ	100Ω-1 MΩ	100Ω-1 MΩ	100Ω-1 MΩ	100Ω-1 MΩ
Resistance Tolerance (%)	±20% ±10%	±10%	±10%	±10%	±10%
Dimensions H x W x L (In.)	.250 dia. x .175 (Pin styles W, P) .320 x .250 x .225 (Pin style X)	.375 x .375 x .150	.250 x .250 x .165	.250 x .195 x .750	.375 x .375 x .200
Power Rating (Watts)	0.5 @ 25°C	1.0 @ 70°C	0.25 @ 85°C	0.75 @ 70°C	0.5 @ 85°C
Adjustment	1 Turn	25 Turns	12 Turns	15 Turns	1 Turn
Pin Styles	Side/Top Adjust	Side/Top Adjust	Side/Top Adjust	Side Adjust	Side/Top Adjust

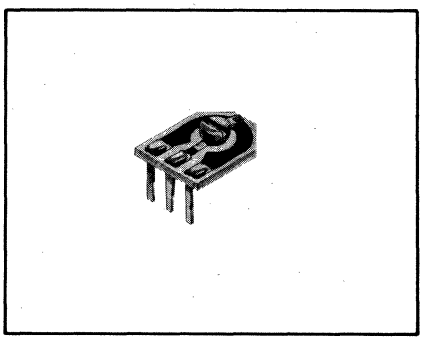
MILITARY CERMET TRIMMERS

MIL-R-22097	**RJ24**	**RJ26**	**RJ50**
Pin Styles	P, W, X	P, W, X	P
Characteristic	C, F	C, F	C, F
Std. Resistance Range	100Ω-1 MΩ	100Ω-1 MΩ	100Ω-1 MΩ
MIL-R-39035	**RJR24**	**RJR26**	
Pin Styles	P, W, X	P, W, X	
Characteristic	C, F, H	F, H	
Std. Resistance Range	100Ω-1 MΩ 20KΩ-1 MΩ for "H" Char.	100Ω-1 MΩ 20KΩ-1 MΩ for "H" Char.	

For information on Mepco/Electra's CAPACITORS/RESISTORS/MILITARY COMPONENTS, A•1124-1126, B•1008-1009 and A•1980-1891.

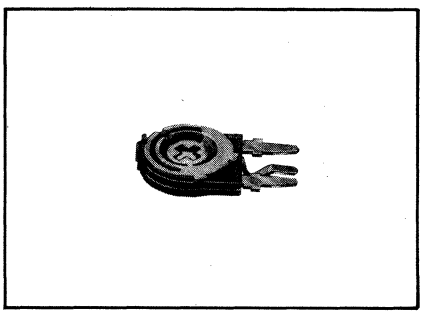
single turn, low cost trimming potentiometers

MURATA ERIE NORTH AMERICA, INC.



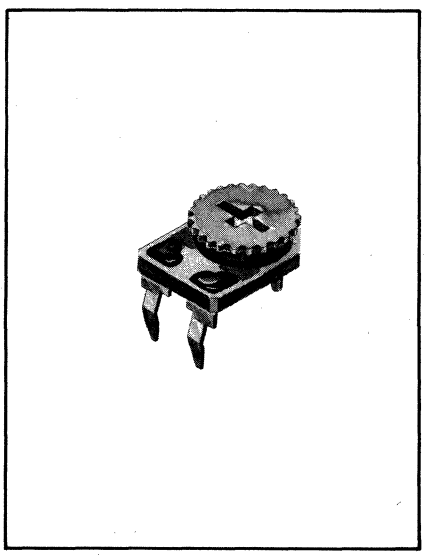
1/10 Watt, Carbon—RVA0607

Resistance Range:	200 ohms to 2 Megohms
Tolerance:	±30%
Residual Resistance:	200 to 500 ohms — 5 ohms max. Over 500 ohms — 1% max.
Taper:	Linear
Power Rating:	0.1W (at 70°C) Derated to 0 watts at 125°C
Max. Working Voltage:	50 VDC
Torque:	.27 to 2.8 oz. in. (20 to 200 g cm)
Terminal Strength:	35.27 oz. (1.0 kg) when the force is applied in the direction of the axes of the terminal
Effective Rotation:	Approx. 220°



1/10 Watt, Carbon—RVF

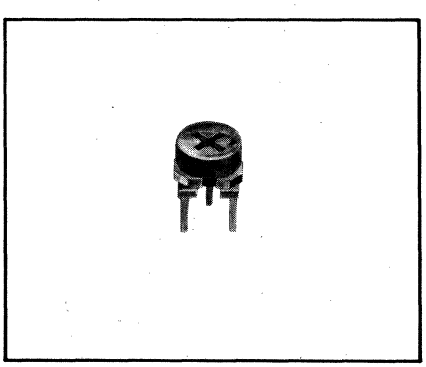
Resistance Range:	200 ohms to 1 Megohm
Tolerance:	±25%
Residual Resistance:	Less than 5% of nominal rated resistance
Taper:	Linear
Power Rating:	0.1W (at 70°C) Derated to 0 watts at 100°C
Max. Working Voltage:	150 VDC
Torque:	.42 to 4.2 oz. in. (2.9-29.4 mNm)
Terminal Strength:	35.27 oz. (98 mNm) when the force is applied in the direction of the axes of the terminal
Effective Rotation:	270° ±10°



1/5 to 3/4 Watt, Carbon, Cond. Plastic & Cermet—0911/1214

Characteristic	RVA (Carbon) RVX (Cond. Plastic)		RVG (Cermet)	
	0911	1214	0911	1214
Resistance Range:	200 — 5 Megohms*		200 — 1 Megohm	
Tolerance:	±20%			
Residual Resistance:	Less than 500Ω. 5Ω maximum 500Ω and up, less than 1% of nominal rated resistance			
Taper:	Linear			
Power Rating**:	1/5W (70°C)	1/3W (70°C)	1/2W (70°C)	3/4W (70°C)
Max. Working Voltage***:	250 VDC	350 VDC	350 VDC	500 VDC
Torque:	0.56-4.86 in. oz.	0.83-6.0 in. oz.	0.56-4.86 in. oz.	0.83-6.0 in. oz.
Terminal Strength:	35.27 oz.			
Effective Rotation: Elec.	240°	250°	240°	250°
Mech.	260° ±10°	280° ±10°	260° ±10°	280° ±10°
Stop Strength:	13.9 oz.			

* 100 ohms available in RVA ** Derated to 0 watts at 125°C
*** Max working V varies with resistance value. Vmax = √ Resistance x Power



1/3 Watt, Cermet—RVS0707

Resistance Range:	100 ohms to 1 Megohm
Tolerance:	±20%
Temperature Coefficient:	100ppm/°C
Residual Resistance:	100 to 500 ohms — 5 ohms max. Over 500 ohms — 1% max.
Taper:	Linear
Power Rating:	1/3W (at 70°C) Derated to 0 Watts at 125°C
Max. Working Voltage:	100 VDC
Torque:	.27 to 2.8 oz. in. (20 to 200 g cm)
Terminal Strength:	12.35 oz. (350 gr) when the force is applied in the direction of the axes of the terminal
Effective Rotation:	200° ±10°

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sealed precision cermet trimming potentiometers—±100 ppm/°c

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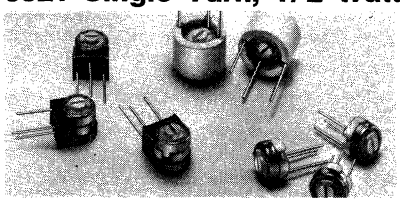
3321 Single Turn, 1/2 Watt



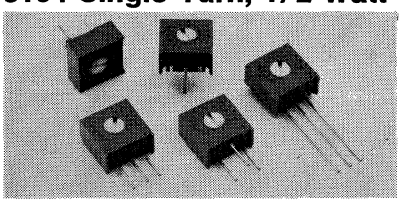
FEATURES

- Flame retardant rotor meets UL94V-0 requirements
- Extremely small size — .260″D. x .181″
- Sealed to withstand wave soldering and immersion cleaning processes

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±20%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	0.5W at 70°C. Derated to 0W at +150°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +150°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

3104 Single Turn, 1/2 Watt



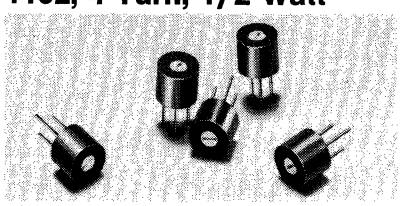
FEATURES

- Low cost
- ⅜″ square

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	2 ohms max.
Power Rating	0.5W at 70°C. Derated to 0W at +125°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	1% or 1 ohm max. whichever is greater

1102, 4-Turn, 1/2 Watt



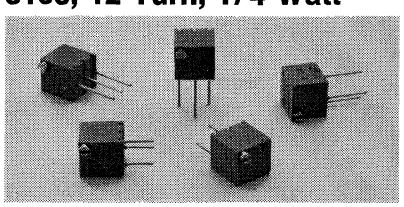
FEATURES

- Unique planetary drive provides the precise setting capability of a multi-turn unit in a small single-turn package
- Just .299″D x .260″
- Sealed to withstand wave soldering and immersion cleaning process

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	0.5W at 70°C. Derated to 0W at +125°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

3103, 12-Turn, 1/4 Watt



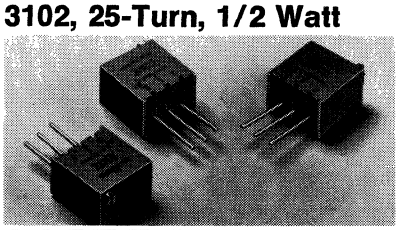
FEATURES

- ¼″ square
- Sealed to MIL-R-22097 standards

SPECIFICATIONS

Resistance Range	10 ohms to 1 Megohm
Tolerance	±10%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	0.25W at 70°C. Derated to 0W at +125°C
Working Voltage	200 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

3102, 25-Turn, 1/2 Watt



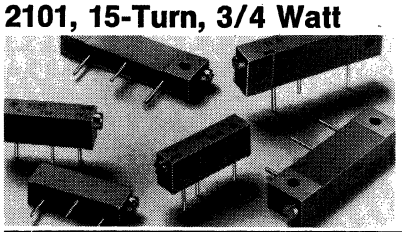
FEATURES

- Small size — .374″ x .394″ x .240″
- Sealed to MIL-R-22097 standards. Will withstand industrial cleaning processes

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	0.5W at 70°C. Derated to 0W at +125°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

2101, 15-Turn, 3/4 Watt



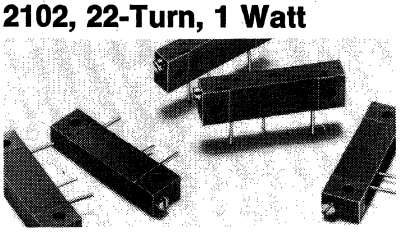
FEATURES

- Small size — .181″ x .252″ x .752″ for close board spacing
- Sealed to MIL-R-22097 standards. Will withstand industrial cleaning processes

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	3% or 1 ohm max. whichever is greater
Power Rating	0.75W at 70°C. Derated to 0W at +125°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

2102, 22-Turn, 1 Watt



FEATURES

- 22 turn mechanism provides extremely fine adjustment capability
- High power dissipation: 1.0W at 70°C
- Sealed to withstand wave soldering and immersion cleaning processes

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	1W at 70°C. Derated to 0W at +150°C
Max. Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +150°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

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MURATA ERIE NORTH AMERICA, INC. 1148 Franklin Rd., S.E., Marietta, Georgia 30067 Tel: (404) 952-9777 Telex: 54-2329 TWX: 810-766-1531

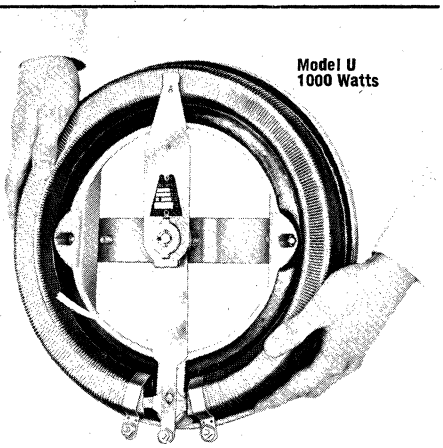
OHMITE® Vitreous Enameled Rheostats (Potentiometers)

Now, Ohmite offers TWELVE sizes in its line of famous rheostats.

In all Ohmite rheostats, the resistance wire is wound on a solid ceramic core. The turns are locked in place with tough, protective vitreous enamel or Ohmicone® silicone ceramic. Pivoted, universal action mounting of the brush, assures perfect contact. Metal-graphite contact brushes, varied to fit current and resistance, insure good contact with negligible wear of the wire. Terminals at each end of the winding permit connection of the unit as a potentiometer.

NOW, FOR IT'S RATING, INDUSTRY'S SMALLEST RHEOSTAT!

Model C
7½ Watts



Model U
1000 Watts

Dimensions and Other Parameters	Mod. C Encl.	Model E Unencl.	Model E Encl.	Model H	Model J	Model G	Model K	Model L	Model P	Model N	Model R	Model T	Model U
Rated Watts	7½	12½		25	50	75	100	150	225	300	500	750	1000
Resistance Range - Ohms	10 to 5,000	1 to 15,000		1 to 25,000	0.5 to 50,000	0.5 to 50,000	0.5 to 50,000	0.5 to 50,000	1 to 30,000	1 to 50,000	1 to 20,000	1 to 15,000	1 to 20,000
Overall Diameter	.515	⅞	1¾₆₄	1⅜₁₆	2⅝₁₆	2¾	3⅛	4	5	6	8	10	12
Overall Depth Behind Panel	⅞	1¹⁄₁₆	1⅞₂	1⅜	1⅜	1¾	1¾	2	2⅛	2⅜	2⅛	3	3
Weight - Lbs.	.017	.037	.053	0.19	0.32	0.52	0.64	1.1	2	2.6	4	7.6	10
Mtg. Centers (Dimension "M")	(Single-Hole Mounting)								⅞	1¾₁₆	1½	1⅞	3

MODEL C — 7½ WATT* — STANDARD & LOCKING SHAFT

Ohms	Amps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New	Locking Shaft Catalog No. Old	Locking Shaft Catalog No. New
10	.86	4908	RCS10R	4948	RCL10R
15	.71	4909	RCS15R	4949	RCL15R
25	.55	4910	RCS25R	4950	RCL25R
35	.46	4911	RCS35R	4951	RCL35R
50	.39	4912	RCS50R	4952	RCL50R
75	.32	4913	RCS75R	4953	RCL75R
100	.27	4914	RCS100	4954	RCL100
150	.22	4915	RCS150	4955	RCL150
200	.19	4916	RCS200	4956	RCL200
250	.17	4917	RCS250	4957	RCL250
350	.15	4918	RCS350	4958	RCL350
500	.12	4919	RCS500	4959	RCL500
750	.10	4920	RCS750	4960	RCL750
1000	.086	4921	RCS1K0	4961	RCL1K0
1500	.071	4922	RCS1K5	4962	RCL1K5
2500	.055	4923	RCS2K5	4963	RCL2K5
3500	.046	4924	RCS3K5	4964	RCL3K5
5000	.039	4925	RCS5K0	4965	RCL5K0

* Rating on metal panel — unit is silicone-ceramic coated.

MODEL "E" — 12½ WATT* — UNENCLOSED & ENCLOSED

Total Ohms	Max. Amps	Appr. Steps	Unenclosed Standard Shaft Catalog No. Old	Unenclosed Standard Shaft Catalog No. New	Unenclosed Locking Shaft Catalog No. Old	Unenclosed Locking Shaft Catalog No. New	Enclosed Standard Shaft Catalog No. Old	Enclosed Standard Shaft Catalog No. New
1	3.53	32	0101	RES1R0	L0101	REL1R0	W0101	REE1R0
2	2.50	28	0102	RES2R0	L0102	REL2R0	W0102	REE2R0
2.5	2.24	31	0102A	RES2R5	L0102A	REL2R5	W0102A	REE2R5
3	2.04	33	0103	RES3R0	L0103	REL3R0	W0103	REE3R0
5	1.58	61	0103A	RES5R0	L0103A	REL5R0	W0103A	REE5R0
6	1.44	58	0104	RES6R0	L0104	REL6R0	W0104	REE6R0
8	1.25	61	0105	RES8R0	L0105	REL8R0	W0105	REE8R0
10	1.12	76	0106	RES10R	L0106	REL10R	W0106	REE10R
15	.91	64	0107	RES15R	L0107	REL15R	W0107	REE15R
25	.71	67	0108	RES25R	L0108	REL25R	W0108	REE25R
35	.60	73	0109	RES35R	L0109	REL35R	W0109	REE35R
50	.50	83	0110	RES50R	L0110	REL50R	W0110	REE50R
75	.40	101	0111	RES75R	L0111	REL75R	W0111	REE75R
100	.35	106	0112	RES100	L0112	REL100	W0112	REE100
125	.32	132	0113	RES125	L0113	REL125	W0113	REE125
150	.29	125	0113A	RES150	L0113A	REL150	W0113A	REE150
175	.27	145	0114	RES175	L0114	REL175	W0114	REE175
200	.25	132	0114A	RES200	L0114A	REL200	W0114A	REE200
250	.22	128	0115	RES250	L0115	REL250	W0115	REE250
350	.19	149	0116	RES350	L0116	REL350	W0116	REE350
500	.16	213	0117	RES500	L0117	REL500	W0117	REE500
750	.13	193	0118	RES750	L0118	REL750	W0118	REE750
1000	.10	257	0119	RES1K0	L0119	REL1K0	W0119	REE1K0
1500	.090	255	0120	RES1K5	L0120	REL1K5	W0120	REE1K5
2500	.070	277	0121	RES2K5	L0121	REL2K5	W0121	REE2K5
3500	.060	313	0122	RES3K5	L0122	REL3K5	W0122	REE3K5
5000	.050	255	0123	RES5K0	L0123	REL5K0	W0123	REE5K0
7500	.041	299	4190	RES7K5	L4190	REL7K5	W4190	REE7K5
10,000	.035	398	4191	RES10K	L4191	REL10K	W4191	REE10K
12,500	.031	434	4192	RES12K5	L4192	REL12K5	W4192	REE12K5
15,000	.029	521	4193	RES15K	L4193	REL15K	W4193	REE15K

* Rating on metal panel — unit is silicone-ceramic coated.

25 WATT MODEL "H" — UL Listed

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New	Locking Shaft Catalog No. Old	Locking Shaft Catalog No. New
1	5.0	30	0140	RHS1R0	L0140	RHL1R0
2	3.54	30	0141	RHS2R0	L0141	RHL2R0
3	2.88	31	0142	RHS3R0	L0142	RHL3R0
6	2.04	50	0143	RHS6R0	L0143	RHL6R0
8	1.77	53	0144	RHS8R0	L0144	RHL8R0
10	1.58	52	0145	RHS10R	L0145	RHL10R
15	1.29	67	0146	RHS15R	L0146	RHL15R
25	1.0	89	0147	RHS25R	L0147	RHL25R
35	.845	98	0148	RHS35R	L0148	RHL35R
50	.707	80	0149	RHS50R	L0149	RHL50R
75	.575	107	0150	RHS75R	L0150	RHL75R
100	.50	142	0151	RHS100	L0151	RHL100
125	.445	139	0152	RHS125	L0152	RHL125
175	.375	154	0153	RHS175	L0153	RHL175
250	.316	177	0154	RHS250	L0154	RHL250
350	.267	197	0155	RHS350	L0155	RHL350
500	.222	220	0156	RHS500	L0156	RHL500
750	.182	261	0157	RHS750	L0157	RHL750
1000	.155	278	0158	RHS1K0	L0158	RHL1K0
1500	.129	267	0159	RHS1K5	L0159	RHL1K5
2500	.10	341	0160	RHS2K5	L0160	RHL2K5
3500	.084	315	0161	RHS3K5	L0161	RHL3K5
5000	.070	355	0162	RHS5K0	L0162	RHL5K0
7500	.058	439	4200	RHS7K5	L4200	RHL7K5
10,000	.050	476	4201	RHS10K	L4201	RHL10K
15,000	.041	431	4202	RHS15K	L4202	RHL15K
20,000	.035	422	4203	RHS20K	L4203	RHL20K
25,000	.032	527	4204	RHS25K	L4204	RHL25K

50 WATT MODEL "J" — UL Listed

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New
0.5	10.0	24	0308	RJSR50
1	7.07	44	0309	RJS1R0
2	5.00	43	0310	RJS2R0
4	3.53	42	0311	RJS4R0
6	2.88	45	0312	RJS6R0
8	2.50	43	0313	RJS8R0
12	2.04	86	0314	RJS12R
16	1.76	91	0315	RJS16R
22	1.50	100	0316	RJS22R
35	1.19	125	0317	RJS35R
50	1.00	112	0318	RJS50R
80	.79	143	0319	RJS80R
125	.63	176	0320	RJS125
150	.575	170	0321	RJS150
225	.470	199	0322	RJS225
300	.408	211	0323	RJS300
500	.316	284	0324	RJS500
800	.250	282	0325	RJS800
1000	.224	352	0326	RJS1K0
1600	.176	355	0327	RJS1K6
2500	.141	449	0328	RJS2K5
3500	.119	496	0329	RJS3K5
5000	.100	459	0330	RJS5K0
8000	.079	576	0331	RJS8K0
10,000	.070	565	0332	RJS10K
15,000	.058	568	4210	RJS15K
20,000	.050	599	4211	RJS20K
25,000	.045	573	4212	RJS25K
30,000	.041	688	4213	RJS30K
40,000	.035	673	4214	RJS40K
50,000	.032	842	4215	RJS50K

75 WATT MODEL "G" — UL Listed

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New
0.5	12.3	27	1100	RGSR50
1	8.66	27	1101	RGS1R0
2	6.12	30	1102	RGS2R0
3	5.0	28	1103	RGS3R0
5	3.88	53	1104	RGS5R0
7.5	3.16	50	1105	RGS7R5
10	2.74	53	1106	RGS10R
16	2.17	91	1107	RGS16R
25	1.73	113	1108	RGS25R
50	1.23	142	1109	RGS50R
75	1.0	134	1110	RGS75R
100	.866	178	1111	RGS100
200	.612	180	1112	RGS200
300	.50	211	1113	RGS300
400	.433	223	1114	RGS400
500	.388	279	1115	RGS500
750	.316	338	1116	RGS750
1000	.274	356	1117	RGS1K0
1500	.224	420	1118	RGS1K5
2000	.194	443	1119	RGS2K0
2500	.173	441	1120	RGS2K5
5000	.123	564	1121	RGS5K0
7500	.100	547	1122	RGS7K5
10,000	.087	572	1123	RGS10K

100 WATT MODEL "K" — UL Listed

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New
0.5	14.1	33	0440	RKSR50
1	10	33	0441	RKS1R0
2	7.07	32	0442	RKS2R0
3	5.75	39	0443	RKS3R0
5	4.47	57	0444	RKS5R0
7.5	3.65	60	0445	RKS7R5
10	3.16	57	0446	RKS10R
16	2.50	88	0447	RKS16R
25	2.0	109	0448	RKS25R
50	1.41	137	0449	RKS50R
75	1.15	163	0450	RKS75R
100	1.00	172	0451	RKS100
200	.707	216	0452	RKS200
300	.575	261	0453	RKS300
400	.500	272	0454	RKS400
500	.447	269	0455	RKS500
750	.365	325	0456	RKS750
1000	.316	343	0457	RKS1K0
1500	.258	404	0458	RKS1K5
2000	.224	426	0459	RKS2K0
2500	.200	426	0460	RKS2K5
5000	.141	543	0461	RKS5K0
7500	.115	528	0462	RKS7K5
10,000	.100	704	0463	RKS10K

150 WATT MODEL "L" — UL Listed

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New
0.5	17.3	29	0524	RLSR50
1	12.3	41	0525	RLS1R0
2	8.65	40	0526	RLS2R0
3	7.07	42	0527	RLS3R0
5	5.48	44	0528	RLS5R0
7.5	4.47	75	0529	RLS7R5
10	3.88	79	0530	RLS10R
15	3.16	75	0531	RLS15R
25	2.45	120	0532	RLS25R
35	2.07	133	0533	RLS35R
50	1.74	151	0534	RLS50R
75	1.42	179	0535	RLS75R
100	1.23	190	0536	RLS100
150	1.00	225	0537	RLS150
200	.865	239	0538	RLS200
250	.775	236	0539	RLS250
350	.655	265	0540	RLS350
500	.548	296	0541	RLS500
750	.447	362	0542	RLS750
1250	.346	473	0543	RLS1K25
1800	.288	537	0544	RLS1K8
2250	.259	529	0545	RLS2K25
3000	.224	558	0546	RLS3K0
4000	.182	667	0547	RLS4K0
7500	.141	714	0548	RLS7K5
10,000	.122	952	0549	RLS10K

OHMITE® Vitreous Enameled Rheostats (Potentiometers)

225 WATT MODEL "P" — UL Listed

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	New
1	15	42	1250	RPS1R0
2	10.6	41	1251	RPS2R0
3	8.66	61	1252	RPS3R0
4	7.50	58	1253	RPS4R0
5	6.71	57	1254	RPS5R0
7.5	5.49	60	1255	RPS7R5
10	4.74	115	1256	RPS10R
15	3.87	108	1257	RPS15R
25	3.00	114	1258	RPS25R
50	2.12	218	1259	RPS50R
75	1.73	206	1260	RPS75R
100	1.50	275	1261	RPS100
150	1.22	259	1262	RPS150
200	1.06	345	1263	RPS200
300	.866	326	1264	RPS300
400	.750	342	1265	RPS400
700	.567	483	1266	RPS700
900	.500	484	1267	RPS900
1200	.433	513	1268	RPS1K2
1500	.387	641	1269	RPS1K5
1750	.358	603	1270	RPS1K75
2000	.336	690	1270A	RPS2K0
2500	.300	679	1271	RPS2K5

300 WATT MODEL "N" — UL Listed

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	New
1	17.32	56	0650	RNS1R0
2	12.24	51	0651	RNS2R0
3	10.00	51	0652	RNS3R0
4	8.66	77	0653	RNS4R0
5	7.75	76	0654	RNS5R0
7.5	6.32	72	0655	RNS7R5
10	5.48	76	0656	RNS10R
15	4.47	144	0657	RNS15R
25	3.46	134	0658	RNS25R
50	2.45	230	0659	RNS50R
75	2.00	275	0660	RNS75R
100	1.73	288	0661	RNS100
150	1.41	345	0662	RNS150
200	1.22	364	0663	RNS200
300	1.00	433	0664	RNS300
400	.866	456	0665	RNS400
700	.655	500	0666	RNS700
900	.578	517	0667	RNS900
1200	.500	541	0668	RNS1K2
1500	.447	676	0669	RNS1K5
1750	.414	625	0670	RNS1K75
2000	.387	714	0670A	RNS2K0
2500	.346	720	0671	RNS2K5

500 WATT MODEL "R"

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	New
1	22.3	56	0849	RRS1R0
1.5	18.2	71	0850	RRS1R5
2	15.8	75	0851	RRS2R0
2.5	14.1	78	0852	RRS2R5
3	12.9	79	0853	RRS3R0
4	11.2	74	0854	RRS4R0
5	10.0	104	0855	RRS5R0
8	7.9	104	0856	RRS8R0
12.5	6.3	115	0857	RRS12R5
16	5.6	186	0858	RRS16R
25	4.47	205	0859	RRS25R
40	3.54	206	0860	RRS40R
50	3.16	205	0872	RRS50R
80	2.52	316	0861	RRS80R
125	2.0	388	0862	RRS125
175	1.69	434	0863	RRS175
250	1.41	490	0864	RRS250
325	1.24	505	0865	RRS325
500	1.00	614	0866	RRS500
750	.817	735	0867	RRS750
1000	.707	769	0868	RRS1K0
1500	.577	932	0869	RRS1K5
2000	.50	971	0870	RRS2K0
2500	.447	962	0871	RRS2K5

750 WATT MODEL "T"

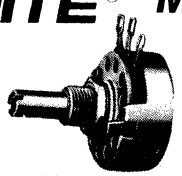
Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	New
1	27.4	72	1300	RTS1R0
1.5	22.3	72	1301	RTS1R5
2	19.4	96	1302	RTS2R0
2.5	17.3	101	1303	RTS2R5
3	15.8	96	1304	RTS3R0
4	13.6	94	1305	RTS4R0
5	12.2	104	1306	RTS5R0
8	9.65	100	1307	RTS8R0
10	8.65	139	1308	RTS10R
12.5	7.75	138	1309	RTS12R5
16	6.82	139	1310	RTS16R
25	5.47	137	1311	RTS25R
50	3.87	246	1312	RTS50R
80	3.06	381	1313	RTS80R
100	2.74	376	1314	RTS100
160	2.17	476	1315	RTS160
200	1.94	469	1316	RTS200
300	1.58	562	1317	RTS300
400	1.37	593	1318	RTS400
600	1.18	705	1319	RTS600
750	1.00	694	1320	RTS750
1200	.791	889	1321	RTS1K2
1800	.646	1050	1322	RTS1K8
2000	.610	935	1322A	RTS2K0
2500	.547	1170	1323	RTS2K5

1000 WATT MODEL "U"

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	New
1	31.6	91	1450	RUS1R0
1.5	25.8	90	1451	RUS1R5
2	22.4	90	1452	RUS2R0
2.5	20.0	127	1453	RUS2R5
3	18.3	114	1454	RUS3R0
4	15.8	120	1455	RUS4R0
5	14.1	124	1456	RUS5R0
8	11.2	118	1457	RUS8R0
10	10.0	117	1458	RUS10R
12.5	8.95	163	1459	RUS12R5
16	7.90	166	1460	RUS16R
25	6.33	162	1461	RUS25R
50	4.47	327	1462	RUS50R
75	3.65	307	1463	RUS75R
100	3.16	446	1464	RUS100
175	2.39	490	1465	RUS175
225	2.11	630	1466	RUS225
300	1.83	661	1467	RUS300
400	1.58	704	1468	RUS400
500	1.41	695	1469	RUS500
750	1.15	828	1470	RUS750
1000	1.00	870	1471	RUS1K0
1500	.816	1040	1472	RUS1K5
2500	.633	1100	1473	RUS2K5

OHMITE® Molded Composition Potentiometers

STYLE CMU
MIL STYLE
RV4N



Ohmite molded composition potentiometers (Type AB) provide high quality and dependable performance.

Because the resistance element is a thick, solid-molded ring, longer life and smoother operation are obtained. This is due also to the molded composition contact. Units are dust and splash proof, fungus and corrosion resistant and meet the requirements of military specification MIL-R-94.

Type AB is rated 2 watts at 70°C ambient.

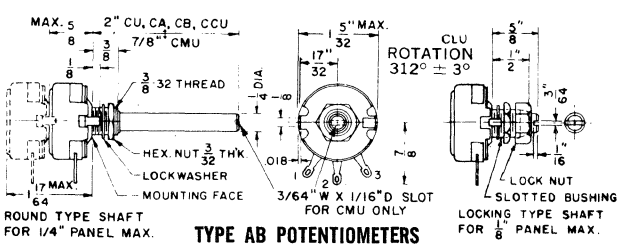
TYPE AB IS AVAILABLE WITH:

⅞" slotted shaft (CMU)
2" unslotted shaft (CU, CA, CB, CCU) and in a slotted shaft with locking type bushing (CLU)

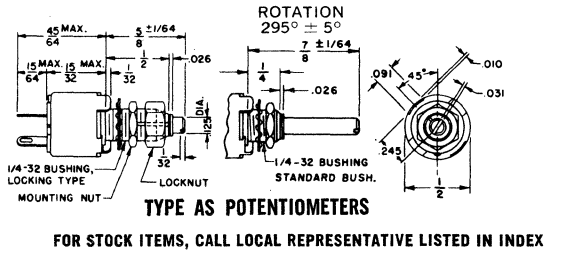
TYPE AS AVAILABLE WITH:

- Locking type bushing and slotted shaft (Style AS)
- Standard bushing with longer, slotted shaft (Style ASM)

Resistance Ohms Except As Noted Tol. ±10% except * ±20%	Type AB (1½" Dia.) Rated 2 Watts: Single Unit ⅞" Shaft Style CMU Linear	Single Unit 2" Shaft: Style CU Linear	Style CA CW log	Style CB CCW log	Locking Style CLU Linear	Dual Style CCU Linear	Type AS (½" Dia.) Rated ½ Watt: Miniature Locking Style AS Linear	Miniature ⅞" Shaft Style ASM Linear
50	CMU5001	CU5001			CLU5001			
100	CMU1011	CU1011			CLU1011		AS3601	ASM6661
150	CMU1511	CU1511			CLU1511			
250	CMU2511	CU2511			CLU2511		AS3602	ASM6662
350	CMU3511	CU3511			CLU3511			
500	CMU5011	CU5011			CLU5011		AS3603	ASM6663
750	CMU7511	CU7511			CLU7511			
1000	CMU1021	CU1021			CLU1021	Resistance	AS3604	ASM6664
1500	CMU1521	CU1521			CLU1521	Shown is		
2500	CMU2521	CU2521			CLU2521	for Each Unit	AS3605	ASM6665
3500	CMU3521	CU3521			CLU3521			
5000	CMU5021	CU5021			CLU5021		AS3606	ASM6666
7500	CMU7521	CU7521			CLU7521			
10,000	CMU1031	CU1031		CB1031	CLU1031	CCU1031	AS3607	ASM6667
15,000	CMU1531	CU1531			CLU1531			
25,000	CMU2531	CU2531		CB2531	CLU2531	CCU2531	AS3608	ASM6668
35,000	CMU3531	CU3531			CLU3531			
50,000	CMU5031	CU5031		CB5031	CLU5031	CCU5031	AS3609	ASM6669
75,000	CMU7531	CU7531			CLU7531			
.1 meg.	CMU1041	CU1041	CA1041		CLU1041	CCU1041	AS3610	ASM6670
.15 meg.	CMU1541	CU1541			CLU1541			
25 meg.	CMU2541	CU2541	CA2541		CLU2541	CCU2541	AS3611	ASM6671
.35 meg.	CMU3541	CU3541			CLU3541			
.5 meg.	CMU5041	CU5041	CA5041		CLU5041	CCU5041	AS3612	ASM6672
.75 meg.*	CMU7542	CU7542			CLU7542			
1.0 meg.*	CMU1052	CU1052	CA1052		CLU1052	CCU1052	AS3613	ASM6673
1.5 meg.*	CMU1552	CU1552			CLU1552			
2.0 meg.*	CMU2052	CU2052			CLU2052		AS3684	ASM6674
2.5 meg.*	CMU2552	CU2552	CA2552		CLU2552		AS3614	ASM6675
3.5 meg.*	CMU3552	CU3552			CLU3552			
5.0 meg.*	CMU5052	CU5052			CLU5052		AS3615	ASM6676
Weight	.064 lb.	.084 lb.			.070 lb.	.123 lb.	.017 lb.	.017 lb.



TYPE AB POTENTIOMETERS



TYPE AS POTENTIOMETERS

FOR STOCK ITEMS, CALL LOCAL REPRESENTATIVE LISTED IN INDEX

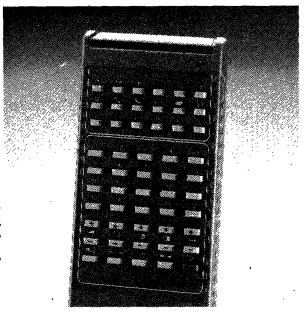
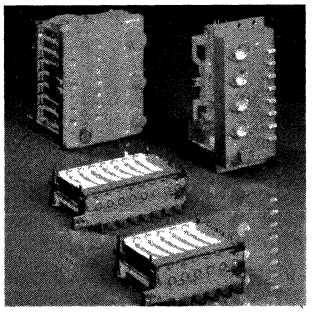
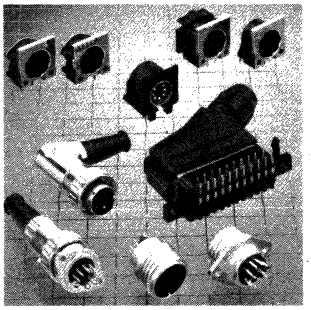
PREH ELECTRONICS INDUSTRIES, INC.

PREH ELECTRONIC INDUSTRIES, INC.
5665 WEST HOWARD ST., NILES, IL 60648
(312) 647-8338 TELEX: 297112 PEIUR.

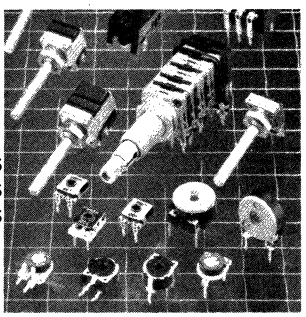
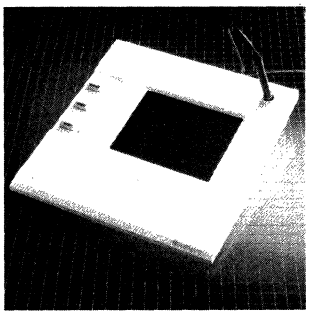
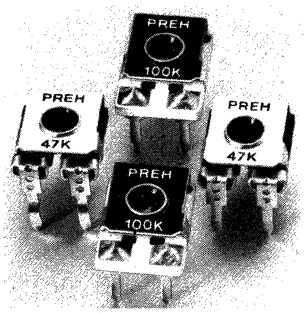
PEI is a wholly owned subsidiary of Preh Elektrofeinmechanische Werke, Bad Neustadt a/d Saale, West Germany with offices and plants in Germany, Austria, Portugal, and Singapore.

QUALITY ELECTRONIC PRODUCTS FROM PREH

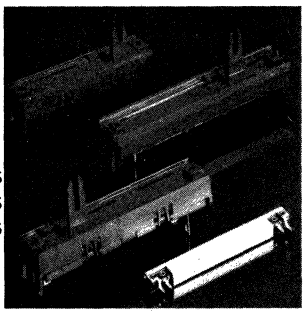
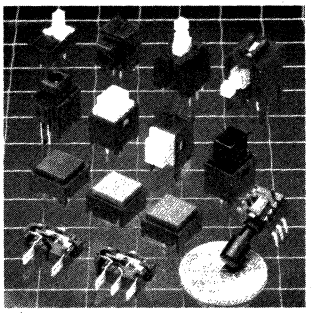
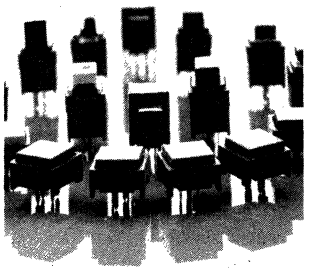
Remote Control Systems
Tuning Units
Peripheral Equipment
Connectors

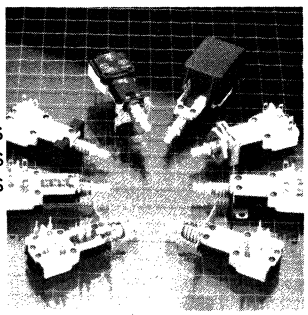
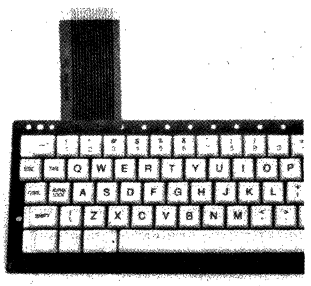
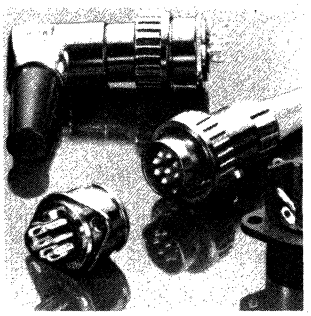
Rotary Potentiometers
Computer Graphic Pads
Trimmers

Slide Potentiometers
Miniature Switches
Keyswitches

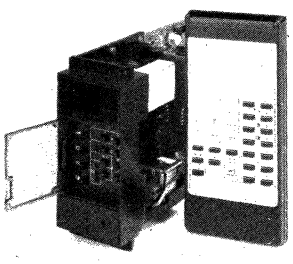
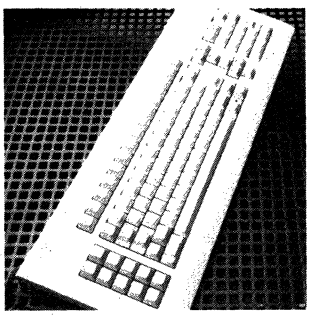
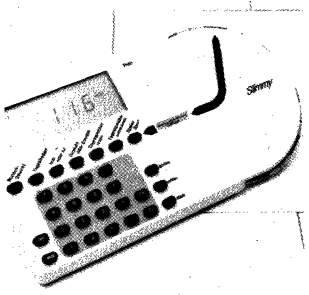




Power Switches
Keyboards
Circular DIN Connectors

Electronic Tuning Systems
IBM-PC Compatible
Keyboards
Diet Calculators

Preh

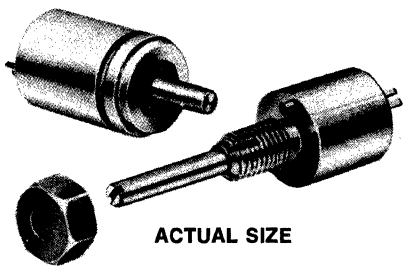
FOR DETAILED INFORMATION PHONE (312) 647-8338

SAMARIUS INC.

300 SEYMOUR AVENUE, DERBY, CONN. 06418 (203) 735-7405 • TWX: 710-451-2495

PRECISION POTENTIOMETERS

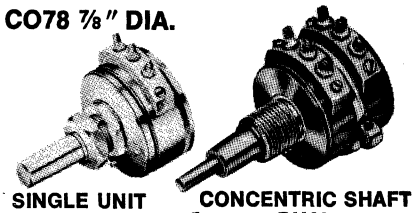
C-050 ½" DIA.



ACTUAL SIZE

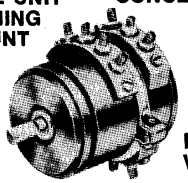
Available in resistance values to 500K. Dual Gang Units available both Bushing & Servo Mt.

CO78 ⅞" DIA.



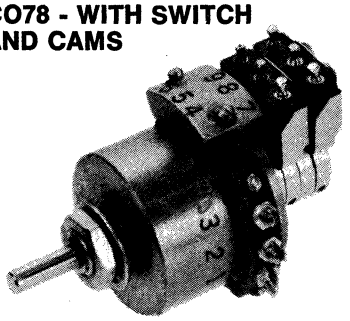
SINGLE UNIT BUSHING MOUNT

CONCENTRIC SHAFT DUAL



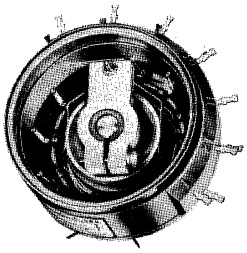
DUAL UNIT WITH TAPS

CO78 - WITH SWITCH AND CAMS



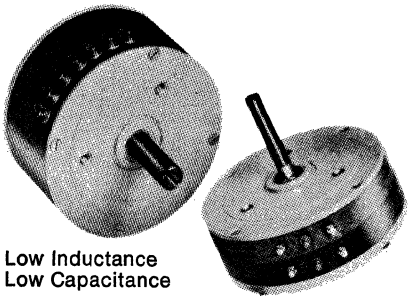
Designed for aircraft and commercial applications.

BC200 - C200P 2" DIA.



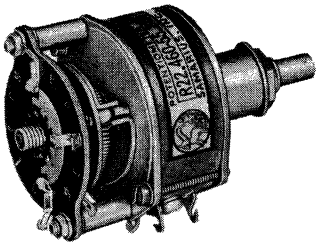
Most versatile unit- all resistance values. Taps economically supplied. Gangable and available in both Bushing & Servo Mount.

M300, M301, M400 INSTRUMENT POTENTIOMETERS



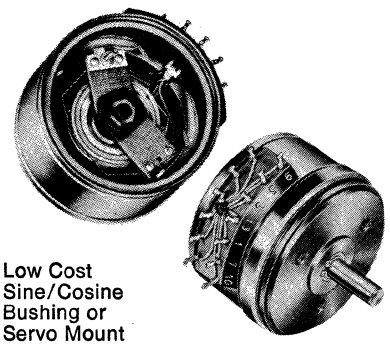
Low Inductance
Low Capacitance

MODEL L140 LOOP CONTROL



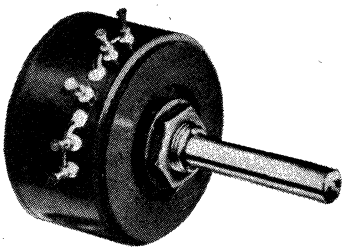
Spring return to center with or without switch and center tap. Used in Satellite and Radar Antennas. Also Medical, Robot and Comparators.

BC200 - C200P SINE/COSINE



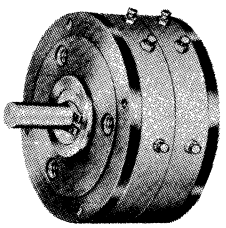
Low Cost Sine/Cosine Bushing or Servo Mount

M158 - CP158 1⅝"



Low Cost Industrial Wirewound & Conductive Plastic Units

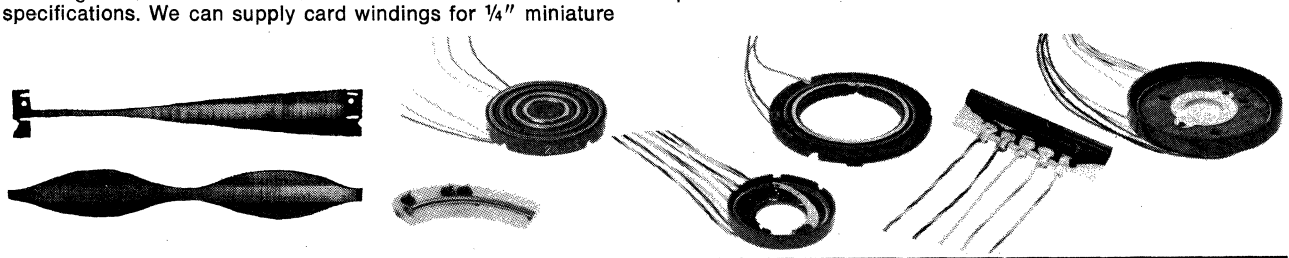
SERIES HP-200, HP-300, HP-500 2", 3", 5" HIGH RESOLUTION

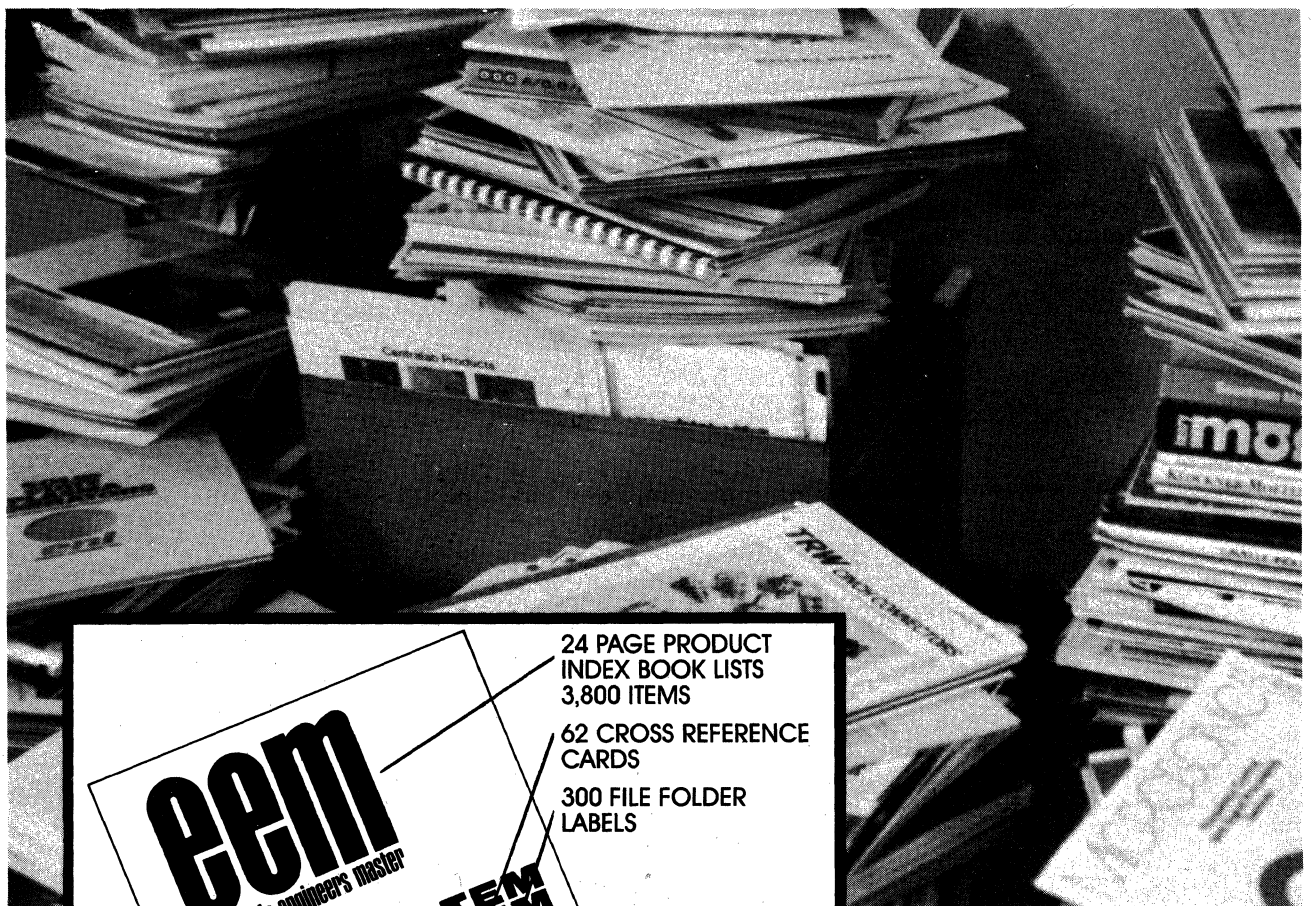


Ideal for Tight Linearity Long Elect Angles

HIGH PRECISION POTENTIOMETER AND RESISTOR ASSEMBLY

Samarius, Inc. furnish their clients with a custom winding service for wire wound potentiometer elements in card and mandrel types. Linear or functional requirements are achieved through cooperative R & D with customers. Card profiles are ground with exact duplication from master templates on our own engineered and built machines to tolerances to meet all specifications. We can supply card windings for ¼" miniature potentiometers to cards 12 feet long and 4 inches wide. Mandrel windings are available up to 16 feet long in any type of wire needed. Over 30 years' experience in supplying high precision potentiometer windings to the field. Call on our engineering staff for their help in solving your winding or potentiometer problems.





24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS

62 CROSS REFERENCE CARDS

300 FILE FOLDER LABELS

ALL NEW with this edition of EEM

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The EEM File System is shipped in one neat package. The package contains everything you need to set up your very own filing system. Best of all, it's easy to get and very affordable. Send a check or money order for $25.00 and EEM will pay the postage and sales tax. If you must use a purchase order, please add $5.00 for postage and handling. An invoice will accompany your System.

Don't waste any more time. Get organized now!

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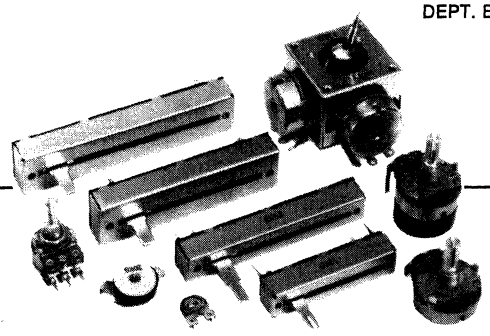
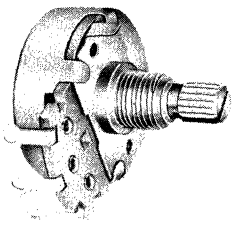


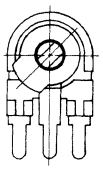
DEPT. EM, 287 NORTHERN BOULEVARD
GREAT NECK, NEW YORK 11021
(516) 466-0911
CABLE: "SHOGYONEWYORK"
TELEX: 12218 + 4758024
FAX: (516) 466-0922

SHOGYO
INTERNATIONAL CORPORATION



ROTARY

Angle of Rotation Ranges: 260° ±5° through 300° ±5°
Resistance Range: 500Ω through 2MΩ
Power Rating: .05W through .25W
Voltage Rating: 150V through 500V
Torque: 200 through 350g—cm
For Switch, Gang Error and Electrical Tap Specifications please consult Shogyo directly.



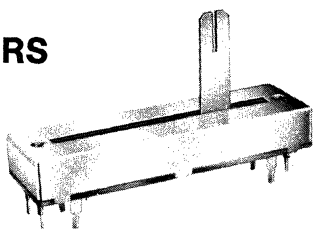
SEMI-FIXED

Resistance Range: 100Ω through 2KΩ
Resistance Tolerance: ±20%
Taper: Linear
Rated Power: 0.1W
Maximum Operating Voltage: 100V
Rotating Angle: 260 ±15%
Rotating Torque: 40 — 250g—cm
Rotating Life: Maximum 10% resistance change @ 50 rotations

Temperature Characteristic: +5 — 20% resistance change after 5 hours at 70°C
Load Characteristic: ±5% resistance change after 5 hours @ normal temperature
Moisture Characteristic: 7 — 15% resistance change after 5 hours at 95% humidity, 40°C

SLIDE & VARIABLE RESISTORS

The products illustrated and listed are only a small representation of the full range of items available.



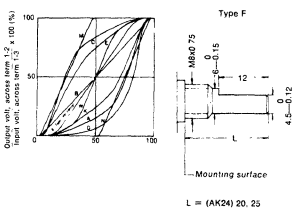
Travel: 20 ±0.5(mm) through 60 ±0.5(mm)
Mounting Pitch: 65(mm) — 31 ±0.3(mm) through 85(mm)
Resistance Range: 500Ω — 1MΩ, 5KΩ through 1MΩ
Power Rating: 0.1W through 0.5W
Voltage Rating: 150V through 500V
Sliding Force: 50 — 350g
Single and Double Types available.

RESISTANCE CHARACTERISTICS

TAPER	CHECK POINT	$\frac{V1\text{-}2}{V1\text{-}3}$ x 100 (%)	$\frac{V2\text{-}3}{V1\text{-}3}$ x 100 (%)
A	60%	15 ~ 30%	
B	50%	40 ~ 60%	
C	60%		15 ~ 30%
D	50%	2 ~ 15%	
E	50%		15 ~ 35%
M	25% 50%	40 ~ 60% 98 ~ 100%	
N	50% 75%	0 ~ 2% 40 ~ 60%	
W	30% 50% 70%	5 ~ 15% 40 ~ 60% 85 ~ 95%	

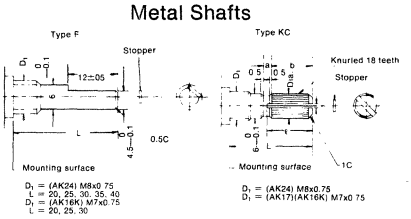
ILLUSTRATION OF SHAFT

Insulated Shafts



Any special taper as customers required available on request

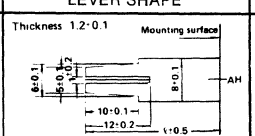
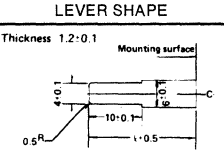
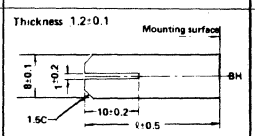
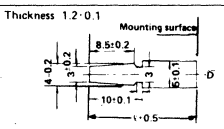
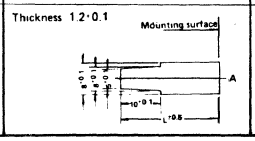
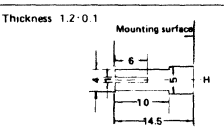
Metal Shafts



	△					△	△
L	15	20	25	30	35	40	60
a	1.5	2	4	4	4	4	4.5
b	6	10	12	12	12	12	21
L	7	11	14	14	14	14	14

△ AK24 only

STANDARD LEVERS FOR SLIDE VARIABLE RESISTOR

LEVER DESIGNATION	LEVER SHAPE	LENGTH	APPLICABLE TYPES	LEVER DESIGNATION	LEVER SHAPE	LENGTH	APPLICABLE TYPES
AH		L = 20, 25, 30mm	**AK-451** **AK-452** **AK-601** **AK-602**	**C**		L = 15, 20, 25mm	**AK-305** **AK-306** **AK-451** **AK-452** **AK-601** **AK-602**
BH		L = 20, 25, 30mm	**AK-451** **AK-452** **AK-601** **AK-602**	**D**		L = 15, 20, 25mm	**AK-305** **AK-306** **AK-451** **AK-452** **AK-601** **AK-602**
A		L = 20, 25, 30mm	**AK-451** **AK-452** **AK-601** **AK-602**	**H**		L = 15, 20, 25mm	**AK-201** **AK-202** **AK-301** **AK-302** **AK-305** **AK-306**

SEE OUR OTHER CATALOG PAGES IN EEM SECTIONS 1300/2100/2450/2950/5600/6000

EEM PRODUCT SELECTION GUIDES

Use the EEM Product Selection Guides. There are 34 Guides in this edition of EEM. See page 2 (A•2, B•2, C•2, D•2) of each volume to locate the Product Selection Guides that pertain to your needs.

Spectrol

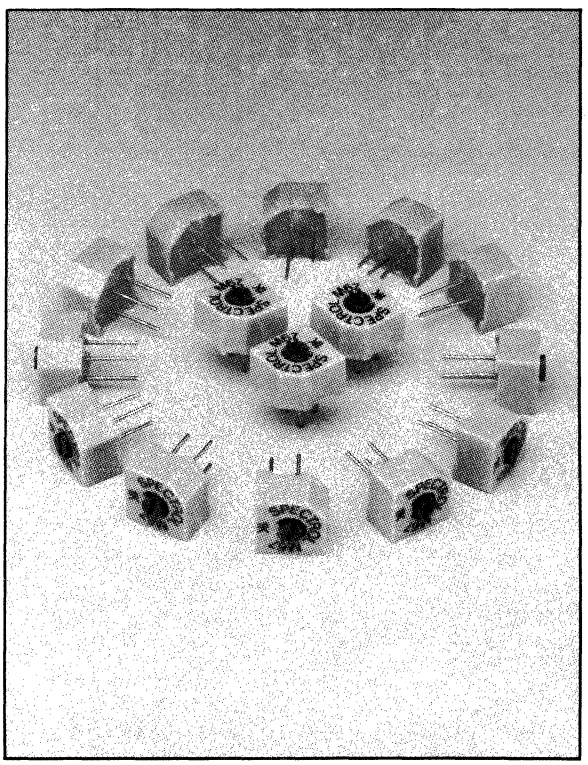
SPECTROL MODEL 67

New Product

New competitive high quality ¼" square single turn trimmer with a unique feature*

Features

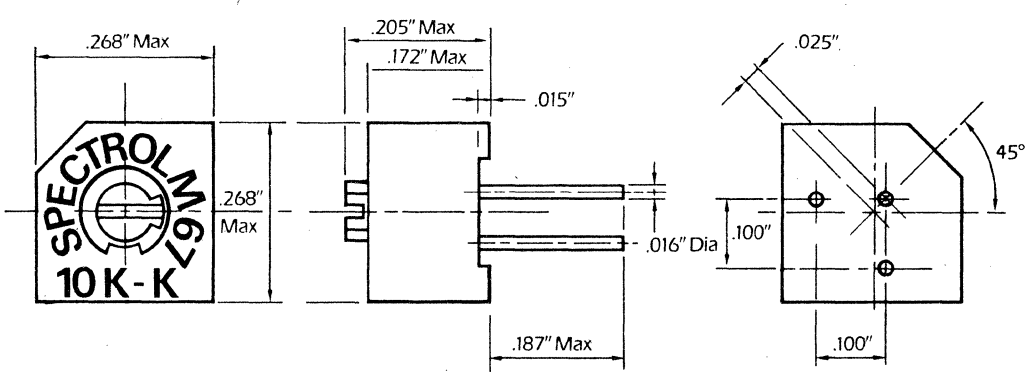
- Solid Stop Mechanism
- Thermal Swaged Terminations
- Visual Setting
- Sealed (85°C for 1 minute)
- Will fit in envelope of similar pin configurations using round body
- 0.016" (0.406mm) Tin Plated Terminal Pins



Technical Data

Resistance Range	100Ω to 1 Megohm
Mechanical Adjustment	270°
Resistance Tolerance	±20%
Tempco	±100 PPM/°C
Setability	±0.05% RT
Power Rating	0.5 Watt at 70°C

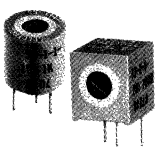
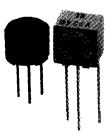
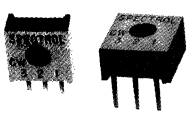
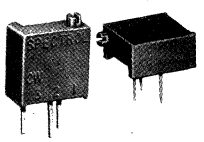
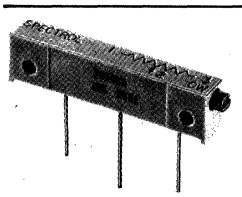
* Pin Configuration identified by "Flat" on housing



Spectrol Electronics 17070 E. Gale Avenue, City of Industry, CA 91745; phone: (818) 964-6565.

Spectrol

CERMET TRIMMING POTENTIOMETERS

Actual size	MODEL NO.	NOMINAL SIZE (INCHES)	NOM. ADJ. TURNS	TERMINAL[1] STYLE	RESISTANCE TOLERANCE	MAXIMUM POWER RATING (WATTS)	TEMPCO (PPM/° C)	STANDARD RESISTANCE RANGE (OHMS)
	▶ 43	0.75 Long	20	PC	±10%	0.75 @ 70° C	±100 (100 Ω–2 Meg) +200 –100 (10, 20 & 50 Ω)	10 Ω–2 Meg.
	▶ 53	0.34 Dia. Top Adjust 0.31 x 0.36 Side Adjust	240°	PC	±20% (±10% Available)	0.5 @ 85° C	±100 (100 Ω– 1 Meg) 0 to +400 (10, 20 & 50 Ω)	10 Ω– 1 Meg.
	▶ 62	0.25 Dia. Top Adjust .025 Square Side Adjust	215°	PC	±20% (±10% Available)	0.5 @ 70° C	±100 (100 Ω– 1 Meg) 0 to +450 (10, 20 & 50 Ω)	10 Ω– 1 Meg.
	▶ 63	0.38 Square	270°	PC	±20% (± 10% Available)	0.5 @ 70° C	±100 (100 Ω–2 Meg) 0 to +250 (10, 20, 50 Ω)	10 Ω–2 Meg.
	▶ 64	0.38 Square	25	PC	± 10%	0.5 @ 85° C	± 100 (100Ω–2 Meg) 0 to +250 (10, 20, 50Ω)	10 Ω–2 Meg.
	▶ 70	1.25 Long	20	L, PC, SH	± 10%	1.0 @ 85° C	±100 (100 Ω–2 Meg) –100 to + 200 (10, 20 & 50 Ω)	10 Ω-2 Meg.

TRIMMER ADJUSTMENT TOOL

½ actual size

▶ 8

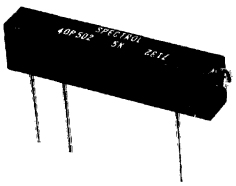
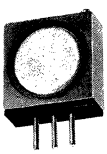
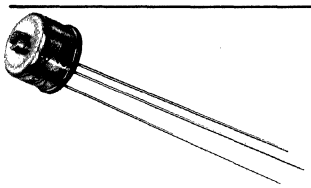
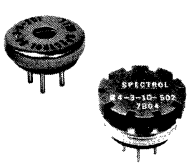
5.0 Long

This Adjustment Tool is designed to adjust trimmers of all sizes and has an extended as well as recessed blade for critical adjustments.

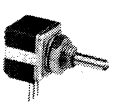
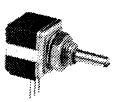
▶ DISTRIBUTOR AUTHORIZED STOCKING ITEM

Spectrol

WIREWOUND TRIMMING POTENTIOMETERS

Actual size	MODEL NO.	NOMINAL SIZE (INCHES)	NOM. ADJ. TURNS	TERMINAL[1] STYLE	RESISTANCE TOLERANCE	MAXIMUM POWER RATING (WATTS)	TEMPCO (PPM/° C)	STANDARD RESISTANCE RANGE (OHMS)
	▶ **40** (RT 12 Available)	1.25 Long	22	L,PC,SH	±5%	1.0 @ 70° C	±50	10Ω–10K 20K 50K 100K
	▶ **50** (RT 24 Available)	0.38 Square	23	L,PC	±5%	0.75 @ 85° C	±50	10Ω–10K 20K 50K
	▶ **55** (RT 22 Available)	0.50 Square	23	L,PC	±5%	1.5 @ 70° C	±50	10Ω–10K 20K 50K
	**80**	0.35 Dia.	310°	PC	5%	1.0 @ 50° C	±50	10Ω–10K 20K 50K
	▶ **84**	0.50 Dia. (Base)	300°	PC,SH	±5%	1.5 @ 70° C	±50	Screw 10Ω–10K Driver 20K Knob 10Ω–10K 20K Panel 10Ω–10K Mt. 20K
	85	0.55 x 0.54 Side Adjust	300°	PC	±5%	1.5 @ 70° C	±50	Screw 10Ω–10K Driver 20K

PANEL CONTROL POTENTIOMETERS

Units shown 1/2 actual size	MODEL NO.	SIZE	RESISTANCE RANGE (OHMS)	STANDARD RESISTANCE TOLERANCE	LINEARITY TOLERANCE	MAXIMUM POWER RATING (WATTS)	MOUNTING AVAILABLE
	▶ **148** (Conductive Plastic)	0.500 Square	100 to 1 Meg.	±20%	±5%	0.5 @ 70°C	Bushing
	▶ **149** (Cermet)	0.500 Square	100 to 2 Meg.	±10%	±5%	1.0 @ 85°C	Bushing

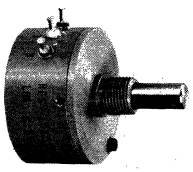
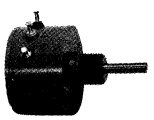
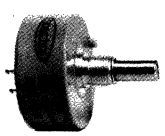
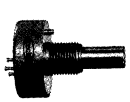
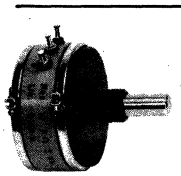
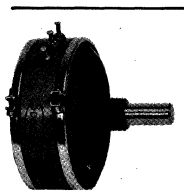
[1]TERMINATIONS: L – COLOR CODED LEAD WIRES, SH – SOLDER HOOKS, PC – PRINTED CIRCUIT PINS.

▶ DISTRIBUTOR AUTHORIZED STOCKING ITEM

SINGLE-TURN WIREWOUND PRECISION POTENTIOMETERS

Spectrol

All units shown ½ actual size

	MODEL NO.	NOMINAL DIA.[2] (INCHES)	RESISTANCE RANGE (OHMS)	STANDARD RESISTANCE TOLERANCE	LINEARITY TOLERANCE STANDARD	LINEARITY TOLERANCE BEST PRACTICAL[1]	MAXIMUM POWER RATING (WATTS)	MOUNTING AVAILABLE
	**100**	1.312	5 to 35K	± 3% (± 5% below 50Ω)	5Ω to 100Ω ±1.0% 100Ω to 35KΩ ± 0.5%	±.15%	2.75 @ 40° C	Bushing Servo
	**122** (Style RR 1100 Available)	1.062	5 to 20K	± 3% (±5% below 20Ω)	5Ω to 200Ω ±1.0% 200Ω to 20KΩ ± 0.5%	±.20%	1.5 @ 70° C	Bushing Servo
	▶ **132**	1.312	5 to 35K	± 3% (± 5% below 50Ω)	5Ω to 200Ω ± 1.0% 200Ω to 35KΩ ± 0.5%	±.25%	2.75 @ 40° C	Bushing
	▶ **140**	.500	50 to 50K	± 5%	± 1.0%	±.50%	2.0 @ 40° C	Bushing
	142	.500	50 to 50K	±5%	±1.0%	±.50%	2.0 @ 40°C	Servo
	**152**	.875	5 to 40K	± 3% (±5% below 50Ω)	5Ω to 500Ω ±1.0% 500Ω and above ±0.5%	±.35%	2.0 @ 40° C	Bushing Servo
	**172** (Style RR1300 Available)	1.438	5 to 40K	±3% (±5% below 50Ω)	5Ω to 200Ω ±1.00% 200Ω to 2KΩ ± 0.5% 2K to 50KΩ ±.25%	±.15%	2.0 @ 70°C	Bushing Servo
	182	.750	5 to 30K	±3% (±5% below 20Ω)	5Ω to 2KΩ ±1.0% 2KΩ to 30KΩ ±0.5%	±.25%	1.5 @ 70°C	Servo
	**202**	1.750	5 to 65K	± 3% (± 5% below 50Ω)	5Ω to 50Ω ± 1.0% 50Ω to 500Ω ±0.5% 500Ω to 65KΩ ±.25%	±.15%	3.5 @ 70° C	Bushing Servo

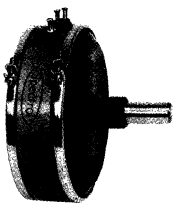
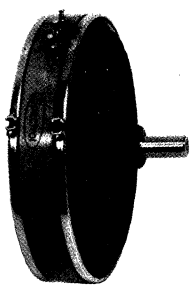
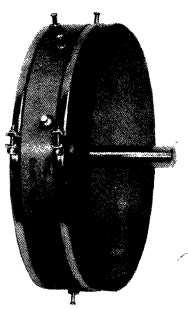
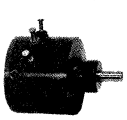
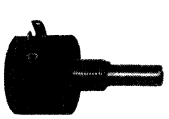
[1] BEST PRACTICAL LINEARITY FIGURES SHOWN FOR THE VARIOUS MODELS APPLY TO HIGHER RESISTANCE UNITS. CONSULT FACTORY WITH SPECIFIC REQUIREMENTS.

▶ DISTRIBUTOR AUTHORIZED STOCKING ITEM

[2] SIZES SHOWN ARE FOR THE BUSHING MOUNT VERSIONS. SHAFT DIA. .125" FOR MODELS 122, 140, 142, 502, 552, 702, AND CW05; .094" FOR MODELS 162 AND 164; .250" FOR ALL OTHER MODELS.

Spectrol

SINGLE-TURN WIREWOUND PRECISION POTENTIOMETERS

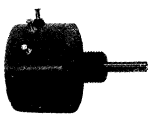
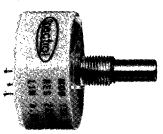
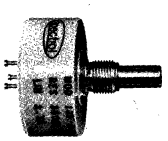
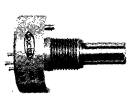
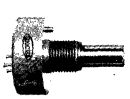
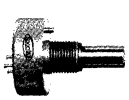
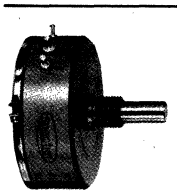
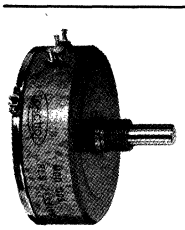
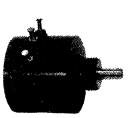
All units shown ½ actual size	MODEL NO.	NOMINAL DIA.[2] (INCHES)	RESISTANCE RANGE (OHMS)	STANDARD RESISTANCE TOLERANCE	LINEARITY TOLERANCE STANDARD	LINEARITY TOLERANCE BEST PRACTICAL[1]	MAXIMUM POWER RATING (WATTS)	MOUNTING AVAILABLE
	**302** (Style RR 2000 Available)	2.000	5 to 85K	±3% (±5% below 50Ω)	5Ω to 50Ω ±1.0% 50Ω to 200Ω ±0.5% 200Ω to 85KΩ ±.25%	±.10%	4.0 @ 70° C	Bushing Servo
	**402** (Style RR 3000 Available)	3.000	10 to 150K	±3% (±5% below 100Ω)	10Ω to 200Ω ±0.5% 200Ω to 150KΩ ±.25%	±.075%	6.0 @ 70° C	Bushing Servo
	**452** SIN/COS	3.000	250 to 25K per quad	±3%	250Ω to 2.5KΩ ±0.5% (PK To PK) 2.5KΩ and above ±0.3% (PK To PK)		6.0 @ 70°C	Servo
	**702** (Style RR 2100 Available)	.875	5 to 100K	±3% (±5% below 20Ω)	5Ω to 500Ω ±1.0% 500Ω to 20KΩ ±0.5%	±.25%	1.25 @ 70° C	Bushing Servo
	**MW**	.906	5 to 50K	±10%	±5%	±2%	1 @ 20°C	Bushing

[1]BEST PRACTICAL LINEARITY FIGURES SHOWN FOR THE VARIOUS MODELS APPLY TO HIGHER RESISTANCE UNITS. CONSULT FACTORY WITH SPECIFIC REQUIREMENTS.

[2]SIZES SHOWN ARE FOR THE BUSHING MOUNT VERSIONS. SHAFT DIA. .125" FOR MODELS 122, 140, 142, 502, 552, 702, AND CW05; .094" FOR MODELS 162 AND 164; .250" FOR ALL OTHER MODELS.

Spectrol

SINGLE-TURN CONDUCTIVE PLASTIC AND CERMET POTENTIOMETERS

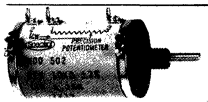
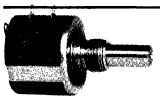
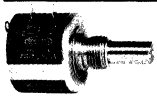
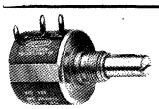
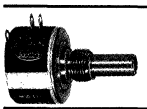
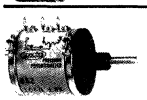
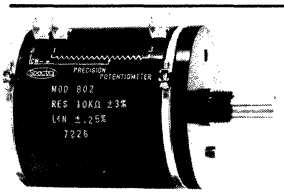
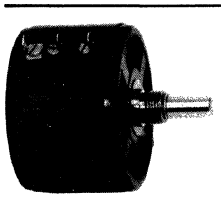
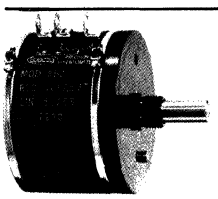
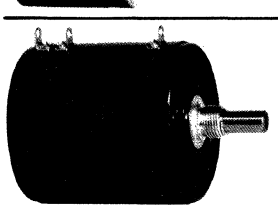
All units shown ½ actual size — MODEL NO.	NOMINAL DIA. (INCHES)	RESISTANCE RANGE (OHMS)	RESISTANCE TOLERANCE	LINEARITY	MAXIMUM POWER RATING (WATTS)	OUTPUT SMOOTHNESS	TEMPCO (PPM/° C)	MOUNTING AVAILABLE
 **128** (Conductive Plastic)	1.062	500 to 50K	±10% (Special to ± 5%)	± 0.5% (Special to ± .15%)	1.25 @ 70° C	0.1% Max.	±400	Bushing Servo
 **138** (Conductive Plastic)	1.312	1K to 50K	±10% (Special to ±5%)	± 0.5% (Special to ±.25%)	2.0 @ 40° C	0.1% Max.	±500	Bushing
 **139** (Cermet)	1.312	500 to 2 Meg.	± 20% (Special to ±5%)	± 0.5% (Special to ±0.25%)	5.0 @ 40° C	0.1% Max.	±100	Bushing
 **157** (Conductive Plastic)	.875	1K to 50K	± 20% (Special to ± 5%)	± 2.0% (Special to ± 0.25%)	1.0 @ 125° C	0.1% Max.	±600	Bushing
 **158** (Conductive Plastic)	.875	500 to 50K	±10% (Special to ±5%)	± 0.5% (Special to ±0.25%)	1.0 @ 40° C	0.1% Max.	±400	Bushing* Servo
 **159** (Cermet)	.875	500 to 2 Meg.	± 20% (Special to ± 5%)	± 0.2% (Special to ±0.5%)	3.5 @ 40° C	0.1% Max.	±100	Bushing Servo
 **208** (Conductive Plastic)	1.750	500 to 50K	± 10% (Special to± 5%)	± 0.3% (Special to ±0.1%)	1.75 @ 70° C	0.1% Max.	±400	Bushing Servo
 **308** (Conductive Plastic)	2.000	500 to 100K	± 10% (Special to ± 5%)	± .25% (Special to ± .05%)	2.0 @ 70° C	0.1% Max.	±400	Bushing Servo
 **708** (Conductive Plastic)	.875	500 to 50K	±10% (Special to ± 5%)	± 0.5% (Special to ± 0.2%)	1.0 @ 70° C	0.1% Max.	±400	Bushing Servo

*CONSULT FACTORY FOR NEW LOW-COST VERSION

Spectrol

MULTI-TURN WIREWOUND PRECISION POTENTIOMETERS

All units shown ½ actual size

MODEL NO.	NOMINAL DIA.[2] (INCHES)	RESISTANCE RANGE (OHMS)	STANDARD RESISTANCE TOLERANCE	LINEARITY TOLERANCE STANDARD	LINEARITY TOLERANCE BEST PRACTICAL[1]	MAXIMUM POWER RATING (WATTS)	MOUNTING AVAILABLE
▶ (10 Turn) **162/164**	.500	100 to 115K	±5%	±.30%	±.1%	2.0 @ 40° C	162 Bushing 164 Servo
 (Style RR 1000 Available) **502** (10 Turn)	.875	15 to 150K	±3% (±5% below 100Ω)	±.25%	±.05%	2.0 @ 70° C	Bushing Servo
 ▶ **533** (3 Turn)	.875	50 to 20K	±5%	±.25%	±.15%	1.0 @ 70° C	Bushing Servo
▶ **534** (10 Turn)	.875	100 to 100K	±5%	±.25%	±.075%	2.0 @ 70° C	Bushing Servo
 ▶ **535** (5 Turn)	.875	50 to 50K	±5%	±.25%	±.10%	1.5 @ 70° C	Bushing Servo
 ▶ **536** (10 Turn)	.875	100 to 100K	±5%	±.25%	±.10%	2.0 @ 70° C	Bushing
 **537** (3 Turn)	.875 (.590 Length)	5 to 60K	±5%	±.25%	±.10%	1.0 @ 70° C	Bushing Servo
 **552** (3 Turn)	.875	5 to 45K	±3% (±5% below 50Ω)	±.25%	±.125%	1.0 @ 70° C	Bushing Servo
 **802** (10 Turn) (Style RR 2100 Available)	1.812	20 to 500K	±3% (±5% below 200Ω)	±.25%	±.025%	5.0 @ 70° C	Bushing Servo
 ▶ **830** (3 Turn)	1.812	15 to 150K	±3% (±5% below 100Ω)	±.25%	±.05%	3.0 @ 40° C	Bushing
 **852** (3 Turn)	1.812	15 to 150K	±3% (±5% below 100Ω)	±.25%	±.05%	2.0 @ 70° C	Bushing Servo
 ▶ **860** (10 Turn)	1.812	20 to 500K	±3% (±5% below 200Ω)	±.25%	±.025%	8.0 @ 40° C	Bushing

▶ DISTRIBUTOR AUTHORIZED STOCKING ITEM

Spectrol

SWITCHES AND MULTIDIALS

SUBMINIATURE SWITCHES

All units shown actual size

	MODEL NO.	NOMINAL DIA. (INCHES)	SWITCH ACTION	CONTACT CURRENT RATING	LIFE AT RATED CURRENT	CONTACT RESISTANCE (OHMS)	DESCRIPTION
	▶ 87-11-XX	.500	Positive Detent, 36° Indexing, Stops	250MA @ 28VDC	4,000 Switching Operations, Per Position	.05 Maximum	Screwdriver Adjust
	▶ 87-21-XX	.550	Positive Detent, 36° Indexing, Stops	250MA @ 28VDC	4,000 Switching Operations, Per Position	.05 Maximum	Knob Adjust
	▶ 87-31-XX	.500	Positive Detent, 36° Indexing, Stops	250MA @ 28 VDC	4,000 Switching Operations, Per Position	.05 Maximum	Bushing Panel Mounting
	97	.360	Positive Detent, 45° Indexing, Stops	250MA @ 28VDC	10,000Switching Operations, Per Position	.05 Maximum	Screwdriver Adjust

NUMBER OF POLES AND ACTIVE POSITIONS – MODEL 87

NUMBER OF POLES	ACTIVE POSITIONS	ACTIVE TERMINAL PIN NUMBERS	BASIC PART NUMBER
SINGLE-POLE	1	1 (ON–OFF)	87-XX-11
	2	1 and 2	87-XX-12
	3	1 thru 3	87-XX-13
	4	1 thru 4	87-XX-14
	5	1 thru 5	87-XX-15
	6	1 thru 6	87-XX-16
	7	1 thru 7	87-XX-17
	8	1 thru 8	87-XX-18
	9	1 thru 9	87-XX-19
	10	1 thru 10	87-XX-10

NUMBER OF POLES	ACTIVE POSITIONS	ACTIVE TERMINAL PIN NUMBERS	BASIC PART NUMBER
TWO-POLE	1	3 and 8 (ON–OFF)	87-XX-21
	2	2, 3, 7, and 8	87-XX-22
	3	2, 3, 4, 7, 8, and 9	87-XX-23
	4	1 thru 4, 6 thru 9	87-XX-24
	5	1 thru 10	87-XX-25
THREE-POLE	1	1, 4, and 8 (ON–OFF)	87-XX-31
	2	1, 2, 4, 5, 8, and 9	87-XX-32
	3	1 thru 6, 8 thru 10	87-XX-33

TYPICAL SWITCH APPLICATIONS

● Logic switching. ● Internal switching device for optional equipment add-ons. ● Test point switching. ● Adapting main-frame computers to peripheral equipment. ● Standardizing printed circuit boards. ● Selecting operational voltages. ● Selecting calibration resistors.

MULTIDIALS

All units shown 1/3 actual size.

	MODEL NO.	NOMINAL DIA. (INCHES)	NUMBER OF TURNS	MINOR SCALE DIVISION	SHAFT BORE ■ (INCHES)	FINISH ■
	▶ 11-1-11	1.000	11	1/50 Turn	.250	Satin Chrome
	▶ 15-1-11	H 1.750 W 1.000	10 (3 Digit)	1/500 Turn	.250	Satin Chrome
	▶ 15-2-11	H 1.750 W 1.000	100 (4 Digit)	1/500 Turn	.250	Satin Chrome
	▶ 16-1-11	.875	15	1/50 Turn	.250	Clear Anodized
	▶ 21-1-11	1.812	15	1/100 Turn	.250	Satin Chrome

▶ DISTRIBUTOR AUTHORIZED STOCKING ITEM

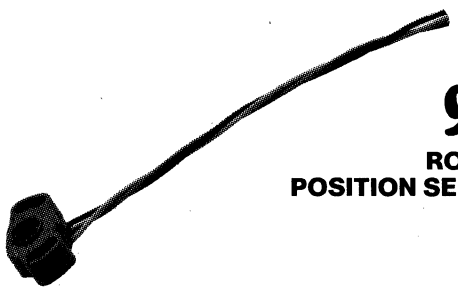
■ OTHER SHAFT BORE SIZES AND FINISHES AVAILABLE

Spectrol

MOTION AND POSITION SENSORS

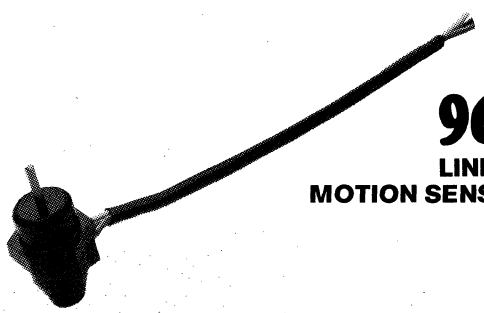
New Product

SPECIFICATIONS:



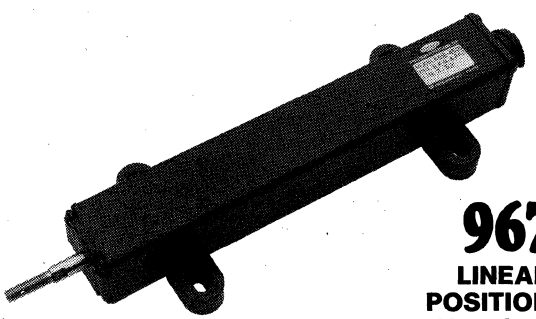
961
ROTARY POSITION SENSOR

Total Resistance
5K ohm ±20%
Linearity (Independent)
±2% over electrical angle
Active Electrical Angle
85° ±2°
Power Rating
1 Watt @ 40°C derated to zero at 135°C
Mechanical Rotation
120° ±5° rotor spring return to ccw stop
Nominal Size
1.600 long X .540 wide



962
LINEAR MOTION SENSOR

Total Resistance
10K ohm ±20%
Linearity (Independent)
±3%
Electrical Travel
.405 ±.015
Power Rating
1 Watt @ 40°C derated to zero at 135°C
Mechanical Travel
.425 ±.015 shaft spring return to extended position
Nominal Size
2.432 long X 1.250 hex



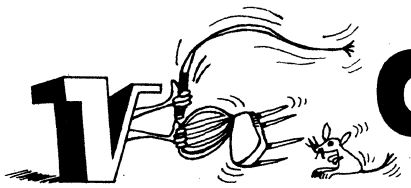
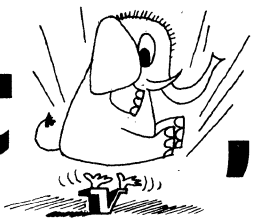
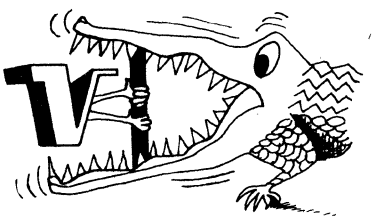
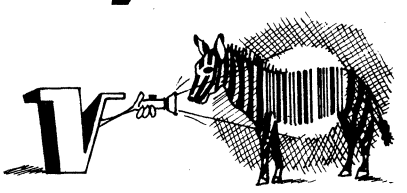
967
LINEAR POSITION TRANSDUCER

Total Resistance Range
See Table
Linearity (Independent)
±0.5% std.
Resistance Tolerance
±20% Std., ±10% available
Power Rating
0.4 Watts/cm of travel @ 40°C to 0.1 Watt/cm @ 125°C

Complete with connector and mounting clamps

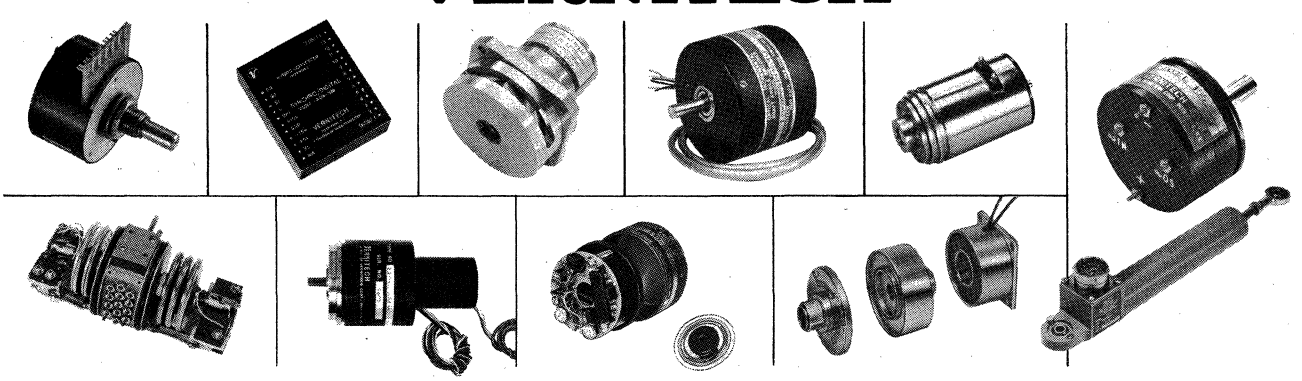
Model 967-	-H10	-H15	-H20	-H25	-H30	-H35	-H40
Electrical Stroke in. ±.030 (mm)	3.940 (100)	5.905 (150)	7.875 (200)	9.840 (250)	11.810 (300)	13.780 (350)	15.750 (400)
Mechanical Stroke in. ±.030 (mm)	4.015 (102)	5.985 (152)	7.950 (202)	9.920 (252)	11.890 (302)	13.860 (352)	15.825 (402)
Body Length "L" in. (mm)	6.575 (167)	8.545 (217)	10.510 (267)	12.480 (317)	14.450 (367)	16.420 (417)	18.385 (467)
Resistance STD	5K	7,5K	10K	12,5K	15K	17,5K	20K

If you want to move it, control it, sense it, stop it, or scan it, call Vernitech.

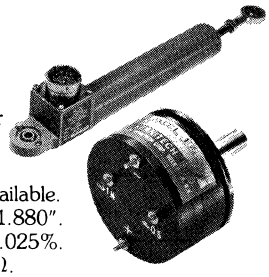
That is, if you're looking for instrument motors, optical and contacting shaft angle encoders, rotary and linear potentiometers, potentiometric pressure transducers, industrial precision brakes or clutches, or laser scanning motors, we'll probably have just what you're looking for. Just look on the opposite page. And if you *don't* find what you want, call Vernitech, give us the particulars, and we'll make it for you.

VERNITECH



VERNITECH, a division of Vernitron Corp., 300 Marcus Blvd., Deer Park, NY 11729 • 516-586-5100 • TWX 510-227-6089

POTENTIOMETERS



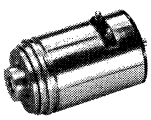
employing Vernitech's unique conductive film and precious metal wipers... respond to wiper motions as small as .000005".

Rotary Single Turn
Linear, non-linear, sine/cosine available.
Sizes 0.5", L 0.5" to Dia 5.0", L 1.880".
Linearity or conformity ±2% to 0.025%.
Resistance range 1KΩ to −250KΩ.

Rotary Multi-Turn
10 to 100 turns available.
Sizes Dia 0.5", L 1.5" to Dia 2.0", L 2.625".
Linearity or conformity ±0.5% to 0.015%.
Resistance range 1KΩ to 500KΩ.

Linear Motion
Electrical stroke lengths 1" to 60".
Linearity or conformity ±0.2% to 0.01%.
Resistance range 250Ω/in to 250KΩ/in.

CLUTCHES AND BRAKES
(electromagnetic)



hundreds of models and sizes available from stock.

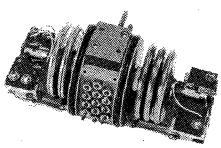
Precision Instrument Type
Sizes 5, 8, 11, 13, 15, and 18.
Standard length and wafer types. Spring and magnetic.
Meet MIL-E-5272C. Zero backlash.
Torque 5 to 150 oz. in. Response time 5 to 142 ms.

Industrial Types — open frame
Sizes 8, 12, 17, 22, 26. Torque to 75 in. lb.
Response time 6-30 ms at rated voltage.

Industrial Types — enclosed frame
Hybrid or special units designed for particular applications when MIL-SPECS and close tolerances are not essential, but where having a complete "self-contained" unit is desirable: cassette tape decks, analog devices actuators, etc.

Fail Safe
Braking action occurs 10 ms after coil is de-energized or power fails. Sizes 8, 17, 30, and 45.
Torque up to 50 in. lb. Zero backlash. Adjustable to compensate for wear.

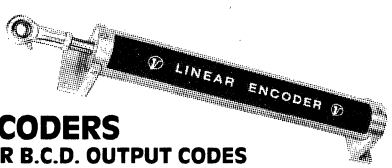
PRESSURE TRANSDUCERS
potentiometer type,



featuring infinite resolution, long life, and high reliability through the use of conductive film resistance elements, multiple wipers, and direct coupling of pressure sensing element to potentiometer wipers.

Pressure ranges from 0.1 to 10,000 psi in gage, absolute and differential types.

Linearity to ±0.3%. Air speed, altitude and low cost types available.



LINEAR ENCODERS
BINARY, GRAY OR B.C.D. OUTPUT CODES
1", 2", 4", 8", 12", 24", 36" and 48" STROKE LENGTHS
RESOLUTIONS TO 12 BITS.

VERNITECH

MOTORS

Over 1500 Standard Designs or Custom Designed to your requirements.

Synchronous — for laser scanning
Sizes 5, 8, 11, 15, 18, 20, 25, 35.
Speeds 100 to 48,000 rpm.
5 through 1600 Hz. 2, 4, 8, 12 poles.

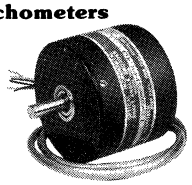
Servo
Viscous damped — sizes 8, 10, 11, 15, 18.
Speeds 3000 to 10,000 rpm.
Inertially damped — sizes 8, 11, 15, 18.
Speeds 3000 to 9500 rpm.

Stepper
Sizes 5, 8, 11, 15. Stepping angles 7.5°, 15°, 45°, 90°.
Stepping rates 100, 110, 125, 130, 175, 180, 225, 240, 260, 400, 725, 800, 1000 pps.

Precision Motor Generators Sizes 8, 10, 11, 15, 18, 23.

Integrating and Computer Motor Tachometers
Sizes 8, 10, 11, 15, 18, 23.

SHAFT ANGLE ENCODERS



featuring precision chrome on glass discs for highest accuracy.

Optical Incremental
VOE 005 — Dia. 0.500", 0.510" L. To 256 pulses (modular)
VOE 05 — Dia. 0.500", 0.820" L. To 256 pulses
VOE 11 — Dia. 1.062", L. 1.80". To 1024 pulses
VOE 015 — Dia. 1.510", L. 0.88". To 1024 pulses (modular)
VOE M15 "Dial Coder" — panel mounted, 1.500" dia., L. 1.08" 127-256 pulses
VOE 023 — Dia. 2.25", L. 80". To 1250 pulses (modular)
VOE 23 — Dia. 2.250", L. 1.875". To 1250 pulses (available sealed)
VOE L23 "Thrift-Line" Dia. 2.250" L. 1.875". To 600 pulses
VOE 25 — Dia. 2.500", L. 2.500". To 3000 pulses (available sealed)

Optical Absolute
VOE 23: Binary, Gray or BCD to 512 counts per turn. Counting speed: 3000 rpm.
VOE 30: Single or multi-turn; Binary, Gray or BCD. To 1024 counts per turn. Max count (2^{19}) in 512 turns. Counting Speed: 30KHz.

Contacting Absolute
Sizes 11, 18, 23, & 31. Binary, Gray, and BCD. Single or multi-turn. Max count (2^{19}) in 2048 turns. 64 to 1024 counts per turn. Operating speed 200 rpm max.

SYNCHRO CONVERTER MODULES

Tracking Synchro-to-Digital and Resolver-to-Digital Converters
Economy Series VSD/VRD. Precision Series VSDH/VRDH
Compact, solid state, high performance converters employing type 11 servo loops for lag free tracking at rates to 3600°/sec. Resolution 10 bits, 12 bits, or 14 bits.

Digital-to-Synchro and Digital-to-Resolver Converters Series VDS/VDR:Accept shaft angle data in digital form for conversion to analog at accuracies up to ±4'.

Tracking Synchro-to-Linear DC Converter Module
Series VSDCH/VRDCH:Accept 3-wire synchro or 4-wire resolver input data, convert it to DC analog voltage proportional to synchro angle of input. Accuracy ±6' (typ.).

Tracking Angle Position Indicator
VNST-104: Tracking Synchro-to-Digital Converter, can also be used as a control element. Four decade 0.8" red LED display. Display accuracy ±6' arc (typical). Tracking rate 3600°/sec max. Parallel binary or BDC output. Self contained line operated power supply.

Custom designs available to your specifications.

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K
kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L
LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microforad
MHz megahertz
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOSIGT metal-oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM nuclear instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLL phased lock loop
PPI plan position indicator
PROM programmable read only memory
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

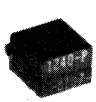
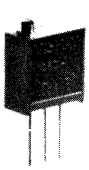
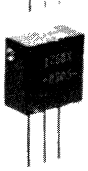
Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

VISHAY RESISTIVE SYSTEMS GROUP

TRIMMERS

Precision Trimming Potentiometers

	Model Number	Resistance (Ohms)	Tolerance	Power	No. of Adj. Turns	Nominal Dimensions (Excluding Leads) H x L x W Inch (mm) and Termination Styles	Load-Life Stability (Max.ΔR)[2]	TCR (End-to-End)[3]
	1202* (RJ12 Style)	2, 5, 10 20, 50, 100, 200, 500, 1K 2K, 5K, 10K, 20K	±10%, ±20%, ±5%, ±10%	0.5W @ 85°C	25 ±2	0.325 x 1.250 x 0.195 (8.255) x (31.750) x (4.953) Type P: In-line pins Type Y: Staggered pins Type L: Flexible leads Type LB: Panel-mount with flexible leads	0.5% 2,000 hrs. @ 85°C	-55°C to +25°C +10ppm/°C +25°C to +150°C -10ppm/°C
	1208	20, 50, 100 200, 250, 500 1K, 2K, 5K, 10K	±20% ±10%				1.0% 2,000 hrs. @ 85°C	-55°C to +25°C +20ppm/°C +25°C to +150°C -20ppm/°C
	1240* (RJR26 Style)	5, 10 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K,	±10% ±5%	0.25W @ 85°C	21 ±2	0.250 x 0.250 x 0.175 (6.350) x (6.350) x (4.445) Type X: Edge-mount, side-adjust Type W: Edge-mount, top-adjust 0.175 x 0.250 x 0.250 (4.445) x (6.350) x (6.350) Type P: Flat-mount, side adjust	1.0% 10,000 hrs. @ 85°C	-55°C to +25°C +10ppm/°C +25°C to +150°C -10ppm/°C
	1242† (RJ26)	50, 100, 200, 500, 1K, 2K 5K	±10%				1.0% 1,000 hrs. @ 85°C	-55°C to +25°C +10ppm/°C +25°C to +150°C -10ppm/°C
	**1248**	20, 50, 100, 200, 500, 1K, 2K, 5K	±10%				1.0% 1,000 hrs. @ 85°C	-55°C to +25°C +20ppm/°C +25°C to +150°C -20ppm/°C
	**1260***	5, 10, 20, 50, 100, 200, 500 1K, 2K, 5K, 10K	±10% ±5%	0.25W @ 85°C	21 ±2	0.420 x 0.375 x 0.170 (10.67) x (9.53) x (4.32) Type W: Edge-mount, top-adjust Type X: Edge-mount, side adjust	1.0% 10,000 hrs. @ 85°C	-55°C to +25°C +10ppm/°C +25°C to +150°C -10ppm/°C
	**1268**	20, 50, 100 200, 500, 1K, 2K, 5K	±10%				1.0% 1,000 hrs. @ 85°C	-55°C to +25°C +20ppm/°C +25°C to +150°C -20ppm/°C
	1280*	10, 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K	±10%	0.75W @ 25°C	26 ±2	0.270 x 0.750 x 0.190 (6.86) x (19.05) x (4.83) (Panel mount available)	0.5% 2,000 hrs. @ 25°C	-55°C to +25°C +15ppm/°C +25°C to +125°C -15ppm/°C
	1285*	10 20, 50 100, 200, 500 1K, 2K, 5K, 10K, 20K	±10% ±5%	0.75W @ 25°C	26 ±2	0.270 x 0.750 x 0.190 (8.86) x (19.06) x (4.83) (Panel mount available)	0.5% 2,000 hrs. @ 25°C	-55°C to +25°C +5ppm/°C +25°C to +125°C -5ppm/°C

* Screening for low noise (CRV) is available.
† Qualified to MIL-R-22097

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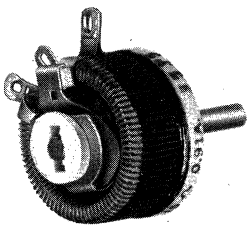
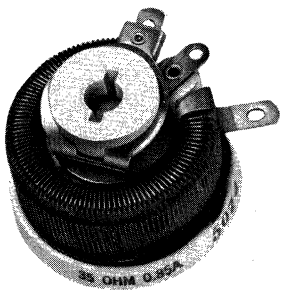
VISHAY-ANGSTROHM

Vitreous Enameled Power Rheostats

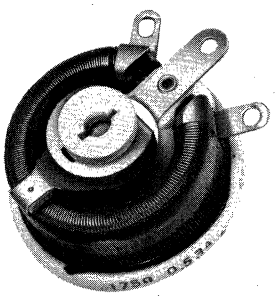
TYPE MP06 12.5 WATT



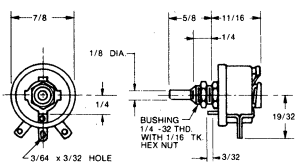
TYPE MP10 25 WATT



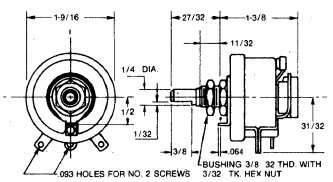
TYPE MP15 50 WATT



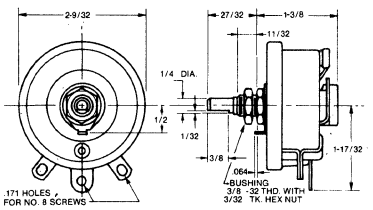
DIMENSIONS



Diameter 7/8" . . . Depth behind panel 11/16" . . . Shaft 1/8" diameter . . . Rotation 300°, ±5°. Mounts on panels up to 1/8" by means of 1/4"-32 bushing and hex nut . . . Non-turn lugs require 1/8" hole 1/4" below center of shaft (Type "A" shaft). WEIGHT: .037 lb., 17 Gms.



Diameter 1 9/16" . . . Depth behind panel 1 3/8" . . . Shaft 1/4" diameter . . . Rotation 300°, ±5°. Mounts on panels up to 1/4" by means of 3/8"-32 bushing and hex nut . . . Non-turn lugs require 3/16" hole 1/2" below center of shaft. (Type "A" shaft). WEIGHT: .180 lb., 82 Gms.



Diameter 2 9/32". . . Depth behind panel 1 3/8 . . . Shaft 1/4" diameter . . . Rotation 300°, ±5°. Mounts on panels up to 1/4" by means of 3/8"-32 bushing and hex nut . . . Non-turn lugs require 3/16" hole 1/2" below center of shaft. (Type "A" shaft). WEIGHT: .321 lb., 145 Gms.

RESISTANCE VALUES

Total Ohms	Max. Amps.	Approx. Steps	Total Ohms	Max. Amps	Approx. Steps	Total Ohms	Max. Amps	Approx. Steps
1.0	3.53	29	1.0	5.00	28	0.5	10.00	24
2.0	2.50	42	2.0	3.54	31	1.0	7.07	46
2.5	2.24	38	3.0	2.89	48	2.0	5.00	50
3.0	2.04	44	6.0	2.04	51	4.0	3.54	44
5.0	1.58	40	8.0	1.77	54	6.0	2.89	74
6.0	1.44	48	10	1.58	54	8.0	2.50	85
8.0	1.25	51	15	1.29	64	12	2.04	108
10	1.12	51	25	1.00	86	16	1.76	108
15	0.91	51	35	0.85	105	22	1.50	123
25	0.71	73	50	0.71	115	35	1.19	148
35	0.60	75	75	0.58	135	50	1.00	113
50	0.50	86	100	0.50	152	80	0.79	147
75	0.41	103	125	0.45	143	125	0.63	178
100	0.35	108	175	0.38	160	150	0.58	173
125	0.32	128	250	0.32	185	225	0.47	203
150	0.29	128	350	0.27	205	300	0.41	214
175	0.27	148	500	0.22	230	500	0.32	290
200	0.25	130	750	0.18	270	800	0.25	365
250	0.22	166	1000	0.16	292	1000	0.22	358
350	0.19	185	1500	0.13	353	1600	0.18	367
500	0.16	215	2500	0.10	358	2500	0.14	460
750	0.13	255	3500	0.08	392	3500	0.12	505
1000	0.11	260	5000	0.07	440	5000	0.10	565
1500	0.091	310				8000	0.08	695
2500	0.071	321				10000	0.07	693
3500	0.060	378						
5000	0.050	430						

All other intermediate resistance values are available and can be manufactured on normal delivery cycle.

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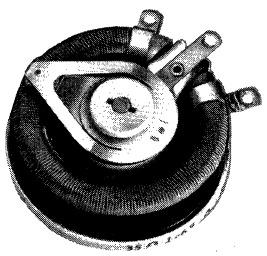
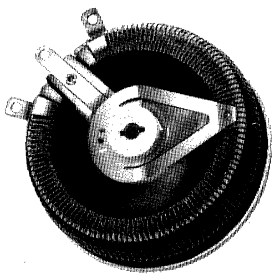
VISHAY-ANGSTROHM

Angstrohm's broad line of vitreous enameled power rheostats is designed to provide exceptional reliability through the application of the most modern manufacturing techniques and sophisticated materials. These same techniques have resulted in a line of power rheostats that feature a very compact size for their dissipation rating. Furthermore, many standard value rheostats are available for off-the-shelf delivery while special devices are available with short delivery cycles. Rheostats are also available in tapered windings, in tandem assemblies, with off positions and with special shaft assemblies.

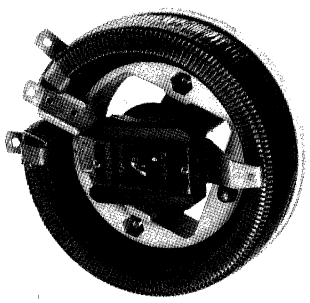
TYPE MP25 100 WATT



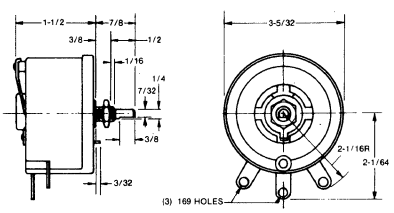
TYPE MP30 150 WATT



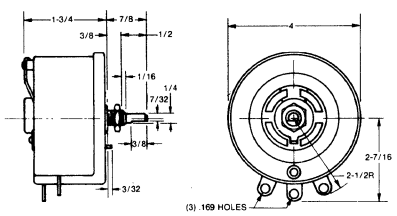
TYPE MP40 300 WATT



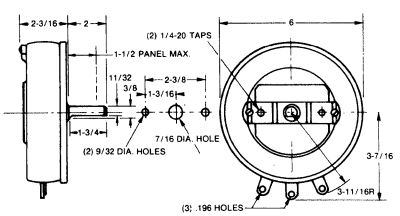
DIMENSIONS



Diameter 3 5/32". . . Depth behind panel 1 1/2" . . .Shaft 1/4" diameter . . . Rotation 300°, ±5°. . . Mounts on panels up to 1/4" by means of 3/8"-32 bushing and hex nut . . . Non-turn lugs require a 3/16" hole 1/2" below center of shaft. (Type "A" shaft) WEIGHT: .594 lbs., 268 Gms.



Diameter 4" . . . Depth behind panel 1 3/4" . . . Shaft 1/4" diameter . . . Rotation 300°, ±5°. . . Mounts on panels up to 1/4" by means of 3/8"-32 bushing and hex nut . . . Non-turn lugs require a 3/16" hole 1/2" below center of shaft. (Type "A" shaft) WEIGHT: 1.014 lbs., 460 Gms.



Diameter 6". . . Depth behind panel 2 3/16". . . Shaft 3/8" diameter . . . Rotation 315°, ±5°. . . Mounts on panels up to 1 1/4" by means of mounting bracket with two 1/4"-20 flat head screws. (Type "A" shaft) WEIGHT: 2.625 lbs., 1.191 Kg.

RESISTANCE VALUES

Total Ohms	Max. Amps.	Approx. Steps	Total Ohms	Max. Amps	Approx. Steps	Total Ohms	Max. Amps	Approx. Steps
.5	14.140	30	.5	17.350	35			
1	10.000	30	1	12.247	39	1	17.320	40
2	7.071	56	2	8.660	39	1.5	14.142	58
3	5.774	66	3	7.071	70	2	12.247	78
5	4.472	56	5	5.477	73	2.5	10.954	78
7.5	3.652	66	7.5	4.472	70	3	10.000	73
10	3.162	104	10	3.873	70	4	8.660	78
15	2.582	113	15	3.162	120	5	7.745	78
25	2.000	144	25	2.449	152	7.5	6.324	148
50	1.414	180	50	1.732	190	10	5.477	154
75	1.155	180	75	1.414	228	15	4.472	147
100	1.000	216	100	1.225	228	25	3.464	155
200	.707	252	200	.866	265	35	2.927	231
300	.577	252	300	.707	303	50	2.449	267
400	.500	252	400	.612	342	75	2.000	308
500	.447	324	500	.548	342	100	1.732	326
750	.365	396	750	.447	418	150	1.414	270
1000	.316	410	1000	.387	432	200	1.224	308
2000	.224	410	2000	.274	575	300	1.000	340
2500	.200	410	2500	.244	456	400	.866	370
5000	.141	685	5000	.173	865	500	.774	455
7500	.115	820	7500	.141	1000	750	.632	514
10000	.100	820	10000	.122	1000	1000	.547	578
—	—	—	—	—	—	1500	.447	675
—	—	—	—	—	—	2500	.346	720

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A DIVISION OF VERNITRON CORPORATION

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100

½" Round Wirewound Single-Turn Trimmer
Power rating: 1W @ 70°C
Standard resistance range: 20Ω to 20KΩ
Resistance tolerance: ±5% std.
Temperature coefficient: ±50ppm/°C max.
Noise during adjustment: 100Ω max.
End resistance: 1Ω or 2% (W.I.G.)
Dielectric strength: 1500VAC
Insulation resistance: 1000MΩ
Absolute minimum resistance: .25% or 1Ω (W.I.G.)

150

½" Round Cermet Single-Turn Trimmer
Power rating: 0.75W @ 85°C (300V max.)
Standard resistance range: 50Ω to 2MΩ
Resistance tolerance: ±10% std.
Temperature coefficient: ±100ppm/°C max.
(±50ppm/°C available — consult factory)
Contact resistance variation: 20Ω or 3% (W.I.G.)
End resistance: 5Ω max. or 2% (W.I.G.)
Dielectric strength: 1500VAC
Insulation resistance: 1000MΩ
Absolute minimum resistance: 1Ω or .25% (W.I.G.)

170

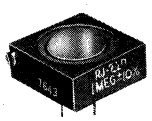
¼" Round Cermet Single-Turn Trimmer
Power rating: 0.5W @ 85° (300V max.)
Standard resistance range: 10Ω to 2 MΩ
Resistance tolerance: ±10% 100Ω to 2MΩ
(±20% below 100Ω)
Temperature coefficient: ±100ppm/°C max.
(±50ppm/°C available — consult factory)
Contact resistance variation: 3Ω or 3% (W.I.G.)
End resistance: 2Ω max. or 2% (W.I.G.)
Dielectric strength: 400VAC
Insulation resistance: 100MΩ
Absolute minimum resistance: 2Ω or 1% (W.I.G.)

180

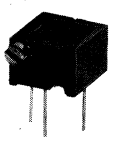
¼" Square Cermet Single-Turn Trimmer
Power rating: 0.5W @ 85°C (300V max.)
Standard resistance range: 10Ω to 2MΩ
Resistance tolerance: ±10% 100Ω to 2MΩ
(±20% below 100Ω)
Temperature coefficient: ±100ppm/°C max.
(±50ppm/°C available — consult factory)
Contact resistance variation: 3Ω or 3% (W.I.G.)
End resistance: 2Ω or 2% (W.I.G.)
Dielectric strength: 900VAC
Insulation resistance: 1000MΩ
Absolute minimum resistance: 2Ω or 1% (W.I.G.)

205

½" Square Wirewound Multi-Turn Trimmer
Power rating: 1W @ 70°C
Standard resistance range: 10Ω to 20KΩ
Resistance tolerance: ±5% std.
Temperature coefficient: ±50ppm/°C max.
Noise during adjustment: 100Ω max.
End resistance: 2Ω max. or 2% (W.I.G.)
Dielectric strength: 1000VAC
Insulation resistance: 1000MΩ
Absolute minimum resistance: 1% or 1Ω (W.I.G.)

255


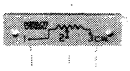
½" Square Cermet Multi-Turn Trimmer
Power rating: 1.0W @ 70°C
Standard resistance range: 20Ω to 2MΩ
Resistance tolerance: ±10% std.
Temperature coefficient: ±100ppm/°C max.
(±50ppm/°C available — consult factory)
Contact resistance variation: 3Ω or 3% (W.I.G.)
End resistance: 2Ω or 2% (W.I.G.)
Dielectric strength: 900VAC
Insulation resistance: 1000MΩ
Absolute minimum resistance: 1Ω or 3% (W.I.G.)

260


¼" Square Cermet Multi-Turn Trimmer
Power rating: ¼W at 70°C derate to zero at 125°C
Standard resistance range: 10Ω to 1MΩ
Resistance tolerance: ±10% standard
Temperature coefficient of resistance of potentiometer:
±100 ppm/°C (±50 ppm/°C available consult factory)
Contact resistance variation: 3Ω or 3% (W.I.G.)
Insulation resistance: 1000 meg ohms at 500VDC
Dielectric strength: 900VAC

400

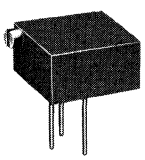
1¼" Rectangular Wirewound Multi-Turn Trimmer
Power rating: 1W @ 70°C
Standard resistance range: 10Ω to 20KΩ
Resistance tolerance: ±5% std.
Temperature coefficient: ±50ppm/°C max.
Noise during adjustment: 100Ω max.
End resistance: 1Ω or 2% (W.I.G.)
Dielectric strength: 900VAC
Insulation resistance: 1000MΩ
Absolute minimum resistance: 1Ω or .25% (W.I.G.)

450


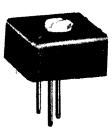
1¼" Rectangular Cermet Multi-Turn Trimmer
Power rating: 1W @ 70°C (300V max.)
Standard resistance range: 10Ω to 2MΩ
Resistance tolerance: ±10% std.
Temperature coefficient: ±100ppm/°C max.
(±50ppm/°C available — consult factory)
Contact resistance variation: 3Ω or 3% (W.I.G.)
End resistance: 2Ω or 2% (W.I.G.)
Dielectric strength: 900VAC
Insulation resistance: 1000MΩ
Absolute minimum resistance: 2Ω max.

700

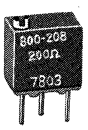
⅜" Square Wirewound Multi-Turn Trimmer
Power rating: 0.75W @ 70°C
Standard resistance range: 10Ω to 20KΩ
Resistance tolerance: ±5% std.
Temperature coefficient: ±50ppm/°C max.
Noise during adjustment: 100Ω max.
End resistance: 1Ω or 2% (W.I.G.)
Dielectric strength: 1000VAC
Insulation resistance: 1000MΩ
Absolute minimum resistance: 1Ω or 0.25% (W.I.G.)

752


⅜" Square Cermet Multi-Turn Trimmer
Power rating: 0.5W @ 85°C (300V max.)
Standard resistance range: 20Ω to 2MΩ
Resistance tolerance: ±10% 100Ω to 2MΩ
(±20% below 100Ω)
Temperature coefficient: ±100ppm/°C max.
Contact resistance variation: 3Ω or 3% (W.I.G.)
End resistance: 2Ω or 2% (W.I.G.)
Dielectric strength: 900VAC
Insulation resistance: 1000MΩ min.
Absolute minimum resistance: 1Ω

780


⅜" Square Cermet Single-Turn Trimmer
Power rating: 0.5W @ 85°C (300V max.)
Standard resistance range: 10Ω to 2MΩ
Resistance tolerance: ±10% 100Ω to 2MΩ
(±20% below 100Ω)
Temperature coefficient: ±100ppm/°C max.
(±50ppm/°C available — consult factory)
Contact resistance variation: 3Ω or 3% (W.I.G.)
End resistance: 2Ω or 2% (W.I.G.)
Dielectric strength: 900VAC
Insulation resistance: 1000MΩ
Absolute minimum resistance: 2Ω max.

800


5/16" Square Wirewound Multi-Turn Trimmer
Power rating: 0.6W @ 70°C
Standard resistance range: 10Ω to 20KΩ
Resistance tolerance: ±5% std.
Temperature coefficient: ±50ppm/°C max.
Noise during adjustment: 100Ω max.
End resistance: 1Ω or 2% (W.I.G.)
Dielectric strength: 900VAC
Insulation resistance: 1000MΩ
Absolute minimum resistance: 1Ω or 0.25% (W.I.G.)

850

5/16" Square Cermet Multi-Turn Trimmer
Power rating: 0.3W @ 70°C (300V max.)
Standard resistance range: 20Ω to 2MΩ
Resistance tolerance: ±10% std.
Temperature coefficient: ±100ppm/°C max.
(±50ppm/°C available — consult factory)
Contact resistance variation: 3Ω or 3% (W.I.G.)
End resistance: 2Ω max. or 2% (W.I.G.)
Dielectric strength: 900VAC
Insulation resistance: 1000MΩ
Absolute minimum resistance: 1Ω

910

¾" Rectangular Wirewound Multi-Turn Trimmer
Power rating: 1W 40°C
Standard resistance range: 10Ω to 20KΩ
Resistance tolerance: ±10% std.
Temperature coefficient: ±50 ppm/°C nominal
Noise during adjustment: 100Ω max.
End resistance: 1Ω or 2% (W.I.G.)
Dielectric strength: 1000VAC
Insulation resistance: 100MΩ
Absolute minimum resistance: 1Ω or .5% (W.I.G.)

960

¾" Rectangular Cermet Multi-Turn Trimmer
Power rating: 0.75W @ 70°C (300V max.)
Standard resistance range: 10Ω to 2MΩ
Resistance tolerance: ±10% std.
Temperature coefficient: ±100ppm/°C max.
(±50ppm/°C available — consult factory)
Contact resistance variation: 3Ω or 3% (W.I.G.)
End resistance: 2Ω or 2% (W.I.G.)
Dielectric strength: 1000VAC
Insulation resistance: 1000MΩ
Absolute minimum resistance: 1Ω or 3% (W.I.G.)

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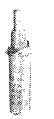
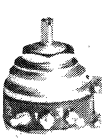
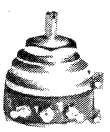
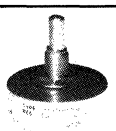
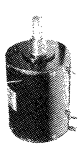
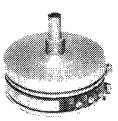
PRECISION POTENTIOMETERS

MODEL	DESCRIPTION
5001	**½" Diameter Single-Turn Wirewound** **Power rating:** 2W @ 40°C **Standard resistance range:** 10Ω to 50KΩ **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±5% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 320° ±5°
 **5000**	**½" Diameter Multi-Turn Wirewound** **Power rating:** @ 40°C 1W (5000) 1.5W (5005) **Standard resistance range:** 100Ω to 100KΩ (5000) 50Ω to 50KΩ (5005) **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% std. (closer upon request) **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 125°C **Mechanical rotation:** 3600° +6° −0 (5000) 1800° +6° −0 (5005) **Electrical rotation:** Same as mechanical
7501	**¾" Diameter Single-Turn Wirewound** **Power rating:** 2.25W @ 40°C **Standard resistance range:** 50Ω to 50KΩ **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±1% **Noise (ENR):** 100Ω max. **Operating temperature range:** −55 to 125°C **Mechanical rotation:** Continuous **Electrical rotation:** 320° ±5°
7561	**¾" Single-Turn Conductive Plastic** **Power rating:** 1W @ 70°C **Standard resistance range:** 100Ω to 200KΩ **Resistance tolerance:** ±20% **Temperature coefficient:** ±500ppm/°C **Linearity (Ind.):** ±1% std. (closer available) **Output smoothness:** .5% std. **Operating temperature range:** −65 to 125°C **Mechanical rotation:** Continuous **Electrical rotation:** 340° ±5°
7400/ 7500	**¾" Diameter Multi-Turn Wirewound** **Power rating:** @ 40°C 3W (7400) 2W (7405) **Standard resistance range:** 100Ω to 100KΩ (7400) 100Ω to 50KΩ (7405) **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** .25% (7400) .5% (7405) **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 125°C **Mechanical rotation:** 3600° +6° −0 (7400) 1800° +6° −0 (7405) **Electrical rotation:** Same as mechanical
 **0871**	**⅞" Diameter Single-Turn Wirewound** **Power rating:** 1.25W @ 70°C **Standard resistance range:** 100Ω to 10KΩ **Resistance tolerance:** ±3% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±2°
8400/ 8500	**⅞" Diameter Multi-Turn Wirewound** **Power rating:** @ 40°C 3W (8400/8500) 2W (8403-05/8503-05) **Standard resistance range:** 100Ω to 100KΩ (8400/8500) 50Ω to 50KΩ (8403-05/8503-05) **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.25% (8400/8500) ±.5% (8403-05/8503-05) **Noise (ENR):** 100Ω max. **Operating temperature range:** −55 to 125°C **Mechanical rotation:** 3600° +10° −0 (8400/8500) 1800° +10° −0 (8405-8505); 1080° +10° −0 (8403/8503) **Electrical rotation:** Same as mechanical

Most singleturn models are available with cermet or conductive plastic elements. All styles are supplied with linear taper as standard. Many are available with non-linear tapers. All styles are available in a bushing mount. Many are available in a servo mount option.

MODEL	DESCRIPTION
7800	**⅞" Diameter Multi-Turn Wirewound** **Power rating:** 2W @ 40°C **Standard resistance range:** 100Ω to 50KΩ **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.25% **Noise (ENR):** 100Ω max. **Operating temperature range:** −55 to 105°C **Mechanical rotation:** 3600° +10° −0 **Electrical rotation:** Same as mechanical
1000/ 1220	**1" Diameter Multi-Turn Wirewound** **Power rating:** @ 40°C 3W (1000) 2W (1005) 4W (1215) 5W (1220) **Standard resistance range:** 500Ω to 250KΩ (1000) 250Ω to 100KΩ (1005) 500Ω to 450KΩ (1215) 1KΩ to 600KΩ (1220) **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% (1000/1005) ±.1% (1215/1220) **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 125°C **Mechanical rotation:** 3600° +4° −0 (1000) 1800° +4° −0 (1005) 5400° +4° −0 (1215) 7200° +4° −0 (1220) **Electrical rotation:** Same as mechanical
 **1061**	**1 1/16" Diameter Single-Turn Wirewound** **Power rating:** 1.5W @ 40°C **Standard resistance range:** 50Ω to 50KΩ **Resistance tolerance:** ±3% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±2°
1441	**1 7/16" Diameter Single-Turn Wirewound** **Power rating:** 2W @ 40°C **Standard resistance range:** 100Ω to 40KΩ **Resistance tolerance:** ±3% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±2°
 **151**	**1½" Diameter Single-Turn Wirewound** **Power rating:** 3.5W @ 40°C **Standard resistance range:** 100Ω to 100KΩ **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±5°
 **HD150**	**1½" Diameter Multi-Turn Wirewound** **Power rating:** @ 40°C 5W (HD150) 3W (HD153) 4W (HD155) **Standard resistance range:** 500Ω to 500KΩ (HD150) 200Ω to 250KΩ (HD153) 200Ω to 500KΩ (HD155) **Resistance tolerance:** ±3% (HD150) ±5% (HD153/155) **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.25% (HD150) ±.5% (HD153/155) **Noise (ENR):** 100Ω max. **Operating temperature range:** −55 to 100°C **Mechanical rotation:** 3600° +4° −0 (HD150) 1080° +4° −0 (HD153) 1800° +4° −0 (HD155) **Electrical rotation:** Same as mechanical
1751	**1¾" Diameter Single-Turn Wirewound** **Power rating:** 2.5W @ 40°C **Standard resistance range:** 50Ω to 50KΩ **Resistance tolerance:** ±3% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.25% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±2°
 **2000/ 3000**	**2" and 3" Diameter Single-Turn Wirewound** **Power rating:** @ 40°C 4W (2000) 6W (3000) **Standard resistance range:** 100Ω to 60KΩ (2000) 200Ω to 100KΩ (3000) **Resistance tolerance:** ±3% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.25% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±2°

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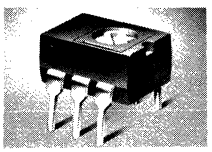
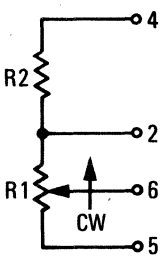
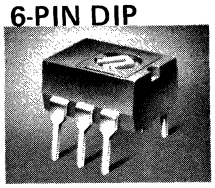
SERIES 0605A
6-PIN DIP

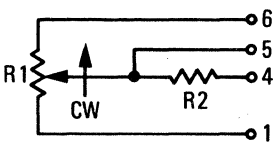




Model Numbers	Resistance Values (Ohms)			
	R1	R2	R3	R4
0605A-102-502	1K	4K	—	—
0605A-102-103	2K	8K	—	—
0605A-102-504	100K	400K	—	—
0605A-105-102	500	500	—	—
0605A-105-103	5K	5K	—	—
0605A-105-503	25K	25K	—	—
0605A-105-104	50K	50K	—	—
0605A-107-503	35K	15K	—	—
0605A-108-502	4K	1K	—	—
0605A-108-504	400K	100K	—	—
0605A-109-103	9K	1K	—	—
0605A-109-104	90K	10K	—	—

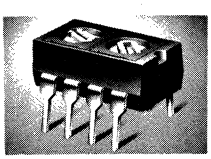
SERIES 0608A
6-PIN DIP

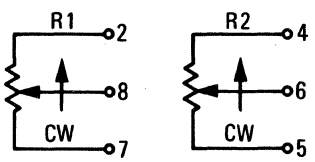




0608A-101-104	100K	100K	—	—
0608A-105-502	5K	25K	—	—
0608A-105-103	10K	50K	—	—

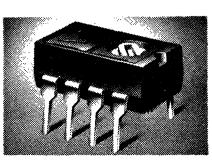
SERIES 0802B
8-PIN DIP

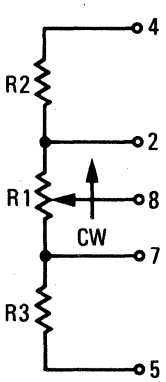




0802B-210-101	100	100	—	—
0802B-210-102	1K	1K	—	—
0802B-210-103	10K	10K	—	—
0802B-210-104	100K	100K	—	—
0802B-210-504	500K	500K	—	—
0802B-211-103	10K	20K	—	—
0802B-211-104	100K	200K	—	—
0802B-212-102	1K	10K	—	—
0802B-212-103	10K	100K	—	—

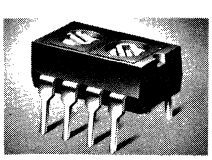
SERIES 0806B
8-PIN DIP

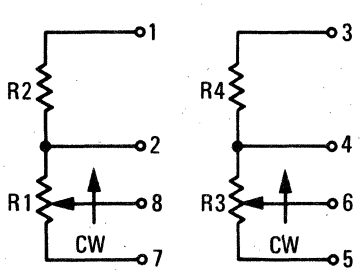




0806B-119-103	8K	1K	1K	—
0806B-127-503	25K	15K	10K	—
0806B-137-503	20K	15K	15K	—
0806B-137-504	200K	150K	150K	—
0806B-146-102	200	400	400	—
0806B-146-104	20K	40K	40K	—
0806B-145-103	1K	5K	4K	—
0806B-157-104	20K	30K	50K	—

SERIES 0825B
8-PIN DIP





0825B-201-502	500	4.5K	500	4.5K
0825B-201-503	5K	45K	5K	45K
0825B-203-503	15K	35K	15K	35K
0825B-207-502	3.5K	1.5K	3.5K	1.5K
0825B-207-103	7K	3K	7K	3K
0825B-207-503	35K	15K	35K	15K
0825B-209-104	90K	10K	90K	10K

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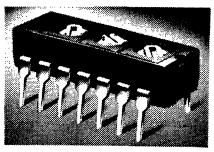
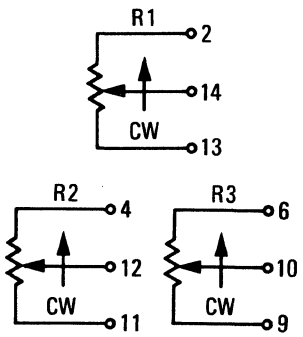
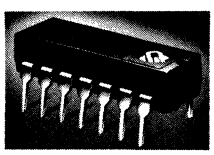
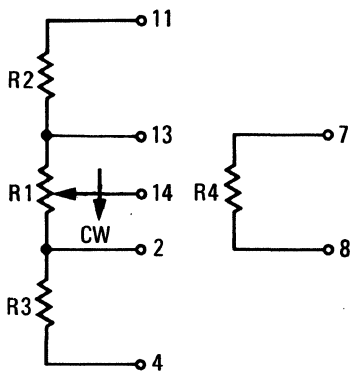
SERIES 1403C 14-PIN DIP



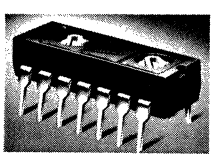


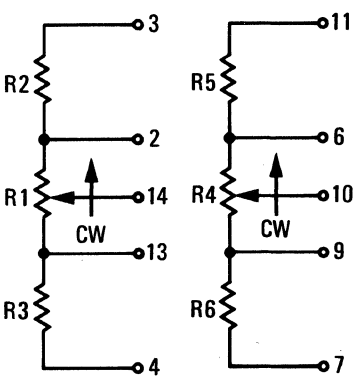
SERIES 1407C 14-PIN DIP



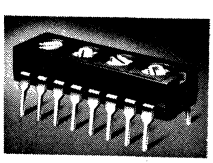


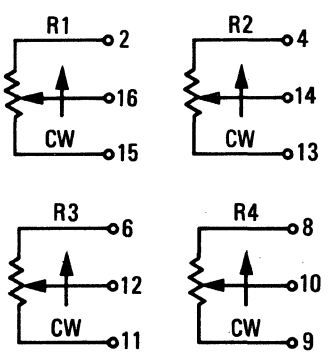
SERIES 1426C 14-PIN DIP





SERIES 1604D 16-PIN DIP





Model Numbers	Resistance Values (Ohms)					
	R1	R2	R3	R4	R5	R6
1403C-310-102	1K	1K	1K	—	—	—
1403C-310-103	10K	10K	10K	—	—	—
1403C-310-104	100K	100K	100K	—	—	—
1403C-312-103	10K	20K	20K	—	—	—
1403C-314-102	1K	10K	2K	—	—	—
1403C-314-103	10K	100K	20K	—	—	—
1407C-111-104	1.7K	90K	8.3K	7.6K	—	—
1407C-112-104	200	90K	9.8K	8.8K	—	—
1426C-237-503	20K	15K	15K	20K	15K	15K
1426C-245-103	1K	5K	4K	1K	5K	4K
1604D-410-101	100	100	100	100	—	—
1604D-410-102	1K	1K	1K	1K	—	—
1604D-410-103	10K	10K	10K	10K	—	—
1604D-410-104	100K	100K	100K	100K	—	—
1604D-410-504	500K	500K	500K	500K	—	—
1604D-419-103	10K	20K	20K	20K	—	—
1604D-420-103	10K	100K	20K	20K	—	—
1604D-423-103	10K	100K	10K	100K	—	—

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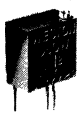
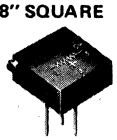
GENERAL PURPOSE WIREWOUND POTENTIOMETERS SQUARE, RECTANGULAR AND ROUND COMMERCIAL

SANGAMO WESTON
Schlumberger

	Model	Terminal Type	Turns	Size L W T	Stops	Power Rating (W)	Max. Oper. Temp. °C	T.C. ±PPM/°C	Res. Tol. %	Resistance Range
3/8" SQUARE	850P 850W 850X	P W X	22	.375 x .375 x .187	Wiper Idles	1 @ 50°C	125	100	10% (*)	10Ω - 2 Meg.
	Other Models Available. Consult Factory.									
1/4" SQUARE 	860W 860X	W X	16	.250 x .250 x .185	Wiper Idles	.5 @ 85°C	150	100	10% (*)	100Ω - 1 Meg.
	Other Models Available. Consult Factory.									
3/8" SQUARE (NEW)	950P 950W 950X	P W X	22	.375 x .375 x .187	Wiper Idles	1 @ 50°C	150	100	10% (*)	100Ω - 2 Meg
1/2" RECTANGULAR	522-00HS	P	10	.50 x .17 x .10	Wiper Idles	.30 @ 85°C	150	100	10% (*)	10Ω - 1 Meg.
3/8" SQUARE 	546-00HS	L	25	.375 x .375 x .150	Wiper Idles	.50 @ 85°C	150	100	10% (*)	10Ω - 1 Meg.
	547-00HS	P		.375 x .375 x .170						10Ω - 1 Meg.
	548-00HS	W		.417 x .375 x .165						
	548-72HS	X		.417 x .375 x .165						
1/4" ROUND	566-00HS 567-00HS	P P	1	.270 Dia. x .215	Solid	.50 @ 70°C	150	100	10% (*)	10Ω - 1 Meg.

Humidity: (All Models) MIL-STD-202, Method 106

Terminals: L, Insulated Flexible Leads; P, Printed Circuit Pins Base Mounted; W, Printed Circuit Pins Edge Mounted 180° from Screw; X, Printed Circuit Pins Edge Mounted 90° from Screw; Y, Printed Circuit Pins Base Mounted.

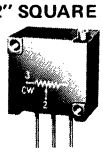
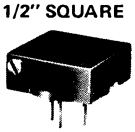
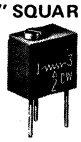
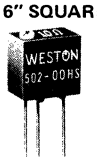
Specifications Subject to Change Without Notice.

*Note: Resistance Tolerance for 10Ω, 20Ω ±20%

SANGAMO WESTON
Schlumberger

GENERAL PURPOSE WIREWOUND POTENTIOMETERS SQUARE, RECTANGULAR AND ROUND COMMERCIAL

SANGAMO

	Model	Terminal Type	Turns	Size L W T	Stops	Power Rating (W)	Max. Oper. Temp.°C	T.C. ±PPM/°C	Res. Tol. %	Resistance Range
1/2" ROUND	1000-00HS	P	1	.500 Dia. x .315	Solid	1 @ 70°C	150	50	5%	10Ω - 50K
	1000-67HS	P		.500 Dia. x .250						10Ω - 50K
	1000-68HS	X		.562 x .500 x .312						10Ω - 50K
	Other Models Available. Consult Factory.									
1 1/4" RECTANGULAR	534-00HS	L	24	1.25 x .315 x .190	Wiper Idles	1 @ 70°C	150	50	5%	10Ω - 50K
	535-00HS	P		1.25 x .315 x .190						
	539-00HS	Y		1.25 x .325 x .195						
3/8" SQUARE	543-00HS	L	25	.375 x .375 x .160	Wiper Idles	1 @ 70°C	150	50	5%	10Ω - 50K
	544-00HS	P		.375 x .375 x .170						10Ω - 50K
	545-00HS	W		.417 x .375 x .170						
	545-72HS	X		.417 x .375 x .170						
1/2" SQUARE 	553-00HS	L	35	.500 x .500 x .187	Wiper Idles	1 @ 70°C	150	50	5%	10Ω - 50K
	555-00HS	W		.535 x .500 x .220						10Ω - 50K
	555-72HS	X		.535 x .500 x .220						
1/2" SQUARE 	701-00HS	P	37	.500 x .500 x .230	Wiper Idles	1 @ 70°C	150	50	5%	10Ω - 50K
1/4" SQUARE 	561-00HS	P	13	.170 x .250 x .250	Wiper Idles	.25 @ 70°C	150	50	5%	10Ω - 25K
	562-00HS	W		.250 x .250 x .170						10Ω - 25K
	562-72HS	X		.250 x .250 x .170						
5/16" SQUARE 	501-00HS	P	15	.175 x .312 x .312	Wiper Idles	.6 @ 70°C	150	70	5%	10Ω - 20K
	502-00HS	W		.312 x .312 x .175						10Ω - 20K
	502-72HS	X		.312 x .312 x .175						

Humidity: (All Models) MIL-STD-202, Method 106

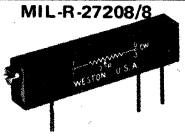
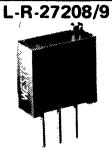
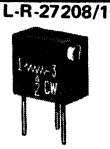
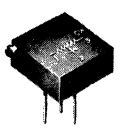
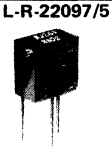
Terminals: L, Insulated Flexible Leads; P, Printed Circuit Pins Base Mounted; W, Printed Circuit Pins Edge Mounted 180° from Screw; X, Printed Circuit Pins Edge Mounted 90° from Screw; Y, Printed Circuit Pins Base Mounted.

Specifications Subject to Change Without Notice.

SANGAMO

MILITARY APPROVED POTENTIOMETERS WIREWOUND - MIL-R-27208 NON-WIREWOUND - MIL-R-22097

SANGAMO WESTON
Schlumberger

	Model	Terminal Type	Military Designation	Turns	Size L W T	Stops	Power Rating (W)	Max. Oper. Temp. °C	T.C. ±PPM/°C	Res. Tol. %	Resistance Range
MIL-R-27208/8  1 1/4" RECTANGULAR	534-118HS	L	RT12C2L	24	1.25 x .315 x .190	Wiper Idles	.75 @ 85°C	150	50	5%	10Ω - 20K
	535-105HS	P	RT12C2P		1.25 x .315 x .190						
	539-105HS	Y	RT12C2Y		1.25 x .325 x .195						
MIL-R-27208/9  3/8" SQUARE	543-118HS	L	RT24C2L	25	.375 x .375 x .160	Wiper Idles	.75 @ 85°C	150	50	5%	10Ω - 10K
	544-105HS	P	RT24C2P		.375 x .375 x .170						10Ω - 10K
	545-101HS	W	RT24C2W		.417 x .375 x .170						
	545-102HS	X	RT24C2X		.417 x .375 x .170						
MIL-R-27208/4 1/2" SQUARE	553-118HS	L	RT22C2L	35	.500 x .500 x .187	Wiper Idles	.75 @ 85°C	150	50	5%	50Ω - 20K
	555-101HS	W	RT22C2W	35	.535 x .500 x .220						50Ω - 20K
	555-102HS	X	RT22C2X	35	.535 x .500 x .220						
	701-105HS	P	RT22C2P	37	.500 x .500 x .230						10Ω - 20K
MIL-R-27208/10  1/4" SQUARE	561-105HS	P	RT26C2P	13	.170 x .250 x .250	Wiper Idles	.25 @ 85°C	150	50	5%	10Ω - 5K
	562-101HS	W	RT26C2W		.250 x .250 x .170						10Ω - 5K
	562-102HS	X	RT26C2X		.250 x .250 x .170						
MIL-R-22097/4  3/8" SQUARE	546-118HS	L	RJ24FL	25	.375 x .375 x .160	Wiper Idles	.50 @ 85°C	150	100	10%	50Ω - 1 Meg.
	547-105HS	P	RJ24FP		.375 x .375 x .170						50Ω - 1 Meg.
	548-101HS	W	RJ24FW		.417 x .375 x .170						
	548-102HS	X	RJ24FX		.417 x .375 x .170						
	870-105HS	P	RJ24FP	22	.375 x .375 x .187					10%	100Ω - 100K
	870-101HS	W	RJ24FW								
	870-102HS	X	RJ24FX								
	Also available: Characteristic "C" (250 PPM/°C)										
MIL-R-22097/5  1/4" SQUARE	860-101HS	W	RJ26FW	16	.250 x .250 x .185	Wiper Idles	.25 @ 85°C	150	100	10%	100Ω - 1 Meg.
	860-102HS	X	RJ26FX								
	Also available: Characteristic "C" (250 PPM/°C)										
MIL-R-22097/6 1/4" ROUND	567-105HS	P	RJ50CP	1	.270 Dia. x .215	Solid	.25 @ 85°C	150	250	10%	100Ω - 1 Meg

Humidity: (All Models) MIL-STD-202, Method 106

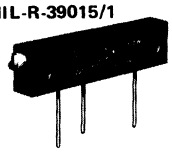
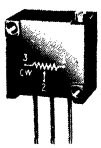
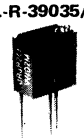
Terminals: L, Insulated Flexible Leads; P, Printed Circuit Pins Base Mounted; W, Printed Circuit Pins Edge Mounted 180° from Screw; X, Printed Circuit Pins Edge Mounted 90° from Screw; Y, Printed Circuit Pins Base Mounted.

Specifications Subject To Change Without Notice.

SANGAMO WESTON
Schlumberger

MILITARY APPROVED POTENTIOMETERS HI-RELIABILITY - WIREWOUND - MIL-R-39015 HI-RELIABILITY - NON-WIREWOUND - MIL-R-39035

SANGAMO

	Model	Terminal Type	Military Designation	Turns	Size L W T	Stops	Power Rating (W)	Max. Oper. Temp. °C	T.C. ±PPM/°C	Res. Tol. %	Resistance Range
MIL-R-39015/1  **1 1/4" RECTANGULAR**	534-160HS	L	RTR12DL	24	1.25 x .315 x .190	Wiper Idles	.75 @ 85°C	150	50	5%	100Ω - 20K
	535-160HS	P	RTR12DP		1.25 x .315 x .190						
	539-160HS	Y	RTR12DY		1.25 x .325 x .195						
	RTR12DL - "M" & "P" Failure Rate Level; RTR12DP and RTR12DY-"M" Failure Rate Level										
MIL-R-39015/2  **1/2" SQUARE**	553-160HS	L	RTR22DL	35	.500 x .500 x .187	Wiper Idles	.75 @ 85°C	150	50	5%	100Ω - 20K
	555-160HS	W	RTR22DW	35	.535 x .500 x .220						100Ω - 20K
	555-161HS	X	RTR22DX	35	.535 x .500 x .220						100Ω - 20K
	701-160HS	P	RTR22DP	37	.500 x .500 x .230						10Ω - 20K
	RTR22DL & RTR22DP - "M" & "P" Failure Level; RTR22DW & RTR22DX - "M" Failure Level										
MIL-R-39015/3 **3/8" SQUARE**	543-160HS	L	RTR24DL	25	.375 x .375 x .150	Wiper Idles	.75 @ 85°C	150	50	5%	200Ω - 10K
	"M" Failure Rate Level										
MIL-R-39035/2 **3/8" SQUARE**	870-160HS	P	RJR24FP	22	.375 x .375 x .187	Wiper Idles	.50 @ 85°C	150	100	10%	100Ω - 100K
	870-161HS	W	RJR24FW								
	870-162HS	X	RJR24FX								
	Also available: Characteristic "C" (250 PPM/°C) "M" Failure Rate Level										
MIL-R-39035/3  **1/4" SQUARE**	860-160HS	W	RJR26FW	16	.250 x .250 x .185	Wiper Idles	.25 @ 85°C	150	100	10%	100Ω - 1 Meg.
	860-161HS	X	RJR26FX								
	"M" & "P" Failure Rate Level										

Humidity: (All Models) MIL-STD-202, Method 106

Terminals: L, Insulated Flexible Leads; P, Printed Circuit Pins Base Mounted; W, Printed Circuit Pins Edge Mounted 180° from Screw; X, Printed Circuit Pins Edge Mounted 90° from Screw; Y, Printed Circuit Pins Base Mounted.

Failure Rate Designation: In percent/1000 Hours M=1.0, P = 0.1, R = 0.01, S = 0.001

Specifications Subject to Change Without Notice.

Military Part Number: Consists of the document number and a dash number with letters which signify - Terminal Type and Failure Rate.

Example: M39015/1 - 001 L M

- M39015/1 - Document number
- 001 - Dash number from table
- L - Terminal type
- M - Failure rate level

RTR12 D L 101 M

- RTR12 - Style
- D - Characteristics
- L - Terminals
- 101 - Resistance Mil-Code
- M - Failure rate level

SANGAMO

SERIES 860 POTENTIOMETERS ¼" LOW COST CERMET

SANGAMO WESTON
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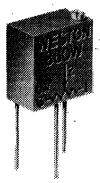
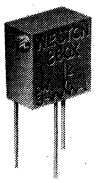




- Sealed to guard against contaminants: Sealed to withstand "Flow" Soldering and Industrial type immersion cleaning
- Wide resistance range, 10 ohms to 1 megohm
- Weston hi-stability cermet element
- Mechanical protection, stop and clutches
- Resolution, essentially infinite
- Adjustments ratio 16 to 1

SPECIFICATIONS

ELECTRICAL

Standard Resistance Range: 10 ohms to 1 megohm

Resistance Tolerance: ± 10%

Contact Resistance Variation: 3% or 20 ohms, whichever is greater

Temperature Coefficient: ± 100 P.P.M./°C max.

Power Rating: 0.5 watt at 85°C

Insulation Resistance: 1000 megohms minimum (500 V.D.C.)

Dielectric Strength: 600 V.A.C. room conditions

Maximum Working Voltage: 200 V.D.C. (RMS) or within power rating, whichever is less

Continuity: Maintained for full mechanical range

Resolution: Essentially infinite

MECHANICAL

Mechanical Protection: Slip clutch, wiper idles

Mechanical Adjustment: 16 turns nominal

Rotational Life: 200 cycles min. with no discontinuity

Torque: 3 oz. in. maximum

Weight: .5 gram maximum

ENVIRONMENTAL

Operating Temperature Range: -55°C to + 150°C

Moisture Resistance: MIL-R-22097, MIL-STD-202, Method 106

Shock: 100 G's per MIL-R-22097

Vibration: 20 G's 10 to 2000 cycles per MIL-R-22097, Test Condition D

Load Life: 1000 hrs. @ rated power per MIL-R-22097

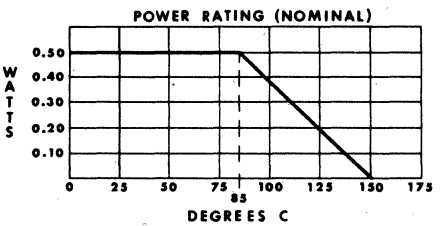
High Temperature Exposure: MIL-R-22097

Low Temperature Operation: MIL-R-22097

Evaluation samples available upon request.

RESISTANCE OHMS

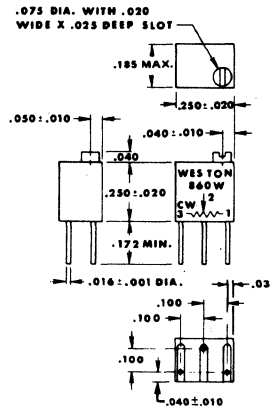
10	200	5K	100K
20	500	10K	200K
50	1K	20K	250K || 100	2K	50K	500K
			1 Meg



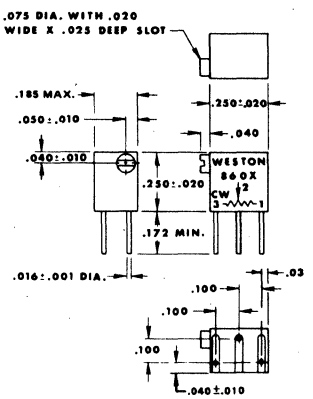
METRIC CONVERSIONS

In.	M.M.	In.	M.M.
.001	0.025	.050	1.270
.005	0.127	.075	1.905
.010	0.254	.100	2.540
.016	0.406	.172	4.369
.020	0.508	.185	4.699
.025	0.635	.250	6.350
.030	0.762	.300	7.620
.040	1.016		

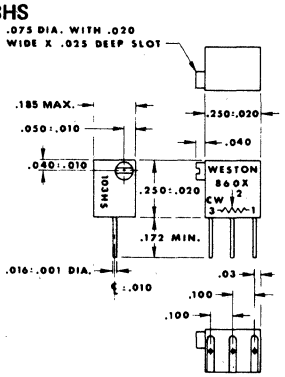
860W



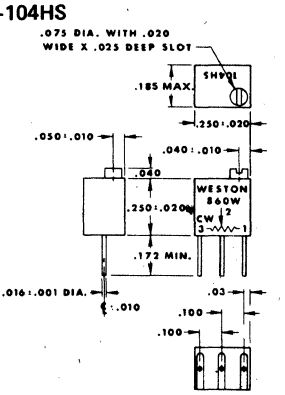
860X



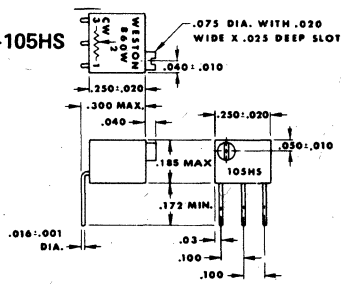
860-103HS



860-104HS



860-105HS



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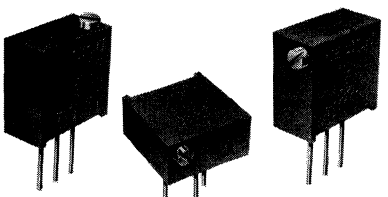
SANGAMO WESTON
Schlumberger

SANGAMO

SERIES 950 POTENTIOMETERS ⅜" LOW COST CERMET



950W 950P 950X

- Sealed to guard against contaminants: Sealed to withstand "Flow" Soldering and Industrial type immersion cleaning
- Weston hi-stability cermet element
- Wide resistance range, 10 ohms to 2 megohm
- Resistance tolerance ± 10%
- Resolution, essentially infinite
- Adjustability — 22 turns nominal
- High power — 1 watt at 50°C
- Wide operating temperature range -55°C to + 150°C
- Temperature coefficient ± 100 PPM/°C max.

SPECIFICATIONS

ELECTRICAL

Standard Resistance Range: 10 ohms to 2 megohms

Resistance Tolerance: ± 10%

End Resistance: 2 ohms maximum

Contact Resistance Variation: 3% or 20 ohms, whichever is greater

Temperature Coefficient: ± 100 PPM/°C maximum

Power Rating: 1 watt at 50°C

Insulation Resistance: 1000 megohms minimum (500 VDC)

Dielectric Strength: 900 VAC room conditions

Maximum Working Voltage: 300 VDC (RMS) or within power rating, whichever is less

Continuity: Maintained for full mechanical range

Resolution: Essentially infinite

MECHANICAL

Decimal Tolerance: .XX = ±.010

Unless Otherwise Specified: .XXX = ±.005

Mechanical Protection: Slip clutch, wiper idles

Mechanical Adjustment: 22 turns nominal

Rotational Life: 200 cycles minimum with no discontinuity

Torque: 5 oz. in. maximum

Weight: 1 gram maximum

ENVIRONMENTAL

Operating Temperature Range: -55°C to + 150°C

Moisture Resistance: MIL-R-22097, MIL-STD-202, Method 106 2%*

Shock: 100 G's per MIL-R-22097 1%*

Vibration: 20 G's 10 to 2000 cycles per MIL-R-22097, Test Condition D

Load Life: 1000 hours @ rated power per MIL-R-22097 3%*

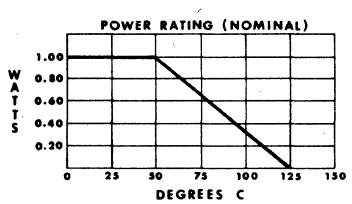
High Temperature Exposure: MIL-R-22097 3%*

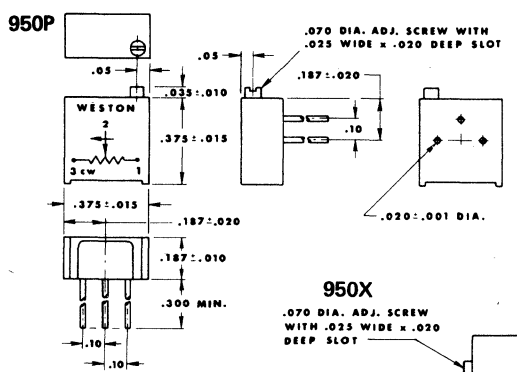
Low Temperature Operation: MIL-R-22097 2%*

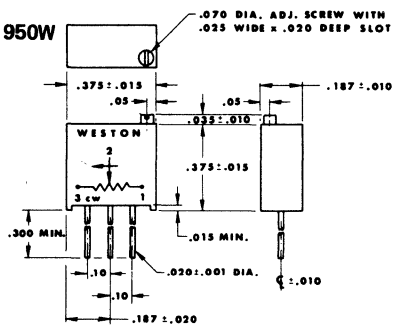
*ALLOWABLE RESISTANCE CHANGE

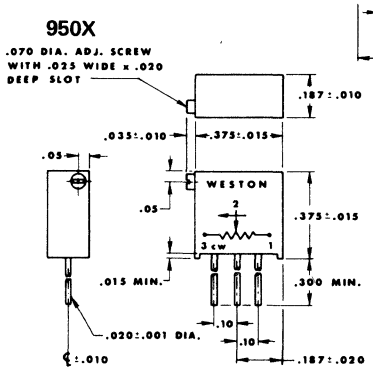
Evaluation samples available upon request.

RESISTANCE	OHMS
10	10 K
20	20 K
50	25 K
100	50 K
200	100 K
500	200 K
1 K	250 K
2 K	500 K
5 K	1 Meg
	2 Meg



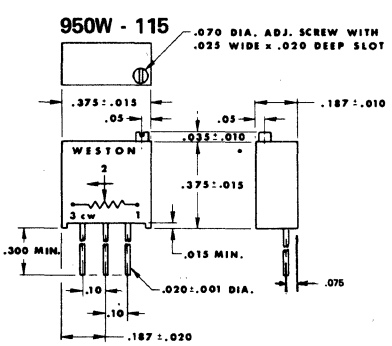


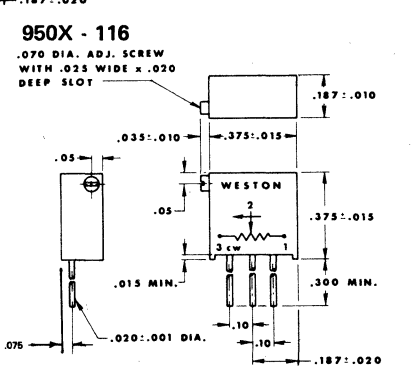




METRIC CONVERSION

INCHES	M.M.	INCHES	M.M.
.001	0.025	.050	1.270
.010	0.254	.070	1.778
.015	0.381	.100	2.540
.020	0.508	.187	4.750
.025	0.635	.300	7.620
.035	0.889	.375	9.525





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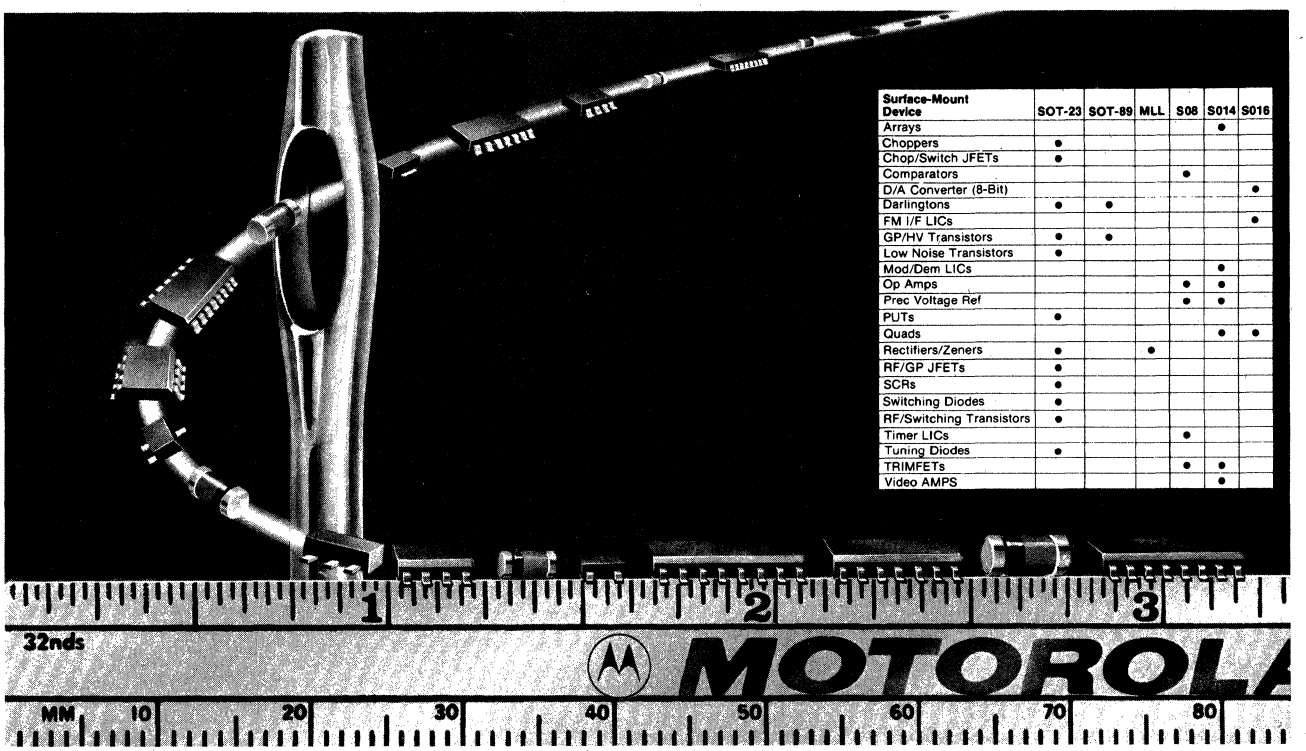
MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 85/86 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1166, **B**•1012, **C**•1028, **D**•1016
ASCII Code ..... **D**•1087
Batteries, Product Selection Guide ..... **D**•1413
Batteries & Fuel Cells, Characteristics ..... **D**•1430
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide ..... **A**•1003
Circuit Boards (Printed) Product Selection Guide ..... **C**•1099
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1205
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1863
Connectors, Miniglossary ..... **C**•1129
Connectors, Terminals, & Sockets, Product Selection Guide ..... **C**•1105
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Gude ..... **A**•1309
Delay Lines, Product Selection Guide ..... **A**•1459
Discrete Semiconductors, Product Selection Guide ..... **A**•2067
Displays, Readouts, Lamps, & Lights, Product Selection Guide ..... **B**•1015
EBCDIC Code ..... **D**•1092
Encapsulation, Miniglossary ..... **C**•1086
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide .. **C**•1623
Filters, Product Selection Guide ..... **A**•1583
Instruments, Graphic Recording Product Selection Guide ..... **D**•1401
Instruments, Panel Meters, Product Selection Guide ..... **D**•1329
Instruments, Test & Measuring Product Selection Guide ..... **D**•1175
Interconnection Systems, Product Selection Guide ..... **C**•1699
Keyboards & Keypads, Product Selection Guide ..... **B**•1705
Logofinder & Trademark Directories ..... **B**•901
Microwave Components, Product Selection Guide ..... **A**•1701
Military Qualified Products Lists ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1129
Opto Semiconductors, Miniglossary ..... **B**•1214
Oscilloscopes, Product Selection Guide ..... **D**•1385
Panel Hardware, Product Selection Guide ..... **C**•1589
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide ..... **A**•1991
Power Supplies, Miniglossary ..... **D**•1462
Power Supplies, AC, Product Selection Guide ..... **D**•1877
Power Supplies, DC, Product Selection Guide ..... **D**•1447
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide .... **B**•1225
Relay Contact Forms ..... **B**•1317
Relays, Electromechanical, Miniglossary ..... **B**•1308
Relays, Product Selection Guide ..... **B**•1261
Resistor Color Codes ..... **A**•1828
Resistors, Product Selection Guide ..... **A**•1785
Servo Components, Miniglossary ..... **D**•1985
Solenoids, Product Selection Guide ..... **B**•1463
Switches, Product Selection Guide ..... **B**•1477
Thermal Components, Product Selection Guide ..... **B**•1741
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1744
Thyristors/High Power Diodes, Miniglossary ..... **A**•2076
Transducers & Encoders, Product Selection Guide ..... **B**•1777
Transformers, Product Selection Guide ..... **A**•2099
Wire & Cable, Product Selection Guide ..... **C**•1743
Wire Gauges—Diameter, Area, Copper Weight ..... **C**•1844

More squeeze per square inch. Motorola surface mount.



Surface-Mount Device	SOT-23	SOT-89	MLL	S08	S014	S016
Arrays					•	
Choppers	•					
Chop/Switch JFETs	•					
Comparators				•		
D/A Converter (8-Bit)						•
Darlingtons	•	•				
FM I/F LICs						•
GP/HV Transistors	•	•				
Low Noise Transistors	•					
Mod/Dem LICs					•	
Op Amps				•	•	
Prec Voltage Ref				•	•	
PUTs	•					
Quads					•	•
Rectifiers/Zeners	•		•			
RF/GP JFETs	•					
SCRs	•					
Switching Diodes	•					
RF/Switching Transistors	•					
Timer LICs				•		
Tuning Diodes	•					
TRIMFETs				•	•	
Video AMPS					•	

Motorola surface-mount technology slashes system size and weight to one-tenth or less of what's acceptable now. Packages aren't much bigger than the chips they contain. Layers are cut in half, costs plunged 75% or more, higher frequencies optimized through short, uniform trace lengths.

You can mass-place them at up to 200K/hour.

We already offer the broadest line of easy, automatable, testable, surface-mount semiconductors--over 800--with more coming.

Pick and place in a fraction of discrete space.

Choose from most-popular switching transistors, Darlingtons, HV and low-noise types, RF, JFETs, tuning diodes, thyristors, rectifiers and PINs, plus numerous other discrete functions. All are SOT-23 packaged, with many in SOT-89 and MLL outlines for application flexibility. All SOT-23s are ready for placement; no lead forming is required. SOT-23/SOT-89 packaging is laser-marked. And, we'll encapsulate almost any discrete in a SOT package, depending on die compatibility and requirements. Low-profile, too.

MLL. Most economical of all.

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SOIC. Space-saving linear alternative.

Get standard linear DIP performance in tiny SOICs from Motorola and give yourself a 2.5:1 delta in board space savings.

Out lineup includes op amps, comparators, voltage regulators, TRIMFETs™, DACs, arrays and timers.

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The squeeze is on.

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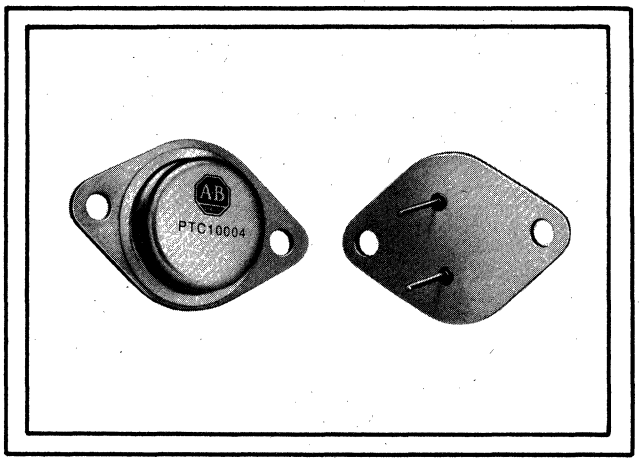
	SCR	Triacs	Diacs	Silicon	Germanium	Selenium	Bridges & Assemblies	Zener	Varactor		
Allen-Bradley				A•2069						A•2069	Power Modules
American MicroSemiconductor	A•2070	A•2070		A•2070	A•2070		A•2070	A•2070			
IEI-Iskra				A•2072							
International Components				A•2074			A•2074	A•2074		A•2074	Switching Diodes
ISL Products				A•2075			A•2075				
Motorola	A•2077 A•2083	A•2083		A•2085			A•2085	A•2077 A•2084	A•2077	A•2077 A•2082 A•2083 A•2086 A•2087	Switching Diodes RF Power Hybrid Modules SIDACs Optoelectronic Components Sensors, Pressure & Temperature
Murata Erie				A•2089							
Philips ECG Sylvania	A•2090	A•2090	A•2091	A•2090	A•2090		A•2090	A•2090	A•2090	A•2090 A•2091	Varistors, Pin Diodes SBS; SUS; SAS; SCS
Teccor Semiconductors	A•2092 A•2093	A•2092 A•2093	A•2092 A•2093							A•2092 A•2093	SIDACs; Quadracs
TRW Optoelectronics				A•2094				A•2094		A•2094	Schottky Rectifiers
Varo Semiconductor				A•2095			A•2095				
Voltage Multipliers (VMI)				A•2097			A•2097			A•2097	HV Multipliers

TRANSISTORS

Manufacturer	RF (Incl. Microwave)	Power		Switching	UJT	Darlington	Chip	Germanium	Small Signal
		Bipolar	FET						
Allen-Bradley		A•2068		A•2068		A•2068			
American MicroSemiconductor		A•2070	A•2070					A•2070	
General Electric			A•2095						
Motorola	A•2082	A•2082 A•2078 A•2079 A•2084	A•2082 A•2078 A•2079 A•2084			A•2078 A•2079 A•2084	A•2082		A•2080 A•2081 A•2082
Philips ECG					A•2091				



Series PTC

High Voltage NPN Darlington Transistors

FEATURES

- High Voltage Ratings
- Fast-Switching Capabilities/Fast Turn-Off Time
- Glass Passivated Die to Provide Excellent High Temperature Stability
- Thermally Stable Structure for Reliability in Power Cycling
- No Parasitic Diode on Output Transistor

APPLICATIONS

- High Voltage Switching Power Supplies
- Inverters/Regulators
- Deflection Circuits
- Pulse-Width-Modulated (PWM) System Control Circuitry

For more information request PTC Publications.

HIGH VOLTAGE NPN DARLINGTON TRANSISTORS

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Series PTC 6022/6023 — 40A-600V
Series PTC 6060/6061/6062/6063 — 20A-500V
Series PTC 6072/6073 — 40A-400V
Series PTC 7000/7001/7002/7003 — 50A-500V
Series PTC 9000/9001/9002 — 20A-750, 850, 900V
Series PTC 10000/10001 — 20A-400V
Series PTC 10002/10003 — 10A-400V
Series PTC 10004/10005 — 20A-400V
Series PTC 10006/10007 — 10A-400V
Series PTC 10008/10009 — 20A-500V
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Series PTC 10020/10021 — 60A-400V
Series PTC 10022/10023 — 40A-400V

High Voltage NPN Transistors

FEATURES

- High Voltage Ratings
- Glass Passivation
- Superior Resistance to Thermal Fatigue
- Industrial and Military Applications

APPLICATIONS

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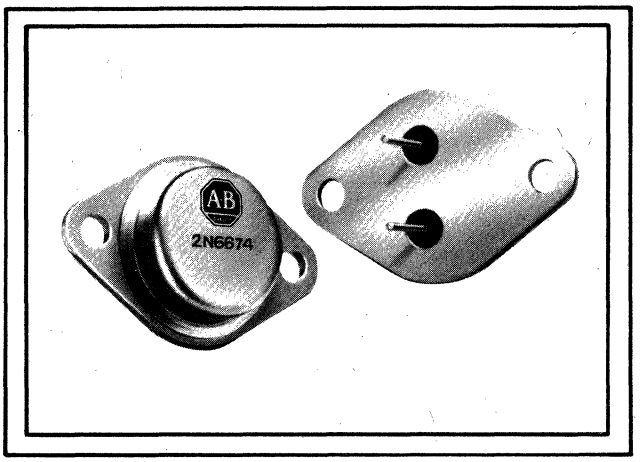
- PWM Inverters
- Deflection Circuits
- Motor Controls
- Solenoid Drivers



HIGH VOLTAGE NPN TRANSISTORS

Series PTC 401/402 — 3A-700V
Series PTC 403/409 — 3.5A-400V
Series PTC 410/411 — 3.5A-300V
Series PTC 413/423 — 3.5A-400V
Series PTC 424/425 — 3.5A-700V
Series PTC 430/431 — 7A-400V
Series 2N6674/2N6675 — 10A-400V
Series 2N6676/2N6677/2N6678 — 15A-400V

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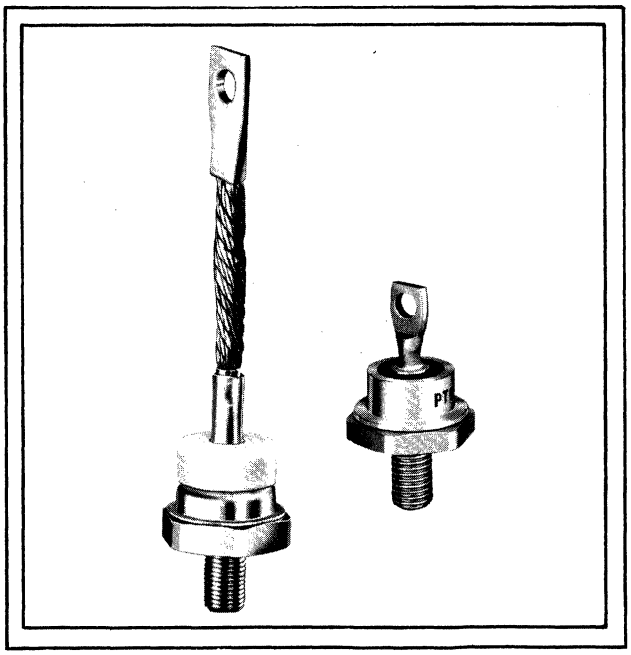
Greensboro, North Carolina 27405



Series PTC

Fast Recovery Power Rectifiers

FEATURES

- Low Forward Voltages
- High Voltage Ratings
- Fast Reverse Recovery Time
- Glass Passivated Die to Provide Excellent High Temperature Stability
- High Surge Capability

APPLICATIONS

- Switching Power Supplies
- Inverters/Regulators
- Free Wheeling Diodes

FAST RECOVERY RECTIFIERS

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40 Amperes — 200-600 Volts

Series PTC 872/874/876
50 Amperes — 200-600 Volts

Series PTC 920/921/922/923
50 Amperes — 900-1200 Volts

Series PTC 940/941/942/943
100 Amperes — 900-1200 Volts

Series PTC 950/951/952/953
130 Amperes — 900-1200 Volts

General

The Powermode rectifier line features high voltage, high current and fast recovery times. These rectifiers are intended for use in switching power supplies and as freewheeling diodes in inverter circuits. The ratings of the rectifier line range from 40 to 130 amperes with voltages of 200 to 1200 volts.

For more information request PTC Publications.

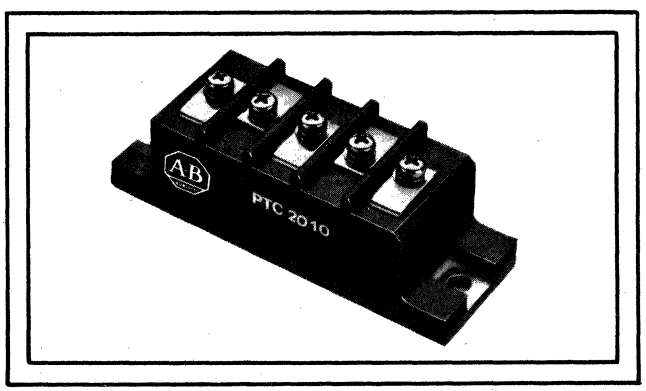
Power Darlington Modules

FEATURES

- Isolated Collectors
- High Voltage Rating
- Glass Passivated Die to Provide Excellent High Temperature Stability

APPLICATIONS

- High Current Switching Power Supplies
- Inverters/Regulators
- Pulse-Width-Modulated (PWM) System Control Circuitry



MODULES

Series PTC 2000/2001
50 Amperes-1000 Volts

Series PTC 2010/2011
30 Amperes-1000 Volts

Series PTC 2050/2051
50 Amperes-900 Volts

Series PTC 2200/2201
30 Amperes-600 Volts

Series PTC 2400/2401
50 Amperes-600 Volts

ALLEN-BRADLEY

Greensboro, North Carolina 27405

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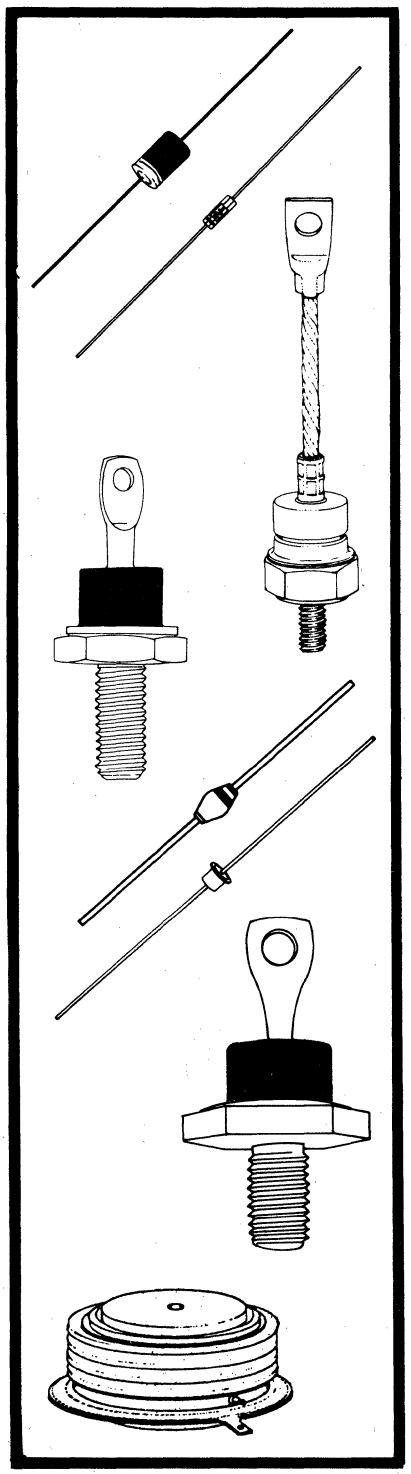

SIGNAL DIODES

1N87	1N350	1N464	1N993	1N3223	1N3731	1N4726
1N137	1N351	1N488	1N999	1N3298	1N3933	1N4727
1N138	1N352	1N799	1N2146	1N3381	1N3954	1N4830
1N193	1N353	1N804	1N2327	1N3391	1N3983	1N4864
1N194	1N354	1N810	1N2328	1N3471	1N4148	1N4888
1N195	1N401	1N844	1N2902	1N3480	1N4150	1N4952
1N251	1N403	1N892	1N2911	1N3485	1N4157	1N5179
1N252	1N404	1N899	1N2925	1N3538	1N4320	1N5220
1N300	1N405	1N908	1N3062	1N3565	1N4392	1N5319
1N301	1N406	1N912	1N3071	1N3568	1N4457	1N5414
1N302	1N407	1N914	1N3124	1N3579	1N4548	1N5431
1N303	1N408	1N917	1N3147	1N3614	1N4608	1N5609
1N304	1N433	1N931	1N3180	1N3625	1N4610	1N5627
1N330	1N434	1N934	1N3206	1N3647	1N4718	1N5767
1N331	1N456	1N948				

REFERENCE DIODES

1N701	1N821	1N970	1N2984	1N4733	1N5227	1N5334
1N716	1N826	1N974	1N2988	1N4741	1N5228	1N5335
1N721	1N829	1N978	1N2992	1N4747	1N5229	1N5336
1N727	1N935	1N982	1N2996	1N4753	1N5230	1N5337
1N733	1N939	1N986	1N3000	1N4759	1N5231	1N5338
1N739	1N943	1N990	1N3003	1N4764	1N5232	1N5339
1N745	1N948	1N992	1N3007	1N5223	1N5233	1N5340
1N751	1N957	1N2970	1N3011	1N5224	1N5234	1N5521
1N757	1N959	1N2972	1N3015	1N5225	1N5235	1N5530
1N766	1N960	1N2976	1N4000	1N5226	1N5333	1N5535
1N769	1N966	1N2980				

GERMANIUM DIODES

1N34A	1N65	1N98	1N127A	1N281	1N631	1N933
1N35	1N67A	1N99	1N128	1N283	1N632	1N995
1N38A	1N68A	1N100	1N191	1N294	1N633	1N996
1N48	1N69A	1N115	1N192	1N295	1N634	1N3125
1N54A	1N70A	1N116	1N198	1N297	1N636	1N3287
1N58A	1N81A	1N117	1N270	1N298	1N695	1N3592
1N60	1N87	1N118	1N277	1N498	1N770	1N4008
1N63	1N90	1N126A	1N279	1N500	1N805	1N4524
1N64	1N91					

RECTIFIERS

1N200	1N526	1N877	1N1167	1N1701	1N2367	1N4000
1N205	1N530	1N889	1N1176	1N1730	1N2374	1N4001
1N217	1N534	1N1028	1N1191	1N1907	1N2424	1N4002
1N222	1N540	1N1039	1N1197	1N1912	1N2536	1N4003
1N250	1N547	1N1051	1N1202	1N1916	1N2560	1N4004
1N316	1N563	1N1063	1N1217	1N2103	1N2572	1N4005
1N321	1N596	1N1075	1N1223	1N2108	1N2606	1N4006
1N332	1N600	1N1081	1N1226	1N2154	1N2781	1N4007
1N342	1N606	1N1084	1N1251	1N2174	1N2858	1N4245
1N349	1N645	1N1085	1N1255	1N2187	1N2864	1N4530
1N365	1N649	1N1092	1N1406	1N2199	1N3053	1N4822
1N413	1N676	1N1095	1N1443	1N2211	1N3055	1N5062
1N440	1N681	1N1100	1N1486	1N2240	1N3084	1N5188
1N443	1N689	1N1105	1N1492	1N2258	1N3196	1N5406
1N445	1N846	1N1128	1N1587	1N2293	1N3494	1N5599
1N503	1N853	1N1139	1N1624	1N2316	1N3549	1N5679
1N514	1N865	1N1150	1N1692			

MISCELLANEOUS DIODES

DB3	ST2	1N82A	1N3713	1N3834	1N3837	1N5411
GT32	1N23	1N830A	1N3833	1N3835	1N3838	1N5760
HT32						

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- TRANSISTORS, DIODES, SILICON CONTROLLED RECTIFIERS, TRIACS
- INTEGRATED CIRCUITS
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- LARGE INVENTORY
- OBSOLETE DEVICES

LOW POWER TRANSISTORS

2N117	2N476	2N2221	2N2913	2N3495	2N3904	2N4410
2N118	2N477	2N2222	2N2914	2N3563	2N3905	2N4937
2N119	2N706	2N2330	2N2915	2N3565	2N4080	2N5400
2N120	2N707	2N2368	2N2916	2N3566	2N4125	2N5401
2N327	2N916	2N2369	2N2917	2N3567	2N4126	2N5824
2N328	2N929	2N2569	2N2918	2N3568	2N4143	2N5825
2N329	2N930	2N2837	2N2919	2N3569	2N4383	2N5826
2N336	2N1150	2N2890	2N2920	2N3638	2N4400	2N5827
2N337	2N1156	2N2891	2N3241	2N3641	2N4401	2N5828
2N338	2N2217	2N2904	2N3242	2N3642	2N4402	2N5856
2N473	2N2218	2N2905	2N3250	2N3643	2N4403	2N5858
2N474	2N2219	2N2906	2N3251	2N3646	2N4409	2N5910
2N475	2N2220	2N2907	2N3494	2N3903		

HIGH POWER TRANSISTORS

2N122	2N2880	2N3234	2N3446	2N3771	2N4235	2N6249
2N1015A	2N2892	2N3235	2N3447	2N3772	2N4398	2N6292
2N1016	2N2893	2N3252	2N3448	2N3878	2N4399	2N6338
2N1485	2N3053	2N3253	2N3632	2N3879	2N4404	2N6377
2N1613	2N3054	2N3375	2N3713	2N4037	2N4405	2N6380
2N1711	2N3055	2N3432	2N3714	2N4040	2N4905	2N6474
2N2876	2N3118	2N3439	2N3715	2N4231	2N4918	2N6486
2N2877	2N3119	2N3440	2N3716	2N4232	2N5323	2N6579
2N2878	2N3232	2N3442	2N3766	2N4233	2N5680	2N6584
2N2879	2N3233	2N3445	2N3767	2N4234		

GERMANIUM TRANSISTORS

2N34	2N77	2N174	2N404	2N705	2N1306	2N4048
2N35	2N78	2N277	2N414	2N1011	2N1502	2N5324
2N43	2N104	2N326	2N441	2N1099	2N1751	2N5435
2N45	2N108	2N350	2N464	2N1175	2N2142	2N5887
2N59	2N109	2N375	2N525	2N1295	2N2043	2N5900
2N60	2N111	2N393	2N652	2N1305	2N3428	2N5901
2N61	2N123					

FIELD EFFECT TRANSISTORS

2N2386	2N3436	2N3824	2N4339	2N5103	2N5459	2N5951
2N2608	2N3453	2N3968	2N4382	2N5159	2N5592	2N5952
2N3066	2N3460	2N3994	2N4416	2N5270	2N5798	2N5953
2N3087	2N3578	2N4092	2N4856	2N5393	2N5803	2N6452
2N3365	2N3684	2N4119	2N4979	2N5433	2N5950	2N6568
2N3370	2N3819	2N4221				

MISCELLANEOUS

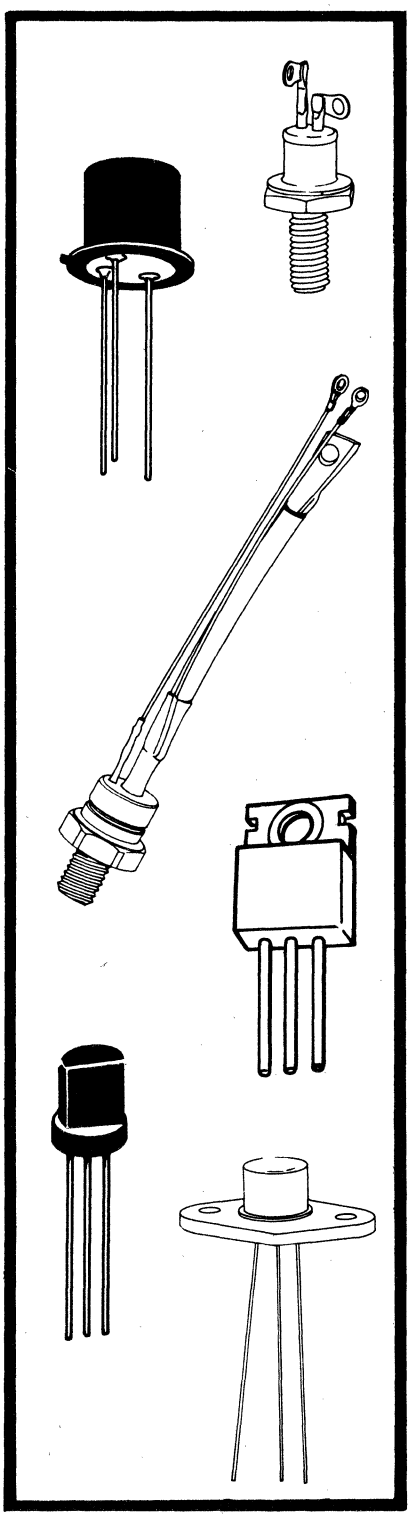
2N489	2N494	2N2419	2N2646	2N4852	2N4947	2N6384
2N490	2N1671	2N2420	2N2647	2N4853	2N4948	2N6385
2N491	2N2160	2N2421	2N3980	2N4870	2N4949	2N6387
2N492	2N2417	2N2422	2N4851	2N4871	2N6383	2N6388
2N493	2N2418					

SCR's

2N681	2N877	2N1798	2N2030	2N3272	2N3872	2N5204
2N682	2N889	2N1842	2N2322	2N3529	2N3940	2N6167
2N683	2N1595	2N1848	2N2329	2N3649	2N4152	2N6174
2N685	2N1604	2N1909	2N2574	2N3658	2N4198	2N6394
2N690	2N1770	2N1916	2N2579			
2N692	2N1773	2N2023	2N3096	2N3753	2N5164	2N6404

TRIACS

2N5567	2N5571	2N5755	2N6070	2N6073	2N6139	2N6174
2N5568	2N5572	2N5756	2N6071	2N6074	2N6155	2N6342
2N5569	2N5573	2N6068	2N6072	2N6075	2N6165	2N6347
2N5570	2N5754	2N6069				



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SEMICONDUCTORS

BRIDGES, DIODES, HIGH VOLTAGE, HIGH CURRENT DEVICES

1N4000 SERIES SILICON RECTIFIER DIODES 1 AMP, 50-1000V

△ **Plastic Rectifiers**
△ **Subminiature Size Axial Lead Mounted Rectifiers for General Purpose Low-Power Applications**
△ **Silicone Passivated, JEDEC Numbered**
△ **Available Bulk or Taped and Reeled**

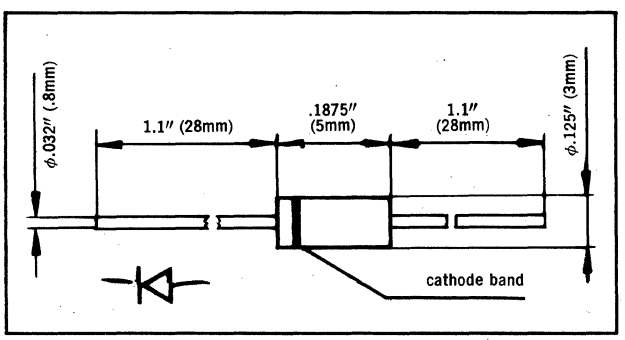
MAXIMUM RATINGS

Rating	Symbol	Unit	1N4001	1N4002	1N4003	1N4004	1N4005	1N4006	1N4007
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	U_{RRM} U_{RM} U_R	V	50	100	200	400	600	800	1000
Non-Repetitive Peak Reverse Voltage 10 ms (Halfwave, Single Phase 50 Hz Peak)	U_{RSM}	V	(100)* 60	(150)* 120	(300)* 240	(600)* 480	(900)* 720	(1200)* 1000	(1500)* 1200
RMS Voltage	U_{RMS}	V	35	70	140	280	420	560	700
Average Rectified Forward Current (Single Phase, Resistive Load 50 Hz)	I_O	A	1.0						
Non-Repetitive Peak Current (Surge Current, 1 Cycle for 10 ms)	I_{FSM}	A	50						
Operating Temperature	T_{op}	°C	−65 to +175						
Storage Temperature	T_{STG}	°C	−65 to +175						

**Available on special request*

ELECTRICAL CHARACTERISTICS

Characteristics and Conditions	Symbol	Unit	Head
Max. Instantaneous Forward Voltage Drop (I_F = 1,0A T_j = 25°C)	U_{FWD}	V	1.1
Max. Reverse Current at U_{RRM} (T_j = 25°C)	I_R	μA	10
Max. Reverse Current at U_{RRM} (T_j = 100°C)	I_R	μA	50
Typical Thermal Resistance Junction to Ambient (Mounting Method A)	R_{TH}	°C/W	85



ALSO AVAILABLE IN 5400 SERIES 3 AMP, 50 - 1000 V

Also in 5400 Series 3 Amp Rectifiers

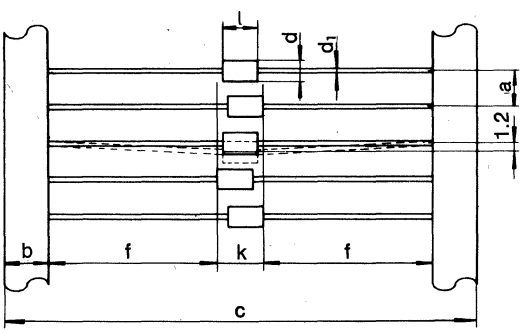
TAPE AND REEL

In accordance with IEC publication 286, DIN 40810, EIA industrial standards RS — 296.

MECHANICAL DATA

Dimensions:	a	d	l	d_1
(mm)	25.4	3.1	5.1	0.86

Case: JEDEC DO-41 package
Epoxy: UL 94 — 0 rate, flame retardant
Lead: MIL-STD 202 — method 208C guaranteed
Weight: 0.35 grams, approximately
Polarity: Cathode indicated by polarity band



Reel dimensions:	c	b	a	l	d_1	d	f	k
(mm)	65^{-2}	$6^{\pm1}$	$5^{\pm0.5}$	5^{+1}	0.86	3.1	$23.2^{\pm1}$	6.5

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SEMICONDUCTORS

BRIDGES, DIODES, HIGH VOLTAGE, HIGH CURRENT DEVICES

0.8—1.5 AMPERES RECTIFIER BRIDGES

Series
BxxC 800
BxxC 1000
BxxC 1500

GENERAL PURPOSE

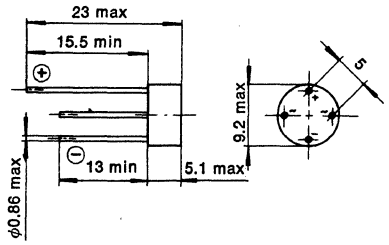
△ Single-phase full-wave bridges for general purpose low-power applications.

FEATURES:

△ High current
△ High surge current capability
△ Low forward voltage drop
△ Economical plastic package

MECHANICAL DATA

Case: Potted epoxy encapsulated
Lead: MIL-STD-202 — method 208C
Dimensions: (mm)



ELECTRICAL CHARACTERISTICS

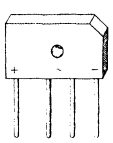
Characteristics and Conditions	Symbol	Unit	Value
Max. reverse current at U_{RRM} (θ_j = 25°C)	I_R	μA	10
Max. reverse current at U_{RRM} (θ_j = 100°C)	I_R	μA	50
Max. forward voltage drop at 25°C, 1 A:			
C 800 type			1.3
C 1000 type	U_F	V	1.2
C 1500 type			1.1

Ratings and characteristics hold for every diode in the bridge structure.

MAXIMUM RATINGS

Type	Symbol	Unit	C 800						C 1000						C 1500					
			B 40	B 80	B 125	B 250	B 380	B 500	B 40	B 80	B 125	B 250	B 380	B 500	B 40	B 80	B 125	B 250	B 380	B 500
Non-repetitive peak reverse voltage	U_{RSM}	V	120	240	350	720	1000	1200	120	240	350	720	1000	1200	120	240	350	720	1000	1200
Repetitive peak reverse voltage	U_{RRM}	V	100	200	300	600	800	1000	100	200	300	600	800	1000	100	200	300	600	800	1000
Average forward current at 45°C (C load)	I_{FAV}	A	0.8						1.0						1.5					
Surge forward current (1 cycle, 10 ms, sine wave) θ_j = 25°C	I_{FSM}	A	50						50						50					
Typical thermal resistance, junction to lead (lead length 5 mm, mounted on infinite heatsink)	R_{thjl}	K/W	52						45						31					
Operating and storage temperature	θ_{op}	°C	−40 to +175						−40 to +175						−40 to +175					

3—5 AMPERES BRIDGES



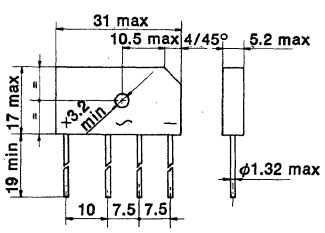
Series
BxxxC 3200/2200
BxxxC 5000/3300

SINGLE-PHASE FULL WAVE

Plastic encapsulated bridge rectifier assembly comprising four silicon double diffused pellets. It is primarily intended for use in the power supplies of many types of transistorized equipment operating at line frequency.

MECHANICAL DATA

Case: Potted epoxy, encapsulated
Lead: MIL-STD-202—method 208C guaranteed
Dimensions: (mm)



ELECTRICAL CHARACTERISTICS

Characteristics and Conditions	Symbol	Unit	Value
Max. reverse current at U_{RRM} (θ_j = 25°C)	I_R	μA	100
Max. reverse current at U_{RRM} (θ_j = 100°C)	I_R	μA	500
Max. forward voltage drop θ_j = 25°C:			
—C 3200/2200 at 6 A			
—C 5000/3300N at 10 A	U_F	V	1.1
—C 5000/3300S at 18 A			

Ratings and characteristics hold for every diode in the bridge structure.

MAXIMUM RATINGS

Type	Symbol	Unit	C 3200/2200				C 5000/3300N				C 5000/3300S			
			B 40	B 80	B 125	B 250	B 40	B 80	B 125	B 250	B 40	B 80	B 125	B 250
Non-repetitive peak reverse voltage	U_{RSM}	V	120	240	350	720	120	240	350	720	120	240	350	720
Repetitive peak reverse voltage	U_{RRM}	V	100	200	300	600	100	200	300	600	100	200	300	600
Average forward current at θ_{amb} = 45°C	I_{FAV}	A	3.2				5 (θ_{amb} = 25°C)				5			
— on Al heatsink 200 cm² — on PC board (C load)			2.2				3.3				3.3			
Surge forward current (1 cycle, 10 ms, sine wave) θ_j = 25°C	I_{FSM}	A	100				150				200			
Typical thermal resistance, junction to ambient on Al plate 200 cm²	R_{thja}	K/W	15				13.5				12			
Operating and storage temperature	θ_{op}	°C	−40 to +150				−40 to +150				−40 to +150			

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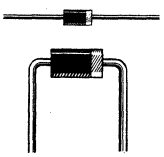
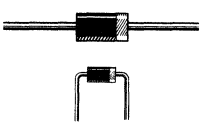
DIODES by International C

ICC has created a line of diodes that satisfies a broad range of requirements. Included are Plastic Silicon Rectifiers, Fast Recovery Rectifiers, Bridges, Switching and Zener Diodes. We invite inquiries about the types described here as well as any other diode you may require.



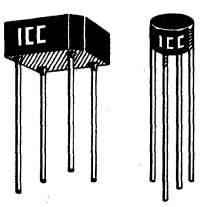
Plastic Silicon Rectifiers — General Purpose Cathode Band I.D.

1N4001 - 1N4007	1.0 AMP - 50V to 1000V	Case DO-41
1N5391 - 1N5399	1.5 AMP - 50V to 1000V	Case DO-15
1N5400 - 1N5408	3.0 AMP - 50V to 1000V	Case DO-27



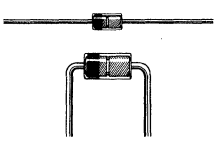
Plastic Silicon Rectifiers — Fast Recovery — 150ns to 500ns Cathode Band I.D.

ICC1001 - ICC1007	1.0 AMP - 50V to 1000V	Case DO-41
ICC1501 - ICC1507	1.5 AMP - 50V to 1000V	Case DO-15
ICC3001 - ICC3007	3.0 AMP - 50V to 1000V	Case DO-27



Bridge Rectifiers

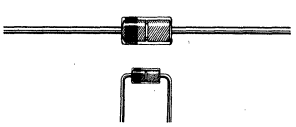
BRR101M - BRR107M	1.0 AMP - 50V to 1000V
BRR151M - BRR157M	1.5 AMP - 50V to 1000V



Silicon Switching Diodes — Cathode Band I.D.

1N4148 - 1N4536

Peak Inverse Voltage 25V to 75V
Reverse Recovery Time 2.0ns to 4.0ns
Capacitance - 2.0 pF to 4.0 pF
Case DO-35



Zener Diodes — Cathode Band I.D.

1N5231B - 1N5257B	0.5 watt	5% Tolerance	Case DO-35
1N4733A - 1N4752A	1.0 watt	5% Tolerance	Case DO-41

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SILICON DIODES AND BRIDGES

Silicon rectifier diodes 1A 50V to 1,000V, 1N4001 – 1N4007

Type	U_{RRM} (V)	U_{RSM} 10 ms (V)	I_{FAV} (A)	I_{FSM} 10 ms (A)	T_{op} (°C)	U_F I_F= 1.0A T_j= 25°C (V)	I_R at U_{RRM} T_j= 25°C (μA)
1N4001	50	60	1.0	50	−65 to +175	1.1	10
1N4002	100	120					
1N4003	200	240					
1N4004	400	480					
1N4005	600	720					
1N4006	800	1,000					
1N4007	1,000	1,200					

Silicon rectifier diodes 3A 100V to 1,200V, 1N5400 – 1N5408

Type	U_{RRM} (V)	U_{RSM} 10 ms (V)	I_{FAV} T_L= 45°C L= 10mm (A)	I_{FSM} 10 ms (A)	T_{op} (°C)	U_F I_F= 6A T_j= 25°C (V)	I_R at U_{RRM} T_j= 25°C (μA)	I_R at U_{RRM} T_j= 150°C (μA)
1N5400	50	60	3	150	−40 to +175	1.3	20	500
1N5401	100	120						
1N5402	200	240						
1N5403	300	360						
1N5404	400	480						
1N5405	500	600						
1N5406	600	720						
1N5407	800	1,000						
1N5408	1,000	1,200						

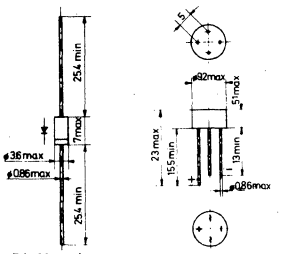
Silicon planar epitaxial signal diodes BA500 series

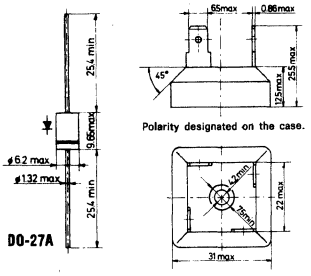
Type	U_{BR} 100 μA (V)	I_o (mA)	U_F at I_F at 25°C (V)	(mA)
BA511 (1N4148)	100	75	1.0	10
BA513 (1N4448)	100	75	1.0	100
BA517 (1N4150)	70 1 μA	200	1.0	200
BA518 (1N4151)	75 5 μA	75	1.0	50
BA519 (1N4152)	40 5 μA	75	0.88	20
BA520 (1N4153)	75 5 μA	75	0.88	20
BA521 (1N4154)	35 5 μA	75	1.0	30
BA523 (1N4444)	70 5 μA	200	1.0	100
BA531 (IN4727)	30 5 μA	75	0.85	10
BA533 (1N4864)	125	100	1.1	100
BA543 (BAY17)	15	200	1.0	100
BA544 (BAY18)	60	200	1.0	100
BA545 (BAY19)	120	200	1.0	100
BA546 (BAY20)	180	200	1.0	100
BA547 (BAY80)	150	100	1.0	100

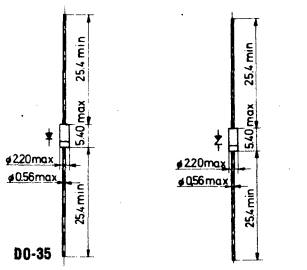
Type	I_R at 25°C (nA)	I_R at 150°C (μA)	at U_R (V)	C at 1 MHz U_R=0V (pF)	t_{rr} (ns)
BA511 (1N4148)	25	50	20	4	4[1]
BA513 (1N4448)	25	50	20	4	4[1]
BA517 (1N4150)	100	100	50	2.5	6[4]
BA518 (1N4151)	50	50	50	2	2[1]
BA519 (1N4152)	50	50	30	2	2[1]
BA520 (1N4153)	50	50	50	2	2[1]
BA521 (1N4154)	100	100	25	4	2[1]
BA523 (1N4444)	50	50	50	2	7[2]
BA531 (IN4727)	100	10 (100°C)	20	4	Q=40 pC
BA533 (1N4864)	100	100	80	1.3	4[1]
BA543 (BAY17)	100	15	12	1.5	50[3]
BA544 (BAY18)	100	15	50	1.5	50[3]
BA545 (BAY19)	100	15	100	1.5	50[3]
BA546 (BAY20)	100	15	150	1.5	50[3]
BA547 (BAY80)	100	100	120	6	50[3]

Reverse recovery time:

1. I_F=10 mA U_R=6V R_L=100Ω measured at I_R=1 mA
2. I_F=10 mA U_R=1V R_L=100Ω measured at I_R=1 mA
3. I_F=30 mA I_R=30 mA R_L=100Ω measured at I_R=3 mA
4. I_F=10 mA I_R=1 mA measured at I_R=0.1 mA







Index of symbols

- α — Conduction angle
- C — Capacitance
- I_F — Forward (DC) current
- I_{FAV} — Average forward current 40 to 1,000 Hz of one halfsine wave at T_{amb} or T_{case}
- I_{FSM} — Surge forward current, peak value 10 ms
- I_Z — Zener (reverse) current
- I_R — Reverse current, maximum value at T_j and U_{RRM}
- L — Distance from case
- P_{tot} — Total power dissipation
- R — Resistance
- t_{rr} — Reverse recovery time, typical value
- T_{amb} — Ambient temperature
- T_{case} — Case temperature
- T_j — Junction temperature
- T_L — Lead temperature
- T_{op} — Operating temperature
- T_{stg} — Storage temperature
- U_{BR} — Breakdown voltage
- U_F — Forward voltage drop, maximum value at rated I_F
- U_{RMS} — RMS voltage
- U_{RRM} — Repetitive Peak reverse voltage
- U_{RSM} — Peak reverse voltage, 10 ms
- U_Z — Zener (reverse) voltage

Single-phase bridge B . . . C800, B . . . C1000, B . . . C1500

Type	U_{RRM}[1] (V)	U_{RSM}[1] 10 ms (V)	I_{FAV} T_{amb} 45°C C load (A)	I_{FSM}[1] t= 10 ms T_j= 25°C (A)	T_{op} (°C)	U_F[1] I_F= 1.0A T_j= 25°C (V)	I_R[1] at U_{RRM} T_j= 25°C (μA)
B40C800	100	120	0.8	50	−40 to +175	1.3	10
B80C800	200	240					
B125C800	300	350					
B250C800	600	720					
B380C800	800	1,000					
B500C800	1,000	1,200					
B40C1000	100	120	1	50	−40 to +175	1.2	10
B80C1000	200	240					
B125C1000	300	350					
B250C1000	600	720					
B380C1000	800	1,000					
B500C1000	1,000	1,200					
B40C1500	100	120	1.5	50	−40 to +175	1.1	10
B80C1500	200	250					
B125C1500	300	350					
B250C1500	600	720					
B380C1500	800	1,000					
B500C1500	1,000	1,200					

Single-phase bridge B. . . C10, B . . . C25

T_j at 25°C Type	U_{RRM}[1] (V)	U_{RSM}[1] (V)	I_{FAV} T_c=80°C (A)	I_{FSM}[1] t=10 ms (A)	T_{op} (°C)
B40C10	100	120	10	250	−40 to +150
B80C10	200	240			
B125C10	300	350			
B250C10	600	720			
B500C10	800	1,000			
B40C25	100	120	25	350	−40 to +150
B80C25	200	240			
B125C25	300	350			
B250C25	600	720			
B500C25	800	1,000			

[1] Ratings and characteristics hold for every diode in the bridge structure.

Zener diodes 500 mW, 0.7V to 35V/±5%, BZX . . .

Type	Zener Voltage at I_z=5 mA Min.	Max.	$I_{z\,max}$ mA at 45°C amb	αU_z 10^{-4}/K	R_z typ. Ω at I_z	U_R min. V at 100 nA
BZX3.3	3.1	3.5	109	−8 . . . − 3	80 (<90)	–
BZX3.6	3.4	3.8	101	−8 . . . − 3	80 (<90)	–
BZX3.9	3.7	4.1	92	−7 . . . − 3	80 (<90)	–
BZX4.3	4.0	4.6	85	−6 . . . + 1	80 (<90)	–
BZX4.7	4.4	5.0	76	−5 . . . + 2	70 (<78)	–
BZX5.1	4.8	5.4	67	−3 . . . + 4	30 (<60)	0.8
BZX5.6	5.2	6.0	59	−2 . . . + 6	10 (<40)	1
BZX6.2	5.8	6.6	54	−1 . . . + 7	4.8 (<10)	2
BZX6.8	6.4	7.2	49	+2 . . . + 7	4.5 (<8)	3
BZX7.5	7.0	7.9	44	+3 . . . + 7	4.0 (<7)	5
BZX8.2	7.7	8.7	40	+4 . . . + 7	4.5 (<7)	6
BZX9.1	8.5	9.6	36	+5 . . . + 8	4.8 (<10)	7
BZX10	9.4	10.6	33	+5 . . . + 8	5.2 (<15)	7.5
BZX11	10.4	11.6	30	+5 . . . + 9	6.0 (<20)	8.5
BZX12	11.4	12.7	28	+6 . . . + 9	7.0 (<20)	9
BZX13	12.4	14.1	25	+7 . . . + 9	9.0 (<25)	10
BZX15	13.8	15.6	23	+7 . . . + 9	11 (<30)	11
BZX16	15.3	17.1	20	+8 . . . + 9.5	13 (<40)	12
BZX18	16.8	19.1	18	+8 . . . +10	18 (<50)	14
BZX20	18.8	21.2	17	+8 . . . +10	20 (<50)	15
BZX22	20.8	23.3	16	+8 . . . +10	25 (<55)	17
BZX24	22.8	25.6	13	+8 . . . +10	28 (<80)	18
BZX27	25.1	28.9	12	+8 . . . +10	30 (<80)	20
BZX30	28.0	32.0	10	+8 . . . +10	35 (<80)	22.5
BZX33	31.0	35.0	9	+8 . . . +10	40 (<80)	25

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SEE OUR PAGES ON CAPACITORS IN SECTION 1500 PAGES A•1094, A•1095

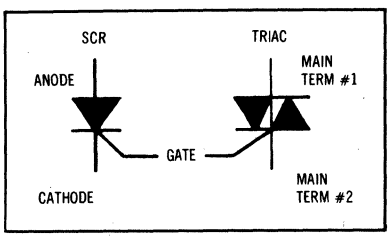
eem MINIGLOSSARY THYRISTORS/ HIGH POWER DIODES

THYRISTORS

A thyristor is a four-layer semiconductor (pnpn) that can be switched from an OFF to an ON state. This is usually done by a voltage or current pulse to the gate terminal. The device will then continue to conduct so long as the principal current of the device flows through the thyristor's two main terminals.

In many respects a thyristor is analogous to an electromechanical latching relay. In fact, thyristors have largely replaced these relays in newer equipment designs. But, misapplications and/or failure to fully understand the parameters of these and other solid state devices often leads to catastrophic field failures.

The terminology shown on this page has been condensed from common industry data books and is intended to be a guide for the engineer.



di/dt: *Critical rate of rise of ON state current* is the user's maximum design limit (Fig. 1).

di_R/dt: *Rate of decay of ON state current* (Fig. 1 & 2).

dv/dt (critical): *Rate of rise of OFF state voltage*. Lowest voltage rate of rise to cause a thyristor to turn ON.

dv/dt (reapplied) : *Rate of rise of reapplied OFF state voltage.*

I_{FSM}: *Nonrepetitive ON state surge current in diodes.* Maximum peak value of ½ cycles (60 Hz) a diode can withstand up to 100 times in its lifetime.

I_{TSM}: *Nonrepetitive ON state surge current in thyristors*. Maximum peak value of 60 Hz cycles a thyristor can withstand up to 100 times in its lifetime.

I_{DRM}/I_{RRM}: *Maximum peak forward/reverse leakage current* at specified temperature and repetitive conditions.

I_{GDM}: *Continuous gate current not to trigger*. Highest dc gate current that will *not* cause thyristor to switch from OFF to ON at a specific temperature.

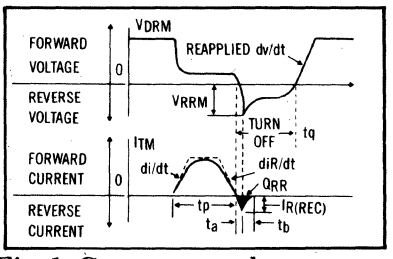


Fig. 1. Concurrent voltage and current waveforms

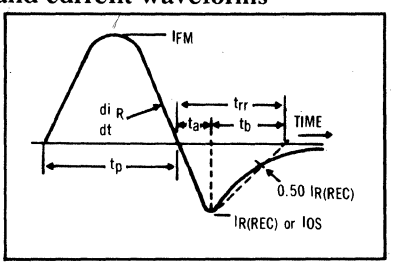


Fig. 2. Recovery current waveform

I_{GT}: *Continuous gate trigger current.* Absolute minimum gate current required to switch thyristor from OFF to ON.

I_H: *Holding Current*. Minimum current required to hold thyristor ON.

I_L: *Latching current*. Minimum current required to hold thyristor ON after removal of gate drive.

$I_{(REC)}$; *Recovery current*. Peak value of reverse current during recovery or turn OFF (Fig. 1 & 2).

I_{OS}: *Overshoot current*. See $I_{R(REC)}$.

I^2t: Maximum ON state, short time thermal capacity of the silicon element for operations less than ½ cycle of 180° conduction angle.

$I_{T(AV)}$: *Average ON state current* (max.)

Q_{RR}: *Reverse recovered charge* (Fig. 1).

$R_{\theta JC}$: *Junction-to-case thermal resistance* in degrees C per watt.

$T_{C(MAX)}$: *Max. allowable case temperature.*

$T_{J(MAX)}$: *Maximum allowable junction temp.*

t_d: *Delay time*. Interval between a specified point at beginning of gate pulse and the instant at which the principal voltage drops to a specified value. (OFF-ON) (Fig. 3)

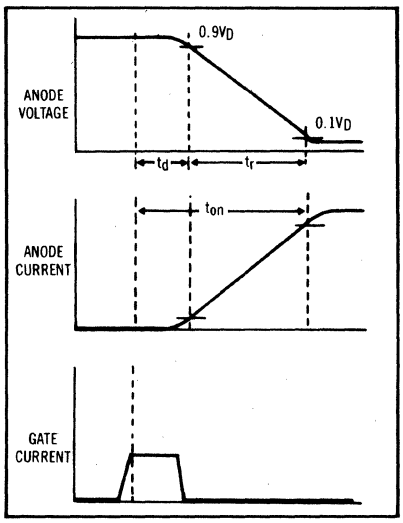


Fig. 3. Turn-on time waveforms

t_{on}: *Turn-on time*. The sum of delay time and rise time. (OFF-ON) (Fig. 3)

t_q: *Turn-off time*. Time between principal current reaching zero and the instant thyristor can block forward voltage without turning ON. (Fig. 1)

t_r: *Rise time*. Time between principal voltage dropping from one value to a second lower value when thyristor turns from OFF to ON. (Fig. 3)

t_{rr}: *Reverse recovery time*. (Fig. 2)

V_{DRM}/V_{RRM}: *Maximum repetitive peak OFF state/reverse voltage* excluding non-repetitive transients.

V_{DSM}/V_{RSM}: *Maximum nonrepetitive peak OFF state/reverse voltage.*

V_{FM}/V_{TM}: *Maximum forward voltage drop* at a specific forward current and case temp.

V_{GDM}: *Gate nontrigger voltage*. Highest dc voltage that will *not* cause thyristor to switch from OFF to ON.

V_{LATCH}: *Latching voltage*. Voltage required for thyristor to latch ON at a given gate current and junction temp.

$V_{TM(DYN)}$: *Dynamic ON state voltage*. Transient ON state voltage of thyristor when triggered into conduction for a given load and time.

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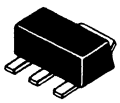
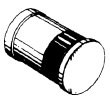
SURFACE MOUNT DEVICES

SOT-23
CASE 318

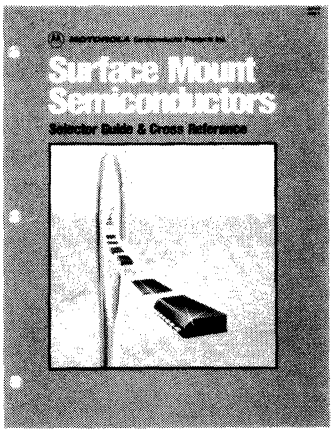


SOT-89
CASE 345-01

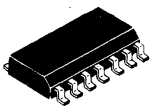
MLL34
CASE 362-01



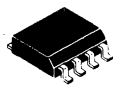
MLL41
CASE 362B-01



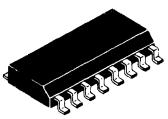
BR127



SO-14
CASE 751A



SO-8
CASE 751



SO-16
CASE 751B

Miniaturization is becoming an increasingly important aspect of modern electronic equipment. Until recently, miniaturized electronics took the shape of hybrid circuits, using various forms of unencapsulated semiconductor "chips" as the basic elements. Now, advances in packaging technology yield fully encapsulated semiconductor components which, when mounted on a circuit board, impose only a very small penalty on overall space requirement. These surface-mount packages are being adopted to a variety of devices, including integrated circuits as well as discrete components.

As an alternative to chips in miniaturized equipment, surface-mount components offer an array of imposing improvements:

- **Complete Pretest Capability** — Unlike unecapsulated die, which can only be partially tested in wafer form by probing, surface mounts are 100% electrically tested after die separation, wire bonding, and encapsulation, giving performance comparability to their largest discrete counterparts.
- **Handling and Assembly Ease** — Surface mount standard package outlines permit both transistors and diodes to be placed on substrates using automated handling equipment. Contact pads can also be standardized throughout the layout.
- **Preformed Leads** — ready for placement onto the substrate, with no intermediate lead forming steps required (SOT-23s).
- **Reliability** — Discrete chips used are nitride passivated of glassivated, and are epoxy encapsulated for superior mechanical strength and moisture resistance.
- **Excellent RF Performance** — Microminiature leads reduce RF parasitics.
- **Marking Capability** — A multi-digit code is laser marked on SOT-23 and SOT-89 devices for easy identification.

A wide variety of discrete components from Motorola's repertoire of reliability-proven semiconductor processes and geometries are available in many different surface mount packages including SOT-23, SOT-89, MLL34, MLL41, SO-8, SO-14, and SO-16.

Motorola offers devices in the following product lines in surface mount packages:

Small Signal Bipolar Transistors	general-purpose, switching, VHF/UHF amplifiers, mixers, oscillators, choppers, Darlingtons, low-noise, high-voltage, drivers, and RF.
Small Signal Field Effect Transistors	general-purpose, RF JFETs, TMOS FETs, and chopper/switches.
Diodes	zener, tuning, and switching.
Thyristors	SCRs, and PUTs.
Rectifiers	general-purpose, and Schottky.
Amplifiers	operational, and FM IF.
Regulators	5 V, 12 V, 15 V, and fixed voltage.
Communications Circuits	electronic telephone chip, telephone speech network & tone dialer, speakerphone, IC, and telephone tone ringer.

Motorola will also encapsulate almost any discrete die in a SOT package, depending on die compatability and volume requirements. Inquiries regarding custom production runs are invited.

Available Literature

BR127 — The Surface Mount Semiconductors Selector Guide and Cross Reference contains information on Motorola's surface mount technologies and dimensions of each surface mount package while providing device specifications and a complete industry cross reference.

This literature is available free from your local Motorola Sales Office or Distributor.

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Motorola Power Semiconductors . . . In Brief

TMOS POWER TRANSISTORS

Metal Packaged Power MOSFETs are all housed in the industry-standard TO-204AA (formerly TO-3) package, offering a current range from 1 amp to 60 amps, breakdown voltages up to 1000 volts and power dissipation as high as 250 watts. Both N-channel and P-channel devices are available to increase circuit-design flexibility.

Plastic Packaged Power MOSFETs, in three different packages, offer current ratings to 40 amps with breakdown voltages up to 1000 volts. N-channel and P-channel availability and rapidly dwindling prices are influencing increased market penetration.

Plastic Packaged ENERGY MANAGEMENT SERIES MOSFETs increase the power capabilities of conventionally packaged devices. Current ratings up to 200 amps and voltages as high as 600 volts open new applications for high-power, high-speed switching regulators and motor control. The top-leaded package allows bussing that meets UL spacing requirements.

BIPOLAR POWER TRANSISTORS

NPNs and PNPs, single and multiple (Darlington) transistor structures, and metal and plastic packages covers the widest range of specifications for virtually every potential applications requirement. With current ranges from 0.5 to 300 amperes, voltage ranges from 25 to 1500 volts, and power dissipation ranges from 5 to 500 watts, this line of bipolar transistors is one of the most pervasive in the industry.

Darlingtons

Consisting of two transistors, two resistors, and (up to) two diodes, Darlington transistors achieve gain figures up to 20,000 in a single package. Rapid line expansion, and the resulting widespread implementation make Motorola Darlingtons highly cost-effective in a fast growing number of applications.

GEMFETs — a combination of bipolar and MOS features

Recently, Motorola has introduced the first of a new series of power transistors (GEMFETs) that combine the low voltage drop of bipolar transistors with the high input impedance of MOSFETs. Suitable primarily for low-speed applications at present, the devices are available with 5 A and 20 A current ratings. Prices are relatively low due to a space efficient structure that permits small die geometries.

SMARTpower™ Devices

An offshoot of discrete power technology, SMARTpower ICs combine power transistors with integrated circuit technology to yield high-density power integrated circuits. Already, SMARTpower devices utilizing various combinations of processes have been introduced. These harbingers of a rapidly expanding capability promise to add a new dimension to system design alternatives.

Typical of Motorola's SMARTpower devices is the MPC2000 series of overvoltage/overtemperature protection circuits designed to protect systems from overvoltage transients and extreme temperature variations. The devices combine CMOS logic with TMOS output structures. Designed to protect 5-, 12- and 15-volt bus systems, the devices "crowbar" the bus system if either voltage or temperature exceeds preset levels. Devices are available with 7.5 A, 15 A and 35 A (continuous) current ratings.

Chips, Chips, Chips!

Designing a hybrid? Motorola's wide range of power transistors is available . . . UNENCAPSULATED: Check with your Motorola Sales representative for price and delivery quotations.

Specials Unlimited

Need a unique transistor with specifications not available off-the-shelf? Chances are Motorola can produce it quickly and inexpensively. Routine use of four major power processes and more than two decades of experience in the pioneering of new structures and geometries provide the insight and capability to meet any required specification within the limits of state-of-the-art technology.

Available Literature

DL111 — The Bipolar Power Transistor and Thyristor Data Book offers a compilation of data sheets and selection guides on bipolar silicon power transistors, thyristors and triggers.

DL135 — Motorola's TMOS Power MOSFETs Data Book provides the designer with complete data sheets on TMOS products. Also, nearly 200 pages are devoted to device theory and applications information.

SG48 — The Power Leader selector guide provides basic specifications comparisons and also an industry cross reference to Motorola's broad line of bipolar and MOS field effect power transistors.

This literature is available free from your Motorola Sales Office or Distributor.

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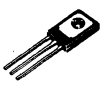
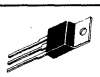
POWER TRANSISTORS (CONT)

POWER TRANSISTOR PACKAGE SELECTION

The broad scope of Motorola's Power Transistor line is illustrated by the package selection shown in the following tables.

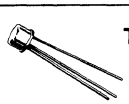
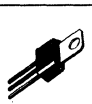
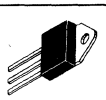
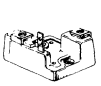
The range of drain current, drain-source voltage and power dissipation associated with devices in the various packages is indicated.

TMOS POWER MOSFETS

PACKAGE	I_D RANGE (AMPS)	V_{DS} RANGE (VOLTS)	P_D (WATTS)	PACKAGE	I_D RANGE (AMPS)	V_{DS} RANGE (VOLTS)	P_D (WATTS)
TO-204AA* (TO-3) Case 1-04 Case 1-05	1.0–60	50–1000	75–250	 TO-225AA (TO-126) Case 77	0.3–5.0	50–200	12.5–40
TO-218AC Case 340	3.0–40	50–1000	80–150	MO-040AA Case 346	30–200	50–600	500
 TO-220AB Case 221A-02	1.0–25	40–1000	40–125	Case 353	60–100	50–600	250

*Consult factory for Military approved power MOSFETs.

BIPOLAR POWER TRANSISTORS

PACKAGE	I_C RANGE (AMPS)	V_{CE} RANGE (VOLTS)	P_D (WATTS)	PACKAGE	I_C RANGE (AMPS)	V_{CE} RANGE (VOLTS)	P_D (WATTS)
TO-204AA (TO-3) Case 1 Case 11	2.5–30	40–1500	36–200	TO-202AC Case 306	0.1–3.0	30–350	6.25–12.5
TO-204AE Case 197	40–60	60–500	250–300	TO-220AB Case 221A	0.5–15	30–800	15–125
 TO-205AA Case 31 (TO-5)	3.0	40–80	6.0	TO-225AA (TO-126) Case 77	0.3–5.0	25–400	12.5–40
TO-205AD (TO-39) Case 79	0.5–5.0	40–400	5.0–10	TO-225AB Case 90	5.0–15	40–100	65–100
TO-210AA (TO-59) Case 160	7.0–10	60–100	60	 Case 152	0.5–2.0	30–300	10
TO-213AA (TO-66) Case 80	1.0–10	40–325	20–90	MO-040AA Case 346	50–200	200–850	500
 TO-218AC Case 340	5.0–25	40–800	80–150	 Case 353	25–100	250–850	250

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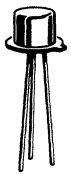
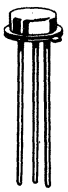
SMALL-SIGNAL TRANSISTORS

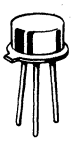
CASE 20
TO-206AF
(TO-72)



CASE 22
TO-206AA
(TO-18)

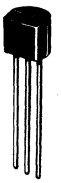


CASE 26
TO-206AB
(TO-46)



CASE 79
TO-205AD
(TO-39)

BIPOLAR METAL PACKAGES



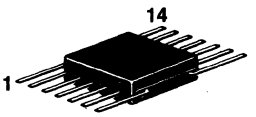
CASE 29-02
TO-226AA
(TO-92)

CASE 29-03
TO-226AE
TO-92
(1 WATT)

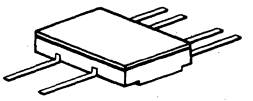
BIPOLAR
PLASTIC PACKAGES

CASE 20
TO-206AF
(TO-72)

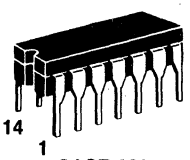
CASE 22
TO-206AA
(TO-18)



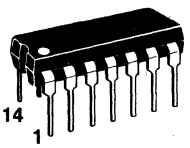
CASE 607



CASE 610A



CASE 632
MO-001AA
(TO-116)



CASE 646
PLASTIC

CASE 654

BIPOLAR MULTIPLE PACKAGES

Bipolars and FETs, singles and multiples, low frequency and RF, amplifiers and switches, plastic and metal (packages) — no semiconductor product line offers the specifications selection and no manufacturer matches Motorola in production capacity for small-signal transistors. Military qualifications to JAN, JANTX, JANTXV, and JANS of selected devices attest to the reliability of Motorola's small-signal product lines.

BIPOLAR TRANSISTORS

Metal Package

Motorola's Small-Signal Metal Can Transistors are designed for use as general-purpose amplifiers, high-speed switches, high-voltage amplifiers, low-level/low-noise amplifiers, high-frequency oscillators, choppers, and Darlingtons. These devices are manufactured in a variety of packages with specifications that match any design requirement.

Plastic Package

Small-Signal TO-92 Plastic Transistors encompass hundreds of devices with characteristics for general-purpose, amplifier, RF, and switching applications. General purpose transistors have minimum breakdown voltages from 25 to 80 volts and maximum currents (I_C) from 100 mA to 2 A. The switching transistors have a breakdown voltage range from 12 to 15 V, while the amplifying transistors have voltages from 12 to 80 V.

The popular high-volume, low priced TO-92 package combines proven reliability, performance, economy and convenience to provide the perfect solution for industrial and consumer design problems.

Multiple Transistors, Metal and Plastic

A variety of multiple small-signal transistors to compete with the increasing influx of integrated circuits. Included are quad, dual, and Darlington transistors for off-the-shelf delivery. These transistors vary in collector current (I_C) from 30 mA to 1.5 A with V_{CEO} ranging from 12 to 250 V.

The chips used in the quad and dual transistors are those that have emerged as the most popular ones for discrete transistor applications. But even beyond that, Motorola offers its entire vast repertoire of discrete small-signal transistors for multiple-device packaging. For special applications, special configurations can be supplied with quick turnaround time and at low premiums.

Bipolar Small-Signal RF Transistors

Small-signal TO-92 RF bipolar transistors with gain-bandwidth products from 1.0 GHz to 8.0 GHz operate with currents from 0.25 mA to over 50 mA. These devices are available for low-noise/high-gain amplifier mixer and multiplier applications, UHF and microwave oscillator applications, high-frequency current-mode switches, and Class A linear CATV, MATV applications.

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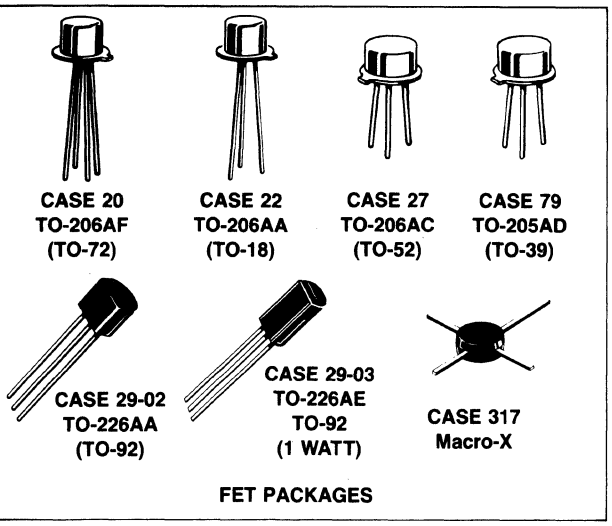
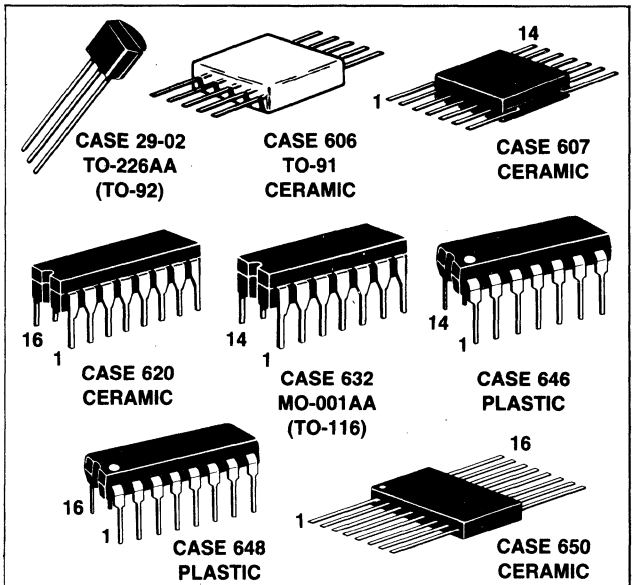
SMALL-SIGNAL TRANSISTORS (CONT)



FET PACKAGES



DIODE PACKAGES

FIELD-EFFECT TRANSISTORS

A line of field-effect transistors encompasses the latest technology and covers the full range of FET applications. Included here are junction FETs, MOSFETs (with P- and N-channel polarity with both single and dual gates) and TMOS FETs. These FETs include devices developed for operation across the frequency range from dc to UHF in switching and amplifying applications. Package options from low cost plastic to metal TO-72 packages are available.

JFETs. JFETs are available in both N- and P-channel and in metal and plastic packages. Applications include general-purpose amplifiers, switches and choppers, and RF amplifiers and mixers. These devices are economical and very rugged and offer a lower noise figure than standard MOSFETs.

With a constant I_D of 1 A, switching JFET devices have a range of $r_{DS(on)}$ from 8 to 300 ohms. Low frequency/low noise devices range in $I_{DSS(max)}$ from 0.6 to 30 mA, and high frequency amplifiers range from 5 to 60 mA.

MOSFETs. Small-signal MOSFET transistors are available either in the depletion/enhancement or the enhancement mode and both single and dual gate construction. Low frequency/low noise single gate devices range in $I_{DSS(max)}$ from 0.25 to 25 mA and from 11 to 40 mA for dual gate MOSFETS.

MOSFET applications include use in smoke detectors, RF amplifier and mixer applications, and VHF/UHF amplifier and mixer applications.

TMOS FETs. TMOS FETs are field effect transistors with an oxide insulated gate which controls vertical current flow. These devices exhibit higher input impedance, faster switching, enhanced thermal stability, and easier paralleling than bipolar transistors. In addition, they have lower "on" resistance and higher power handling capability than conventional horizontal MOSFETs or JFETs. These TMOS devices are available in either single or quad packages with most of the $r_{DS(on)}$ ratings from 1.4 to 4 ohms maximum with an I_D of 1 A.

SMALL-SIGNAL DIODES

A limited number of small-signal diodes are included in Motorola's small-signal device lines. These include dual diodes, designed for low cost biasing, steering, and voltage doubler applications, and diode arrays, for high-current, fast-switching core-driver applications.

The dual diodes offer minimum reverse breakdown voltage ratings of 70 and 100 V at breakdown currents of 100 μA. The reverse currents for these devices are rated at 0.1 μA at reverse voltages of 50 V.

The diode arrays are multiple junctions fabricated by a planer process and mounted in integrated circuit packages. These arrays offer many of the advantages of ICs such as high-density packaging and improved reliability. They are available in dual 10-diode, dual 8-diode, and 8-diode arrays with reverse breakdown voltages of 40 and 50 V and reverse currents of 0.5 and 1 μA.

Available Literature

DL126 — The Small-Signal Data book contains complete device specifications for nearly 2,000 bipolar and field-effect transistors in the form of data sheets and selector guides.

SG97 — The Small-Signal Metal Transistors selector guide provides preliminary data in the form of specifications tables to allow for quick design decisions.

SG21 — The Plastic Encapsulated Small-Signal Transistors selector guide offers package characteristics and device specifications listed by application for quick reference.

This literature is available free from your local Motorola Sales Office or Distributor.

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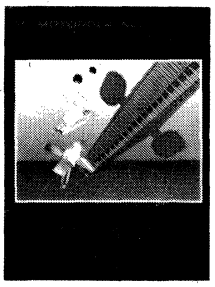
RF PRODUCTS

SG46R2



DL110

While Motorola is considered the supermarket for semiconductor products, nowhere is the selection more diverse, or more complete, than in products designated for RF communications systems design. Motorola offers device categories that serve the designer's needs from tuning and switching diodes in receiver front ends, to power and small-signal transistors extending into the microwave range.

Bipolar RF Power Transistors

Bipolar RF Power Transistors are specified for HF, VHF, UHF, 800 MHz, and Microwave applications in military and commercial land mobile, avionics, and marine transmitters. The devices are available in many frequency ranges:

RF Bipolar Power Transistors

APPLICATION	FREQUENCY RANGE	OUTPUT POWER (WATTS)
HF	1.5–30 MHz 14–30 MHz 27–50 MHz	3.0–250 PEP/CW 0.5–80 1.0–70
VHF	30–200 MHz 66–88 MHz 136–174 MHz 225 MHz	1.0–100 1.5–25 1.0–75 1.0–13
UHF	225–400 MHz 407–512 MHz 806–960 MHz	0.02–125 0.5–80 0.5–40
MICROWAVE	960–1215 MHz 1.7–2.3 GHz 2.0 GHz	0.2–325 1.0–16 1.0–10

RF Power Field Effect Transistors

RF Power FETs provide high gain, improved high order intermodulation distortion, high input impedance, and built-in gain control for ALC and manual power output control. Motorola offers FETs in many frequency ranges including HF for fixed, mobile, and marine transmitters, and VHF and VHF/UHF for military and commercial aircraft radio transmitters.

RF Power FETs

APPLICATION	FREQUENCY RANGE MHz	OUTPUT POWER (WATTS)
HF/SSB	1.5–150	30, 150
VHF	2–200	5–125
VHF/UHF	2–400	5–25

Small-Signal RF Transistors

Small-Signal RF Transistors include GaAs FETs and Bipolar Transistors characterized for low noise amplifiers, mixers, oscillators, multipliers, non-saturated switches, and low-power drivers.

Gallium Arsenide FETs. Motorola Gallium Arsenide FETs offer low noise, high gain RF performance in addition to the high input impedance and direct AGC capability associated with field-effect transistors.

Medium Power RF Transistors. Small-Signal and medium power RF transistors with gain-bandwidth products from 1.0 GHz to 8.0 GHz operate with currents from 0.25 mA to over 140 mA. Motorola offers these transistors in a wide range of transistor/package combinations. Special matching of complimentary transistors is available upon request.

Hybrid Amplifiers

Motorola's Hybrid Amplifiers allow compact, simple designs due to their impedance matching and small size. Their consistency and reliability stem from thin-film hybrid construction, all gold metallization, laser-trimmed nichrome resistors and MOS capacitors. These hybrids are designed and specified for land mobile power, CATV distribution, and general purpose wideband amplifiers.

For the land **mobile devices,** the frequency ranges from 407 to 512 MHz and from 806 to 960 MHz; for the **CATV distribution devices,** the frequencies are 330 MHz and 450 MHz for forward amplifiers and 200 MHz for reverse amplifiers; for the wideband amplifiers, frequencies range from 0.1 to 1000 MHz.

RF Diodes

Motorola also offers a wide variety of RF diodes that are designed for electronic tuning, mixing and switching high frequency signals. RF diodes include general purpose tuning diodes, FM radio and TV hyper-abrupt tuning diodes, AM tuning diodes, hot carrier diodes, PIN diodes, and high capacitance tuning diodes. These devices are available in the hermetic DO-204AA (DO-7) and low cost TD-226AA/AC (TO-92) packages.

Available Literature

DL110 — The RF Device Data book contains technical information on over 500 devices in the form of data sheets, 19 application notes, and 22 engineering bulletins. Also included is an industry cross reference and a selector guide to make design decisions easier.

SG46 — The RF & Microwave Products Data Selector Guide and Cross Reference offers an easy solution to bulky catalogs and data books while providing the designer the necessary information to make preliminary component choices quickly and accurately.

This literature is available free from your local Motorola sale Office or Distributor.

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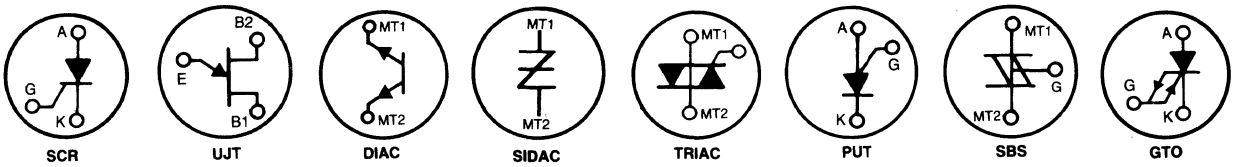
THYRISTORS



One-stop shopping for thyristors and related products is one of the benefits of Motorola's extensive power semiconductor line. For example:

- A full line of Triacs and SCRs covering a forward current range from 0.5 to 55 amperes and blocking voltages from 15 to a new 1000-volt limit.
- Two basic package categories — plastic for lowest cost; metal for hermetically-sealed requirements in high-reliability projects.
- An extensive line of trigger devices that includes UJTs, PUTs, Diacs, SBS, Sidacs — even optically-coupled triac drivers from Motorola's optoelectronic product line.

SCRs

Silicon-Controlled Rectifiers (SCRs) are thyristors intended to switch load currents in one direction only, making them useful for dc and half-wave ac applications as well as full-wave applications in which bidirectional current is routed in one direction through the SCR via a bridge rectifier.

Motorola offers SCRs with blocking voltages from 25 to 1000 volts, on-state RMS currents from 0.5 to 55 amperes, and gate currents from 0.1 mA to 8 mA.

Additionally, Power FET technology is now extended to include a two-transistor equivalent to latching silicon controlled rectifiers, the MCR1000 series. This first-generation TMOS SCR has very fast switching times, high line transient voltage rejection (DV/DT) and asymmetrical blocking. Possible applications are laser drivers, printers, switching power supplies and inverters, and direct-drive-from-logic robotics.

GTOs

Motorola's Gate Turn-Off thyristors (GTOs) are designed primarily for dc power switching applications such as motor drives, switching power supplies, inverters — or wherever a need exists for high surge current capabilities and fast switching speeds.

The MGTO series contains asymmetrical gate turn-off thyristors with blocking voltages ranging from 1000 to 1400 volts, on-state RMS current ratings of 18 A and a gate current rating of 300 mA.

Triacs

Triacs are bidirectional thyristors in which a single trigger source turns the device on for load current in either direction. Because they do not require a bridge rectifier in order to handle full-wave ac, triacs are useful in power applications that require full source power control capability to be applied to the load.

Motorola offers triacs with on-state RMS current ratings from 0.6 A to 40 A with blocking voltages up to 1000 V.

THYRISTOR TRIGGERS

Unijunction Transistors

Motorola unijunction transistors (UJTs) are highly stable devices for general-purpose trigger applications and as pulse generators (oscillators) and timing circuits. They are available in low-cost plastic package TO-92 and in hermetically sealed metal package Case 22A.

Programmable Unijunction Transistors

Programmable UJTs (PUTs) are similar to UJTs except that I_V, I_P and intrinsic standoff voltage are programmable (adjustable) by means of an external voltage divider. This stabilizes the circuit performance for variations in device parameters. The general operating frequency is from 0.01 Hz to 10 kHz, making them suitable for long-duration timer circuits.

Silicon Bidirectional Switch (SBS)

Applications similar to DIAC, but has gate electrode that permits synchronization.

SIDACs

High voltage trigger devices similar in operation to a Triac. Upon reaching the breakover voltage in either direction, the device switches to a low-voltage on-state.

Bilateral Triggers — DIACs

Specifically designed as low-cost bidirectional triggers in line-operated Triac control circuits such as light dimmers, motor controls, and temperature controls.

Optically Isolated Triac Driver

An infrared LED and a bidirectional photodetector in one 7500 V isolated plastic DIP allows safe, economical triggering of Triacs and SCRs from logic sources as low as 3 Volts, 15 mA.

Available Literature

DL111 — The Bipolar Power Transistor and Thyristor Data book supplies complete specifications in the form of data sheets while accompanying selection guides provide a quick comparison of characteristics to simplify the task of choosing the best device for a circuit.

SG34 — The Thyristor Selection Guide and Cross Reference provides specifications and outline dimensions for many of Motorola's SCRs, TRIACs and Triggers.

This information is available free from your local Motorola Sales Office or Distributor.

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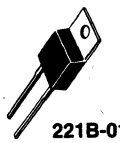
REGULATOR AND REFERENCE DIODES

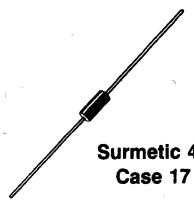


221B-01
(TO-220AC)
Plastic

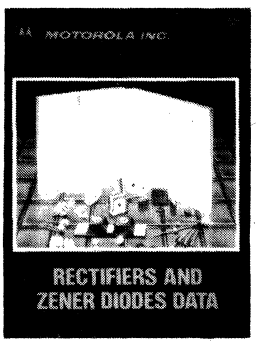
362B-01
Glass
Leadless

299-02
(DO-204AH)
Glass

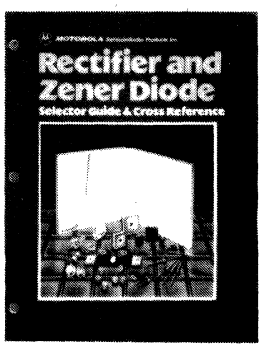
Metal
Case 56
(DO-4)



Surmetic 40
Case 17



DL125



SG44

In every language under the sun, the name most commonly associated with solid-state regulator and reference devices is Motorola. A pioneer in Zener diode development, Motorola has consistantly led the industry in parameter improvements, packaging proliferation and specifications innovation. Today, Motorola serves the industry with an incomparable line of zener and avalanche diodes, transient suppressors and temperature compensated reference devices designed to provide the exact degree of regulation required, at the point in the circuit or system where it can be used most conveniently at the lowest cost.

Motorola's standard **Zeners and Avalanche diodes** comprise the largest inventoried line in the industry. Continuous development of improved manufactured techniques have resulted in computerized diffusion and test, as well as critical process controls learned from surface-sensitive MOS fabrication. Resultant high yields lower factory cost which is passed on to the customer.

Some of the features associated with Motorola's Regulator and Reference diodes are:

- Wide selection of package materials and styles:
  Plastic (surmetic) for low cost, mechanical ruggedness.
  Glass for highest reliability, lowest cost.
  Metal for highest power.
  Leadless for surface mount technology.
- Power ratings from 0.25 to 50 watts.
- Zener voltages from 1.8 to 200 volts.
- Tolerances from 10% (low cost) to as tight as 1% (critical applications) with off-the-shelf delivery.
- Special selection of electrical characteristics available at low cost due to high-volume lines (check your Motorola sales representative for special quotations.
- JAN/JANTX(V)/JANS availability.
- Special glass now used in DO- type packages is compatible with low temperature alloy processes, yielding sharper breakdown and low leakage.

Motorola offers **temperature compensated reference devices** for applications where output voltage must remain within narrow limits during changes in input voltage, load resistance and temperature. These are available with Zener voltages from 6.2 to 11.7 volts.

Field Effect Current Regulator Diodes are high impedance diodes whose "constant current source" characteristics complements the "constant voltage" of the Zener line. Currents are available from 0.22 to 4.7 mA with usable voltage compliance as high as 100 V.

Transient suppressors are designed for applications requiring protection of voltage sensitive electronic devices in danger of destruction by high energy voltage transients. These devices are offered with peak power dissipations of 600, 1500 and 8000 watts for 1.0 ms.

Automotive transient suppressors are designed for protection against over-voltage conditions in the auto electrical system that typically occurs when the battery open circuits while the car is running.

Available Literature

DL125 — The Rectifiers and Zener Diodes Data book provides complete technical data for the broad line of Motorola's silicon rectifiers and zener diodes. A comprehensive selector guide and industry cross reference are included to simplify the task of choosing the best set of components required for a specific application.

SG44 — The Rectifier and Zener Diode Selector Guide and Cross Reference supplies extensive tables of technical information and an alphanumeric industry cross reference to Motorola's line of devices.

This literature is offered free from your local Motorola Sales Office or Distributor.

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SEMICONDUCTORS

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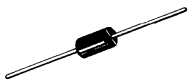
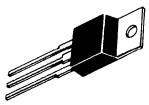
RECTIFIERS

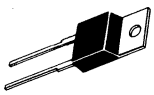
Case 59-03
(DO-41)
Plastic



Case 267-01
Plastic

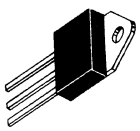


Case 221A-02
(TO-220AB)
Plastic



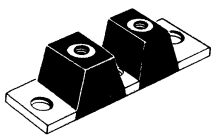
Case 221B-01
(TO-220AC)
Plastic

Case 245
(DO-4)
Metal



Case 340-01
(TO-218AC)
Plastic

Case 257
(DO-5)
Metal



Case 357B-01
Plastic
Power Tap

Typical of the product and package selection associated with Motorola rectifiers is this line of case variations for Ultrafast Rectifiers.

Motorola rectifiers embody the same precision technology as the most advanced ICs, and are capable of passing stringent environmental testing, including under the hood of an automobile. In addition to improved quality, rectifier product trends are toward higher operating temperature, faster switching times, plastic packages (translate lower costs) and use of dual rectifier modules.

Schottky Power Rectifiers

SWITCHMODE Schottky Power Rectifiers with the high speed and low forward voltage drop characteristics of Schottky's metal/silicon junctions are produced with ruggedness and temperature performance comparable to silicon-junction rectifiers. Ideal for use in low voltage, high frequency power supplies and as very fast clamping diodes, these devices feature switching times less than 10 ns, and are offered in current ranges from 0.5 to 300 amperes, and reverse voltages to 60 volts. Guardrings are included in all Schottky die for reverse voltage stress protection from high rates of dv/dt to virtually eliminate the need for snubber networks and they also act as zeners and avalanches when subjected to voltage transients.

Ultrafast Rectifiers

Expanding the SWITCHMODE Rectifier family are ultrafast devices (MUR family) with reverse recovery times of 25 to 100 nanoseconds. They compliment the broad Schottky offering for use at higher voltages (to 600 V) and in switching power supplies as operating frequencies increase from 20 kHz to 250 kHz.

Fast Recovery Rectifiers

Fast Recovery Rectifiers are available for designs requiring a power rectifier having maximum switching times ranging from 200 ns to 750 ns. These devices are offered in current ranges of 1.0 to 50 amperes and in voltages to 1000 volts.

General Purpose Rectifiers

For lowest cost, Motorola offers a wide variety of general purpose rectifiers, packaged to meet diverse mounting requirements. Avalanche capability is available in the axial lead 1.5, 3 and 6 amp packages to provide protection from transients. Higher power packages provide current ratings up to 50 amperes at voltages up to 1000 volts.

Bridge Rectifiers

Motorola SUPERBRIDGES offer cost effectiveness and reliability in single phase applications. Chip/leadframe techniques are used for lower-current types, while the higher current assemblies combine pretested "button" rectifier cells for low assembly cost and high yields. Performance of four individual diodes is achieved at the cost of only two, with reliability of the whole assembly comparable to that of a single unit.

Available Literature

DL125 — The Rectifier and Zener Diode Data book provides complete data sheets, a selection guide, and an industry cross reference to simplify the task of selecting the best components for a specific application.

SG44 — The Rectifier and Zener Diode Selector Guide and Cross Reference offers the designer a quick solution to finding the right device to fill the requirements of system designs.

This literature is available free from your local Motorola Sales Office or Distributor.

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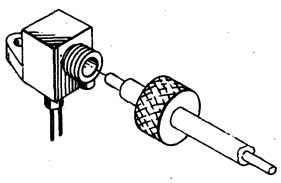
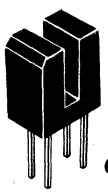
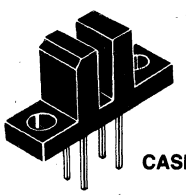
OPTOELECTRONICS COMPONENTS



FIBER OPTIC SYSTEM

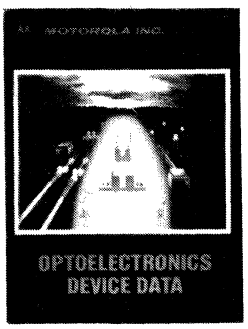


CASE 354

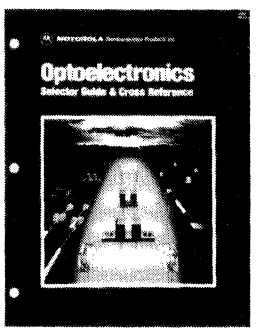


CASE 354A

SLOTTED COUPLERS



DL118



SG87

Motorola offers a range of optoelectronic components . . . from fiber optic emitters/detectors to optoisolators, optocouplers, and infrared emitters/detectors.

Fiber Optic Components

Fiber optic devices are available for high performance systems requiring greater than 100 MHz analog bandwidth over several kilometers, and also for very low-cost systems requiring bandwidths of less than 10 MHz over short distances. Infrared emitters are available with typical output power ratings from 0.9 mW to 3.5 mW at forward currents of 100 mA. Photodetectors are available with responsivities from 0.05 to 10,000 $\mu A/\mu W$ at wavelengths of 820 or 900 nm. All of Motorola's fiber optic packages fit directly into standard connector systems and are spectrally matched to minimize attenuation regions of most fiber optic cables.

The FLCS System. The Fiber optic Low Cost System (FLCS) consists of an infrared emitter and several detectors in a complete package with the fiber alignment and locking mechanism and the means for attaching to a board. Each package has a molded lens which efficiently couples the light to and from the cable.

Optocouplers/Isolators

Motorola's line of optocouplers/isolators consists of Gallium Arsenide infrared emitting diodes optically coupled to silicon photodetector/output devices in light-shielding packages. These provide a range of current transfer ratios (CTR) from 2% to 1000%. The variety of output devices includes a choice of transistors, Darlingtons, Triacs, SCRs and Schmitt triggers, as well as a complete preamplifier output, which adapt them easily to specific end-use requirements. Standard devices are available in the popular 6-pin DIP package.

Optointerrupters/Slotted Couplers

Optointerrupters/slotted couplers consist of an infrared emitting diode facing a photodetector in a molded plastic housing. A slot in the housing between the emitter and the detector provides a means of interrupting the signal. Standard devices range in CTR from 5% to 20% (min) at forward currents of 20 mA with a V_{CE} of 5 volts. Motorola offers a wide selection of emitters and detectors (see below) that can be installed in custom housings for specific applications.

Infrared Emitting Diodes

Motorola's infrared emitting diodes are made by the liquid phase epitaxial process for long life and stability. They provide high power output and quick response at 820 nm and 930 nm with low power input drive current.

Photodetectors

A variety of silicon photodetectors are also offered, varying from simple PIN diodes to complex, single chip 400 volt triac drivers. They are available in packages offering choices of viewing angle and size in either economical plastic cases or rugged, hermetic metal cans. These photodetectors are spectrally matched for use with Motorola infrared emitting diodes.

Available Literature

DL 118R1 — Up-to-date specifications on infrared devices, GaAs emitters, silicon detectors, high-technology optocoupler/isolators, and Fiber Optic components.

SG87 — This selector guide enables the designer to make preliminary decisions on optoelectronic devices.

This literature is available free from your nearest Motorola Sales Office or Distributor.

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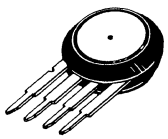
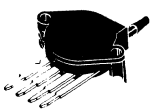
SENSORS



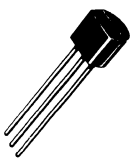
CASE 344-03
Basic Element



CASE 350-01

CASE 352-01
PRESSURE SENSORS

CASE 318-02
TO-236AA
SOT-23



CASE 29-02
(TO-226AA)

TEMPERATURE SENSORS

Motorola's line of pressure transducers and temperature sensors provide solid-state reliability, while affording cost advantage due to high volume processing technologies.

Pressure Transducers

Pressure sensors using unique piezoresistive shear stress design give voltage outputs that are directly proportional to pressure, with high sensitivity, accuracy and linearity. This piezoresistive technology allows the device to produce a change in output voltage when a sensing element's resistance changes. In the conventional pressure sensor, the sensing element is one of four resistors in a wheatstone bridge. The values of the resistors must be closely matched in order to allow ease of temperature compensation. Motorola's "X-ducer" piezoresistive shear stress strain guage utilizes a single p-type diffused silicon resistor. This resistor is strategically placed in an etched silicon diaphram to maximize shear stress and sensitivity to shear stress. This technological advancement yields a sensing element with improved part reproducibility by eliminating the need to match resistors, allowing batch processing at low cost.

These devices have pressure ranges from 0 to 30 PSI and are available in packages 344, 350, and 352 as shown above.

The MPX10, 11, and 12 series of pressure sensors provides typical outputs of 35 to 55 mV for highly accurate pressure measurements from 0 to 1.5 PSI with linearity deviations of less than ±1.0% of full scale (FS). These transducers are designed for use in air movement control, environment control systems, fluid level measurement, leak detection, medical instruments and various types of industrial controls.

The MPX50, 51 and 52 series offers typical outputs of 45 to 60 mV from 0 to 7.5 PSI with linearities from ±0.05 to ±.5% FS. They are designed for automotive, industrial, medical and other applications.

The MPX100 series of pressure sensors provides as low as ±0.05% FS linearity for pressures from 0 to 14.5 PSI for applications in the automotive, industrial and medical industries.

The MPX200 and 201 series offers pressure sensing from 0 to 29 PSI with linearities as low as ±0.05% FS. These devices are also designed for automotive, industrial and medical applications.

Temperature Compensated Pressure Transducers

Motorola offers the **MPX2000 SERIES on-chip temperature compensated pressure sensors** which features the same silicon shear-stress strain guage design as the other MPX sensors. These devices afford excellent temperature stability and highly accurate pressure measurements for critical applications in industrial, automotive, medical and environmental controls.

With a differential pressure range of 0 to 7.3 PSI, deviation from straight line linearity is less than 40 μV for the MPX2050 and less than 100 μV for the MPX2051. The MPX2100 and MPX2101 offer a pressure range of 0 to 15 PSI and the MPX2200 and MPX2201 offer a 0 to 30 PSI range. These devices are also available in packages 344, 350, and 352.

Temperature Sensors

Motorola's line of temperature sensors yields very linear voltage outputs verses temperature over temperature ranges from −40°C to +150°C and with response times as fast as 400 ms. These devices offer temperature matching accuracies from ±2°C to ±5°C depending on the needs of the designer. These devices are available in case 29-02 and 318-02 as shown above and are designed for temperature sensing applications in automotive, consumer, and industrial products requiring low cost, small size, and high accuracy.

Available Literature

BR158 — The MPX Series Pressure Sensor Elements brochure provides the designer with technical information on Motorola's line of pressure sensors.

— Individual data sheets are available for these devices:

MPX10, 11, 12	MPX200, 201	MPX2200, 2201
MPX50, 51, 52	MPX2050, 2051	MTS102, 103, 105
MPX100	MPX2100, 2101	MMBTS102, 103, 105

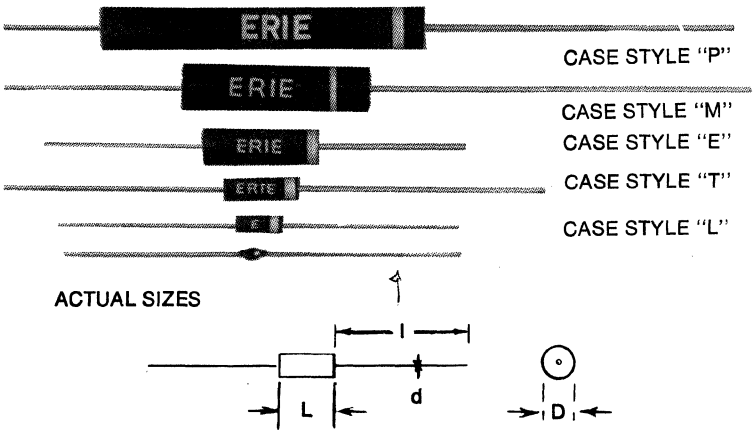
This literature is available free from your local Motorola Sales Office or Distributor.

EEM PRODUCT SELECTION GUIDES

Use the EEM Product Selection Guides. There are 34 Guides in this edition of EEM. See page 2 (A•2, B•2, C•2, D•2) of each volume to locate the Product Selection Guides that pertain to your needs.

high voltage silicon rectifiers fast recovery, HX / low leakage, HV

MURATA ERIE NORTH AMERICA, INC.



Murata Erie high voltage silicon rectifiers are available with peak reverse voltage rating from 1KV to 30KV, in either transfer molded or epoxy protected packages. Features include nanoampere leakage, compact design and high reliability over a wide temperature range. These rectifiers have found applications in numerous military, industrial and aerospace projects.

Case Style	Dimensions (Inches) L (Max.)	D (Max.)	l (Min.)	d
P	.130	.085	.75	.015
M	.25	.105	.75	.015
E	.625	.20	.70	.015
T	1.03	.26	1.0	.030
L	1.70	.235	1.00	.030

ELECTRICAL CHARACTERISTICS AND RATINGS

Part Number	Case Style	Peak Reverse Voltage (P.R.V.) Volts Peak	Min. Peak Transient Reverse Voltage Rating Volts Peak	Max. Forward Current.. (I_F) @ 100°C mA DC	Max. Forward Voltage (V_F) @ 10mADC and 25°C Volts DC	Max. Reverse Current (I_r) @ P.R.V. At 25°C nA	Max. Reverse Current (I_r) @ P.R.V. At 100°C µA	Reverse Recovery Time (Typ.) (T_{rr}) TEK "S" 2mAI$_F$→2mAI$_r$ µS	Max. Capacitance @ 100VDC pF	Max. Operating Temperature °C	Storage Temperature Range °C	Cathode Identification
HV10P	P	1000	1500	50	5.0	10	1.0	2.5		150		1 Brown Dot
HV10M	M	1000	1500	50	5.0	10	1.0	2.5		150		Cathode Band
HX10P	P	1000	1500	40	7.5	100	3.0	0.25		125		2 Brown Dots
HX10M	M	1000	1500	40	7.5	100	3.0	0.25		125		Cathode Band
HF10P	P	1000	1500	40	9.0	100	3.0	0.1		125		1 Brown, 1) White Dot
HF10M	M	1000	1500	40	9.0	100	3.0	0.1		125		Cathode Band
***HV20P**	P	2000	3000	50	5.0	10	1.0	2.5		150		1 Red Dot
HV20M	M	2000	3000	50	5.0	10	1.0	2.5		150		Cathode Band
***HX20P**	P	2000	3000	40	7.5	100	3.0	0.25		125		2 Red Dots
HX20M	M	2000	3000	40	7.5	100	3.0	0.25		125		Cathode Band
HF20P	P	2000	3000	40	9.0	100	3.0	0.1		125		1 Red, 1 White Dot
HF20M	M	2000	3000	40	9.0	100	3.0	0.1		125		Cathode Band
***HV30P**	P	3000	4500	50	5.0	10	1.0	2.5		150		1 Orange Dot
***HV30M**	M	3000	4500	50	5.0	10	1.0	2.5		150		Cathode Band
***HX30P**	P	3000	4500	40	7.5	100	3.0	0.25		125		2 Orange Dots
***HX30M**	M	3000	4500	40	7.5	100	3.0	0.25		125	−55	Cathode Band
HF30P	P	3000	4500	40	9.0	100	3.0	0.1		125	to	1 Orange, 1 White Dot
HF30M	M	3000	4500	40	9.0	100	3.0	0.1		125	+175	Cathode Band
***HV40P**	P	4000	6000	50	5.0	10	1.0	2.5	0.5	150		1 Yellow Dot
***HV40M**	M	4000	6000	50	5.0	10	1.0	2.5		150		Cathode Band
***HX40P**	P	4000	6000	40	7.5	100	3.0	0.25		125		2 Yellow Dots
***HX40M**	M	4000	6000	40	7.5	100	3.0	0.25		125		Cathode Band
HF40P	P	4000	6000	40	9.0	100	3.0	0.1		125		1 Yellow, 1 White Dot
HF40M	M	4000	6000	40	9.0	100	3.0	0.1		125		Cathode Band
***HV50P**	P	5000	7500	50	5.0	10	1.0	2.5		150		1 Green Dot
***HV50M**	M	5000	7500	50	5.0	10	1.0	2.5		150		Cathode Band
***HX50P**	P	5000	7500	40	7.5	100	3.0	0.25		125		2 Green Dots
***HX50M**	M	5000	7500	40	7.5	100	3.0	0.25		125		Cathode Band
HX50E	E	5000	7500	40	7.5	100	3.0	0.25		125		Cathode Band
HF50P	P	5000	7500	40	9.0	100	3.0	0.1		125		1 Green, 1 White Dot
HF50M	M	5000	7500	40	9.0	100	3.0	0.1		125		Cathode Band
***HV80ML**	M	8000	12000	25	10.0	50	3.0	2.5		150		Cathode Band
***HX80ML**	M	8000	12000	20	15.5	100	5.0	0.25		125		Cathode Band
HF80ML	M	8000	12000	40	18.0	100	5.0	0.1		125		Cathode Band
HTV100	T	10000	15000	5.0	25	100	5.0	0.25		100	−55	Cathode Band
***HTV125S**	E	12500	18000	5.0	30	100	5.0	0.25		125	to	Cathode Band
***HTV150S**	E	15000	20000	5.0	30	100	5.0	0.25		125	+150	Cathode Band

* **NOTE:** Further encapsulation is recommended for rectifiers marked "*"

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Bi-Polar Types	Both Silicon and Germanium
Complementary Pairs	Up to 200 watts, up to 1500 volts
Bi-Polar Selector Guide (Silicon & Germanium)	
RF Selector Guide	Covering RF Power devices to 870 MHz
Field Effect Transistors (FET)	Both single and dual gate devices. Suitable from audio through UHF
Darlington Power Transistors	Gain up to 90K, power up to 250W, IC to 50A
DIODES AND RECTIFIERS	42 case styles for most applications
General Purpose	Both Silicon and Germanium
PIN Diodes	For fast switching
HV Rectifiers	Voltages to 45,000 volts
Varistors (Temperature Compensating Diodes)	Biasing diodes to achieve stability
Varistors (Voltage Compensating Diodes)	
Varactors (Variable Capacitance Diodes)	For tuning, AFC
Bridge Rectifiers	1 Amp to 40 Amps, up to 1000 volts
HV Rectifiers (Avalanche Silicon)	High voltage and high current
ZENER DIODES	From ½ to 50 watts, from 2.4 to 200 volts, axial and stud cases
INDUSTRIAL RECTIFIERS	From 3 to 2200 Amps up to 1600 volts
SILICON CONTROL RECTIFIERS (SCR)	
Phase Control	0.8 to 1880 Amps, voltages to 1200v
Switching	Frequencies to 16 kHz
TRIACS	0.8 to 40 amperes, with voltages up to 1000v in a variety of case styles to accommodate most applications
MICROPROCESSORS/RAM's	Seven popular microprocessors and their peripherals

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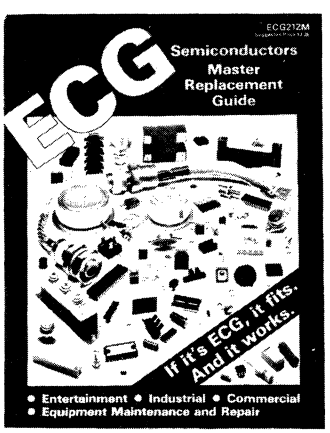

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TRIACS, SCRs, DIACS, SIDACS

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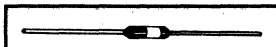


DO-35	TO-92	TO-202 AB	TO-220 AB ISOLATED	TO-220 AB NON-ISOLATED	TO-3 BASE	TO-218X	SOT-89 (TO-243)
HT	E	F	L	R	P	W	U

LOGIC TRIACS

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	I_{GT}*(mA)	PKG. TYPE
1 AMP	L201E3	200	3	E
	L201E5	200	5	
	L201E7	200	10	
	L201E9	200	25	
	L401E3	400	3	
	L401E5	400	5	
	L401E7	400	10	
	L401E9	400	25	
1.6 AMPS	L2001L3	200	3	L
	L2001L5	200	5	
	L2001L7	200	10	
	L2001L9	200	25	
	L4001L3	400	3	
	L4001L5	400	5	
	L4001L7	400	10	
	L4001L9	400	25	
4 AMPS	L2004L3	200	3	
	L2004L5	200	5	
	L2004L7	200	10	
	L2004L9	200	25	
	L4004L3	400	3	
	L4004L5	400	5	
	L4004L7	400	10	
	L4004L9	400	25	
	L2004F31	200	3	F
	L2004F51	200	5	
	L2004F71	200	10	
	L2004F91	200	25	
	L4004F31	400	3	
	L4004F51	400	5	
	L4004F71	400	10	
	L4004F91	400	25	

*I_{GT} *in Quadrants I, II, III, & IV*

QUADRACS
(Internal Diac Trigger)

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	VOLTS	PKG. TYPE
1.6 AMPS	Q2001LT	200	30–40	L
	Q4001LT	400		
3 AMPS	Q2003LT	200	30–40	L
	Q4003LT	400		
4 AMPS	Q2004FT1	200	30–40	F
	Q4004FT1	400		
	Q5004FT1	500		
	Q6004FT1	600		
	Q2004LT	200	30–40	L
	Q4004LT	400		
	Q5004LT	500		
	Q6004LT	600		
6 AMPS	Q2006FT1	200	30–40	F
	Q4006FT1	400		
	Q5006FT1	500		
	Q6006FT1	600		
	Q2006LT	200	30–40	L
	Q4006LT	400		
	Q5006LT	500		
	Q6006LT	600		
8 AMPS	Q2008FT1	200	30–40	F
	Q4008FT1	400		
	Q5008FT1	500		
	Q6008FT1	600		
	Q2008LT	200	30–40	L
	Q4008LT	400		
	Q5008LT	500		
	Q6008LT	600		
10 AMPS	Q2010FT1	200	30–40	F
	Q4010FT1	400		
	Q5010FT1	500		
	Q6010FT1	600		
	Q2010LT	200	30–40	L
	Q4010LT	400		
	Q5010LT	500		
	Q6010LT	600		
15 AMPS	Q2015LT	200	30–40	
	Q4015LT	400		
	Q5015LT	500		
	Q6015LT	600		

SIDACS

PART NUMBER	VOLTS	PKG. TYPE
K1050E	105	E
K1100E	110	
K1200E	120	
K1300E	130	
K2000F1	200	F
K2200F1	220	
K2400F1	240	

DIACS

PART NUMBER	V_{BO}	PKG. TYPE
HT-5760	28	HT
HT-32	32	
HT-5761	32	
HT-5761A	32	
HT-5762	36	
HT-35	40	
HT-40	45	
HT-50	58	
HT-60	60	
HT-105	113	
HT-110	118	
HT-120	125	
HT-130	138	
HT-200	200	
HT-220	230	
HT-240	250	

TRIACS

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	$I_{GT(mA)}$	PKG. TYPE
1 AMP	Q201E3	200	10	E
	Q201E4	200	25	
	Q401E3	400	10	
	Q401E4	400	25	
	Q2001L3	200	10	L
	Q2001L4	200	25	
	Q4001L3	400	10	
	Q4001L4	400	25	
3 AMPS	Q2003L3	200	10	
	Q2003L4	200	25	
	Q4003L3	400	10	
	Q4003L4	400	25	
4 AMPS	Q2004F31	200	10	F
	Q2004F41	200	25	
	Q4004F31	400	10	
	Q4004F41	400	25	
	Q5004F41	500	25	
	Q6004F41	600	25	
	Q2004L3	200	10	L
	Q2004L4	200	25	
	Q4004L3	400	10	
	Q4004L4	400	25	
	Q5004L3	500	10	
	Q5004L4	500	25	
	Q6004L4	600	25	
	Q8004L4	800	25	
	Q2004R4	200	25	R
	Q4004R4	400	25	
	Q5004R4	500	25	
	Q6004R5	600	50	
6 AMPS	Q2006F41	200	25	F
	Q4006F41	400	25	
	Q5006F41	500	25	
	Q6006F51	600	50	
	Q2006L4	200	25	L
	Q2006L5	200	50	
	Q4006L4	400	25	
	Q4006L5	400	50	
	Q5006L4	500	25	
	Q5006L5	500	50	
	Q6006L5	600	50	

TRIACS (Cont'd.)

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	$I_{GT(mA)}$	PKG. TYPE
6 AMPS	Q2006R4	200	25	R
	Q4006R4	400	25	
	Q5006R4	500	25	
	Q6006R5	600	50	
8 AMPS	Q2008F41	200	25	F
	Q4008F41	400	25	
	Q5008F41	500	25	
	Q6008F51	600	50	
	Q2008L4	200	25	L
	Q2008L5	200	50	
	Q4008L4	400	25	
	Q4008L5	400	50	
	Q5008L4	500	25	
	Q5008L5	500	50	
	Q6008L5	600	50	
	Q2008R4	200	25	R
	Q4008R4	400	25	
	Q5008R4	500	25	
	Q6008R5	600	50	
10 AMPS	Q2010F41	200	25	F
	Q4010F41	400	25	
	Q5010F41	500	25	
	Q6010F51	600	50	
	Q2010L4	200	25	L
	Q2010L5	200	50	
	Q4010L4	400	25	
	Q4010L5	400	50	
	Q5010L4	500	25	
	Q5010L5	500	50	
	Q6010L5	600	50	
	Q8010L5	800	50	
	Q2010R4	200	25	R
	Q4010R4	400	25	
	Q5010R4	500	25	
	Q6010R5	600	50	
	Q8010R5	800	50	
12 AMPS	Q2012L5	200	50	L
	Q4012L5	400	50	
	Q5012L5	500	50	
	Q6012L5	600	50	
	Q8012L5	800	50	
	Q2012R5	200	50	R
	Q4012R5	400	50	
	Q5012R5	500	50	
	Q6012R5	600	50	
	Q8012R5	800	50	
15 AMPS	Q2015L5	200	50	L
	Q4015L5	400	50	
	Q5015L5	500	50	
	Q6015L5	600	50	
	Q8015L5	800	50	
	Q2015R5	200	50	R
	Q4015R5	400	50	
	Q5015R5	500	50	
	Q6015R5	600	50	
	Q8015R5	800	50	
25 AMPS	Q2025L5	200	50	L
	Q4025L5	400	50	
	Q5025L5	500	50	
	Q6025L5	600	50	
	Q2025R5	200	50	R
	Q4025R5	400	50	
	Q5025R5	500	50	
	Q6025R5	600	50	
	Q2025P	200	80	P
	Q4025P	400	80	
	Q5025P	500	80	
	Q6025P	600	80	
40 AMPS	Q2040P	200	100	
	Q4040P	400	100	
	Q5040P	500	100	
	Q6040P	600	100	
	Q2040W7	200	100	*W
	Q4040W7	400	100	
	Q5040W7	500	100	
	Q6040W7	600	100	

TRIACS, SCRs, DIACS, SIDACS

THYRISTOR SPECIALIST

TECCOR ELECTRONICS
214/252-7651

SENSITIVE SCR's

$I_{T(RMS)}$	PART NUMBER	V_{DRM} V_{RRM}	$I_{GT(\mu A)}$	PKG. TYPE
.8 AMPS	S0300US2	30	200	U
	S1000US2	100	200	
	S2000US2	200	200	
	S3000US2	300	200	
	S4000US2	400	200	
	S5000US2	500	200	
	S6000US2	600	200	
	EC103Y	30	200	E
	EC103Y1	30	10	
	EC103Y2	30	50	
	EC103Y3	30	500	
	EC103A	100	200	
	EC103A1	100	10	
	EC103A2	100	50	
	EC103A3	100	500	
	EC103B	200	200	
	EC103B1	200	10	
	EC103B2	200	50	
	EC103B3	200	500	
	EC103C	300	200	
	EC103C1	300	10	
	EC103C2	300	50	
	EC103C3	300	500	
	EC103D	400	200	
	EC103D1	400	10	
	EC103D2	400	50	
	EC103D3	400	500	
	EC103E	500	200	
	EC103E1	500	10	
	EC103E2	500	50	
	EC103E3	500	500	
	EC103M	600	200	
	EC103M1	600	10	
	EC103M2	600	50	
	EC103M3	600	500	
	2N5060	30	200	
	2N5061	60	200	
	2N5062	100	200	
	2N5063	150	200	
	2N5064	200	200	
1.6 AMPS	S0301LS1	30	100	L
	S0301LS2	30	200	
	S0301LS3	30	500	
	S0501LS1	50	100	
	S0501LS2	50	200	
	S0501LS3	50	500	
	S1001LS1	100	100	
	S1001LS2	100	200	
	S1001LS3	100	500	
	S2001LS1	200	100	
	S2001LS2	200	200	
	S2001LS3	200	500	
	S4001LS1	400	100	
	S4001LS2	400	200	
	S4001LS3	400	500	
3 AMPS	S0303LS1	30	100	
	S0303LS2	30	200	
	S0303LS3	30	500	
	S0503LS1	50	100	
	S0503LS2	50	200	
	S0503LS3	50	500	
	S1003LS1	100	100	
	S1003LS2	100	200	
	S1003LS3	100	500	
	S2003LS1	200	100	
	S2003LS2	200	200	
	S2003LS3	200	500	
	S4003LS1	400	100	
	S4003LS2	400	200	
	S4003LS3	400	500	
4 AMPS	T106Q1	15	200	F
	T107Q1	15	500	
	T106Y1	30	200	
	T107Y1	30	500	
	T106F1	50	200	
	T107F1	50	500	
	T106A1	100	200	
	T107A1	100	500	
	T106B1	200	200	
	T107B1	200	500	
	T106C1	300	200	
	T107C1	300	500	
	T106D1	400	200	
	T107D1	400	500	
	T106E1	500	200	
	T107E1	500	500	
	T106M1	600	200	
	T107M1	600	500	
6 AMPS	S0306FS21	30	200	
	S0306FS31	30	500	
	S0506FS21	50	200	
	S0506FS31	50	500	
	S1006FS21	100	200	
	S1006FS31	100	500	
	S2006FS21	200	200	
	S2006FS31	200	500	
	S4006FS21	400	200	
	S4006FS31	400	500	
	S0306LS2	30	200	L
	S0306LS3	30	500	
	S0506LS2	50	200	

SEN. SCR's (Cont'd.)

$I_{T(RMS)}$	PART NUMBER	V_{DRM} V_{RRM}	$I_{GT(\mu A)}$	PKG. TYPE
6 AMPS	S0506LS3	50	500	L
	S1006LS2	100	200	
	S1006LS3	100	500	
	S2006LS2	200	200	
	S2006LS3	200	500	
	S4006LS2	400	200	
	S4006LS3	400	500	
8 AMPS	S0308FS21	30	200	F
	S0308FS31	30	500	
	S0508FS21	50	200	
	S0508FS31	50	500	
	S1008FS21	100	200	
	S1008FS31	100	500	
	S2008FS21	200	200	
	S2008FS31	200	500	
	S4008FS21	400	200	
	S4008FS31	400	500	
	S0308LS2	30	200	L
	S0308LS3	30	500	
	S0508LS2	50	200	
	S0508LS3	50	500	
	S1008LS2	100	200	
	S1008LS3	100	500	
	S2008LS2	200	200	
	S2008LS3	200	500	
	S4008LS2	400	200	
	S4008LS3	400	500	
10 AMPS	S0310FS21	30	200	F
	S0310FS31	30	500	
	S0510FS21	50	200	
	S0510FS31	50	500	
	S1010FS21	100	200	
	S1010FS31	100	500	
	S2010FS21	200	200	
	S2010FS31	200	500	
	S4010FS21	400	200	
	S4010FS31	400	500	
	S0310LS2	30	200	L
	S0310LS3	30	500	
	S0510LS2	50	200	
	S0510LS3	50	500	
	S1010LS2	100	200	
	S1010LS3	100	500	
	S2010LS2	200	200	
	S2010LS3	200	500	
	S4010LS2	400	200	
	S4010LS3	400	500	

SCR's

$I_{T(RMS)}$	PART NUMBER	V_{DRM} V_{RRM}	$I_{GT(mA)}$	PKG. TYPE
1 AMPS	S031E	30	10	E
	S051E	50	10	
	S101E	100	10	
	S201E	200	10	
	S401E	400	10	
	S601E	600	10	
1.6 AMPS	S0301L	30	10	L
	S0501L	50	10	
	S1001L	100	10	
	S2001L	200	10	
	S4001L	400	10	
	S6001L	600	10	
3 AMPS	S0303L	30	10	
	S0503L	50	10	
	S1003L	100	10	
	S2003L	200	10	
	S4003L	400	10	
	S6003L	600	10	
4 AMPS	S0304F1	30	10	F
	S0504F1	50	10	
	S1004F1	100	10	
	S2004F1	200	10	
	S4004F1	400	10	
	S6004F1	600	10	
6 AMPS	S0306F1	30	15	
	S0506F1	50	15	
	S1006F1	100	15	
	S2006F1	200	15	
	S4006F1	400	15	
	S6006F1	600	15	
	S0306L	30	15	L
	S0506L	50	15	
	S1006L	100	15	
	S2006L	200	15	
	S4006L	400	15	
	S6006L	600	15	
8 AMPS	S0308F1	30	15	F
	S0508F1	50	15	
	S1008F1	100	15	
	S2008F1	200	15	
	S4008F1	400	15	
	S6008F1	600	15	

SCR's (Cont'd.)

$I_{T(RMS)}$	PART NUMBER	V_{DRM} V_{RRM}	$I_{GT(mA)}$	PKG. TYPE
8 AMPS	S0308L	30	15	L
	S0508L	50	15	
	S1008L	100	15	
	S2008L	200	15	
	S4008L	400	15	
	S6008L	600	15	
	S0308R	30	15	R
	S0508R	50	15	
	S1008R	100	15	
	S2008R	200	15	
	S4008R	400	15	
	S6008R	600	15	
10 AMPS	S0310F1	30	15	F
	S0510F1	50	15	
	S1010F1	100	15	
	S2010F1	200	15	
	S4010F1	400	15	
	S6010F1	600	15	
	S0310L	30	15	L
	S0510L	50	15	
	S1010L	100	15	
	S2010L	200	15	
	S4010L	400	15	
	S6010L	600	15	
12 AMPS	S0312L	30	20	
	S0512L	50	15	
	S1012L	100	20	
	S2012L	200	20	
	S4012L	400	20	
	S6012L	600	20	
	S0312R	30	15	R
	S0512R	50	15	
	S1012R	100	20	
	S2012R	200	20	
	S4012R	400	20	
	S6012R	600	20	
15 AMPS	S0315L	30	30	L
	S0515L	50	15	
	S1015L	100	30	
	S2015L	200	30	
	S4015L	400	30	
	S6015L	600	30	
	S8015L	800	50	
16 AMPS	S0316R	30	30	R
	S0516R	50	15	
	S1016R	100	30	
	S2016R	200	30	
	S4016R	400	30	
	S6016R	600	30	
	S8016R	800	50	
20 AMPS	S0320L	30	30	L
	S0520L	50	30	
	S1020L	100	30	
	S2020L	200	30	
	S4020L	400	30	
	S6020L	600	30	
	S8020L	800	50	
25 AMPS	S0325L	30	30	
	S0525L	50	30	
	S1025L	100	30	
	S2025L	200	30	
	S4025L	400	30	
	S6025L	600	30	
	S8025L	800	50	
	S0325R	30	30	R
	S0525R	50	30	
	S1025R	100	30	
	S2025R	200	30	
	S4025R	400	30	
	S6025R	600	30	
	S8025R	800	50	
65 AMPS	S0365P	30	50	P
	S0565P	50	50	
	S1065P	100	50	
	S2065P	200	50	
	S4065P	400	50	
	S6065P	600	50	
	S1065W	100	50	**W
	S2065W	200	50	
	S4065W	400	50	
	S6065W	600	50	

Power Semiconductors

Fast Recovery Rectifiers (T_{case}=25°C unless otherwise noted)

Part No.	Case Style	I_F Average Forward Current (Amps dc)	PIV Peak Inverse Voltage (Min.) (Volts dc)	V_F Maximum Forward Voltage @ I_F (Volts dc)	t_{rr} Maximum Reverse Recovery Time (nsec)
DSR3050	Double-Slug A Pkg.	1.0	50	1.0	25(1)
DSR3051	Double-Slug A Pkg.	1.0	50	1.1	50(1)
DSR3100	Double-Slug A Pkg.	1.0	100	1.0	25(1)
DSR3101	Double-Slug A Pkg.	1.0	100	1.1	50(1)
DSR3150	Double-Slug A Pkg.	1.0	150	1.0	25(1)
DSR3151	Double-Slug A Pkg.	1.0	150	1.1	50(1)
DSR3200	Double-Slug A Pkg.	1.0	200	1.1	25(1)
DSR3201	Double-Slug A Pkg.	1.0	200	1.2	50(1)
DSR3400X	Double-Slug A Pkg.	1.0	400	1.5	30(2)
DSR3500X	Double-Slug A Pkg.	1.0	500	1.8	30(2)
DSR3600X	Double-Slug A Pkg.	1.0	600	1.8	50(2)
DSR5050	Double-Slug B Pkg.	4.0	50	1.0	25(1)
DSR5051	Double-Slug B Pkg.	4.0	50	1.1	50(1)
DSR5100	Double-Slug B Pkg.	4.0	100	1.0	25(1)
DSR5101	Double-Slug B Pkg.	4.0	100	1.1	50(1)
DSR5150	Double-Slug B Pkg.	4.0	150	1.0	25(1)
DSR5151	Double-Slug B Pkg.	4.0	150	1.1	50(1)
DSR5200	Double-Slug B Pkg.	4.0	200	1.1	25(1)
DSR5201	Double-Slug B Pkg.	4.0	200	1.2	50(1)
DSR5400X	Double-Slug B Pkg.	4.0	400	1.5	30(2)
DSR5500X	Double-Slug B Pkg.	4.0	500	1.8	30(2)
DSR5600X	Double-Slug B Pkg.	4.0	600	1.8	50(2)

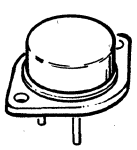
Double-Slug A Package

Double-Slug B Package

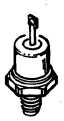
(1) 1.0 A to 1.0 A to 0.5 A
(2) 0.5 A to 1.0 A to 0.25 A

Schottky Rectifiers (T_{case}=25°C unless otherwise noted)

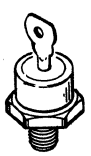
Part No.	Case Style	V_{RWM}(3) Peak Working Reverse Voltage (Volts)	V_{FM}(5) Maximum Forward Voltage @ I_F (Volts dc)	I_F Average Forward Current @ T_C (°C) (Amps dc)
SD241(6)(4)	TO-3	35	0.6	20 @ 125°C
SD41(6)	DO-4	35	0.55	30 @ 125°C
SD51(6)	DO-5	35	0.6	60 @ 125°C
SD5171(6)	DO-203AB DO-5 with Flexible Lead	35	0.65	60 @ 125°C
SD75(6)	DO-5	35	0.66	75 @ 150°C
IN6095	DO-4	30	0.86	25 @ 70°C
IN6096	DO-4	40	0.86	25 @ 70°C
IN6097	DO-5	30	0.86	50 @ 70°C
IN6098	DO-5	40	0.86	50 @ 70°C



TO-3



DO-4

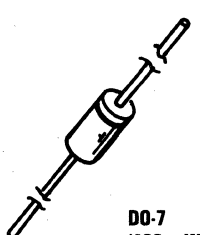


DO-5

(3) Voltage pulse width, 400 μsec, duty cycle 1%
(4) Dual unit. Specifications for each diode
(5) Current pulse width, 300 μsec, duty cycle 1%
(6) Trademark of TRW Inc. as shown or in hyphenated form (example: SD-51)

Zener Diodes (T_{case}=25°C unless otherwise noted)

Part No.(7)	Case Style	Vz Nominal Zener Voltage @ Rated Iz (Volts dc)	Zz(2) Maximum Dynamic Impedance @ Iz (Ohms)	Maximum(3) Noise Density @ 250 μA (μV/√Hz)	I_R Maximum Reverse Leakage @ Rated V_R (μA dc)
LVA43A	DO-7	4.3 @ 20 mA	18	4.0	4.0 @ 1.5 V
LVA47A	DO-7	4.7 @ 10 mA	15	4.0	4.0 @ 2.0 V
LVA51A	DO-7	5.1 @ 5 mA	15	4.0	0.1 @ 2.0 V
LVA56A	DO-7	5.6 @ 1 mA	40	4.0	0.05 @ 3.0 V
LVA62A	DO-7	6.2 @ 1 mA	50	4.0	0.05 @ 4.0 V
LVA68A	DO-7	6.8 @ 1 mA	50	4.0	0.05 @ 5.0 V
LVA75A	DO-7	7.5 @ 1 mA	100	4.0	0.01 @ 6.0 V
LVA82A	DO-7	8.2 @ 1 mA	100	4.0	0.01 @ 6.5 V
LVA91A	DO-7	9.1 @ 1 mA	100	4.0	0.01 @ 8.0 V
LVA100A	DO-7	10 @ 1 mA	100	4.0	0.01 @ 9 V



DO-7 (400 mW)

(7) Suffix denotes zener voltage tolerance: A = ±5%, B = ±2%

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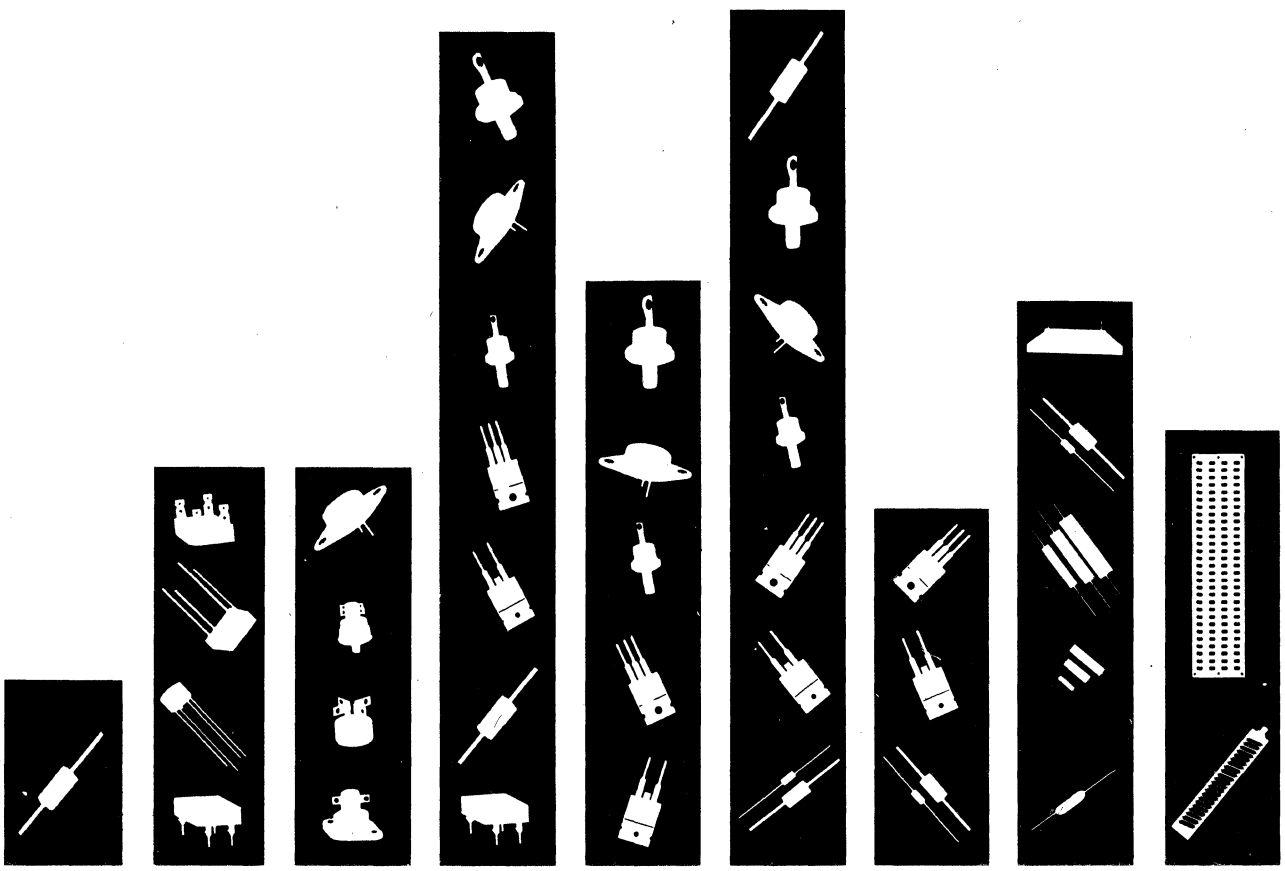

Epoxy Axial Lead: V3 Series; 3a w/100-200a surge; 50v to 1000v; Fast Recovery (200 ns)

Epoxy Bridge: VM, VE, VS, VH, VJ, VK Series; 1a-30a; 25v to 1000v; Fast Recovery (200 ns)

Integrated Bridge: IN, VT, VY, R700 Series; 10a to 36a; 200v to 600v; Fast Recovery (200 ns)

Schottky Barrier: VSB, VSK Series; 750ma-60a; 20v to 45v; Ultra Fast Recovery (< 10 ns)

High Temp Schottky: VSK Series; 10a to 75a; 20v to 50v; Ultra Fast Recovery (< 10 ns)

EPI High Schottky: VHE Series; 1a to 70a; 50v to 600v; Fast Recovery (35-50 ns)

Very Fast Recovery: TG Series; 1a to 16a; 400v to 1000v; (100 ns)

HV Silicon: H, VA, VB, VG, VF, VC Series; 3ma to 2a; 1kV to 50kV; Fast Recovery (100-250 ns)

HV Assemblies: H series; X-Ray; Pollution Control; 7 kV to 360kV; Fast Recovery (100-250 ns)

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VARO Semiconductor, Box 469013, Garland, TX 75046-9013, Telex: 163-135

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K
kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L
LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microforad
MHz megahertz
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOSIGT metal-oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM nuclear instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLL phased lock loop
PPI plan position indicator
PROM programmable read only memory
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

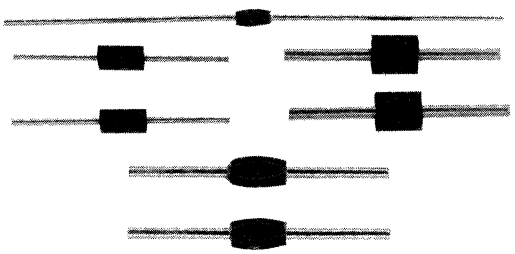
V
VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

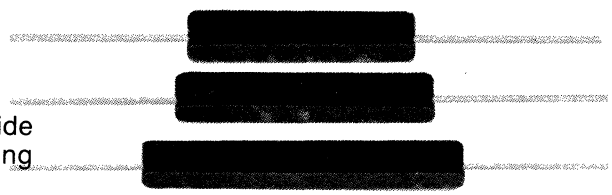
Z
ZIF zero insertion force

HIGH VOLTAGE DISCRETES 1.5 KV to 10 KV



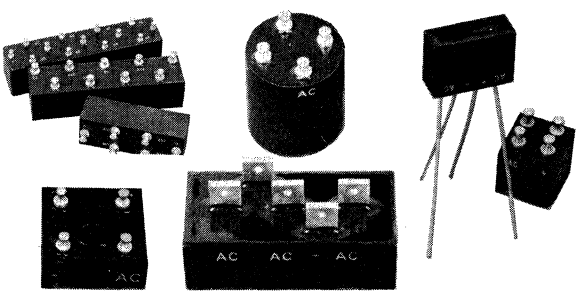
- 25 MA - 80 MA to 100 NS Recovery Time (Body Size .090" x .250")
- 100 MA - 250 MA to 100 NS Recovery Time (Body Size .125" x .250")
- 500 MA - 2 AMP to 100 NS Recovery Time (Body Size .200" x .250")

HIGH VOLTAGE RECTIFIER STACKS



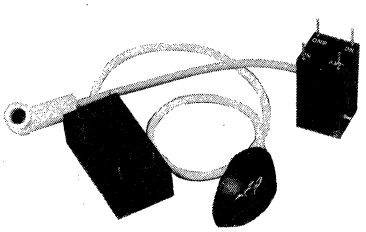
Stacked High Voltage Discretes repotted to provide the PIV needed. Size made depending on operating in air or oil media.

HIGH or LOW VOLTAGE ASSEMBLIES



Single bridge or multiple bridge configurations available or to your package criteria. Low voltage with or without MIL QPL Rectifiers.

HIGH VOLTAGE MULTIPLIERS



Multipliers made with number of stages to yield output to 150 KV+.

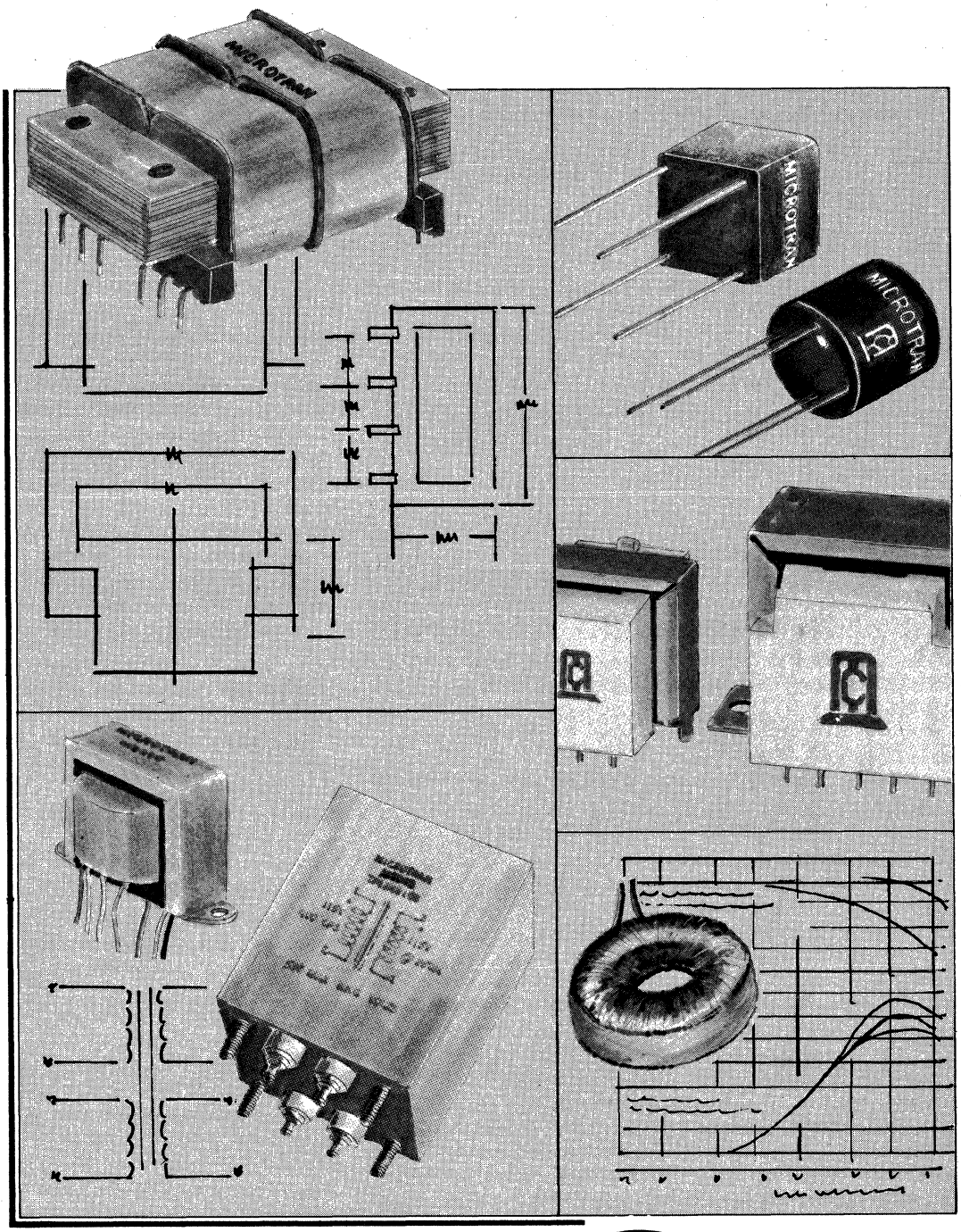
CUSTOM PACKAGING/PROCESSING

- Packaging can be tailored to characteristics and space.
- Processing of discretes or assemblies can be to specs or MIL.

VMI VOLTAGE MULTIPLIERS, INC.

8711 West Roosevelt ■ Visalia, CA 93291 ■ (209) 651-1402 ■ TLX 530484

MICRAN TRANSFORMERS



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AUDIO-POWER
COMMERCIAL-MIL

Immediate Delivery From Distributors

See EEM Pages A•2184 to A•2197 and Coil Section 1800 Page A•1241

POWER & CONTROL

Manufacturer	Power												Control			
	115/230V Input															
	50/60 Hz	400 Hz	Filament	Rectifier	Split Bobbin	Isolation	Voltage Regulating	DC-to-DC Converter	Variable (Incl. Auto Transformer)	High Voltage	Scott T	PC Mount	Synchro/ Resolver/ Synchro	Servo	Current (Instrument)	Switch Mode
Abbott	A•2102• A•2108*	A•2102- A•2108*	A•2102- A•2107*	A•2105- A•2107*												
Amecon	A•2114 A•2115														A•2112	A•2112
Arstan Products	A•2118		A•2118	A•2118	A•2118							A•2120				
BH Electronics	A•2123											A•2123				
Dale Electronics	A•2128- A•2131			A•2128- A•2131	A•2130	A•2128 A•2131		A•2125 A•2132				A•2125 A•2128- A•2132				
Del Electronics	A•2133					A•2133				A•2133					A•2133	
Electromech	A•2134					A•2134		A•2134	A•2134			A•2134				
Endicott Coil	A•2135*															
EWC Inc.	A•2136- A•2142* A•2145				A•2138 A•2144- A•2146	A•2144			A•2144			A•2136- A•2143				
Flex-Core															A•2149	
Freed Transformer	A•2150* A•2153	A•2150*	A•2150* A•2153			A•2153			A•2153	A•2150*		A•2150*				
Hipotronics	A•2154- A•2156			A•2156		A•2155			A•2154 A•2155	A•2154- A•2156						
Hisonic	A•2157*	A•2157*						A•2157		A•2157			A•2157			
Hitran	A•2158		A•2158	A•2158		A•2158	A•2158			A•2158						
ISL Products	A•2159				A•2159											
JM Transformer See Indexed Page	A•2160- A•2163	A•2160- A•2163	A•2160- A•2163	A•2160- A•2163	A•2160- A•2163	A•2160- A•2163			A•2160- A•2163			A•2160 A•2163				
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Nano Pulse Inds.															A•2206	
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OPT Industries	A•2212*															
Pan-Magnetics																
Paraline	A•2221- A•2223		A•2221- A•2223									A•2221- A•2223				
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Perkin-Elmer						A•2232					A•2232	A•2232	A•2232	A•2232		
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Shogyo																
Signal Transformer																
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* Mil. Spec.

POWER & CONTROL (cont'd)

Manufacturer	Power												Control			
	115/230V Input		Filament	Rectifier	Split Bobbin	Isolation	Voltage Regulating	DC-to-DC Converter	Variable (incl. Auto Transformer)	High Voltage	Scott T	PC Mount	Synchro/ Resolver/ Synchro	Servo	Current (Instrument)	Switch Mode
	50/60 Hz	400 Hz														
Technipower							A•2306		A•2306							
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AUDIO, RF, SPECIAL

Manufacturer	Audio								RF-IF	Pulse (Including Trigger)
	Driver	Input	Interstage	Matching	Microphone	Output	Telephone Coupling	Isolation		
Arstan Products							A•2120			A•2120
BH Electronics										A•2123
Dale Electronics							A•2126 A•2127	A•2128- A•2131		
Del Electronics								A•2133		
EWC Inc.								A•2144		A•2147
Freed Transformer								A•2153		A•2150*
Hipotronics								A•2155		
Hisonic				A•2157					A•2157	A•2157
ISL Products							A•2159			
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OPT Industries	A•2212*									
Pan-Magnetics										
Paraline							A•2222 A•2223			
PC Transformer		A•2229	A•2229			A•2229	A•2229			
Pearson Electronics										A•2230
Pico Electronics		A•2233- A•2249* A•2254*		A•2233- A•2249*	A•2233*					A•2233* A•2250* A•2251*
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* Mil. Spec.

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 85/86 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1166, **B**•1012, **C**•1028, **D**•1016
ASCII Code ..... **D**•1087
Batteries, Product Selection Guide ..... **D**•1413
Batteries & Fuel Cells, Characteristics ..... **D**•1430
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide ..... **A**•1003
Circuit Boards (Printed) Product Selection Guide ..... **C**•1099
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1205
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1863
Connectors, Miniglossary ..... **C**•1129
Connectors, Terminals, & Sockets, Product Selection Guide ..... **C**•1105
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Gude ..... **A**•1309
Delay Lines, Product Selection Guide ..... **A**•1459
Discrete Semiconductors, Product Selection Guide ..... **A**•2067
Displays, Readouts, Lamps, & Lights, Product Selection Guide ..... **B**•1015
EBCDIC Code ..... **D**•1092
Encapsulation, Miniglossary ..... **C**•1086
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide .. **C**•1623
Filters, Product Selection Guide ..... **A**•1583
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Instruments, Panel Meters, Product Selection Guide ..... **D**•1329
Instruments, Test & Measuring Product Selection Guide ..... **D**•1175
Interconnection Systems, Product Selection Guide ..... **C**•1699
Keyboards & Keypads, Product Selection Guide ..... **B**•1705
Logofinder & Trademark Directories ..... **B**•901
Microwave Components, Product Selection Guide ..... **A**•1701
Military Qualified Products Lists ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1129
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Oscilloscopes, Product Selection Guide ..... **D**•1385
Panel Hardware, Product Selection Guide ..... **C**•1589
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide ..... **A**•1991
Power Supplies, Miniglossary ..... **D**•1462
Power Supplies, AC, Product Selection Guide ..... **D**•1877
Power Supplies, DC, Product Selection Guide ..... **D**•1447
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide .... **B**•1225
Relay Contact Forms ..... **B**•1317
Relays, Electromechanical, Miniglossary ..... **B**•1308
Relays, Product Selection Guide ..... **B**•1261
Resistor Color Codes ..... **A**•1828
Resistors, Product Selection Guide ..... **A**•1785
Servo Components, Miniglossary ..... **D**•1985
Solenoids, Product Selection Guide ..... **B**•1463
Switches, Product Selection Guide ..... **B**•1477
Thermal Components, Product Selection Guide ..... **B**•1741
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1744
Thyristors/High Power Diodes, Miniglossary ..... **A**•2076
Transducers & Encoders, Product Selection Guide ..... **B**•1777
Transformers, Product Selection Guide ..... **A**•2099
Wire & Cable, Product Selection Guide ..... **C**•1743
Wire Gauges—Diameter, Area, Copper Weight ..... **C**•1844

abbott TRANSFORMERS — 60 Hz Power Transformers — MODEL 6B

SPECIFICATIONS

INPUT PRIMARY: 115 VAC standard. 230 VAC at 10% additional cost. Specify by suffixing "A" to model number. 115/230 VAC dual input at 10% additional cost. Specify by suffixing "B" to model number.

INPUT FREQUENCY: 50 to 400 Hz, 1 phase.

REGULATION: 15% max. from no load to full load (6% on units size 8 and larger).

SECONDARY VOLTAGE TOLERANCE: Within 5% of listed output voltage when measured at full load and 115 VAC input.

INSULATION TEST: 1500 VAC.

OPERATING TEMPERATURE: 80°C maximum ambient (70°C on units size 8 and larger).

APPROXIMATE EFFICIENCY: Ranges from 80% to 90%.

CONSTRUCTION: Commercial grade using Silicon Iron for core and heavy insulated synthetic film magnet wire with class "B" rating impregnated with a high quality insulating varnish having a class "H" rating. Other outputs and/or inputs available on request.

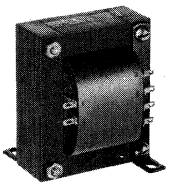


FIG. 1, 2, 3

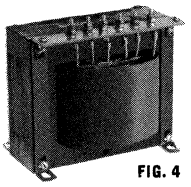


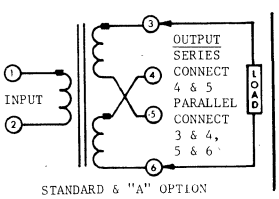
FIG. 4

Output Volts (F.L.)	Output Current (Amps) Parallel Connection	Output Current (Amps) Series Connection	Size	Weight Lbs. Typ.	Model Number
5V Parallel	2.0	1.0	1	1.2	6B5-10
10V C.T. Series	3.0	1.5	2	1.5	6B5-15
	6.0	3.0	3	2.2	6B5-30
	12.0	6.0	4	3.0	6B5-60
	18.0	9.0	5	4.3	6B5-90
	26.0	13.0	6	5.5	6B5-130
	32.0	16.0	7	7.0	6B5-160
	60.0	30.0	8	13.0	6B5-300†
	100.0	50.0	9	23.0	6B5-500†
6.3V Parallel	1.60	0.80	1	1.2	6B6-10
12.6V C.T. Series	2.40	1.20	2	1.5	6B6-15
	4.80	2.40	3	2.2	6B6-30
	9.40	4.70	4	3.0	6B6-60
	14.4	7.20	5	4.3	6B6-90
	20.6	10.3	6	5.5	6B6-130
	25.4	12.7	7	7.0	6B6-160
	48.0	24.0	8	13.0	6B6-300†
	95.0	47.5	9	23.0	6B6-600†
8V Parallel	1.20	0.60	1	1.2	6B8-10
16V C.T. Series	1.80	0.90	2	1.5	6B8-15
	3.60	1.80	3	2.2	6B8-30
	7.60	3.80	4	3.0	6B8-60
	11.2	5.60	5	4.3	6B8-90
	16.2	8.10	6	5.5	6B8-130
	20.0	10.0	7	7.0	6B8-160
	37.5	18.75	8	13.0	6B8-300†
	75.0	37.50	9	23.0	6B8-600†
	100.0	50.0	10	26.0	6B8-800†
10V Parallel	1.0	0.5	1	1.2	6B10-10
20V C.T. Series	1.5	0.75	2	1.5	6B10-15
	3.0	1.5	3	2.2	6B10-30
	6.0	3.0	4	3.0	6B10-60
	9.0	4.5	5	4.3	6B10-90
	13.0	6.5	6	5.5	6B10-130
	16.0	8.0	7	7.0	6B10-160
	30.0	15.0	8	13.0	6B10-300†
	60.0	30.0	9	23.0	6B10-600†
	85.0	42.5	10	26.0	6B10-850†
	100.0	50.0	11	36.0	6B10-1000†
12V Parallel	0.82	0.41	1	1.2	6B12-10
24V C.T. Series	1.24	0.62	2	1.5	6B12-15
	2.50	1.25	3	2.2	6B12-30
	5.0	2.50	4	3.0	6B12-60
	7.5	3.75	5	4.3	6B12-90
	10.82	5.41	6	5.5	6B12-130
	13.32	6.66	7	7.0	6B12-160
	25.00	12.50	8	13.0	6B12-300*
	50.00	25.00	9	23.0	6B12-600†
	71.00	35.50	10	26.0	6B12-850†
	100.00	50.00	11	36.0	6B12-1200†
17V Parallel	0.58	0.29	1	1.2	6B17-10
34V C.T. Series	0.88	0.44	2	1.5	6B17-15
	1.76	0.88	3	2.2	6B17-30
	3.52	1.76	4	3.0	6B17-60
	5.28	2.64	5	4.3	6B17-90
	7.64	3.82	6	5.5	6B17-130
	9.40	4.70	7	7.0	6B17-160
	17.65	8.8	8	13.0	6B17-300*
	35.00	17.5	9	23.0	6B17-600†
	50.00	25.00	10	26.0	6B17-850†
	76.5	38.25	11	36.0	6B17-1300†
20V Parallel	0.5	0.25	1	1.2	6B20-10
40V C.T. Series	0.74	0.37	2	1.5	6B20-15
	1.5	0.75	3	2.2	6B20-30
	3.0	1.5	4	3.0	6B20-60
	4.5	2.25	5	4.3	6B20-90
	6.5	3.25	6	5.5	6B20-130
	8.0	4.0	7	7.0	6B20-160
	15.0	7.50	8	13.0	6B20-300*
	30.0	15.0	9	23.0	6B20-600†
	42.5	21.25	10	26.0	6B20-850†
	65.0	32.50	11	36.0	6B20-1300†
28V Parallel	0.36	0.18	1	1.2	6B28-10
56V C.T. Series	0.52	0.26	2	1.5	6B28-15
	1.06	0.53	3	2.2	6B28-30
	2.14	1.07	4	3.0	6B28-60
	3.20	1.60	5	4.3	6B28-90
	4.64	2.32	6	5.5	6B28-130
	5.70	2.85	7	7.0	6B28-160
	10.70	5.35	8	13.0	6B28-300*
	21.43	10.71	9	23.0	6B28-600*
	30.36	15.18	10	26.0	6B28-850*
	46.42	23.21	11	36.0	6B28-1300†
44V Parallel	0.22	0.11	1	1.2	6B44-10
88V C.T. Series	0.34	0.17	2	1.5	6B44-15
	0.68	0.34	3	2.2	6B44-30
	1.36	0.68	4	3.0	6B44-60
	2.04	1.02	5	4.3	6B44-90
	2.94	1.47	6	5.5	6B44-130
	3.62	1.81	7	7.0	6B44-160
	6.82	3.41	8	13.0	6B44-300*
	13.64	6.82	9	23.0	6B44-600*
	19.32	9.66	10	26.0	6B44-850
	29.54	14.77	11	36.0	6B44-1300†
60V Parallel	0.16	0.08	1	1.2	6B60-10
120V C.T. Series	0.250	0.125	2	1.5	6B60-15
	0.50	0.25	3	2.2	6B60-30
	1.0	0.50	4	3.0	6B60-60
	1.5	0.75	5	4.3	6B60-90
	2.16	1.08	6	5.5	6B60-130
	2.66	1.33	7	7.0	6B60-160
	5.00	2.50	8	13.0	6B60-300*
	10.00	5.00	9	23.0	6B60-600*
	14.16	7.08	10	26.0	6B60-850*
	21.67	10.83	11	36.0	6B60-1300†

* Use Fig. 3 for layout †Use Fig. 4 for layout

SIZE	A	B	C	D	E	F	HOLE	FIG.
1	1.95	1.68	2.31	2.37	—	2.87	0.18	1
2	2.26	1.93	2.68	2.81	—	3.12	0.18	1
3	2.57	2.18	3.06	3.12	—	3.56	0.18	1
4	2.81	2.43	3.37	2.25	2.12	2.70	0.2 x 0.37	2
5	3.12	2.68	3.75	2.50	2.25	2.86	0.2 x 0.37	2
6	3.44	2.93	4.12	2.75	2.37	2.98	0.2 x 0.37	3
7	3.75	3.18	4.50	3.00	2.50	3.11	0.2 x 0.37	3
8	5.25	3.87	4.37	4.37	2.85	3.75	0.26 x 0.4	3 or 4
9	6.37	4.62	5.31	5.31	3.22	4.20	0.26 x 0.4	3 or 4
10	6.37	4.99	5.31	5.31	3.60	4.58	0.26 x 0.4	3 or 4
11	7.50	5.37	6.25	6.75	3.60	4.85	0.26 x 0.4	3 or 4

DIMENSIONAL TOLERANCE: ±0.06 except B is max.



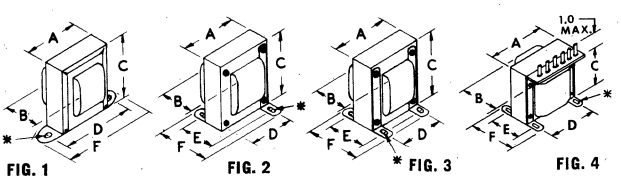


FIG. 1 FIG. 2 * FIG. 3 FIG. 4

ABBOTT TRANSISTOR LABORATORIES, INC.

Transformer Div., Western Offices: 639 S. Glenwood Pl., Burbank, CA 91506 (818) 841-3630. Telex: 69-6282
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New England: (617) 272-5676 • Florida: (305) 788-0845 • Southeast: (205) 881-2207 • E. Canada: (416) 675-6235
MN, WI, ND, SD: (612) 786-7641 • IA, MO, NE, KS: (314) 839-0800

abbott TRANSFORMERS

60 Hz 3 Ø Power Transformers

MODEL 6D

SPECIFICATIONS

INPUT PRIMARY: **WYE:** 120V L-Com. Suffix A
WYE: 208V L-L Suffix B
DELTA: 120V L-L Suffix C
DELTA: 230V L-L Suffix E
DELTA: 440V L-L Suffix F

NOTE: To order a specific input voltage add suffix to model number.
(EXAMPLE: 6D ( ) 15-200E has input 230V L-L (3 wire DELTA)).

INPUT FREQUENCY: 50 Hz to 60 Hz.

OUTPUT: See specific models listed.

OUTPUT VOLTAGE TOLERANCE: Within 5% when measured at full load and nominal VAC input.

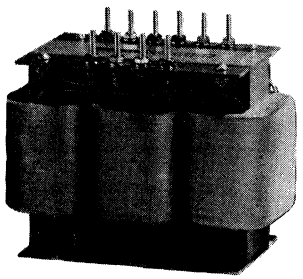
REGULATION: 10% max. no load to full load. (6% on size 3 thru 6).

INSULATION TEST: 1500 VRMS

EFFICIENCY: Ranges from 90% to 95%.

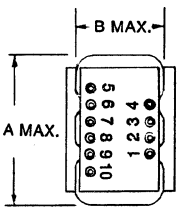
OPERATING TEMP.: +80°C ambient max.

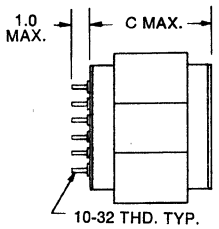
CONSTRUCTION: Industrial Grade (open frame): Specify the letter "F" in the model number. (Example: 6DF 15-200 ( )). MIL-T-27D (Grade 5 Class S). Specify the letter "M" in the model number. (Example: 6DM15-200 ( )). NOTE: MIL-T-27D add .20 to Dim. A, B, C. Other inputs and/or outputs available.

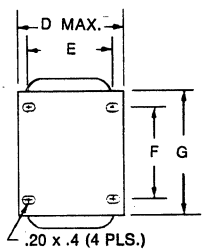


Model No.	Output Per Phase: Delta: L to L (3 wire) WYE: L to Com. (4 wire) Volts R.M.S.	Delta: L to L (3 wire) WYE: L to Com. (4 wire) Load Current (Amps)	WYE: L to L (3 wire) Volts R.M.S.	WYE: L to L (3 wire) Load Current (Amps)	Size	Wt. Lbs. (Typ.)
6D( )5-200( )	5	13.30	8.66	7.70	1	14
6D( )5-450( )	5	30.00	8.66	17.30	2	20
6D( )5-650( )	5	43.30	8.66	25.00	3	28
6D( )12-200( )	12	5.56	20.8	3.21	1	14
6D( )12-450( )	12	12.50	20.8	7.21	2	20
6D( )12-650( )	12	18.10	20.8	10.40	3	28
6D( )12-850( )	12	23.60	20.8	13.60	4	42
6D( )12-1100( )	12	30.60	20.8	17.60	5	51
6D( )12-1500( )	12	41.70	20.8	24.00	6	67
6D( )15-200( )	15	4.44	26.0	2.56	1	14
6D( )15-450( )	15	10.00	26.0	5.77	2	20
6D( )15-650( )	15	14.40	26.0	8.33	3	28
6D( )15-850( )	15	18.90	26.0	10.90	4	42
6D( )15-1100( )	15	24.40	26.0	14.10	5	51
6D( )15-1500( )	15	33.30	26.0	19.20	6	67
6D( )20-200( )	20	3.33	34.6	1.93	1	14
6D( )20-450( )	20	7.50	34.6	4.33	2	20
6D( )20-650( )	20	10.80	34.6	6.26	3	28
6D( )20-850( )	20	14.20	34.6	8.19	4	42
6D( )20-1100( )	20	18.30	34.6	10.60	5	51
6D( )20-1500( )	20	25.00	34.6	14.40	6	67

Model No.	Output Per Phase: Delta: L to L (3 wire) WYE: L to Com. (4 wire) Volts R.M.S.	Delta: L to L (3 wire) WYE: L to Com. (4 wire) Load Current (Amps)	WYE: L to L (3 wire) Volts R.M.S.	WYE: L to L (3 wire) Load Current (Amps)	Size	Wt. Lbs. (Typ.)
6D( )28-200( )	28	2.38	48.5	1.37	1	14
6D( )28-450( )	28	5.36	48.5	3.09	2	20
6D( )28-650( )	28	7.74	48.5	4.47	3	28
6D( )28-850( )	28	10.10	48.5	5.83	4	42
6D( )28-1100( )	28	13.10	48.5	7.56	5	51
6D( )28-1500( )	28	17.90	48.5	10.30	6	67
6D( )48-200( )	48	1.39	83.1	.80	1	14
6D( )48-450( )	48	3.13	83.1	1.81	2	20
6D( )48-650( )	48	4.51	83.1	2.61	3	28
6D( )48-850( )	48	5.90	83.1	3.41	4	42
6D( )48-1100( )	48	7.64	83.1	4.41	5	51
6D( )48-1500( )	48	10.40	83.1	6.02	6	67
6D( )115-200( )	115	.58	200.0	.34	1	14
6D( )115-450( )	115	1.30	200.0	.75	2	20
6D( )115-650( )	115	1.88	200.0	1.09	3	28
6D( )115-850( )	115	2.46	200.0	1.42	4	42
6D( )115-1100( )	115	3.19	200.0	1.84	5	51
6D( )115-1500( )	115	4.35	200.0	2.51	6	67

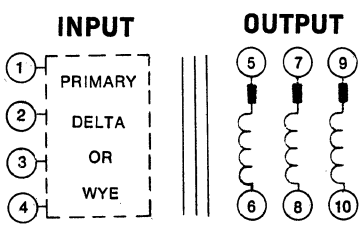






SIZE	A	B	C	D	E	F	G
1	6.10	4.10	4.62	4.10	3.10	3.75	4.81
2	7.70	4.10	5.43	4.10	3.10	4.00	6.00
3	7.70	5.10	5.43	5.10	4.10	4.00	6.00
4	9.20	4.85	6.78	5.35	4.11	5.24	7.50
5	9.20	5.35	6.78	5.85	4.61	5.24	7.50
6	11.00	5.35	8.13	5.60	4.36	6.40	9.00

DIM. TOL.: E, F, G ±.06



INPUT CONNECTION

WYE: L-Com. 1, 2, 3 Line. 4 com.
WYE: L-L 1, 2, 3
DELTA: L-L 1, 2, 3

OUTPUT CONNECTION

WYE: L-Com. connect 6-8-10 Load 5-6, 7-6, 9-6
DELTA: L-L Connect 6-7, 8-9, 5-10 Load 5, 7, 9
WYE: L-L connect 6-10, 8-10 Load 5, 7, 9

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New England: (617) 272-5676 • Florida: (305) 788-0845 • Southeast: (205) 881-2207 • E. Canada: (416) 675-6235
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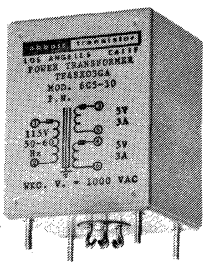
abbott TRANSFORMERS

60 Hz-400 Hz MIL-T-27D Transformers

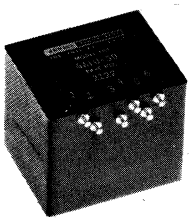
MODELS 6C 4A

SPECIFICATIONS

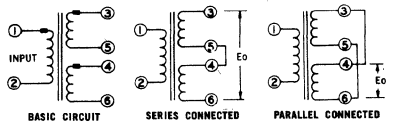
	6C Series	4A Series
INPUT PRIMARY:	115 VAC, 50 to 65 Hz, 1 Phase	115V, 400 Hz ±20 Hz, 1 Phase
REGULATION:	10% no load to full load	10% no load to full load
SECONDARY VOLTAGE TOLERANCE:	Within 3% when measured at full load and 115 VAC input	Within 5% when measured at full load and 115 VAC input
INSULATION TEST:	1500 VAC	1500 VAC
OPERATING TEMP.:	90°C maximum ambient operating temperature	95°C maximum ambient operating temperature
CONSTRUCTION	To MIL-T-27D, grade 4, class "S", life "X", (10,000 hrs.)	To MIL-T-27D, grade 5, class "S", life "X", (10,000 hrs.)
EFFICIENCY:	From 80% to 90%	From 90% to 93%
ENVIRONMENT	Encapsulated to meet MIL-STD-810C for vibration, shock, sand, dust, humidity, salt spray, fungus, sunshine, rain, explosion, and altitude (to a vacuum). NOTE: for high altitude operation, encapsulate terminals.	
OPTIONS AVAILABLE:	Other output voltages and 230 VAC input are available. Please consult our nearest office for complete information.	



MODEL 6C



MODEL 4A

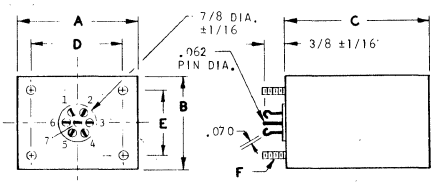


BASIC CIRCUIT SERIES CONNECTED PARALLEL CONNECTED

Output Volts (F.L.)	6C Series Output Current (Amps) Parallel Connection	6C Series Output Current (Amps) Series Connection	6C Series Size	6C Series Weight Lbs. Typ.	6C Series Model Number	4A Series Output Current (Amps) Parallel Connection	4A Series Output Current (Amps) Series Connection	4A Series Size	4A Series Weight Lbs. Typ.	4A Series Model Number
5V Parallel	1.00	0.50	EB	1.2	6C5-5	1.40	0.70	1	0.26	4A5-7
10V C.T.	3.00	1.50	FA	2.2	6C5-15	2.00	1.00	2	0.30	4A5-10
Series	6.00	3.00	GA	3.3	6C5-30	5.00	2.50	3	0.47	4A5-25
	12.00	6.00	HA	4.7	6C5-60	8.00	4.00	4	0.77	4A5-40
	20.00	10.00	JA	7.4	6C5-100	24.0	12.0	5	1.6	4A5-120
						30.0	15.0	6	2.0	4A5-150
6.3V Parallel	0.80	0.40	EB	1.2	6C6-5	1.11	0.55	1	0.26	4A6-7
12.6V C.T.	2.38	1.19	FA	2.2	6C6-15	1.58	0.79	2	0.30	4A6-10
Series	4.76	2.38	GA	3.3	6C6-30	4.00	2.00	3	0.47	4A6-25
	9.52	4.76	HA	4.7	6C6-60	8.00	4.00	4	0.77	4A6-50
	20.00	10.00	JA	7.4	6C6-126	19.0	9.50	5	1.6	4A6-120
						23.8	11.9	6	2.0	4A6-150
8V Parallel	0.62	0.31	EB	1.2	6C8-5	0.874	0.437	1	0.26	4A8-7
16V C.T.	1.86	0.93	FA	2.2	6C8 15	1.25	0.625	2	0.30	4A8-10
Series	3.72	1.86	GA	3.3	6C8-30	3.12	1.56	3	0.47	4A8-25
	7.44	3.72	HA	4.7	6C8-60	6.24	3.12	4	0.77	4A8-50
	17.50	8.75	JA	7.4	6C8-140	15.0	7.50	5	1.6	4A8-120
	20.00	10.00	KA	9.8	6C8-160	18.7	9.35	6	2.0	4A8-150
10V Parallel	0.50	0.25	EB	1.2	6C10-5	0.70	0.35	1	0.26	4A10-7
20V C.T.	1.50	0.75	FA	2.2	6C10-15	1.00	0.50	2	0.30	4A10-10
Series	3.00	1.50	GA	3.3	6C10-30	2.50	1.25	3	0.47	4A10-25
	6.00	3.00	HA	4.7	6C10-60	5.00	2.50	4	0.77	4A10-50
	14.00	7.00	JA	7.4	6C10-140	12.0	6.00	5	1.6	4A10-120
	17.00	8.50	KA	9.8	6C10-170	15.0	7.50	6	2.0	4A10-150
12V Parallel	0.40	0.20	EB	1.2	6C12-5	0.58	0.29	1	0.26	4A12-7
24V C.T.	1.20	0.60	FA	2.2	6C12-15	0.84	0.42	2	0.30	4A12-10
Series	2.40	1.20	GA	3.3	6C12-30	2.08	1.04	3	0.47	4A12-25
	4.80	2.40	HA	4.7	6C12-60	4.16	2.08	4	0.77	4A12-50
	11.60	5.80	JA	7.4	6C12-140	10.0	5.00	5	1.6	4A12-120
	14.16	7.08	KA	9.8	6C12-170	12.5	6.25	6	2.0	4A12-150
17V Parallel	0.30	0.15	EB	1.2	6C17-5	0.411	0.205	1	0.26	4A17-7
34V C.T.	0.88	0.44	FA	2.2	6C17-15	0.588	0.294	2	0.30	4A17-10
Series	1.76	0.88	GA	3.3	6C17-30	1.47	0.735	3	0.47	4A17-25
	3.52	1.76	HA	4.7	6C17-60	2.94	1.47	4	0.77	4A17-50
	8.20	4.10	JA	7.4	6C17-140	7.06	3.53	5	1.6	4A17-120
	10.00	5.00	KA	9.8	6C17-170	8.82	4.41	6	2.0	4A17-150
20V Parallel	0.24	0.12	EB	1.2	6C20-5	0.35	0.175	1	0.26	4A20-7
40V C.T.	0.72	0.36	FA	2.2	6C20-15	0.50	0.250	2	0.30	4A20-10
Series	1.44	0.72	GA	3.3	6C20-30	1.25	0.625	3	0.47	4A20-25
	2.88	1.44	HA	4.7	6C20-60	2.50	1.25	4	0.77	4A20-50
	7.00	3.50	JA	7.4	6C20-140	6.00	3.00	5	1.6	4A20-120
	8.50	4.25	KA	9.8	6C20-170	7.50	3.75	6	2.0	4A20-150
28V Parallel	0.18	0.09	EB	1.2	6C28-5	0.250	0.125	1	0.26	4A28-7
56V C.T.	0.54	0.27	FA	2.2	6C28-15	0.356	0.178	2	0.30	4A28-10
Series	1.08	0.54	GA	3.3	6C28-30	0.892	0.446	3	0.47	4A28-25
	2.16	1.08	HA	4.7	6C28-60	1.78	0.89	4	0.77	4A28-50
	5.00	2.50	JA	7.4	6C28-140	4.28	2.14	5	1.6	4A28-120
	6.06	3.03	KA	9.8	6C28-170	5.36	2.68	6	2.0	4A28-150
44V Parallel	0.10	0.05	EB	1.2	6C44-5	0.158	0.079	1	0.26	4A44-7
88V C.T.	0.30	0.15	FA	2.2	6C44-15	0.226	0.113	2	0.30	4A44-10
Series	0.60	0.30	GA	3.3	6C44-30	0.568	0.284	3	0.47	4A44-25
	1.20	0.60	HA	4.7	6C44-60	1.12	0.56	4	0.77	4A44-50
	3.16	1.58	JA	7.4	6C44-140	2.72	1.36	5	1.6	4A44-120
	3.86	1.93	KA	9.8	6C44-170	3.40	1.70	6	2.0	4A44-150
60V Parallel	0.08	0.04	EB	1.2	6C60-5	0.116	0.058	1	0.26	4A60-7
120V C.T.	0.24	0.12	FA	2.2	6C60-15	0.166	0.083	2	0.30	4A60-10
Series	0.48	0.24	GA	3.3	6C60-30	0.416	0.208	3	0.47	4A60-25
	0.96	0.48	HA	4.7	6C60-60	0.82	0.41	4	0.77	4A60-50
	2.32	1.16	JA	7.4	6C60-140	2.00	1.00	5	1.6	4A60-120
	2.82	1.41	KA	9.8	6C60-170	2.50	1.25	6	2.0	4A60-150

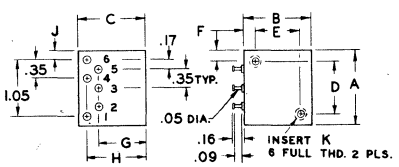
Size	A	B	C	D	E	F
EB	1.938	1.812	2.438	1.375	1.250	6-32 x 3/8
FA	2.312	2.062	3.125	1.688	1.438	6-32 x 3/8
GA	2.750	2.375	3.812	2.125	1.750	6-32 x 3/8
HA	3.062	2.625	4.250	2.297	1.859	8-32 x 3/8
JA	3.562	3.062	4.875	2.625	2.125	8-32 x 3/8
KA	3.938	3.375	5.250	3.000	2.438	10-32 x 1/2

Dimension A, B = +0.000 −0.125.
Dimension C = +0.000 −0.188
Dimension D, E = ±0.016 except size KA = 0.031
Dimension F = ±0.062

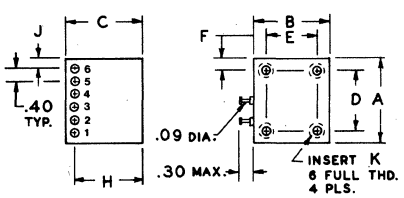


SIZES EB, FA, GA, HA, JA, KA

Size	A	B	C	D	E	F	G	H	J	K
1	1.37	1.25	1.31	1.00	.87	.19	1.00	1.19	.16	4-40
2	1.50	1.37	1.37	1.12	1.00	.19	1.06	1.25	.22	4-40
3	1.75	1.50	1.56	1.25	1.00	.25	1.25	1.44	.35	6-32
4	2.00	1.62	1.81	1.50	1.12	.25	1.50	1.69	.47	6-32
5	2.43	2.00	2.10	1.93	1.50	.25	—	1.90	.21	6-32
6	2.81	2.12	2.43	2.21	1.52	.30	—	2.23	.40	8-32



SIZES 1, 2, 3, 4



SIZES 5, 6

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abbott TRANSFORMERS

60 Hz Transformers

MODEL **P**

SPECIFICATIONS

INPUT PRIMARY: 115 VAC, 60 Hz ±5 Hz, 1 phase.

REGULATION: 10% no load to full load.

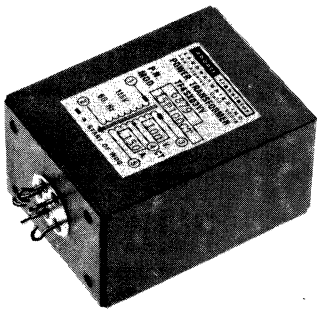
SECONDARY VOLTAGE TOLERANCE: Within 3% of listed output voltage when measured at full load and 115 VAC input.

CONSTRUCTION: To MIL-T-27D, grade: 4 class: "S", Case: steel.

ENVIRONMENT: To operate in 95°C maximum ambient temperature. Encapsulated to meet MIL-STD-810C for vibration, shock, acceleration, sand, dust, humidity, saltspray, fungus, sunshine, rain, explosion, and altitude (to a vacuum). NOTE: For high altitude operation, encapsulate terminals.

INSULATION TEST: 1750 VAC.

SECONDARY: See output voltage and current of specific models listed. For 50 Hz operation, reduce secondary current by 10% of ratings listed. These units are capable of 400 Hz operation; however, see Abbott's distinct line of miniature 400 Hz transformers.



Output Volts (F.L.)	Output Current (Amp)	Size	Secondary DCR ohms (typical)	Model Number
5.0	1.00	A1	0.335	5P5CT
	2.00	A2	0.12	10P5CT
	3.00	A3	0.07	15P5CT
	4.00	A4	0.066	20P5CT
	6.00	A5	0.04	30P5CT
	8.00	A6	0.03	40P5CT
	16.00	A7	0.014	80P5CT
6.3	0.79	A1	0.53	5P6.3CT
	1.58	A2	0.18	10.6:3CT
	2.38	A3	0.094	15P6.3CT
	3.16	A4	0.1	20P6.3CT
	4.76	A5	0.06	30P6.3CT
	6.35	A6	0.059	40P6.3CT
	12.70	A7	0.02	80P6.3CT
	19.00	A8	0.0014	120P6.3CT
8.0	0.67	A1	0.87	5P8CT
	1.25	A2	0.27	10P8CT
	1.88	A3	0.16	15P8CT
	2.50	A4	0.15	20P8CT
	3.76	A5	0.08	30P8CT
	5.00	A6	0.079	40P8CT
	10.00	A7	0.04	80P8CT
	15.00	A8	0.022	120P8CT
	20.00	A9	0.0072	160P8CT
10	0.50	A1	1.34	5P10CT
	1.00	A2	0.42	10P10CT
	1.50	A3	0.23	15P10CT
	2.00	A4	0.23	20P10CT
	3.00	A5	0.14	30P10CT
	4.00	A6	0.11	40P10CT
	8.00	A7	0.05	80P10CT
	12.00	A8	0.031	120P10CT
	16.00	A9	0.008	160P10CT
	20.00	A10	0.02	200P10CT
12.6	0.39	A1	2.06	5P12.6CT
	0.79	A2	0.65	10P12.6CT
	1.19	A3	0.4	15P12.6CT
	1.59	A4	0.34	20P12.6CT
12.6	2.38	A5	0.2	30P12.6CT
	3.18	A6	0.18	40P12.6CT
	6.35	A7	0.07	80P12.6CT
	9.53	A8	0.041	120P12.6CT
	12.70	A9	0.035	160P12.6CT
	15.90	A10	0.027	200P12.6CT
14	0.36	A1	2.95	5P14CT
	0.72	A2	0.74	10P14CT
	1.07	A3	0.6	15P14CT
	1.43	A4	0.4	20P14CT
	2.15	A5	0.23	30P14CT
	2.86	A6	0.19	40P14CT
	5.72	A7	0.1	80P14CT
	8.59	A8	0.055	120P14CT
	11.40	A9	0.042	160P14CT
	14.30	A10	0.029	200P14CT
16	0.34	A1	3.35	5P16CT
	0.68	A2	1.08	10P16CT
	0.94	A3	0.67	15P16CT
	1.25	A4	0.52	20P16CT
	1.87	A5	0.28	30P16CT
	2.50	A6	0.28	40P16CT
	5.00	A7	0.12	80P16CT
	7.50	A8	0.072	120P16CT
	10.00	A9	0.046	160P16CT
	12.50	A10	0.034	200P16CT
	18.70	A11	0.02	300P16CT
18	0.28	A1	4.65	5P18CT
	0.55	A2	1.42	10P18CT
	0.83	A3	0.78	15P18CT
	1.11	A4	0.62	20P18CT
	1.67	A5	0.38	30P18CT
	2.21	A6	0.36	40P18CT
	4.44	A7	0.16	80P18CT
	6.68	A8	0.08	120P18CT
	8.89	A9	0.060	160P18CT
	11.10	A10	0.04	200P18CT
	16.70	A11	0.022	300P18CT
20	0.25	A1	5.25	5P20CT
	0.50	A2	1.54	10P20CT
	0.75	A3	0.9	15P20CT
	1.00	A4	0.85	20P20CT
	1.50	A5	0.4	30P20CT
	2.00	A6	0.43	40P20CT
	4.00	A7	0.19	80P20CT
	6.00	A8	0.120	120P20CT
	8.00	A9	0.070	160P20CT
	10.00	A10	0.066	200P20CT
	15.00	A11	0.026	300P20CT
22	0.22	A1	7.3	5P22CT
	0.45	A2	1.9	10P22CT
	0.68	A3	1.2	15P22CT
	0.91	A4	0.95	20P22CT
	1.36	A5	0.55	30P22CT
	1.82	A6	0.57	40P22CT
	3.64	A7	0.25	80P22CT
	5.45	A8	0.125	120P22CT
	7.27	A9	0.092	160P22CT
	9.10	A10	0.073	200P22CT
	13.60	A11	0.031	300P22CT
25	0.20	A1	8.23	5P25CT
	0.40	A2	2.55	10P25CT
	0.60	A3	1.4	15P25CT
	0.80	A4	1.37	20P25CT
	1.20	A5	0.7	30P25CT
	1.60	A6	0.67	40P25CT
	3.20	A7	0.3	80P25CT
	4.80	A8	0.182	120P25CT
	6.40	A9	0.11	160P25CT
	8.00	A10	0.079	200P25CT
	12.00	A11	0.042	300P25CT
28	0.18	A1	11.4	5P28CT
	0.36	A2	3.0	10P28CT
	0.54	A3	1.9	15P28CT
	0.71	A4	1.6	20P28CT
	1.07	A5	0.94	30P28CT
	1.43	A6	0.90	40P28CT
28	2.86	A7	0.4	80P28CT
	4.29	A8	0.205	120P28CT
	5.72	A9	0.150	160P28CT
	7.10	A10	0.11	200P28CT
	10.70	A11	0.046	300P28CT
31	0.16	A1	13.8	5P31CT
	0.32	A2	3.8	10P31CT
	0.48	A3	2.2	15P31CT
	0.64	A4	2.2	20P31CT
	0.97	A5	0.96	30P31CT
	1.29	A6	0.95	40P31CT
	2.58	A7	0.45	80P31CT
	3.87	A8	0.31	120P31CT
	5.17	A9	0.166	160P31CT
	6.40	A10	0.12	200P31CT
	9.67	A11	0.054	300P31CT
35	0.14	A1	17.6	5P35CT
	0.29	A2	4.5	10P35CT
	0.43	A3	3.0	15P35CT
	0.57	A4	2.4	20P35CT
	0.86	A5	1.4	30P35CT
	1.14	A6	1.32	40P35CT
	2.28	A7	0.5	80P35CT
	3.43	A8	0.35	120P35CT
	4.57	A9	0.240	160P35CT
	5.71	A10	0.17	200P35CT
	8.59	A11	0.072	300P35CT
39	0.13	A1	19.7	5P39CT
	0.26	A2	6.3	10P39CT
	0.38	A3	3.5	15P39CT
	0.51	A4	3.6	20P39CT
	0.77	A5	1.62	30P39CT
	1.03	A6	1.5	40P39CT
	2.05	A7	0.7	80P39CT
	3.07	A8	0.342	120P39CT
	4.10	A9	0.270	160P39CT
	5.12	A10	0.18	200P39CT
	7.69	A11	0.08	300P39CT

Other standard models to 486V

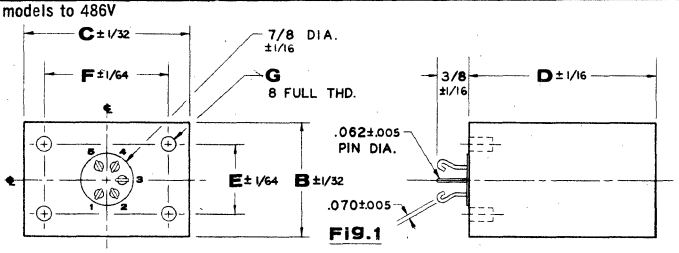


Fig. 1

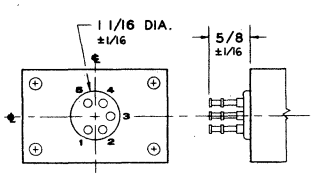


Fig. 2

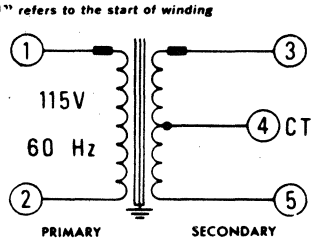
Size	B	C	D	E	F	G
A1	1½	1¾	2⅜	1⅛	1¼	6-32
A2	1¾	2⅛	2¾	1¼	1½	6-32
A3	1⅞	2⅜	3⅛	1¼	1¾	8-32
A4	2	2⅜	3⅛	1½	1¾	8-32
A5	2⅛	2 1/16	3½	1½	2	8-32
A6	2¼	2 1/16	3½	1⅝	2	8-32
A7*	2⅝	3⅛	4⅛	2	2¼	8-32
A8*	2⅞	3 1/16	4½	2¼	2½	10-32
A9*	3⅛	3¾	4⅞	2 1/16	2¾	10-32
A10*	3⅜	4 1/16	5¼	2⅝	3	¼-20
A11*	3⅞	4 1/16	6	2¾	3½	¼-20

Model Type	Weight Lbs. (Max.)	Primary DCR (ohms typical)
5P	1.0	86
10P	1.5	36
15P	2.0	24
20P	2.5	15
30P	3.0	8.5
40P	3.3	6.7
80P	5.0	3.7
120P	6.5	1.9
160P	8.2	1.6
200P	10.5	1.1
300P	17.0	0.5

* See Fig. 2 for header configuration used on any unit with output current greater than 10 amps.

TYPICAL CIRCUIT DIAGRAM

"■" refers to the start of winding



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abbott TRANSFORMERS

400 Hz Transformers

MODEL **E**

SPECIFICATIONS

Input Primary
115V, 400 Hz ±20 Hz, 1 phase

Regulation
10% no load to full load

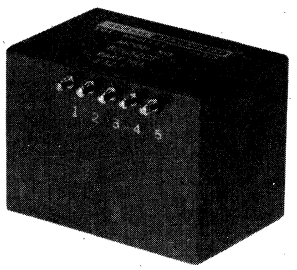
Secondary Voltage Tolerance
Within 5% when measured at full load and 115 VAC input

Construction
To MIL-T-27D, grade 5, class: "S" Molded Diallyl Phthalate

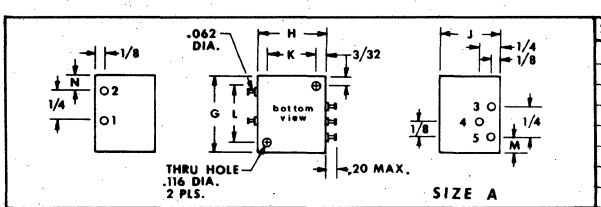
Environment
Encapsulated to meet MIL-STD-810C, including vibration, ambient temperature ot 85°C, shock, sand, dust, humidity, saltspray, fungus, sunshine, rain, explosion, and altitude (to a vacuum).

Output Secondary
See voltage and current of specific models listed.

Other models are available. Contact our nearest office for complete information.



Output Volts	Output Current (Amps)	Size	Sec. DCR (ohms)	Model Number
5.0	0.400	A	0.60	2E5CT
	1.200	B	0.144	6E5CT
	3.000	C	0.046	15E5CT
	4.800	D	0.040	24E5CT
	16.000	E2	0.009	80E5CT
	35.000	F2	0.012	175E5CT
6.3	0.317	A	1.06	2E6.3CT
	0.950	B	0.24	6E6.3CT
	2.380	C	0.088	15E6.3CT
	3.800	D	0.107	24E6.3CT
	12.800	E2	0.016	80E6.3CT
	27.800	F2	0.019	175E6.3CT
8.0	0.250	A	1.63	2E8CT
	0.750	B	0.396	6E8CT
	1.880	C	0.135	15E8CT
	3.000	D	0.140	24E8CT
	10.000	E2	0.017	80E8CT
	22.000	F2	0.010	175E8CT
10.0	0.200	A	2.50	2E10CT
	0.600	B	0.587	6E10CT
	1.500	C	0.27	15E10CT
	2.400	D	0.180	24E10CT
	8.000	E	7.2	80E10CT
	17.500	F2	0.020	175E10CT
12.6	0.158	A	4.10	2E12.6CT
	0.475	B	0.99	6E12.6CT
	1.180	C	0.32	15E12.6CT
	1.900	D	0.225	24E12.6CT
	6.350	E	0.030	80E12.6CT
	13.900	F2	0.021	175E12.6CT
14.0	0.142	A	5.59	2E14CT
	0.428	B	1.11	6E14CT
	1.070	C	0.35	15E14CT
	1.720	D	0.32	24E14CT
	5.600	E	0.04	80E14CT
	12.500	F2	0.022	175E14CT
16	0.125	A	6.63	2E16CT
	0.375	B	1.58	6E16CT
	0.940	C	0.54	15E16CT
	1.500	D	0.35	24E16CT
	5.000	E	0.05	80E16CT
	10.900	F2	0.025	175E16CT
18	0.111	A	9.00	2E18CT
	0.333	B	2.21	6E18CT
	0.832	C	0.74	15E18CT
	1.330	D	0.40	24E18CT
	4.450	E	0.08	80E18CT
	9.700	F	0.027	175E18CT
20	0.100	A	10.9	2E20CT
	0.300	B	2.78	6E20CT
	0.750	C	1.4	15E20CT
	1.200	D	0.48	24E20CT
	4.000	E	0.09	80E20CT
	8.750	F	0.020	175E20CT
22	0.091	A	14.6	2E22CT
	0.273	B	2.80	6E22CT
	0.680	C	0.92	15E22CT
	1.090	D	0.63	24E22CT
	3.630	E	0.12	80E22CT
	7.900	F	0.020	175E22CT
25	0.080	A	20.4	2E25CT
	0.240	B	3.60	6E25CT
	0.600	C	1.3	15E25CT
	0.900	D	0.68	24E25CT
	3.200	E	0.13	80E25CT
	7.000	F	0.042	175E25CT
28	0.071	A	30.0	2E28CT
	0.214	B	4.20	6E28CT
	0.535	C	1.83	15E28CT
	0.855	D	0.98	24E28CT
	2.850	E	0.14	80E28CT
	6.250	F	0.043	175E28CT
31	0.064	A	25.6	2E31CT
	0.192	B	5.71	6E31CT
	0.485	C	1.62	15E31CT
	0.717	D	1.27	24E31CT
	2.470	E	0.18	80E31CT
	5.650	F	0.061	175E31CT
35	0.057	A	29.5	2E35CT
	0.171	B	6.89	6E35CT
	0.428	C	2.28	15E35CT
	0.685	D	1.70	24E35CT
	2.280	E	0.28	80E35CT
	5.000	F	0.098	175E35CT
39	0.051	A	38.6	2E39CT
	0.154	B	9.39	6E39CT
	0.384	C	2.54	15E39CT
	0.615	D	2.20	24E39CT
	2.050	E	0.32	80E39CT
	4.480	F	0.110	175E39CT
43	0.046	A	44.3	2E43CT
	0.139	B	10.25	6E43CT
	0.348	C	2.85	15E43CT
	0.556	D	2.42	24E43CT
	1.860	E	0.35	80E43CT
	4.060	F	0.114	175E43CT
48	0.041	A	57.0	2E48CT
	0.125	B	15.30	6E48CT
	0.312	C	4.05	15E48CT
	0.500	D	3.27	24E48CT
	1.660	E	0.40	80E48CT
	3.650	F	0.160	175E48CT
55	0.036	A	89.0	2E55CT
	0.109	B	17.30	6E55CT
	0.262	C	7.2	15E55CT
	0.435	D	3.83	24E55CT
	1.450	E	0.67	80E55CT
	3.170	F	0.196	175E55CT
63	0.031	A	100.0	2E63CT
	0.095	B	24.9	6E63CT
	0.238	C	6.51	15E63CT
	0.380	D	5.35	24E63CT
	1.270	E	0.71	80E63CT
	2.770	F	0.20	175E63CT
70	0.028	A	139.0	2E70CT
	0.085	B	27.1	6E70CT
	0.214	C	9.4	15E70CT
	0.342	D	8.10	24E70CT
	1.140	E	0.80	80E70CT
	2.500	F	0.25	175E70CT
80	0.025	A	163.0	2E80CT
	0.075	B	39.0	6E80CT
	0.198	C	13.4	15E80CT
	0.300	D	9.0	24E80CT
	1.000	E	0.92	80E80CT
	2.180	F	0.34	175E80CT
90	0.022	A	218.0	2E90CT
	0.067	B	41.0	6E90CT
	0.166	C	15.9	15E90CT
	0.267	D	12.5	24E90CT
	0.890	E	1.08	80E90CT
	1.940	F	0.38	175E90CT
100	0.020	A	283.0	2E100CT
	0.060	B	59.5	6E100CT
	0.150	C	16.8	15E100CT
	0.240	D	14.4	24E100CT
	0.800	E	1.64	80E100CT
	1.750	F	0.52	175E100CT
110	0.018	A	392.0	2E110CT
	0.054	B	62.3	6E110CT
	0.136	C	22.1	15E110CT
	0.218	D	19.5	24E110CT
	0.728	E	2.03	80E110CT
	1.590	F	0.72	175E110CT

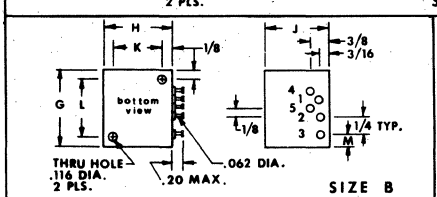


SIZE A

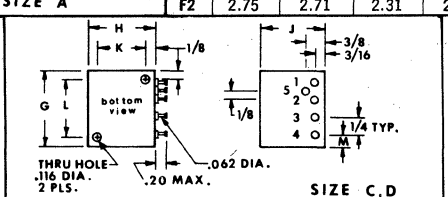
SIZE	G	H	J	K	L	M	N
A	.87	.74	.78	.55	.68	3/16	3/16
B	1.25	1.19	.88	.94	1.00	1/4	—
C	1.43	1.24	1.27	.99	1.18	1/4	—
D	1.47	1.28	1.40	1.03	1.22	1/4	—
E	2.31	1.52	1.75	1.02	1.81	1/2	—
E2	2.31	1.52	1.75	1.02	1.81	1/2	3/4
F	2.75	2.71	2.31	2.21	2.25	3/4	—
F2	2.75	2.71	2.31	2.21	2.25	3/4	1

Dim. Tol. =
Fraction ±1/32,
xx = ±0.015,
xxx = ±0.005

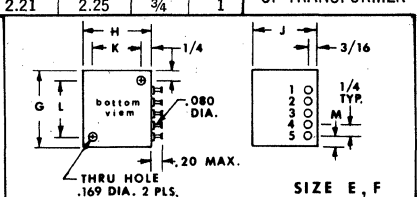
NOTE:
DIMENSIONS G & H MEASURED AT TOP OF TRANSFORMER



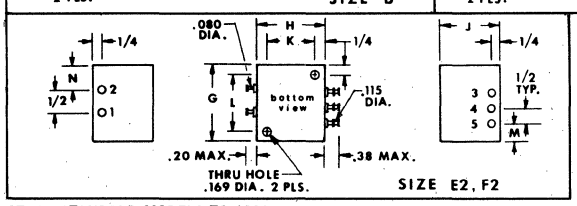
SIZE B



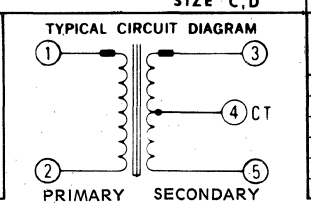
SIZE C,D



SIZE E, F



SIZE E2, F2



MODEL TYPE	WEIGHT lbs. (max)	PRIMARY DCR ohms (typical)
2E	0.06	201
6E	0.15	61
15E	0.28	14
24E	0.32	12
80E	0.80	2.0
175E	2.2	0.7

OTHER STANDARD MODELS TO 1200V.

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abbott TRANSFORMERS

400 Hz Power Toroid Transformers

MODELS TM TF

SPECIFICATIONS

INPUT PRIMARY: 115V, 400 Hz ±20 Hz, 1 phase for 230V operation add the suffix "A"

REGULATION: 5% or less, no load to full load

SECONDARY VOLTAGE TOLERANCE: Within 5% when measured at full load and 115 VAC input

INSULATION TEST: 1000 VAC

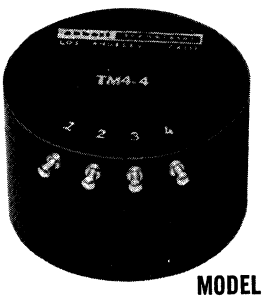
OPERATING TEMPERATURE: MODEL TM 90°C Maximum ambient/MODEL TF 80°C Maximum ambient

APPROXIMATE EFFICIENCY: 90% to 95%

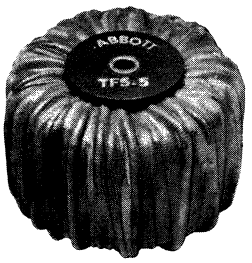
OUTPUT SECONDARY: See voltage and current of specific models listed

CONSTRUCTION: MODEL TF — Open frame, Industrial Grade with Teflon leads 6" long MODEL TM — to meet MIL-T-27D, Grade 5, Class S, MIL-type Designation TF5S03ZZ

OPTIONS: "A" option is for 230V input primary. Add suffix "A" to model number (i.e. TF10-1A). "C" option is for center tapped output. Add suffix "C" to model number (i.e. TF10-1C)



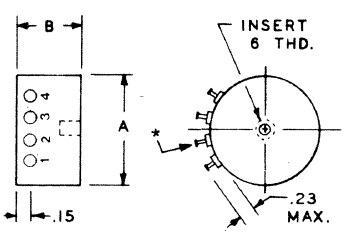
MODEL TM



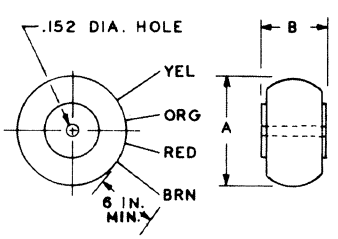
MODEL TF

Output Volts (F.L.)	Model No. TM	Model No. TF	Output Current (Amps)	Size	VA
5V	TM1-1	TF1-1	3.00	1	15
	TM1-2	TF1-2	5.00	2	25
	TM1-3	TF1-3	10.00	3	50
7V	TM2-1	TF2-1	2.14	1	15
	TM2-2	TF2-2	3.57	2	25
	TM2-3	TF2-3	7.14	3	50
	TM2-4	TF2-4	10.00	4	70
10V	TM3-1	TF3-1	1.50	1	15
	TM3-2	TF3-2	2.50	2	25
	TM3-3	TF3-3	5.00	3	50
	TM3-4	TF3-4	7.50	4	75
	TM3-5	TF3-5	10.00	5	100
12V	TM4-1	TF4-1	1.25	1	15
	TM4-2	TF4-2	2.08	2	25
	TM4-3	TF4-3	4.17	3	50
	TM4-4	TF4-4	6.25	4	75
	TM4-5	TF4-5	8.33	5	100
14V	TM5-1	TF5-1	1.07	1	15
	TM5-2	TF5-2	1.79	2	25
	TM5-3	TF5-3	3.57	3	50
	TM5-4	TF5-4	5.36	4	75
	TM5-5	TF5-5	7.14	5	100

Output Volts (F.L.)	Model No. TM	Model No. TF	Output Current (Amps)	Size	VA
17V	TM6-1	TF6-1	0.88	1	15
	TM6-2	TF6-2	1.47	2	25
	TM6-3	TF6-3	2.94	3	50
	TM6-4	TF6-4	4.41	4	75
	TM6-5	TF6-5	5.88	5	100
24V	TM7-1	TF7-1	0.63	1	15
	TM7-2	TF7-2	1.04	2	25
	TM7-3	TF7-3	2.08	3	50
	TM7-4	TF7-4	3.13	4	75
	TM7-5	TF7-5	4.17	5	100
28V	TM8-1	TF8-1	0.54	1	15
	TM8-2	TF8-2	0.89	2	25
	TM8-3	TF8-3	1.79	3	50
	TM8-4	TF8-4	2.68	4	75
	TM8-5	TF8-5	3.57	5	100
34V	TM9-1	TF9-1	0.44	1	15
	TM9-2	TF9-2	0.75	2	25
	TM9-3	TF9-3	1.47	3	50
	TM9-4	TF9-4	2.21	4	75
	TM9-5	TF9-5	2.94	5	100
115V	TM10-1	TF10-1	0.13	1	15
	TM10-2	TF10-2	0.21	2	25
	TM10-3	TF10-3	0.43	3	50
	TM10-4	TF10-4	0.65	4	75
	TM10-5	TF10-5	0.87	5	100



MODEL TM

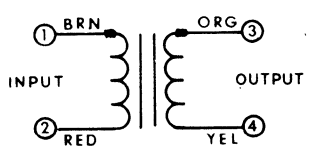


MODEL TF

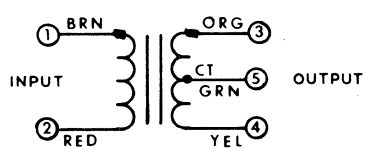
SIZE	1		2		3		4		5	
MODEL	TM	TF	TM	TF	TM	TF	TM	TF	TM	TF
DIM A	1.62	1.50	1.75	1.63	2.13	2.00	2.13	2.00	2.38	2.25
DIM B	0.95	0.95	1.00	1.00	1.10	1.10	1.30	1.30	1.60	1.60
WT. (LB. MAX.)	0.26	0.17	0.33	0.25	0.52	0.38	0.66	0.52	1.1	0.79
INSERT	6-32	—	8-32	—	8-32	—	10-32	—	10-32	—

DIMENSIONAL TOLERANCE: Model TM ±.03; Model TF Dim A, B Max.
*Terminal Spacing is 0.35.

STANDARD & OPTION A



OPTION C



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abbott TRANSFORMERS

400 Hz 3 Ø Power Transformers

MODEL 4D

SPECIFICATIONS

INPUT PRIMARY:
WYE: (4 wire) Line to Common 115 VAC
WYE: (3 wire) Line to Line 200 VAC
DELTA: (3 wire) Line to Line 115 VAC (see option "A")
DELTA: (3 wire) Line to Line 200 VAC (see option "B")

INPUT FREQUENCY: 400 Hz ±20 Hz.

OUTPUT: See specific models listed.

OUTPUT VOLTAGE TOLERANCE: Within 5% when measured at full load and nominal VAC input.

REGULATION: 10% no load to full load.

INSULATION TEST: 1500 VRMS.

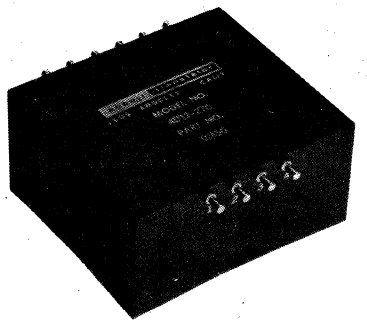
EFFICIENCY: Ranges from 90% to 95%.

OPERATING AMBIENT TEMPERATURE: 80°C Maximum

TEMPERATURE RISE: Less than 50°C.

CONSTRUCTION: To MIL-T-27D, Grade 5, class "S".

ENVIRONMENT: Encapsulated to meet MIL-STD-810C, including vibration, temperature to 80°C, shock, sand, dust, humidity, saltspray, fungus, sunshine, rain, explosion. Note: For high altitude operation encapsulate terminals.



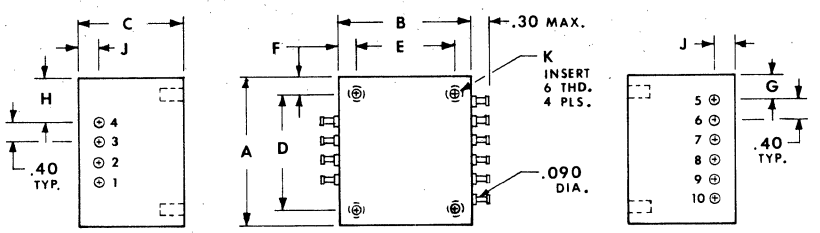
Model Number	OUTPUT PER PHASE: DELTA: L to L (3 wire) — WYE: L to COM. (4 wire) Volts RMS	DELTA: L to L (3 wire) — WYE: L to COM. (4 wire) Load Current (Amps)	WYE: L to L (3 wire) Volts RMS	WYE: L to L (3 wire) Load Current (Amps)	Size	Weight Lbs. Max.
4D5-90	5	6.00	8.66	3.47	1	1.3
4D5-120	5	8.00	8.66	4.62	2	1.6
4D5-150	5	10.00	8.66	5.78	3	2.3
4D5-200	5	13.34	8.66	7.70	4	2.4
4D12-90	12	2.50	20.8	1.45	1	1.3
4D12-120	12	3.34	20.8	1.93	2	1.6
4D12-150	12	4.17	20.8	2.41	3	2.3
4D12-200	12	5.56	20.8	3.21	4	2.4
4D12-270	12	7.50	20.8	4.33	5	2.8
4D12-375	12	10.42	20.8	6.02	6	3.8
4D15-90	15	2.00	26.0	1.16	1	1.3
4D15-120	15	2.67	26.0	1.54	2	1.6
4D15-150	15	3.34	26.0	1.93	3	2.3
4D15-200	15	4.45	26.0	2.57	4	2.4
4D15-270	15	6.00	26.0	3.47	5	2.8
4D15-375	15	8.34	26.0	4.82	6	3.8
4D20-90	20	1.50	34.6	0.87	1	1.3
4D20-120	20	2.00	34.6	1.16	2	1.6
4D20-150	20	2.50	34.6	1.45	3	2.3
4D20-200	20	3.34	34.6	1.93	4	2.4
4D20-270	20	4.50	34.6	2.60	5	2.8
4D20-375	20	6.25	34.6	3.61	6	3.8
4D28-90	28	1.08	48.5	0.62	1	1.3
4D28-120	28	1.43	48.5	0.83	2	1.6
4D28-150	28	1.79	48.5	1.03	3	2.3
4D28-200	28	2.38	48.5	1.38	4	2.4
4D28-270	28	3.22	48.5	1.86	5	2.8
4D28-375	28	4.47	48.5	2.58	6	3.8
4D48-90	48	0.63	83.1	0.36	1	1.3
4D48-120	48	0.84	83.1	0.49	2	1.6
4D48-150	48	1.05	83.1	0.61	3	2.3
4D48-200	48	1.39	83.1	0.81	4	2.4
4D48-270	48	1.88	83.1	1.09	5	2.8
4D48-375	48	2.61	83.1	1.51	6	3.8
4D115-90	115	0.26	200	0.15	1	1.3
4D115-120	115	0.35	200	0.20	2	1.6
4D115-150	115	0.44	200	0.25	3	2.3
4D115-200	115	0.58	200	0.34	4	2.4
4D115-270	115	0.79	200	0.45	5	2.8
4D115-375	115	1.09	200	0.63	6	3.8

Option "A" — To order DELTA input 115 VAC L-L. Add suffix "A" to Model No. e.g. 4D5-90A
Option "B" — To order DELTA input 200 VAC L-L. Add suffix "B" to Model No. e.g. 4D5-90B

Size	A	B	C	D	E
1	2.90	2.40	1.45	2.50	2.00
2	2.90	2.70	1.55	2.50	2.30
3	3.65	2.80	1.70	3.15	2.30
4	3.65	3.00	1.70	3.15	2.50
5	3.65	3.00	1.95	3.15	2.50
6	4.95	3.20	1.90	4.45	2.70

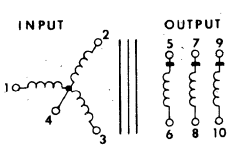
Size	F	G	H	J	K
1	.20	.45	.85	.20	6-32
2	.20	.45	.85	.20	6-32
3	.25	.82	1.22	.20	8-32
4	.25	.82	1.22	.20	8-32
5	.25	.82	1.22	.20	8-32
6	.25	1.47	1.87	.20	8-32

DIMENSIONAL TOL.: D, E ±0.02; all others ±0.04



INPUT CONNECTION:
WYE, 115V to Com 1, 2, 3 Line 4 Com
WYE, 200V L-L 1, 2, 3
DELTA 115V or 200V L-L 1, 2, 3

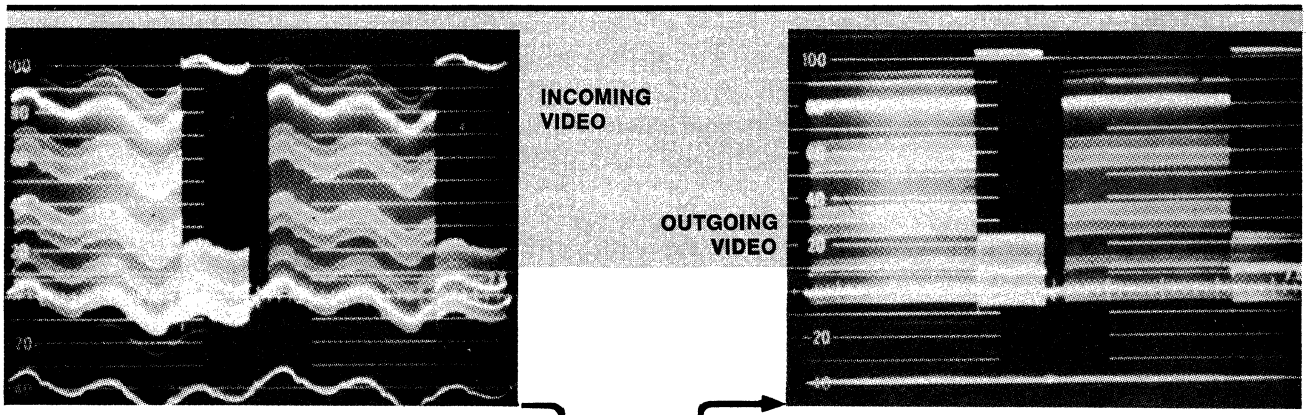
OUTPUT CONNECTION:
WYE, L-Com Connect 6-8-10 Load 5-6, 7-6, 9-6
DELTA L-L Connect 6-7, 8-9, 5-10 Load 5, 7, 9
WYE, L-L Connect 6-10, 8-10 Load 5, 7, 9



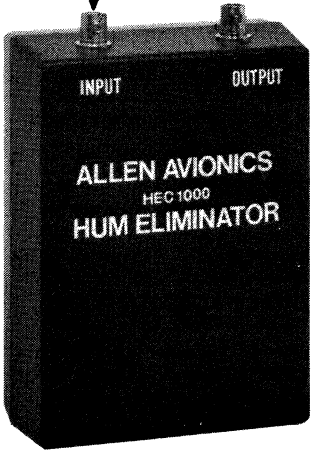
ABBOTT TRANSISTOR LABORATORIES, INC.
Transformer Div., Western Offices: 639 S. Glenwood Pl., Burbank, CA 91506 (818) 841-3630. Telex: 69-6282
Eastern: 520 Main St., Ft. Lee, NJ 07024 (201) 461-4411. Telex: 13-5332 • Southwest: 710 Kindred Lane, Richardson, TX 75080 (214) 437-0697
New England: (617) 272-5676 • Florida: (305) 788-0845 • Southeast: (205) 881-2207 • E. Canada: (416) 675-6235
MN, WI, ND, SD: (612) 786-7641 • IA, MO, NE, KS: (314) 839-0800

ALLEN AVIONICS, INC.
224 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • PHONES: 516-248-8080 OR 516-747-5450

HUM ELIMINATOR HEC1000



ELIMINATES HUM AND OTHER INTERFERENCE in Video Lines caused by differences in Ground Potential



- FLAT - DC to 10 MHz
- For Color and Black & White
- No Low Frequency or High Frequency Roll-Off
- No Differential Gain Distortion
- No Differential Phase Distortion
- Passive Device - Failure Free
- Reversible
- Small Compact Package
- Low Price

IN FIELD:

Between Remote Truck & Telco
Between Remote Truck & Microwave
For Intertruck Hookup
For VTR Units
For Monitoring Lines

IN STUDIO:

Between Buildings
On long runs in Buildings
Between Studios & Transmitter
On incoming Telco Circuits
On outgoing Telco Circuits

SPECIFICATIONS:

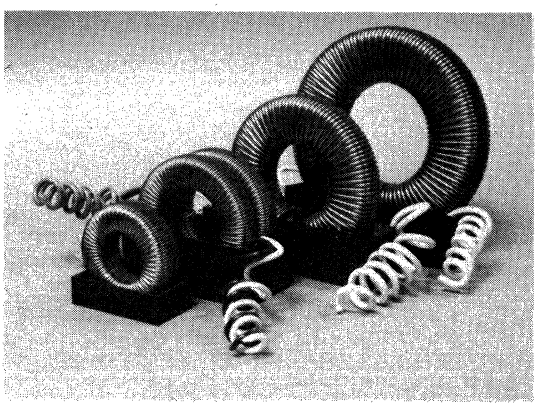
Impedance	75 ohms, unbalanced
Connectors	Type BNC
Bandwidth	DC to 10 MHz (0.6 dB @ 10 MHz)
Hum Reduction	to 50 dB depending on system
Dimensions	5.3″ x 4.0″ x 2.0″ (135 x 102 x 51 mm)
Weight	Approx. 3 lbs. (1.36kg)
Insertion Loss	< 0.2 dB

AMECON
QUALITY MAGNETIC COMPONENTS • DESIGNED WITH 25 YRS. OF EXPERTISE
1900 CHRIS LANE / ANAHEIM, CA 92805 / TEL 714-634-2220/800-392-2292

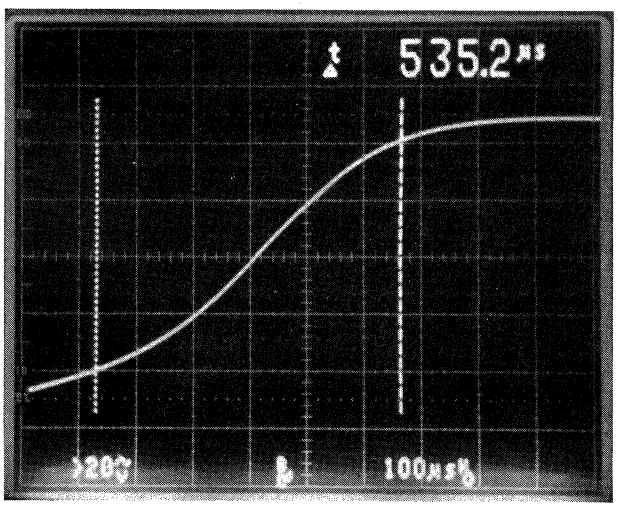
ADVANCED HEAVY DUTY TOROIDAL FILTER INDUCTORS

FOR PROFESSIONAL LIGHT DIMMERS: THEATRICAL, TOURING & ARCHITECTURAL FOR E.M.I/R.F.I SCR CONTROLS, MOTOR CONTROLS, LINE FILTERS, ETC.

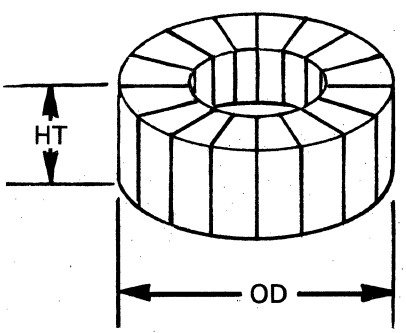
- Open • semi enclosed • totally enclosed styles
- Horizontal & vertical mounting
- All "UL" recognizable materials
- From 1,000 to 18,000 watts at 120 v. & 2,000 to 36,000 w. @ 240 v.
- Absolutely latest "State of the Art" materials, production & testing technologies are employed throughout all phases of this product line, which is designed for peak performance.



VERTICAL MTG. SHOWN LEFT TO RIGHT.
10A, DUAL 20A., 50A & 100.A.



TYPICAL TURN ON RISE TIME 90° FIRING



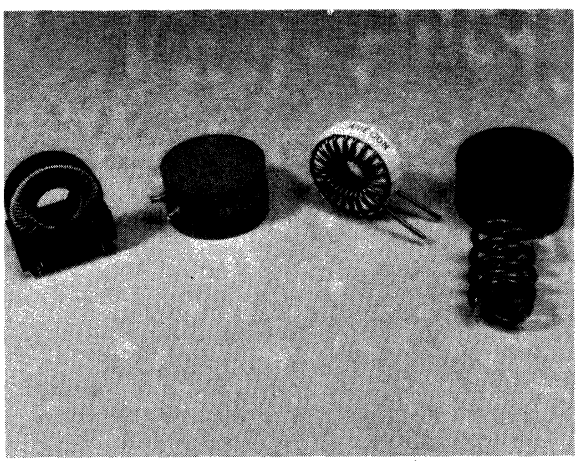
Part No.	Current Rating AMPS RMS	Line Drop VRMS	di/dt 10% to 90% μs	Δt°C Above Ambient	Dimensions Open Style OD HT
5007	8.33	1.85	150	69	2.06 × 1.00
5008	8.33	1.75	150	60	2.18 × 0.87
5009	8.33	3.00	260	62	2.20 × 1.25
5011	10.00	2.20	155	78	2.06 × 1.00
5012	10.00	2.10	155	70	2.18 × 0.87
5013	10.00	3.30	260	70	2.20 × 1.25
5014	10.00	3.20	255	79	2.50 × 0.95
5015	10.00	4.60	320	116	2.50 × 1.00
5016	10.00	5.3	400	100	3.25 × 0.75
5021	15.00	2.85	250	76	2.55 × 1.09
5022	15.00	3.00	315	78	2.56 × 1.56
5026	16.66	2.95	255	82	2.55 × 1.09
5027	16.66	3.10	320	84	2.56 × 1.56
5031	20.00	3.85	300	113	2.56 × 1.56
5032	20.00	4.00	365	98	3.25 × 1.32
5033	20.00	4.30	410	75	3.28 × 1.85

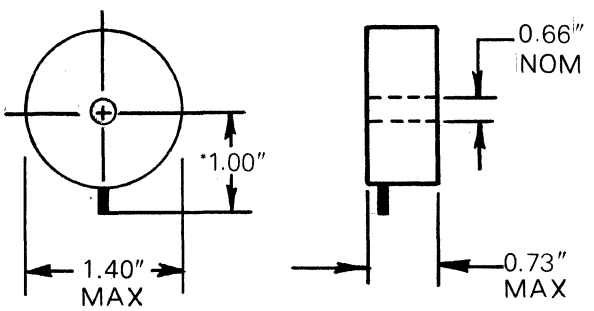
Part No.	Current Rating AMPS RMS	Line Drop VRMS	di/dt 10% to 90% μs	Δt°C Above Ambient	Dimensions Open Style OD HT
5034	20.00	5.10	520	76	4.28 × 1.18
5035	20.00	4.4	466	72	4.30 × 1.45
5036	20.00	5.5	600	86	4.30 × 1.70
5045	25.00	5.0	275	92	330 × 1.32
5046	25.00	4.1	430	70	4.3 × 1.25
5047	25.00	5.8	525	102	4.30 × 1.18
5051	30.00	3.5	405	87	3.30 × 1.85
5052	30.00	6.4	510	130	4.30 × 1.18
5055	40.00	4.00	405	101	4.30 × 1.60
5056	40.00	5.60	465	116	4.30 × 1.80
5061	50.00	5.20	485	109	4.25 × 1.70
5062	50.00	4.40	440	93	4.30 × 1.80
5068	75.00	N/A	~425	~115	4.30 × 2.20
5070	100.00	N/A	~405	~104	5.87 × 2.37
5072	125.00	N/A	~400	~106	5.87 × 3.20
5075	150.00	N/A	~380	~108	6.00 × 4.00

AMECON
QUALITY MAGNETIC COMPONENTS SINCE 1972
1900 CHRIS LANE / ANAHEIM, CA 92805 / TEL 714-634-2220/800-392-2292

MPP TOROIDS

FOR PRECISION LC FILTERS





*Optional Per Customer Specification

PART NUMBER	INDUCTANCE VALUE (@ KHZ)	Q_{MIN} @ KHZ	R_{DC} ±20%	*$F_{S\ R\ MIN}$ (KHZ)	I_{REF} (MA)
5701	5.0 MH ± 2.5% @ 5	115 @ 7.0	0.60	255	402
5702	6.0 MH ± 2.5% @ 5	115 @ 7.0	0.67	229	402
5703	7.2 MH ± 1.5% @ 5	115 @ 7.0	0.88	208	320
5704	8.6 MH ± 1.5% @ 5	115 @ 7.0	1.00	187	320
5705	10.0 MH ± 1.5% @ 5	115 @ 5.0	1.07	172	320
5706	12.0 MH ± 1.5% @ 2	115 @ 5.0	1.19	157	320
5707	15.0 MH ± 1.5% @ 2	115 @ 5.0	1.65	139	254
5708	17.5 MH ± 1.5% @ 2	115 @ 5.0	1.79	135	254
5709	20.0 MH ± 1.5% @ 2	115 @ 5.0	1.89	127	254
5710	24.0 MH ± 1.0% @ 2	115 @ 5.0	2.62	107	201
5711	30.0 MH ± 1.0% @ 2	115 @ 5.0	2.93	95	201
5712	36.0 MH ± 1.0% @ 2	115 @ 5.0	4.07	87	160
5713	43.0 MH ± 1.0% @ 2	115 @ 5.0	4.38	78	160
5714	50.0 MH ± 1.0% @ 2	115 @ 5.0	6.00	72	127
5715	60.0 MH ± 1.0% @ 2	115 @ 5.0	6.61	65	127
5716	72.0 MH ± 1.0% @ 2	105 @ 4.0	7.20	59	127
5717	86.0 MH ± 1.0% @ 2	105 @ 4.0	9.91	54	100
5718	100 MH ± 1.0% @ 1	105 @ 4.0	10.60	50	100
5719	120 MH ± 1.0% @ 1	105 @ 4.0	14.66	45	80.0
5720	150 MH ± 1.0% @ 1	105 @ 4.0	16.50	40	80.0
5721	175 MH ± 1.0% @ 1	105 @ 4.0	17.76	37	80.0
5722	200 MH ± 1.0% @ 1	105 @ 4.0	23.90	34	63.0
5723	240 MH ± 1.0% @ 1	93 @ 3.0	26.20	30	63.0
5724	300 MH ± 1.0% @ 1	93 @ 3.0	37.00	28	50.0
5725	360 MH ± 1.0% @ 1	93 @ 3.0	40.50	25	50.0
5726	430 MH ± 1.0% @ 1	93 @ 3.0	44.20	23	50.0
5727	500 MH ± 1.0% @ .4	93 @ 3.0	60.20	21	40.0
5728	600 MH ± 1.0% @ .4	73 @ 2.0	65.90	19	40.0
5729	720 MH ± 1.0% @ .4	73 @ 2.0	91.00	17	31.5
5730	860 MH ± 1.0% @ .4	73 @ 2.0	99.70	16	31.5
5731	1.00 HY ± 1.0% @ .4	73 @ 2.0	107	15	31.5
5732	1.20 HY ± 1.0% @ .4	73 @ 2.0	148	13	25.0
5733	1.50 HY ± 1.0% @ .4	58 @ 1.5	185	12	25.0

*Minimum self resonant frequency in KHZ.

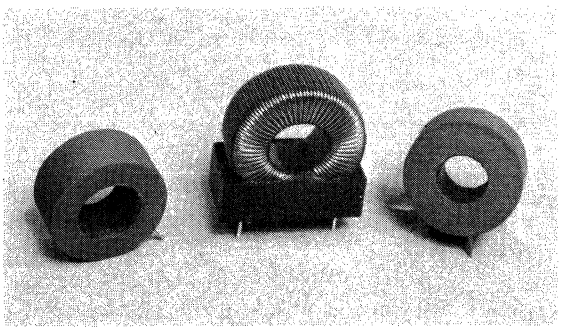
PART NUMBER	INDUCTANCE VALUE (@ KHZ)	Q_{MIN} @ KHZ	R_{DC} ±20%	*$F_{S\ R\ MIN}$ (KHZ)	I_{REF} (MA)
5734	1.75 HY ± 1.0% @ .4	58 @ 1.5	225	11	20.0
5735	2.00 HY ± 1.0% @ .4	58 @ 1.5	240	10	20.0
5736	2.40 HY ± 1.0% @ .1	58 @ 1.5	260	9	20.0
5737	3.00 HY ± 1.0% @ .1	58 @ 1.5	372	8	16.0
5738	3.60 HY ± 1.0% @ .1	42 @ 1.0	407	7.5	16.0
5739	4.30 HY ± 1.0% @ .1	42 @ 1.0	562	6.5	12.5
5740	5.00 HY ± 1.0% @ .1	42 @ 1.0	605	6.0	12.5
5741	5.0 MH ± 1.5% @ 7	145 @ 10	1.0	260	320
5742	6.0 MH ± 1.5% @ 7	145 @ 10	1.5	235	254
5743	7.2 MH ± 1.5% @ 5	145 @ 10	1.6	213	254
5744	8.6 MH ± 1.5% @ 5	145 @ 10	1.8	193	254
5745	10.0 MH ± 1.5% @ 5	145 @ 10	2.3	178	202
5746	12.0 MH ± 1.5% @ 5	145 @ 10	2.5	161	202
5747	15.0 MH ± 1.0% @ 5	145 @ 10	2.8	153	202
5748	17.5 MH ± 1.0% @ 3	145 @ 10	4.0	130	160
5749	20.0 MH ± 1.0% @ 3	145 @ 10	4.3	120	160
5750	24.0 MH ± 1.0% @ 3	145 @ 10	5.9	109	127
5751	30.0 MH ± 1.0% @ 3	145 @ 10	6.6	97	127
5752	36.0 MH ± 1.0% @ 3	117 @ 7	7.3	87	127
5753	43.0 MH ± 1.0% @ 2	117 @ 7	10.0	79	100
5754	50.0 MH ± 1.0% @ 2	117 @ 7	11.0	73	100
5755	60.0 MH ± 1.0% @ 2	117 @ 7	15.0	66	80.0
5756	72.0 MH ± 1.0% @ 2	117 @ 7	16.5	60	80.0
5757	86.0 MH ± 1.0% @ 2	117 @ 7	18.0	54	80.0
5758	100 MH ± 1.0% @ 2	117 @ 7	24.0	50	63.0
5759	120 MH ± 1.0% @ 1	95 @ 5	26.5	45	63.0
5760	150 MH ± 1.0% @ 1	95 @ 5	38.0	40	50.0
5761	175 MH ± 1.0% @ 1	95 @ 5	41.0	37	50.0
5762	200 MH ± 1.0% @ 1	95 @ 5	44.0	35	50.0
5763	240 MH ± 1.0% @ 1	95 @ 5	60.0	31	40.0
5764	300 MH ± 1.0% @ 1	77 @ 4	67.0	28	40.0
5765	360 MH ± 1.0% @ 1	77 @ 4	92.0	25	31.5
5766	430 MH ± 1.0% @ 1	77 @ 4	102	23	31.5
5767	500 MH ± 1.0% @ 1	77 @ 4	110	21	31.5

*Minimum self resonant frequency in KHZ.

AMECON
QUALITY MAGNETIC COMPONENTS FOR S.M.P.S. SINCE 1972
1900 CHRIS LANE / ANAHEIM, CA 92805 / TEL 714-634-2220/800-392-2292

TOROIDAL CURRENT SENSE TRANSFORMERS

- Designed for switching power supply applications.
- Cost effective design.
- Operating frequency 20KHZ above.
- Pri Peak current up to 20 amps
- Available with open winding type, pvc sealed, and totally epoxy encapsulated.
- All our SMPS components backed by 19 yrs. of experience.



Part Number	Turns Ratio	Fig.	L_{MIN}(MH) @ 20KHZ 1 Volt	DCR_{MAX} (OHMS)	R_L (OHMS)	Dimensions (inch) L_{MAX}	ID_{MIN}	HT_{MAX}	W_{MAX}	CXD
5600	30:1	1	2.0	0.30	30	0.67	0.18	0.75	0.4	0.50 x 0.25
5601	50:1	1	5.0	0.50	50					
5602	100:1	1	20.0	1.20	100					
5603	200:1	1	90.0	2.00	200					
5604	400:1	1	210.0	5.0	400	1.18	0.31	1.25	0.50	0.75 x 0.37
5605	600:1	1	480.0	9.0	600					
5606	800:1	1	850.0	15.0	800					
5607	20CT:1	2	1.0	0.20	20	0.67	0.18	0.75	0.4	0.50 x 0.25
5608	40CT:1	2	3.5	0.40	40					
5609	100CT:1	2	22.0	1.20	100					
5610	200CT:1	2	90.0	2.00	200					
5611	500CT:1	2	350.0	7.5	500	1.18	0.31	1.25	0.50	0.75 x 0.37
5612	800CT:1	2	850.0	15.0	800					
5613	1000CT:1	2	1400.0	24.5	1000					

FIGURE 1

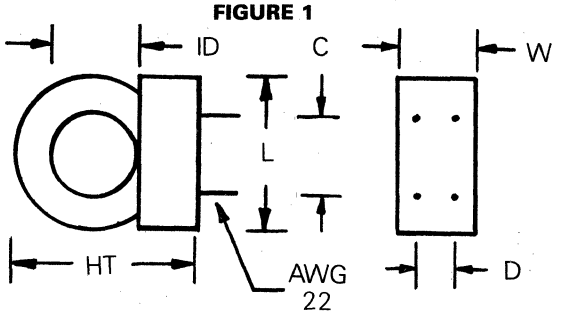
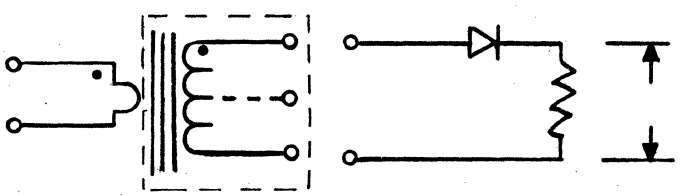
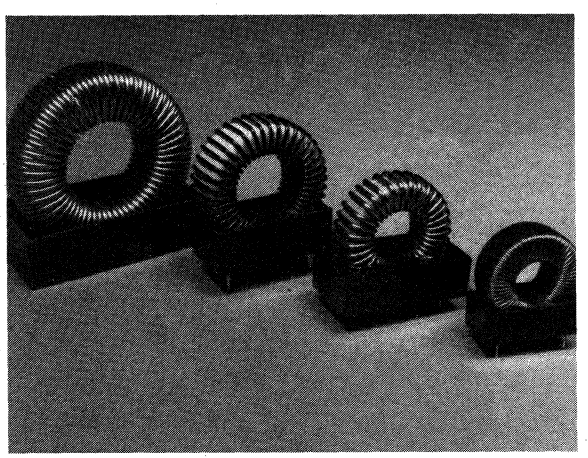


FIGURE 2



SWITCHING MODE POWER SUPPLY FILTER INDUCTORS

- Minimum possible size • Low profile
- Performance verified in 25KHZ switching power supply
- Large selection of sizes available
- Available with open winding type or encapsulated and semi-encapsulated constructions.
- Custom designs are available up to 200 AMPS.
- Advanced materials
- Best production technologies, with 19 yrs. of SMPS expertise



AMECON
QUALITY MAGNETIC COMPONENTS FOR S.M.P.S. SINCE 1972
1900 CHRIS LANE / ANAHEIM, CA 92805 / TEL 714-634-2220/800-392-2292

SWITCHING MODE POWER SUPPLY FILTER INDUCTORS

I_{dc} (AMPS)	Part Number	L_{MIN} (μh) @ Rated I_{dc}	L_{MIN} (μh) @ Zero I_{dc}	DCR_{NOM} (OHMS)	Min Energy Storage (μ-Joule)	Mechanical Specifications (inch)	
						$OD_{NOM.}$	$HT_{NOM.}$
5 VOLTS POWER INDUCTORS							
1	5500	480	430	0.360	240	1.12	0.49
2	5501	275	330	0.150	550	1.14	0.52
3	5502	160	210	0.080	720	1.17	0.54
5	5503	104	160	0.055	1250	1.20	0.58
8	5504	60	84	0.015	1920	1.25	0.76
10	5505	50	62	0.012	2500	1.30	0.81
12	5506	40	48	0.009	3456	1.32	0.84
15	5507	30	50	0.009	3712	1.52	0.57
20	5508	25	40	0.006	5000	1.56	0.72
25	5509	20	26	.004	6250	1.62	0.76
30	5510	16	28	.004	7200	1.65	1.25
40	5511	12	20	.003	9600	1.72	1.28
50	5512	10	14	.002	12500	2.12	1.00
60	5513	8	12	.0015	14400	2.20	1.10
100	5514	5	7	.001	25000	2.12	1.00
10 VOLTS POWER INDUCTORS							
1	5520	1000	850	0.53	500	1.12	0.63
2	5521	500	510	0.27	1000	1.14	0.66
3	5522	310	320	0.13	1395	1.17	0.68
5	5523	180	210	0.17	2250	1.42	0.55
8	5524	120	150	0.04	3840	1.72	0.73
10	5525	100	140	0.03	5000	1.75	0.76
12	5526	75	110	0.02	7920	1.78	0.80
15	5527	68	100	0.016	8437	1.81	0.82
20	5528	51	65	0.010	10200	2.10	1.00
30	5529	32	42	0.010	14400	1.90	1.87
15 VOLTS POWER INDUCTORS							
1	5530	1250	1250	0.650	625	1.60	0.52
2.5	5531	500	520	0.170	1000	1.62	0.54
5.0	5532	250	315	0.080	3937	1.70	0.70
7.5	5533	170	225	0.050	4780	1.75	0.75
10	5534	125	170	0.030	6250	1.78	0.78
15	5535	85	130	0.017	9560	2.06	0.94
25	5536	50	90	0.009	15625	2.12	1.00
30	5537	43	75	0.008	19350	2.31	1.42
24 VOLTS POWER INDUCTORS							
2	5540	1100	1050	0.22	2200	1.95	0.82
5	5541	550	510	0.10	6875	2.00	0.87
7.5	5542	300	380	0.06	8437	2.12	1.00
10	5543	225	300	0.04	11250	2.25	1.12
15	5544	150	220	0.026	16875	2.35	1.31
25	5545	90	150	0.013	28125	2.30	1.88
35	5546	65	95	0.008	39812	2.4	2.06
48 VOLTS POWER INDUCTORS							
5	5550	750	820	0.14	9375	2.0	1.6
10	5551	375	520	2.06	18750	2.25	1.87
15	5552	250	450	0.05	28125	2.37	1.93
25	5553	150	280	0.03	46875	2.5	2.5

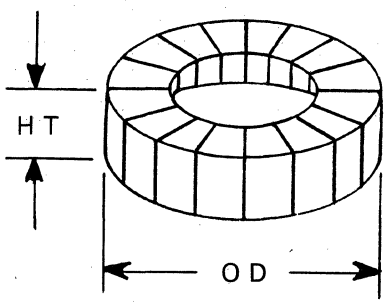
AMECON
QUALITY MAGNETIC COMPONENTS • DESIGNED FOR PEAK PERFORMANCE
1900 CHRIS LANE / ANAHEIM, CA 92805 / TEL 714-634-2220/800-392-2292

LARGEST SELECTION OF HEAVY DUTY 50/60Hz TOROIDAL POWER TRANSFORMER

SOME ADVANTAGES OF TOROIDAL POWER TRANSFORMERS COMPARED TO LAMINATED TRANSFORMERS

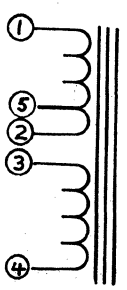
- Lower mechancial hum
- Lower electrical noise
- Lower magnetic leakage
- Easier to electrostatically shield
- Lower weight
- Smaller dimensions
- Higher efficiency
- And most important price competitive vs. old fashioned laminated transformers

MECHANICAL DRAWING



INTERNATIONAL PRIMARY CONFIGURATIONS

Voltage	100 V	120 V	220 V	240 V
Input	1 & 5	1 & 2	1 & 4	1 & 4
Connection	1 & 3 5 & 4	1 & 3 2 & 4	5 & 3	2 & 3



Secondary Power VA	Part No.	Secondary			Dimensions	
		No Load Voltage V	Load Voltage V	Load Current A	Nom. OD	(Inch) HT
5	5100	7,0	6	0.83	2.00	1.06
	5101	13.9	12	0.41		
	5102	17.4	15	0.33		
10	5110	10.4	9	1.11	2.37	1.10
	5111	13.9	12	0.83		
	5112	17.4	15	0.67		
	5113	34.8	30	0.33		
15	5120	11.6	10	1.5	2.37	1.31
	5121	17.4	15	1.0		
	5122	34.8	30	0.5		
	5123	2 × 7.0	2 × 6	1.25		
	5124	2 × 10.5	2 × 9	0.83		
	5125	2 × 13.9	2 × 12	0.62		
	5126	2 × 17.4	2 × 15	0.50		
	5127	2 × 20.9	2 × 18	0.41		
	5128	2 × 27.8	2 × 24	0.31		
	5129	2 × 32.5	2 × 28	0.27		

Secondary Power VA	Part No.	Secondary			Dimensions	
		No Load Voltage V	Load Voltage V	Load Current A	Nom. OD	(Inch) HT
24	5130	11.6	10	2.4	2.75	1.37
	5131	13.9	12	2.0		
	5132	27.7	24	1.0		
	5133	34.7	30	0.8		
	5134	2 × 7	2 × 6	2.0		
	5135	2 × 11.6	2 × 10	1.2		
	5136	2 × 17.3	2 × 15	0.8		
	5137	2 × 20.7	2 × 18	0.67		
	5138	2 × 27.7	2 × 26	0.5		
	5139	2 × 32.4	2 × 28	0.43		
30	5140	17.3	15	2.0	2.81	1.43
	5141	27.7	24	1.25		
	5142	34.7	30	1.0		
	5143	2 × 7	2 × 6	2.5		
	5144	2 × 11.6	2 × 10	1.5		
	5145	2 × 17.3	2 × 15	1.0		
	5146	2 × 20.7	2 × 18	0.83		
	5147	2 × 27.7	2 × 24	0.62		

AMECON
QUALITY MAGNETIC COMPONENTS • APPLICATION ORIENTED DESIGNS
1900 CHRIS LANE / ANAHEIM, CA 92805 / TEL 714-634-2220/800-392-2292

LARGEST SELECTION OF HEAVY DUTY 50/60Hz TOROIDAL POWER TRANSFORMER

Secondary Power VA	Part No.	Secondary			Dimensions	
		No Load Voltage V	Load Voltage V	Load Current A	Nom. OD	(inch) HT
50	5150	27.2	24	2.10	3.25	1.43
	5151	34.2	30	1.67		
	5152	2 × 13.6	2 × 12	2.10		
	5153	2 × 17.1	2 × 15	1.67		
	5154	2 × 20.5	2 × 18	1.39		
	5155	2 × 22.8	2 × 20	1.25		
	5156	2 × 27.2	2 × 24	1.04		
80	5160	17.0	15	5.3•	3.75	1.45
	5161	27.0	24	3.3		
	5162	33.4	30	2.67		
	5163	40.5	36	2.22		
	5164	47.4	42	1.90		
	5165	2 × 6.8	2 × 6	6.6		
	5166	2 × 20.4	2 × 18	2.2		
	5167	2 × 27.0	2 × 24	1.04		
	5168	2 × 33.4	2 × 30	1.33		
100	5170	16.8	15	6.67	4.00	1.50
	5171	20.2	18	5.55		
	5172	26.8	24	4.17		
	5173	33.6	30	3.33		
	5174	2 × 9	2 × 8	6.25		
	5175	2 × 16.8	2 × 15	3.33		
	5176	2 × 20.2	2 × 18	2.8		
	5177	2 × 26.8	2 × 24	2.08		
	5178	2 × 33.6	2 × 30	1.67		
120	5180	26.8	24	5.0	4.12	1.75
	5181	33.6	30	4.0		
	5182	47.0	42	2.8		
	5183	2 × 20	2 × 18	3.3		
	5184	2 × 24.5	2 × 22	2.7		
	5185	2 × 31.2	2 × 28	2.14		
	5186	2 × 33.5	2 × 30	2.0		
	5187	133.5	120	1.0		
150	5190	26.5	24	6.25	4.37	1.87
	5191	33.2	30	5.0		
	5192	66.5	60	2.5		
	5193	2 × 20	2 × 18	4.16		
	5194	2 × 26.5	2 × 24	3.12		
	5195	2 × 39.8	2 × 36	2.08		
200	5200	26.5	24	8.3	4.37	2.12
	5201	39.8	36	5.55		
	5202	66.5	60	3.33		
	5203	2 × 66.4	2 × 60	1.63		
		13.2	12	8.5		
	5204	2 × 33	2 × 30	3.33		

Secondary Power VA	Part No.	Secondary			Dimensions	
		No Load Voltage V	Load Voltage V	Load Current A	Nom. OD	(Inch) HT
250	5210	26.5	24	10.4	4.75	2.12
	5211	2 × 26.5	2 × 24	5.2		
	5212	2 × 33	2 × 30	4.17		
	5213	2 × 66	2 × 60	2.08		
	5214	2 × 53	2 × 48	2.48		
			12	1.0		
300	5220	26.0	24	12.5	4.75	2.37
	5221	32.5	30	10		
	5222	52.0	2 × 48	3.0		
		13.0	12	1.0		
	5223	2 × 65	2 × 60	2.4		
		13.0	12	1.0		
400	5230	25.8	24	16.7	4.87	2.50
	5231	64.8	60	6.7		
	5232	38.6	2 × 36	5.56		
	5233	40.7	2 × 38	5.10		
			12	1.0		
	5234	51.6	2 × 48	4.04		
			12	1.0		
500	5240	2 × 25.7	2 × 24	10.4	5.50	2.60
	5241	2 × 29.7	2 × 28	8.9		
	5242	2 × 35	2 × 33	8.3		
	5243	2 × 40.3	2 × 38	6.5		
	5244	2 × 51	2 × 48	5.2		
	5245	2 × 64	2 × 60	4.17		
750	5250	2 × 31.6	2 × 30	12.5	6.25	2.75
	5251	2 × 50.5	2 × 48	7.8		
	5252	2 × 63.4	2 × 60	6.25		
	5253	2 × 126.5	2 × 120	3.12		
1K	5260	2 × 31.4	2 × 30	16.7	6.37	2.87
	5261	2 × 63	2 × 60	8.3		
	5262	2 × 125	2 × 120	4.12		
2.5K	5270	2 × 49.8	2 × 48	26.0	9.25	3.25
	5271	2 × 62.4	2 × 60	20.8		
	5272	2 × 124.5	2 × 120	10.4		
5K	5280	2 × 62.2	2 × 60	41.6	10.87	4.25
	5281	2 × 124	2 × 120	20.8		
7.5K	5290	2 × 61.5	2 × 60	62.5	12.62	4.25
	5291	2 × 122.5	2 × 120	31.2		
10K	5295	2 × 61.5	2 × 60	83.3	14.75	5.25
	5296	2 × 122.5	2 × 120	41.6		

IMPORTANT NOTES:

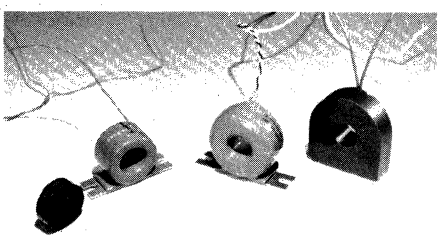
1. All transformers have been designed for 50/60HZ.
2. 60HZ to 400HZ. Designs available upon request.
3. Custom designs tailored to your specs. are made & evaluated on a 2 wk. cycle.
4. 100% electrostatic shielding available on all transformers with a small power derating.
5. Magnetic shielding & lower magnetic leakage designs for sensitive areas such as encountered in computers & audio equipment, are available on all transformers.
6. Low profile designs are available upon request.
7. Amecon has the world's most complete toroidal mfg. facilities. We can machine wind toroids in excess of 50" dia. & 2000 lbs.

AMECON

QUALITY MAGNETIC COMPONENTS • DESIGNED WITH 25 YRS. OF EXPERTISE

1900 CHRIS LANE / ANAHEIM, CA 92805 / TEL 714-634-2220/800-392-2292

Amecon quality components for current sensing, metering & relaying. From small economical units for op amps & switched mode power supplies to very large units (i.e. over four feet in diameter) for the power distribution & switch gear markets. These are all precision wound machine made transformers . Most larger units are multitap and have evenly distributed windings. Amecon, the people with over 100 years of collective engineering toroidal expertise.



Amecon can pack more regulation and VA into toroidal power transformers than most any one else . Just weigh them.You'll find ours to be heavier. Power range: 5VA to 50 KVA, 50 to 400HZ. P.S. We can toroidally wind copper ribbon and heavy rectangular conductors.

Corporate Headquarters
1900 Chris Lane
Anaheim,CA 92805

714 / 634-2220
TWX: 510-100-0364

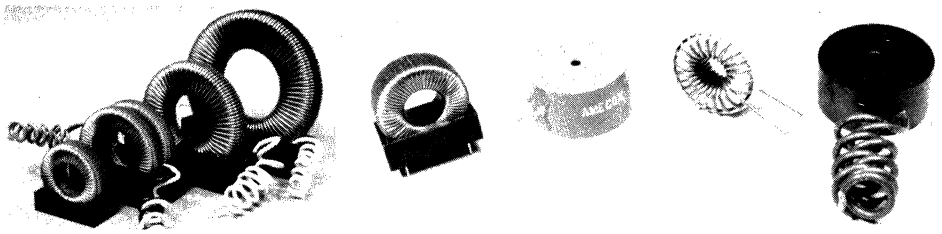
Serving OEM's for 13 Years

AMECON

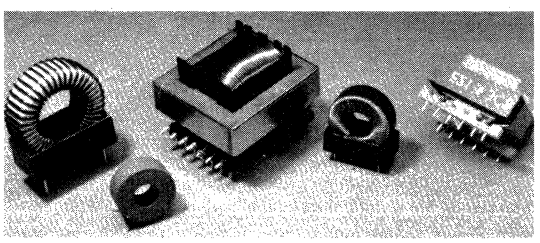
QUALITY MAGNETIC COMPONENTS • DESIGNED WITH 25 YRS. OF EXPERTISE

1900 CHRIS LANE / ANAHEIM, CA 92805 / TEL 714-634-2220/800-392-2292

Amecon has many times been referred to as the Toroidal Filter Inductor People; we were absolutely first in introducing the so called heavy-duty toroidal filter inductors to the electronic controls markets *and*, at extremely competitive prices. Through the years, we have built probably the largest selection of filter inductors anywhere. ½ amp to 300 amps, for many applications (SCR's, EMI / RFI, precision filters,etc.).



Amecon was the first company, circa 1977, to standardize commercial grade (i.e. lower prices) switched mode power supply magnetics. We have over 45 years of collective engineering experience, all of which is clearly visible in our end products, especially in the consistent quality of our switching inverter transformers.



Corporate Headquarters
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Anaheim,CA 92805
714 / 634-2220
TWX: 510-100-0364

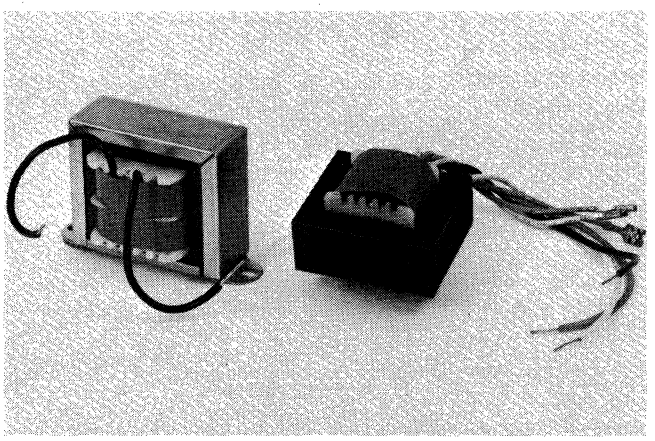
Serving OEM's for 13 Years

ARSTAN POWER TRANSFORMERS TO 100 WATTS OUR SPECIALTY

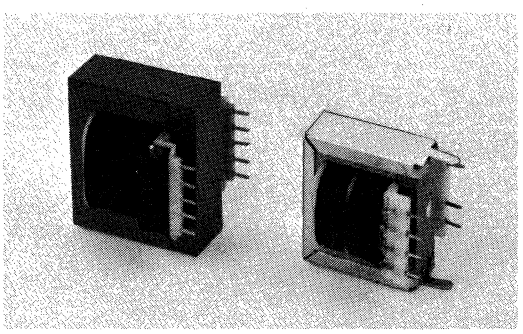
Our products are manufactured in the **FAR EAST** and are competitively priced. We can cross reference to standard designs or our engineers will help you select the features which will best fit your application.

AVAILABLE FEATURES

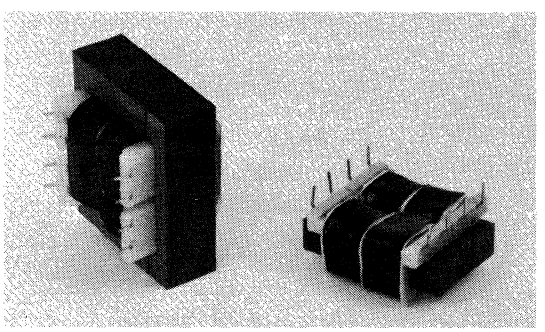
- ☐ Any combination of output voltages and load currents
- ☐ Single and dual primaries 120/240 volts
- ☐ 50/60 Hz operation
- ☐ Single or split secondaries
- ☐ Split bobbin or concentric winding
- ☐ Vertical or horizontal mounting
- ☐ Leads or terminals
- ☐ Specified breakdown voltage 500-3500 VAC
- ☐ High efficiency, specified power dissipation
- ☐ Designed to meet UL/CSA/VDE as required



STYLE HMV **STYLE HMH**



STYLE PCV1 **STYLE PCV2**



STYLE PCH **STYLE PCL**

STYLE AND SIZE SELECTION GUIDE (SIZE IN INCHES — LxWxH)

POWER VA	HMV/HMH	PCV	PCH	PCL
1 - 1.5	✲	1.375 x 1.125 x 1.187	1.375 x 1.125 x .937	✲
1.5 - 5	1.625 x 1.062 x 1.183	1.625 x 1.25 x 1.375	1.375 x 1.125 x 1.187	1.875 x 1.562 x .65
5 - 8	1.687 x 1.25 x 1.375	✲	1.625 x 1.312 x 1.312	1.875 x 1.562 x .85
8 - 15	1.937 x 1.375 x 1.625	1.875 x 1.437 x 1.625	1.875 x 1.562 x 1.437	2.50 x 2.00 x 1.065
15 - 25	✲	1.625 x 2.25 x 1.375	2.25 x 1.875 x 1.437	✲
25 - 35	2.312 x 1.687 x 1.937	✲	2.625 x 2.187 x 1.562	✲
35 - 60	2.687 x 1.812 x 2.25	———	———	———
60 - 100	3.062 x 2.25 x 1.562	———	———	———

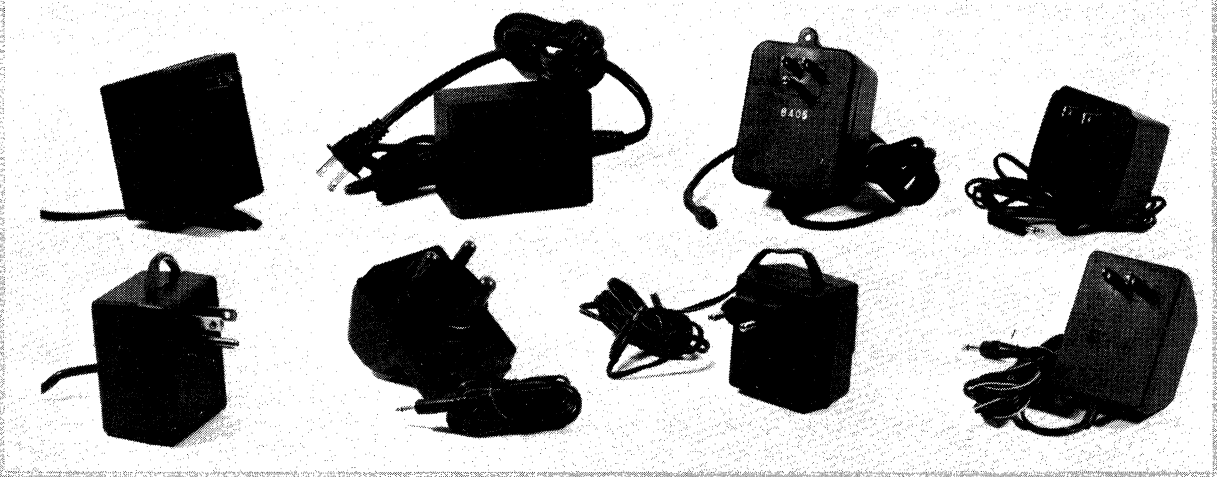
✲Available in non-standard sizes.

We are transformer specialists! You get technical assistance from our engineers here and top performance at low prices from our factories in the FAR EAST. We provide approval samples on quantity orders prior to production. TECHNICAL EXPERTISE, PERFORMANCE, PRICE... It's all here!

ARSTAN **PRODUCTS INTERNATIONAL LTD.**
99 JERICHO TPKE., JERICHO, NY 11753● (516)333-8100● FAX(516)333-8911

ARSTAN AC TO AC AND AC TO DC WALL PLUG-IN ADAPTERS

Our products are manufactured in the **FAR EAST** and are competitively priced. Selection available from a variety of designs which are UL/CSA recognized or have our engineers help you select a custom design for your application.



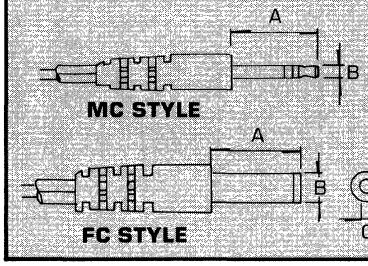
AVAILABLE FEATURES

- ☐ Any combination of voltage and load current
- ☐ Selection of input voltages for domestic or overseas use
- ☐ Center tap for AC adapters
- ☐ Specified regulation
- ☐ Selection of cords and connectors
- ☐ Table top option for large adapters
- ☐ UL/CSA recognized or designed as required

SIZE SELECTION GUIDE

POWER (watts)	SIZE (inches) H x W x D	AC to AC (TYPICAL STANDARD DESIGNS)		AC to DC (TYPICAL STANDARD DESIGNS)	
6	2.0 x 1.687 x 1.375	———	———	8 V @ 50 MA	12 V @ 100 MA
10	2.375 x 2.0 x 1.312	9 V @ 600 MA	15 V @ 300 MA	6 V @ 500 MA	9 V @ 300 MA
18	2.375 x 2.375 x 1.875	12 V @ 1.25 A	16 V @ 700 MA	9 V @ 800 MA REG	24 V @ 400 MA
20	2.75 x 1.96 x 1.5	12 V @ 830 MA	24 V @ 170 MA CT	———	———
30	3.125 x 2.187 x 1.875	15 V @ 1.2 A	20 V @ 850 MA	10 V @ 1.2 A	26 V @ 400 MA
40	3.375 x 2.375 x 2.125	20 V @ 1.5 A	———	±15V @ 200 MA REG	———
50	3.375 x 2.625 x 2.375	24 V @ 1.2 A	———	12 V @ 1.2 A	———

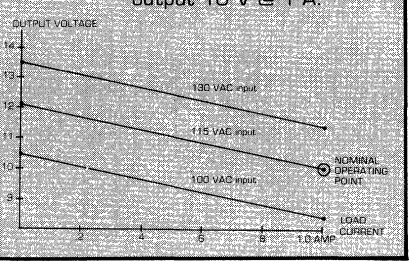
TYPICAL CONNECTORS



CONNECTOR SELECTION GUIDE

STYLE	Dimensions (mm) A	B	C
MC 1	14.5	3.5	——
MC 2	11.5	2.5	——
FC 1	12	5.0	2.0
FC 2	12	5.0	2.5
FC 3	12	5.5	2.1
FC 4	12	5.5	2.5

TYPICAL OUTPUT LOAD CURVES for adapter with nominal output 10 V @ 1 A.



ARSTAN PRODUCTS INTERNATIONAL LTD.
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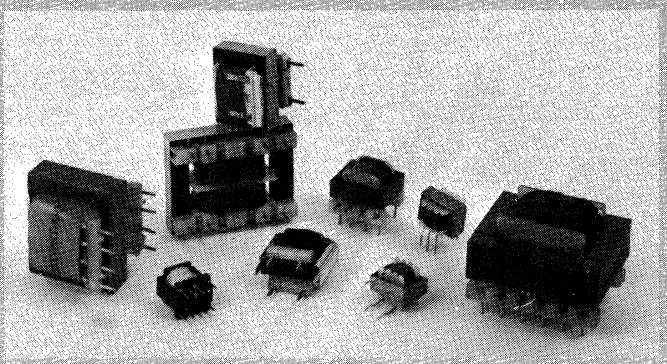
ARSTAN QUALITY INDUCTIVE COMPONENTS

Large variety of standard and custom designed components. Technical expertise and design assistance here as well as competitive prices from our factories in the **FAR EAST.**

TRANSFORMERS FOR PULSE, COMMUNICATIONS AND TELEPHONE APPLICATIONS

We can cross reference to standard designs or our engineers will help you select the features which will best fit your application.



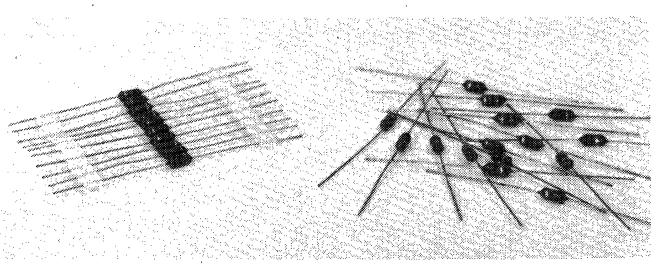
AVAILABLE FEATURES

- ☐ Choice of input/output impedance
- ☐ Optimum tradeoff between DC current, DCR insertion loss, frequency response and return loss
- ☐ Wide selection of sizes
- ☐ Pulse transformers, optimum design for band width and rise time specifications

TYPICAL AVAILABLE DESIGNS

	COUPLING NO DC	COUPLING WITH 100 MA DC	PULSE
Input/output impedance	600/600 ohms	600/600 ohms	120/120ohms
Insertion loss	1.0 db	2.5 db	0.5 db
Frequency response	± .5 db	± .5 db	± .5db
Return loss	26 db	20 db	———
Bandwidth	———	———	500-500,000 Hz
Rise time	———	———	.5 microsecond

We have a full line of molded choke inductors for unwanted signal suppression and a variety of other applications.

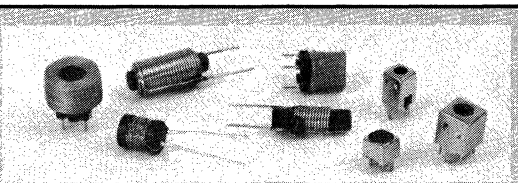


Inductance range	.22-1000 microhenry
Tolerance	± 10%
DCR range	.1-20 ohms✲
Min Q range	35-50✲
DC current range	100-3000 MA✲
Temperature range	-20 to +90°C
Coating	Epoxy
Leads	Tinned copper

✲Depends on inductance value

FIXED AND VARIABLE INDUCTORS

A variety of inductors and high frequency transformers for a wide array of applications.



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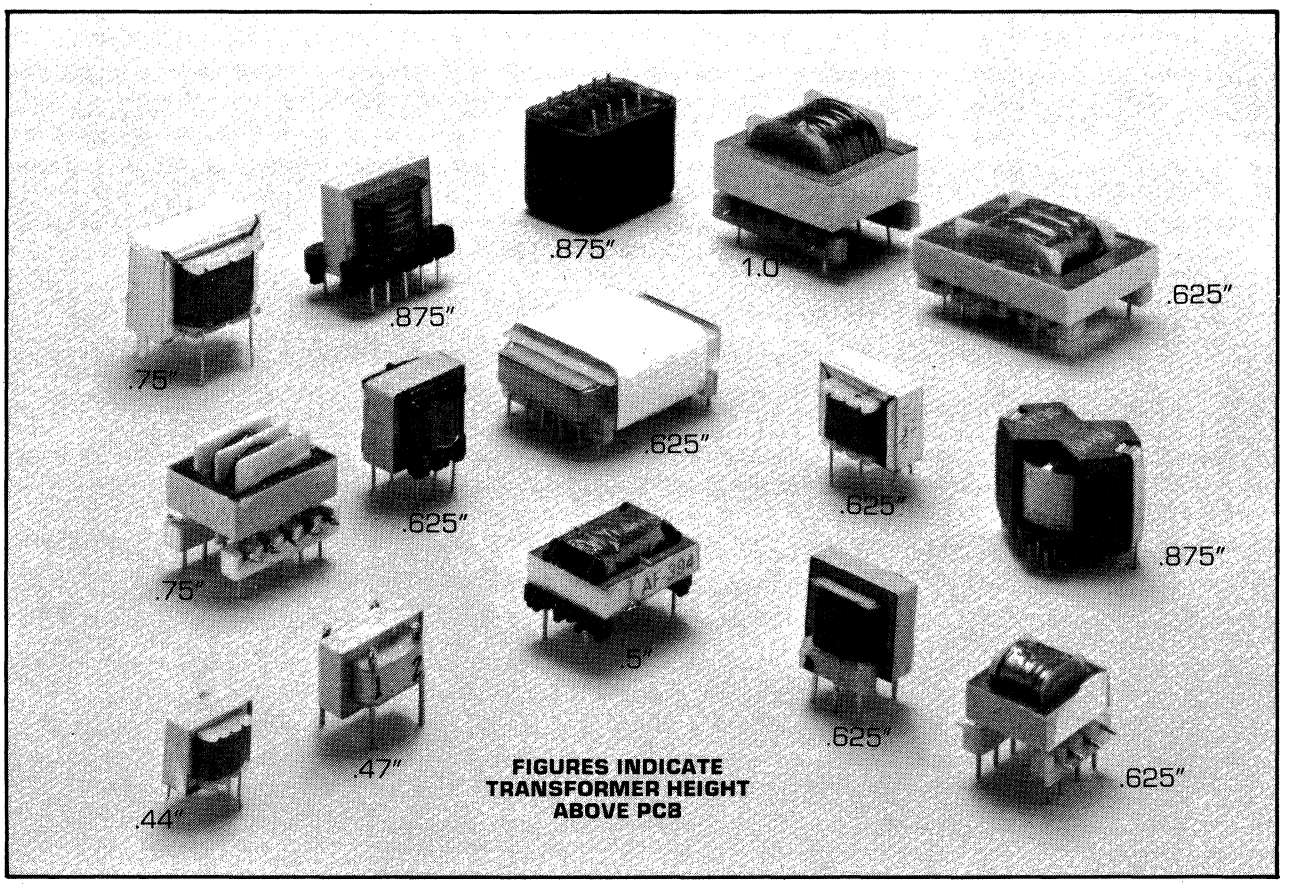
KEEP A LOW PROFILE WITH OUR COUPLING/ MATCHING/HYBRID TRANSFORMERS

TELEPHONE LINE INTERFACE FOR VOICE/DATA PER FCC PART 68

Our products are manufactured in the **FAR EAST** and are competitively priced. We can cross reference to standard designs or our engineers will help you select the features which will best fit your application.

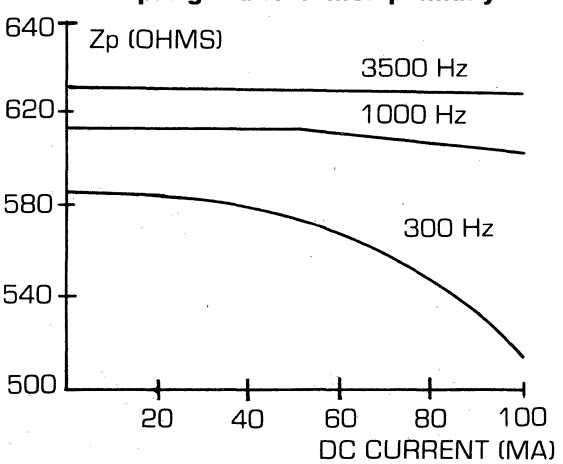


RANGE OF PARAMETERS-SELECTION GUIDE:

Impedances 50/100/150/300/600/900/1200/ 1500 Ohms
Impedance Matching 5-25% inside range of 200-5000 Hz
Return Loss ..... 10-36 DB
DC Current ..... 0-120 MA
DCR ..... 10-300 Ohms
Frequency Response ..... .3-3 DB
Insertion Loss 3-6DB
Max. Power Level ..... 0 to +12 DBM
Logitudinal Balance ..... 40-80 DB
Cross Talk ..... 60-90 DB
Breakdown Voltage ..... 250-4000 VRMS

*We will help you select the optimum design in the smallest package based on your exact parameters.

Typical reflected impedance Vs DC Current in coupling transformer primary

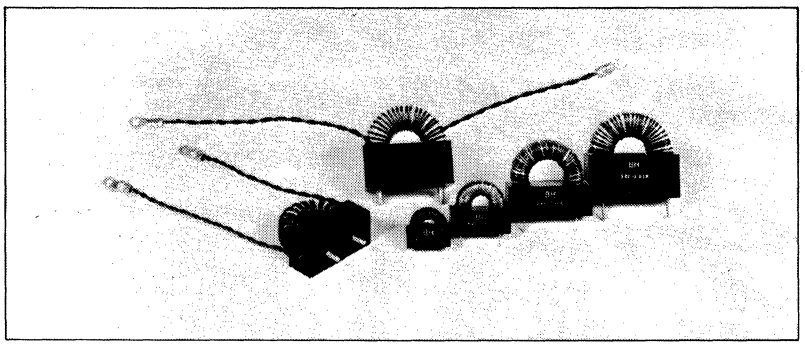


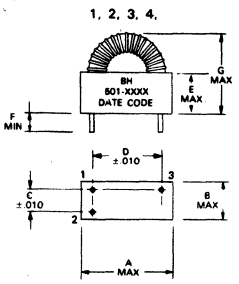
We are transformer specialists! You get technical assistance from our engineers here and top performance at low prices from our factories in the FAR EAST. We provide approval samples on quantity orders prior to production. TECHNICAL EXPERTISE, PERFORMANCE, PRICE... It's all here!

PRODUCTS INTERNATIONAL LTD.
99 JERICHO TPKE., JERICHO, NY 11753● (516)333-8100● FAX(516)333-8911

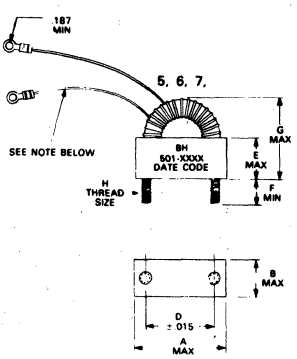
BH Electronics, Inc.

TOROID INDUCTORS FOR SWITCHING POWER SUPPLIES





- Current Range, 1 AMP To 50 AMPS
- Cost Effective Design
- Wide Range Of Inductance
- Maximum Temperature Rise, 40°C Above Ambient
- PC Mount

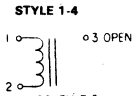


NOTE: Style 5, 6, 7 Leads Cut to 6" Length/Custom Lengths Available Upon Request

ELECTRICAL CHARACTERISTICS AT 25°C

BH PART NUMBER	RATED DC CURRENT (AMPS)	MINIMUM INDUCTANCE AT RATED DC μh	MINIMUM INDUCTANCE AT ZERO DC μh	DC RESISTANCE MAXIMUM Ω	MIN. ENERGY STORAGE ½ LI²	PACKAGE STYLE	LEAD DIA. INCHES ±.004
501-1001	1.0	725	1400	.75	366	1	.025
501-1002	2.5	115	230	.12	366	1	.025
501-1003	2.5	370	740	.23	1166	2	.025
501-1004	4.1	40	80	.045	361	1	.032
501-1005	4.1	140	280	.086	1185	2	.032
501-1006	4.1	360	720	.177	3034	3	.032
501-1007	6.5	15	30	.018	359	1	.040
501-1008	6.5	50	100	.035	1162	2	.040
501-1009	6.5	140	280	.070	3000	3	.040
501-1010	6.5	290	580	.098	6190	4	.040
501-1011	10.0	7	14	.0075	350	1	.051
501-1012	10.0	20	40	.014	1150	2	.051
501-1013	10.0	60	120	.028	3000	3	.051
501-1014	10.0	120	240	.040	6200	4	.051
501-1015	20.0	6	12	.004	1200	5	NA
501-1016	20.0	15	30	.0072	3200	6	NA
501-1017	20.0	30	60	.010	6400	7	NA
501-1018	40.0	3.5	7.0	.0017	2800	6	NA
501-1019	40.0	7	14	.0024	5920	7	NA
501-1020	50.0	4.5	9	.0016	5875	7	NA

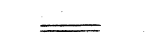
STYLE 1-4



SCHEMATIC

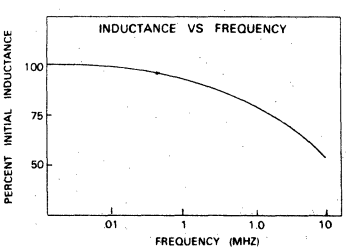
STYLE	A	B	C	D	E	F	G	H
1	1.05 26,67	.55 13,97	.400 10,16	.800 20,32	.55 13,97	.20 5,08	1.10 27,94	N/A
2	1.45 36,83	.80 20,32	.600 15,24	.900 22,86	.58 14,73	.20 5,08	1.40 35,56	N/A
3	2.00 50,80	.95 24,13	.700 17,78	1.20 30,48	.75 19,05	.20 5,08	1.90 48,26	N/A
4	2.16 54,86	1.12 28,45	.900 22,86	1.50 38,10	1.05 26,67	.20 5,08	2.20 55,88	N/A
5	1.45 36,83	.80 20,32	N/A	.900 22,86	.58 14,73	.25 6,35	1.40 15,56	6-32
6	2.00 50,80	.95 24,13	N/A	1.20 30,48	.75 19,05	.25 6,35	1.90 48,26	8-32
7	2.16 54,86	1.12 28,45	N/A	1.50 38,10	1.05 26,67	.25 6,35	2.20 55,88	10-32

STYLE 5-7



SCHEMATIC

TYPICAL INDUCTANCE CHARACTERISTICS



—CUSTOM VERSIONS AVAILABLE ON REQUEST—

331 BREMER BLDG
ST PAUL, MN 55101
BH Electronics, Inc.
PHONE 612/228-6463

BH Electronics, Inc.

SERIES 505 - SCR TRIGGER TRANSFORMERS

- FOUR CASE STYLES
- 1600 OR 2500 VRMS ISOLATION
- TINNED COPPER LEADS
- LOW Ciw TO PREVENT FALSE TRIGGERING
- AVAILABLE FROM STOCK
- ORDER BY PART NUMBER 505-XX YY
  - ★ SPECIFY CASE STYLE
  - ★★ SPECIFY ELECTRICAL PARAMETERS

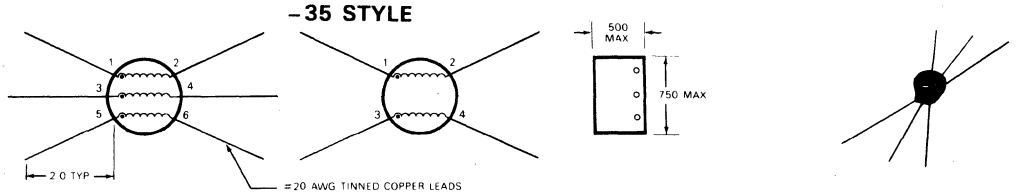
★ STANDARD CASE STYLES

CASE NO.	PCB MOUNTING	ISOLATION VOLTAGE	TEMPERATURE RANGE	ENCAPSULATED	LEAD SIZE
35	YES	1600 VRMS 60HZ	−10°C TO +70°C	YES	20 AWG
36	YES	1600 VRMS 60HZ	0°C TO 60°C	YES	20 AWG
37	YES	1600 VRMS 60HZ	0°C TO 60°C	NO	20 AWG
55	YES	2500 VRMS 60HZ	0°C TO 60°C	YES	20 AWG

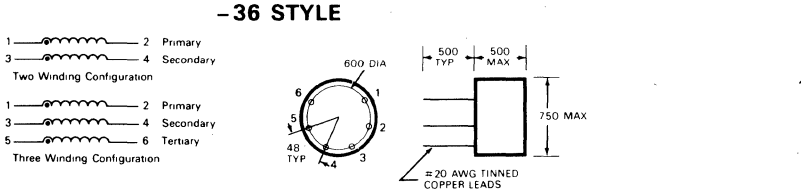
★★ STANDARD ELECTRICAL SPECIFICATIONS

ELECTRICAL PARAMETER NUMBER	TURNS RATIO	PRIMARY INDUCTANCE (mh −MIN.)	PRIMARY ET CONSTANT (V−μsec MIN.)	INTERWINDING CAPACITANCE (PF −MAX.)	LEAKAGE INDUCTANCE (μh −MAX.)
00	1:1	.25	45	20	5
01	1:1	1.0	90	30	20
02	1:1	5.0	180	30	45
03	1:1	20.0	360	50	200
04	1:1:1	.25	45	20	5
05	1:1:1	1.0	90	30	20
06	1:1:1	5.0	180	30	45
07	1:1:1	20.0	360	50	200
08	2:1	1.0	90	30	40
09	2:1	5.0	180	30	60
10	2:1:1	1.0	90	30	40
11	2:1:1	5.0	180	30	60
12	5:1	20.0	360	50	200
13	5:1:1	20.0	360	50	200

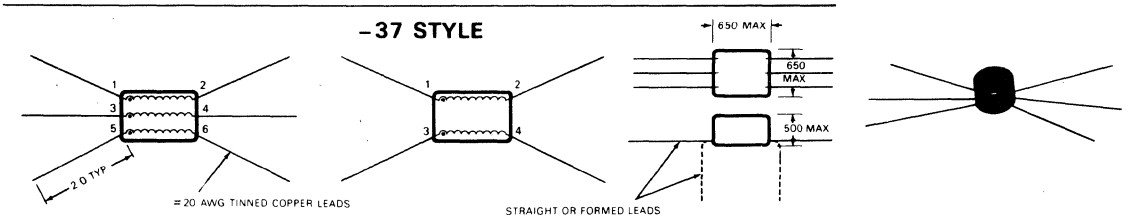
−35 STYLE



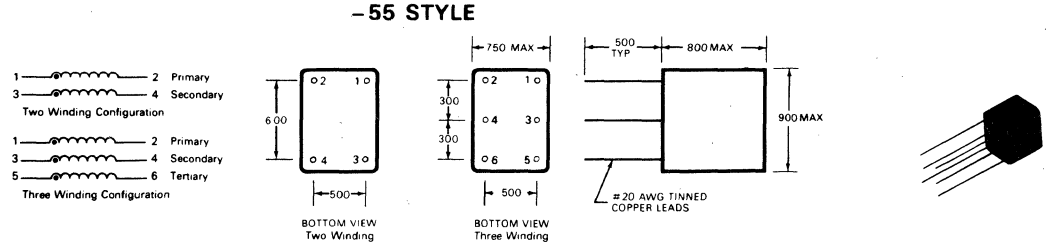
−36 STYLE



−37 STYLE



−55 STYLE



CUSTOM VERSIONS AVAILABLE

SEND FOR FULL CATALOG

331 BREMER BLDG.
ST. PAUL, MN 55101

BH Electronics, Inc.

PHONE 612/228-6463

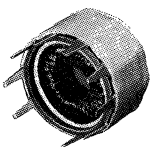
MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 85/86 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1166, **B**•1012, **C**•1028, **D**•1016
ASCII Code ..... **D**•1087
Batteries, Product Selection Guide ..... **D**•1413
Batteries & Fuel Cells, Characteristics ..... **D**•1430
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide ..... **A**•1003
Circuit Boards (Printed) Product Selection Guide ..... **C**•1099
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1205
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1863
Connectors, Miniglossary ..... **C**•1129
Connectors, Terminals, & Sockets, Product Selection Guide ..... **C**•1105
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Gude ..... **A**•1309
Delay Lines, Product Selection Guide ..... **A**•1459
Discrete Semiconductors, Product Selection Guide ..... **A**•2067
Displays, Readouts, Lamps, & Lights, Product Selection Guide ..... **B**•1015
EBCDIC Code ..... **D**•1092
Encapsulation, Miniglossary ..... **C**•1086
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide .. **C**•1623
Filters, Product Selection Guide ..... **A**•1583
Instruments, Graphic Recording Product Selection Guide ..... **D**•1401
Instruments, Panel Meters, Product Selection Guide ..... **D**•1329
Instruments, Test & Measuring Product Selection Guide ..... **D**•1175
Interconnection Systems, Product Selection Guide ..... **C**•1699
Keyboards & Keypads, Product Selection Guide ..... **B**•1705
Logofinder & Trademark Directories ..... **B**•901
Microwave Components, Product Selection Guide ..... **A**•1701
Military Qualified Products Lists ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1129
Opto Semiconductors, Miniglossary ..... **B**•1214
Oscilloscopes, Product Selection Guide ..... **D**•1385
Panel Hardware, Product Selection Guide ..... **C**•1589
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide ..... **A**•1991
Power Supplies, Miniglossary ..... **D**•1462
Power Supplies, AC, Product Selection Guide ..... **D**•1877
Power Supplies, DC, Product Selection Guide ..... **D**•1447
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide .... **B**•1225
Relay Contact Forms ..... **B**•1317
Relays, Electromechanical, Miniglossary ..... **B**•1308
Relays, Product Selection Guide ..... **B**•1261
Resistor Color Codes ..... **A**•1828
Resistors, Product Selection Guide ..... **A**•1785
Servo Components, Miniglossary ..... **D**•1985
Solenoids, Product Selection Guide ..... **B**•1463
Switches, Product Selection Guide ..... **B**•1477
Thermal Components, Product Selection Guide ..... **B**•1741
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1744
Thyristors/High Power Diodes, Miniglossary ..... **A**•2076
Transducers & Encoders, Product Selection Guide ..... **B**•1777
Transformers, Product Selection Guide ..... **A**•2099
Wire & Cable, Product Selection Guide ..... **C**•1743
Wire Gauges—Diameter, Area, Copper Weight ..... **C**•1844

DALE® CONVERTER TRANSFORMERS



MODEL TC

FEATURES

- High conversion efficiency from DC input to filtered DC output
- Designed especially for low-power solid state circuits • Designed for mounting on printed circuit boards • Miniature size for minimum space
- Choice of encapsulated or open (impregnated) styles

SPECIFICATIONS

ELECTRICAL

Transformer Power Rating: 3 watts

Isolation, Primary-Secondary: 500 volts 60 Hz, operating characteristics may be varied to suit specific applications by appropriate selection of circuit components

ENVIRONMENTAL

Operating Temp. Range: −20°C to +80°C, intended for use in enclosed commercial and industrial applications

MECHANICAL

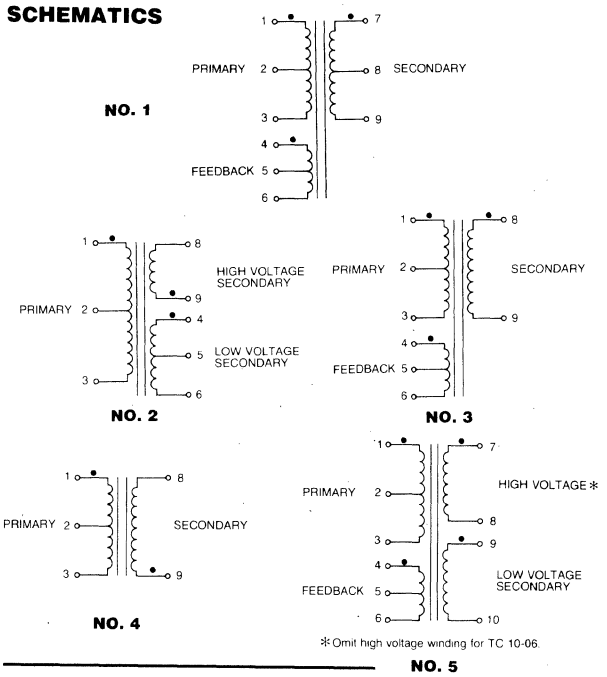
Coating: Varnish dip coat or epoxy encapsulated

Terminals: .015″ thick, solder plated, varnish-free. Intended for P.C. board mounting

TYPICAL APPLICATIONS

Power supply for gas discharge display, battery-operated portable instruments, operational amplifier power supplies.

SCHEMATICS



*Omit high voltage winding for TC 10-06.

OPERATING CHARACTERISTICS*

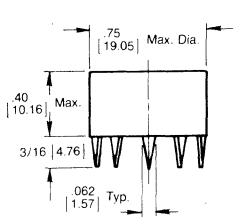
MODEL NO.	INPUT	OUTPUT	FREQUENCY ±20%	EFFICIENCY MIN.	TEST CIRCUIT	SCHEMATIC NO.
TC 10-01	3.6 VDC	+7.2 ± .2 VDC at 150 MW - 7.2 ± .2 VDC at 150 MW	7.5 KHz	50%	1	1
TC 10-02	5 VDC	200 ± 10 VDC at 250 MW	11 KHz	64%	2	4
TC 10-03	5 VDC	200 ± 10 VDC at 250 MW +15 ± .4 VDC at 125 MW - 15 ± .4 VDC at 125 MW	11 KHz	60%	2	2
TC 10-04	5 VDC	+15 ± .4 VDC at 500 MW - 15 ± .4 VDC at 500 MW	8 KHz	75%	3	1
TC 10-05	5 VDC	+170 ± 5.1 VDC at 850 MW +32 ± 1.0 VDC at 510 MW	11 KHz	75%	4	5
TC 10-06	5 VDC	+35 ± 1.0 VDC at 610 MW	11 KHz	70%	4	5
TC 10-07	7.5 VDC	16.3 ± .4 VDC at 330 MW	7 KHz	65%	5	1
TC 10-08	12 VDC	15 ± .4 VDC at 1 watt	7.5 KHz	72%	3	1
TC 10-09	12 VDC	160 ± 5 VDC at 1.5 watts	10 KHz	75%	6	3
TC 10-10	12 VDC	14.2 ± .7 VDC at 3 watts	10 KHz	70%	5	1
TC 10-11	12 VDC	+24 ± .5 VDC at 2.0 watts	10 KHz	80%	5	1
TC 10-12	24 VDC	170 ± 5.1 VDC at 850 MW 32 ± 1.0 VDC at 510 MW	11 KHz	70%	4	5

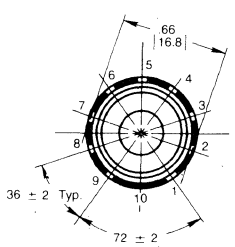
*Characteristics relate to transformer when operated in applicable test circuit and at specified load power.

[Numbers in brackets indicate millimeters]

DIMENSIONS (All Models)

OPEN STYLE

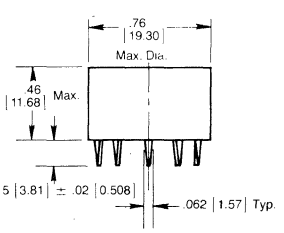


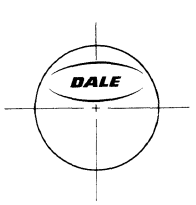


BOTTOM VIEW *

*Shows typical pin spacing. Pin 10 is omitted on all models except 05, 06, 12

ENCAPSULATED STYLE C-A





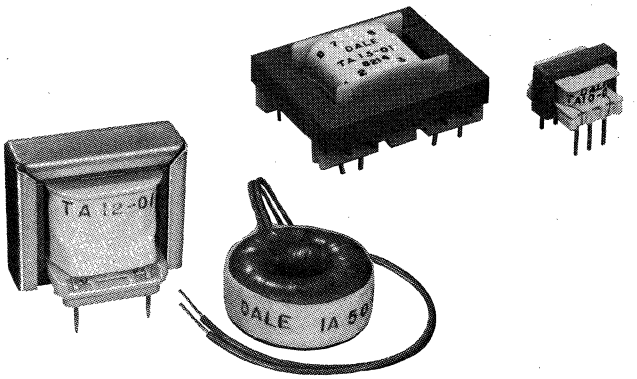
ORDERING INFORMATION

TC-10	−01	A
	DASH NUMBER	ENCAPSULATED STYLE. Leave blank for open style.

For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078 • Phone 605-665-9301

TELEPHONE COUPLING AUDIO TRANSFORMERS AND HOLDING COILS

MODELS TA and IA



FEATURES

- Designed and built to meet telephone company requirements for data and voice access on leased private telephone lines or through the dial-up switched telephone network.
- Provides line isolation, impedance matching, line balance, hybrid and holding coil applications.

SPECIFICATIONS

ELECTRICAL

Frequency Response: ±.5 DB from 300 to 3500 Hz

Power Level: −45 DBM to +7 DBM

Impedance Matching: ±10% from 300 to 3500 Hz

Return Loss:
22 DB min. = TA 10-03
13 DB min. = TA 13-01
14 DB min. = TA 14-01
26 DM min. = TA 10-01, TA 10-02, TA 10-04, TA 10-05, TA 10-06, TA 10-07, TA 11-01

Longitudinal Balance: Per FCC 68.310

Distortion: .5% max.

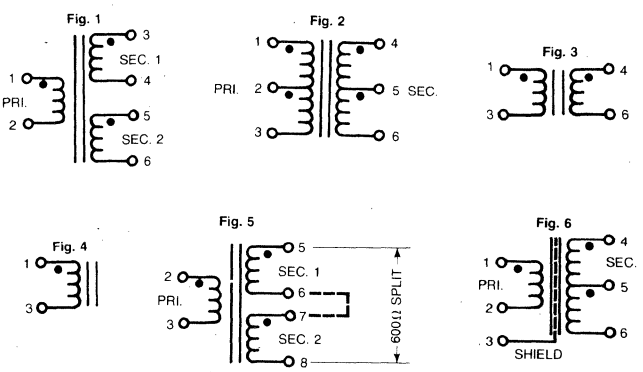
Dielectric Test: 1500V Peak Per FCC 68.310

MECHANICAL

Coating: TA = Vacuum impregnated with polyester varnish.
IA = Tough vinyl coating.

Terminals: TA = Precision spaced PC type plug-in terminals.
IA = #28 AWG teflon coated insulated terminals.

SCHEMATICS



ELECTRICAL CHARACTERISTICS

MODEL NO.	APPLICATION	PRIMARY IMPEDANCE	SECONDARY IMPEDANCE	FIGURE LETTER	SCHEMATIC FIGURE NO.	NO. OF UNITS REQ'D	TERMINAL NUMBERS USED	UNBALANCED DC CURRENT
TA 10-01	HYBRID	600Ω	600Ω/600Ω	C	1	2	1, 2, 3, 4, 5, 6	0
TA 10-02	COUPLING	600Ω	900Ω	C	3	1	1, 3, 4, 6	0
TA 10-03	BRIDGING	4KΩ	600Ω	C	3	1	1, 3, 4, 6	0
TA 10-04	COUPLING	600Ω CT	600Ω CT	C	2	1	1, 2, 3, 4, 5, 6	0
TA 10-05	COUPLING	600Ω	600Ω	C	3	1	1, 3, 4, 6	0
TA 10-06	COUPLING	900Ω	900Ω	C	3	1	1, 3, 4, 6	0
TA 10-07	COUPLING	600Ω	600Ω	A	3	1	1, 3, 4, 6	0
TA 11-01	HYBRID	600Ω	600Ω/600Ω	C	1	2	1, 2, 3, 4, 5, 6	0
TA 13-01	COUPLING	600Ω	600Ω SPLIT	B	5	1	2, 3, 5, 6, 7, 8	75mA
TA 14-01	COUPLING	600Ω	900Ω/600Ω	D	6	1	1, 2, 3, 4, 5, 6	100/120mA
TA 12-01	HOLDING COIL	2.0 H @ 60 MA, 1.3 H @ 100 MA DC DCR = 180Ω		C	4	1	1, 3	—
IA 40-01	HOLDING COIL	1.0 H @ 0 MA, .8 H @ 25 MA DC DCR = 225Ω		—	4	1	—	—
IA 50-01	HOLDING COIL	1.0 H @ 0 MA, .8 H @ 40 MA DC DCR = 113Ω		—	4	1	—	—

DIMENSIONS—TA [Numbers in brackets indicate millimeters]

MODEL NO.	A	B	C	D	E	F	G	WEIGHT (Ozs.)
TA 10-01	.187 [4.75]	.375 [9.52]	.187 [4.75]	.420 [10.7]	.719 [18.3]	.688 [17.5]	.766 [19.4]	.5
TA 10-02	.187 [4.75]	.375 [9.52]	.187 [4.75]	.420 [10.7]	.719 [18.3]	.688 [17.5]	.766 [19.4]	.5
TA 10-03	.187 [4.75]	.375 [9.52]	.187 [4.75]	.420 [10.7]	.719 [18.3]	.688 [17.5]	.766 [19.4]	.5
TA 10-04	.187 [4.75]	.375 [9.52]	.187 [4.75]	.420 [10.7]	.719 [18.3]	.688 [17.5]	.766 [19.4]	.5
TA 10-05	.187 [4.75]	.375 [9.52]	.187 [4.75]	.420 [10.7]	.719 [18.3]	.688 [17.5]	.766 [19.4]	.5
TA 10-06	.187 [4.75]	.375 [9.52]	.187 [4.75]	.420 [10.7]	.719 [18.3]	.688 [17.5]	.766 [19.4]	.5
TA 10-07	.150 [3.81]	.300 [7.62]	.187 [4.75]	.500 [12.7]	.470 [11.94]	.675 [17.14]	.766 [19.4]	.4
TA 11-01	.200 [5.08]	.400 [10.16]	.250 [6.35]	.781 [19.8]	.844 [21.4]	.953 [24.2]	1.01 [25.6]	1.2
TA 12-01	.312 [7.92]	.625 [15.9]	.375 [9.52]	1.00 [25.4]	1.187 [30.2]	1.125 [28.6]	1.375 [34.9]	3.5
TA 13-01	.250 [6.35]	.625 [15.9]	—	1.00 [25.4]	.645 [16.38]	1.313 [33.34]	1.625 [41.27]	2.5
TA 14-01	.400 [10.16]	.800 [20.32]	.680 [17.27]	1.30 [33.02]	1.60 [40.64]	1.438 [36.51]	2.00 [50.8]	9.5

FIGURE A

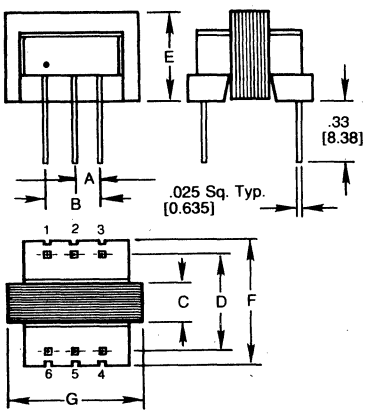


FIGURE B

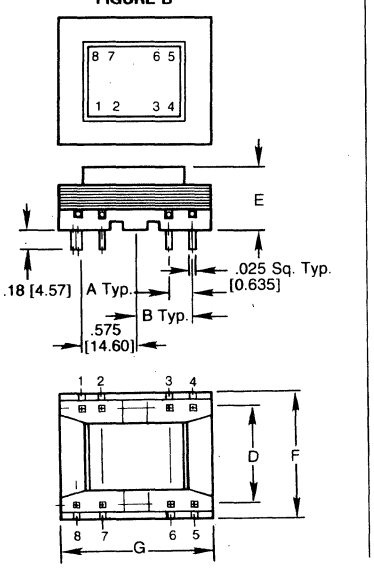


FIGURE C

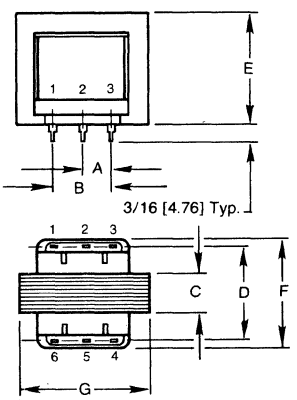
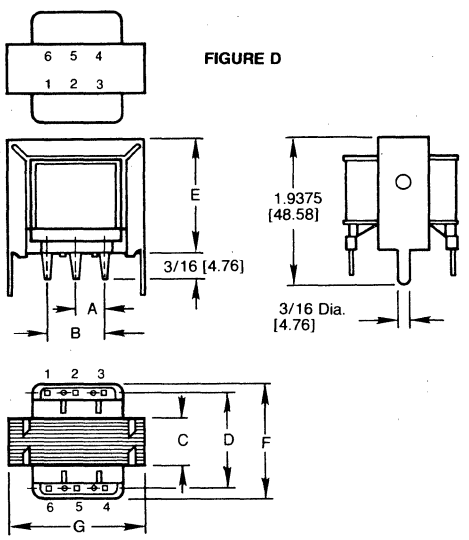
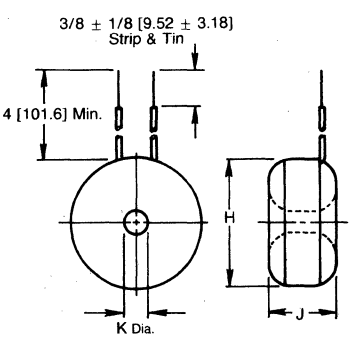


FIGURE D



DIMENSIONS—IA [Numbers in brackets indicate millimeters]

MODEL NO.	H (Max.)	J (Max.)	K (Min.)	WEIGHT (Ozs.)
IA 40-01	1.06 [26.9]	.437 [11.1]	.22 [5.59]	.75
IA 50-01	1.32 [33.5]	.688 [17.5]	.22 [5.59]	2



ORDERING INFORMATION

The following model number information must be supplied when ordering transformers.

MODEL TA

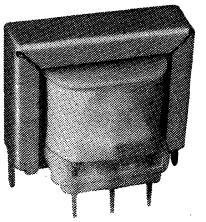
TA	14, 13, 12, 11, 10	-01 thru -07
STYLE	SIGNIFIES SIZE OF UNIT	DASH NUMBER SIGNIFIES VALUE

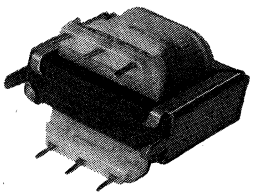
MODEL IA

IA	50 40	-01
STYLE	SIGNIFIES SIZE OF UNIT	DASH NUMBER SIGNIFIES VALUE

For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078 • Phone 605-665-9301

SINGLE PRIMARY, INPUT 115 VOLTS
LOW POWER TRANSFORMERS





PL SERIES
Dual Secondary: PL-11, PL-12, PL-13, PL-14
Single Secondary: PL-32, PL-33, PL-34

COMMON FEATURES

- P.C. pin mounting
- Recognized under the Component Program of Underwriters Laboratories, Inc. (U.L. File E71961). For general purpose transformers (U.L. Standard 506)
- Provides isolation from power line
- Laminated construction for low-cost industrial applications, including power supplies, controls, and instrumentation
- Mounting frames and bobbin standoff are available
- Modification to these standard items are available as specialty products

UNIQUE FEATURES

PL-11, PL-12, PL-13, PL-14
- Dual secondaries for **series connection** to obtain twice voltage with center tap or, **parallel connection** for twice current rating

PL-32, PL-33, PL-34
- Single secondary
- Lower cost construction

SPECIFICATIONS

Output Power Rating:
PL-11 = 0.75VA
PL-12, PL-32 = 1.50VA
PL-13, PL-33 = 4.50VA
PL-14, PL-34 = 10.0VA

Output Voltage: (See table)

Excitation Current at 120V 60Hz:
PL-11, PL-12, PL-32 = 25 MA max.
PL-13, PL-33 = 35 MA max.
PL-14, PL-34 = 45 MA max.

Dielectric Strength: All models are 1500V 60Hz from primary to secondary windings and all windings to core

Temperature Rise: 35°C max.

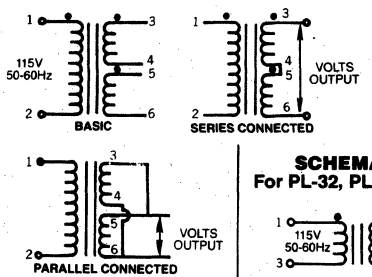
Temperature Class:
Insulation Class A, +105°C
Operation Ambient −55°C to +65°C
Storage Ambient −55°C to +105°C

MECHANICAL

Terminals: Brass, solder coated

Weight:
PL-11 = 35 grams
PL-12, PL-32 = 100 grams
PL-13, PL-33 = 160 grams
PL-14, PL-34 = 240 grams

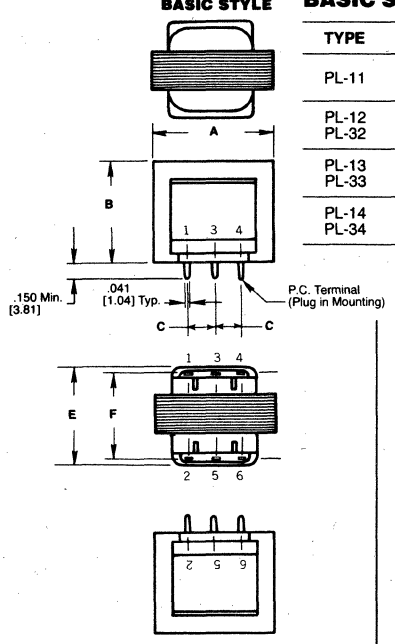
SCHEMATIC
For PL-11, PL-12, PL-13, PL-14



SCHEMATIC
For PL-32, PL-33, PL-34

DIMENSIONS

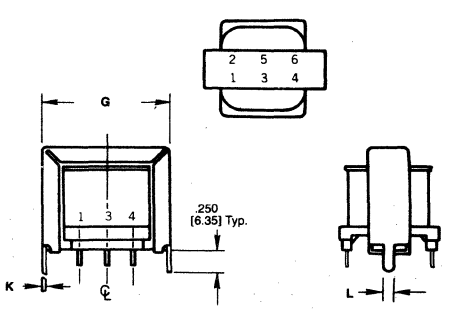
BASIC STYLE



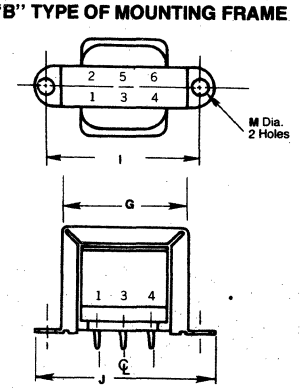
BASIC SCHEMATICS [Numbers in brackets indicate millimeters]

TYPE	A	B	C	E	F	G	I	J	K	L	M
PL-11	1.04 [26.4]	.860 [21.8]	.250 [6.35]	.920 [23.4]	.720 [18.3]	1.07 [27.2]	1.38 [34.9]	1.69 [42.9]	.018 [.46]	.125 [3.20]	.125 [3.18]
PL-12 PL-32	1.43 [36.3]	1.20 [30.5]	.312 [7.92]	1.19 [30.2]	1.00 [25.4]	1.50 [38.1]	1.75 [44.4]	2.12 [53.8]	.031 [.79]	.125 [3.20]	.188 [4.78]
PL-13 PL-33	1.68 [42.7]	1.38 [35.1]	.400 [10.2]	1.30 [33.0]	1.10 [27.9]	1.75 [44.5]	2.00 [50.8]	2.44 [62.0]	.031 [.79]	.125 [3.20]	.188 [4.78]
PL-14 PL-34	1.93 [48.0]	1.64 [41.7]	.400 [10.2]	1.48 [37.6]	1.30 [33.0]	2.00 [50.8]	2.38 [60.3]	2.88 [73.2]	.031 [.79]	.188 [4.78]	.188 [4.78]

"A" TYPE OF MOUNTING FRAME



"B" TYPE OF MOUNTING FRAME



For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078. Phone 605-665-9301

ELECTRICAL CHARACTERISTICS
INPUT VOLTAGE = 115V @ 60Hz
OUTPUT VOLTAGE TABLE

DUAL SECONDARY					SINGLE SECONDARY		
OUTPUT VOLTAGE		OUTPUT CURRENT (MA)		MODEL NO.	OUTPUT VOLTAGE	OUTPUT CURRENT (MA)	MODEL NO.
Series	Parallel	Series	Parallel				
					6.4 V	200	PL-32-01
						700	PL-33-01
						1300	PL-34-01
8 V CT	4 V	94	188	PL-11-01			
		188	376	PL-12-01			
		562	1124	PL-13-01			
		940	1880	PL-14-01			
10 V CT	5 V	75	150	PL-11-02	10 V	120	PL-32-02
		120	240	PL-12-02		450	PL-33-02
		440	880	PL-13-02		800	PL-34-02
		1000	2000	PL-14-02			
12.6 V CT	6.3 V	60	120	PL-11-03	12.6 V	100	PL-32-03
		100	200	PL-12-03		350	PL-33-03
		350	700	PL-13-03		650	PL-34-03
		800	1600	PL-14-03			
15 V CT	7.5 V	50	100	PL-11-04	15 V	80	PL-32-04
		100	200	PL-12-04		300	PL-33-04
		300	600	PL-13-04		550	PL-34-04
		500	1000	PL-14-04			
16 V CT	8 V	47	94	PL-11-05			
		75	150	PL-12-05			
		260	520	PL-13-05			
		640	1280	PL-14-05			
20 V CT	10 V	38	76	PL-11-06	20 V	60	PL-32-05
		60	120	PL-12-06		225	PL-33-05
		220	440	PL-13-06		400	PL-34-05
		500	1000	PL-14-06			
24 V CT	12 V	31	62	PL-11-07	24 V	50	PL-32-06
		50	100	PL-12-07		185	PL-33-06
		180	360	PL-13-07		330	PL-34-06
		450	900	PL-14-07			
30 V CT	15 V	25	50	PL-11-08	30 V	40	PL-32-07
		50	100	PL-12-08		150	PL-33-07
		150	300	PL-13-08		270	PL-34-07
		250	500	PL-14-08			
34 V CT	17 V	22	44	PL-11-09			
		35	70	PL-12-09			
		125	250	PL-13-09			
		300	600	PL-14-09			
40 V CT	20 V	19	38	PL-11-10			
		30	60	PL-12-10			
		110	220	PL-13-10			
		250	500	PL-14-10			
54 V CT	27 V	28	56	PL-12-11	54 V	22	PL-32-08
		84	168	PL-13-11		80	PL-33-08
		140	280	PL-14-11		150	PL-34-08
56 V CT	28 V	20	40	PL-12-12			
		80	160	PL-13-12			
		180	360	PL-14-12			
76 V CT	38 V	20	40	PL-12-13	76 V	16	PL-32-09
		60	120	PL-13-13		60	PL-33-09
		100	200	PL-14-13		110	PL-34-09
88 V CT	44 V	15	30	PL-12-14	88 V	14	PL-32-10
		50	100	PL-13-14		50	PL-33-10
		120	240	PL-14-14		90	PL-34-10
					115 V	10	PL-32-11
						40	PL-33-11
						70	PL-34-11
120 V CT	60 V	10	20	PL-12-15			
		35	70	PL-13-15			
		85	170	PL-14-15			
180 V CT	90 V	6	12	PL-12-16	180 V	7	PL-32-12
		24	48	PL-13-16		25	PL-33-12
		55	110	PL-14-16		45	PL-34-12
230 V CT	115 V	5	10	PL-12-17	230 V	5	PL-32-13
		20	40	PL-13-17		20	PL-33-13
		40	80	PL-14-17		35	PL-34-13

ORDERING INFORMATION The following model number information must be supplied when ordering transformers.

PL-11	–01	A	S
POWER TRANSFORMER, Miniature P.C. Mount	**DASH NUMBER** for Output Voltage and Current	**TYPE OF MOUNTING FRAME,** if required (If none, leave blank.)	**FOR BOBBIN STANDOFF** (If not required, leave blank.)

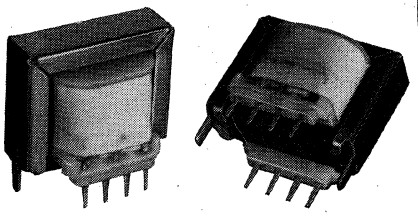
Special designs not listed, available upon request.

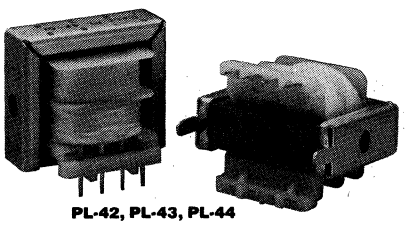
.063" [1.6] Bobbin Standoff

For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078 • Phone 605-665-9301

DUAL PRIMARY–DUAL SECONDARY LOW POWER TRANSFORMERS

PL SERIES–115/230 Volts
PL-22, PL-23, PL-24, PL-42, PL-43, PL-44





PL-42, PL-43, PL-44

COMMON FEATURES

- P.C. pin mounting
- Dual Primary for operation at 115V or 230V, 50/60Hz
- Dual Secondary for **series connection** obtains twice winding voltage with center tap, or for **parallel connection** obtains twice winding current rating.
- Provides isolation from power line
- Mounting brackets and bobbin standoff are available
- Laminated construction for low-cost industrial applications, including power supplies, controls and instrumentation
- Modification to these standard items are available as specialty products

UNIQUE FEATURES

PL-22, PL-23, PL-24

- Concentric windings for increased coupling, decreased leakage reactance and improved regulation
- Recognized under the Component Program of Underwriters Laboratories, Inc. (U.L. File E71961)

PL-42, PL-43, PL-44

- Split-section winding for increased dielectric strength between primary and secondary windings plus reduced interwinding capacitance
- Designed to meet U.L. requirements

SPECIFICATIONS

Output Power Rating: PL-22, PL-42 = 1.50VA
PL-23, PL-43 = 4.50VA
PL-24, PL-44 = 10.0VA

Output Voltage: (See table)

Excitation Current at 120V 60Hz:
PL-22, PL-42 = 25 MA max.
PL-23, PL-43 = 35 MA max.
PL-24, PL-44 = 45 MA max.

Temperature Rise: PL-22, PL-23, PL-24 = 35°C
PL-42, PL-43, PL-44 = 40°C

Dielectric Strength:
Between primary windings and secondary windings and core:
PL-22, PL-23, PL-24 = 1500V
PL-42, PL-43, PL-44 = 2500V
Between secondary windings to core: All Units = 1000V
Between primary to primary windings: All Units = 500V
Between secondary to secondary windings: All Units = 500V

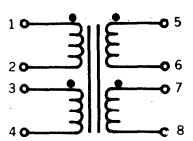
Temperature Class:
PL-22, PL-23, PL-24
Insulation Class A, 105°C
Operation Ambient −55°C to +65°C
Storage Ambient −55°C to +105°C
PL-42, PL-43, PL-44
Insulation Class B, 130°C
Operation Ambient −55°C to +85°C
Storage Ambient −55°C to +130°C

MECHANICAL

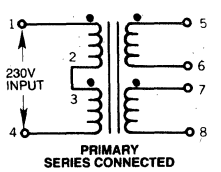
Terminals: Brass, solder coated

Weight: PL-22, PL-42 = 100 grams
PL-23, PL-43 = 160 grams
PL-24, PL-44 = 240 grams

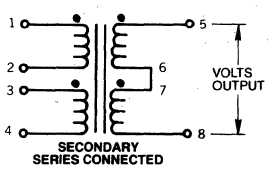
SCHEMATIC BASIC STYLE



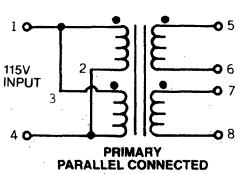
SCHEMATIC OPTIONS



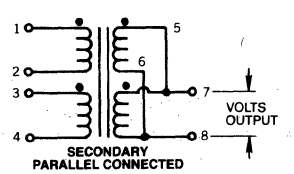
PRIMARY SERIES CONNECTED



SECONDARY SERIES CONNECTED



PRIMARY PARALLEL CONNECTED

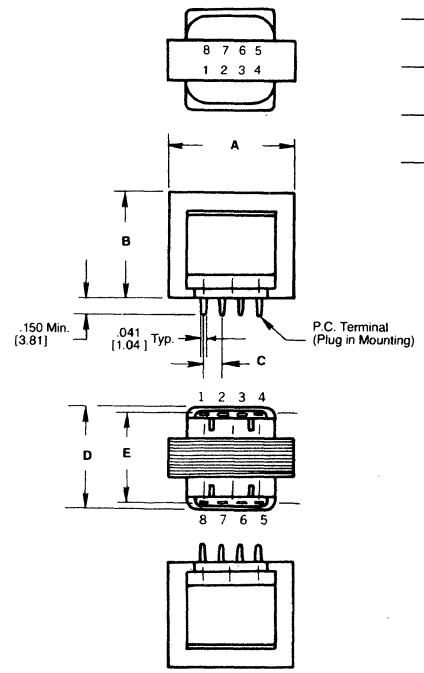


SECONDARY PARALLEL CONNECTED

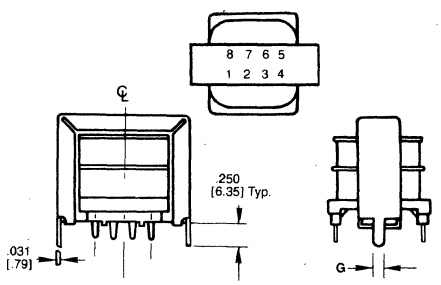
For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078 · Phone 605-665-9301

DIMENSIONS

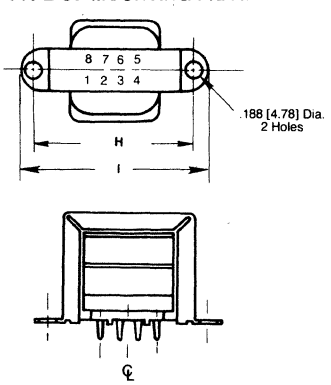
BASIC STYLE



"A" TYPE OF MOUNTING FRAME



"B" TYPE OF MOUNTING FRAME



BASIC SCHEMATICS [Numbers in brackets indicate millimeters]

TYPE	A	B	C	D	E	G	H	I
PL-22 PL-42	1.43 [26.4]	1.20 [30.5]	.20 [5.08]	1.19 [30.2]	1.00 [25.4]	.125 [3.20]	1.75 [44.4]	2.12 [53.8]
PL-23 PL-43	1.68 [42.7]	1.38 [35.1]	.25 [6.35]	1.30 [33.0]	1.10 [27.9]	.125 [3.20]	2.00 [50.8]	2.44 [62.0]
PL-24 PL-44	1.93 [48.0]	1.64 [41.7]	.25 [6.35]	1.48 [37.6]	1.30 [33.0]	.188 [4.78]	2.38 [60.3]	2.88 [73.2]

ELECTRICAL CHARACTERISTICS
INPUT VOLTAGE = 115V 60Hz OR 230V 50-60Hz
OUTPUT VOLTAGE TABLE

OUTPUT VOLTAGE		OUTPUT CURRENT (MA)		MODEL NO.	
Series	Parallel	Series	Parallel	Concentric Windings	Split-Section Windings
8 V CT	4 V	188 562 940	376 1124 1880	PL-22-01 PL-23-01 PL-24-01	PL-42-01 PL-43-01 PL-44-01
10 V CT	5 V	120 440 1000	240 880 2000	PL-22-02 PL-23-02 PL-24-02	PL-42-02 PL-43-02 PL-44-02
12.6 V CT	6.3 V	100 350 800	200 700 1600	PL-22-03 PL-23-03 PL-24-03	PL-42-03 PL-43-03 PL-44-03
15 V CT	7.5 V	100 300 500	200 600 1000	PL-22-04 PL-23-04 PL-24-04	PL-42-04 PL-43-04 PL-44-04
16 V CT	8 V	75 260 640	150 520 1280	PL-22-05 PL-23-05 PL-24-05	PL-42-05 PL-43-05 PL-44-05
20 V CT	10 V	60 220 500	120 440 1000	PL-22-06 PL-23-06 PL-24-06	PL-42-06 PL-43-06 PL-44-06
24 V CT	12 V	50 180 450	100 360 900	PL-22-07 PL-23-07 PL-24-07	PL-42-07 PL-43-07 PL-44-07
30 V C T	15 V	50 150 250	100 300 500	PL-22-08 PL-23-08 PL-24-08	PL-42-08 PL-43-08 PL-44-08
34 V CT	17 V	35 125 300	70 250 600	PL-22-09 PL-23-09 PL-24-09	PL-42-09 PL-43-09 PL-44-09
40 V CT	20 V	30 110 250	60 220 500	PL-22-10 PL-23-10 PL-24-10	PL-42-10 PL-43-10 PL-44-10
54 V CT	27 V	28 84 140	56 168 280	PL-22-11 PL-23-11 PL-24-11	PL-42-11 PL-43-11 PL-44-11
56 V CT	28 V	20 80 180	40 160 360	PL-22-12 PL-23-12 PL-24-12	PL-42-12 PL-43-12 PL-44-12
76 V CT	38 V	20 60 100	40 120 200	PL-22-13 PL-23-13 PL-24-13	PL-42-13 PL-43-13 PL-44-13
88 V CT	44 V	15 50 120	30 100 240	PL-22-14 PL-23-14 PL-24-14	PL-42-14 PL-43-14 PL-44-14
120 V CT	60 V	10 35 85	20 70 170	PL-22-15 PL-23-15 PL-24-15	PL-42-15 PL-43-15 PL-44-15
180 V CT	90 V	6 24 55	12 48 110	PL-22-16 PL-23-16 PL-24-16	PL-42-16 PL-43-16 PL-44-16
230 V CT	115 V	5 20 40	10 40 80	PL-22-17 PL-23-17 PL-24-17	PL-42-17 PL-43-17 PL-44-17

ORDERING INFORMATION The following model number information must be supplied when ordering transformers.

PL-22	-01	A	S
POWER TRANSFORMER, Miniature P.C. Mount	**DASH NUMBER** for Output Voltage and Current	**TYPE OF MOUNTING FRAME** if required (If none, leave blank.)	**FOR BOBBIN STANDOFF** (If not required, leave blank.) .063" [1.6] Bobbin Standoff

Special designs not listed, available upon request.

For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078. Phone 605-665-9301

DALE® CUSTOM INDUCTIVE PRODUCTS

Can't find it in the catalog? Dale has the custom capability to design and produce a wide range of magnetic components to your requirements.

POWER TRANSFORMERS: 50 to 400 Hz, VA ratings to 100 VA. Specialty models in Low Profile and PC Mount

INDUCTORS: Inductance values to 20 H, current ratings to 60 amps. Capability of many styles, including: Toroidal, Laminated, E Core, Pot Core, Slug Core, Air Core

AUDIO TRANSFORMERS: Coupling Transformers and Hybrid Transformers available in PC Mount, Leadset and Low Profile

SWITCH MODE MAGNETICS: Switching Converters, Power Transformers, Current Sense Transformers, Inductors

• UL, CSA & VDE Capabilities • Designs to Military Specifications

TOUGH COIL JOBS

Whether you need a hundred pieces or a million, we offer:

- Complete facilities to design, engineer and produce prototype quantities.
- Faster turn-around on custom samples and short run production quantities.
- Close production coordination including cost-saving statistical control on high volume items.

ENGINEERING AND DEVELOPMENT

When engineering assistance is required, Dale is staffed and equipped to perform...

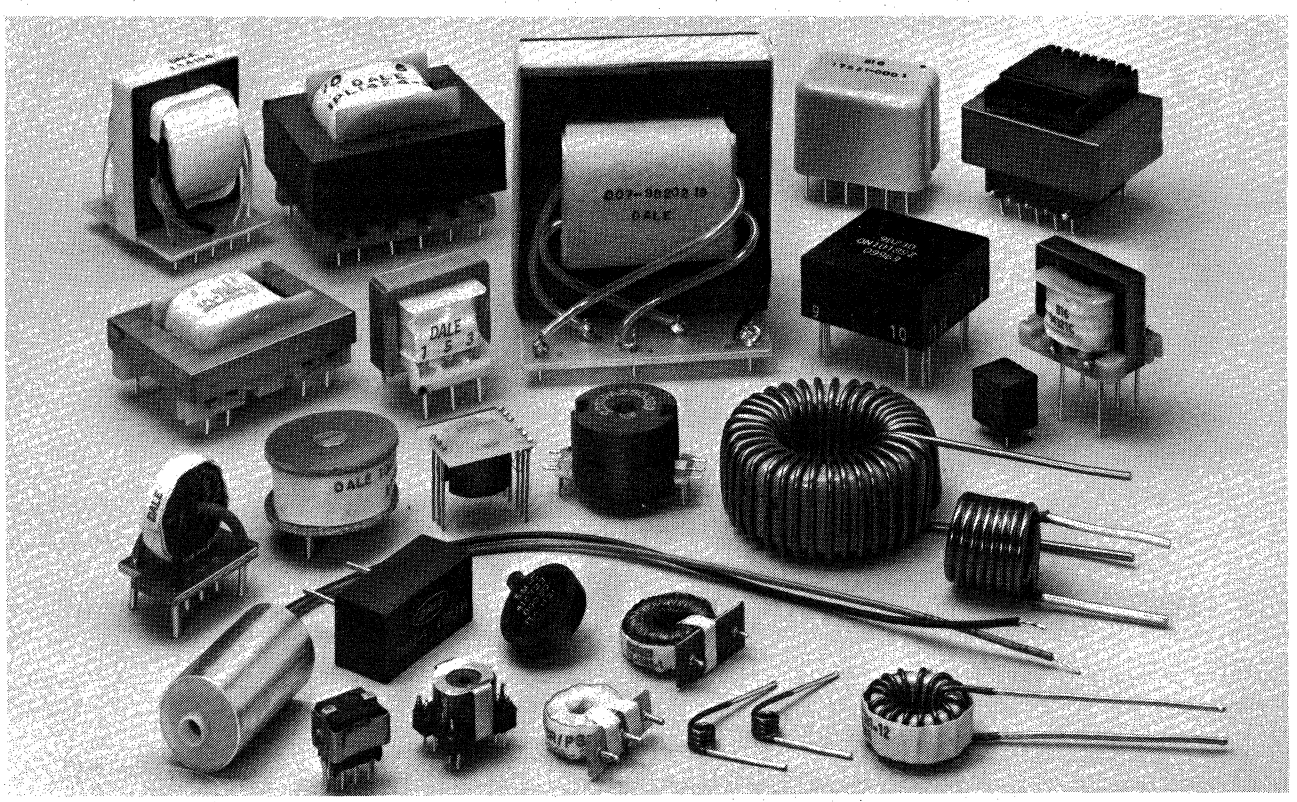
1. Production Engineering to translate your specifications into a product with **optimum quality** and **economy.**
2. Development Engineering to provide the electrical function you require.
3. Design Engineering to transform your basic idea into parts.

PRODUCTION

Ability to move quickly in converting your order to finished parts is a Dale trademark. Facilities are available for everything from high volume commercial parts to highly sophisticated military items requiring specialized production and test equipment. In dealing with Dale, you draw on a background of production experience which can provide a definite advantage in accelerating availability.

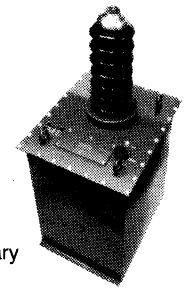
QUALITY CONTROL

Full time quality control personnel and the facilities of Dale's company-wide reliability and quality control organization enable fast action in establishing military test procedures and in meeting other government requirements—including MIL-Q-9858.



For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078. Phone 605-665-9301

High Voltage Line Isolation Transformers In Oil Insulating Tanks



Model 3–TR–150–11

FEATURES:

- ▼ Complete varnish impregnation under vacuum
- ▼ Epoxy anchoring
- ▼ Immersed in high grade insulating oil*
- ▼ Electrostatic shield between primary and secondary windings
- ▼ "AN" type connector provided for input connections
- ▼ Good regulation

*Note: Shipped without oil to minimize transportation charges, except when otherwise specified in order.

SPECIFICATIONS:

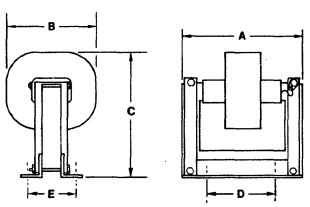
- ▼ Each model available with porcelain output insulator
- ▼ Models also available with two shielded polyethylene output cables in place of porcelain insulator
- ▼ Standard types available for 120V and 240V input lines in 1:1, 1:2, and 2:1 voltage ratios with other input and output voltages available upon request
- ▼ Recommended for industrial, research, and developmental applications

Standard 60Hz Types				
Model No.*	Max. kVA	kV dc Insulation	Tank Size (in.) (W X D X H)**	Insulator Height (in.)***
1-TR-30-XX	1	30	10 X 12 X 11	6
1.5-TR-30-XX	1.5	30	13 X 13⅞ X 16½	6
1-TR-50-XX	1	50	13 X 13⅞ X 16⅜	8½
3-TR-50-XX	3	50	13 X 13⅞ X 16⅜	8½
1-TR-60-XX	1	60	9¾ X 12⅜ X 13⅜	11
2-TR-60-XX	2	60	16½ X 16½ X 21⅜	11
3-TR-60-XX	3	60	16½ x 16½ X 21⅜	11
5-TR-60-XX	5	60	16½ X 16½ X 21⅜	11
3-TR-75-XX	3	75	16½ X 16½ X 22	11
1-TR-100-XX	1	100	20¾ X 17½ X 17¹³⁄₁₆	14
3-TR-100-XX	3	100	20¾ X 17½ X 17¹³⁄₁₆	14
3-TR-150-XX	3	150	15½ X 18¾ X 24	19½
5-TR-150-XX	5	150	15½ X 18¾ X 24	19½
0.5-TR-250-XX	0.5	250	25 X 33 X 37⁵⁄₁₆	28¾
2-TR-250-XX	2	250	25 X 33 X 37⁵⁄₁₆	28¾
3-TR-250-XX	3	250	29¾ X 29¾ X 36⅜	28¾
5-TR-250-XX	5	250	25 X 33 X 37¼	28¾
4-TR-300-XX	4	300	39½ X 47½ X 50½	35
Models With Shielded Cables Instead Of Porcelain Insulator:				
0.5-CTR-250-XX	0.5	250	25 X 33 X 37⁵⁄₁₆	
2-CTR-250-XX	2	250	25 X 33 X 37⁵⁄₁₆	
3-CTR-250-XX	3	250	29¾ X 29¾ X 36⅜	
4-CTR-300-XX	4	300	25 X 33 X 37¼	
5-CTR-250-XX	5	250	39½ X 47½ X 50½	

*Note: Add the following suffix in place of XX:

For	Suffix	For	Suffix
120/120	11	240/120	21
120/240	12	240/240	22

**Note: Dimensions are nominal and outline drawings are available upon request.
***Note: If shielded polyethylene output cables are desired in place of porcelain insulator, designate part number with a "C" prefix, e.g., 1-CTR-30-XX.



Transformer, High Voltage—Filament Isolation Open Type Construction—Epoxy Coated

High Voltage Filament Isolation Transformers				
Type	Secondary Volts	Secondary Amps	Isolation kV dc (Working)	Size (A X B X C)
AD 3227	5	1	10	2⅝ X 2⅜ X 3⅛
AD 3231	5	3	10	3 X 2⅝ X 3½
AD 3234	5	5	10	3¼ X 2⅝ X 3⅞
AD 3226	6.3	1	10	2⅝ X 2⅜ X 3⅛
AD 3230	6.3	3	10	3 X 2⅞ X 3½
AD 3233	6.3	5	10	3¼ X 2⅞ X 3⅞
AD 3238	5	1	20	4½ X 3 X 4
AD 3239	5	3	20	4⅜ X 3½ X 4⅜
AD 3240	5	5	20	4⅞ X 3½ X 5⅛
AD 3241	6.3	1	20	4½ X 3 X 4
AD 3242	6.3	3	20	4⅜ X 3½ X 4⅜
AD 3243	6.3	5	20	4⅞ X 3½ X 5⅛
AD 3247	5	1	30	4⅞ X 3½ X 5
AD 3248	5	3	30	5¾ X 3¾ X 5¼
AD 3249	5	5	30	6¼ X 3¾ X 6½
AD 3250	6.3	1	30	4⅞ X 3½ X 5
AD 3251	6.3	3	30	5¾ X 3¾ X 5¼
AD 3252	6.3	5	30	6¼ X 3¾ X 6½

All primaries: 115 volts, 60Hz.

Transformer, High Voltage—Line Isolation Open Type Construction—Epoxy Coated

FEATURES:

- ▼ Designed for continuous operation at rated voltage and power
- ▼ Epoxy coated, air insulated up to 30kV dc, oil insulated over 30kV dc
- ▼ Well suited to applications requiring reliable isolated line voltage at power ratings up to 1kVA
- ▼ Other higher voltage and power units available upon request

SPECIFICATIONS:
Primaries: 115V or 230V, 60Hz
Secondaries: 115V

Type	Rating kVA	Size (A X B X C)	Mounting Dimensions (D X E)	Insulation kV dc Working
AD 1640	0.200	6⅛ X 4 X 5⅛	4½ X 3	10
AD 1641	0.500	7⅝ X 5⅞ X 7¾	5⅜ X 4¼	10
AD 1642	0.750	9½ X 6⁵⁄₁₆ X 8¼	7¼ X 4¹³⁄₁₆	10
AD 1643	1.000	8½ X 8 X 9¾	6 X 5	10
AD 1644	0.200	8½ X 4 X 5⅝	6⅞ X 3⅛	20
AD 1645	0.500	10¼ X 5⅝ X 7½	8 X 4¼	20
AD 1646	0.750	9¾ X 6¾ X 8	7½ X 4¹³⁄₁₆	20
AD 1647	1.000	11¼ X 6⅝ X 8¾	8¾ X 4⅝	20
AD 3060	0.250	8½ X 7¼ X 6½	7⁵⁄₁₆ X 3⅜	30
AD 3061	0.500	9¾ X 7 X 8¾	7¹³⁄₁₆ X 3½	30
AD 3062	0.750	10½ X 7½ X 9½	8½ X 3⅝	30
AD 3063	1.000	11 X 9 X 9½	8¾ X 3¾	30
AD 3064	0.250	10 X 7 X 6½	8¹³⁄₁₆ X 3⅜	40
AD 3065	0.500	11¼ X 7¼ X 8¾	9⅛ X 3½	40
AD 3066	0.750	12½ X 7½ X 9½	10¼ X 3⅝	40
AD 3067	1.000	12¾ X 9 X 9½	10⁷⁄₁₆ X 3¾	40
AD 3068	0.250	13¼ X 7¼ X 6½	12 X 3⅜	50
AD 3069	0.500	13¼ X 7¼ X 8¾	11⅛ X 3½	50
AD 3070	0.750	14½ X 7½ X 9½	12¼ X 3⅝	50
AD 3071	1.000	14¾ X 9 X 9½	12⁷⁄₁₆ X 3¾	50

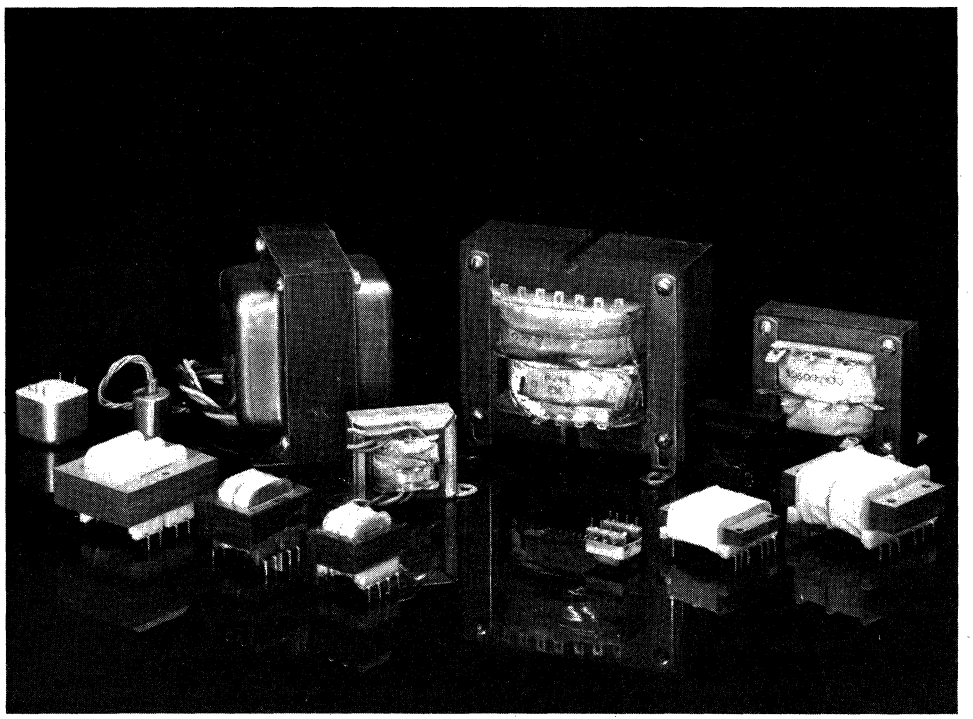
DEL

DEL ELECTRONICS CORPORATION
250 East Sandford Boulevard, Mount Vernon, New York 10550
Phone: 914/699-2000 TWX 710-562-0130

Electromech

TRANSFORMERS

FULL LINE OF QUALITY MAGNETIC COMPONENTS • TAILORED TO YOUR EXACT NEEDS



- **POWER**
- **ISOLATION**
- **CONTROL**
- **AUTO**
- **STEPUP**
- **STEPDOWN**
- **CURRENT**
- **C.V.T.**
- **CHOKES**
- **HI FREQ**
- **INDUCTORS**

FEATURES

TRANSFORMERS

Power—.5VA to 50KVA

115V, 57 to 63 Hz
115/230V, 47 to 63 Hz
International power input, 47 to 63 Hz
400 Hz
Single or multi outputs
For power supply, control, filament & rectifier circuits (+5, ±12, ±15 or any combination)
• Non concentric winding technique • Minimum inter-winding capacitance • Excellent isolation • Very low leakage • Minimum electrical noise • High efficiency • UL recognized components for Class B (130°C)

Hi Freq—Up to 40 KHz

Ferrite cores
Switching power supply
AC-DC converter
DC-DC converter
Inverter

Current—Up to 500 Amp

Sense
Instrumentation
Measuring devices
AC and DC

INDUCTORS

Power—50, 60, 400 Hz

1 μH to 50H of inductance
1μ Amp to 60 Amp of current

Hi Freq—Up to 40 KHz

1 μH to 50H of inductance
Switching power supply
Ferrite cores
Converter
Inverter

FORMATS

PC MOUNT

(Hi Pot 2500 VRMS)

• Low profile • Split pack
• Horizontal • Vertical

CHASSIS MOUNT

(Hi Pot 2500 VRMS)

• Low profile • Split pack
• Quick connect, solder tab, lead wire, or any type of termination
Open frame/Closed frame

SERVICES

• Design to your specifications • Design to UL standards • First article engineering sample within one week • No engineering set up charge • O.E.M. services • 100% Q.C.—guaranteed reliability • Our CAD system eliminates the need for a catalog

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Magnetic Components To Your Specs.

When you need transformers, solenoids, coils, torroids or similar magnetic components, ECC has the experience, personnel and facilities to design, build and deliver your parts . . . on time.

Whatever techniques your magnetic components require:
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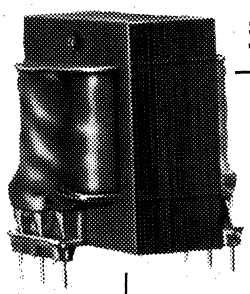
Endicott Coil Co., Inc.

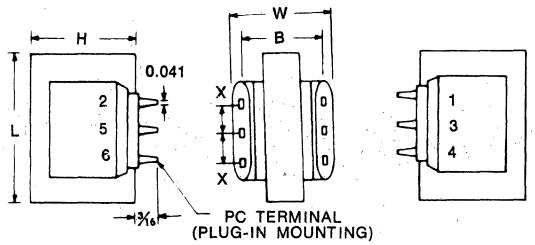
24 Charlotte Street • P.O. Box 67 • Binghamton, NY 13905
607-797-1263

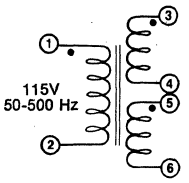
Power Transformers-P.C.

Recognized Component
Underwriters Labs, Inc.

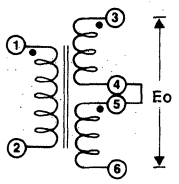


SINGLE 115V PRIMARY TYPE PC-6 PINS

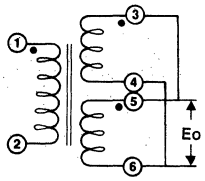




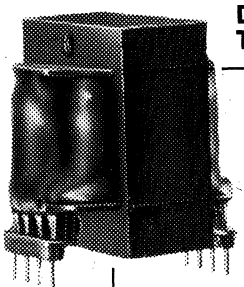
BASIC SCHEMATIC
Transformer can be connected in series or parallel.



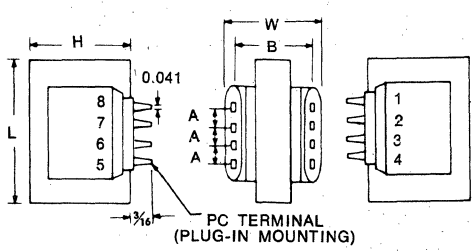
SERIES CONNECTED

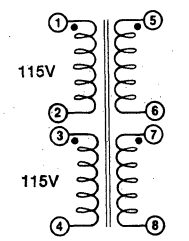


PARALLEL CONNECTED

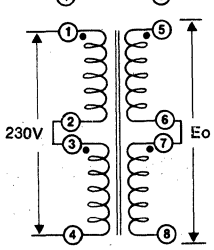


DUAL 115/230V PRIMARY TYPE DPC-8 PINS

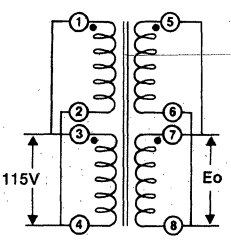




BASIC SCHEMATIC
Transformer can be connected in series or parallel.



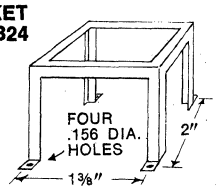
SERIES CONNECTED



PARALLEL CONNECTED

BRACKET AND CHANNEL FRAME MOUNTING AVAILABLE FOR SINGLE AND DUAL PRIMARY

"SLIDE ON" BRACKET FOR SIZE 24 P/N B24



Size	VA	L	W	H	6 PIN X	8 PIN A	B	Wt. Oz.
25	1.0	1	1 3/8	0.83	0.250	0.200	1.200	2.5
37	1.2	1 3/8	1 1/8	1 3/16	0.312	0.200	1.000	3
50	4.4	1 5/8	1 1/4	1 3/8	0.400	0.250	1.100	5
62	10	1 7/8	1 7/16	1 5/8	0.400	0.250	1.300	9
24	24	1 5/8	2 1/4	1 3/8	0.400	0.250	2.100	12

HOW TO ORDER

D PC - 10 - 2400 B 4

Primary Rating

No Letter	115V	50/60 Hz	6 pin
C	230V	50/60 Hz	6 pin
D	115/230V	50/60 Hz	8 pin
E	277V	50/60 Hz	6 pin
F	332V	50/60 Hz	6 pin

Transformer Series
PC—Single Section Bobbin PC Transformers
EL—"2" Section" Split Bobbin PC Transformer

Secondary Voltage Rating — in volts RMS

Secondary Current Rating — in ma RMS

Individual Spec

Mechanical-Configuration
A = Channel Frame Mounting — Style A — Screw Mount
B = No Frame
C = Channel Frame Mounting — Style C — PC Mount
E = Channel Frame — No Mounting
P = Potted — FORM-TRAN™ Construction

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

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Recognized Component
Underwriters Labs, Inc.

Power Transformers-P.C.

SECONDARY RMS RATING			PRIMARY 50/500 Hz				
Series V.C.T. MA	Parallel @ 2x Current V MA	Size	* Single 115V 6 Pin	* Single 230V 6 Pin	* Dual 115/230V 8 Pin	Single 277V 6 Pin	Single 332V 6 Pin
10 @ 90	5 @ 180	25	PC-10-90B53	CPC-10-90B53	DPC-10-90B53	EPC-10-90B53	FPC-10-90B53
10 @ 120	5 @ 240	37	PC-10-120B1	CPC-10-120B1	DPC-10-120B1	EPC-10-120B1	FPC-10-120B1
10 @ 440	5 @ 880	50	PC-10-440B2	CPC-10-440B2	DPC-10-440B2	EPC-10-440B2	FPC-10-440B2
10 @ 1000	5 @ 2000	62	PC-10-1000B3	CPC-10-1000B3	DPC-10-1000B3	EPC-10-1000B3	FPC-10-1000B3
10 @ 2400	5 @ 4800	24	PC-10-2400B4	CPC-10-2400B4	DPC-10-2400B4	EPC-10-2400B4	FPC-10-2400B4
12.6 @ 70	6 @ 140	25	PC-12-70B54	CPC-12-70B54	DPC-12-70B54	EPC-12-70B54	FPC-12-70B54
12.6 @ 100	6.3 @ 200	37	PC-12-100B5	CPC-12-100B5	DPC-12-100B5	EPC-12-100B5	FPC-12-100B5
12.6 @ 350	6.3 @ 700	50	PC-12-350B6	CPC-12-350B6	DPC-12-350B6	EPC-12-350B6	FPC-12-350B6
12.6 @ 800	6.3 @ 1600	62	PC-12-800B7	CPC-12-800B7	DPC-12-800B7	EPC-12-800B7	FPC-12-800B7
12.6 @ 2000	6.3 @ 4000	24	PC-12-2000B8	CPC-12-2000B8	DPC-12-2000B8	EPC-12-2000B8	FPC-12-2000B8
16 @ 55	8 @ 110	25	PC-16-55B55	CPC-16-55B55	DPC-16-55B55	EPC-16-55B55	FPC-16-55B55
16 @ 75	8 @ 150	37	PC-16-75B9	CPC-16-75B9	DPC-16-75B9	EPC-16-75B9	FPC-16-75B9
16 @ 260	8 @ 520	50	PC-16-260B10	CPC-16-260B10	DPC-16-260B10	EPC-16-260B10	FPC-16-260B10
16 @ 640	8 @ 1280	62	PC-16-640B11	CPC-16-640B11	DPC-16-640B11	EPC-16-640B11	FPC-16-640B11
16 @ 1500	8 @ 3000	24	PC-16-1500B12	CPC-16-1500B12	DPC-16-1500B12	EPC-16-1500B12	FPC-16-1500B12
20 @ 45	10 @ 90	25	PC-20-45B56	CPC-20-45B56	DPC-20-45B56	EPC-20-45B56	FPC-20-45B56
20 @ 60	10 @ 120	37	PC-20-60B13	CPC-20-60B13	DPC-20-60B13	EPC-20-60B13	FPC-20-60B13
20 @ 220	10 @ 440	50	PC-20-220B14	CPC-20-220B14	DPC-20-220B14	EPC-20-220B14	FPC-20-220B14
20 @ 500	10 @ 1000	62	PC-20-500B15	CPC-20-500B15	DPC-20-500B15	EPC-20-500B15	FPC-20-500B15
20 @ 1200	10 @ 2400	24	PC-20-1200B16	CPC-20-1200B16	DPC-20-1200B16	EPC-20-1200B16	FPC-20-1200B16
24 @ 35	12 @ 70	25	PC-24-35B57	CPC-24-35B57	DPC-24-35B57	EPC-24-35B57	FPC-24-35B57
24 @ 50	12 @ 100	37	PC-24-50B17	CPC-24-50B17	DPC-24-50B17	EPC-24-50B17	FPC-24-50B17
24 @ 180	12 @ 360	50	PC-24-180B18	CPC-24-180B18	DPC-24-180B18	EPC-24-180B18	FPC-24-180B18
24 @ 450	12 @ 900	62	PC-24-450B19	CPC-24-450B19	DPC-24-450B19	EPC-24-450B19	FPC-24-450B19
24 @ 1000	12 @ 2000	24	PC-24-1000B20	CPC-24-1000B20	DPC-24-1000B20	EPC-24-1000B20	FPC-24-1000B20
28 @ 30	14 @ 60	25	PC-28-30B58	CPC-28-30B58	DPC-28-30B58	EPC-28-30B58	FPC-28-30B58
28 @ 40	14 @ 80	37	PC-28-40B49	CPC-28-40B49	DPC-28-40B49	EPC-28-40B49	FPC-28-40B49
28 @ 160	14 @ 320	50	PC-28-160B50	CPC-28-160B50	DPC-28-160B50	EPC-28-160B50	FPC-28-160B50
28 @ 360	14 @ 720	62	PC-28-360B51	CPC-28-360B51	DPC-28-360B51	EPC-28-360B51	FPC-28-360B51
28 @ 800	14 @ 1.6A	24	PC-28-800B52	CPC-28-800B52	DPC-28-800B52	EPC-28-800B52	FPC-28-800B52
34 @ 25	17 @ 50	25	PC-34-25B59	CPC-34-25B59	DPC-34-25B59	EPC-34-25B59	FPC-34-25B59
34 @ 35	17 @ 70	37	PC-34-35B21	CPC-34-35B21	DPC-34-35B21	EPC-34-35B21	FPC-34-35B21
34 @ 125	17 @ 250	50	PC-34-125B22	CPC-34-125B22	DPC-34-125B22	EPC-34-125B22	FPC-34-125B22
34 @ 300	17 @ 600	62	PC-34-300B23	CPC-34-300B23	DPC-34-300B23	EPC-34-300B23	FPC-34-300B23
34 @ 700	17 @ 1400	24	PC-34-700B24	CPC-34-700B24	DPC-34-700B24	EPC-34-700B24	FPC-34-700B24
40 @ 20	20 @ 40	25	PC-40-20B60	CPC-40-20B60	DPC-40-20B60	EPC-40-20B60	FPC-40-20B60
40 @ 30	20 @ 60	37	PC-40-30B25	CPC-40-30B25	DPC-40-30B25	EPC-40-30B25	FPC-40-30B25
40 @ 110	20 @ 220	50	PC-40-110B26	CPC-40-110B26	DPC-40-110B26	EPC-40-110B26	FPC-40-110B26
40 @ 250	20 @ 500	62	PC-40-250B27	CPC-40-250B27	DPC-40-250B27	EPC-40-250B27	FPC-40-250B27
40 @ 600	20 @ 1200	24	PC-40-600B28	CPC-40-600B28	DPC-40-600B28	EPC-40-600B28	FPC-40-600B28
56 @ 15	28 @ 30	25	PC-56-15B61	CPC-56-15B61	DPC-56-15B61	EPC-56-15B61	FPC-56-15B61
56 @ 20	28 @ 40	37	PC-56-20B29	CPC-56-20B29	DPC-56-20B29	EPC-56-20B29	FPC-56-20B29
56 @ 80	28 @ 160	50	PC-56-80B30	CPC-56-80B30	DPC-56-80B30	EPC-56-80B30	FPC-56-80B30
56 @ 180	28 @ 360	62	PC-56-180B31	CPC-56-180B31	DPC-56-180B31	EPC-56-180B31	FPC-56-180B31
56 @ 420	28 @ 840	24	PC-56-420B32	CPC-56-420B32	DPC-56-420B32	EPC-56-420B32	FPC-56-420B32
88 @ 10	44 @ 20	25	PC-88-10B62	CPC-88-10B62	DPC-88-10B62	EPC-88-10B62	FPC-88-10B62
88 @ 15	44 @ 30	37	PC-88-15B33	CPC-88-15B33	DPC-88-15B33	EPC-88-15B33	FPC-88-15B33
88 @ 50	44 @ 100	50	PC-88-50B34	CPC-88-50B34	DPC-88-50B34	EPC-88-50B34	FPC-88-50B34
88 @ 120	44 @ 240	62	PC-88-120B35	CPC-88-120B35	DPC-88-120B35	EPC-88-120B35	FPC-88-120B35
88 @ 270	44 @ 540	24	PC-88-270B36	CPC-88-270B36	DPC-88-270B36	EPC-88-270B36	FPC-88-270B36
120 @ 8	60 @ 16	25	PC-120-8B63	CPC-120-8B63	DPC-120-8B63	EPC-120-8B63	FPC-120-8B63
120 @ 10	60 @ 20	37	PC-120-10B37	CPC-120-10B37	DPC-120-10B37	EPC-120-10B37	FPC-120-10B37
120 @ 35	60 @ 70	50	PC-120-35B38	CPC-120-35B38	DPC-120-35B38	EPC-120-35B38	FPC-120-35B38
120 @ 85	60 @ 170	62	PC-120-85B39	CPC-120-85B39	DPC-120-85B39	EPC-120-85B39	FPC-120-85B39
120 @ 200	60 @ 400	24	PC-120-200B40	CPC-120-200B40	DPC-120-200B40	EPC-120-200B40	FPC-120-200B40
180 @ 5	90 @ 10	25	PC-180-5B64	CPC-180-5B64	DPC-180-5B64	EPC-180-5B64	FPC-180-5B64
180 @ 6	90 @ 12	37	PC-180-6B41	CPC-180-6B41	DPC-180-6B41	EPC-180-6B41	FPC-180-6B41
180 @ 24	90 @ 48	50	PC-180-24B42	CPC-180-24B42	DPC-180-24B42	EPC-180-24B42	FPC-180-24B42
180 @ 55	90 @ 110	62	PC-180-55B43	CPC-180-55B43	DPC-180-55B43	EPC-180-55B43	FPC-180-55B43
180 @ 130	90 @ 260	24	PC-180-130B44	CPC-180-130B44	DPC-180-130B44	EPC-180-130B44	FPC-180-130B44
230 @ 4	115 @ 8	25	PC-230-4B65	CPC-230-4B65	DPC-230-4B65	EPC-230-4B65	FPC-230-4865
230 @ 5	115 @ 10	37	PC-230-5B45	CPC-230-5B45	DPC-230-5B45	EPC-230-5B45	FPC-230-5B45
230 @ 20	115 @ 40	50	PC-230-20B46	CPC-230-20B46	DPC-230-20B46	EPC-230-20B46	FPC-230-20B46
230 @ 40	115 @ 80	62	PC-230-40B47	CPC-230-40B47	DPC-230-40B47	EPC-230-40B47	FPC-230-40B47
230 @ 100	115 @ 200	24	PC-230-100B48	CPC-230-100B48	DPC-230-100B48	EPC-230-100B48	FPC-230-100B48

RATINGS BASED ON 20% REGULATION.

METHOD OF DETERMINING SECONDARY RMS CURRENT:

Rectifier Type	Filter Type	RMS Secondary Current
Full Wave Center Tap	Choke Input	.7 x DC Amps
Full Wave Center Tap	Capacitor Input	1.2 x DC Amps
Full Wave Bridge	Choke Input	1.0 x DC Amps
Full Wave Bridge	Capacitor Input	1.8 x DC Amps

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

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EWC® INC.

Economy Line of Split-Bobbin Miniature Power Transformers

Recognized Component Underwriters Labs, Inc.

For printed circuit plug-in applications

ATTRACTIVE PRICE SAVINGS IN QUANTITIES OF 500 AND OVER!

Available only in three types of channel frames as shown and in three different VA ratings these units are priced lower than our standard PC/DPC series and will afford substantial savings in larger quantity ranges. Additional savings can be realized if single secondary can be used in lieu of dual secondaries as shown.

Electrical characteristics differ from our standard PC/DPC series.

Style "C" channel frames supplied hot tin dipped to assure proper solderability. Other styles supplied electro tin plated.

SECONDARY RMS RATING

Series V.C.T. MA	Parallel @ 2x Current V MA	Size
10 @ 120	5 @ 240	37
10 @ 440	5 @ 880	50
10 @ 1000	5 @ 2000	62
10 @ 2400	5 @ 4800	24
12.6 @ 100	6.3 @ 200	37
12.6 @ 350	6.3 @ 700	50
12.6 @ 800	6.3 @ 1600	62
12.6 @ 2000	6.3 @ 4000	24
16 @ 75	8 @ 150	37
16 @ 260	8 @ 520	50
16 @ 640	8 @ 1280	62
16 @ 1500	8 @ 3000	24
20 @ 60	10 @ 120	37
20 @ 220	10 @ 440	50
20 @ 500	10 @ 1000	62
20 @ 1200	10 @ 2400	24
24 @ 50	12 @ 100	37
24 @ 180	12 @ 360	50
24 @ 450	12 @ 900	62
24 @ 1000	12 @ 2000	24
28 @ 40	14 @ 80	37
28 @ 160	14 @ 320	50
28 @ 360	14 @ 720	62
28 @ 800	14 @ 1.6A	24
34 @ 35	17 @ 70	37
34 @ 125	17 @ 250	50
34 @ 300	17 @ 600	62
34 @ 700	17 @ 1400	24
40 @ 30	20 @ 60	37
40 @ 110	20 @ 220	50
40 @ 250	20 @ 500	62
40 @ 600	20 @ 1200	24
56 @ 20	28 @ 40	37
56 @ 80	28 @ 160	50
56 @ 180	28 @ 360	62
56 @ 420	28 @ 840	24
88 @ 15	44 @ 30	37
88 @ 50	44 @ 100	50
88 @ 120	44 @ 240	62
88 @ 270	44 @ 540	24
120 @ 10	60 @ 20	37
120 @ 35	60 @ 70	50
120 @ 85	60 @ 170	62
120 @ 200	60 @ 400	24
180 @ 6	90 @ 12	37
180 @ 24	90 @ 48	50
180 @ 55	90 @ 110	62
180 @ 130	90 @ 260	24
230 @ 5	115 @ 10	37
230 @ 20	115 @ 40	50
230 @ 40	115 @ 80	62
230 @ 100	115 @ 200	24

PRIMARY 50/60 Hz

Single 115V 6 Pin	Dual 115/230V 8 Pin
EL-10-120*1	DEL-10-120*1
EL-10-440*2	DEL-10-440*2
EL-10-1000*3	DEL-10-1000*3
EL-10-2400*4	DEL-10-2400*4
EL-12-100*5	DEL-12-100*5
EL-12-350*6	DEL-12-350*6
EL-12-800*7	DEL-12-800*7
EL-12-2000*8	DEL-12-2000*8
EL-16-75*9	DEL-16-75*9
EL-16-260*10	DEL-16-260*10
EL-16-640*11	DEL-16-640*11
EL-16-1500*12	DEL-16-1500*12
EL-20-60*13	DEL-20-60*13
EL-20-220*14	DEL-20-220*14
EL-20-500*15	DEL-20-500*15
EL-20-1200*16	DEL-20-1200*16
EL-24-50*17	DEL-24-50*17
EL-24-180*18	DEL-24-180*18
EL-24-450*19	DEL-24-450*19
EL-24-1000*20	DEL-24-1000*20
EL-28-40*49	DEL-28-40*49
EL-28-160*50	DEL-28-160*50
EL-28-360*51	DEL-28-360*51
EL-28-800*52	DEL-28-800*52
EL-34-35*21	DEL-34-35*21
EL-34-125*22	DEL-34-125*22
EL-34-300*23	DEL-34-300*23
EL-34-700*24	DEL-34-700*24
EL-40-30*25	DEL-40-30*25
EL-40-110*26	DEL-40-110*26
EL-40-250*27	DEL-40-250*27
EL-40-600*28	DEL-40-600*28
EL-56-20*29	DEL-56-20*29
EL-56-80*30	DEL-56-80*30
EL-56-180*31	DEL-56-180*31
EL-56-420*32	DEL-56-420*32
EL-88-15*33	DEL-88-15*33
EL-88-50*34	DEL-88-50*34
EL-88-120*35	DEL-88-120*35
EL-88-270*36	DEL-88-270*36
EL-120-10*37	DEL-120-10*37
EL-120-35*38	DEL-120-35*38
EL-120-85*39	DEL-120-85*39
EL-120-200*40	DEL-120-200*40
EL-180-6*41	DEL-180-6*41
EL-180-24*42	DEL-180-24*42
EL-180-55*43	DEL-180-55*43
EL-180-130*44	DEL-180-130*44
EL-230-5*45	DEL-230-5*45
EL-230-20*46	DEL-230-20*46
EL-230-40*47	DEL-230-40*47
EL-230-100*48	DEL-230-100*48

RATINGS BASED ON 20% REGULATION.

* Specify letter "E", "A" or "C" for mounting style of channel frame required. Size #24 only style B and P available. For FORM-TRAN® construction use letter "P". See Page A•2141.

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

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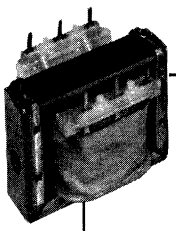
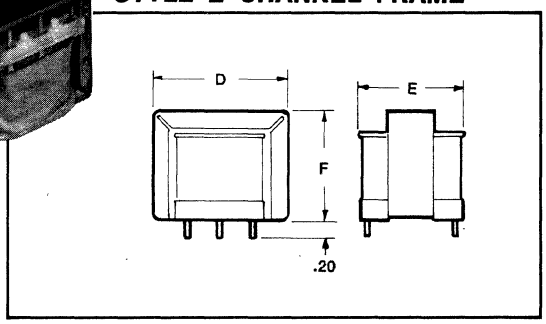
Recognized Component
Underwriters Labs, Inc.

Economy Line of Split-Bobbin Miniature Power Transformers

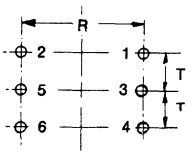
P.C. Board Layout (Circuit Side)



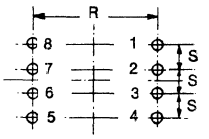
STYLE E CHANNEL FRAME

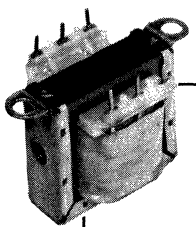


6 PIN

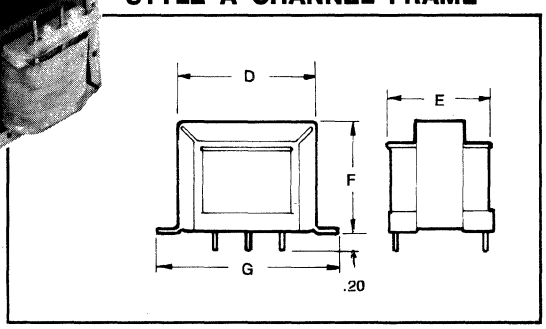


8 PIN

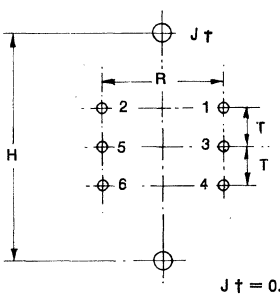




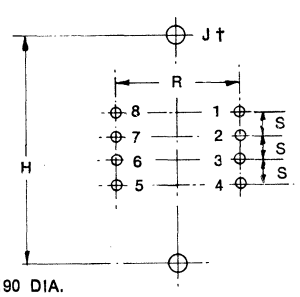
STYLE A CHANNEL FRAME



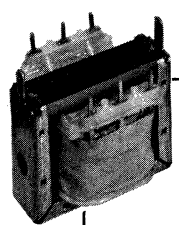
6 PIN



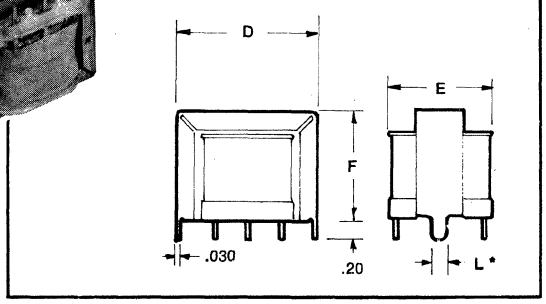
8 PIN



J † = 0..190 DIA.

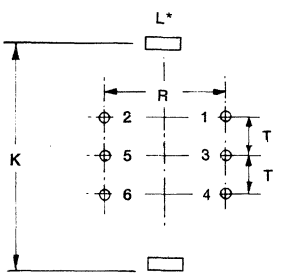


STYLE C CHANNEL FRAME

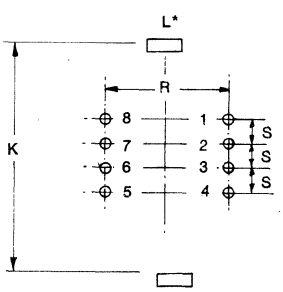


* FOR SIZE 37 & 50 = .13
FOR SIZE 62 = .19

6 PIN

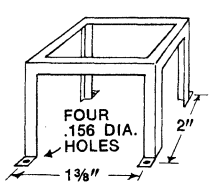


8 PIN



Recommended PC Hole Dia. = 0.052

"SLIDE ON" BRACKET FOR SIZE 24 P/N B24



Size	D	E	F	G	H	K	R	S	T	Wgt. Oz.
37	1½	1⅛	1 7/32	2 1/16	1.75	1.422	1.000	0.200	0.312	3
50	1 23/32	1¼	1 13/32	2⅜	2.00	1.672	1.100	0.250	0.400	5
62	1 31/32	1 1/16	1 21/32	2 13/16	2.38	1.922	1.300	0.250	0.400	9
24	1⅝	2¼	1⅜	NA	**	**	2.100	0.250	0.400	12

** Use B24 Bracket

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EWC® INC.

Miniature Plug-In Power Transformers

Recognized Component
Underwriters Labs, Inc.

For triple-output regulated supplies

IDEAL FOR MICROPROCESSOR APPLICATIONS

This line was designed around our standard PC and LP Series and is specified in terms of DC output.

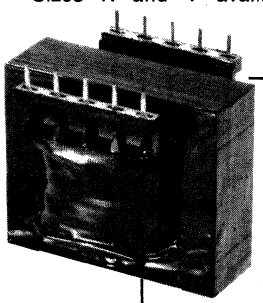
Size "V" available with single primary only.

Sizes "X" and "Y" available with single or dual primary.

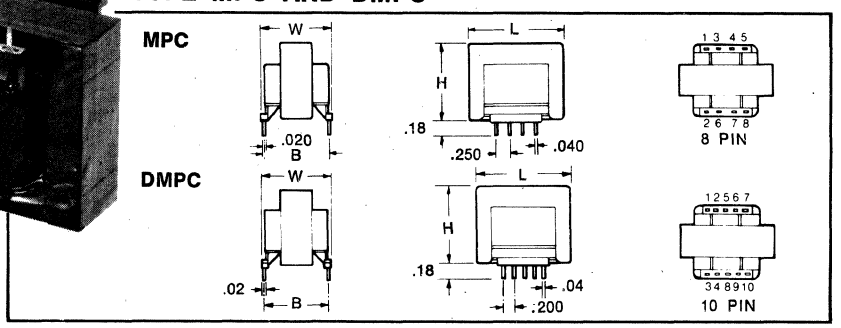
Sizes "6" and "12" available with dual primary only.

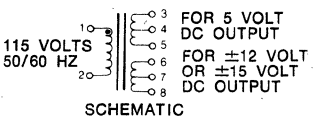
1500V hipot is standard on Sizes "V", "X" and "Y".

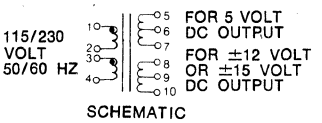
1500V hipot is standard on Sizes "6" and "12".



TYPE MPC AND DMPC

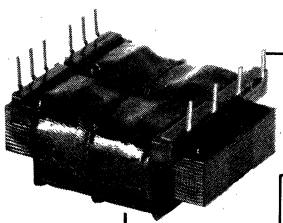




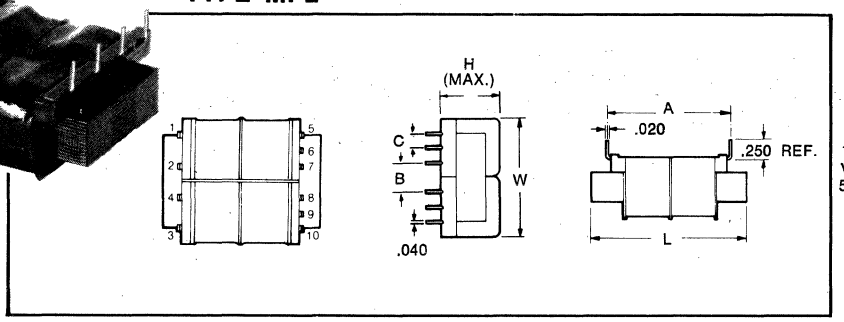


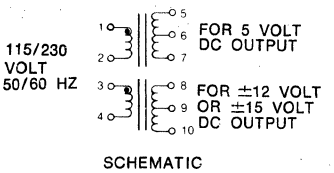
Size	L	W	H	8-Pin	10-Pin	B	Lbs.
V	1⅝	1¼	1⅜	0.250	0.200	1.100	0.31
X	1⅞	1 7/16	1⅝	0.250	0.200	1.300	0.56
Y	1⅝	2¼	1⅜	0.250	0.200	2.100	0.75

MPC and DMPC's also available with channel frames see page **A**•2139 or FORM-TRAN® Construction.
See page **A**•2139 for ordering information.



TYPE MPL





Size	L	W	H	A	B	C	Lbs.
6	1⅞	1 7/16	0.850	1.600	0.375	0.187	0.43
12	2½	2.000	1.065	2.000	0.500	0.250	0.68

Part Number Primary 50/60 Hz		DC Output		
115V (8 Pin)	115/230V (10 Pin)	Output #1	Output #2	Size
MPC-V-12B1	N/A	5VDC 180ma	±12VDC 35ma	V
MPC-V-15B2	N/A	5VDC 180ma	±15VDC 30ma	V
MPC-X-12B11	DMPC-X-12B31	5VDC 360ma	±12VDC 60ma	X
MPC-X-15B12	DMPC-X-15B32	5VDC 360ma	±15VDC 50ma	X
MPC-Y-12B21	DMPC-Y-12B41	5VDC 835ma	±12VDC 150ma	Y
MPC-Y-15B22	DMPC-Y-15B42	5VDC 835ma	±15VDC 130ma	Y
N/A	MPL-6-12B51	5VDC 135ma	±12VDC 40ma	6
N/A	MPL-6-15B52	5VDC 135ma	±15VDC 35ma	6
N/A	MPL-12-12B61	5VDC 270ma	±12VDC 85ma	12
N/A	MPL-12-15B62	5VDC 270ma	±15VDC 70ma	12

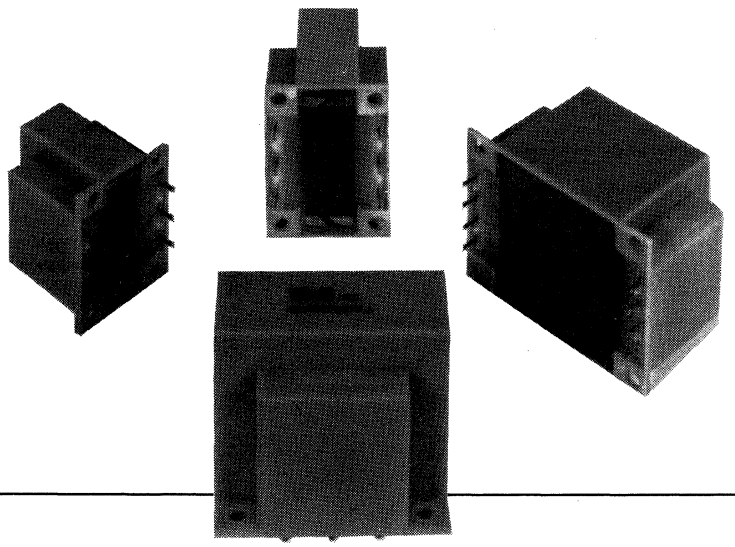
EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

EWC® INC. 725 FEDERAL AVENUE, KENILWORTH, NJ 07033 • (201) 245-3200 TWX 710-996-5993 800-526-4048

Recognized Component
Underwriters Labs, Inc.

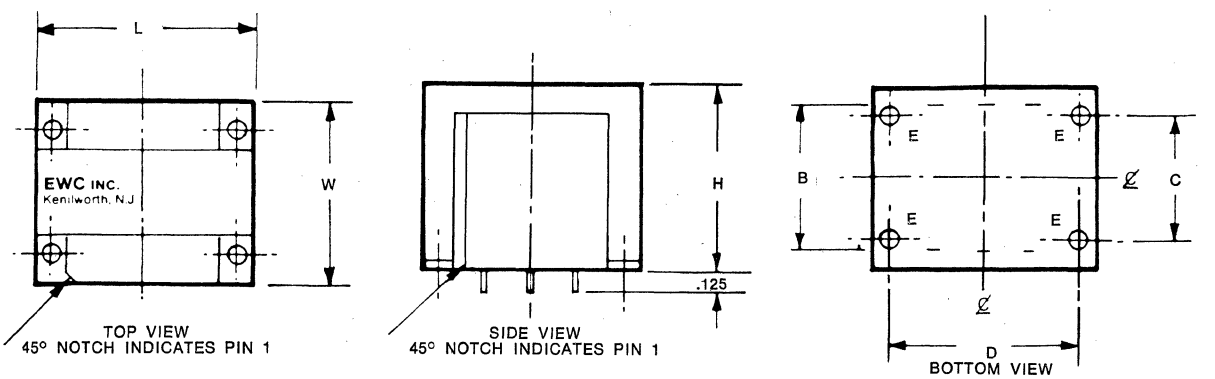
FORM-TRAN™

For military style packaging of printed circuit board plug-in transformers — at commercial prices



FEATURES

- Assures greater reliability.
- Encapsulated in form fitting shells to protect against possible damage due to use of water soluble and other fluxes as well as electrolytic corrosion experienced on open type construction
- Enhances physical appearance of your printed circuit board.
- In addition to UL recognition modified "Form-Tran" packaging can be provided that will meet safety requirements valid in all member countries of the European Community and Canada.



FORM-TRAN PACKAGING CAN BE PROVIDED FOR OUR STANDARD LINES OF

PC/DPC*
EL/DEL*
MPC/DMPC*

Simplify by inserting the letter "P" for mechanical configuration.

* See preceeding pages for part numbers and details.

Size	L ±.03	W ±.03	H ±.03	B ±.010	C ±.010	D ±.010	E DIA.
25	1.11	1.45	0.92	1.200	**	**	NA
37	1.52	1.22	1.26	1.000	.840	1.270	.125 .132
50	1.77	1.30	1.44	1.100	1.000	1.463	.159 .169
62	2.02	1.50	1.70	1.300	1.125	1.625	.159 .169
24	1.70	2.32	1.42	2.100	2.000	1.463	.159 .169

** No mtng's. for size #25.

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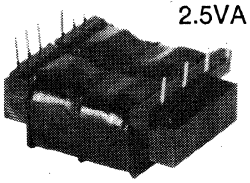
725 FEDERAL AVENUE, KENILWORTH, NJ 07033 • (201) 245-3200 TWX 710-996-5993 800-526-4048

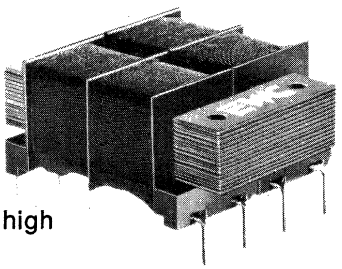
Miniature LO-PROFILE Plug-In Power Transformers

Recognized Component Underwriters Labs, Inc.

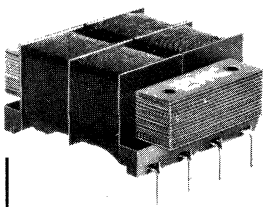
For printed circuit applications

2.5VA — 0.650 inches high

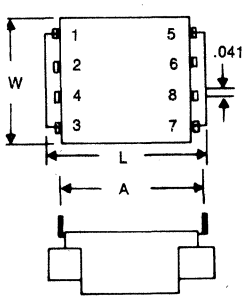


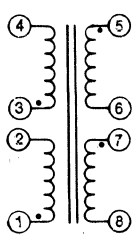


12VA — 1.065 inches high



6VA — 0.850 inches high





PRIMARIES
115/230V
50/60 Hz

* INDICATES LIKE POLARITY

Size	L	W	H	A	B	Oz.
2	1⅞	1⅜	0.650	1.600	0.375	5
6	1⅞	1⅜	0.850	1.600	0.375	7
12	2½	2	1.065	2.000	0.500	11

*Regulation of Size 2 and 6 units is 30%, i.e., no load-secondary voltage is 30% higher than full load. Regulation of Size 12 units is 20%.

THREE SIZES:

EWC's lo-profile, plug-in power transformers are designed for low height, critical pc board applications in semiconductor control and instrumentation. Interchangeable with those of other manufacturers, the units are for use in single, dual or reference dc supplies, or isolated control circuits.

EWC TRANSFORMERS FEATURE

- Non-concentric winding, achieved by secondary being wound alongside primary rather than directly over it, to lower inter-winding capacitance, thus eliminating the use of an electro-static shield.
- Hum-bucking (semi-toroidal) construction to diminish radiated magnetic field and balance winding.
- Lo-profile design permitting close card spacing: ¾″ for 2.5VA units, 1″ for 6VA units and 1¼″ for 12VA units.
- Dual Primaries: 115/230V, 50/60 Hz
- 1500V RMS HIPOT

Part No.	Size	SECONDARY* Series	SECONDARY* Parallel
LP 10-250-B23	2	10V C.T. @ 250MA	5V @ 500MA
LP 10-600-B1	6	10V C.T. @ 600MA	5V @ 1.2A
LP 10-1200-B2	12	10V C.T. @ 1200MA	5V @ 2.4A
LP 12-200-B24	2	12.6V C.T. @ 200MA	6.3V @ 400MA
LP 12-450-B3	6	12.6V C.T. @ 450MA	6.3V @ 900MA
LP 12-900-B4	12	12.6V C.T. @ 900MA	6.3V @ 1.8A
LP 16-150-B25	2	16V C.T. @ 150MA	8V @ 300MA
LP 16-350-B5	6	16V C.T. @ 350MA	8V @ 700MA
LP 16-700-B6	12	16V C.T. @ 700MA	8V @ 1.4A
LP 20-125-B26	2	20V C.T. @ 125MA	10V @ 250MA
LP 20-300-B7	6	20V C.T. @ 300MA	10V @ 600MA
LP 20-600-B8	12	20V C.T. @ 600MA	10V @ 1.2A
LP 24-100-B27	2	24V C.T. @ 100MA	12V @ 200MA
LP 24-250-B9	6	24V C.T. @ 250MA	12V @ 500MA
LP 24-500-B10	12	24V C.T. @ 500MA	12V @ 1A
LP 34-75-B28	2	34V C.T. @ 75MA	17V @ 150MA
LP 34-170-B11	6	34V C.T. @ 170MA	17V @ 340MA
LP 34-340-B12	12	34V C.T. @ 340MA	17V @ 680MA
LP 40-60-B29	2	40V C.T. @ 60MA	20V @ 120MA
LP 40-150-B13	6	40V C.T. @ 150MA	20V @ 300MA
LP 40-300-B14	12	40V C.T. @ 300MA	20V @ 600MA
LP 56-45-B30	2	56V C.T. @ 45MA	28V @ 90MA
LP 56-100-B15	6	56V C.T. @ 100MA	28V @ 200MA
LP 56-200-B16	12	56V C.T. @ 200MA	28V @ 400MA
LP 88-28-B31	2	88V C.T. @ 28MA	44V @ 56MA
LP 88-65-B17	6	88V C.T. @ 65MA	44V @ 130MA
LP 88-130-B18	12	88V C.T. @ 130MA	44V @ 260MA
LP 120-20-B32	2	120V C.T. @ 20MA	60V @ 40MA
LP 120-50-B19	6	120V C.T. @ 50MA	60V @ 100MA
LP 120-100-B20	12	120V C.T. @ 100MA	60V @ 200MA
LP 230-10-B33	2	230V C.T. @ 10MA	115V @ 20MA
LP 230-25-B21	6	230V C.T. @ 25MA	115V @ 50MA
LP 230-50-B22	12	230V C.T. @ 50MA	115V @ 100MA

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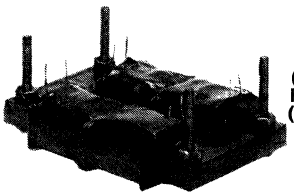
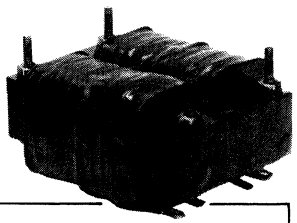
LO-PROFILE Hi-Power Humbucking Transformers



Varnish Finish (Standard)

(Plug-In P.C. Leads)
H.B. Size I
(20VA — .85" High)



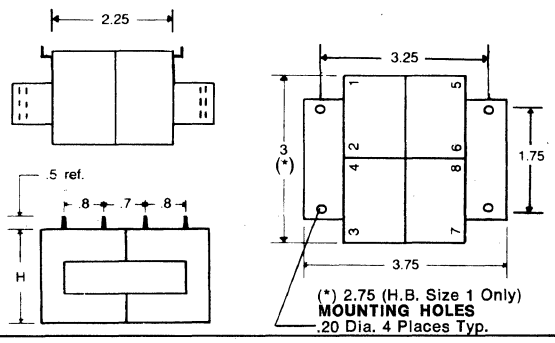
(Solder Terminals)
H.B. Size IV
(135VA — 1.85" High)

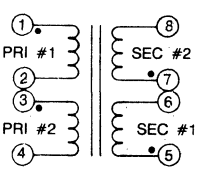
- PLUG-IN P.C. LEADS OR SOLDER TERMINALS
- SIDE-BY-SIDE BOBBINS
- 20VA TO 200VA • 115/230V @ 50/60Hz
- 1.5KV RMS HIPOT • CLASS B (130°C)

ADVANTAGES:

- Side-By-Side Bobbins (Secondary Wound alongside of Primary) Lower Interwinding Capacitance — eliminates the need for electro-static shield
- Hum-bucking (Semi-Toroidal) Construction [Lower Radiated Magnetic Fields, Balanced Wdgs., Larger Heat Radiating Surface and Lower Center of Gravity]
- High Power for Low Panel Heights and Narrow Card Spacing

P.C. LEADS LAYOUT (.03 Dia-Typ < 2.5A)
SOLDER TERMINALS (.5-1-.5) Approx. Spacing





H.B. Size	H (Max.)	Wt. (lbs.) (Approx.)	VA (Nom.)	Reg. (%) (Typ.)	T. Rise (°C) (Typ.)
I	.850	1.00	20	30	25
II	1.25	1.75	50	30	45
III	1.50	2.25	75	25	55
IV	1.85	3.00	135	20	65
V	2.35	4.25	200	15	75

PLUG IN PC LEADS: Standard for currents up to 2.5A.

SOLDER TERMINAL: Standard for currents over 2.5A but available on all units.

MOUNTING: (4) Lamination Holes .20 Dia. Insulated hardware required.

RATINGS PER SECONDARY OUTPUT: VA-SEC = 0.5 x VA (Output) • V-SEC = V-SEC (Parallel) • I-SEC = I-SEC (Series)

NON-STANDARD RATINGS: Tapped primaries, secondaries different voltages, currents or frequencies can be furnished.

Units with higher VA ratings up to 1.25 KVA can also be supplied.

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

DUAL PRI. 115/230V 50/60 Hz Part No.	H.B. Size	FIVE STOCK SIZES SECONDARY RMS RATING Series	Parallel
LP 10-234*	I	10 V C.T. @ 2A•	5 V @ 4A
LP 10-535*	II	10 V C.T. @ 5A	5 V @ 10A
LP 10-7.536*	III	10 V C.T. @ 7.5A	5 V @ 15A
LP 10-13.537*	IV	10 V C.T. @ 13.5A	5 V @ 27A
LP 10-2038*	V	10 V C.T. @ 20A	5 V @ 40A
LP 12-1.639*	I	12.6 V C.T. @ 1.6A•	6.3 V @ 3.2A
LP 12-440*	II	12.6 V C.T. @ 4A	6.3 V @ 8A
LP 12-641*	III	12.6 V C.T. @ 6A	6.3 V @ 12A
LP 12-1142*	IV	12.6 V C.T. @ 11A	6.3 V @ 22A
LP 12-1643*	V	12.6 V C.T. @ 16A	6.3 V @ 32A
LP 16-1.2544*	I	16 V C.T. @ 1.25A•	8 V @ 2.5A
LP 16-3.1545*	II	16 V C.T. @ 3.15A	8 V @ 6.3A
LP 16-4.7546*	III	16 V C.T. @ 4.75A	8 V @ 9.5A
LP 16-8.547*	IV	16 V C.T. @ 8.5A	8 V @ 17A
LP 16-12.548*	V	16 V C.T. @ 12.5A	8 V @ 25A
LP 20-149*	I	20 V C.T. @ 1A•	10 V @ 2A
LP 20-2.550*	II	20 V C.T. @ 2.5A•	10 V @ 5A
LP 20-3.7551*	III	20 V C.T. @ 3.75A	10 V @ 7.5A
LP 20-6.7552*	IV	20 V C.T. @ 6.75A	10 V @ 13.5A
LP 20-1053*	V	20 V C.T. @ 10A	10 V @ 20A
LP 24-0.8554*	I	24 V C.T. @ 0.85A•	12 V @ 1.7A
LP 24-2.155*	II	24 V C.T. @ 2.1A•	12 V @ 4.2A
LP 24-3.1556*	III	24 V C.T. @ 3.15A	12 V @ 6.3A
LP 24-5.7557*	IV	24 V C.T. @ 5.75A	12 V @ 11.5A
LP 24-8.558*	V	24 V C.T. @ 8.5A	12 V @ 17A
LP 34-0.659*	I	34 V C.T. @ 0.6A•	17 V @ 1.2A
LP 34-1.560*	II	34 V C.T. @ 1.5A•	17 V @ 3A
LP 34-2.2561*	III	34 V C.T. @ 2.25A•	17 V @ 4.5A
LP 34-462*	IV	34 V C.T. @ 4A	17 V @ 8A
LP 34-663*	V	34 V C.T. @ 6A	17 V @ 12A
LP 40-0.564*	I	40 V C.T. @ 0.5A•	20 V @ 1A
LP 40-1.2565*	II	40 V C.T. @ 1.25A•	20 V @ 2.5A
LP 40-1.966*	III	40 V C.T. @ 1.9A•	20 V @ 3.8A
LP 40-3.467*	IV	40 V C.T. @ 3.4A	20 V @ 6.8A
LP 40-568*	V	40 V C.T. @ 5A	20 V @ 10A
LP 56-0.3569*	I	56 V C.T. @ 0.35A•	28 V @ 0.7A
LP 56-0.970*	II	56 V C.T. @ 0.9A•	28 V @ 1.8A
LP 56-1.3571*	III	56 V C.T. @ 1.35A•	28 V @ 2.7A
LP 56-2.472*	IV	56 V C.T. @ 2.4A•	28 V @ 4.8A
LP 56-3.573*	V	56 V C.T. @ 3.5A	28 V @ 7A
LP 88-0.2374*	I	88 V C.T. @ 0.23A•	44 V @ 0.46A
LP 88-0.57575*	II	88 V C.T. @ 0.575A•	44 V @ 1.15A
LP 88-0.8576*	III	88 V C.T. @ 0.85A•	44 V @ 1.7A
LP 88-1.577*	IV	88 V C.T. @ 1.5A•	44 V @ 3A
LP 88-2.378*	V	88 V C.T. @ 2.3A•	44 V @ 4.6A
LP 120-0.1779*	I	120 V C.T. @ 0.17A•	60 V @ 0.34A
LP 120-0.42580*	II	120 V C.T. @ 0.425A•	60 V @ 0.85A
LP 120-0.62581*	III	120 V C.T. @ 0.625A•	60 V @ 1.25A
LP 120-1.182*	IV	120 V C.T. @ 1.1A•	60 V @ 2.2A
LP 120-1.783*	V	120 V C.T. @ 1.7A•	60 V @ 3.4A
LP 230-0.0984*	I	230 V C.T. @ 0.09A•	115 V @ 0.18A
LP 230-0.2285*	II	230 V C.T. @ 0.22A•	115 V @ 0.44A
LP 230-0.32586*	III	230 V C.T. @ 0.325A•	115 V @ 0.65A
LP 230-0.687*	IV	230 V C.T. @ 0.6A•	115 V @ 1.2A
LP 230-0.988*	V	230 V C.T. @ 0.9A•	115 V @ 1.8A

* **HOW TO ORDER:** Select Part Number from table and specify terminations PC or ST (Solder Terminal). • These sizes are available in PC or ST. All others ST terminal only.

725 Federal Avenue, Kenilworth, New Jersey 07033 • (201) 245-3200 • (800) 526-4048 • TWX 710-996-5993

EWC® INC.

Split-Bobbin Dual Chokes
Split-Bobbin Isolation Transformers & Auto Transformers

SPLIT BOBBIN DUAL CHOKES FOR RECTIFIER POWER CIRCUITS

UL Class B (130°C) — Open Frame (STD)
0.1 AD.C to 100 AD.C — 1500V RMS Hipot

RATINGS PARALLEL (DUAL CHOKES)

L = 0.25 x IND (Series: I-DC = 2 x AMPS (Series)
RDC = 0.25 x OHMS (Series): ET = 0.5 x ET (Series)

Rectifier Power Choke (Two For One)	Series (Nom Values) Inductance (MHY)	I-DC (Amps)	DCR (Ohms)	ET (Volt-sec) Series	Mtg. Style (OF)	Size
RP-CL 0.1/0.2	3000	0.1	280	0.4	C	I
RP-CM 0.1/0.2	6000	0.1	360	0.75	C	II
RP-CH 0.1/0.2	14,000	0.1	500	1.75	C	IV
RP-CL 0.25/0.5	480	0.25	44	0.15	C	I
RP-CM 0.25/0.5	1500	0.25	72	0.5	C	III
RP-CH 0.25/0.5	3200	0.25	96	1.0	C	V
RP-CL 0.5/1	240	0.5	14	0.15	C	II
RP-CM 0.5/1	560	0.5	20	0.35	C	IV
RP-CH 0.5/1	1200	0.5	36	0.80	C	VI
RP-CL 1/2	100	1.0	4.4	0.125	C	III
RP-CM 1/2	200	1.0	6.0	0.25	C	V
RP-CH 1/2	380	1.0	8.0	0.50	C	VII
RP-CL 2/4	25	2.0	1.1	0.06	C	III
RP-CM 2/4	50	2.0	1.4	0.125	C	V
RP-CH 2/4	160	2.0	3.0	0.40	C	VIII
RP-CL 4/8	8.4	4.0	0.3	0.045	C	IV
RP-CM 4/8	24	4.0	0.5	0.125	C	VII
RP-CH 4/8	68	4.0	1.00	0.30	B	IX
RP-CL 6/12	7.2	6.0	0.2	0.065	C	VI
RP-CM 6/12	17	6.0	0.3	0.125	C	VIII
RP-CH 6/12	28	6.0	0.4	0.20	B	IX
RP-CL 8/16	10	8.0	0.18	0.10	C	VIII
RP-CM 8/16	26	8.0	0.36	0.25	B	X
RP-CH 8/16	76	8.0	0.56	0.75	B	XIV
RP-CL 10/20	6	10	0.10	0.075	C	VIII
RP-CM 10/20	22	10	0.28	0.25	B	XI
RP-CH 10/20	46	10	0.34	0.55	B	XIV
RP-CL 12/24	4.6	12	0.072	0.06	C	VIII
RP-CM 12/24	15	12	0.18	0.20	B	XI
RP-CH 12/24	32	12	0.22	0.45	B	XIV
RP-CL 15/30	4	15	0.064	0.08	B	IX
RP-CM 15/30	16	15	0.14	0.30	B	XII
RP-CH 15/30	32	15	0.22	0.55	B	XVI
RP-CL 25/50	1.7	25	0.028	0.05	B	IX
RP-CM 25/50	6.8	25	0.056	0.20	B	XIV
RP-CH 25/50	12	25	0.080	0.35	B	XVI
RP-CL 50/100	0.9	50	0.012	0.055	B	XI
RP-CM 50/100	1.7	50	0.014	0.10	B	XIV
RP-CH 50/100	3.0	50	0.020	0.175	B	XVI

SPLIT BOBBIN ISOLATION TRANSFORMERS

3 VA to 1.25 KVA (50/60 Hz) 230V/230V or 115V/115V or 230V/115V or 115V/230V 1.5 KV RMS Hipot — UL Class B (130°C) Open or Enclosed.

Isolation Transformer (Four For One)	VA Max.	Mtg. Style (OF)	Mtg. Style (EF)	Size
IT 200.3	3	C	EC	I
IT 200.7	7	C	EC	II
IT 201.5	15	C	EC	III
IT 202.5	25	C	EB-V	IV
IT 204	40	C	EB-V	V
IT 206	60	C	EB-V	VI
IT 208	80	C	EB-V	VII
IT 212	120	C	EB-V	VIII
IT 218	180	B	EB-V	IX
IT 225	250	B	EB-V	X
IT 235	350	B	EB-V	XI
IT 255	550	B	EB-V	XII
IT 280	800	B	EB-V	XIV
IT 2125	1250	B	EB-V	XV

ISOLATION TRANSFORMER PART NO. SYSTEM

IT—(VA Part No.)—OF: (Four For One)—Std
IT—(VA Part No.)—EF-1: (115V/115V)—Std
IT—(VA Part No.)—EF-2: (230V/230V)—Std
IT—(VA Part No.)—EF-12: (115V/230V)—Non Std
IT—(VA Part No.)—EF-21: (230V/115V)—Non Std

BOBBIN AUTO TRANSFORMERS

10 VA to 2.5 KVA (50-500 Hz) Step Down: 230V/115V or Step Up: 115V/230V 1.5 KV RMS Hipot — UL Class B (130°C) Open or Enclosed.

Auto Transformer (Two For One)	VA Max.	Mtg. Style (OF)	Mtg. Style (EF)	Size
AT 101	10	C	EC	I
AT 102	20	C	EC	II(a)
AT 104	40	C	EC	III
AT 107	70	C	EB-V	IV
AT 110	100	C	EB-V	V
AT 112	120	C	EB-V	V(a)
AT 115	150	C	EB-V	VI
AT 120	200	C	EB-V	VII
AT 125	250	C	EB-V	VIII
AT 135	350	B	EB-V	IX
AT 150	500	B	EB-V	IX(a)
AT 175	750	B	EB-V	IX(b)
AT 1100	1000	B	EB-V	XII
AT 1120	1200	B	EB-V	XIII
AT 1150	1500	B	EB-V	XIV
AT 1250	2500	B	EB-V	XV

AUTO TRANSFORMER PART NO. SYSTEM

AT——(VA Part No.)—OF: (Two For One)—Std
AT—(VA Part No.) EF-SD: (Step Down)—Std
AT—(VA Part No.)—EF-SU: (Step Up)—Non Std

MECHANICAL DIMENSIONS

Size	RPT (Max.) VA	RPT (Max.) REG (%)	Wt (#) OF (Approx)	Mtg. Scr.	Mtg. Styles See RPT Data Sheet	W OF (Approx)	W EF (Nom)	C : EC : B L (Nom)	C : EC : B H (Nom)	C : EC : B ML (Nom)	B:B-V MW (Nom)	C-V : B-V : EB-V L (Nom)	C-V : B-V : EB-V H (Nom)	C-V : B-V : EB-V ML (Nom)	EB-V MW (Nom)
I	2.5	30	.25	#8	C:EC	1¼	1⅜	2 1/16	1 3/16	1¾	—	—	—	—	—
II	6.5	25	.375	#8	C:EC:C-V	1⅜	1¾	2⅜	1⅜	2	—	2	1 11/16	1 23/32	—
II(a)	—	—	.5	#8	C:EC	1½	1⅞	2⅜	1⅜	2	—	—	—	—	—
III	13	25	.625	#8	C:EC:C-V	1½	1⅞	2 13/16	1⅝	2⅜	—	2 1/16	1 13/16	2	—
IV	25	25	1.0	#8	C:C-V	1⅝	—	3¼	1 15/16	2 13/16	—	2⅞	2 5/16	2⅜	—
IV	—	—	—	#8	EB-V	—	2⅛	—	—	—	—	1⅞	2¼	1½	1 5/16
V	40	25	1.25	#8	C:C-V	1⅞	—	3¼	1 15/16	2 13/16	—	2⅞	2 5/16	2⅜	—
V	—	—	—	#8	EB-V	—	2⅜	—	—	—	—	1⅞	2¼	1½	1 5/16
V(a)	—	—	1.5	#8	C:EB-V	2⅛	2⅝	3¼	1 13/16	2 13/16	—	1⅞	2¼	1½	1 13/16
VI	65	20	1.75	#8	C:C-V	2	—	3 11/16	2¼	3⅛	—	3⅛	2 11/16	2 13/16	—
VI	65	20	1.75	#8	B:B-V:EB-V	2	2 1/16	2⅝	2 3/16	2 3/16	2	2 3/16	2⅝	1¾	1 1/16
VII	90	20	2.5	#8	C:C-V	2¼	—	4	2 5/16	3 5/16	—	3 5/16	3 1/16	3⅛	—
VII	90	20	2.5	#8	B:B-V:EB-V	2¼	2 11/16	3	2½	2½	2	2½	3	2	1 11/16
VIII	130	15	3.5	#8	C	2½	—	4½	2⅞	4	—	—	—	—	—
VIII	130	15	3.5	#8	B:B-V:EB-V	2½	3 3/16	3⅜	2 13/16	2 13/16	2⅛	2 13/16	3⅜	2¼	2
IX	185	15	4.75	#8	B:B-V:EB-V	2¾	3 7/16	3¾	3⅛	3⅛	2¼	3⅛	3¾	2½	2 3/16
IX(a)	—	—	6.0	#10	B:B-V:EB-V	3¼	3 15/16	3¾	3⅛	3⅛	2¾	3⅛	3¾	2½	2 11/16
IX(b)	—	—	8.0	#10	B:B-V:EB-V	4	4⅝	3¾	3⅛	3⅛	3 3/16	3⅛	3¾	2½	3⅜
X	270	10	6.25	#10	B:B-V:EB-V	3	3 13/16	4⅛	3 7/16	3 7/16	2⅜	3 7/16	4⅛	2¾	2 11/16
XI	360	10	8.0	#10	B:B-V:EB-V	3¼	3 15/16	4½	3¾	3¾	2½	3¾	4½	3	2 13/16
XII	550	7½	12.0	#10	B:B-V:EB-V	4¼	4 15/16	4½	3¾	3¾	3½	3¾	4½	3	3 13/16
XIII	575	7½	12.5	¼	B:B-V:EB-V	3¾	4⅞	5¼	4⅜	4⅜	2⅞	4⅜	5¼	3½	3¼
XIV	825	5	17.0	¼	B:B-V:EB-V	4½	5⅝	5¼	4⅜	4⅜	3⅝	4⅜	5¼	3½	4
XV	1600	5	25.0	¼	B:B-V:EB-V	6	7⅛	5¼	4⅜	4⅜	5⅛	4⅜	5¼	3½	5½
XVI	1500	5	22.5	¼	B:B-V	4½	—	6⅜	5 5/16	5 5/16	3¼	5 5/16	6⅜	4¼	—

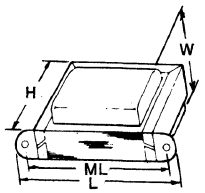
For special requirements please contact our Engineering Departments at listed telephone numbers or addresses.
EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

EWC® INC. 725 FEDERAL AVENUE, KENILWORTH, NJ 07033 • (201) 245-3200 TWX 710-996-5993 800-526-4048

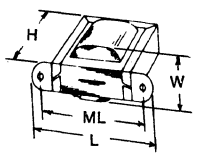
Recognized Component
Underwriters Labs, Inc.

Split-Bobbin Rectifier Power Transformers

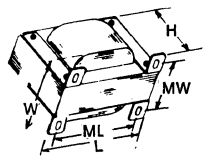
End Covers & Channels — (2) Mtg. Holes. End Bells & L-BKTS — (4) Mtg. Slots.



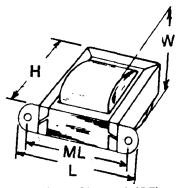
Horiz. End Covers (EF)
(Mtg. Style: EC)
(STD. SIZE I-III) (AT & IT only)



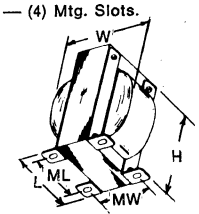
Horiz. Channel (OF)
(Mtg. Style: C)
(STD: SIZE I-VIII)
(STD: SZE I-VII) (RPT)



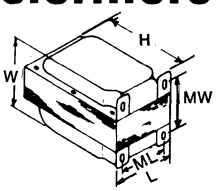
Horiz. L-BKT (OF)
(Mtg. Style: B)
(STD: SIZE IX-XVI)
(STD: SIZE VIII-XVI) (RPT)



Vert. Channel (OF)
(Mtg. Style: C-V)



Vert. L-BKT (OF)
(Mtg. Style: B-V)



Vert. End Bells (EF)
(Mtg. Style: EB-V)
(STD: SIZE IV-XV) (AT & IT only)

1 VA to 1.5 KVA — 115V @ 50/60 Hz Primary **1500V RMS Hipot — UL Class B (130°C) — Open Frame (STD)**

Primary 115V 50/60 Hz	Secondary Ratings (RMS) Series	Secondary Ratings (RMS) Parallel	Mtg. Style	Size
RPT 10-0.1	10V C.T. @ 0.1A	5V C.T. @ 0.2A	C	I
RPT 10-0.25	10V C.T. @ 0.25A	5V C.T. @ 0.5A	C	I
RPT 10-0.5	10V C.T. @ 0.5A	5V C.T. @ 1A	C	II
RPT 10-1	10V C.T. @ 1A	5V C.T. @ 2A	C	III
RPT 10-2	10V C.T. @ 2A	5V C.T. @ 4A	C	IV
RPT 10-4	10V C.T. @ 4A	5V C.T. @ 8A	C	V
RPT 10-6	10V C.T. @ 6A	5V C.T. @ 12A	C	VI
RPT 10-8	10V C.T. @ 8A	5V C.T. @ 16A	C	VII
RPT 10-12	10V C.T. @ 12A	5V C.T. @ 24A	B	VIII
RPT 10-15	10V C.T. @ 15A	5V C.T. @ 30A	B	IX
RPT 10-25	10V C.T. @ 25A	5V C.T. @ 50A	B	X
RPT 10-30	10V C.T. @ 30A	5V C.T. @ 60A	B	XI
RPT 10-50	10V C.T. @ 50A	5V C.T. @ 100A	B	XII
RPT 10-75	10V C.T. @ 75A	5V C.T. @ 150A	B	XIV
RPT 10-100	10V C.T. @ 100A	5V C.T. @ 200A	B	XVI
RPT 12.8-0.1	12.8V C.T. @ 0.1A	6.4V C.T. @ 0.2A	C	I
RPT 12.8-0.25	12.8V C.T. @ 0.25A	6.4V C.T. @ 0.5A	C	II
RPT 12.8-0.5	12.8V C.T. @ 0.5A	6.4V C.T. @ 1A	C	II
RPT 12.8-1	12.8V C.T. @ 1A	6.4V C.T. @ 2A	C	III
RPT 12.8-2	12.8V C.T. @ 2A	6.4V C.T. @ 4A	C	V
RPT 12.8-4	12.8V C.T. @ 4A	6.4V C.T. @ 8A	C	VI
RPT 12.8-6	12.8V C.T. @ 6A	6.4V C.T. @ 12A	C	VII
RPT 12.8-8	12.8V C.T. @ 8A	6.4V C.T. @ 16A	B	VIII
RPT 12.8-12	12.8V C.T. @ 12A	6.4V C.T. @ 24A	B	IX
RPT 12.8-20	12.8V C.T. @ 20A	6.4V C.T. @ 40A	B	X
RPT 12.8-25	12.8V C.T. @ 25A	6.4V C.T. @ 50A	B	XI
RPT 12.8-50	12.8V C.T. @ 50A	6.4V C.T. @ 100A	B	XIV
RPT 12.8-100	12.8V C.T. @ 100A	6.4V C.T. @ 200A	B	XVI
RPT 16-0.1	16V C.T. @ 0.1A	8V C.T. @ 0.2A	C	I
RPT 16-0.25	16V C.T. @ 0.25A	8V C.T. @ 0.5A	C	II
RPT 16-0.5	16V C.T. @ 0.5A	8V C.T. @ 1A	C	III
RPT 16-1	16V C.T. @ 1A	8V C.T. @ 2A	C	IV
RPT 16-2	16V C.T. @ 2A	8V C.T. @ 4A	C	V
RPT-16-4	16V C.T. @ 4A	8V C.T. @ 8A	C	VI
RPT 16-6	16V C.T. @ 6A	8V C.T. @ 12A	B	VIII
RPT 16-8	16V C.T. @ 8A	8V C.T. @ 16A	B	VIII
RPT 16-10	16V C.T. @ 10A	8V C.T. @ 20A	B	IX
RPT 16-12	16V C.T. @ 12A	8V C.T. @ 24A	B	X
RPT 16-20	16V C.T. @ 20A	8V C.T. @ 40A	B	XI
RPT 16-25	16V C.T. @ 25A	8V C.T. @ 50A	B	XII
RPT 16-50	16V C.T. @ 50A	8V C.T. @ 100A	B	XIV
RPT 16-75	16V C.T. @ 75A	8V C.T. @ 150A	B	XVI
RPT 24-0.1	24V C.T. @ 0.1A	12V C.T. @ 0.2A	C	I
RPT 24-0.25	24V C.T. @ 0.25A	12V C.T. @ 0.5A	C	II
RPT 24-0.5	24V C.T. @ 0.5A	12V C.T. @ 1A	C	III
RPT 24-1	24V C.T. @ 1A	12V C.T. @ 2A	C	IV
RPT 24-2	24V C.T. @ 2A	12V C.T. @ 4A	C	VI
RPT 24-3	24V C.T. @ 3A	12V C.T. @ 6A	C	VII
RPT 24-4	24V C.T. @ 4A	12V C.T. @ 8A	B	VIII
RPT 24-6	24V C.T. @ 6A	12V C.T. @ 12A	B	IX
RPT 24-8	24V C.T. @ 8A	12V C.T. @ 16A	B	X
RPT 24-12	24V C.T. @ 12A	12V C.T. @ 24A	B	XI
RPT 24-20	24V C.T. @ 20A	12V C.T. @ 40A	B	XII
RPT 24-25	24V C.T. @ 25A	12V C.T. @ 50A	B	XIV
RPT 24-50	24V C.T. @ 50A	12V C.T. @ 100A	B	XVI
RPT 36-0.1	36V C.T. @ 0.1A	18V C.T. @ 0.2A	C	II
RPT 36-0.25	36V C.T. @ 0.25A	18V C.T. @ 0.5A	C	III
RPT 36-0.5	36V C.T. @ 0.5A	18V C.T. @ 1A	C	IV
RPT 36-1	36V C.T. @ 1A	18V C.T. @ 2A	C	VI
RPT 36-2	36V C.T. @ 2A	18V C.T. @ 4A	C	VII
RPT 36-3	36V C.T. @ 3A	18V C.T. @ 6A	B	VIII
RPT 36-4	36V C.T. @ 4A	18V C.T. @ 8A	B	IX
RPT 36-6	36V C.T. @ 6A	18V C.T. @ 12A	B	X
RPT 36-8	36V C.T. @ 8A	18V C.T. @ 16A	B	XI
RPT 36-12	36V C.T. @ 12A	18V C.T. @ 24A	B	XII
RPT 36-20	36V C.T. @ 20A	18V C.T. @ 40A	B	XIV
RPT 36-25	36V C.T. @ 25A	18V C.T. @ 50A	B	XVI
RPT 36-30	36V C.T. @ 30A	18V C.T. @ 60A	B	XVI
RPT 56-01	56V C.T. @ 0.1A	28V C.T. @ 0.2A	C	II
RPT 56-0.25	56V C.T. @ 0.25A	28V C.T. @ 0.5A	C	IV
RPT 56-0.5	56V C.T. @ 0.5A	28V C.T. @ 1A	C	V
RPT 56-1	56V C.T. @ 1A	28V C.T. @ 2A	C	VI
RPT 56-2	56V C.T. @ 2A	28V C.T. @ 4A	B	VIII
RPT 56-3	56V C.T. @ 3A	28V C.T. @ 6A	B	IX
RPT 56-4	56V C.T. @ 4A	28V C.T. @ 8A	B	X
RPT 56-6	56V C.T. @ 6A	28V C.T. @ 12A	B	XI
RPT 56-8	56V C.T. @ 8A	28V C.T. @ 16A	B	XII
RPT 56-12	56V C.T. @ 12A	28V C.T. @ 24A	B	XIV
RPT 56-20	56V C.T. @ 20A	28V C.T. @ 40A	B	XVI
RPT 56-25	56V C.T. @ 25A	28V C.T. @ 50A	B	XVI

Primary 115V 50/60 Hz	Secondary Ratings (RMS) Series	Secondary Ratings (RMS) Parallel	Mtg. Style	Size
RPT 68-0.1	68V C.T. @ 0.1A	34V C.T. @ 0.2A	C	III
RPT 68-0.25	68V C.T. @ 0.25A	34V C.T. @ 0.5A	C	IV
RPT 68-0.5	68V C.T. @ 0.5A	34V C.T. @ 1A	C	V
RPT 68-1	68V C.T. @ 1A	34V C.T. @ 2A	C	VII
RPT 68-1.5	68V C.T. @ 1.5A	34V C.T. @ 3A	B	VIII
RPT 68-2	68V C.T. @ 2A	34V C.T. @ 4A	B	IX
RPT 68-3	68V C.T. @ 3A	34V C.T. @ 6A	B	X
RPT 68-4	68V C.T. @ 4A	34V C.T. @ 8A	B	XI
RPT 68-6	68V C.T. @ 6A	34V C.T. @ 12A	B	XII
RPT 68-8	68V C.T. @ 8A	34V C.T. @ 16A	B	XII
RPT 68-12	68V C.T. @ 12A	34V C.T. @ 24A	B	XIV
RPT 68-15	68V C.T. @ 15A	34V C.T. @ 30A	B	XVI
RPT 68-20	68V C.T. @ 20A	34V C.T. @ 40A	B	XVI
RPT 80-0.1	80V C.T. @ 0.1A	40V C.T. @ 0.2A	C	III
RPT 80-0.25	80V C.T. @ 0.25A	40V C.T. @ 0.5A	C	IV
RPT 80-0.5	80V C.T. @ 0.5A	40V C.T. @ 1A	C	VI
RPT 80-1	80V C.T. @ 1A	40V C.T. @ 2A	C	VII
RPT 80-1.5	80V C.T. @ 1.5A	40V C.T. @ 3A	B	VIII
RPT 80-2	80V C.T. @ 2A	40V C.T. @ 4A	B	IX
RPT 80-3	80V C.T. @ 3A	40V C.T. @ 6A	B	X
RPT 80-4	80V C.T. @ 4A	40V C.T. @ 8A	B	XI
RPT 80-6	80V C.T. @ 6A	40V C.T. @ 12A	B	XII
RPT 80-8	80V C.T. @ 8A	40V C.T. @ 16A	B	XIV
RPT 80-12	80V C.T. @ 12A	40V C.T. @ 24A	B	XVI
RPT 88-0.1	88V C.T. @ 0.1A	44V C.T. @ 0.2A	C	III
RPT 88-0.25	88V C.T. @ 0.25A	44V C.T. @ 0.5A	C	IV
RPT 88-0.5	88V C.T. @ 0.5A	44V C.T. @ 1A	C	VI
RPT 88-1	88V C.T. @ 1A	44V C.T. @ 2A	C	VII
RPT 88-2	88V C.T. @ 2A	44V C.T. @ 4A	B	IX
RPT 88-3	88V C.T. @ 3A	44V C.T. @ 6A	B	X
RPT 88-4	88V C.T. @ 4A	44V C.T. @ 8A	B	XI
RPT 88-6	88V C.T. @ 6A	44V C.T. @ 12A	B	XII
RPT 88-8	88V C.T. @ 8A	44V C.T. @ 16A	B	XIV
RPT 88-12	88V C.T. @ 12A	44V C.T. @ 24A	B	XVI
RPT 120-0.1	120V C.T. @ 0.1A	60V C.T. @ 0.2A	C	III
RPT 120-0.25	120V C.T. @ 0.25A	60V C.T. @ 0.5A	C	V
RPT 120-0.5	120V C.T. @ 0.5A	60V C.T. @ 1A	C	VI
RPT 120-1	120V C.T. @ 1A	60V C.T. @ 2A	B	VIII
RPT 120-1.5	120V C.T. @ 1.5A	60V C.T. @ 3A	B	IX
RPT 120-2	120V C.T. @ 2A	60V C.T. @ 4A	B	X
RPT 120-3	120V C.T. @ 3A	60V C.T. @ 6A	B	XI
RPT 120-4	120V C.T. @ 4A	60V C.T. @ 8A	B	XII
RPT 120-6	120V C.T. @ 6A	60V C.T. @ 12A	B	XIV
RPT 120-8	120V C.T. @ 8A	60V C.T. @ 16A	B	XVI
RPT 120-12	120V C.T. @ 12A	60V C.T. @ 24A	B	XVI
RPT 160-0.1	160V C.T. @ 0.1A	80V C.T. @ 0.2A	C	IV
RPT 160-0.25	160V C.T. @ 0.25A	80V C.T. @ 0.5A	C	VI
RPT 160-0.5	160V C.T. @ 0.5A	80V C.T. @ 1A	C	VII
RPT 160-0.75	160V C.T. @ 0.75A	80V C.T. @ 1.5A	B	VIII
RPT 160-1	160V C.T. @ 1A	80V C.T. @ 2A	B	IX
RPT 160-1.5	160V C.T. @ 1.5A	80V C.T. @ 3A	B	X
RPT 160-2	160V C.T. @ 2A	80V C.T. @ 4A	B	XI
RPT 160-4	160V C.T. @ 4A	80V C.T. @ 8A	B	XIV
RPT 160-6	160V C.T. @ 6A	80V C.T. @ 12A	B	XVI
RPT 160-8	160V C.T. @ 8A	80V C.T. @ 16A	B	XVI
RPT 180-0.1	180V C.T. @ 0.1A	90V C.T. @ 0.2A	C	IV
RPT 180-0.25	180V C.T. @ 0.25A	90V C.T. @ 0.5A	C	VI
RPT 180-0.5	180V C.T. @ 0.5A	90V C.T. @ 1A	C	VII
RPT 180-1	180V C.T. @ 1A	90V C.T. @ 2A	B	IX
RPT 180-1.5	180V C.T. @ 1.5A	90V C.T. @ 3A	B	X
RPT 180-2	180V C.T. @ 2A	90V C.T. @ 4A	B	XI
RPT 180-4	180V C.T. @ 4A	90V C.T. @ 8A	B	XIV
RPT 180-6	180V C.T. @ 6A	90V C.T. @ 12A	B	XVI
RPT 180-8	180V C.T. @ 8A	90V C.T. @ 16A	B	XVI
RPT 230-0.1	230V C.T. @ 0.1A	115V C.T. @ 0.2A	C	IV
RPT 230-0.25	230V C.T. @ 0.25A	115V C.T. @ 0.5A	C	VI
RPT 230-0.5	230V C.T. @ 0.5A	115V C.T. @ 1A	B	VIII
RPT 230-0.75	230V C.T. @ 0.75A	115V C.T. @ 1.5A	B	IX
RPT 230-1	230V C.T. @ 1A	115V C.T. @ 2A	B	X
RPT 230-1.5	230V C.T. @ 1.5A	115V C.T. @ 3A	B	XI
RPT 230-2	230V C.T. @ 2A	115V C.T. @ 4A	B	XII
RPT 230-4	230V C.T. @ 4A	115V C.T. @ 8A	B	XVI
RPT 230-6	230V C.T. @ 6A	115V C.T. @ 12A	B	XVI
RPT 300-0.1	300V C.T. @ 0.1A	150V C.T. @ 0.2A	C	V
RPT 300-0.25	300V C.T. @ 0.25A	150V C.T. @ 0.5A	C	VII
RPT 300-0.5	300V C.T. @ 0.5A	150V C.T. @ 1A	B	IX
RPT 300-1	300V C.T. @ 1A	150V C.T. @ 2A	B	XI
RPT 300-2	300V C.T. @ 2A	150V C.T. @ 4A	B	XIV
RPT 300-4	300V C.T. @ 4A	150V C.T. @ 8A	B	XVI

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

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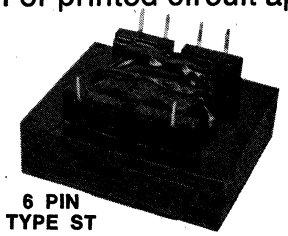
EWC® INC.

Miniature Split-Bobbin Plug-In Power Transformers

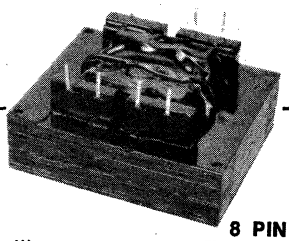
Recognized Component
Underwriters Labs, Inc.

For printed circuit applications

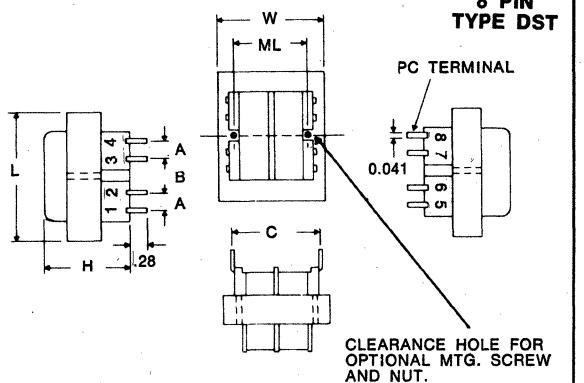


6 PIN
TYPE ST

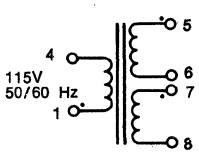
SPLIT BOBBIN — HIGHLY ISOLATED



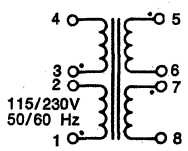
8 PIN
TYPE DST



NOTE: PINS 2 & 3 OMITTED ON SINGLE PRIMARY VERSIONS



6 PIN
TYPE ST



8 PIN
TYPE DST

TRANSFORMERS WOUND ON A SPLIT BOBBIN PERMIT THE PRIMARIES AND SECONDARIES TO BE WOUND SIDE BY SIDE RATHER THAN ONE OVER THE OTHER.

FEATURES ARE:

2500V RMS Hipot
Elimination of electro-static shield
No cross-overs of primary and secondary leads
Class S insulation — 130°C

Transformers can be supplied with single 115V or 115/230V, 50/60 Hz dual primaries. Secondaries can be series or parallel connected.

Size	VA	L	W	H	ML	A	B	C	Lbs.
2	1.1	1 3/8	1 1/8	15/16	—	.250	.250	1.200	0.17
3	2.4	1 3/8	1 1/8	1 3/16	—	.250	.250	1.200	0.25
4	6	1 5/8	1 5/16	1 5/16	1 1/16	.250	.350	1.280	0.44
5	12	1 7/8	1 9/16	1 7/16	1 1/4	.300	.400	1.410	0.70
6	20	2 1/4	1 7/8	1 7/16	1 1/2	.300	.400	1.600	0.80
7	36	2 5/8	2 3/16	1 9/16	†	.400	.400	1.850	1.10

†Size 7 has 4 mtg. holes on 2 3/16 x 1 3/4 centers for a #6 screw. Need not be nylon.

Part Number		Secondary RMS Rating	
Single 115V 6 Pin	Dual 115/230V 8 Pin	Series	Parallel
ST 2-10B41	DST 2-10B41	10V C.T. @ 0.11A	5V @ 0.22A
ST 3-10B1	DST 3-10B1	10V C.T. @ 0.25A	5V @ 0.5A
ST 4-10B2	DST 4-10B2	10V C.T. @ 0.6A	5V @ 1.2A
ST 5-10B3	DST 5-10B3	10V C.T. @ 1.2A	5V @ 2.4A
ST 6-10B4	DST 6-10B4	10V C.T. @ 2A	5V @ 4A
ST 7-10B51	DST 7-10B51	10V C.T. @ 3.6A	5V @ 7.2A
ST 2-12B42	DST 2-12B42	12.6V C.T. @ 0.09A	6.3V @ 0.18A
ST 3-12B5	DST 3-12B5	12.6V C.T. @ 0.2A	6.3V @ 0.4A
ST 4-12B6	DST 4-12B6	12.6V C.T. @ 0.5A	6.3V @ 1.0A
ST 5-12B7	DST 5-12B7	12.6V C.T. @ 1.0A	6.3V @ 2.0A
ST 6-12B8	DST 6-12B8	12.6V C.T. @ 1.6A	6.3V @ 3.2A
ST 7-12B52	DST 7-12B52	12.6V C.T. @ 2.85A	6.3V @ 5.7A
ST 2-16B43	DST 2-16B43	16V C.T. @ 0.07A	8V @ 0.14A
ST 3-16B9	DST 3-16B9	16V C.T. @ 0.15A	8V @ 0.3A
ST 4-16B10	DST 4-16B10	16V C.T. @ 0.4A	8V @ 0.8A
ST 5-16B11	DST 5-16B11	16V C.T. @ 0.8A	8V @ 1.6A
ST 6-16B12	DST 6-16B12	16V C.T. @ 1.25A	8V @ 2.5A
ST 7-16B53	DST 7-16B53	16V C.T. @ 2.25A	8V @ 4.5A
ST 2-20B44	DST 2-20B44	20V C.T. @ 0.055A	10V @ 0.11A
ST 3-20B13	DST 3-20B13	20V C.T. @ 0.12A	10V @ 0.24A
ST 4-20B14	DST 4-20B14	20V C.T. @ 0.3A	10V @ 0.6A
ST 5-20B15	DST 5-20B15	20V C.T. @ 0.6A	10V @ 1.2A
ST 6-20B16	DST 6-20B16	20V C.T. @ 1A	10V @ 2A
ST 7-20B54	DST 7-20B54	20V C.T. @ 1.8A	10V @ 3.6A
ST 2-24B45	DST 2-24B45	24V C.T. @ 0.045A	12V @ 0.09A
ST 3-24B17	DST 3-24B17	24V C.T. @ 0.1A	12V @ 0.2A
ST 4-24B18	DST 4-24B18	24VC.T. @ 0.25A	12V @ 0.5A
ST 5-24B19	DST 5-24B19	24V C.T. @ 0.5A	12V @ 1.0A
ST 6-24B20	DST 6-24B20	24V C.T. @ 0.8A	12V @ 1.6A
ST 7-24B55	DST 7-24B55	24V C.T. @ 1.5A	12V @ 3.0A
ST 2-28B46	DST 2-28B46	28V C.T. @ 0.04A	14V @ 0.08A
ST 3-28B21	DST 3-28B21	28V C.T. @ 0.085A	14V @ 0.17A
ST 4-28B22	DST 4-28B22	28V C.T. @ 0.2A	14V @ 0.4A
ST 5-28B23	DST 5-28B23	28V C.T. @ 0.42A	14V @ 0.84A
ST 6-28B24	DST 6-28B24	28V C.T. @0.7A	14V @ 1.4A
ST 7-28B56	DST 7-28B56	28V C.T. @ 1.3A	14V @ 2.6A
ST 2-36B47	DST 2-36B47	36V C.T. @ 0.03A	18V @ 0.06A
ST 3-36B25	DST 3-36B25	36V C.T. @ 0.065A	18V @ 0.13A
ST 4-36B26	DST 4-36B26	36V C.T. @ 0.17A	18V @ 0.34A
ST 5-36B27	DST 5-36B27	36V C.T. @ 0.35A	18V @ 0.7A
ST 6-36B28	DST 6-36B28	36V C.T. @ 0.55A	18V @ 1.1A
ST 7-36B57	DST 7-36B57	36V C.T. @ 1A	18V @ 2A
ST 2-48B48	DST 2-48B48	48V C.T. @ 0.023A	24V @ 0.046A
ST 3-48B29	DST 3-48B29	48V C.T. @ 0.05A	24V @ 0.1A
ST 4-48B30	DST 4-48B30	48V C.T. @ 0.125A	24V @ 0.25A
ST 5-48B31	DST 5-48B31	48V C.T. @ 0.25A	24V @ 0.5A
ST 6-48B32	DST 6-48B32	48V C.T. @ 0.4A	24V @ 0.8A
ST 7-48B58	DST 7-48B58	48V C.T. @ 0.75A	24V @ 1.5A
ST 2-56B49	DST 2-56B49	56V C.T. @ 0.02A	28V @ 0.04A
ST 3-56B33	DST 3-56B33	56V C.T. @ 0.045A	28V @ 0.09A
ST 4-56B34	DST 4-56B34	56V C.T. @ 0.11A	28V @ 0.22A
ST 5-56B35	DST 5-56B35	56V C.T. @ 0.22A	28V @ 0.44A
ST 6-56B36	DST 6-56B36	56V C.T. @ 0.35A	28V @ 0.7A
ST 7-56B59	DST 7-56B59	56V C.T. @ 0.65A	28V @ 1.3A
ST 2-120B50	DST 2-120B50	120V C.T. @ 0.01A	60V @ 0.02A
ST 3-120B37	DST 3-120B37	120V C.T. @ 0.02A	60V @ 0.04A
ST 4-120B38	DST 4-120B38	120V C.T. @ 0.05A	60V @ 0.1A
ST 5-120B39	DST 5-120B39	120V C.T. @ 0.1A	60V @ 0.2A
ST 6-120B40	DST 6-120B40	120V C.T. @ 0.16A	60V @ 0.32A
ST 7-120B60	DST 7-120B60	120V C.T. @ 0.3A	60V @ 0.6A

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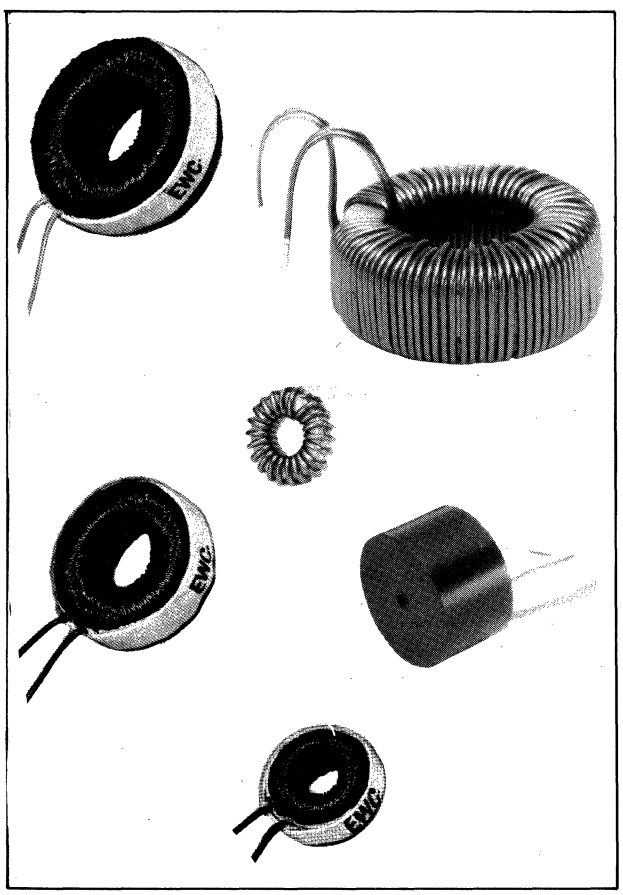
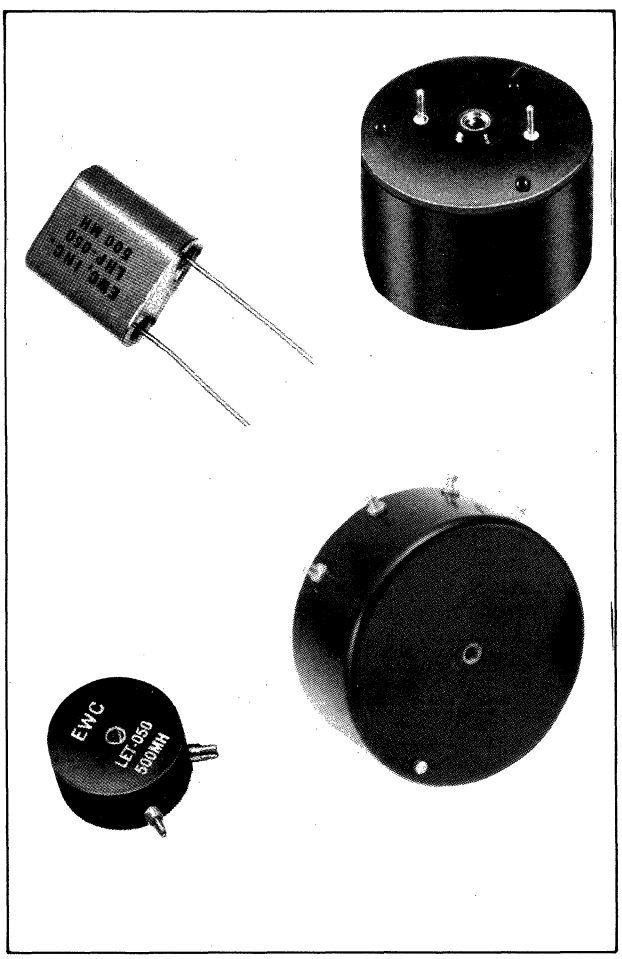


MILITARY

- Experience — over 20 years on programs such as B1B, F16, JTIDS, Space Shuttle, etc.
- Facilities — modern efficient plant



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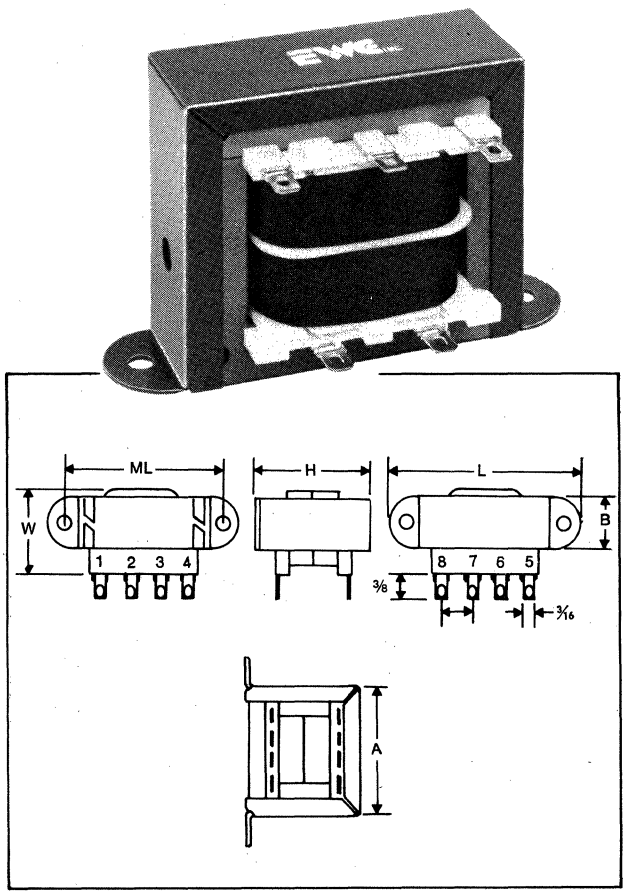

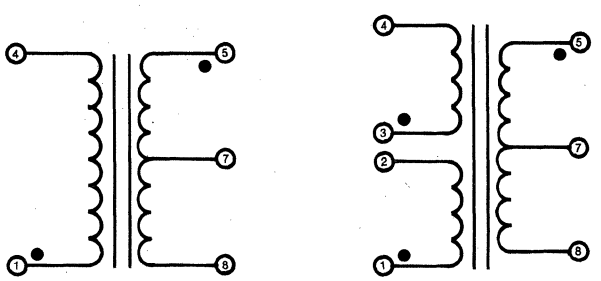

SIZE	VA	L	W	H	A	B	ML	LBS.
3	2.4	2 1/16	1 1/16	1 3/16	1 7/16	9/16	1 3/4	0.25
4	6	2 3/8	1 1/4	1 3/8	1 11/16	11/16	2	0.44
5	12	2 13/16	1 3/8	1 5/8	1 15/16	13/16	2 3/8	0.7
6	30	3 1/4	1 11/16	1 15/16	2 5/16	1 1/16	3 13/16	1.1
7	56	3 11/16	1 13/16	2 1/4	2 11/16	1 1/16	3 1/8	1.7
8	100	4 1/32	2 1/4	2 9/16	3 1/16	1 5/16	3 9/16	2.75

QUICK CONNECT POWER TRANSFORMERS

2500 Volt RMS Hipot in a variety of practical sizes. Maximum operating temperature 130°C available with either single 115 or dual 115/230V primary.

EWC's split bobbin and non-concentric winding provide better insulation and high signal isolation, thus eliminating the need for electrostatic shielding.

Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.

PART NUMBER		SECONDARY RMS RATING
SINGLE 115V	DUAL 115/230V	
241-3-10A1	Not Available	10V C.T. @ 0.25A
241-4-10A11	DP 241-4-10A11	10V C.T. @ 0.6A
241-5-10A21	DP 241-5-10A21	10V C.T. @ 1.2A
241-6-10A31	DP 241-6-10A31	10V C.T. @ 3.0A
241-7-10A41	DP 241-7-10A41	10V C.T. @ 5.0A
241-8-10A51	DP 241-8-10A51	10V C.T. @ 10A
241-3-12A2	Not Available	12.6V C.T. @ 0.2A
241-4-12A12	DP 241-4-12A12	12.6V C.T. @ 0.5A
241-5-12A22	DP 241-5-12A22	12.6V C.T. @ 1.0A
241-6-12A32	DP 241-6-12A32	12.6V C.T. @ 2.5A
241-7-12A42	DP 241-7-12A42	12.6V C.T. @ 4.0A
241-8-12A52	DP 241-8-12A52	12.6V C.T. @ 8.0A
241-3-16A3	Not Available	16V C.T. @ 0.15A
241-4-16A13	DP 241-4-16A13	16V C.T. @ 0.4A
241-5-16A23	DP 241-5-16A23	16V C.T. @ 0.8A
241-6-16A33	DP 241-6-16A33	16V C.T. @ 2.0A
241-7-16A43	DP 241-7-16A43	16V C.T. @ 3.5A
241-8-16A53	DP 241-8-16A53	16V C.T. @ 6.25A
241-3-20A4	Not Available	20V C.T. @ 0.12A
241-4-20A14	DP 241-4-20A14	20V C.T. @ 0.3A
241-5-20A24	DP 241-5-20A24	20V C.T. @ 0.6A
241-6-20A34	DP 241-6-20A34	20V C.T. @ 1.5A
241-7-20A44	DP 241-7-20A44	20V C.T. @ 2.8A
241-8-20A54	DP 241-8-20A54	20V C.T. @ 5.0A
241-3-24A5	Not Available	24V C.T. @ 0.1A
241-4-24A15	DP 241-4-24A15	24V C.T. @ 0.25A
241-5-24A25	DP 241-5-24A25	24V C.T. @ 0.5A
241-6-24A35	DP 241-6-24A35	24V C.T. @ 1.25A
241-7-24A45	DP 241-7-24A45	24V C.T. @ 2.4A
241-8-24A55	DP 241-8-24A55	24V C.T. @ 4.0A
241-3-28A6	Not Avalaible	28V C.T. @ 0.085A
241-4-28A16	DP 241-4-28A16	28V C.T. @ 0.2A
241-5-28A26	DP 241-5-28A26	28V C.T. @ 0.42A
241-6-28A36	DP 241-6-28A37	28V C.T. @ 1.1A
241-7-28A44	DP 241-7-28A47	28V C.T. @ 2.0A
241-8-28A56	DP 241-8-28A57	28V C.T. @ 3.6A
241-3-36A7	Not Available	36V C.T. @ 0.65A
241-4-36A17	DP 241-4-36A17	36V C.T. @ 0.17A
241-5-36A27	DP 241-5-36A27	36V C.T. @ 0.35A
241-6-36A37	DP 241-6-36A37	36V C.T. @ 0.85A
241-7-36A47	DP 241-7-36A47	36V C.T. @ 1.5A
241-8-36A57	DP 241-8-36A57	36V C.T. @ 2.8A
241-3-48A8	Not Available	48V C.T. @ 0.05A
241-4-48A18	DP 241-4-48A18	48V C.T. @ 0.125A
241-5-48A28	DP 241-5-48A28	48V C.T. @ 0.25A
241-5-48A38	DP 241-6-48A38	48V C.T. @ 0.53A
241-7-48A48	DP 241-7-48A48	48V C.T. @ 1.2A
241-8-48A58	DP 241-8-48A58	48V C.T. @ 2.0A
241-3-56A9	Not Available	56V C.T. @ 0.45A
241-4-56A19	DP 241-4-56A19	56V C.T. @ 0.11A
241-5-56A29	DP 241-5-56A29	56V C.T. @ 0.22A
241-6-56A39	DP 241-6-56A39	56V C.T. @ 0.54A
241-7-56A49	DP 241-7-56A49	56V C.T. @ 1.0A
241-8-56A59	DP 241-8-56A59	56V C.T. @ 1.8A
241-3-120A10	Not Available	120V C.T. @ 0.02A
241-4-120A20	DP 241-4-120A20	120V C.T. @ 0.05A
241-5-120A30	DP 241-5-120A30	120V C.T. @ 0.1A
241-6-120A40	DP 241-6-120A40	120V C.T. @ 0.25A
241-7-120A50	DP 241-7-120A50	120V C.T. @ 0.5A
241-8-120A60	DP 241-8-120A60	120V C.T. @ 0.85A

Eplanation of part number series 241 Size-4 Sec. Volts — 36 Prefix "DP" used in dual primary versions.

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EWC® INC.

FLEX-CORE DIV.
MORLAN & ASSOCIATES, INC.
6625 McVEY BLVD. — WORTHINGTON, OHIO 43085
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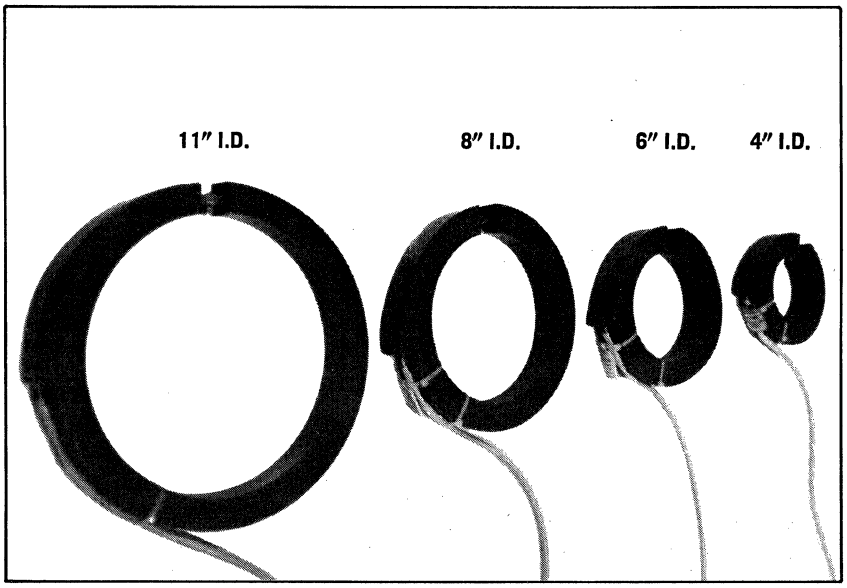
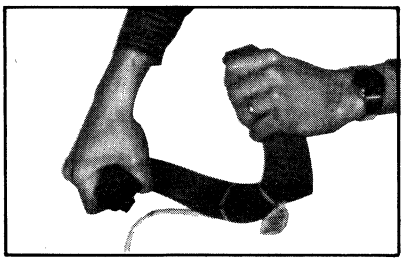
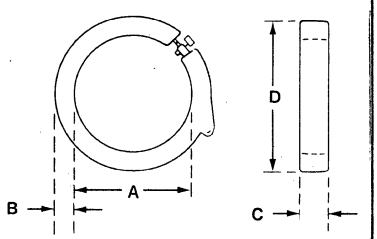
SPLIT-CORE CURRENT TRANSFORMERS





NOTE: Open split-core with a twisting motion only.

- OTHER RATIOS AVAILABLE
- FOUR OPENING SIZES
- 1, 3, OR 5 AMP SECONDARIES
- DUAL TAP RATIOS AVAILABLE
- ALL RATIOS STOCKED
- LOOP COIL MULTIPLIER AVAILABLE



A	B	C	D
4"	1¼"	1½"	6½"
6"	1¼"	1½"	8½"
8"	1¼"	1½"	10½"
11"	1¼"	1½"	13½"

DESCRIPTION: This split-core current transformer was designed for easy installation on large bus or wire conductors in order to make electrical load surveys or for continuous monitoring of current.

APPLICATION: To be used with any 5 amp indicating or recording ammeter or amp or watt transducer. Also useable with indicating or recording clamp-on ammeter.

CONSTRUCTION: Directional silicon steel is used for the flexible core. Secondary windings are of copper. Unit is encapsulated in silicon rubber which protects against moisture, dirt, oil and corona. Remains flexible from −45° to +200°C.

INSULATION LEVEL: 600VAC — can be used over insulated conductors on higher voltage circuits.

SAFETY FACTOR: Secondary voltage limited to less than 50VAC when secondary leads are open circuited.

SECONDARY LEADS: 12 feet long with spade connectors.

COLOR: Transformer (red) — leads (yellow).

CURRENT RATIO	INSIDE DIAMETER 4"	6"	8"	11"	BURDEN CAPACITY	ACCURACY	THERMAL FACTOR	OTHER APPLICATIONS
300/5	X	X	—	—	2VA	4%	1.25	• WATT TRANSDUCER • CURRENT TRANSDUCER • KWH METER • DEMAND METER • ENERGY MANAGEMENT SYSTEMS • POWER FACTOR METER • CURRENT SENSING RELAYS
400/5	X	X	—	—	2VA	4%	1.25	
500/5	X	X	—	—	3VA	3%	1.25	
600/5	X	X	—	—	3VA	3%	1.25	
800/5	X	X	—	—	5VA	2%	1.5	
1000/5	X	X	—	—	10VA	2%	2.0	
1200/5	X	X	—	—	10VA	2%	2.0	
1500/5	X	X	X	—	10VA	2%	2.0	
2000/5	X	X	X	—	10VA	2%	2.0	
2500/5	—	X	X	—	10VA	2%	2.0	
3000/5	—	X	X	X	10VA	2%	1.5	
3500/5	—	X	X	X	10VA	2%	1.5	
4000/5	—	X	X	X	10VA	2%	1.25	
5000/5	—	X	X	X	10VA	2%	1.25	
6000/5	—	—	X	X	10VA	2%	1.25	

FREED TRANSFORMER CO., INC.

MIL-T-27 COMPONENTS

TRANSISTOR SUPPLY TRANSFORMERS
TST SERIES

Manufactured and Guaranteed to Specifications MIL-T-27

TST-6 — Frequency 57 Hz to 63 Hz — Primary 115 volts units with * primary 115 and/or 230 volts

TST-4 — Frequency 380 Hz to 1000 Hz — Primary 115 volts

TST units can be supplied in commercial type construction (channel or shell type with leads).

**When ordering specify (6) for 57 to 63 Hz and (4) for 380 to 1000 Hz

D.C. to RMS Conversion Chart

Resistive or Inductive Loads		Capacitive Loads	
Full Wave Center Tapped	Full Wave Bridge	Full Wave Center Tapped	Full Wave Bridge
E_{RMS} = 2.22 Edc	E_{RMS} = 1.11 Edc	E_{RMS} = 1.6 Edc	E_{RMS} = .8 Edc
I_{RMS} = .75 Idc	I_{RMS} = 1.05 Idc	I_{RMS} = 1.1 Idc	I_{RMS} = 1.55 Idc

Edc – should include voltage drop across reactor and voltage drop across one diode for F.W.C.T. and voltage drop across two diodes for F.W. Bridge

Part No.	R.M.S. Output Volt	Amp	Case —4	—6
TST(**)-1	6.3 CT	.30	AH	AH
TST(**)-2	6.3 CT	.60	AH	AJ
TST(**)-3	12.6 Split	.80	AJ	EB
TST(**)-4	12.6 Split	1.5	AJ	FA
TST(**)-5	12.6 Split	2.0	AJ	GB*
TST(**)-6	25.2 Split	1.5	EB	GA*
TST(**)-7	25.2 Split	4.0	GB	JA*
TST(**)-8	30 Split	.50	AJ	FA
TST(**)-9	30 Split	1.0	AJ	GB*
TST(**)-10	30 Split	1.5	EB	GA*
TST(**)-11	30 Split	2.0	FA	HA*
TST(**)-12	40 Split	.50	AJ	FA
TST(**)-13	40 Split	1.0	EB	GA*
TST(**)-14	40 Split	1.5	FA	HA*
TST(**)-15	40 Split	2.0	FA	JB*
TST(**)-16	50 Split	.50	AJ	GB*
TST(**)-17	50 Split	1.0	FA	GA*
TST(**)-18	50 Split	1.5	FA	JB*
TST(**)-19	50 Split	2.0	GB	JA*
TST(**)-20	60 Split	.50	AJ	GB*
TST(**)-21	60 Split	1.0	FA	HA*
TST(**)-22	60 Split	1.5	FA	JA*
TST(**)-23	70 Split	.50	EB	GA*
TST(**)-24	70 Split	1.0	FA	JB*
TST(**)-25	70 Split	1.5	GB	JA*
TST(**)-26	80 Split	.25	AJ	FA
TST(**)-27	80 Split	.50	EB	GA*
TST(**)-28	80 Split	1.0	FA	JB*
TST(**)-29	90 Split	.25	AJ	GB*
TST(**)-30	90 Split	.50	EB	GA*
TST(**)-31	90 Split	1.0	FA	JA*
TST(**)-32	100 Split	.25	AJ	GB*
TST(**)-33	100 Split	.50	FA	GA*
TST(**)-34	100 Split	1.20	GA	KB*

STANDARD MILITARY AUDIO TRANSFORMERS
Frequency Response 300-10,000 Hz ±2 DB

Catalog No.	Application	Type Designation	Impedance Level in Ohms Primary	Secondary	Ratio	Max. Power Level DBM	Pri. D.C. Per Side in Ma	Max. D.C. unbalance	Case
MGA 1	Transformer; interstage, single or P.P. plates to single or P.P. grid	TF4RX15AJ	10,000 C.T.	90,000 split and C.T.	1:3 overall	+15	10	10	AJ
MGA 2	Transformer; matching 600 ohm line to voice coil.	TF4RX16AJ	600 split	4, 8, 16	6.12:1 overall	+33	0	0	AJ
MGA 3	Transformer; input, 600 ohm line to single or P.P. grids.	TF4RX10AJ	600 split	135,000 C.T.	1:15	+15	0	0	AJ
MGA 4	Transformer; matching, 600 ohm line to 600 ohm line.	TF4RX16AJ	600 split	600 split	1:1	+15	0	0	AJ
MGA 5	Transformer; output, single plate 7,600 ohm, 4,800 ohm to 600 ohm line.	TF4RX13AJ	7,600 tap @ 4,800	600 split	3.56:1	+33	40	40	AJ
MGA 6	Transformer; output, single plate 7,600 ohm, 4,800 ohm to voice coil.	TF4RX13AJ	7,600 tap @ 4,800	4, 8, 16	21.8:1	+33	40	40	AJ
MGA 7	Transformer; output, single or P.P. plates to 600 ohm line.	TF4RX13AJ	15,000 C.T.	600 split	5:1	+33	10	10	AJ
MGA 8	Transformer; output, P.P. plates to 600 ohm line.	TF4RX13AJ	24,000 C.T.	600 split	6.32:1	+30	10	1	AJ
MGA 9	Transformer; output, P.P. plates to 600 ohm line.	TF4RX13AJ	60,000 C.T.	600 split	10:1	+27	10	1	AJ

STANDARD MILITARY POWER AND FILAMENT TRANSFORMERS
Primary 105/115/125V 60~

SINGLE PHASE 400 Hz, AND THREE PHASE 60 AND 400 Hz TRANSFORMERS CAN BE SUPPLIED ON SPECIAL ORDER.

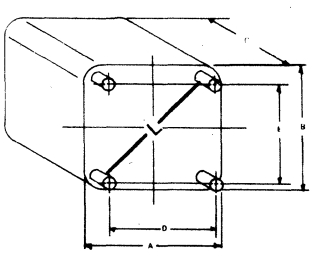
Catalog No.	MIL-T-27 Type Designation	Hi Volt	D.C. Volts	D.C. Amps	Fil. No. 1	Fil. No. 2	Case
MGP 1	TF4RX03HA001	200/100/0/100/200	185	.070	5 6. 3V @ 2A	6. 3V @ 3A	HA
MGP 2	TF4RX03JB002	690 C.T.	260	.070	5/6. 3V @ 2A	6. 3V @ 4A	JB
MGP 3	TF4RX03KB006	650 C.T.	245	.150	6. 3V @ 5A	5V @ 3A	KB
MGP 4	TF4RX03LB003	800 C.T.	318	.175	5V @ 3A	6. 3V @ 8A	LB
MGP 5	TF4RX03MB004	900 C.T.	345	.250	5V @ 3A	6. 3V @ 8A	MB
MGP 6	TF4RX02KB001	700 C.T.	255	.250			KB
MGP 7	TF4RX02LB002	1100 C.T.	419	.250			LB
MGP 8	TF4RX02NB003	1600 C.T.	640	.250			NB

Catalog No.	MIL-T-27 Type Designation	Secondary Volts	Secondary Current Amps	Secondary Test Volts RMS	Case
MGF 1	TF4RX01EB002	2.5	3.0	2,500	EB
MGF 2	TF4RX01GB003	2.5	10.0	2,500	GB
MGF 3	TF4RX01FB004	5.0	3.0	2,500	FB
MGF 4	TF4RX01HB005	5.0	10.0	2,500	HB
MGF 5	TF4RX01FB006	6.3	2.0	2,500	FB
MGF 6	TF4RX01GB007	6.3	5.0	2,500	GB
MGF 7	TF4RX01JB008	6.3	10.0	2,500	JB
MGF 8	TF4RX01KB009	6.3	20.0	2,500	KB
MGF 9	TF4RX01JB012	2.5	10.0	10,000	JB
MGF 10	TF4RX01KB013	5.0	10.0	10,000	KB

PULSE TRANSFORMERS

Catalog No.	MIL Type	Blocking Osc.	Inter-stage Coupling	Low Power Output	Pulse Voltage Kilovolts	Pulse Duration Micro-seconds	Duty Rate	No. of Windings	Test Voltage KV, RMS	Character-istic Impedance Ohms	Case No.
MPT-1	TF4RX35YY	√	√		0.25/0.25/0.25	0.2-1.0	.004	3	0.7	250	DM-20
MPT-2	TFR4X35YY	√	√		0.25/0.25	0.2-1.0	.004	2	0.7	250	DM-20
MPT-3	TF4RX35YY	√	√		0.5/0.5/0.5	0.2-1.5	.002	3	1.0	250	DM-18
MPT-4	TF4RX35YY	√	√		0.5/0.5	0.2-1.5	.002	2	1.0	250	DM-18
MPT-5	TF4RX35YY	√	√		0.5/0.5/0.5	0.5-2.0	.002	3	1.0	500	DM-20
MPT-6	TF4RX35YY	√	√		0.5/0.5	0.5-2.0	.002	2	1.0	500	DM-20
MPT-7	TF4RX35YY	√	√	√	0.7/0.7/0.7	0.5-1.5	.002	3	1.5	200	DM-18
MPT-8	TF4RX35YY	√	√	√	0.7/0.7	0.5-1.5	.002	2	1.5	200	DM-18
MPT-9	TF4RX35YY	√	√	√	1.0/1.0/1.0	0.7-3.5	.002	3	2.0	200	DM-18
MPT-10	TF4RX35YY	√	√	√	1.0/1.0	0.7-3.5	.002	2	2.0	200	DM-18
MPT-11	TF4RX35YY	√	√	√	1.0/1.0/1.0	1.0-5.0	.002	3	2.0	500	DM-01
MPT-12	TF4RX35YY	√	√	√	0.15/0.15/0.3/0.3	0.2-1.0	.004	4	0.7	700	DM-8

MIL CASES, NOMINAL DIMENSIONS, INCHES



Mil Case	A	B	C	D	L	E	Mtg. Studs	Wt. Lbs.
AH	1 5/16	1 5/16	1 3/4		1 1/4		6-32 x 3/8	3/8
AJ	1 3/8	1 3/8	2 3/8	1 3/16		1 3/16	6-32 x 3/8	2/3
EA	1 15/16	1 13/16	2 3/4	1 3/8		1 1/4	6-32 x 3/8	1
EB	1 15/16	1 13/16	2 7/16	1 1/8		1 1/4	6-32 x 3/8	7/8
FA	2 5/16	2 1/16	3 1/8	1 11/16		1 7/16	6-32 x 3/8	1 3/4
FB	2 5/16	2 1/16	2 1/2	1 11/16		1 7/16	6-32 x 3/8	1 1/2
GA	2 3/4	2 3/8	3 13/16	2 1/8		1 3/4	6-23 x 3/8	3 1/2
GB	2 3/4	2 3/8	2 13/16	2 1/8		1 3/4	6-32 x 3/8	2 1/2
HA	3 1/16	2 5/8	4 1/4	2 19/64		1 55/64	8-32 x 3/8	4 1/2
HB	3 1/16	2 5/8	3 3/16	2 19/64		1 55/64	8-32 x 3/8	3 1/2
JA	3 9/16	3 1/16	4 7/8	2 5/8		2 1/8	8-32 x 3/8	6
JB	3 9/16	3 1/16	3 7/8	2 5/8		2 1/8	8-32 x 3/8	5
KA	3 15/16	3 3/8	5 1/4	3		2 7/16	10-32 x 1/2	8 1/2
KB	3 15/16	3 3/8	4 5/16	3		2 7/16	10-32 x 1/2	7

FREED TRANSFORMER CO., INC.

HERMETICALLY SEALED MINIATURE AND SUB-MINIATURE FILTERS TO MIL-F-18327

Freed Standard Filters are **Hermetically Sealed Miniature and Sub-Miniature** high performance components designed for both production and laboratory applications in the Communications and Electronic industry. In order to achieve attenuation requirements not obtainable with one single filter, one can combine several standard filters of different transmission characteristics. Wide Band Pass characteristics are obtainable by combining low and high Pass Units. The astatic construction of inductive components together with special shielding reduces the hum pick-up of the standard filters.

Low Pass Filters: The attenuation characteristics of Low Pass Filters are 6db or less at cut-off frequency • **ILP-ILM Interstage Low Pass Filter.** Characteristic impedance 10,000 ohms, in and out • **LLP-LLM Line Low Pass Filter.** Characteristic Impedance 500 to 600 ohms, in and out • **High Pass Filters:** The attenuation characteristics of High Pass Filters are 6db or less at cut-off frequency • **IHP-IHM Interstage High Pass Filter.** Characteristic Impedance 10,000 ohms, in and out. • **LHP-LHM Line High Pass Filter.** Characteristic Impedance 500 to 600 ohms, in and out • **Band Pass Filters:** The attenuation characteristics of Band Pass Filters are 2db or less at plus or minus 3% of center frequency • **IBP-IBM Interstage Band Pass Filter.** Normal input impedance — 10,000 ohms. Output impedance .5 megohms. Effective voltage step-up 2:1. (Output voltage to source voltage.) • **LBP-LBM Line Band Pass Filter.** Nominal input impedance 500 to 600 ohms. Output impedance .5 megohms. Effective voltage step-up 5:1. (Output voltage to source voltage.)

Special filters in all six types are available upon request.

MINIATURE

Low Pass Filters — attenuation ≧35 Db at 1.5 x Fc ≧40 Db at 2 x Fc

Catalog No.	Cut-off Frequency Hz
ILP- 100	100
ILP- 200	200
ILP- 300	300
ILP- 500	500
ILP- 750	750
ILP- 1,000	1,000
ILP- 1,500	1,500
ILP- 2,000	2,000
ILP- 2,500	2,500
ILP- 3,000	3,000
ILP- 5,000	5,000
ILP- 7,000	7,000
ILP- 10,000	10,000
ILP- 15,000	15,000
ILP- 20,000	20,000
ILP- 23,000	23,000
ILP- 25,000	25,000
ILP- 32,000	32,000
ILP-130,000	130,000
ILP-150,000	150,000
LLP- 500	500
LLP- 1,000	1,000
LLP- 1,500	1,500
LLP- 1,600	1,600
LLP- 2,000	2,000
LLP- 2,500	2,500
LLP- 3,000	3,000
LLP-16,000	16,000
LLP-20,000	20,000
LLP-70,000	70,000
LLP-80,000	80,000

High Pass Filters — attenuation ≧35 Db at .67 x Fc ≧40 Db at .5 Fc

IHP- 200	200
IHP- 250	250
IHP- 300	300
IHP- 400	400
IHP- 500	500
IHP- 1,000	1,000
IHP- 2,000	2,000
IHP- 3,000	3,000
IHP-10,000	10,000
IHP-15,000	15,000
LHP- 200	200
LHP- 300	300
LHP- 400	400
LHP- 500	500
LHP- 800	800
LHP- 1,000	1,000
LHP- 2,000	2,000
LHP- 6,000	6,000
LHP-10,000	10,000

Band Pass Filters — attenuation ≧40 Db at 0.5 x Fc and 2 x Fc

IBP- 100	100
IBP- 200	200
IBP- 250	250
IBP- 400	400
IBP- 500	500
IBP- 700	700
IBP- 800	800
IBP- 900	900
IBP- 1,000	1,000
IBP- 1,500	1,500
IBP- 2,000	2,000
IBP- 3,000	3,000
IBP- 5,000	5,000
IBP- 7,200	7,200
IBP-10,000	10,000
IBP-12,000	12,000
IBP-15,000	15,000
IBP-30,000	30,000
IBP-57,600	57,600
LBP- 100	100
LBP- 300	300
LBP- 400	400
LBP- 600	600
LBP- 800	800
LBP- 1,000	1,000
LBP- 1,500	1,500
LBP- 2,000	2,000
LBP- 3,000	3,000
LBP- 7,200	7,200
LBP-10,000	10,000
LBP-14,400	14,400
LBP-20,000	20,000
LBP-28,800	28,800

SUB-MINIATURE

Low Pass Filters — attenuation ≧30 Db at 1.5 x Fc ≧40 Db at 2 x Fc

Catalog No.	Cut-off Freq. Hz	Case No.
ILM- 300	300	DF-01
ILM- 500	500	DF-01
ILM- 750	750	DF-01
ILM- 1,000	1,000	DF-01
ILM- 1,500	1,500	DF-01
ILM- 2,000	2,000	DF-01
ILM- 2,500	2,500	DF-01
ILM- 3,000	3,000	DF-01
ILM- 5,000	5,000	DF-01
ILM- 7,000	7,000	DF-01
ILM- 10,000	10,000	DF-01
ILM- 15,000	15,000	DF-01
ILM- 20,000	20,000	DF-01
ILM- 23,000	23,000	DF-01
ILM- 25,000	25,000	DF-01
ILM- 32,000	32,000	DF-01
ILM-130,000	130,000	DF-01
ILM-150,000	150,000	DF-01
LLM- 500	500	DF-03
LLM- 1,000	1,000	DF-03
LLM- 1,500	1,500	DF-02
LLM- 1,600	1,600	DF-02
LLM- 2,000	2,000	DF-02
LLM- 2,500	2,500	DF-02
LLM- 3,000	3,000	DF-02
LLM-16,000	16,000	DF-02
LLM-20,000	20,000	DF-02
LLM-70,000	70,000	DF-02
LLM-80,000	80,000	DF-02

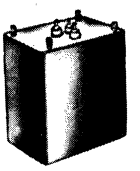
High Pass Filters — attenuation ≧30 Db at .67 x Fc ≧40 Db at .5 Fc

IHM- 300	300	DF-01
IHM- 400	400	DF-01
IHM- 500	500	DF-01
IHM- 1,000	1,000	DF-01
IHM- 2,000	2,000	DF-01
IHM- 3,000	3,000	DF-01
IHM-10,000	10,000	DF-01
IHM-15,000	15,000	DF-01
LHM- 300	300	DF-03
LHM- 400	400	DF-03
LHM- 500	500	DF-03
LHM- 800	800	DF-03
LHM- 1,000	1,000	DF-02
LHM- 2,000	2,000	DF-02
LHM- 6,000	6,000	DF-02
LHM-10,000	10,000	DF-02

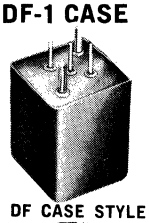
Band Pass Filters — attenuation ≧35 Db at 0.5 x Fc and 2 x Fc

IBM- 400	400	DF-02
IBM- 500	500	DF-02
IBM- 700	700	DF-02
IBM- 800	800	DF-02
IBM- 900	900	DF-02
IBM- 1,000	1,000	DF-02
IBM- 1,500	1,500	DF-02
IBM- 2,000	2,000	DF-01
IBM- 3,000	3,000	DF-01
IBM- 5,000	5,000	DF-01
IBM- 7,200	7,200	DF-01
IBM-10,000	10,000	DF-01
IBM-12,000	12,000	DF-01
IBM-15,000	15,000	DF-01
IBM-30,000	30,000	DF-01
IBM-57,600	57,600	DF-01
LBM- 300	300	DF-02
LBM- 400	400	DF-02
LBM- 600	600	DF-02
LBM- 800	800	DF-02
LBM- 1,000	1,000	DF-01
LBM- 1,500	1,500	DF-01
LBM- 2,000	2,000	DF-01
LBM- 3,000	3,000	DF-01
LBM- 7,200	7,200	DF-01
LBM-10,000	10,000	DF-01
LBM-14,400	14,400	DF-01
LBM-20,000	20,000	DF-01
LBM-28,800	28,800	DF-01

ALL MINIATURE FILTERS ARE SUPPLIED IN DF-1 CASE



DF-1 CASE
Height: 2½"
Width: 1 1/16"
Depth: 1 3/16"
Mtg. Cen.: 1¼"x¾"
Studs: 4 6-32x⅜"
Knockout: ⅞" dia.



DF CASE STYLE DF-01
Height: 1⅜"
Width: ¾"
Depth.: ¾"
Mtg. Cen.: ⅝" Diag.
Studs: 2 ÷ 4-40

DF-02
Height: 1⅜"
Width: 1"
Depth.: 1"
Mtg. Cen.: ¾" Diag.
Studs: 2 ÷ 4-40

DF-03
Height: 1¾"
Width: 1"
Depth.: 1"
Mtg. Cen.: ¾"
Studs: 2 ÷ 4-40

SUBMINIATURE TELEMETERING BAND PASS FILTERS

Type No.	Center Frequency Fo - in Hz	Band Width <3DB	Stop Band Attenuation
MTN-.4	.4	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-.56	.56	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-.73	.73	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-.96	.96	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-1.3	1.3	±7½%	≧38 DB @ 1.75 & .58 Fo
MTN-1.7	1.7	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-2.3	2.3	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-3.0	3.0	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTH-3.9	3.9	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-5.4	5.4	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-7.35	7.35	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTH-10.5	10.5	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-14.5	14.5	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-22	22	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-30	30	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-40	40	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-52.5	52.5	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-70	70	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-22	22	±15%	≧ 40 DB @ 2.5 & .4 Fo
MTW-30	30	±15%	≧ 40 DB @ 2.5 & .4 Fo
MTW-40	40	±15%	≧ 40 DB @ 2.5 & .4 Fo
MTW-52.5	52.5	±15%	≧ 40 DB @ 2.5 & .4 Fo
MTW-70	70	±15%	≧ 40 DB @ 2.5 & .4 Fo

CASE SIZES
DF-01 ¾ x ¾ x 1⅜ — MTN-2.3 Thru MTW-70
DF-02 1 x 1 x 1⅜ — MTN-4 Thru MTN 1.7

NULL "T" FILTERS SERIES 1950

Standard models are available for 30, 60 and 120 cycles in a wide range of impedances. Each network will give a minimum of 50 db attenuation at the null frequency.

The null frequency is adjusted to a tolerance of ±2%.

All Null T Filters are hermetically sealed.

Prices on request.

Catalog No.	Frequency
NTF- 30	30 Hz
NTF- 60	60 Hz
NTF-120	120 Hz

FREED TRANSFORMER CO., INC.

TOROIDAL INDUCTORS

Using the latest developments in the field of magnetic materials and new impregnation and molding techniques the Freed Transformer Co. makes available to the industry the most extensive line of toroidal inductors.

Freed toroids are available in three types of constructions. Open units coated with a special high temperature extremely low loss compound, hermetically sealed in metal cases or molded in special **Freed Epoxy Resin.** Both hermetically sealed and molded units meet the latest military specification MIL-T-27A(graded 1 or 4 and 2 or 5 respectively.)Freed toroidal inductors are supplied with either molypermalloy or carbonyl iron powder cores

1. Temperature Stabilization:

The molypermalloy and carbonyl iron powder cores have a temperature coefficient of inductance. Depending on the degree of temperature stabilization the cores have different temperature coefficients. The degree of stabilization is denoted by a two-letter code.

SF Non-stabilized cores, ±2½% inductance variations from —55°C to +85°C.
SN Non-stabilized cores, +2% inductance variations from —55°C to +85°C.
SE Temperature stabilized cores, +0.1% to —0.4% inductance variations from —1.5°C to +54°C.
SB Temperature stabilized cores, ±0.1% inductance variations from +13°C to +35°C.
SD Temperature stabilized cores, ±0.1% inductance variations from —1.5°C to +54°C.
SW Temperature stabilized cores, ±0.25% inductance variations from —54°C to +85°C.
SM Temperature stabilized cores, ±.25% —65°C to +125°C.
SP Temperature stable carbonyl iron cores, ±0.3% inductance variations from —55°C to +85°C.

The temperature (stabilization) coefficient of an inductor will depend upon the nominal inductance value, operating frequency and A.C. voltage across the coil. Under some unfavorable working conditions the temperature coefficient of inductance corresponding to a given stability characteristic may be exceeded.

Toroids with special requirements such as tapped toroids, toroidal transformers, molded and cased units with dimensions other than standard sizes and high temperature toroids can be supplied on request. Our engineering and laboratory facilities are available for consultation, research and development.

TOROIDAL INDUCTORS

Type	Ω/H	Max. Norm. Idc	Max. Norm. Iac	Max. Norm. Vac	Uncased	Mold	Case	Frequency
TI- 1	70	55	73.5	0.46	OS-8	MR-6	DT-3, DT-5	1–15 KHz
TI- 1A	68	75	90.5	0.57	OS-9	MR-7	DT-4	1–15 KHz
TI- 2	160	90	135	0.85	OS-6	MR-5	DT-3, DT-5	10–50 KHz
TI- 3	600	100	67	0.42	OS-6	MR-5	DT-3, DT-5	50–200 KHz
TI- 3A	310	150	240	1.5	OS-10	MR-8	DT-4	50–200 KHz
TI- 4	110	55	67	0.42	OS-5	MR-4	DT-2, DM-11	1–15 KHz
TI- 5	260	28	35	0.22	OS-3	MR-3	DT-1, DM-2	1–15 KHz
TI- 6	230	75	125	0.80	OS-10	MR-8	DT-4	10–50 KHz
TI- 7	480	40	53	0.33	OS-3	MR-3	DT-1, DM-2	10–50 KHz
TI- 8	1,500	50	80	0.5	OS-3	MR-3	DT-1, DM-2	30–75 KHz
TI- 9	150	200	240	1.5	OS-10	MR-3	DT-4	30–75 KHz
TI-10	430	125	270	1.7	OS-7	MR-5	DT-3, DT-5	30–75 KHz
TI-11	30	120	190	1.2	OS-11	MR-10	DT-4	1–15 KHz
TI-12	45	100	160	1	OS-9	MR-8	DT-4	1–15 KHz
TI-13	55	140	175	1.1	OS-9	MR-8	DT-4	10–50 KHz
TI-14	580	150	—	—	OS-5	MR-4	DT-2, DM-11	10–100 KHz
TI-15	900	100	—	—	OS-3	MR-3	DT-1, DM-2	10–100 KHz
TI-16	600	16	21	0.13	OS-1	MR-1, MS-1	DST-1	1–15 KHz
TI-17	1,200	20	29	0.18	OS-1	MR-1, MS-1	DST-1	10–50 KHz
TI-18	2,600	30	40	0.25	OS-1	MR-1, MS-1	DST-1	30–75 KHz

Type	Ω/H	Max. Norm. Idc	Max. Norm. Iac	Max. Norm. Vac	Uncased	Mold	Case	Frequency
TI-19	4,500	25	29	0.18	OS-1	MR-1, MS-1	DST-1	50–200 KHz
TI-20	2,750	100	*	*	OS-4	MR-3A	DT-2	20KHz-2MHz
TI-21	1,200	350	*	*	OS-1	MR-1, MS-1	DT-1	100KH –10MHz
TI-22	5,600	210	*	*	OS-2	MR-2	DT-1	50KHz–5MHz
TI-23	7,000	250	*	*	OS-2	MR-2	DT-1	50KHz–5MHz
TI-24	330	15	18	0.11	OS-1	MR-1, MS-1	DST-1	200Hz–12KHz
TI-25	200	20	24	0.15	OS-12	MR-2	DT-1	200Hz–12KHz
TI-26	150	25	32	0.20	OS-3	MR-3	DT-1, DM-3	200Hz–12KHz
TI-27	76.5	50	62	0.39	OS-5	MR-4	DT-2, DM-11	200Hz–12KHz
TI-28	48.5	50	64	0.40	OS-8	MR-6	DT-3, DT-5	200Hz–12KHz
TI-29	33.5	70	88	0.55	OS-9	MR-7	DT-4	200Hz–12KHz
TI-30	28	100	135	0.84	OS-9	MR-8	DT-4	200Hz–12KHz
TI-31	19.5	100	136	0.85	OS-11	MR-10	DT-4	200Hz–12KHz
TI-32	48.5	6	14.5	0.09	OS-3	MR-3	DT-1, DM-2	100Hz–10KHz
TI-33	2,150	8	13	0.08	OS-13	MR-11	DT-6	1–15 KHz
TI-34	1,700	8	9.5	0.06	OS-14	MR-11	DT-6	1–15 KHz
TI-35	4,100	10	18	0.11	OS-13	MR-11	DT-6	10–50 KHz
TI-36	3,950	10	11	0.07	OS-14	MR-11	DT-6	10–50 KHz
TI-37	23.5	10	32	0.20	OS-5	MR-14	DT-2, DM-11	100Hz–10KHz
TI-38	100	4	9.5	0.06	OS-1	MR-1, MS-1	DST-1	100Hz–10KHz

*TI-20 through TI-23 have a very low voltage coefficient and inductance will change very little with voltage. Because of high frequency application, the maximum voltage is limited rather by breakdown than by saturation.

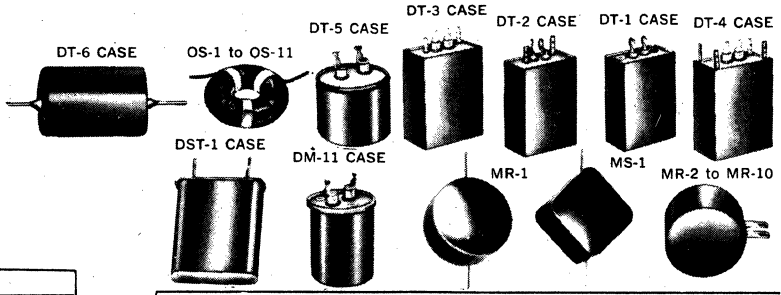
$$\text{Normalized } V_{AC} = \frac{V}{F}\,\frac{1}{\sqrt{L_H}}$$

$$\text{Normalized } I_{AC} = I_{AC}\sqrt{L_H}$$

$$\text{Normalized } I_{DC} = I_{DC}\sqrt{L_H}$$

where F —operating frequency in Hz
L_H —inductance in henries
Iac—A.C. current in MA
Idc—D.C. current in MA
V —A.C. voltage across the core

CASED, UNCASED AND MOLDED UNITS



UNCASED

Type	O.D.	Hi.
OS-1	5/8"	5/16"
OS-2	7/8"	3/16"
OS-3	1"	3/8"
OS-4	1"	9/16"
OS-5	1 5/16"	5/8"
OS-6	1 5/8"	7/8"
OS-7	1 11/16"	5/8"
OS-8	1 7/8"	11/16"
OS-9	2 1/4"	1 1/8"
OS-10	2 3/8"	1 1/4"
OS-11	2 5/8"	1 1/8"
OS-12	13/16"	3/8"
OS-13	3/8"	1/4"
OS-14	7/16"	7/32"

MOLDED

Type	O.D.	Hi.	Clearance Hole Mounting
MR-1	7/8"	13/32"	Pig Tails
MR-2	1 1/16"	1/2"	No. 4
MR-3	1 3/16"	1/2"	No. 6
MR-3A	1 3/16"	11/16"	No. 6
MR-4	1 1/2"	3/4"	No. 8
MR-5	1 7/8"	1"	No. 8
MR-6	2 1/8"	7/8"	No. 8
MR-7	2 3/8"	1 5/16"	No. 10
MR-8	2 1/2"	1 3/8"	No. 10
MR-9	2 5/8"	1 7/16"	No. 10
MR-10	2 7/8"	1 3/8"	No. 10
MR-11	7/16"	1/4"	Pig Tails
MS-1	25/32" x 25/32"	13/32"	Pig Tails

CASED

Type	Hi.	Dia.	Length	Width	Mtg.	Mtg. Cen.	Cutout
DT-1	1 13/32"		1 1/16"	1/2"	2 4-40 inserts	3/4"	5/16" x 1/2".
DT-2	1 3/4"		1 3/16"	13/16"	2 6-32 studs	7/8" x 9/32"	3/8" x 1 1/16"
DT-3	2"		1 25/32"	7/8"	2 6-32 studs	1 1/4" x 3/8"	3/8" x 3/4"
DT-4	3 1/8"		2 3/4"	1 5/16"	4 8-32 studs	2 1/16" x 1 1/16"	3/4" x 3/8"
DT-5	1 3/16"	1 13/16"			2 6-32 inserts	1 1/8"	3/8" x 1"
DT-6	5/8"	1/2"			Pig Tails		
DM-2	1"	1 1/8"			2 4-40 inserts	5/8"	3/8" x 7/8"
DM-11	1 1/2"	1 3/8"			2 6-32 inserts	7/8"	3/8" x 7/8"
DST-1	25/32"		3/4"	11/32"	1/4" long pins	To fit 1/2" crystal socket	

FREED TRANSFORMER COMPANY. INC. 1795 WEIRFIELD ST., RIDGEWOOD, N.Y. 11385

FREED TRANSFORMER CO., INC.

COMMERCIAL GRADE COMPONENTS

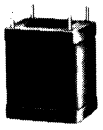
These components are designed to meet the demand for low-cost replacement parts for commercial electronic equipment.

The best commercially available materials have been utilized in the design of these units, to insure reliability and excellent performance characteristics. Vacuum impregnation with a non-hygroscopic varnish to prevent penetration of humidity are employed to give these units long life and trouble-free performance.

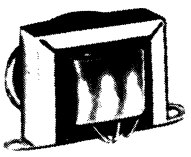
230-115 V, 50-60 C.P.S. Stepdown Transformers rated from 25 V A up to 5,000 V A Rating and line booster transformers are included in this series.

All units, with only a few exceptions, are uncased or of shell-type construction.

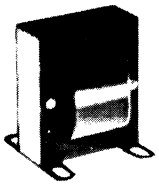
Isolation transformers and Stepdown transformers are equipped with line cord and receptacle.



DC

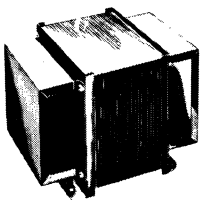


CH

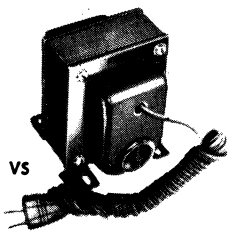


FV

Case No.	Height	Width	Depth	Mtg. Centers	Mtg. Studs
DC2B	3 1/2	2 5/8	2 1/4	2x1 3/4	(4)8-32
DC4A	3 3/4	3 1/8	3	2 1/2 x 2 1/2	(4)8-32
DC5C	4 7/8	4 1/8	3 1/2	3 1/8 x 2 5/8	(4)10-32
DC6A	4 7/8	5	4 1/8	3 3/4 x 3	(4)10-32
CH60	2	3 1/4	1 3/4	2 13/16	(2)3/16
CH62	2	3 1/4	2 1/8	2 13/16	(2)3/16
CH70	2 5/16	3 11/16	2 1/4	3 1/8	(2)3/16
CH80	2 5/8	4	2 5/8	3 5/16	(2)3/16
FV10	3 1/16	2 1/2	2 9/16	2x2	(4) 13/64 x 21/64
FV12	3 1/16	2 1/2	2 11/16	2x2 1/8	(4) 13/64 x 21/64
FV22	3 7/16	2 13/16	2 7/8	2 1/4 x 2 1/4	(4)3/16 x 3/8
FV30	4 1/32	3 1/8	3	2 1/2 x 2 1/4	(4) 13/64 x 21/64
HB718	6 1/4	6 1/2	8 1/2	4 3/4 x 4 1/2	(4) 9/32 x 21/32
HB728	6 1/4	6 1/2	9 3/4	4 3/4 x 5 3/4	(4) 9/32 x 21/32
VS401	3 5/16	2 15/16	3 1/4	2 1/4 x 1 15/16	(4)3/16 x 3/8
VS501	3 29/32	3 1/4	3 3/8	2 1/2 x 2 1/16	(4)3/16 x 3/8
VS503	3 29/32	3 1/4	3 5/8	2 1/2 x 2 5/16	(4)3/16 x 3/8
VS601	4 21/32	3 7/8	3 5/8	3x2 7/16	(4)3/16 x 3/8
VS603	4 21/32	3 7/8	3 7/8	3x2 11/16	(4)3/16 x 3/8
VS604	4 21/32	3 7/8	4	3x2 7/8	(4)3/16 x 3/8
VS611	4 21/32	3 7/8	4 7/8	3x3 11/16	(4)3/16 x 3/8
VS612	4 21/32	3 7/8	5	3x3 13/16	(4)3/16 x 3/8
VS706	5 7/16	4 5/16	5 1/2	3 1/2 x 3 3/4	(4)3/16 x 3/8
VS714	5 7/16	4 5/16	6 1/2	3 1/2 x 4 3/4	(4)3/16 x 3/8
VS718	5 7/16	4 5/16	7	3 1/2 x 5 1/4	(4) 9/32 x 21/32
VS728	5 7/16	4 5/16	8 1/4	3 1/2 x 6 1/2	(4)3/16 x 3/8



HB



VS

FILAMENT TRANSFORMERS

All primaries are for 115V, 50/60 c.p.s.

Catalog No.	Secondary Voltage	Secondary Current Amps	Secondary Test Voltage RMS	Case Size
TF 1	2.5 (C.T.)	7.5	1500	CH60
TF 2	2.5 (C.T.)	10	1500	CH70
TF 3	2.5 (C.T.)	5	7500	DC2B
TF 4	2.5 (C.T.)	10	7500	DC4A
TF 5	5.0 (C.T.)	4	1500	CH60
TF 6	5.0 (C.T.)	6	1500	CH70
TF 7	5.0 (C.T.)	10	1500	CH80
TF 8	5.0 (C.T.)	10	1500	FV10
TF 9	5.0 (C.T.)	20	2500	FV30
TF 10	5.0 (C.T.)	20	10,000	DC6A
TF 11	6.3 (C.T.)	1.35	1500	CH50
TF 12	6.3 (C.T.)	3	1500	CH60
TF 13	6.3 (C.T.)	5	1500	CH70
TF 14	6.3 (C.T.)	7	1500	FV12
TF 15	6.3 (C.T.)	10	1500	FV22
TF 16	10 (C.T.)	5	2500	CH80
TF 17	10 (C.T.)	5	2500	FV10
TF 18	10 (C.T.) or 11 (C.T.) (tapped primary)	12 or 11	7500	DC-5C
TF 19	12.6 (C.T.)	2	1500	CH62

TF 3, 4, 10 & 18 supplied with terminals. All others with leads.

AUTO TRANSFORMERS

To be used as step-down transformer. Equipped with standard receptacle and line cord.

Catalog No.	Transformation	VA Rating	Weight (lbs.)	Case Size
SDT 1*	230/115 V. 50/60 c.p.s.	25	1	CH-60
SDT 2*	230/115 V. 50/60 c.p.s.	50	1 1/4	CH-62
SDT 3	230/115 V. 50/60 c.p.s.	50	2 1/2	VS-300
SDT 4	230/115 V. 50/60 c.p.s.	100	3	VS-401
SDT 5	230/115 V. 50/60 c.p.s.	200	5	VS-501
SDT 6	230/115 V. 50/60 c.p.s.	300	6 1/2	VS-601
SDT 7	230/115 V. 50/60 c.p.s.	400	8	VS-604
SDT 8	230/115 V. 50/60 c.p.s.	500	11	VS-611
SDT 9	230/115 V. 50/60 c.p.s.	750	15	VS-706
SDT 10	230/115 V. 50/60 c.p.s.	1000	23	VS-718
SDT 11	230/115 V. 50/60 c.p.s.	1500	29 1/2	VS-728
SDT 12*	230/115 V. 50/60 c.p.s.	2000	37	HB-718

*Supplied with leads without line cord and receptacle.

ISOLATION TRANSFORMERS

Electrostatic shield between primary and secondary. Equipped with standard receptacle and line cord.

Catalog Number	Primary Voltage 50/60 c.p.s.	Secondary Voltage	VA Rating	Case Size
IT 1	115	115	50	VS-401
IT 2	115	115	100	VS-503
IT 3	115	115	300	VS-700
IT 4	115	115	500	VS-714
IT 5*	220/440	110/220	250	VS-612
IT 6*	220/440	110/220	500	VS-714

*Supplied with leads without line cords and receptacle.

MCV – CONSTANT VOLTAGE TRANSFORMERS – MCV

(FERRO-RESONANT TRANSFORMERS)

The MCV line of constant voltage transformers provides accurate regulation against line and/or load variations, without the use of tubes or moving parts.

Input Voltage Range

95 to 130

Rated output within ± 2% of nominal value. Regulation automatically maintained within ± 1%. Regulation from 25% to full load ± 2%.

- MILITARY SPECIFICATIONS
- NO TUBES
- COMMERCIAL
- NO MOVING PARTS
- ACCURATE REGULATIONS
- FAST RESPONSE
- FULLY AUTOMATIC
- SUPPLIED WITH CONDENSERS

Reg. Output in R.M.S. Volts	Output in V.A. P.F-1	CATALOG NUMBERS			
		60 Cycles		400 Cycles	
		Comm.	Military*	Comm.*	Military*
115	5	MCV65LC	MCV65LM	MCV45LC	MCV45LM
115	25	MCV625LC	MCV625LM	MCV425LC	MCV425LM
115	75	MCV675LC	MCV675LM	MCV475LC	MCV475LM
115	125	MCV6125LC	MCV6125LM	MCV4125LC	MCV4125LM
115	175	MCV6175LC	MCV6175LM	MCV4175LC	MCV4175LM
115	250	MCV6250LC	MCV6250LM	MCV4250LC	MCV4250LM
115	375	MCV6375LC	MCV6375LM	MCV4375LC	MCV4375LM
115	500	MCV6500LC	MCV6500LM	MCV4500LC	MCV4500LM
115	750	MCV6750LC	MCV6750LM	MCV4750LC	MCV4750LM
115	1000	MCV61000LC	MCV61000LM	MCV41000LC	MCV41000LM
26	5	MCV654FC	MCV654FM	MCV454FC	MCV454FM
26	25	MCV6254FC	MCV6254FM	MCV4254FC	MCV4254FM
26	75	MCV6754FC	MCV6754FM	MCV4754FC	MCV4754FM
26	125	MCV61254FC	MCV61254FM	MCV41254FC	MCV41254FM
6.4	5	MCV65FC	MCV65FM	MCV45FC	MCV45FM
6.4	25	MCV625FC	MCV625FM	MCV425FC	MCV425FM
6.4	75	MCV675FC	MCV675FM	MCV475FC	MCV475FM
6.4	125	MCV6125FC	MCV6125FM	MCV4125FC	MCV4125FM

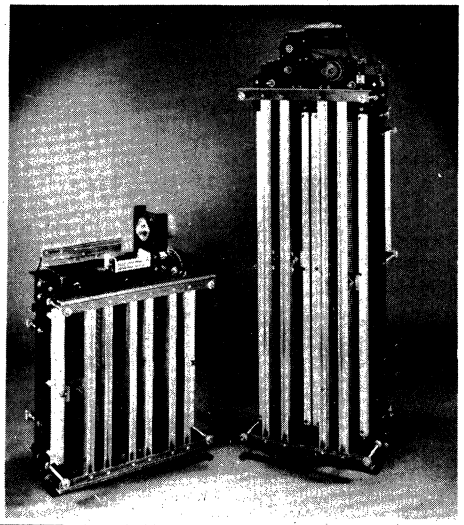
*Condensers are not provided with units. Where condensers are provided they are external to units.

AVAILABLE UPON REQUEST

MAGNETIC AMPLIFIERS AND SATURABLE TRANSFORMERS

FREED TRANSFORMER COMPANY. INC. 1795 WEIRFIELD ST., RIDGEWOOD, N.Y. 11385

PESCHEL VARIABLE TRANSFORMER™



ELECTRICAL FEATURES

- NO SHORTED TURNS
- 1-3% IMPEDANCE
- NO THREE-PHASE IMBALANCE
- 15 TIMES OVERLOAD CAPABILITY
- CONTINUOUSLY ADJUSTABLE OUTPUT
- LINE ISOLATION AVAILABLE
- 25% AND 100% STEP-UP AVAILABLE

MECHANICAL FEATURES

- STANDARD SINGLE OR THREE-PHASE CORE
- EPOXY ENCAPSULATED COIL FACE
- PLATED COIL TAPS/TURNS
- SLIDING COPPER CONTACTS
- SINGLE CORE ASSEMBLY UP TO 240 AMPS
- LESS SIZE AND WEIGHT THAN COMPETITION
- CLASS H, HIGH TEMPERATURE COPPER WIRE
- UPPER LIMIT, LOWER LIMIT, AND ZERO START MICRO SWITCHES
- MOTORIZED CONTROL; FIXED OR VARIABLE SPEED

The patented Peschel Variable Transformer is a linearly wound, continuously adjustable auto-transformer. A sliding copper contact traverses the coil face to provide variable voltage control.

The PVT can provide **variable ac voltage from 240V to 13.8 kV**, one or three phase and variable **dc voltage from 300V to 40 kV.** Flexibility in design enables the PVT to meet varied applications. Applications include: primary voltage control of high voltage and high current power supplies; ac or dc test equipment; motor, furnace and oven control; industrial and laboratory use; line stabilization; transformer testing; and much more.

SERVING APPLICATIONS NEVER BEFORE POSSIBLE WITH A VARIABLE TRANSFORMER

Hipotronics

AC VARIABLE TRANSFORMERS

480 Volt Input, Three Phase, Delta Connected

	KVA	Amps	Model
0-600 V Output	216	120	45A48-60D12
	324	180	45A48-60D18
	432	240	43A48-60D24
0-960 V Output	346	120	45A48-96D12
	518	180	45A48-96D18
	691	240	45A48-96D24

240 Volt Input, Three Phase, Wye Connected

	KVA	Amps	Model
0-300 V Output	31	60	30A24-30Y6
	46	90	30A24-30Y9
	62	120	30A24-30Y12
	93	180	30A24-30Y18
	124	240	30A24-30Y24
	187	360	30A24-30Y36
0-480 V Output	50	60	30A24-48Y6
	75	90	30A24-48Y9
	100	120	30A24-48Y12
	150	180	30A24-48Y18
	200	240	30A24-48Y24
	300	360	30A24-48Y36

480 Volt Input, Three Phase, Wye Connected

	KVA	Amps	Model
0-600 V Output	62	60	30A48-60Y6
	94	90	30A48-60Y9
	125	120	30A48-60Y12
	187	180	30A48-60Y18
	249	240	30A48-60Y24
	374	360	30A48-60Y36
0-960 V Output	150	9	30A48-96Y9
	200	120	30A48-96Y12
	299	180	30A48-96Y18
	399	240	30A48-96Y24
	599	360	30A48-96Y36

240 Volt Input, Single Phase

	KVA	Amps	Model
0-300 V Output	27	90	30A24-30S9
	36	120	30A24-30S12
	54	180	30A24-30S18
	72	240	30A24-30S24
	108	360	30A24-30S36
	144	480	30A24-30S48
0-480 V Output	43	90	45A24-48S9
	57	120	45A24-48S12
	86	180	45A24-48S18
	115	240	45A24-48S24
	173	360	45A24-48S36
	230	480	45A24-48S48

480 Volt Input, Single Phase

	KVA	Amps	Model
0-600 V Output	54	90	30A48-60S9
	72	120	30A48-60S12
	108	180	30A48-60S18
	144	240	30A48-60S24
	240	360	30A48-60S36
0-960 V Output	86	90	45A48-96S9
	115	120	45A48-96S12
	173	180	45A48-96S18
	230	240	45A48-96S24
	346	360	45A48-96S36

HIPOTRONICS INC., DRAWER A, BREWSTER, NY 10509 ▪ 914-279-8091 ▪ TWX 710-574-2420

VARIABLE TRANSFORMER

DESIGN HISTORY

Variable Transformers have been built for over 50 years by many companies around the world. There are two basic designs of electromechanical variable tranformers, linear and toroidal. The linear variable transformer is constructed in a vertical, or linear manner while the toroidal is constructed on a ring core, or "donut." The toroidal variable tranformer is the most common device used.

They are both single layer windings on a laminated steel core. The turns on one face of the coil are exposed. A carbon brush traverses the coil face to provide for voltage adjustment. In order to provide continuous, noninterrupted output voltage, the carbon brush must contact the next turn before leaving the previous turn. This creates a shorted turn condition. When the two turns, at different voltages, are bridged, or shorted, a circulating current results. This current, flowing through the shorted wire loop and carbon brush, creates heat. This heat must be dissipated through the coil and brush holder. This inherent design flaw severely limits the capability of these devices. To build a toroidal variable transformer capable of commutating greater than their limit of 8 kVA of power, would require larger wire sizes and more brushes. Both of these changes would increase the short circuit current, thus rendering such a device impossible, without extravagant heat sinks, forced air, or oil cooling.

In order to use the devices for applications greater than 8 kVA single-phase or 29 kVA three-phase, it becomes necessary to multi-stack or "gang" many core/coil assemblies in a series/parallel configuration. This becomes not only cumbersome, but also less reliable due to the multiple brush and motor drive system required. Serviceability is also difficult with such a "mechanical monster."

Other variable voltage control devices designed for high power voltage control, above 100 kVA, have other design or operational flaws. These devices sacrifice efficiency, size and weight, waveform purity, power factor, and/or cost.

What the industry needed was a variable autotransformer, which is the most efficient variable voltage device, that is smaller, lighter, more reliable, easy to service and reasonably priced.

THE PESCHEL SOLUTION

Having tried every device available, Hipotronics sought to design the perfect voltage control device. What had to be done was to design a variable transformer that eliminated the shorted turn problem. The result of our efforts was the **PESCHEL VARIABLE TRANFORMER.**

Having eliminated the short circuited turn problem, through our patented diode switching technique, it is now possible to build a variable tranformer capable of commutating greater kVAs and voltages than ever before possible. Most PVTs are constructed on a standard single-phase or three-legged, three-phase core. With no series or paralleling of core/coil assemblies necessary (most models), the PVT is generally smaller, lighter, more efficient and more reliable than any other means of variable voltage control.

Construction in a linear fashion affords greater design flexibility; core size, wire size, winding length. This allows for the design and construction of almost any kVA or MVA and any voltage, **enabling the PVT to be used in applications previously impossible with other variable transformers.**

DESIGN

The Peschel Variable Transformer is a continuously adjustable autotransformer. It is constructed of copper coils wound on a linear, laminated steel core. One face of the coil is epoxy encapsulated, then sanded to expose the turns. The exposed coil turns, or taps, are then plated. Each coil is wound in such a fashion as to expose two separate tracks of turns; one track of all the odd turns, the other even. Each track is traversed by a sliding copper contact. The sliding contacts are thinner than the distance between adjacent turns of the same track, thus not shorting the turns. Between the contacts is a series of back-to-back diodes. Using the diodes solely for their forward voltage drop (FVD), the voltage required across the diode before it will conduct current, and maintaining transformer volts per turn less than the total FVD, essentially no current can circulate between the two contacts. As the contacts traverse the coil, the current flow to the load alternates between contacts, depending upon which turn of the transformer is being used, odd or even.

This patented method provides for continuous voltage control with no shorted turns.

PESCHEL VARIABLE TRANSFORMER

Hipotronics

USES:
- DC Motor Speed Controller
- Chemical Processes
- Electro-Magnets
- Electropainting

ADVANTAGES:
- No Electronics
- No Waveshape Chopping
- No Effect on Power Factor
- No EMI
- Same Ripple, Any Voltage

DC VARIABLE TRANSFORMERS

DC Output, Insulated Primary, Three Phase, Full Wave Bridge

Output Voltage	Amps	KW	Model	Input Voltage
300	50	15	D30A24P-30Y5	240
500	50	25	D30A24P-50Y5	240
750	50	30	D30A24P-750Y5	240
1000	50	50	D60A24P-100Y5	240
2500	50	125	D60A48P-250Y5	480
5000	50	250	D60A48P-500Y5	480
10000	50	500	D60A48P-1000Y5	480
20000	50	1000	D60A416P-2000Y5	4160
40000	50	2000	D60A416P-4000Y5	4160

Output Voltage	Amps	KW	Model	Input Voltage
300	90	27	D30A24P-30Y9	240
500	90	45	D30A24P-50Y9	240
750	90	67.5	D30A24P-750Y9	240
1000	90	90	D60A24P-100Y9	240
2500	90	225	D60A48P-250Y9	480
5000	90	450	D60A48P-500Y9	480
10000	90	900	D60A48P-1000Y9	480
20000	90	1800	D60A416P-2000Y9	4160
40000	90	3600	D60A416P-4000Y9	4160

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Hipotronics

TRANSFORMERS "RM" SERIES

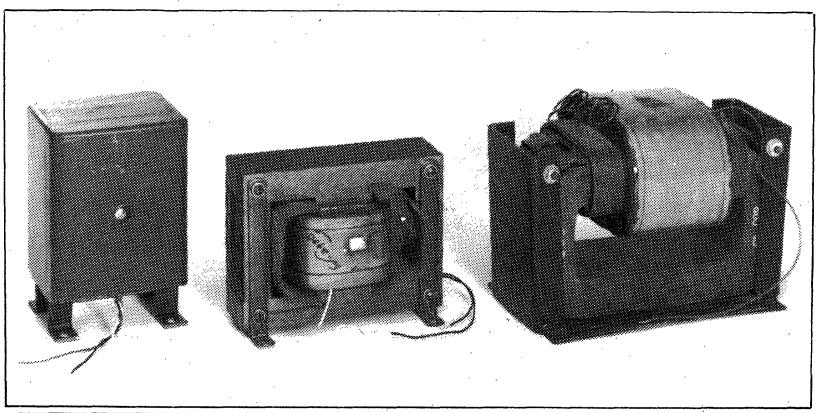
Hipotronics RM Series of high quality transformers are basically designed for air or oil environment. Models RM 17-3, RM 21-3 & RM 25-3 are manufactured for oil environment only.

Models RM 6-1, RM 7-1, RM 8-1, RM 9-1 and RM 10-1 are available manufactured in an epoxy incloser on special request.

TECHNICAL DATA

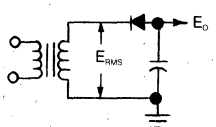
INPUT—117 VOLTS AC
FREQUENCY—TYPE A&C—50/60 Hz TYPE B—60 Hz
OUTPUT CURRENT—15mA AT RATED RMS OUTPUT.

Model Number	Type	Secondary Volts	Half Wave Rectifier (5 mA)	Full Wave Bridge (10 mA)	Full Wave Doubler (5 mA)	Secondary VA	Insulation Primary to Secondary
RM1-1	A	1 kV	1.2 kV	1.2 kV	2.4 kV	15	5 kV
RM1-2	B	1 kV	1.2kV	1.2 kV	2.4	15	5 kV
RM1.5-1	A	1.5 kV	1.8 kV	1.8 kV	3.6	23	5 kV
RM1.5-2	B	1.5 kV	1.8 kV	1.8 kV	3.6	23	5 kV
RM2-1	A	2 kV	2.4 kV	2.4 kV	4.8	30	6 kV
RM2-2	B	2 kV	2.4 kV	2.4 kV	4.8	30	6 kV
RM2.5-1	A	2.5 kV	3 kV	3 kV	6	38	6 kV
RM2.5-2	B	2.5 kV	3 kV	3 kV	6	38	6 kV
RM3-1	A	3 kV	3.6 kV	3.6 kV	7	45	8 kV
RM3-2	B	3 kV	3.6 kV	3.6 kV	7	45	8 kV
RM3.5-1	A	3.5 kV	4.2 kV	4.2 kV	8	53	10 kV
RM3.5-2	B	3.5 kV	4.2 kV	4.2 kV	8	53	10 kV
RM4-1	A	4 kV	4.8 kV	4.8 kV	9.5	60	10 kV
RM4-2	B	4 kV	4.8 kV	4.8 kV	9.5	60	10 kV
RM4.5-1	A	4.5 kV	5.5 kV	5.5 kV	10.5	68	12 kV
RM4.5-2	B	4.5 kV	5.5 kV	5.5 kV	10.5	68	12 kV
RM5-1	A	5 kV	6 kV	6 kV	12	75	12 kV
RM5-2	B	5 kV	6 kV	6 kV	12	75	12 kV
RM6-1	A	6 kV	7 kV	7 kV	14	90	14 kV
RM7-1	A	7 kV	8 kV	8 kV	16	105	15 kV
RM8-1	A	8 kV	9.5 kV	9.5 kV	19	120	17 kV
RM9-1	A	9 kV	10.5 kV	10.5 kV	21	135	20 kV
RM10-1	A	10 kV	12.5 kV	125 kV	24	150	24 kV
RM12.5-3	C	12.5 kV	15 kV	15 kV	30	188	28 kV
RM17-3	C	17 kV	20 kV	20 kV	40	255	32 kV
RM21-3	C	21 kV	25 kV	25 kV	50	315	45 kV
RM25-3	C	25 kV	30 kV	30 kV	60	375	54 kV



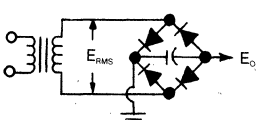
DC RECTIFER CIRCUITS FOR LISTED TRANSFORMERS

HALF WAVE RECTIFIER (COLUMN 5 ABOVE)



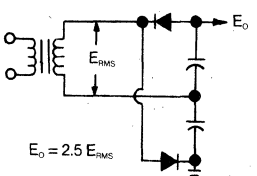
$E_O = 1.25\ E_{RMS}$

FULL WAVE BRIDGE (COLUMN 6 ABOVE)

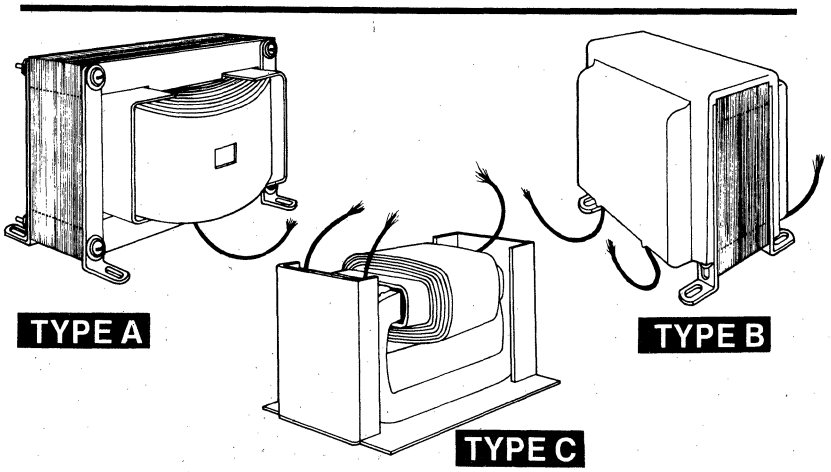


$E_O = 1.25\ E_{RMS}$

FULL WAVE DOUBLER COLUMN 7 ABOVE)



$E_O = 2.5\ E_{RMS}$



DIMENSIONAL DATA

Model Number	Dimensions A in. (mm)	B in. (mm)	C in. (mm)	Weights lbs. (kg)
RM1-1	2-13/16" (71)	3" (76)	2-1/4" (57)	2 (.9)
RM1-2	3-1/16" (77)	2-7/8" (73)	2-3/8" (60)	2-1/2 (1.1)
RM1.5-1	21-3/16" (71)	3-3/8" (86)	2-3/8" (60)	3 (1.4)
RM1.5-2	3-1/16" (77)	2-7/8" (73)	2-3/8" (60)	2-1/2 (1.1)
RM2-1	2-13/16" (71)	3-3/8" (86)	2-3/8" (60)	3 (1.4)
RM2-2	3-1/16" (77)	2-7/8" (73)	2-3/8" (60)	2-1/2 (1.1)
RM2.5-1	3-3/8" (86)	3-3/4" (95)	2-7/16" (62)	3-1/2 (1.6)
RM2.5-2	3-1/16" (77)	2-7/8" (73)	2-3/8" (60)	2-1/2 (1.1)
RM3-1	3-3/8" (86)	3-3/4" (95)	2-7/16" (62)	3-1/2 (1.6)
RM3-2	3-1/16" (77)	2-7/8" (73)	2-3/8" (60)	2-1/2 (1.1)
RM3.5-1	3-3/8" (86)	3-3/4" (95)	2-7/8" (73)	3-3/4 (17)
RM3.5-2	4-1/8" (105)	3-1/8" (79)	2-3/8" (60)	3-3/4 (17)
RM4-1	4" (101)	4-1/2" (14)	3-1/8" (79)	6 (2.7)
RM4-2	4-1/8" (105)	3-1/8" (79)	2-3/8" (60)	3-3/4 (17)
RM4.5-1	" (101)	4-1/2" (114)	3-1/8" (79)	6 (2.7)
RM4.5-2	4-1/8" (105)	3-1/8" (79)	2-3/8" (60)	3-3/4 (17)
RM5-1	4" (101)	4-1/2" (114)	3-1/4" (83)	6-1/8 (28)
RM5-2	4-1/8" (105)	3-1/8" (79)	2-3/8" (60)	3-3/4 (17)
RM6-1	4" (101)	4-1/2" (114)	3-3/8" (86)	6-1/4 (28)
RM7-1	4-1/2" (114)	5-3/4" (146)	3-1/16" (78)	8-3/4 (40)
RM8-1	4-1/2" (114)	5-3/4" (146)	3-3/16" (81)	9 (4.0)
RM9-1	4-1/2" (114)	5-3/4" (146)	3-5/16" (84)	9-1/2 (4.3)
RM10-1	4-1/2" (114)	5-3/4" (146)	3-1/2" (89)	1-3/4 (53)
RM12.5-3	5-3/8" (137)	7-5/8" (194)	4-1/2" (114)	18-3/4 (85)
RM17-3	5-5/8" (142)	7-5/8" (194)	4-1/2" (114)	19-1/2 (87)
RM21-3	5-3/4" (148)	7-5/8" (194)	4-1/2" (114)	19-3/4 (90)
RM25-3	6" (152)	7-5/8" (194)	5" (127)	20-1/4 (92)

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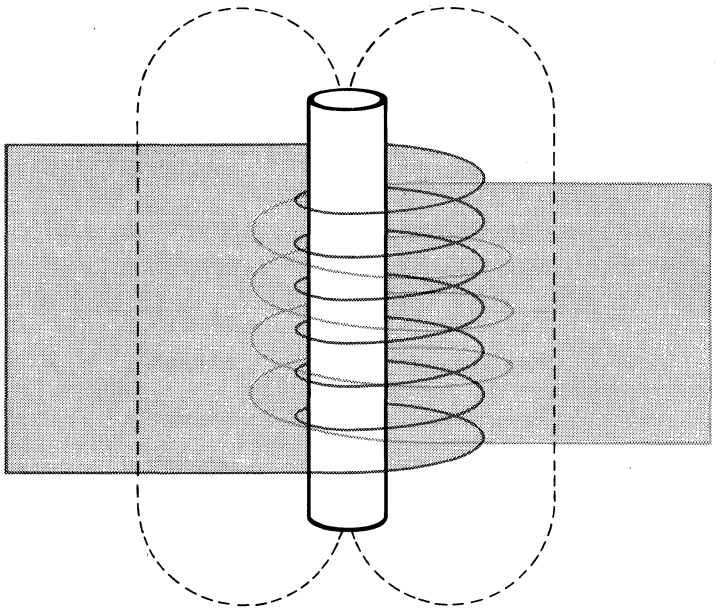
Hisonic... specialists in custom and standard inductor and transformer components

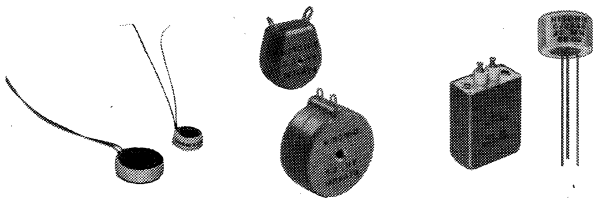


The control of electric current is only as good as the components that carry it.

INDUCTORS: Our manufacturing capabilities are the result of experience dating back to 1950 and now include virtually every known construction your special applications may require . . . and at reasonable prices.

TRANSFORMERS: Hisonic's special power/converter and signal/matching transformers for both audio and wide video ranges are used in airborne comm/nav and ground communications systems. Included are toroidal, pot core, and laminated core types manufactured to commercial and MIL specifications. Our 30 year experience is at your disposal to help solve your transformer and inductor problems.

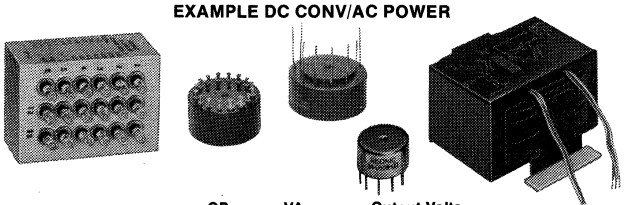
UNCASED | STANDARD MOLDED | METAL CASED



*Toroidal Series	Ind. Range	Max. Q	Freq. Range	DC R Ohms/MH	Uncased Size
J2	5.6MH to 3.3HY	90	Up to 30 KHZ	.50	.620D x .30H
J3	2.7 to 470MH	110	20 to 150KHZ	1.1	.620D x .30H
J4	.56 to 33MH	110	100 to 400KHZ	5.1	.620D x .30H
J5	.10 to 10MH	150	250KHZ to 1.5MHZ	8.9	.620D x .30H
R2	6.8MH to 6.8HY	135	Up to 20KHZ	.18	.960D x .40H
R3	3.3 to 470MH	180	10 to 60KHZ	.39	.960D x .40H
R4	1.2 to 68MH	170	40 to 160KHZ	.90	.960D x .40H
S2	6.8MH to 15HY	160	Up to 15KHZ	.10	1.250D x .62H
S3	3.3 to 560MH	225	10 to 60KHZ	.21	1.250D x .62H
T2	22MH to 39HY	210	Up to 15KHZ	.045	1.850D x .85H
V2	68MH to 68HY	245	Up to 8KHZ	.028	2.400D x .92H
W2	100MH to 100HY	260	Up to 6KHZ	.021	2.700D x 1.05H

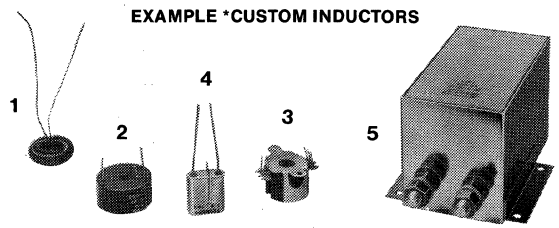
*Write for Series Bulletins on electrical and case style details

EXAMPLE DC CONV/AC POWER



P/N	Input	OP Freq.	VA Rating	Output Volts Peak (or RMS)	Size
24-0170-10	10V DC	24KHZ	0.8	20CT	.28x .6x 48H
24-0193-10	14/28V DC	6KHZ	18	4.7.11.5CT.22.5CT.550	1.8 ODx .94H
06-2124-10	200 V L-L	400HZ-30	840	200L-L	4.3x3.9x2.1H
24-0107-10	14/28V DC	2KHZ	27	90/45CT.180/25.180/25	2.1 ODx .88H
24-0512-10	260V PK	100PPS	20KVA PK	4.6 KV PK PULSE	2.5x2.3x1.1H
24-0114-10	14/28V DC	400HZ	75	26.60	2.9 ODx1.5H
24-0271-10	14/28V DC	5KHZ	80	6.5CT.22.5CT.100.100	2.0x2.0x1.OH
24-0277-10	42V DC	10KHZ	200	100	2.0x2.5x1.2H
24-0177-10	10V AC	400HZ	2	1.4.1.4.10(RMS)	1.9 ODx .86H
24-0169-10	26V AC	400HZ	17	21/13CT(RMS)	1.0x1.4x1.3H
24-0215-10	115V AC	400HZ	180	20.27.27.42(RMS)	3.2x3.8x4.1H

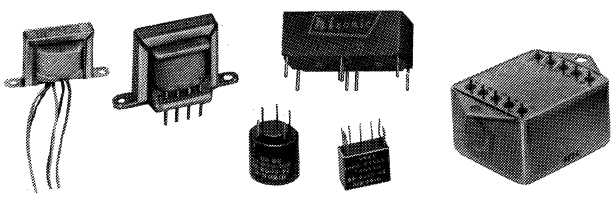
EXAMPLE *CUSTOM INDUCTORS



P/N	Fig.	Description	Characteristics	Type	Size
26-5103 Series	2	Encaps. PC Mtg.	See R Series Std.	Tor.	1.06x.5H
06-4000-27	1	DC Filter Choke	250uH@1.5ACD	Tor.	970Dx.4H
06-4000-39	3	Var. Ind. PC Mtg.	90-110MH Q250	Pot	.80Dx.5H
26-5034 Series	4	Xtal Case Mtg.	See J Series Std.	Tor.	.34x.75x.8H
26-5135-00	5	Shielded Choke	50uH@100ADC	Lam.	2.65x5x3H

*Advise requirements for recommended solution and quotation

EXAMPLE SIGNAL/PULSE/MATCH



P/N	Description	Impedance	Response	Level	Size
24-0239-11	Video Range Match	150:150.25	100KHZ-2.5MHZ	60mw	.63x.63x.44H
24-0275-10	Wide Band Match	135CT:1000	1KHZ-2MHZ	4mw	1.1 ODx.75H
24-0659-10	Syncro/Resolver	800 OHMS	400HZ	270mw	1.5x.75x.56H
24-0240-10	Wide Bank Hybrid	600.600+600	50HZ-50KHZ	1mw	1.8x2.0x1.0H
24-0171-10	Radio Freq. Hybrid	50.100+100	700KHZ-4MHZ	10mw	75 ODx85H
24-0153-10	Pulse Match	10K.40K	tp1.2ms.tr60us	25mw	.53x.53x.7H
24-0180-10	Pulse Output	5.600w/tap	tp.4us.tr.2us	6KW	1.5 ODx.8H

hisonic inc.

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P.O. Box 1130
Olathe, Kansas 66061
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OTHER PRODUCTS: :(Mil Spec & Commercial) Filters — Transformers — Tuned Circuits — Amp/phase Equalizers — Lumped Constant Delay Lines

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Key source for reliable magnetic components, power supplies and control systems for over 40 years.

300 VA TO 3000 KVA STANDARD & SPECIALTY MAGNETIC COMPONENTS

STANDARD TRANSFORMERS

DIT SERIES — Drive Isolation Transformers. (12-550KVA, U.L. Listed)

Designed to provide electrical isolation and voltage transformation for SCR adjustable-speed motor drives. Dry type. 600V class. Single phase and three phase. 50HZ and 60Hz. 5% FCAN and FCBN primary taps. Open frame or NEMA 1 enclosed, 150°C rise/220°C insulation class standard, 115°C or 80°C or 55°C rise/220°C insulation class optional.

Size Range (KVA)

Single Phase

• 1, 1½, 3, 5, 8, 12, 15, 20, 27, 30, 34

Three Phase

• 8, 12, 15, 20, 27, 34, 40, 51, 63, 75, 93, 120, 150, 180, 220, 280, 330, 440, 550, 660, 760, 870, 980, 1100.

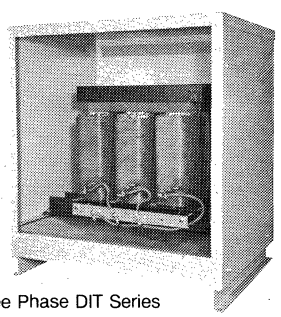
Standard Voltages Available

Single Phase

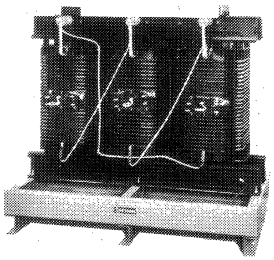
• Primary or Secondary 208, 230, 380, 460, 575, 230/460, 415

Three Phase

• Primary (△) 208, 230, 380, 460, 575, 230/460, 415
• Secondary 208Y/120, 230Y/133, 380Y/220, 460Y/266, 575Y/332, 230x460Y/133x266, 415Y/240



Three Phase DIT Series



1500KVA HVDT 15KV Class Transformer

GPT SERIES — General Purpose Transformers

Designed to provide electrical isolation and voltage transformation for lighting, electric heating and industrial motor loads. Dry type, 600V class, single phase and three phase, 50Hz and 60Hz. FCAN and FCBN primary tap arrangements are standard. 150°C rise/220°C insulation class standard, 115°C or 80°C or 55°C rise/220°C insulation class optional.

Size Range (KVA)

Single Phase

• 3, 5, 7½, 10, 15, 25, 37½, 50, 75, 100, 167

Three Phase

• 3, 6, 9, 15, 30, 45, 60, 75, 112½, 150, 225, 300, 400, 500, 750, 1000

Standard Voltages Available

Single Phase

• Primary (3KVA-15KVA) 240/480, 208, 277, 480, 600
(25KVA-167KVA) 240x480, 480, 600
• Secondary (All KVA sizes) 120/240

Three Phase

• Primary (△) 240, 480, 600
• Secondary 208Y/120, 240△, 480Y/277

HVDT SERIES—High Voltage Distribution Transformers

Designed for in-plant distribution and voltage step-down. Conventional dry type or resin cast coil. 5KV through 15KV class. Single phase and three phase. 50Hz and 60Hz. FCAN and FCBN primary tap arrangements are standard. 150°C rise/220°C insulation class standard, 115°C or 80°C or 55°C rise/220°C insulation class optional.

Size Range (KVA)

Single Phase

• 3, 5, 10, 15, 25, 37½, 50, 75, 100, 167, 200, 250, 333, 500

Three Phase

• 15, 30, 45, 75, 112½, 150, 225, 300, 400, 500, 750, 1000

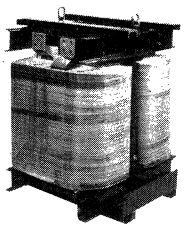
Standard Voltages Available

Single Phase

• Primary
5KV Class: 2400/4160Y
8.66KV Class: 4160/7200Y
15KV Class: 7200/12470Y
7620/13200Y, 7960/13800Y
• Secondary (All KVA Sizes)
120/240

Three Phase

• Primary (△)
5KV Class: 2400, 4160, 4800
8.66KV Class: 7200
15 KV Class: 12000, 12470, 13200, 13800
• Secondary
208Y/120, 240△, 480Y/277



DC Link Choke
4 mH at 1000 Adc
5 KV Class

SPECIALTY MAGNETIC COMPONENTS

Also see our catalog pages under AC POWER SOURCES and DC POWER SOURCES.

Transformers

• Convection, forced air or water cooled.
• Dry type, liquid filled, cast-resin.
• Low voltage, high voltage to 300KV.
• High current to 20,000 Amperes.
• High frequency to 10KHz.
• Low temperature rise, high efficiency.
• Ferroresonant transformers - conventional constant voltage and harmonic-neutralized.
• Computer grade isolation transformers to 0.001 picofarads.
• Low capacitance transformers, electrostatic shielded.
• High reactance transformers - short circuit current limited.
• Modulation (Output) transformers to 50KW.
• Rectifier and filament transformers.

Inductors

LC Series - Link Chokes (DC)

Designed for use as a smoothing inductor in the DC link between rectifier and inverter in variable-speed AC motor drives from 15 to 1000 HP. Dry type, 600V class.

LR Series - Line Reactors (AC)

Designed for use as a line reactor in the three phase input lines supplying variable-speed AC motor drives from 15 to 1000 HP. Dry type, 600V class; three phase; 50Hz and 60Hz.
Other specialty inductors include:
• AC, DC.
• Iron-core, air-core.
• Linear, swinging.
• AC current limiting reactors.
• AC power factor correction reactors.
• DC filter chokes.
• AM modulation reactors.

Saturable Reactors:

Low voltage, High voltage to 15 KV. Sizes to 1000 KVA.

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CAPACITORS / SILICON DIODES / CARBON FILM RESISTORS / LEDS / POTENTIOMETERS / TRANSFORMERS ADAPTORS AND POWER SUPPLIES

TRANSFORMERS

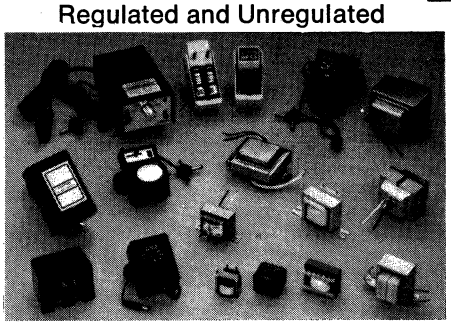
Telecom, Industrial, Power

- Standard and Custom Design
- Power Ranges 75 mW—300W
- UL Construction as Required
- Telecommunications Transformers Meet FCC Specs Part 68
- Split Bobbin and Other Lead Configurations Available

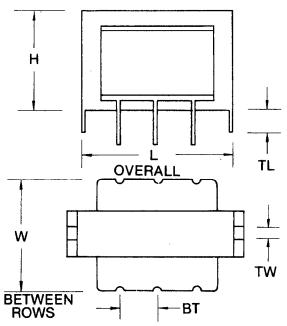
WALL PLUG-IN ADAPTORS AC/AC - AC/DC

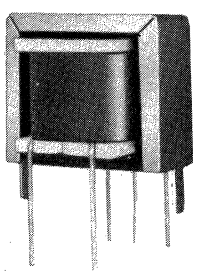
Case Sizes E128 to E157

Regulated and Unregulated

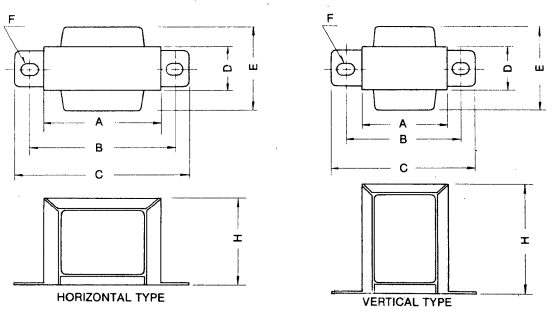


AUDIO/COMMUNICATIONS TELEPHONE TRANSFORMERS





POWER TRANSFORMERS



DIMENSIONS: M/M HORIZONTAL TYPE / VERTICAL TYPE

Type	Part No.	Description	Impedance Pri	Impedance Sec	Resistance Pri	Resistance Sec	Dimension
EI-14 Series .075 Watts Max.	AT-141	Output	500C.T.	8	35	.8	L =15.2mm(.599) H =11.0mm(.433) W =12.0mm(.473) TW= 2.0mm(.079) TL = 3.8mm(.150) BT = 2.5mm(.098) All Dimensions Nom
	AT-142	Coupling	600C.T.	600C.T.	45	40	
	AT-143	Output	1KC.T.	8	60	.8	
	AT-144	Coupling	10KC.T.	600C.T.	450	100	
	AT-145	Driver	10KC.T.	2KC.T.	500	200	
EI-16 Series .100 Watts Max.	AT-161	Output	500C.T.	8	22	.8	L =17.7mm(.697) H =14.0mm(.551) W =16.0mm(.630) TW= 2.2mm(.086) TL = 4.0mm(.157) BT = 2.8mm(.110) All Dimensions Nom
	AT-162	Interstage	500C.T.	500C.T.	30	28	
	AT-163	Output	1.2KC.T.	8	80	.8	
	AT-164	Output	48C.T.	8	2.5	.5	
	AT-165	Output	200C.T.	8	12	.8	
EI-19 Series .200 Watts Max.	AT-191	Output	200C.T.	8	12	.8	L =20.3mm(.800) H =16.2mm(.640) W =14.5mm(.571) TW= 2.2mm(.086) TL = 4.2mm(.165) BT =3.0mm(.118) All Dimensions Nom
	AT-192	Output	500C.T.	8	26	.8	
	AT-193	Coupling	600C.T.	600C.T.	65	55	
	AT-194	Output	800C.T.	8	40	.8	
	AT-195	Output	1.2KC.T.	8	80	.8	
	AT-196	Interstage	1.5KC.T.	500C.T.	120	50	
	AT-197	Coupling	10KC.T.	600C.T.	600	100	
	AT-198	Driver	10KC.T.	2KC.T.	600	155	
EI-24 Series .460 Watts Max.	AT-241	Output	48C.T.	8	2.5	.5	L =25.3mm(.100) H =18.4mm(.725) W =16.0mm(.630) TW= 2.6mm(.102) TL = 4.8mm(.189) BT = 4.5mm(.177) All Dimensions Nom
	AT-242	Output	120C.T.	8	7.0	.7	
	AT-243	Output	200C.T.	8	12.0	.5	
	AT-244	Output	500C.T.	8	180	.7	
	AT-245	Interstage	500C.T.	500C.T.	35	28	
	AT-246	Driver	10KC.T.	2KC.T.	600	155	
	AT-247	Output	1.2KC.T.	8	75	.8	
	AT-248	Coupling	600C.T.	600C.T.	65	55	

• Welcome Offer Original Sample and Diagram

Metric Size Output (VA)	Input	A	B	C	D	E	F	H
EI-28 (1)	120	29.5	37.5	49.5	9-15	25-34	3.5 x 5.8	28
		27	35	47				31
EI-35 (2)	120	36.5	45	56.5	10-17	31-40	3.5 x 5.8	32.5
		31.5	41	53				38
EI-41 (4.5)	120	42.5	52	61	14-24	32-43	3.5 x 5.8	37
		35	45	57				44
EI-48 (7)	120	50.5	60	69.5	17-25	37-46	3.5 x 5.8	43.5
		42	52	64				51
EI-54 (13)	120	56	67	78	20-26	44-56	4.2 x 6.5	49
		48	59	70				56
EI-57 (18)	120	59	70	80	20-26	44-56	4.2 x 6.5	51
		49.5	61	75				60
EI-60 (25)	120	62	75	89	21-33	45-2	4.2 x 6.5	54
		52	66	78				63
EI-66 (40)	120	68.5	81	92	23-41	53-70	4.2 x 6.5	59
		57.5	74	84				69
EI-76 (75)	120	79	90	100	31-41	60	5 x 7	65
		67	78	89				78
EI-86 (110)	120	87.5	105	107	31-41	67	5 x 7	74
		75	86	97				89
EI-96 (300)	120	98	109	120	40-60	77	5 x 7	84
		85	96	107				98

Split Bobbin Transformers

The use of a Split Bobbin allows winding to be nonconcentric (side-by-side), consequently high isolation is achieved at low cost.

- Better insulation — 2500 VRMS hipot is standard.
- Lower capacitance — no need for electro-static shield.

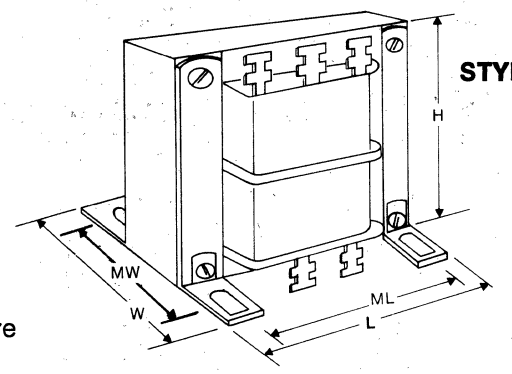
Also available:

- **Units with 4000 VRMS hipot**
- Steel covers
- Flexible leads
- Multiple outputs
- Tapped primaries
- Quick disconnect terminals
- Consult factory for any other configurations you may require

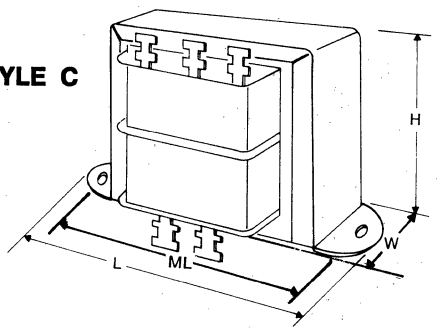
CUSTOM PROTOTYPES AVAILABLE WITHIN ONE WEEK. CHECK OUR LOW PRICES.

WE SPECIALIZE IN POWER TRANSFORMERS FOR MEDICAL ELECTRONICS (PATIENT ATTACHED EQUIPMENT) FOR DOMESTIC AND FOREIGN APPLICATIONS

STYLE B



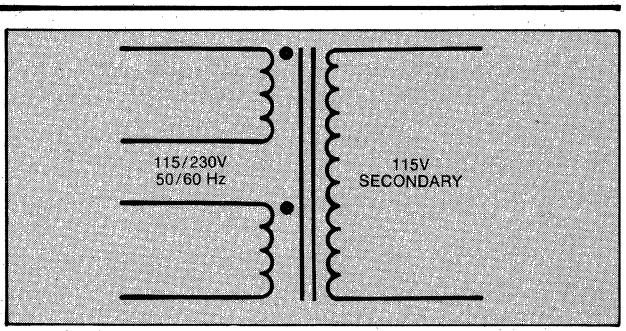
STYLE C



Size	Mounting Style	L	W	H	ML	MW	Approx. Lbs.	Typical Power
40	C	3 11/16	1 31/32	2 1/4	3 1/8	—	1 1/2	40VA
50	C	3 11/16	2 1/16	2 1/4	3 1/8	—	1 3/4	50VA
75	C	4 1/32	2 7/32	2 9/16	3 9/16	—	2	75VA
100	C	4 1/32	2 15/32	2 9/16	3 9/16	—	2 3/4	100VA
120	C	4 1/2	2 15/32	2 7/8	4	—	3	120VA
150	B	3 3/4	2 13/16	3 1/8	3 1/8	2 1/4	4	150VA
200	B	4 1/8	3	3 7/16	3 7/16	2 3/8	5 1/2	200VA
300	B	4 1/2	3 1/4	3 3/4	3 3/4	2 1/2	7	300VA
500	B	4 1/2	4 1/4	3 3/4	3 3/4	3 1/2	11	500VA
750	B	5 1/4	4 1/2	4 3/8	4 3/8	3 5/8	16	750VA
1000	B	6 3/8	4 5/8	5 5/16	5 5/16	3 1/4	20	1000VA
1800	B	7 1/2	5 3/8	6 1/4	6 3/4	3 5/8	32	1800VA

Split Bobbin Power Isolation Transformers

Part Number	Size	Secondary RMS Rating
I-.8	100	115V @ .8A
I-1	120	115V @ 1A
I-1.3	150	115V @ 1.3A
I-1.7	200	115V @ 1.7A
I-2.6	300	115V @ 2.6A
I-4.3	500	115V @ 4.3A
I-6.5	750	115V @ 6.5A
I-9	1000	115V @ 9A
I-15	1800	115V @ 15A



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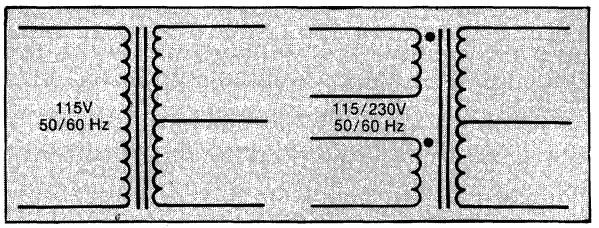
Split Bobbin Power Transformers

Ideal for use in rectifier circuits



Add Prefix D to Part Numbers below if Dual Primary is Required

Part Number	Secondary RMS Rating	Size
10T-4	10VCT @ 4A	40
10T-5	10VCT @ 5A	50
10T-7.5	10VCT @ 7.5A	75
10-10*	10V @ 10A	100
10-12*	10V @ 12A	120
10-15*	10V @ 15A	150
12T-3.2	12.6VCT @ 3.2A	40
12T-4	12.6VCT @ 4A	50
12T-6	12.6VCT @ 6A	75
12T-8	12.6VCT @ 8A	100
12-10*	12.6V @ 10A	120
12-12*	12.6V @ 12A	150
16T-2.5	16VCT @ 2.5A	40
16T-3.2	16VCT @ 3.2A	50
16T-4.5	16VCT @ 4.5A	75
16T-6	16VCT @ 6A	100
16T-8	16VCT @ 8A	120
16-10*	16V @ 10A	150
16-12*	16V @ 12A	200
20T-2	20VCT @ 2A	40
20T-2.5	20VCT @ 2.5A	50
20T-3.8	20VCT @ 3.8A	75
20T-5	20VCT @ 5A	100
20T-6	20VCT @ 6A	120
24T-1.7	24VCT @ 1.7A	40
24T-2	24VCT @ 2A	50
24T-3.2	24VCT @ 3.2A	75
24T-4	24VCT @ 4A	100
24T-5	24VCT @ 5A	120
24T-6	24VCT @ 6A	150
24T-8	24VCT @ 8A	200
24-12*	24V @ 12A	300
28T-1.4	28VCT @ 1.4A	40
28T-1.8	28VCT @ 1.8A	50
28T-2.6	28VCT @ 2.6A	75
28T-3.5	28VCT @ 3.5A	100

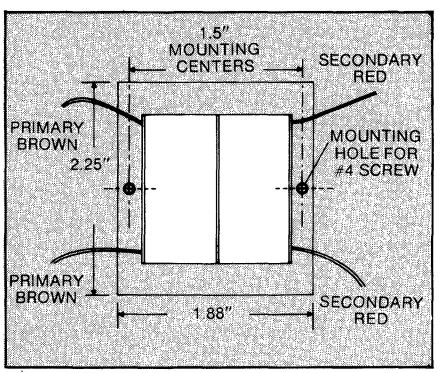
Part Number	Secondary RMS Rating	Size
28T-4.2	28VCT @ 4.2A	120
28T-5.4	28VCT @ 5.4A	150
28T-7	28VCT @ 7A	200
28-10*	28V @ 10A	300
32T-1.2	32VCT @ 1.2A	40
32T-1.5	32VCT @ 1.5A	50
32T-2.4	32VCT @ 2.4A	75
32T-3	32VCT @ 3A	100
32T-3.8	32VCT @ 3.8A	120
32T-4.5	32VCT @ 4.5A	150
32T-6	32VCT @ 6A	200
36T-1	36VCT @ 1A	40
36T-1.4	36VCT @ 1.4A	50
36T-2	36VCT @ 2A	75
36T-2.8	36VCT @ 2.8A	100
36T-3.3	36VCT @ 3.3A	120
36T-4	36VCT @ 4A	150
36T-5.5	36VCT @ 5.5A	200
36T-8	36VCT @ 8A	300
36-12*	36V @ 12A	500
40T-1	40VCT @ 1A	40
40T-1.2	40VCT @ 1.2A	50
40T-1.8	40VCT @ 1.8A	75
40T-2.5	40VCT @ 2.5A	100
40T-3	40VCT @ 3A	120
40T-3.8	40VCT @ 3.8A	150
40T-5	40VCT @ 5A	200
40T-7.5	40VCT @ 7.5A	300
48T-.8	48VCT @ .8A	40
48T-1	48VCT @ 1A	50
48T-1.5	48VCT @ 1.5A	75
48T-2	48VCT @ 2A	100
48T-2.5	48VCT @ 2.5A	120
48T-3	48VCT @ 3A	150
48T-4	48VCT @ 4A	200
48T-6	48VCT @ 6A	300

Part Number	Secondary RMS Rating	Size
56T-.7	56VCT @ .7A	40
56T-.9	56VCT @ .9A	50
56T-1.3	56VCT @ 1.3A	75
56T-1.7	56VCT @ 1.7A	100
56T-2.1	56VCT @ 2.1A	120
56T-2.7	56VCT @ 2.7A	150
56T-3.6	56VCT @ 3.6A	200
56T-5.4	56VCT @ 5.4A	300
56-8*	56V @ 8A	500
56-13*	56V @ 13A	750
68T-.6	68VCT @ .6A	40
68T-.7	68VCT @ .7A	50
68T-1.1	68VCT @ 1.1A	75
68T-1.4	68VCT @ 1.4A	100
68T-1.8	68VCT @ 1.8A	120
68T-2.2	68VCT @ 2.2A	150
68T-2.9	68VCT @ 2.9A	200
68T-4.4	68VCT @ 4.4A	300
68-7*	68V @ 7A	500
68-11*	68V @ 11A	750
80T-.5	80VCT @ .5A	40
80T-.6	80VCT @ .6A	50
80T-.9	80VCT @ .9A	75
80T-1.2	80VCT @ 1.2A	100
80T-1.5	80VCT @ 1.5A	120
80T-1.9	80VCT @ 1.9A	150
80T-2.5	80VCT @ 2.5A	200
80T-3.8	80VCT @ 3.8A	300
80T-6	80VCT @ 6A	500
80-9*	80V @ 9A	750
120T-.3	120VCT @ .3A	40
120T-.4	120VCT @ .4A	50
120T-.6	120VCT @ .6A	75
120T-.8	120VCT @ .8A	100

* These items do not have center-tapped secondaries

Low Profile Split Bobbin Power Transformers

- **Only 1.1 inches high**
- 4″ flexible leads • Wt. ½ lb. • 2500 VRMS hipot
- Ideal for PC Board and Chassis Mtg. where low height is required



STANDARD TRANSFORMERS: 115V 50/60 Hz PRIMARY - 10 VA

Part Number	Secondary RMS Rating
LPS 10-8	8V @ 1.25A
LPS 10-10	10V @ 1A
LPS 10-12	12.6V @ .8A
LPS 10-16	16V @ .63A

Part Number	Secondary RMS Rating
LPS 10-20	20V @ .5A
LPS 10-24	24V @ .42A
LPS 10-32	32V @ .31A

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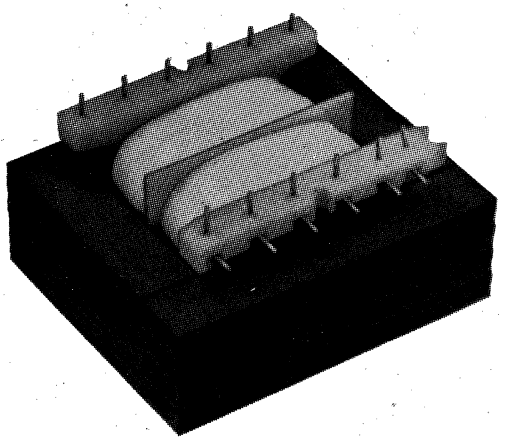
Split Bobbin PC Board Transformers

The use of a Split Bobbin allows winding to be nonconcentric (side-by-side), consequently high isolation is achieved at low cost.

- Better insulation — 2500 VRMS hipot is standard.
- Lower capacitance — no need for electro-static shield.

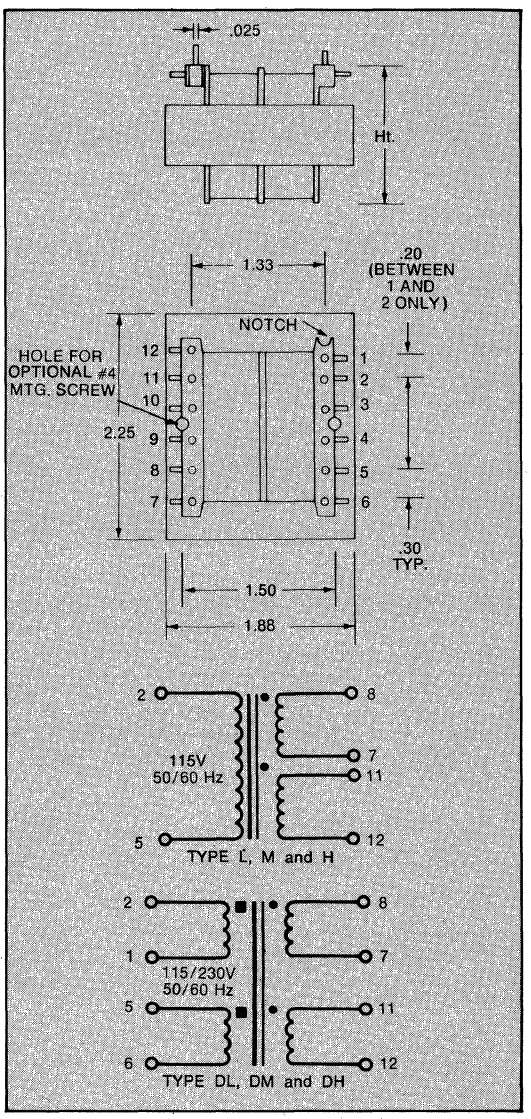
Please note that the standard items listed below utilize 6 or 8 pins, while 12 pins are available. We would like to quote your more complex requirements . . . you may save cost and space by combining two less complex Transformers into one.

We would also be glad to quote your less complex requirements. For example, if only a Single Primary and Single Secondary are needed, you can save considerable cost by utilizing only 4 Pins.



STANDARD TRANSFORMERS

	Part Number		Secondary RMS Ratings			
	Single 115V Pri.	Dual 115/230V Pri.	Series	Parallel	Ht.	Approx. Lbs.
LOW PROFILE	L-10	DL-10	10VCT @ 2A	5V @ 4A	1.34	.75
	L-12	DL-12	12.6VCT @ 1.6A	6.3V @ 3.2A	1.34	.75
	L-16	DL-16	16VCT @ 1.25A	8V @ 2.5A	1.34	.75
	L-20	DL-20	20VCT @ 1A	10V @ 2A	1.34	.75
	L-24	DL-24	24VCT @ .8A	12V @ 1.6A	1.34	.75
	L-32	DL-32	32VCT @ .625A	16V @ 1.25A	1.34	.75
	L-40	DL-40	40VCT @ .5A	20V @ 1A	1.34	.75
	L-48	DL-48	48VCT @ .4A	24V @ .8A	1.34	.75
	L-80	DL-80	80VCT @ .25A	40V @ .5A	1.34	.75
	L-120	DL-120	120VCT @ .16A	60V @ .32A	1.34	.75
	M-10	DM-10	10VCT @ 2.4A	5V @ 4.8A	1.55	.9
	M-12	DM-12	12.6VCT @ 1.9A	6.3V @ 3.8A	1.55	.9
	M-16	DM-16	16VCT @ 1.5A	8V @ 3A	1.55	.9
	M-20	DM-20	20VCT @ 1.2A	10V @ 2.4A	1.55	.9
	M-24	DM-24	24VCT @ 1A	12V @ 2A	1.55	.9
	M-32	DM-32	32VCT @ .75A	16V @ 1.5A	1.55	.9
	M-40	DM-40	40VCT @ .6A	20V @ 1.2A	1.55	.9
	M-48	DM-48	48VCT @ .5A	24V @ 1A	1.55	.9
	M-80	DM-80	80VCT @ .3A	40V @ .6A	1.55	.9
	M-120	DM-120	120VCT @ .2A	60V @ .4A	1.55	.9
	H-10	DH-10	10VCT @ 3A	5V @ 6A	1.79	1.1
	H-12	DH-12	12.6VCT @ 2.4A	6.3V @ 4.8A	1.79	1.1
	H-16	DH-16	16VCT @ 1.8A	8V @ 3.6A	1.79	1.1
	H-20	DH-20	20VCT @ 1.5A	10V @ 3A	1.79	1.1
	H-24	DH-24	24VCT @ 1.25A	12V @ 2.5A	1.79	1.1
	H-32	DH-32	32VCT @ .95A	16V @ 1.9A	1.79	1.1
	H-40	DH-40	40VCT @ .75A	20V @ 1.5A	1.79	1.1
	H-48	DH-48	48VCT @ .625A	24V @ 1.25A	1.79	1.1
	H-80	DH-80	80VCT @ .375A	40V @ .75A	1.79	1.1
	H-120	DH-120	120VCT @ .25A	60V @ .5A	1.79	1.1

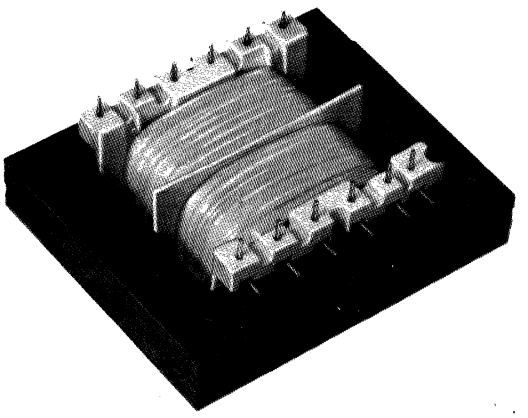


J M Transformer Co., Inc. 112 FLORIDA STREET, FARMINGDALE, NY 11735 • (516) 293-0475

Low Profile Split Bobbin PC Board Transformers

• Only 1.13″ high

XL Series transformers offer a particularly low profile for 18VA, allowing for 1.25″ card spacing.



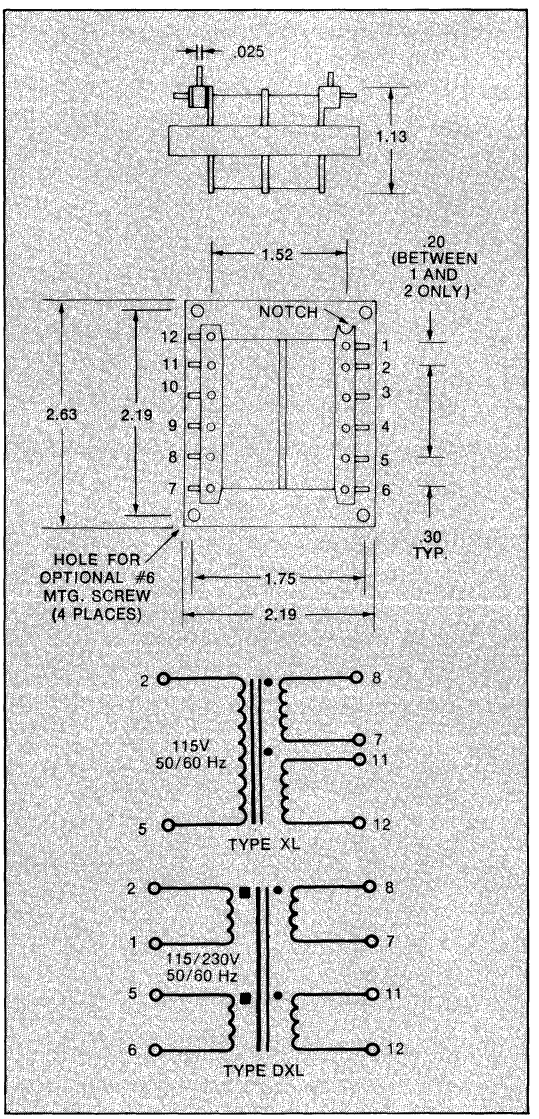
The use of a split bobbin allows winding to be non-concentric (side-by-side), consequently high isolation is achieved at low cost.

- Better Insulation — 2500 VRMS hipot is standard.
- Lower Capacitance — no need for electro-static shield.

If the standard items shown here do not fit your requirements, we would be glad to quote on your custom needs. Often this can save space and considerable cost.

STANDARD TRANSFORMERS

Part Number		Secondary RMS Ratings		Approx. Lbs.
Single 115V Pri.	Dual 115/230V Pri.	Series	Parallel	
XL-10	DXL-10	10VCT @ 1.6A	5V @ 3.2A	.7
XL-12	DXL-12	12.6VCT @ 1.25A	6.3V @ 2.5A	.7
XL-14	DXL-14	14VCT @ 1.28A	7V @ 2.56A	.7
XL-16	DXL-16	16VCT @ 1A	8V @ 2A	.7
XL-18	DXL-18	18VCT @ 1A	9V @ 2A	.7
XL-20	DXL-20	20VCT @ .8A	10V @ 1.6A	.7
XL-22	DXL-22	22VCT @ .8A	11V @ 1.6A	.7
XL-24	DXL-24	24VCT @ .68A	12V @ 1.36A	.7
XL-28	DXL-28	28VCT @ .64A	14V @ 1.28A	.7
XL-32	DXL-32	32VCT @ .5A	16V @ 1A	.7
XL-36	DXL-36	36VCT @ .5A	18V @ 1A	.7
XL-40	DXL-40	40VCT @ .4A	20V @ .8A	.7
XL-44	DXL-44	44VCT @ .4A	22V @ .8A	.7
XL-48	DXL-48	48VCT @ .34A	24V @ .68A	.7
XL-56	DXL-56	56VCT @ .32A	28V @ .64A	.7
XL-72	DXL-72	72VCT @ .25A	36V @ .5A	.7
XL-88	DXL-88	88VCT @ .2A	44V @ .4A	.7
XL-120	DXL-120	120VCT @ .134A	60V @ .268A	.7



AT JM WE USE ONLY PRIME RAW MATERIALS

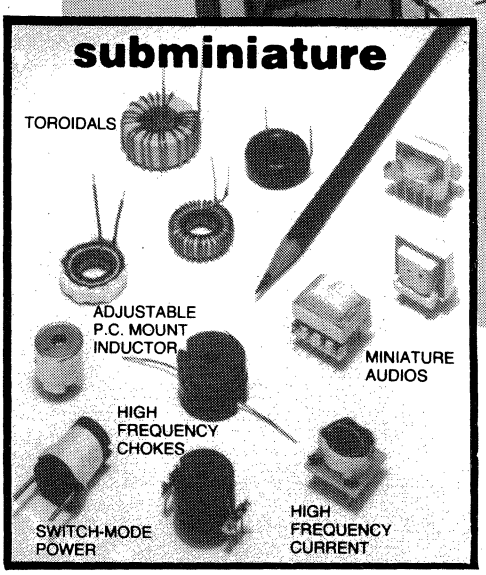
CUSTOM PROTOTYPES AVAILABLE WITHIN ONE WEEK

SERVICE IS AN IMPORTANT PART OF OUR PRODUCTS

112 FLORIDA STREET, FARMINGDALE, NY 11735 • (516) 293-0475 **J M Transformer Co., Inc.**

CUSTOM TRANSFORMERS

prototypes/short runs/high volume runs



Some of the many transformers Lenco has designed and produced for a wide range of industries. Our specialty . . . custom designed to your special application. Prototype through production. Power 10 MW to 1000 VA.

SEE OUR CATALOG IN THOMCAT
THOMAS REGISTER CATALOG FILE

LENCO
ELECTRONICS, INC.

1330-29 BELDEN STREET
McHENRY, ILLINOIS 60050

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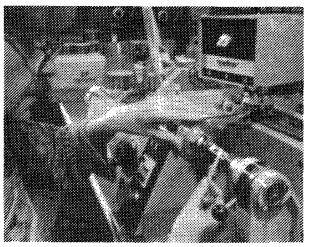
815/344-2900

send specifications for your special requirements


BOBBIN WINDING

PRODUCTION TESTING

LENCO, dedicated to transformer design, product improvement, cost reduction and fast delivery to meet your specifications and most critical production schedule. An endless variety of types, sizes and performance capabilities for a wide variety of industries.

Experienced personnel with specially developed electronic skills for an exacting technology to meet the most critical requirements. Manufactured to conform to UL, CSA, VDE, FCC-Part 68, etc.

Our specialty is your special application and we invite you to send or call for your custom requirements. For no obligation quotes, engineering, design consultation and manufacture, contact Lenco, the performance people.

LAYER WINDING MACHINES

AUDIO Impedance matching — Isolation —Broad frequency response — Low insertion loss — FCC Part 68.

CONSTANT VOLTAGE Regulating transformers built to your specifications for DC power supplies or low distortion AC.

CONTROL Custom designed to UL, VDE, CSA, etc. specifications.

CONVERTER High Conversion efficiency from DC input to filtered DC out. Toroidal, Laminated, Ferrite, (Switch-Mode) etc.

CURRENT Toroidal, Laminated, Core, Impregnated, or Encapsulated.

FILAMENT Dry type, Laminated core.

HIGH TEMPERATURE Vacuum impregnation with temperature material to 200°C. Epoxy encapsulated.

INDUCTORS Filter, A.C. Noise filtering, Switch-mode.

INPUT AND OUTPUT Designed to your specifications.

ISOLATION Audio, Step-down, Step-up, Foil electrostatic shielded, Electromagnetic shielded.

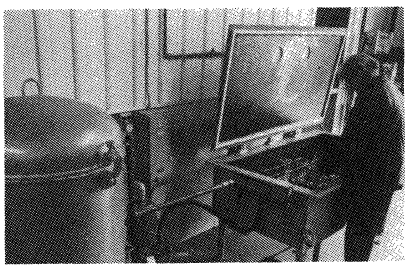
LOW PROFILE PC mount, Split bobbin, Vacuum varnish or epoxy impregnated.

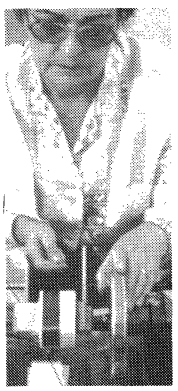
MEDICAL UL 544 Patient connected, or non-patient connected. Power.

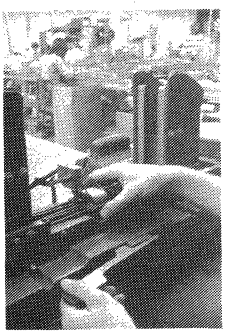
POT CORES PC mount, Frame mount, Encapsulated or Impregnated.

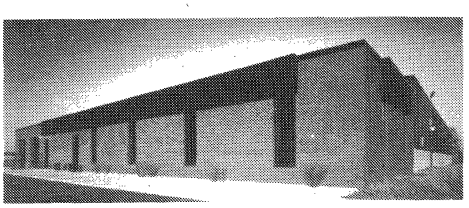
SWITCH-MODE POWER Dry type, Air cooled, Laminated or Ferrite.

THREE PHASE 50-60-400 Hertz up to 1 KVA.


VACUUM IMPREGNATION SYSTEM


HAND WINDING


AUTOMATIC LAMINATING


Modern new 20,500 square foot facility for the production and manufacture of high quality transformers.

LENCO ELECTRONICS, INC.

MEMBER PCPCI POWER CONVERSION PRODUCTS COUNCIL INTERNATIONAL

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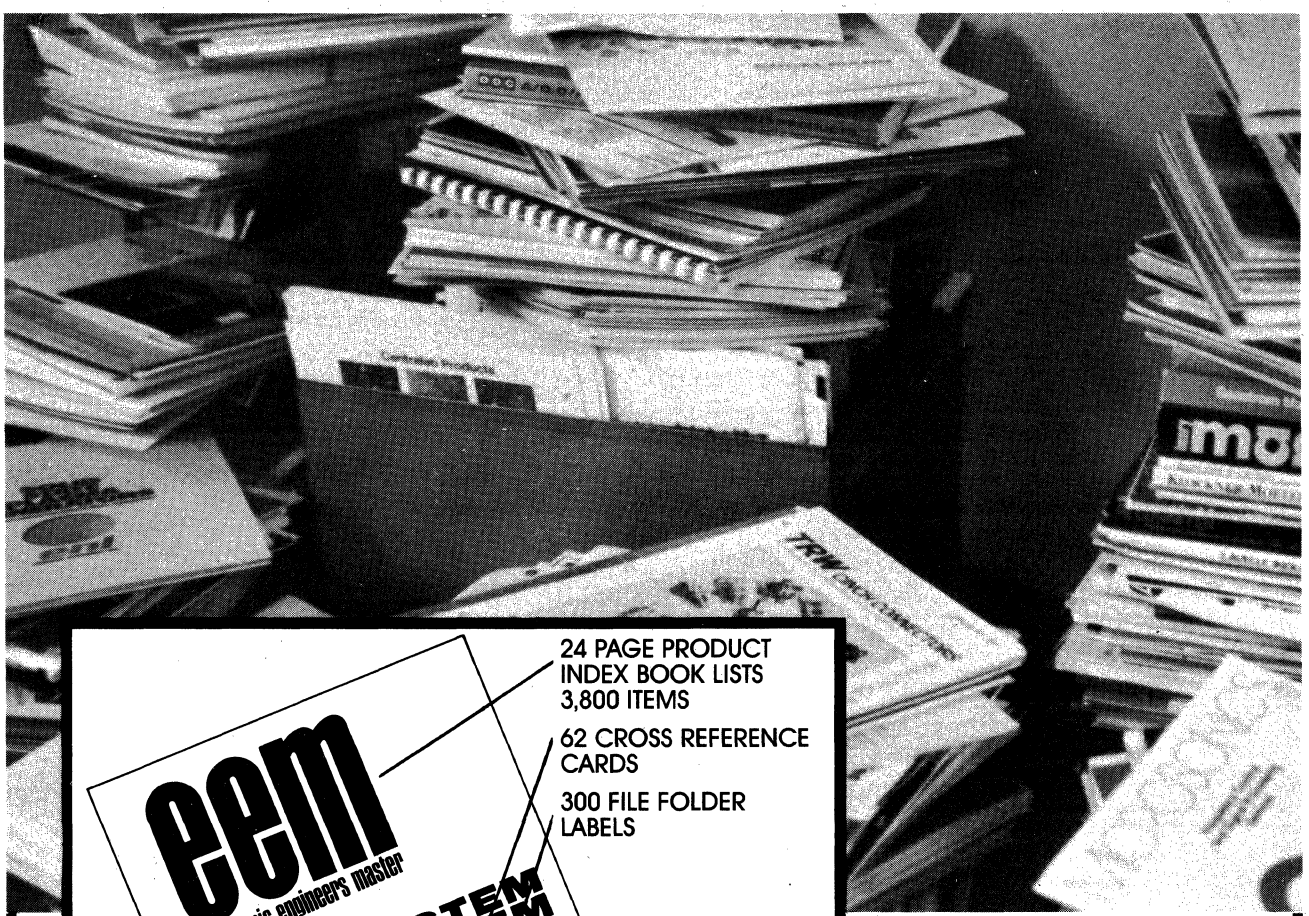

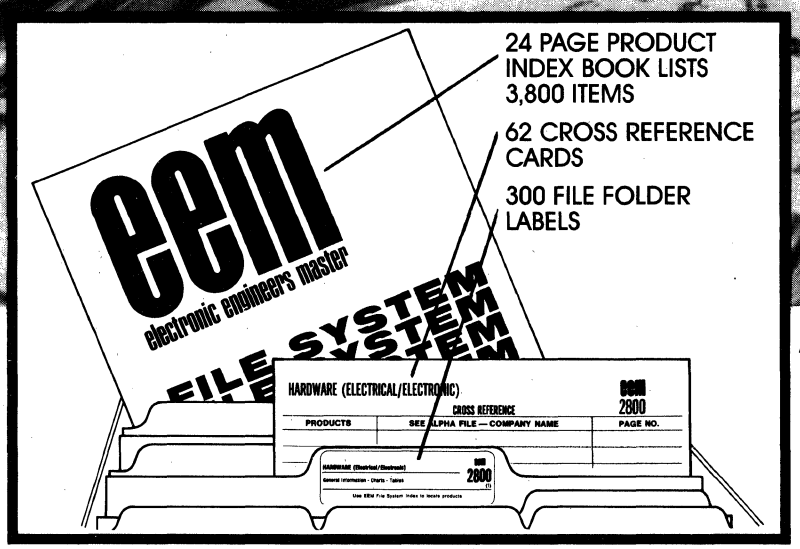

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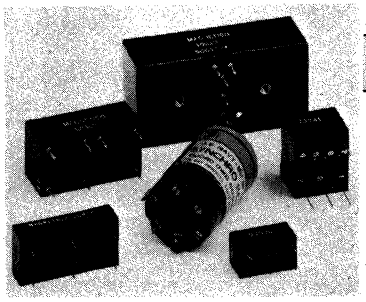
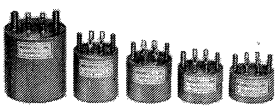
SCOTT T TRANSFORMERS



SYNCHRO TO RESOLVER CONVERTER TRANSFORMERS

Part No.	Input Voltage (L-L)	Output RMS Sine & Cosine	Frequency Hz	Input Z kΩ	Typical Load kΩ	Accuracy Arc Seconds	Size Inches	Weight Oz.
52975	11.8	1	400	20	100	4 min.	7/8 x 1/2 x 7/16	.5
10472	11.8	6	400	10	10	5 min.	3/4 x 1 1/2 x 3/8	.6
11870	90	6 CT	60	500	100	60	1.1 x 2.1 x 1.1	4
12094	90	6 CT	60 & 400	500	100	2 min.	1.1 x 2.1 x 1.1	4
50460	90	6	400	60	10	60	7/8 x 1 5/8 x 1 1/16	2
50642	11.8	6	400	30	10	60	7/8 x 1 5/8 x 1 1/16	2
50726	90	6 CT	400	500	100	60	13/16 x 1 1/2 x 5/8	1.5
9652	11.8	5	400	100	10	30	1 3/8 x 2 3/4 x 7/8	5
9514	90	4.25	400	1000	10	30	1 3/8 x 2 3/4 x 7/8	5
52910	11.8	1	400	10	100	4 min.	1/2 x 7/8 x .31	.5
52450	90	6	400	100	100	5 min.	5/8 x 1 1/4 x 1/2	3 3/4
52290	11.8	3.2	400	20	10	3 min.	7/8 x 1/2 x 7/16	1/3
52569	90	2 CT	400	80	100	5 min.	5/8 x 7/8 x 5/16	1/3
13084	11.8	6 CT	400	100	100	1 min.	3/4 x 1 1/2 x 3/8	1/2
13530	11.8	1	400	10	50	1 min.	5/8 x 1 1/4 x .3	.5

FEATURES:
- PRECISION/INTERCHANGEABILITY
- REPEATABILITY
- STABILITY/NO AGING
- NO SYSTEM TRIMMING REQUIRED



HOW TO ORDER:
Order Magnetico Standard Units directly by using the Magnetico Part Number.

VA RATING	SECONDARY VOLTAGE
Catalog Number	6.0 thru 300 (VRMS)

SCHEMATIC	SHIELD
X — No Tap	N — No Shield
T — Center Tap	S — Electrostatic Shield

EXAMPLE:
To order a 115 V 400 Hz to 26 V center tapped, 6 VA power transformer with no shield. Order Magnetico Number: **9602-26-T-N.**

VA RATING: 9602 **SCHEMATIC:** T
SECONDARY VOLTAGE: 26 **SHIELD:** N

RESOLVER TO SYNCHRO CONVERTER TRANSFORMERS

Part No.	Input Voltage 4 Wire	Output 3 Wire (L-L)	Frequency Hz	Load Ohms (L-L)	Input Z Ohms	Accuracy Arc Minutes	Size Inches	VA Rating
10084	11.8	11.8	400	150	1.5K	2	1 x 2 x .65 H	.5
10086	6.0	11.8	400	150	1K	2	1 x 2 x .65 H	1
10088	9.0	11.8	400	150	2K	1.5	1 3/8 x 2 3/4 x .65 H	1
10090	9.0	90	400	2500	1K	1	1 3/8 x 2 3/4 x 7/8 H	1
11999	7.0	11.8	400	30	500	1	2 x 4 x 1 H	3
50749	7.2	90	60	8000	700	2	1 1/2 x 3 3/8 x 1 1/4 H	3
12186	7.0	90	60	4000	250	1	2 x 4 x 1 1/2 H	3.2
52020	9	11.8	400	14	100	3.5	1 1/2 x 2 1/2 x 1 1/4	4.5
52021	9	90	400	800	100	3.5	2 x 4 x 1 1/4	1
52449	6	90	400	2500	150	3	1 x 1 5/8 x 1 1/16	2
52164	6	90	400	2500	100	2	1 1/2 x 3 x 1 1/8	10
12945	6	11.8	400	300	1K	5	3/4 x 1 1/2 x 7/16	1/2

STANDARD MINIATURE 400 Hz POWER TRANSFORMERS

CONDENSED PERFORMANCE DATA — PRIMARY VOLTAGE 115 VRMS. All Units Designed to Meet MIL-T-27D. IMMEDIATE DELIVERY FOR PROTOTYPE QUANTITIES.

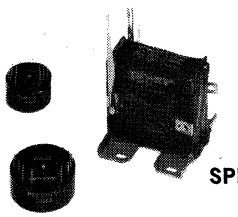
Catalog Number	VA Rating	Secondary Voltage (RMS)	O.D. ±1/32	Height ±1/32	Nominal Weight	Nom. Reg.	Nom.* Temp. Rise
9600	2	6-300 V	1″	19/32″	1 oz/ 30 gm	18%	10°C
9601	4	6-300 V	1″	11/16″	1.2 oz/ 35 gm	15%	12°C
9602	6	6-300 V	1″	7/8″	1.6 oz/ 45 gm	10%	18°C
9603	9	6-300 V	1″	1 1/16″	2.1 oz/ 60 gm	8%	20°C
9604	30	6-300 V	1 3/8″	1 1/2″	5.3 oz/150 gm	7%	23°C
10648	75	10-300 V	2″	1 5/16″	10 oz	±3%	30°C
10649	150	10-300 V	2 1/4″	1 5/16″	18 oz	±3%	40°C

Example: To order a 115 V 400 Hz to 26 V center tapped, 6 VA transformer with no shield — order Magnetico 9602-26-T-N
VA Rating: 9602 Secondary Voltage: 26 Schematic T: Shield: N.

SWITCHING TRANSFORMERS, 20 KHz

13962 — Input 160 VDC — Output (2) 5V @ 4A, (2) 15V @ 1/2A — Rated 55VA — 1.5 D x .8 Hi
13963 — Input 160 VDC — Output (4) 5V @ 4A, (2) 15V @ .66A — Rated 140 Watts — 1.75 D x .8 Hi
53248 — Input 160 VDC — Output (2) 12V @ 65A — Rated 650 Watts — 3″ x 2 3/4″ x 3″ Hi

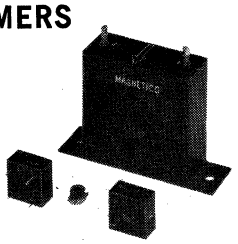
CUSTOM DESIGNS — Multiple Outputs — QUICK RESPONSE



CURRENT TRANSFORMERS

1V/Amp for Switching Applications
PC mount 13960 Series
1V/Amp for 400 Hz Power,
001V/Amp for 3000 Amp
Transmitter Monitor

Custom/Standard — QUICK RESPONSE

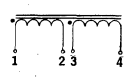


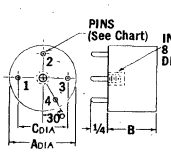
SPECIALS ARE STANDARD WITH US

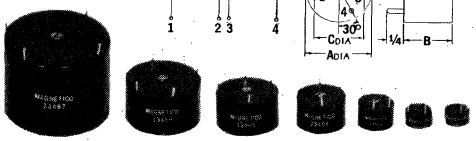
MAGNETICO

SWITCHING INDUCTORS

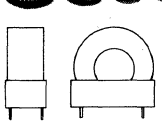
PARALLEL: Connect 1 to 3 & 2 to 4
SERIES: Connect 2 to 3, use 1 & 4







MIL-T-27 GRADE 5
Toroidal design on Molypermalloy Cores provides lowest leakage inductance and low pick up, PC mount, Hi-Q, low loss, stable inductance values.



OPEN TYPES OR VERTICAL MOUNTING (OPTIONAL)

Part No.	Induct. ±8% @ .1V 1kHz Par./Ser.		Res. Ohms Par./Ser.		DC Amps @ 90% Induct. Par./Ser.		Safe Operating Current Par./Ser.		A	B	C
13461-010	10 μH	40 μH	.015	.060	2.50	1.25	2.5†	1.25†	5/8	5/16	.500
-040	40 μH	160 μH	.050	1.00	1.25	.625	1.5†	.60†	5/8	5/16	.500
-100	100 μH	400 μH	.075	.30	.83	.415	1.0*	.5*	5/8	5/16	.500
13463-010	10 μH	40 μH	.005	.020	4.65	2.32	17.0*	8.5*	1	5/8	.875
-040	40 μH	160 μH	.012	.045	2.40	1.20	8.2*	4.1*	1	5/8	.875
-100	100 μH	400 μH	.030	.12	1.50	.75	5.0*	2.5*	1	5/8	.875
13464-090	40 μH	160 μH	.010	.040	5.4	2.7	20.0*	10.0*	1 3/8	7/8	1.250
-100	100 μH	400 μH	.010	.040	3.4	1.7	10.0*	5.0*	1 3/8	7/8	1.250
13465-200	200 μH	800 μH	.020	.080	2.75	1.37	10.0*	5.0*	1 3/4	1	1.625
13466-040	40 μH	160 μH	.003	.012	8.40	4.20	30.0*	15.0*	2	1 1/8	1.875
-100	100 μH	400 μH	—	—	5.60	2.80	20.0*	10.0*	2	1 1/8	1.875
13467-100	100 μH	400 μH	.004	.016	8.00	4.00	30.0*	15.0*	2 1/2	1 1/4	2.375
-200	200 μH	800 μH	.009	.036	4.10	2.05	20.0*	10.0*	2 1/2	1 1/4	2.375
-500	500 μH	2 MH	.015	.060	1.10	.55	4.0*	2.0*	2 1/2	1 1/4	2.375

* 50% Inductance † 90% Inductance

CALL FOR PART BEST SUITED FOR YOUR SPEC

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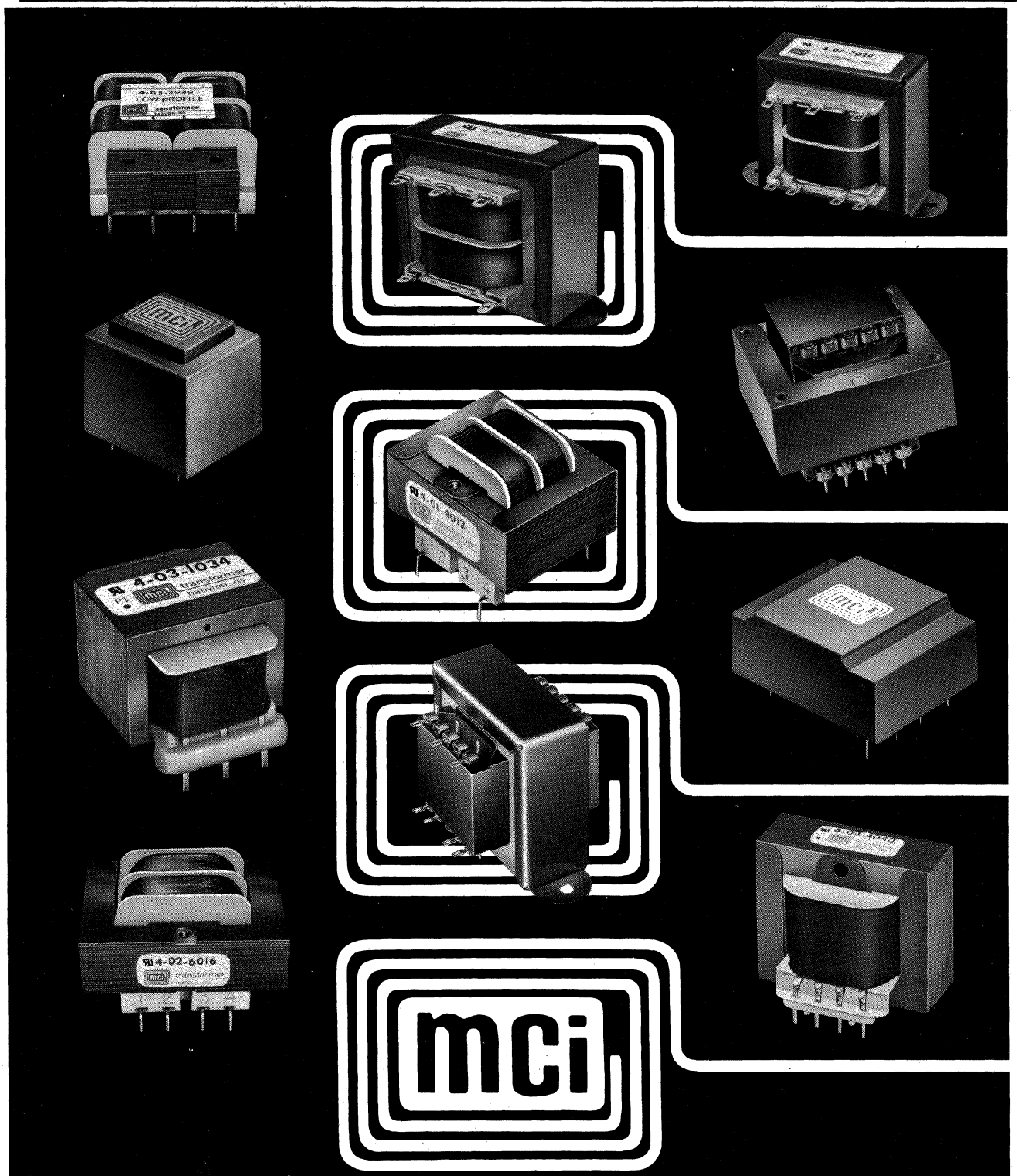
Toroidal Winding Scott-T • Inverter Current • Wideband Pulse

LET MAGNETICO QUOTE "ALL" YOUR REQUIREMENTS • THE BEST IN TRANSFORMERS • FILTERS • AUDIO HYBRIDS • POWER SUPPLIES



MCI TRANSFORMER

MCI Transformer Corporation GUARANTEES DELIVERY

TOLL FREE:
1-800-MCI-TRAN

- **Delivery of 1 to 5 stock transformers within 48 hours**
- **Delivery of 1,000 transformers in four weeks**

IF we don't keep these promises, we will pay the freight on the delivery. Many manufacturers promise prompt delivery but no one else is truly guaranteeing delivery in this manner.

Our modern U.S. manufacturing facilities enable us to service promptly both large and small users. We maintain an extensive inventory of all items so that we can ship small quantities immediately from stock. Since all of our products are manufactured at one location, we can quickly respond to volume requirements and are able to hold our costs to an absolute minimum and pass these savings along to you.

STANDARD STOCK LINE MCI maintains an extensive inventory of Horizontal, Vertical and Low Profile printed circuit board transformers and quick-connect Power Transformers which are recognized under Underwriters Laboratories File No. E86403 (M). MCI promises "Guaranteed Delivery" of 1 to 5 transformers within 48 hours and 1,000 transformers in four weeks.

ENGINEERING AND CUSTOMER SERVICE Many times only one source is listed on an engineering blueprint. The next time you have a requirement, let us assist you. Perhaps you will be able to use one of our stock transformers. If so, you will benefit by saving substantially and having the convenience of off-the-shelf delivery. If your requirements cannot be satisfied by using one of our standard stock units, MCI will assist you in designing the exact transformer you require and, as always, at a competitive price. Start saving today—put MCI on all your transformer prints.

NEW PRODUCTS MCI was founded in 1959. Our experience and technology have enabled us continually to introduce the most innovative designs to accommodate the changing needs of our customers. MCI's encapsulated transformers, series 4-11, 4-12 and 4-15 are perfect examples. These transformers were designed for low power requirements for high volume users. Production of this series is highly automated and MCI can favorably compete with any source in the world, eliminating the need to purchase transformers off-shore. We are pleased to announce that we are introducing a new line of V.D.E. transformers for world wide use.

VALUE ANALYSIS You can be confident when you order an MCI transformer, as only the highest quality materials are ever used in all MCI products. All our transformers are made with strict quality control and each unit is inspected and tested at the end of each manufacturing operation and then tested 100% for output voltages and exciting current in order to comply with our rigid standards.

All MCI products are manufactured in the U.S.A. at one location in the most modern automated manufacturing facilities available. There are no hidden transportation costs from additional manufacturing facilities and no extended delivery times. MCI's decision to have only one location was made with you in mind so that we can offer you the fastest possible response time and the lowest prices in the industry.

You will enjoy dealing directly with MCI without having to deal with sales representatives or distributors. This is another way in which MCI cuts costs and reflects the savings directly in lower costs to you.

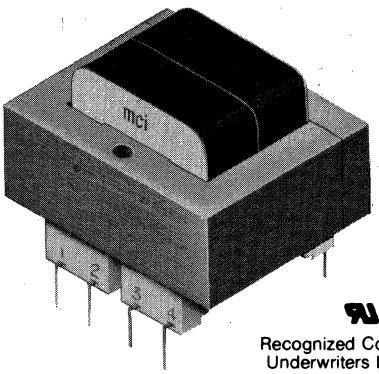
MCI is dedicated to bringing our customers only the best quality and service at highly competitive prices.

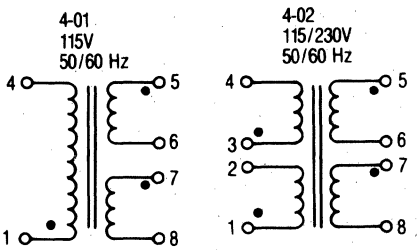
MCI eventually...why not now?

MCI TRANSFORMER CORPORATION 411 MANHATTAN AVENUE, BABYLON, NY 11704 • 516-587-0510

HORIZONTAL PC TRANSFORMERS

SERIES 4-01 & 4-02





Recognized Component
Underwriters Labs Inc.

2,500-volt RMS Hipot, available in a variety of sizes. Maximum operating temperature 130°C. Available with either single 115V, or dual 115/230V primary. MCI's pin configuration is designed for ease of connection in printed circuit boards. Heavier transformers are provided with mounting holes for additional mounting security. Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.

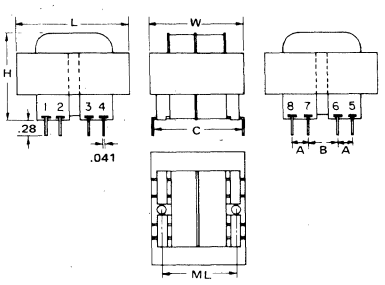
CURRENT RATING

Secondary Voltage	Series Parallel	-010 10V C.T. 5V	-012 12.6V C.T. 6.3V	-016 16V C.T. 8V	-020 20V C.T. 10V	-024 24V C.T. 12V	-028 28V C.T. 14V	-036 36V C.T. 18V	-048 48V C.T. 24V	-056 56V C.T. 28V	-120 120V C.T. 60V
Series											
Size 2		.11A	.09A	.07A	.055A	.045A	.04A	.03A	.023A	.02A	.01A
Size 3		.25A	.2A	.15A	.12A	.1A	.085A	.065A	.05A	.045A	.02A
Size 4		.6A	.5A	.4A	.3A	.25A	.2A	.17A	.125A	.11A	.05A
Size 5		1.2A	1.0A	.8A	.6A	.5A	.42A	.35A	.25A	.22A	.1A
Size 6		2.0A	1.6A	1.25A	1.0A	.8A	.7A	.55A	.4A	.35A	.16A
Size 7		3.6A	2.85A	2.25A	1.8A	1.5A	1.3A	1.0A	.75A	.65A	.3A
Parallel											
Size 2		.22A	.18A	.14A	.11A	.09A	.08A	.06A	.046A	.04A	.02A
Size 3		.5A	.4A	.3A	.24A	.2A	.17 A	.13A	.1A	.09A	.04A
Size 4		1.2A	1.0A	.8A	.6A	.5A	.4A	.34A	.25A	.22A	.1A
Size 5		2.4A	2.0A	1.6A	1.2A	1.0A	.84A	.7A	.5A	.44A	.2A
Size 6		4.0A	3.2A	2.5A	2.0A	1.6A	1.4A	1.1A	.8A	.7A	.32A
Size 7		7.2A	5.7A	4.5A	3.6A	3.0A	2.6A	2.0A	1.5A	1.3A	.6A

DIMENSIONS

Size	VA	L	W	H	ML	A	B	C	Optional Mtg. Screw & Nut	Lbs.
2	1.1	1-3/8	1-1/8	15/16	—	.250	.250	1.200	None	0.17
3	2.4	1-3/8	1-1/8	1-3/16	—	.250	.250	1.200	None	0.25
4	6.0	1-5/8	1-5/16	1-5/16	1-1/16	.250	.350	1.280	4-40 × 1-3/8 Nylon	0.44
5	12.0	1-7/8	1-9/16	1-7/16	1-1/4	.300	.400	1.410	4-40 × 1-3/8 Nylon	0.70
6	20.0	2-1/4	1-7/8	1-7/16	1-1/2	.300	.400	1.600	4-40 × 1-3/8 Nylon	0.80
7	36.0	2-5/8	2-3/16	1-9/16	†	.400	.400	1.850	†	1.1

† 4 mounting holes 2 3/16 × 1 3/4 for #6 screw



HOW TO ORDER A HORIZONTAL PC TRANSFORMER

MCI uses a Seven Digit Part Number

First Digit	4	MCI Product Identification
Second & Third Digits	01	Single 115V Primary
	02	Dual 115/230V Primary
Fourth Digit	2 to 7	Transformer size *(See current rating chart)*
Last three Digits	010 to 120	Secondary voltage *(See current rating chart)*

Example: 4-01-4016 is a 115V primary 6VA transformer with two 8 volt secondary windings to be used as either 16V CT or 8V.

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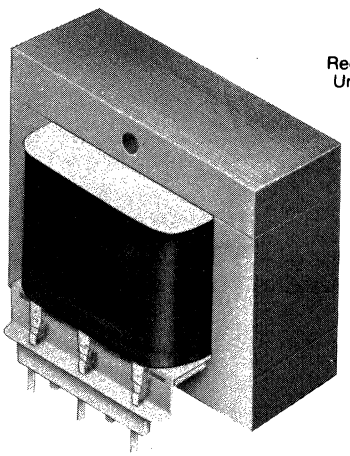
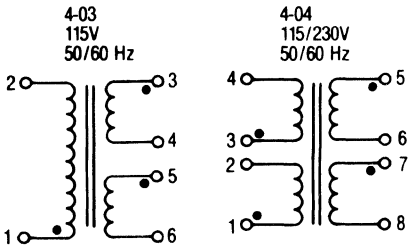
VERTICAL PC TRANSFORMERS

SERIES 4-03 & 4-04



Recognized Component
Underwriters Labs Inc.



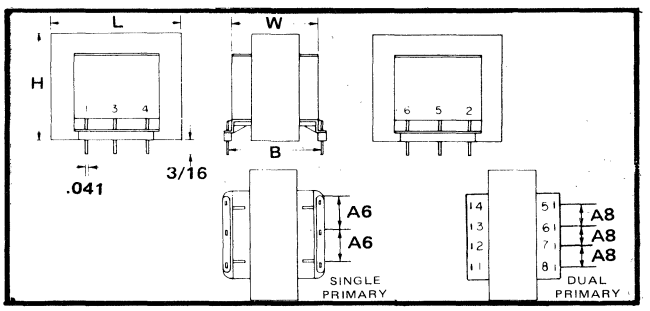
1,500-volt RMS Hipot, available in a variety of sizes. Maximum operating temperature 130°C. Available with dual 115/230V primary. MCI's pin configuration is designed for ease of connection in printed circuit boards. Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.

CURRENT RATING

Secondary Voltage	Series Parallel	-010 10V C.T. 5V	-012 12.6V C.T. 6.3V	-016 16V C.T. 8V	-020 20V C.T. 10V	-024 24V C.T. 12V	-028 28V C.T. 14V	-034 34V C.T. 17V	-040 40V C.T. 20V	-056 56V C.T. 28V	-088 88V C.T. 44V	-120 120V C.T. 60V	-180 180V C.T. 90V	-230 230V C.T. 115V
Series														
Size 1		.090A	.070A	.055A	.045A	.035A	.030A	.025A	.020A	.015A	.010A	.008A		
Size 2		.120A	.100A	.075A	.060A	.050A	.040A	.035A	.030A	.020A	.015A	.010A	.006A	.005A
Size 3		.440A	.350A	.260A	.220A	.180A	.160A	.125A	.110A	.080A	.050A	.035A	.024A	.020A
Size 4		1.0A	.800A	.640A	.500A	.450A	.360A	.300A	.250A	.180A	.120A	.085A	.055A	.040A
Size 5		2.4A	2.0A	1.5A	1.2A	1.0A	.800A	.700A	.600A	.420A	.270A	.200A	.130A	.100A
Parallel														
Size 1		.180A	.140A	.110A	.090A	.070A	.060A	.050A	.040A	.030A	.020A	.016A		
Size 2		.240A	.200A	.150A	.120A	.100A	.080A	.070A	.060A	.040A	.030A	.020A	.012A	.010A
Size 3		.880A	.700A	.520A	.440A	.360A	.320A	.250A	.220A	.160A	.100A	.070A	.048A	.040A
Size 4		2.0A	1.6A	1.28A	1.0A	.900A	.720A	.600A	.500A	.360A	.240A	.170A	.110A	.080A
Size 5		4.8A	4.0A	3.0A	2.4A	2.0A	1.6A	1.4A	1.2A	.840A	.540A	.400A	.260A	.200A

DIMENSIONS

Size	VA	L	W	H	A-6 (6 Pin)	A-8 (8 Pin)	B	WT. (oz.)
1	1.0	1	1-3/8	0.83	0.250	0.200	1.200	2.5
2	1.2	1-3/8	1-1/8	1-3/16	0.312	0.200	1.000	3.0
3	4.4	1-5/8	1-1/4	1-3/8	0.400	0.250	1.100	5.0
4	10.0	1-7/8	1-7/16	1-5/8	0.400	0.250	1.300	9.0
5	24.0	1-5/8	2-1/4	1-3/8	0.400	0.250	2.100	12.0



HOW TO ORDER A VERTICAL PC TRANSFORMER

MCI uses a Seven Digit Part Number

First Digit	4	MCI Product Identification
Second & Third Digits	03	Single 115V Primary
	04	Dual 115/230V Primary
Fourth Digit	1 to 5	Transformer size *(See current rating chart)*
Last three Digits	010 to 230	Secondary voltage *(See current rating chart)*

Example: 4-04-3034 is a dual 115/230V primary, 4.4VA transformer with two 17 volt secondary windings to be used as either 34V CT or 17V.

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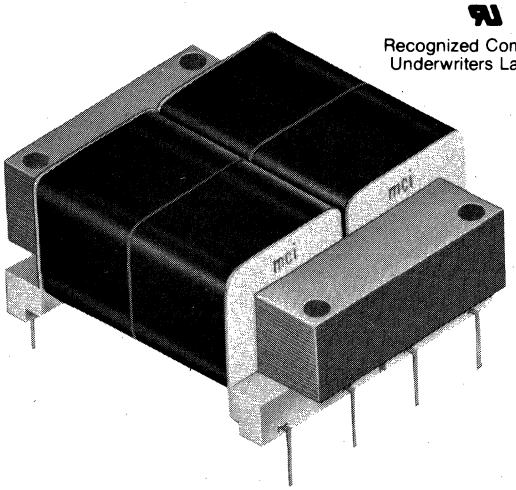
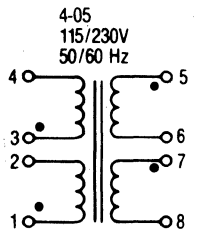
LOW PROFILE PC TRANSFORMERS

SERIES 4-05

Recognized Component
Underwriters Labs Inc.





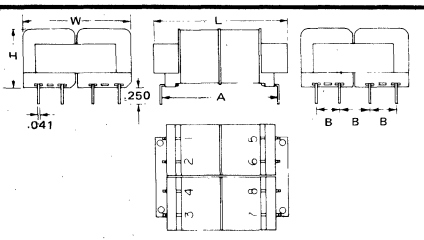
1,500-volt RMS Hipot, available in a variety of sizes. Maximum operating temperature 130°C. Available with either single 115V, or dual 115/230V primary. MCI's pin configuration is designed for ease of connection in printed circuit boards. Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.

CURRENT RATING

Secondary Voltage	Series Parallel	-010 10V C.T. 5V	-012 12.6V C.T. 6.3V	-016 16V C.T. 8V	-020 20V C.T. 10V	-024 24V C.T. 12V	-034 34V C.T. 17V	-040 40V C.T. 20V	-056 56V C.T. 28V	-088 88V C.T. 44V	-120 120V C.T. 60V	-230 230V C.T. 115V
Series												
Size 1		.250A	.200A	.156A	.125A	.104A	.073A	.062A	.044A	.028A	.020A	.010A
Size 2		.600A	.450A	.350A	.300A	.250A	.170A	.150A	.100A	.065A	.050A	.025A
Size 3		1.200A	.900A	.700A	.600A	.500A	.340A	.300A	.200A	.130A	.100A	.050A
Parallel												
Size 1		.500A	.400A	.312A	.250A	.208A	.146A	.124A	.088A	.056A	.040A	.020A
Size 2		1.2A	.900A	.700A	.600A	.500A	.340A	.300A	.200A	.130A	.100A	.050A
Size 3		2.4A	1.8A	1.4A	1.2A	1.0A	.680A	.600A	.400A	.260A	.200A	.100A

DIMENSIONS

Size	VA	L	W	H	A	B	Oz.
1	2.5	1-7/8	1-9/16	0.650	1.600	0.375	5
2	6.0	1-7/8	1-9/16	0.850	1.600	0.375	7
3	12.0	2-1/2	2	1.065	2.000	0.500	11



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HOW TO ORDER A LOW PROFILE TRANSFORMER

MCI uses a Seven Digit Part Number

First Digit	4	MCI Product Identification
Second & Third Digits	05	Dual 115/230V Primary
Fourth Digit	1 to 5	Transformer size *(See current rating chart)*
Last three Digits	010 to 230	Secondary voltage *(See current rating chart)*

Example: 4-05-1020 is a dual 115/230V primary, 2.5VA transformer with two 10 volt secondary windings to be used as either 20V CT or 10V.

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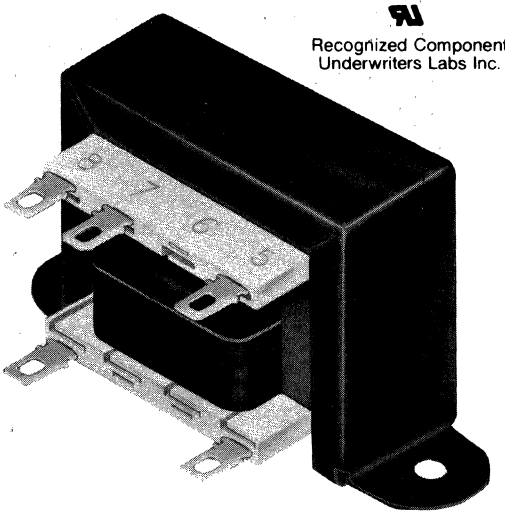
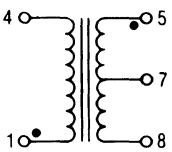
QUICK CONNECT POWER TRANSFORMERS

SERIES 4-06 & 4-07

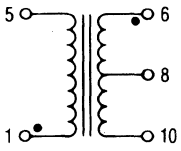


Recognized Component
Underwriters Labs Inc.

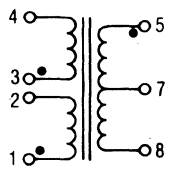
4-06-3, 4, 5
115V
50/60 Hz



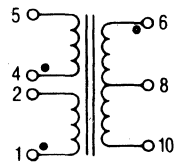
4-06-6, 7, 8
115V
50/60 Hz



4-07-4, 5
115/230V
50/60 Hz



4-07-6, 7, 8
115/230V
50/60 Hz



2500 Volt RMS Hipot in a variety of practical sizes. Maximum operating temperature 130°C available with either single 115 or dual 115/230V primary (for all but 2.4 VA size).

MCI's split bobbin and non-concentric winding provide better insulation and high signal isolation, thus eliminating the need for electrostatic shielding.

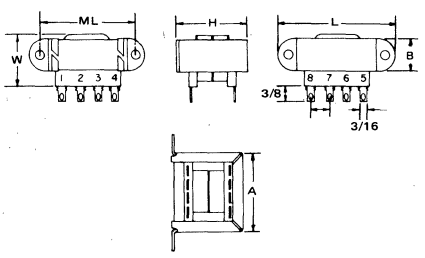
Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.

CURRENT RATING

Secondary Voltage	–010 10V C.T.	–012 12.6V C.T.	–016 16V C.T.	–020 20V C.T.	–024 24V C.T.	–028 28V C.T.	–036 36V C.T.	–048 48V C.T.	–056 56V C.T.	–120 120V C.T.
Transformer Size										
3	.25A	.2A	.15A	.12A	.1A	.085A	.065A	.05A	.045A	.02A
4	.6A	.5A	.4A	.3A	.25A	.2A	.17A	.125A	.11A	.05A
5	1.2A	1.0A	.8A	.6A	.5A	.42A	.35A	.25A	.22A	.1A
6	3.0A	2.5A	2.0A	1.5A	1.25A	1.1A	.85A	.63A	.54A	.25A
7	5.0A	4.0A	3.5A	2.8A	2.4A	2.0A	1.5A	1.2A	1.0A	.5A
8	10.0A	8.0A	6.25A	5.0A	4.0A	3.6A	2.8A	2.0A	1.8A	.85A

DIMENSIONS

Size	VA	L	W	H	A	B	ML	Lbs.
3	2.4	2-1/16	1-1/16	1-3/16	1-7/16	9/16	1-3/4	0.25
4	6	2-3/8	1-1/4	1-3/8	1-11/16	11/16	2	0.44
5	12	2-13/16	1-3/8	1-5/8	1-15/16	13/16	2-3/8	0.7
6	30	3-1/4	1-11/16	1-15/16	2-5/16	1-1/16	2-13/16	1.1
7	56	3-11/16	1-13/16	2-1/4	2-11/16	1-1/16	3-1/8	1.7
8	100	4-1/32	2-1/4	2-9/16	3-1/16	1-5/16	3-9/16	2.75



HOW TO ORDER A QUICK CONNECT POWER TRANSFORMER

MCI uses a Seven Digit Part Number

First Digit	4	MCI Product Identification
Second & Third Digits	06	Single 115V Primary
	07	Dual 115/230V Primary
Fourth Digit	3 to 8	Transformer size *(See current rating chart)*
Last three Digits	010 to 120	Secondary voltage *(See current rating chart)*

Example: 4-06-6016 is a 115V primary 30VA transformer with 16V CT secondary.

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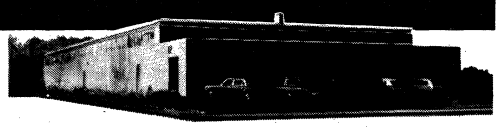
QUALITY TRANSFORMERS AT COMPETITIVE PRICES



Founded a quarter-century ago, MCI Transformer Corporation is an established leader in the manufacture of horizontal, vertical and low profile transformers for printed circuit boards. Recently, the line has been expanded to include quick-connect and encapsulated models.

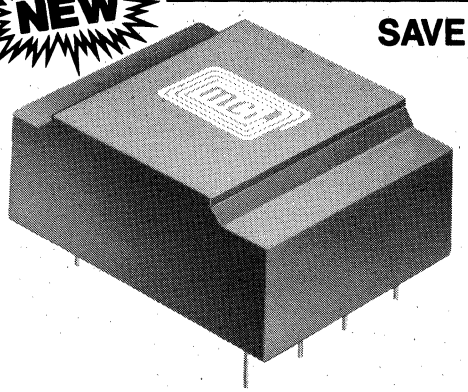
At MCI, the very latest production automation techniques are employed to ensure the highest possible quality at low competitive prices.

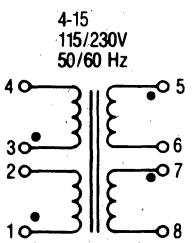
- Made in U.S.A.
- UL-Recognized
- In stock for fast delivery
- Custom designs available
- Shipped in protective vacuum-formed trays

LOW PROFILE PC ENCAPSULATED TRANSFORMERS SERIES 4-15

NEW

SAVE UP TO 40% IN VOLUME





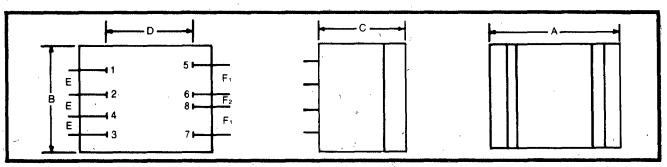
Our encapsulated design offers high reliability because of its mechanical strength, electrical insulation and moisture resistance. The internal construction consists of 2 split bobbins which isolates the primary and secondary thereby eliminating any need for an electrostatic shield. The construction will pass requirements of U.L., C.S.A. and V.D.E.

CURRENT RATING (AMPS)

Secondary Voltage	Series Parallel	-010 10V C.T. 5V	-012 12.6V C.T. 6.3V	-016 16V C.T. 8V	-020 20V C.T. 10V	-024 24V C.T. 12V	-030 30V C.T. 15V	-034 34V C.T. 17V	-040 40V C.T. 20V	-056 56V C.T. 28V	-088 88V C.T. 44V	-120 120V C.T. 60V	-230 230V C.T. 115V
Series													
Size 2		.600	.450	.350	.300	.250	.200	.170	.150	.100	.065	.050	.025
Parallel													
Size 2		1.200	.900	.700	.600	.500	.400	.340	.300	.200	.130	.100	.050

DIMENSIONS

Size	VA	A	B	C	D	Primary E	Secondary F1	Secondary F2	WT.
2	6	2.080	1.655	.850	1.300	.400	.600	.200	.46



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HOW TO ORDER A LOW PROFILE PC ENCAPSULATED TRANSFORMER

MCI uses a Seven Digit Part Number

First Digit	4	MCI Product Identification
Second & Third Digits	15	Dual 115/230V Primary
Fourth Digit	2	Transformer size *(See current rating chart)*
Last three Digits	010 to 230	Secondary voltage *(See current rating chart)*

Example: 4-15-2010 is a dual 115/230V primary, 6VA transformer with two 5 volt secondary windings to be used as either 10V CT or 5V.

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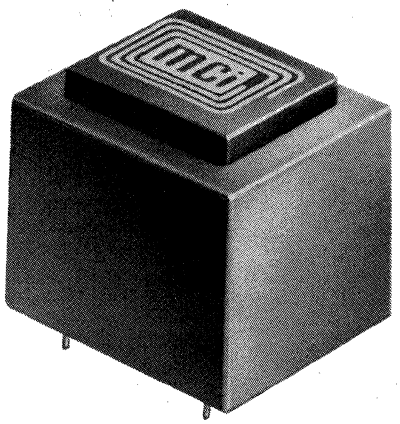
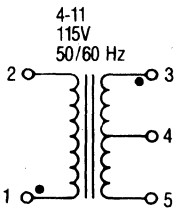
HORIZONTAL PC ENCAPSULATED TRANSFORMERS

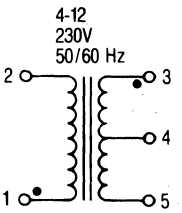
NEW

SAVE UP TO 40% IN VOLUME

SERIES 4-11 & 4-12







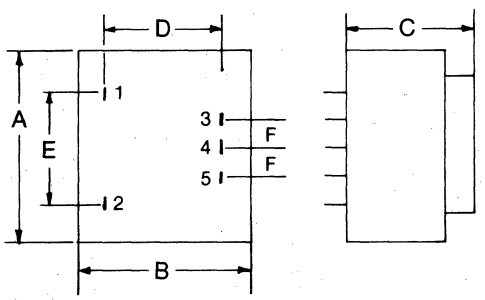
Our encapsulated design offers high reliability because of its mechanical strength, electrical insulation and moisture resistance. The internal construction consits of a split bobbin which isolates the primary and secondary thereby eliminating any need for an electrostatic shield. The construction will pass requirements of U.L., C.S.A. and V.D.E.

CURRENT RATING (AMPS)

Secondary Voltage	-010 10V C.T.	-012 12.6V C.T.	-016 16V C.T.	-020 20V C.T.	-024 24V C.T.	-028 28V C.T.	-036 36V C.T.	-048 48V C.T.	-056 56V C.T.	-120 120V C.T.
Transformer Size										
2	.100	.080	.065	.050	.045	.035	.030	.020	.018	.008
3	.120	.095	.075	.060	.050	.045	.035	.025	.021	.010
4	.180	.145	.115	.090	.075	.065	.050	.038	.032	.015
5	.220	.175	.140	.110	.095	.080	.060	.045	.040	.018
6	.320	.255	.200	.160	.135	.115	.090	.067	.057	.027
7	.450	.360	.280	.225	.190	.160	.125	.095	.080	.038

DIMENSIONS

Size	VA	A	B	C	D	Primary E	Secondary F	Wt. (Lb.)
2	1.0	1.280	1.080	.925	.800	.800	.200	.16
3	1.2	1.280	1.080	.970	.800	.800	.200	.19
4	1.8	1.280	1.080	1.085	.800	.800	.200	.21
5	2.2	1.280	1.080	1.185	.800	.800	.200	.25
6	3.2	1.660	1.415	1.125	1.000	.800	.200	.33
7	4.5	1.780	1.500	1.300	1.000	1.000	.300	.44



HOW TO ORDER A HORIZONTAL PC ENCAPSULATED TRANSFORMER

MCI uses a Seven Digit Part Number

First Digit	4	MCI Product Identification
Second & Third Digits	11	Single 115V Primary
	12	Single 230V Primary
Fourth Digit	2 to 7	Transformer size *(See current rating chart)*
Last three Digits	010 to 120	Secondary voltage *(See current rating chart)*

Example: 4-12-5012 is a 230V primary, 2.2VA transformer with a 12V CT secondary.

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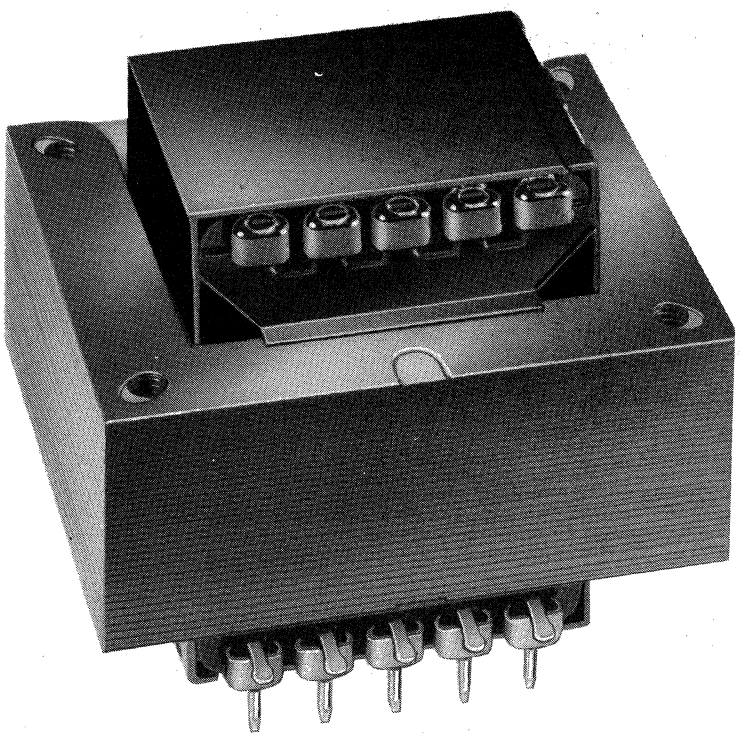
VDE HORIZONTAL P.C. TRANSFORMERS

SERIES 4-41& 4-42



CURRENT RATING										
Secondary Voltage	**-010 10V C.T.**	**-012 12.6V C.T.**	**-016 16V C.T.**	**-020 20V C.T.**	**-024 24V C.T.**	**-028 28V C.T.**	**-036 36V C.T.**	**-048 48V C.T.**	**-056 56V C.T.**	**-120 120V C.T.**
Transformer Size										
2	1.000	.800	.625	.500	.420	.360	.280	.210	.180	.085
3	2.000	1.600	1.250	1.000	.840	.720	.560	.420	.360	.170
4	3.000	2.400	1.875	1.500	1.250	1.075	.835	.625	.540	.250
5	4.500	3.600	2.815	2.250	1.875	1.610	1.250	.940	.805	.375

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HOW TO ORDER A VDE HORIZONTAL PC TRANSFORMER

MCI uses a Seven Digit Part Number

First Digit	4	MCI Product Identification
Second & Third Digits	41	Single 115V Primary
	42	Dual 115/230V Primary
Fourth Digit	2 to 5	Transformer size *(See current rating chart)*
Last three Digits	010 to 120	Second voltage *(See current rating chart)*

Example: 4-41-4024 is a 115V primary 30VA transformer with 24V CT secondary.

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VDE HORIZONTAL P.C. TRANSFORMERS

SERIES 4-41& 4-42

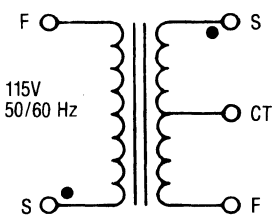
Series 4-41, 4-42

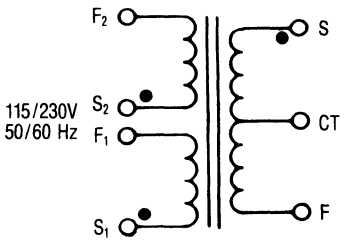
4000 Volt RMS Hipot. In a variety of sizes. Maximum operating temperature 130° C. Available with either 115V or dual 115/230V primary.

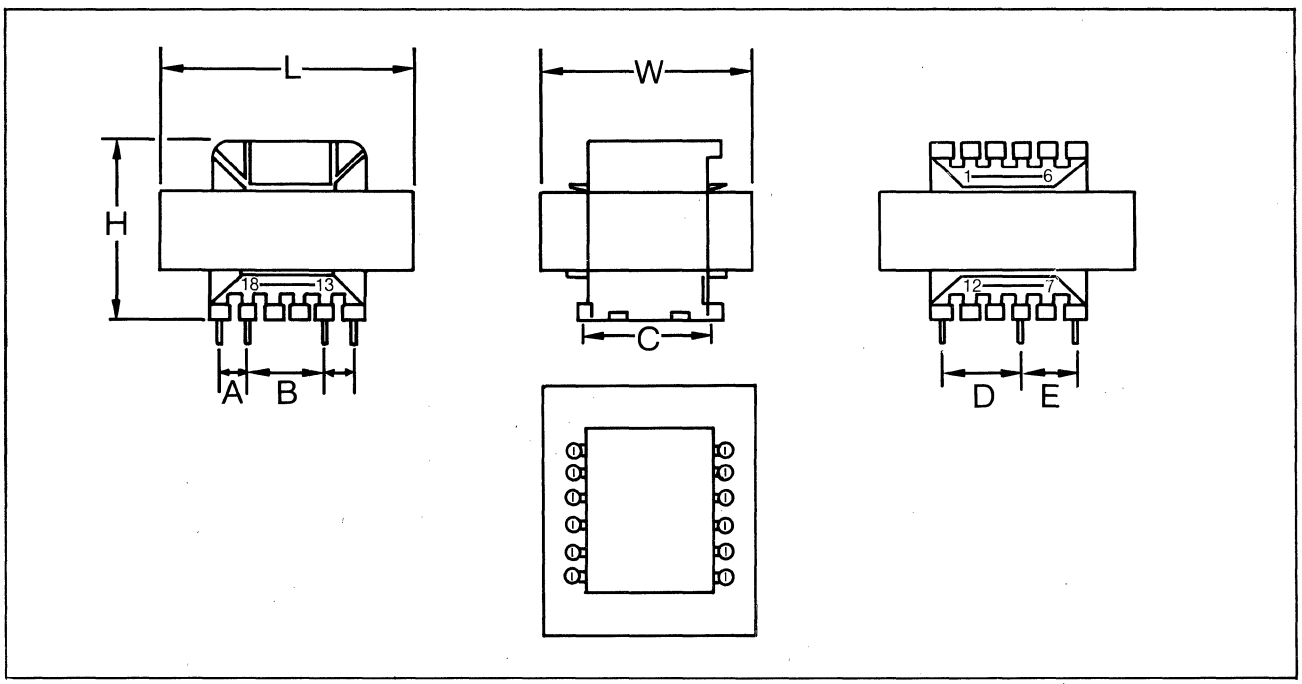
MCI's split bobbin and non-concentric winding provide better insulation and high signal isolation, thus eliminating the need for electrostatic shielding.

These transformers are designed to pass VDE's strict creepage distance requirements.

Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.







TERMINAL POSITIONS									
	4-41 115V Primary		4-42 115/230V Primary				Secondary		
	S	F	S1	F1	S2	F2	S	C.T.	F
2	13	18	13	14	17	18	7	9	12
3	11	15	11	12	14	15	6	8	10
4	11	15	11	12	14	15	6	8	10
5	11	15	11	12	14	15	6	8	10

SIZE	VA	L	W	H	A	B	C	D	E	Lbs.
2	10	1 7/8	1 9/16	1 1/2	.200	.600	1.000	.600	.400	.57
3	20	2 1/4	1 7/8	1 13/16	.300	.600	1.200	.600	.600	.97
4	30	2 1/4	1 7/8	2 1/16	.300	.600	1.200	.600	.600	1.20
5	45	2 5/8	2 3/16	2 1/32	.300	.600	1.400	.600	.600	1.40

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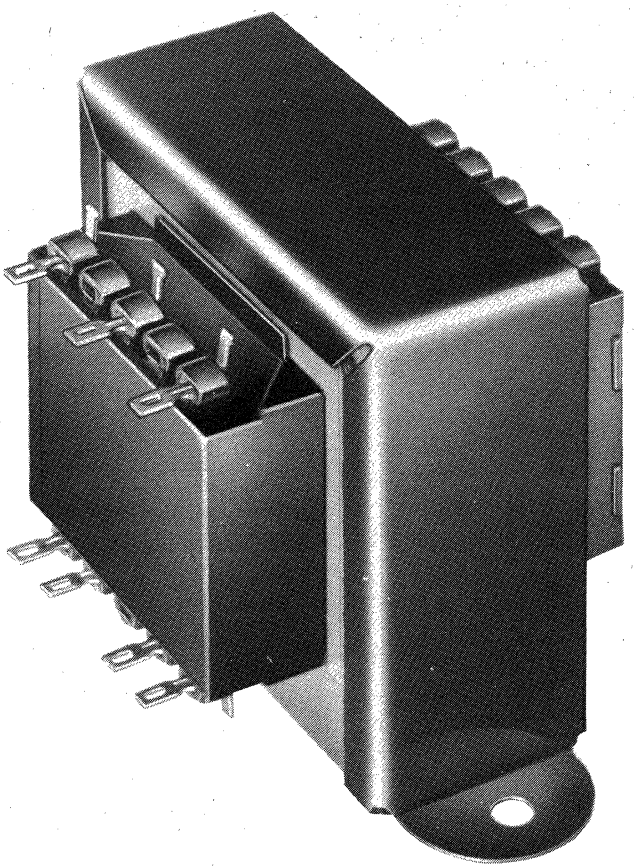
VDE QUICK CONNECT POWER TRANSFORMERS

SERIES 4-46 & 4-47



Secondary Voltage	-010 10V C.T.	-012 12.6V C.T.	-016 16V C.T.	-020 20V C.T.	-024 24V C.T.	-028 28V C.T.	-036 36V C.T.	-048 48V C.T.	-056 56V C.T.	-120 120V C.T.
	CURRENT RATING									
Transformer Size										
2	1.000	.800	.625	.500	.420	.360	.280	.210	.180	.085
3	2.000	1.600	1.250	1.000	.840	.720	.560	.420	.360	.170
4	3.000	2.400	1.875	1.500	1.250	1.075	.835	.625	.540	.250
5	4.500	3.600	2.815	2.250	1.875	1.610	1.250	.940	.805	.375
6	5.600	4.500	3.500	2.800	2.335	2.000	1.560	1.170	1.000	.470
7		5.560	4.375	3.500	2.920	2.500	1.950	1.460	1.250	.585
8			5.000	4.000	3.335	2.860	2.225	1.670	1.430	.670
9				5.000	4.170	3.575	2.780	2.090	1.790	.835

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HOW TO ORDER A VDE QUICK CONNECT POWER TRANSFORMER

MCI uses a Seven Digit Part Number

First Digit	4	MCI Product Identification
Second & Third Digits	46	Single 115V Primary
	47	Dual 115/230V Primary
Fourth Digit	2 to 9	Transformer size *(See current rating chart)*
Last three Digits	010 to 120	Secondary voltage *(See current rating chart)*

Example: 4-47-6028 is a 115/230V primary 56 VA transformer with 28V CT secondary.

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VDE QUICK CONNECT POWER TRANSFORMERS

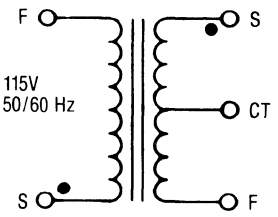
SERIES 4-46 & 4-47

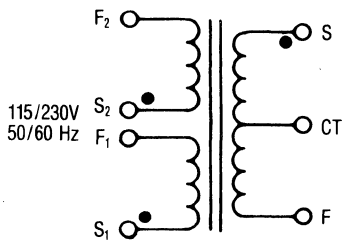
4000 Volt RMS Hipot. In a variety of sizes. Maximum operating temperature 130°C. Available with either 115V or dual 115/230V primary.

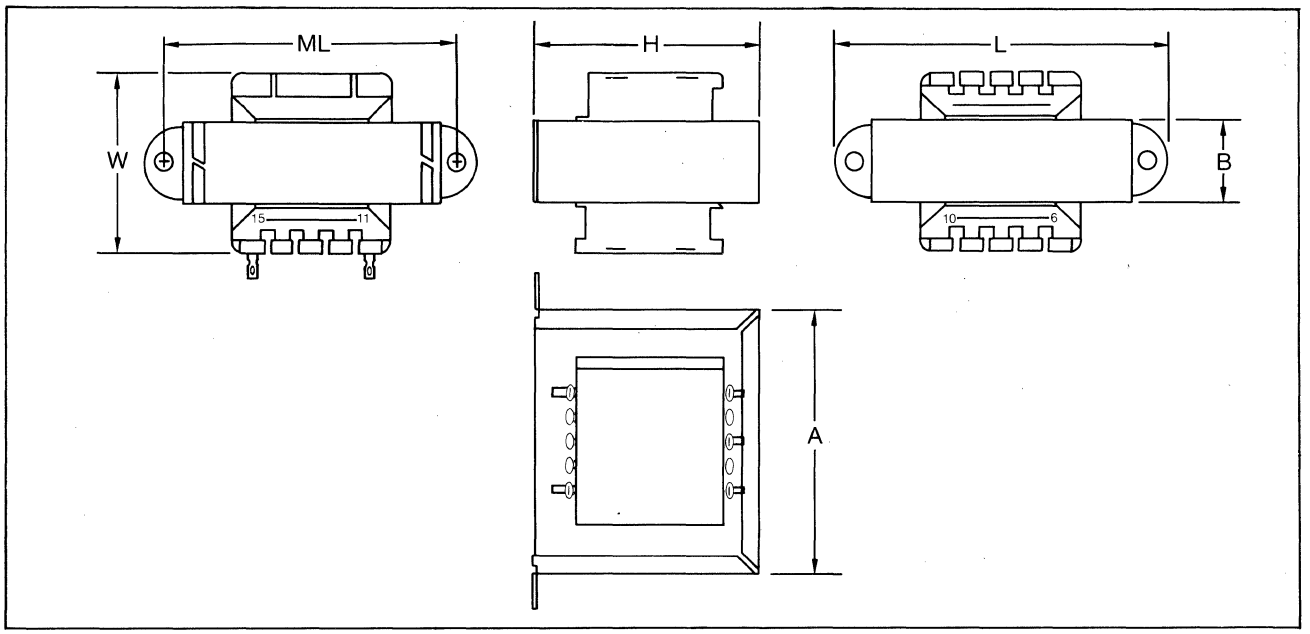
MCI's split bobbin and non-concentric winding provide better insulation and high signal isolation, thus eliminating the need for electrostatic shielding.

These transformers are designed to pass VDE's strict creepage distance requirements.

Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.







TERMINAL POSITIONS

	4-46 115V Primary		4-47 115/230V Primary				Secondary		
	S	F	S1	F1	S2	F2	S	C.T.	F
2	13	18	13	14	17	18	7	9	12
3	11	15	11	12	14	15	6	8	10
4	11	15	11	12	14	15	6	8	10
5	11	15	11	12	14	15	6	8	10
6	11	15	11	12	14	15	6	8	10
7	13	18	13	14	17	18	7	9	12
8	13	18	13	14	17	18	7	9	12
9	13	18	13	14	17	18	7	9	12

SIZE	VA	L	W	H	A	B	ML	Lbs.
2	10	2 13/16	1 1/2	1 5/8	1 15/16	11/16	2 3/8	.57
3	20	3 1/4	1 13/16	1 15/16	2 5/16	7/8	2 13/16	.97
4	30	3 1/4	2 1/32	1 15/16	2 5/16	1 1/8	2 13/16	1.20
5	45	3 11/16	2 1/32	2 1/4	2 11/16	1	3 1/8	1.40
6	56	3 11/16	2 5/32	2 1/4	2 11/16	1 1/8	3 1/8	1.70
7	70	4 1/32	2 9/32	2 9/16	3 1/16	1 1/16	3 9/16	2.40
8	80	4 1/32	2 1/2	2 9/16	3 1/16	1 5/16	3 9/16	2.80
9	100	4 1/2	2 17/32	2 13/16	3 13/32	1 7/32	4	3.20

MCI TRANSFORMER CORPORATION 411 MANHATTAN AVENUE, BABYLON, NY 11704 • 516-587-0510

MCI CROSS REFERENCE GUIDE

HORIZONTAL PC TRANSFORMERS

MCI	SIGNAL	MCI	SIGNAL	MCI	SIGNAL	MCI	SIGNAL
4-01-2010	ST 2-10	4-01-5010	ST 5-10	4-02-2010	DST 2-10	4-02-5010	DST 5-10
4-01-2012	ST 2-12	4-01-5012	ST 5-12	4-02-2012	DST 2-12	4-02-5012	DST 5-12
4-01-2016	ST 2-16	4-01-5016	ST 5-16	4-02-2016	DST 2-16	4-02-5016	DST 5-16
4-01-2020	ST 2-20	4-01-5020	ST 5-20	4-02-2020	DST 2-20	4-02-5020	DST 5-20
4-01-2024	ST 2-24	4-01-5024	ST 5-24	4-02-2024	DST 2-24	4-02-5024	DST 5-24
4-01-2028	ST 2-28	4-01-5028	ST 5-28	4-02-2028	DST 2-28	4-02-5028	DST 5-28
4-01-2036	ST 2-36	4-01-5036	ST 5-36	4-02-2036	DST 2-36	4-02-5036	DST 5-36
4-01-2048	ST 2-48	4-01-5048	ST 5-48	4-02-2048	DST 2-48	4-02-5048	DST 5-48
4-01-2056	ST 2-56	4-01-5056	ST 5-56	4-02-2056	DST 2-56	4-02-5056	DST 5-56
4-01-2120	ST 2-120	4-01-5120	ST 5-120	4-02-2120	DST 2-120	4-02-5120	DST 5-120
4-01-3010	ST 3-10	4-01-6010	ST 6-10	4-02-3010	DST 3-10	4-02-6010	DST 6-10
4-01-3012	ST 3-12	4-01-6012	ST 6-12	4-02-3012	DST 3-12	4-02-6012	DST 6-12
4-01-3016	ST 3-16	4-01-6016	ST 6-16	4-02-3016	DST 3-16	4-02-6016	DST 6-16
4-01-3020	ST 3-20	4-01-6020	ST 6-20	4-02-3020	DST 3-20	4-02-6020	DST 6-20
4-01-3024	ST 3-24	4-01-6024	ST 6-24	4-02-3024	DST 3-24	4-02-6024	DST 6-24
4-01-3028	ST 3-28	4-01-6028	ST 6-28	4-02-3028	DST 3-28	4-02-6028	DST 6-28
4-01-3036	ST 3-36	4-01-6036	ST 6-36	4-02-3036	DST 3-36	4-02-6036	DST 6-36
4-01-3048	ST 3-48	4-01-6048	ST 6-48	4-02-3048	DST 3-48	4-02-6048	DST 6-48
4-01-3056	ST 3-56	4-01-6056	ST 6-56	4-02-3056	DST 3-56	4-02-6056	DST 6-56
4-01-3120	ST 3-120	4-01-6120	ST 6-120	4-02-3120	DST 3-120	4-02-6120	DST 6-120
4-01-4010	ST 4-10	4-01-7010	ST 7-10	4-02-4010	DST 4-10	4-02-7010	DST 7-10
4-01-4012	ST 4-12	4-01-7012	ST 7-12	4-02-4012	DST 4-12	4-02-7012	DST 7-12
4-01-4016	ST 4-16	4-01-7016	ST 7-16	4-02-4016	DST 4-16	4-02-7016	DST 7-16
4-01-4020	ST 4-20	4-01-7020	ST 7-20	4-02-4020	DST 4-20	4-02-7020	DST 7-20
4-01-4024	ST 4-24	4-01-7024	ST 7-24	4-02-4024	DST 4-24	4-02-7024	DST 7-24
4-01-4028	ST 4-28	4-01-7028	ST 7-28	4-02-4028	DST 4-28	4-02-7028	DST 7-28
4-01-4036	ST 4-36	4-01-7036	ST 7-36	4-02-4036	DST 4-36	4-02-7036	DST 7-36
4-01-4048	ST 4-48	4-01-7048	ST 7-48	4-02-4048	DST 4-48	4-02-7048	DST 7-48
4-01-4056	ST 4-56	4-01-7056	ST 7-56	4-02-4056	DST 4-56	4-02-7056	DST 7-56
4-01-4120	ST 4-120	4-01-7120	ST 7-120	4-02-4120	DST 4-120	4-02-7120	DST 7-120

VERTICAL PC TRANSFORMERS

MCI	SIGNAL	MCI	SIGNAL	MCI	SIGNAL	MCI	SIGNAL
4-03-1010	PC 10-90	4-03-1034	PC 34-25	4-04-1010	DPC 10-90	4-04-1034	DPC 34-25
4-03-2010	PC 10-120	4-03-2034	PC 34-35	4-04-2010	DPC 10-120	4-04-2034	DPC 34-35
4-03-3010	PC 10-440	4-03-3034	PC 34-125	4-04-3010	DPC 10-440	4-04-3034	DPC 34-125
4-03-4010	PC 10-1000	4-03-4034	PC 34-300	4-04-4010	DPC 10-1000	4-04-4034	DPC 34-300
4-03-5010	PC 10-2400	4-03-5034	PC 34-700	4-04-5010	DPC 10-2400	4-04-5034	DPC 34-700
4-03-1012	PC 12-70	4-03-1040	PC 40-20	4-04-1012	DPC 12-70	4-04-1040	DPC 40-20
4-03-2012	PC 12-100	4-03-2040	PC 40-30	4-04-2012	DPC 12-100	4-04-2040	DPC 40-30
4-03-3012	PC 12-350	4-03-3040	PC 40-110	4-04-3012	DPC 12-350	4-04-3040	DPC 40-110
4-03-4012	PC 12-800	4-03-4040	PC 40-250	4-04-4012	DPC 12-800	4-04-4040	DPC 40-250
4-03-5012	PC 12-2000	4-03-5040	PC 40-600	4-04-5012	DPC 12-2000	4-04-5040	DPC 40-600
4-03-1016	PC 16-55	4-03-1056	PC 56-15	4-04-1016	DPC 16-55	4-04-1056	DPC 56-15
4-03-2016	PC 16-75	4-03-2056	PC 56-20	4-04-2016	DPC 16-75	4-04-2056	DPC 56-20
4-03-3016	PC 16-260	4-03-3056	PC 56-80	4-04-3016	DPC 16-260	4-04-3056	DPC 56-80
4-03-4016	PC 16-640	4-03-4056	PC 56-180	4-04-4016	DPC 16-640	4-04-4056	DPC 56-180
4-03-5016	PC 16-1500	4-03-5056	PC 56-420	4-04-5016	DPC 16-1500	4-04-5056	DPC 56-420
4-03-1020	PC 20-45	4-03-1088	PC 88-10	4-04-1020	DPC 20-45	4-04-1088	DPC 88-10
4-03-2020	PC 20-60	4-03-2088	PC 88-15	4-04-2020	DPC 20-60	4-04-2088	DPC 88-15
4-03-3020	PC 20-220	4-03-3088	PC 88-50	4-04-3020	DPC 20-220	4-04-3088	DPC 88-50
4-03-4020	PC 20-500	4-03-4088	PC 88-120	4-04-4020	DPC 20-500	4-04-4088	DPC 88-120
4-03-5020	PC 20-1200	4-03-5088	PC 88-270	4-04-5020	DPC 20-1200	4-04-5088	DPC 88-270
4-03-1024	PC 24-35	4-03-1120	PC 120-8	4-04-1024	DPC 24-35	4-04-1120	DPC 120-8
4-03-2024	PC 24-50	4-03-2120	PC 120-10	4-04-2024	DPC 24-50	4-04-2120	DPC 120-10
4-03-3024	PC 24-180	4-03-3120	PC 120-35	4-04-3024	DPC 24-180	4-04-3120	DPC 120-35
4-03-4024	PC 24-450	4-03-4120	PC 120-85	4-04-4024	DPC 24-450	4-04-4120	DPC 120-85
4-03-5024	PC 24-1000	4-03-5120	PC 120-2000	4-04-5024	DPC 24-1000	4-04-5120	DPC 120-2000
4-03-1028	PC 28-30	4-03-2230	PC 230-5	4-04-1028	DPC 28-30	4-04-2230	DPC 230-5
4-03-2028	PC 28-40	4-03-3230	PC 230-20	4-04-2028	DPC 28-40	4-04-3230	DPC 230-20
4-03-3028	PC 28-160	4-03-4230	PC 230-40	4-04-3028	DPC 28-160	4-04-4230	DPC 230-40
4-03-4028	PC 28-360	4-03-5230	PC 230-100	4-04-4028	DPC 28-360	4-04-5230	DPC 230-100
4-03-5028	PC 28-800			4-04-5028	DPC 28-800		

MCI TRANSFORMER CORPORATION 411 MANHATTAN AVENUE, BABYLON, NY 11704 • 516-587-0510

MCI CROSS REFERENCE GUIDE

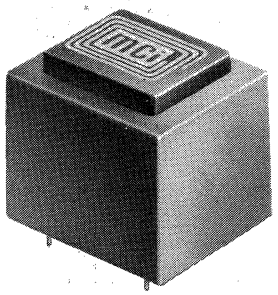
LOW PROFILE PC TRANSFORMERS

MCI	SIGNAL	MCI	SIGNAL	MCI	SIGNAL	MCI	SIGNAL
4-05-1010	LP 10-250	4-05-1020	LP 20-125	4-05-1040	LP 40-60	4-05-1120	LP 120-20
4-05-2010	LP 10-600	4-05-2020	LP 20-300	4-05-2040	LP 40-150	4-05-2120	LP 120-50
4-05-3010	LP 10-1200	4-05-3020	LP 20-600	4-05-3040	LP 40-3000	4-05-3120	LP 120-100
4-05-1012	LP 12-200	4-05-1024	LP 24-100	4-05-1056	LP 56-45	4-05-1230	LP 230-10
4-05-2012	LP 12-450	4-05-2024	LP 24-250	4-05-2056	LP 56-100	4-05-2230	LP 230-25
4-05-3012	LP 12-900	4-05-3024	LP 24-500	4-05-3056	LP 56-200	4-05-3230	LP 230-50
4-05-1016	LP 16-150	4-05-1034	LP 34-75	4-05-1088	LP 88-28		
4-05-2016	LP 16-350	4-05-2034	LP 34-170	4-05-2088	LP 88-65		
4-05-3016	LP 16-700	4-05-3034	LP 34-340	4-05-3088	LP 88-130		

QUICK CONNECT POWER TRANSFORMERS

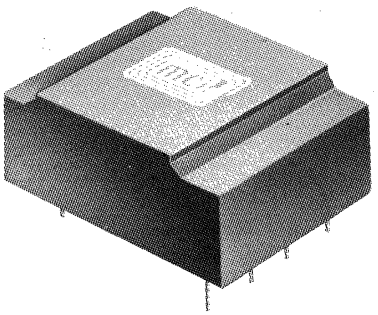
MCI	SIGNAL	MCI	SIGNAL	MCI	SIGNAL	MCI	SIGNAL
4-06-3010	241-3-10	4-06-6010	241-6-10	4-07-4010	DP 241-4-10	4-07-7010	DP 241-7-10
4-06-3012	241-3-12	4-06-6012	241-6-12	4-07-4012	DP 241-4-12	4-07-7012	DP 241-7-12
4-06-3016	241-3-16	4-06-6016	241-6-16	4-07-4016	DP 241-4-16	4-07-7016	DP 241-7-16
4-06-3020	241-3-20	4-06-6020	241-6-20	4-07-4020	DP 241-4-20	4-07-7020	DP 241-7-20
4-06-3024	241-3-24	4-06-6024	241-6-24	4-07-4024	DP 241-4-24	4-07-7024	DP 241-7-24
4-06-3028	241-3-28	4-06-6028	241-6-28	4-07-4028	DP 241-4-28	4-07-7028	DP 241-7-28
4-06-3036	241-3-36	4-06-6036	241-6-36	4-07-4036	DP 241-4-36	4-07-7036	DP 241-7-36
4-06-3048	241-3-48	4-06-6048	241-6-48	4-07-4048	DP 241-4-48	4-07-7048	DP 241-7-48
4-06-3056	241-3-56	4-06-6056	241-6-56	4-07-4056	DP 241-4-56	4-07-7056	DP 241-7-56
4-06-3120	241-3-120	4-06-6120	241-6-120	4-07-4120	DP 241-4-120	4-07-7120	DP 241-7-120
4-06-4010	241-4-10	4-06-7010	241-7-10	4-07-5010	DP 241-5-10	4-07-8010	DP 241-8-10
4-06-4012	241-4-12	4-06-7012	241-7-12	4-07-5012	DP 241-5-12	4-07-8012	DP 241-8-12
4-06-4016	241-4-16	4-06-7016	241-7-16	4-07-5016	DP 241-5-16	4-07-8016	DP 241-8-16
4-06-4020	241-4-20	4-06-7020	241-7-20	4-07-5020	DP 241-5-20	4-07-8020	DP 241-8-20
4-06-4024	241-4-24	4-06-7024	241-7-24	4-07-5024	DP 241-5-24	4-07-8024	DP 241-8-24
4-06-4028	241-4-28	4-06-7028	241-7-28	4-07-5028	DP 241-5-28	4-07-8028	DP 241-8-28
4-06-4036	241-4-36	4-06-7036	241-7-36	4-07-5036	DP 241-5-36	4-07-8036	DP 241-8-36
4-06-4048	241-4-48	4-06-7048	241-7-48	4-07-5048	DP 241-5-48	4-07-8048	DP 241-8-48
4-06-4056	241-4-56	4-06-7056	241-7-56	4-07-5056	DP 241-5-56	4-07-8056	DP 241-8-56
4-06-4120	241-4-120	4-06-7120	241-7-120	4-07-5120	DP 241-5-120	4-07-8120	DP 241-8-120
4-06-5010	241-5-10	4-06-8010	241-8-10	4-07-6010	DP 241-6-10		
4-06-5012	241-5-12	4-06-8012	241-8-12	4-07-6012	DP 241-6-12		
4-06-5016	241-5-16	4-06-8016	241-8-16	4-07-6016	DP 241-6-16		
4-06-5020	241-5-20	4-06-8020	241-8-20	4-07-6020	DP 241-6-20		
4-06-5024	241-5-24	4-06-8024	241-8-24	4-07-6024	DP 241-6-24		
4-06-5028	241-5-28	4-06-8028	241-8-28	4-07-6028	DP 241-6-28		
4-06-5036	241-5-36	4-06-8036	241-8-36	4-07-6036	DP 241-6-36		
4-06-5048	241-5-48	4-06-8048	241-8-48	4-07-6048	DP 241-6-48		
4-06-5056	241-5-56	4-06-8056	241-8-56	4-07-6056	DP 241-6-56		
4-06-5120	241-5-120	4-06-8120	241-8-120	4-07-6120	DP 241-6-120		

TOP QUALITY AT THE BEST PRICES



PRICE LIST

SEPTEMBER 1, 1985



HORIZONTAL PC ENCAPSULATED TRANSFORMERS

	QUANTITY				
	1,000	**2,500**	**5,000**	**10,000**	**25,000**
4-11-2	2.03	1.83	1.66	1.52	1.42
4-11-3	2.16	1.94	1.77	1.62	1.51
4-11-4	2.29	2.06	1.88	1.72	1.60
4-11-5	2.42	2.18	1.98	1.82	1.69
4-11-6	2.52	2.27	2.07	1.89	1.76
4-11-7	2.76	2.48	2.26	2.07	1.93
4-12-2	2.09	1.88	1.71	1.57	1.46
4-12-3	2.21	1.99	1.81	1.66	1.55
4-12-4	2.34	2.11	1.92	1.76	1.64
4-12-5	2.47	2.22	2.03	1.85	1.73
4-12-6	2.56	2.30	2.10	1.92	1.79
4-12-7	2.80	2.52	2.30	2.10	1.96

LOW PROFILE PC ENCAPSULATED TRANSFORMERS

	QUANTITY				
	1,000	**2,500**	**5,000**	**10,000**	**25,000**
4-15-2	4.22	3.81	3.46	3.17	2.95

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TERMS—NET 30 DAYS ON APPROVED CREDIT—F.O.B., BABYLON, N.Y.

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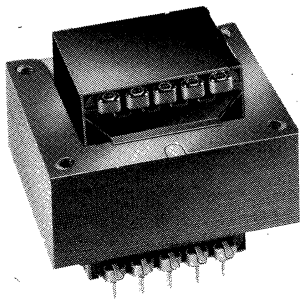

PRICE LIST
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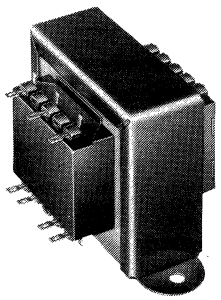

V.D.E. HORIZONTAL PC TRANSFORMERS

	QUANTITY				
	1-9	10-24	25-49	50-99	100-249
4-41-2	8.05	6.76	5.80	4.55	3.74
4-41-3	10.39	8.73	7.48	5.87	4.83
4-41-4	11.40	9.58	8.21	6.44	5.30
4-41-5	13.52	11.36	9.73	7.64	6.29
4-42-2	9.36	7.86	6.74	5.29	4.35
4-42-3	11.83	9.94	8.52	6.68	5.50
4-42-4	13.03	10.95	9.38	7.36	6.06
4-42-5	15.33	12.88	11.04	8.66	7.13

V.D.E. QUICK CONNECT POWER TRANSFORMERS

	QUANTITY				
	1-9	10-24	25-49	50-99	100-249
4-46-2	8.23	6.91	5.93	4.65	3.83
4-46-3	10.62	8.92	7.65	6.00	4.94
4-46-4	11.69	9.82	8.42	6.60	5.44
4-46-5	13.85	11.63	9.97	7.83	6.44
4-46-6	15.15	12.73	10.91	8.56	7.04
4-46-7	20.31	17.06	14.62	11.48	9.44
4-46-8	22.65	19.03	16.31	12.80	10.53
4-46-9	26.50	22.26	19.08	14.97	12.32
4-47-2	9.54	8.01	6.87	5.39	4.44
4-47-3	12.06	10.13	8.68	6.81	5.61
4-47-4	13.32	11.19	9.59	7.53	6.19
4-47-5	15.66	13.15	11.28	8.85	7.28
4-47-6	17.09	14.36	12.30	9.66	7.95
4-47-7	22.44	18.85	16.16	12.68	10.43
4-47-8	24.90	20.92	17.93	14.07	11.58
4-47-9	28.94	24.31	20.84	16.35	13.46

TERMS—NET 30 DAYS ON APPROVED CREDIT—F.O.B., BABYLON, N.Y.

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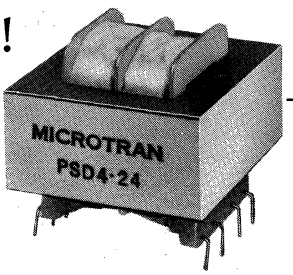
MICROTRAN company, inc.

SPLITFORM® split bobbin power transformers

For PC Board Solid-State Power, Control, and Instrumentation Applications

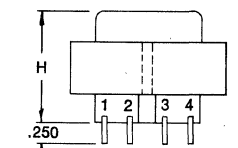
NEW!



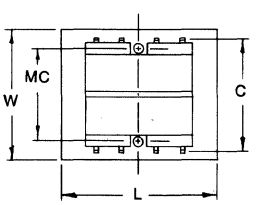
Recognized Component Underwriters Labs Inc.

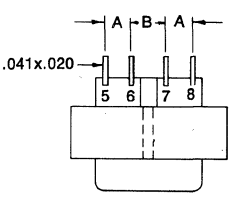
- Split Bobbin Construction
  - Center Flange Insulation Barrier
  - High Isolation for Low Leakage Applications
  - Low Capacitive Coupling Minimizes Line Noise and False Triggering
- 2,500V RMS Hipot
- 115V Single or 115/230V 50/60 Hz Dual Primary
- Dual Secondaries may be either Parallel or Series Connected
- Precision Spaced Molded-in Terminals
  - Terminal Numbers are Molded on Bobbin
- Class S 130°C Insulation
- Attractive Pricing — Superior Quality

PART NO.		SECONDARY RMS RATING			
		Parallel Connected		Series Connected	
Single 115V PSS Series	Dual 115/230V PSD Series	AC Volts	RMS Amps	AC Volts	RMS Amps
PSS2-10	PSD2-10	5.0	0.22	10.0 CT	0.11
PSS3-10	PSD3-10	5.0	0.5	10.0 CT	0.25
PSS4-10	PSD4-10	5.0	1.2	10.0 CT	0.60
PSS5-10	PSD5-10	5.0	2.4	10.0 CT	1.2
PSS2-12	PSD2-12	6.3	0.18	12.6 CT	0.09
PSS3-12	PSD3-12	6.3	0.4	12.6 CT	0.2
PSS4-12	PSD4-12	6.3	1.0	12.6 CT	0.5
PSS5-12	PSD5-12	6.3	2.0	12.6 CT	1.0
PSS2-16	PSD2-16	8.0	0.14	16.0 CT	0.07
PSS3-16	PSD3-16	8.0	0.3	16.0 CT	0.15
PSS4-16	PSD4-16	8.0	0.8	16.0 CT	0.4
PSS5-16	PSD5-16	8.0	1.6	16.0 CT	0.8
PSS2-20	PSD2-20	10.0	0.11	20.0 CT	0.055
PSS3-20	PSD3-20	10.0	0.24	20.0 CT	0.12
PSS4-20	PSD4-20	10.0	0.6	20.0 CT	0.3
PSS5-20	PSD5-20	10.0	1.2	20.0 CT	0.6
PSS2-24	PSD2-24	12.0	0.09	24.0 CT	0.045
PSS3-24	PSD3-24	12.0	0.2	24.0 CT	0.1
PSS4-24	PSD4-24	12.0	0.5	24.0 CT	0.25
PSS5-24	PSD5-24	12.0	1.0	24.0 CT	0.5
PSS2-28	PSD2-28	14.0	0.08	28.0 CT	0.04
PSS3-28	PSD3-28	14.0	0.17	28.0 CT	0.085
PSS4-28	PSD4-28	14.0	0.4	28.0 CT	0.2
PSS5-28	PSD5-28	14.0	0.84	28.0 CT	0.42
PSS2-36	PSD2-36	18.0	0.06	36.0 CT	0.03
PSS3-36	PSD3-36	18.0	0.13	36.0 CT	0.065
PSS4-36	PSD4-36	18.0	0.34	36.0 CT	0.17
PSS5-36	PSD5-36	18.0	0.7	36.0 CT	0.35
PSS2-48	PSD2-48	24.0	0.046	48.0 CT	0.023
PSS3-48	PSD3-48	24.0	0.1	48.0 CT	0.05
PSS4-48	PSD4-48	24.0	0.25	48.0 CT	0.125
PSS5-48	PSD5-48	24.0	0.5	48.0 CT	0.25
PSS2-56	PSD2-56	28.0	0.04	56.0 CT	0.02
PSS3-56	PSD3-56	28.0	0.09	56.0 CT	0.045
PSS4-56	PSD4-56	28.0	0.22	56.0 CT	0.11
PSS5-56	PSD5-56	28.0	0.44	56.0 CT	0.22
PSS2-120	PSD2-120	60.0	0.02	120.0 CT	0.01
PSS3-120	PSD3-120	60.0	0.04	120.0 CT	0.02
PSS4-120	PSD4-120	60.0	0.1	120.0 CT	0.05
PSS5-120	PSD5-120	60.0	0.2	120.0 CT	0.1

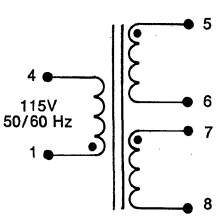


PINS 2 AND 3 OMITTED ON 6 PIN UNITS

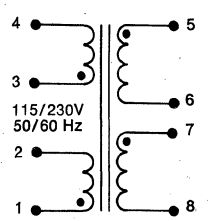




SCHEMATICS



6 PIN PSS SERIES



8 PIN PSD SERIES

DIMENSIONS Inches (mm)									
PSS, PSD Series	VA	L	W	H	MC	A	B	C	Lb. (Gm.)
2	1.1	1.44 (36.6)	1.23 (31.2)	1.00 (25.4)	— —	.250 (6.35)	.250 (6.35)	1.200 (30.5)	0.17 (77.4)
3	2.4	1.44 (36.6)	1.23 (31.2)	1.26 (32)	— —	.250 (6.35)	.250 (6.35)	1.200 (30.5)	0.25 (114)
4	6	1.69 (43)	1.39 (35.3)	1.36 (34.5)	1.0625* (27.0)*	.250 (6.35)	.350 (8.9)	1.280 (32.5)	0.44 (200)
5	12	1.97 (50)	1.63 (41.4)	1.5 (38.1)	1.250* (31.8)*	.300 (7.62)	.400 (10.16)	1.410 (35.8)	0.70 (319)

* Clearance hole for 4-40 x 1⅜″ nylon mtg. screws. Order screw as P/N PS-S and nut as P/N PS-N.

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international series power transformers

For PC Board Solid-State Power, Control, and Instrumentation Applications

- UL Recognized — Meets IEC-65 Safety Requirements for Worldwide Usage
- Physical Barriers Between Primary and Secondary — Double Protection System — 4,000 Volt Hipot

PW SERIES — FOR CONTROL AND POWER SUPPLY APPLICATIONS

115/230V 50/60 Hz Primary

Part No.	Secondary: Parallel Connected AC Volts	Parallel Connected RMS Amps	Series Connected AC Volts	Series Connected RMS Amps	Schematic	Fig.
PW28 SERIES • 0.5 VA						
PW28-10	10.0 CT	.050	(Single Secondary)		1†	A
PW28-16	16.0 CT	.031	(Single Secondary)		1†	A
PW28-24	24.0 CT	.021	(Single Secondary)		1†	A
PW35 SERIES • 1.1 VA						
PW35-10	10.0 CT	.110	(Single Secondary)		1	A
PW35-12	12.6 CT	.090	(Single Secondary)		1	A
PW35-16	16.0 CT	.070	(Single Secondary)		1	A
PW35-24	24.0 CT	.046	(Single Secondary)		1	A
PW35-36	36.0 CT	.031	(Single Secondary)		1	A
PW41 SERIES • 3.5 VA						
PW41-10	10.0 CT	.350	(Single Secondary)		1	B
PW41-12	12.6 CT	.280	(Single Secondary)		1	B
PW41-16	16.0 CT	.220	(Single Secondary)		1	B
PW41-24	24.0 CT	.150	(Single Secondary)		1	B
PW41-36	36.0 CT	.100	(Single Secondary)		1	B
PW48 SERIES • 9.5 VA						
PW48-10	5.0	1.900	10.0 CT	.950	2	B
PW48-12	6.3	1.500	12.6 CT	.750	2	B
PW48-16	8.0	1.200	16.0 CT	.600	2	B
PW48-24	12.0	.800	24.0 CT	.400	2	B
PW48-36	18.0	.520	36.0 CT	.260	2	B
PW48-56	28.0	.340	56.0 CT	.170	2	B
PW54 SERIES • 12.5 VA						
PW54-10	5.0	2.500	10.0 CT	1.250	2	C
PW54-12	6.3	2.000	12.0 CT	1.000	2	C
PW54-16	8.0	1.560	16.0 CT	.780	2	C
PW54-24	12.0	1.040	24.0 CT	.520	2	C
PW54-36	17.0	.700	36.0 CT	.350	2	C
PW54-56	28.0	.446	56.0 CT	.223	2	C

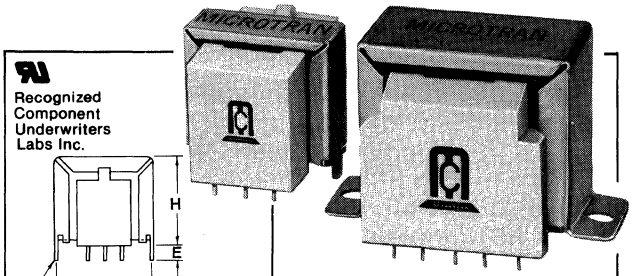
† PW28 Series has 115V only primary. For 230V only primary, order as PW28-10-230, etc.

PWT SERIES — FOR TRIPLE OUTPUT REGULATED AND UNREGULATED POWER SUPPLIES

115/230V 50/60 Hz Primary

Part No.	Secondary #1 AC Volts	Secondary #1 RMS Amps	Secondary #2 AC Volts	Secondary #2 RMS Amps	DC Output #1 CT FW DC Volts	DC Output #1 Cur. mA DC	DC Output #2 CT FW DC Volts	DC Output #2 Cur. mA DC	Schematic	Fig.
PWT54-1024	9.0 CT	.800	24.0 CT	.300	+5	670	±15	170	3	C
PWT54-1633	16.0 CT	.550	33.0 CT	.180	+9.0*	470	±21*	120	4	C

* +9.0 and ±21 DC output volts are for inputs to +5V and ±15V IC Voltage Regulator; see Schematic #4.



Recognized Component Underwriters Labs Inc.

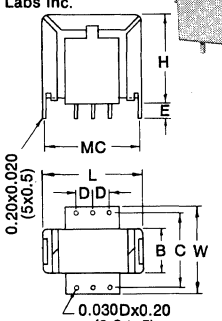


FIG. A*

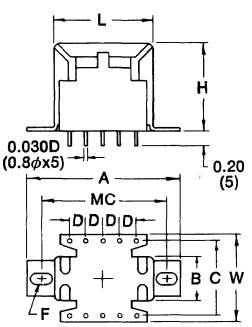


FIG. B*

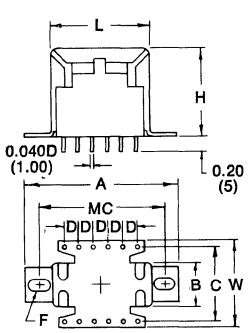
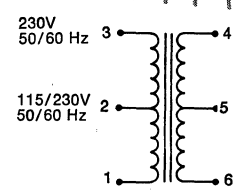
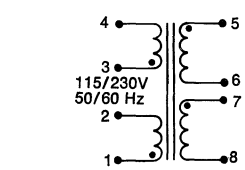


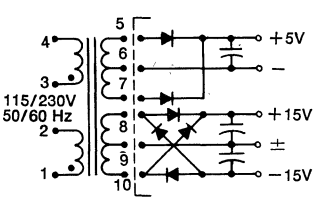
FIG. C*



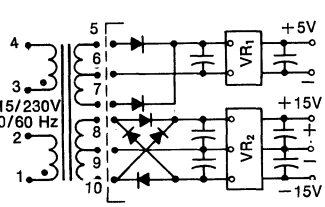
SCHEMATIC 1



SCHEMATIC 2



SCHEMATIC 3



SCHEMATIC 4

DIMENSIONS Inches (mm)

Series	Max VA	L	W	H	MC	A	B	C	D	E	F	Oz. (Gm)
PW28	0.7	1.16 (29.5)	1.32 (33.5)	1.10 (28)	1.12 (28.5)	— —	0.50 (12.5)	0.984 (25)	0.197 (5)	0.20 (5)	— —	2.5 (70)
PW35	2	1.44 (36.5)	1.69 (43)	1.26 (32)	1.40 (35.5)	— —	0.61 (15.5)	1.380 (35)	0.295 (7.5)	0.24 (6)	— —	4.5 (130)
PW41	5	1.67 (42.5)	1.91 (48.5)	1.42 (36)	2.05 (52)	2.36 (60)	0.85 (21.5)	1.575 (40)	0.394 (10)	— —	0.138x0.177 (3.5x4.5)	8.0 (230)
PW48	9.5	1.99 (50.5)	2.05 (52)	1.69 (43)	2.32 (59)	2.72 (69)	1.08 (27.5)	1.772 (45)	0.295 (7.5)	— —	0.177x0.256 (4.5x6.5)	14.0 (400)
PW54	15	2.22 (56.5)	2.09 (53)	1.93 (49)	2.72 (69)	3.15 (80)	1.08 (27.5)	1.772 (45)	0.295 (7.5)	— —	0.177x0.256 (4.5x6.5)	18.0 (510)

PWT54 and PW54 have same dimensions
* Request terminal layout sheet for pin locations.

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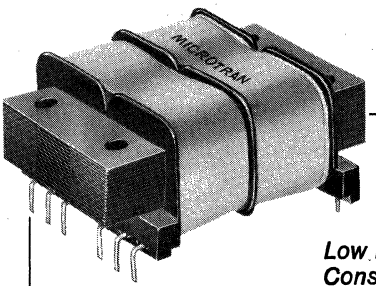
POWER TRANSFORMERS
PRINTED CIRCUIT

MICROTRAN company, inc.

Flat Stack® low profile power transformers
115/230V 50/60 Hz

For Low Height PC Board Solid-State Power, Control, and Instrumentation Applications

- TWO SIZES
  6 VA Types 0.85″ high for 1″ Card Spacing
  12 VA Types 1.065″ high for 1¼″ Card Spacing
- SPLIT BOBBIN — Primaries and Secondaries Wound Side by Side.
  1500V Hipot.
  High Isolation for Low Leakage Applications.
  Low Capacity Coupling Minimizes Line Noise and False Triggering.
- HUM-BUCKING SEMI-TOROIDAL CONSTRUCTION
  Balanced Windings Reduce Magnetic Field Radiation.
- PRECISION SPACE MOLDED-IN TERMINALS
- DUAL PRIMARIES: 115/230V, 50/60 Hz.



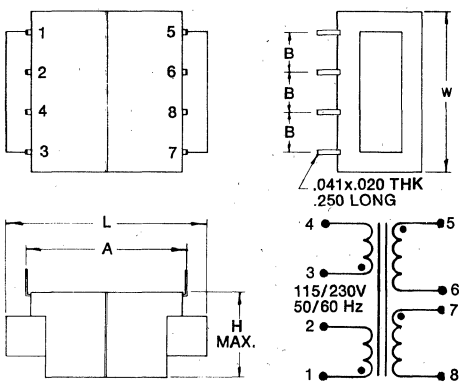
Recognized Component
Underwriters Labs Inc.

Low Profile Construction

PF SERIES — FOR POWER SUPPLIES, INSTRUMENTS, CONTROL EQUIPMENT

Part No.	Secondary			
	Parallel Connected		Series Connected	
	AC Volts	RMS Amps	AC Volts	RMS Amps
PF6 SERIES • 115/230V PRIMARY • 6 VA				
PF6-10	5.0	1.200	10.0 CT	.600
PF6-12	6.3	.900	12.6 CT	.450
PF6-16	8.0	.700	16.0 CT	.350
PF6-24	12.0	.500	24.0 CT	.250
PF6-34	17.0	.340	34.0 CT	.170
PF6-56	28.0	.200	56.0 CT	.100
PF12 SERIES • 115/230V PRIMARY • 12 VA				
PF12-10	5.0	2.400	10.0 CT	1.200
PF12-12	6.3	1.800	12.6 CT	.900
PF12-16	8.0	1.400	16.0 CT	.700
PF12-24	12.0	1.000	24.0 CT	.500
PF12-34	17.0	.680	34.0 CT	.340
PF12-56	28.0	.400	56.0 CT	.200

PF SERIES



DIMENSIONS (Inches)

Series	L	W	H	A	B	Wt. Oz.
PF6-	1⅞	1¾	0.850	1.600	0.375	7
PF12-	2½	2	1.065	2.000	0.500	11

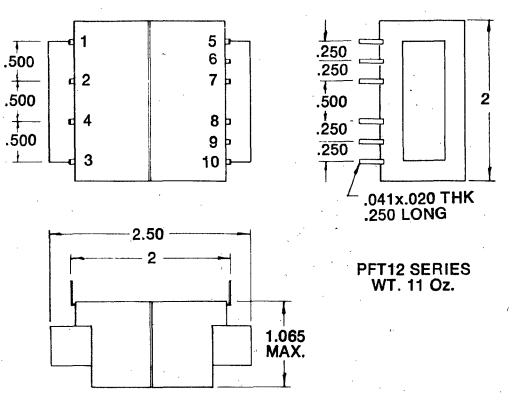
PFT SERIES — FOR TRIPLE OUTPUT REGULATED POWER SUPPLIES

For Microprocessor Logic, and Op Amp Applications

Part No.	Secondary #1		Secondary #2		DC Output #1		DC Output #2	
	AC Volts	RMS Amps	AC Volts	RMS Amps	CT FW DC Volts	Cur. mA DC	CT FW DC Volts	Cur. mA DC
PFT SERIES • 115/230V PRIMARY • 12 VA								
PFT12-35	16.0CT	.360	35.0CT	.150	+8.75*	300	±22*	85

* +8.75 and ±22 DC output volts are for inputs to +5V and ±12 or ±15V IC Voltage Regulators. See PFT schematic. Line input 115/230V ±10%.

PFT SERIES



PFT12 SERIES
WT. 11 Oz.

MICROTRAN company, inc.

POWER TRANSFORMERS
PRINTED CIRCUIT

printed circuit power transformers

COMPACT DESIGN FOR MINIATURIZED SOLID STATE CIRCUITRY

For power supplies, instruments and control applications.

SINGLE 115V PRIMARY

6 Pin Type Part No.	Fig.	Secondary* Parallel Connected AC Volts	RMS Amps	Series Connected AC Volts	RMS Amps
PC6506	A	6.3 CT	.250	(Single Secondary)	
PC6512	A	12.6	.120	25.2 CT	.060
PC6524	A	40.0	.040	80.0 CT	.020
PC6528	A	58.0	.026	116.0 CT	.013
PC6608	C	6.3	.700	12.6 CT	.350
PC6616	C	28.0	.156	56.0 CT	.078
PC6624	C	40.0	.110	80.0 CT	.055
PC6628	C	58.0	.066	116.0 CT	.033
PC6632	C	115.0V @	.020A	and 12.6V @	.150A
PC6708	C	6.3	1.200	12.6 CT	.600
PC6712	C	12.6	.600	25.2 CT	.300
PC6715	C	20.0	.370	40.0 CT	.185
PC6716	C	28.0	.270	56.0 CT	.135
PC6724	C	40.0	.180	80.0 CT	.090
PC6728	C	58.0	.130	116.0 CT	.065
PC6732	C	115.0V @	.025A	and 12.6V @	.250A

* Dual secondaries may be parallel connected to obtain twice the current, or series connected to give twice the voltage of one winding.

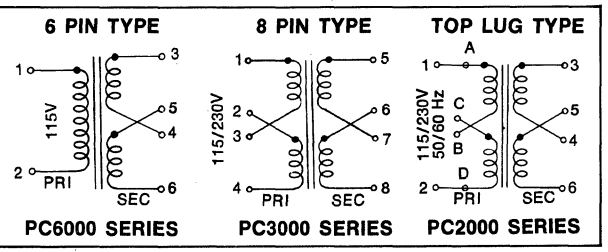
DUAL 115/230V PRIMARY

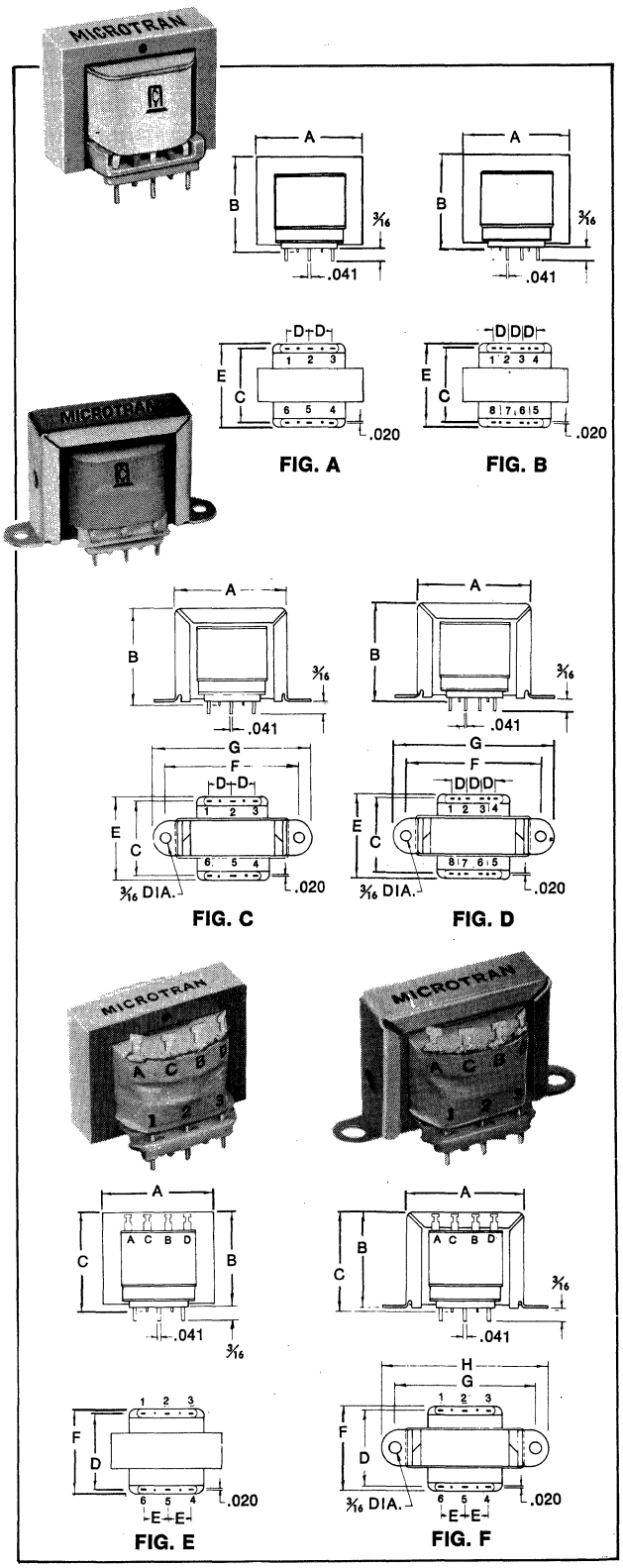
8 Pin Type Part No.	Fig.	Secondary* Parallel Connected AC Volts	RMS Amps	Series Connected AC Volts	RMS Amps	Top Lug Type† Part No.	Fig.
PC3506	B	6.3 CT	.250	(Single Secondary)		PC2506	E
PC3512	B	12.6	.120	25.2 CT	.060	PC2512	E
PC3524	B	40.0	.040	80.0 CT	.020	PC2524	E
PC3528	B	58.0	.026	116.0 CT	.013	PC2528	E
PC3608	D	6.3	.700	12.6 CT	.350	PC2608	F
PC3616	D	28.0	.156	56.0 CT	.078	PC2616	F
PC3624	D	40.0	.110	80.0 CT	.055	PC2624	F
PC3628	D	58.0	.066	116.0 CT	.033	PC2628	F
PC3632	D	115.0V @	.020A	and 12.6V @	.150A	PC2632	F
PC3708	D	6.3	1.200	12.6 CT	.600	PC2708	F
PC3712	D	12.6	.600	25.2 CT	.300	PC2712	F
PC3715	D	20.0	.370	40.0 CT	.185	PC2715	F
PC3716	D	28.0	.270	56.0 CT	.135	PC2716	F
PC3724	D	40.0	.180	80.0 CT	.090	PC2724	F
PC3728	D	58.0	.130	116.0 CT	.065	PC2728	F
PC3732	D	115.0V @	.025A	and 12.6V @	.250A	PC2732	F

* Dual secondaries may be parallel connected to obtain twice the current, or series connected to give twice the voltage of one winding.
† Lugs on PC2000 series provide for 115/230V primary voltage options without changes in PC board.

DIMENSIONS / VA

Series	VA	A	B	C	D	E	F	G	Wt. Oz.
6 PIN TYPE									
PC6500	1½	1 25/64	1 13/64	1.00	.312	1 5/32	—	—	3.2
PC6600	4½	1 45/64	1 7/16	1.10	.400	1 1/4	2	2 3/8	6.5
PC6700	7½	1 61/64	1 11/16	1.30	.400	1 15/32	2 3/8	2 13/16	9.5
8 PIN TYPE									
PC3500	1½	1 25/64	1 13/64	1.00	.200	1 5/32	—	—	3.2
PC3600	4½	1 45/64	1 7/16	1.10	.250	1 1/4	2	2 3/8	6.5
PC3700	7½	1 61/64	1 11/16	1.30	.250	1 15/32	2 3/8	2 13/16	9.5
TOP LUG TYPE									
PC2500	1½	1 25/64	1 11/64	1 13/64	1.00	.312	1 5/32	—	—	3.2
PC2600	4½	1 45/64	1 25/64	1 7/16	1.10	.400	1 1/4	2	2 3/8	6.5
PC2700	7½	1 61/64	1 41/64	1 11/16	1.30	.400	1 15/32	2 3/8	2 13/16	9.5





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POWER TRANSFORMERS
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printed circuit power supply transformers

For Microprocessor Logic and Op Amp Power Supplies

PLUG-IN PC POWER TRANSFORMERS FOR +5V AND ±15V DC POWER SUPPLIES

For construction of low cost, miniaturized, regulated and unregulated DC power supplies for latest solid-state digital and linear circuitry. Permits packaging flexibility unobtainable with prepackaged power supplies. Low-profile, miniaturized construction permits close stacking of PC boards. Precision spaced molded-in terminals.

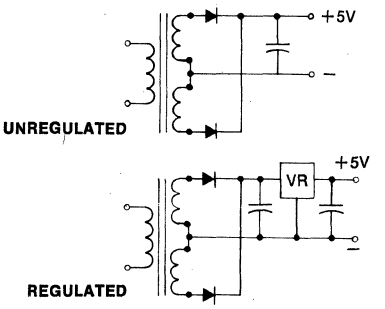
TRANSFORMERS FOR +5V DC SINGLE OUTPUT UNREGULATED AND REGULATED POWER SUPPLIES

* All primaries 115V 50/60 Hz except PCL6605 and PCL6610 which have 115/230V 50/60 Hz primaries.

Part No.	SECONDARY: Parallel Connected AC Volts	SECONDARY: Parallel Connected RMS Amps	SECONDARY: Series Connected AC Volts	SECONDARY: Series Connected RMS Amps	DC OUTPUT: CT FW DC Volts	DC OUTPUT: Current mA DC	Schematic (See Pg. 9)	Fig. (See Pg. 9)
PC6205	4.50	0.18	9.0 CT	0.09	+5	75	1	A
PC6505	4.50	0.36	9.0 CT	0.18	+5	150	1	C
PC6605	4.50	1.10	9.0 CT	0.55	+5	450	1	G
PCL6605*	4.50	1.10	9.0 CT	0.55	+5	450	2	E
PC6705	4.50	2.00	9.0 CT	1.00	+5	825	1	G
PC6905	4.50	5.00	9.0 CT	2.50	+5	2000	1	J
PC6210	7.75	0.12	15.5 CT	0.06	+8.5**	50	1	A
PC6510	7.75	0.22	15.5 CT	0.11	+8.5**	90	1	C
PC6610	7.75	0.64	15.5 CT	0.32	+8.5**	265	1	G
PCL6610*	7.75	0.64	15.5 CT	0.32	+8.5**	265	2	E
PC6710	7.75	1.20	15.5 CT	0.60	+8.5**	500	1	G
PC6910	7.75	3.10	15.5 CT	1.55	+8.5**	1300	1	J

** +8.5 DC output volts for input to +5V IC Voltage Regulator, see Typical Schematic-Regulated.
* 115/230V primary.

TYPICAL SCHEMATICS



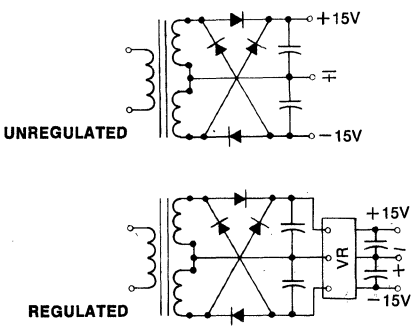
TRANSFORMERS FOR ±15V DC DUAL OUTPUT UNREGULATED AND REGULATED POWER SUPPLIES

* All primaries 115V 50/60 Hz except PCL6611 and PCL6614 which have 115/230V 50/60 Hz primaries.

Part No.	SECONDARY: Parallel Connected AC Volts	SECONDARY: Parallel Connected RMS Amps	SECONDARY: Series Connected AC Volts	SECONDARY: Series Connected RMS Amps	DC OUTPUT: CT FW DC Volts	DC OUTPUT: Current mA DC	Schematic (See Pg. 9)	Fig. (See Pg. 9)
PC6211	12.0	0.07	24.0 CT	0.035	±15	22	1	A
PC6511	12.0	0.13	24.0 CT	0.065	±15	40	1	C
PC6611	12.0	0.40	24.0 CT	0.200	±15	120	1	G
PCL6611*	12.0	0.40	24.0 CT	0.200	±15	120	2	E
PC6711	12.0	0.76	24.0 CT	0.380	±15	220	1	G
PC6911	12.0	1.90	24.0 CT	0.950	±15	550	1	J
PC6214	16.0	0.05	32.0 CT	0.025	±20**	15	1	A
PC6514	16.0	0.10	32.0 CT	0.050	±20**	30	1	C
PC6614	16.0	0.30	32.0 CT	0.150	±20**	90	1	G
PCL6614*	16.0	0.30	32.0 CT	0.150	±20**	90	2	E
PC6714	16.0	0.56	32.0 CT	0.280	±20**	165	1	G
PC6914	16.0	1.40	32.0 CT	0.700	±20**	410	1	J

** ±20 DC output volts for input to ±15V output IC Voltage Regulator, see Typical Schematic-Regulated.
* 115/230V primary.

TYPICAL SCHEMATICS



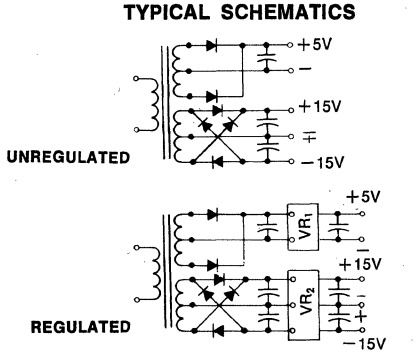
TRANSFORMERS FOR +5V AND ±15V DC TRIPLE OUTPUT UNREGULATED AND REGULATED POWER SUPPLIES

* All primaries 115V 50/60 Hz except PCL6630 and PCL6631 which have 115/230V 50/60 Hz primaries.

Part No.	Secondary #1 AC Volts	Secondary #1 RMS Amps	Secondary #2 AC Volts	Secondary #2 RMS Amps	DC Output #1 CT FW DC Volts	DC Output #1 Cur. mA DC	DC Output #2 CT FW DC Volts	DC Output #2 Cur. mA DC	Schematic (See Pg. 9)	Fig. (See Pg. 9)
PCT6230	9.0 CT	0.048	24.0 CT	0.020	+5	40	±15	12	4	B
PCT6530	9.0 CT	0.072	24.0 CT	0.032	+5	60	±15	20	4	D
PCT6630	9.0 CT	0.240	24.0 CT	0.080	+5	200	±15	50	4	H
PCL6630*	9.0 CT	0.240	24.0 CT	0.080	+5	200	±15	50	3	F
PCT6730	9.0 CT	0.480	24.0 CT	0.160	+5	400	±15	100	4	H
PCT6930	9.0 CT	1.200	24.0 CT	0.440	+5	1000	±15	275	4	K
PCT6531	15.5 CT	0.048	32.0 CT	0.020	+8.5**	40	±20**	12	4	D
PCT6631	15.5 CT	0.140	32.0 CT	0.058	+8.5**	115	±20**	35	4	H
PCL6631*	15.5 CT	0.140	32.0 CT	0.058	+8.5**	115	±20**	35	3	F
PCT6731	15.5 CT	0.300	32.0 CT	0.100	+8.5**	250	±20**	60	4	H
PCT6931	15.5 CT	0.690	32.0 CT	0.298	+8.5**	575	±20**	175	4	K

** +8.5 and ±20 DC output volts are for inputs to +5V and ±15V IC Voltage Regulator, see Typical Schematic-Regulated.
* 115/230V primary.

TYPICAL SCHEMATICS



ALL TRANSFORMERS ARE SUPPLIED WITH ENGINEERING BULLETIN LISTING SUGGESTED COMPONENTS

Bulletin provides typical schematics and suggested components for low-cost, miniaturized, unregulated and regulated power supplies. Regulated units have short circuit, thermal overload and overvoltage protection, and have the following typical specifications: Input 105-125V; Output ±0.1V; Load and Line Regulation 0.1% each; Ripple 1 mV RMS.

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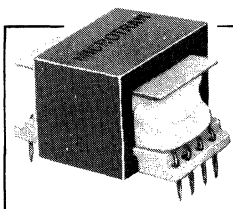
POWER TRANSFORMERS
PRINTED CIRCUIT

Schematics and Outline Drawings for Page A•2188



PC6200 Series
PCT6200 Series
Wt. 2.3 Oz.

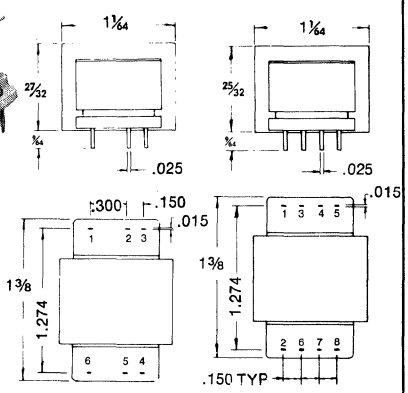
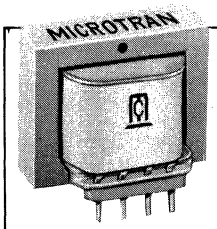


FIG. A — 6 Pins FIG. B — 8 Pins



PC6500 Series
PCT6500 Series
Wt. 3.2 Oz.

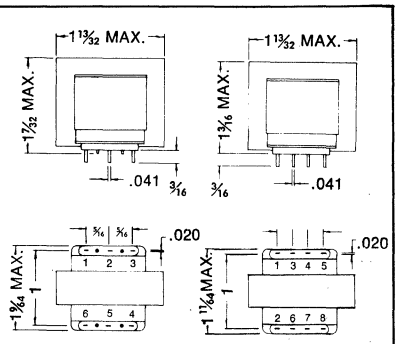
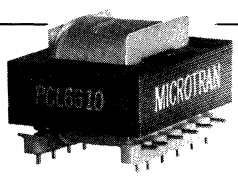


FIG. C — 6 Pins FIG. D — 8 Pins



PCL6600 Series
Wt. 6.5 Oz.

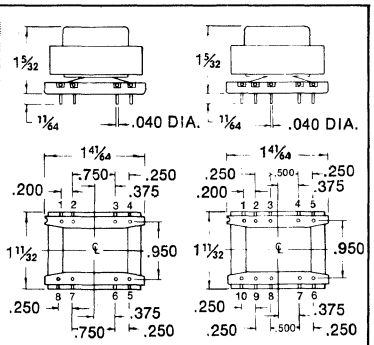
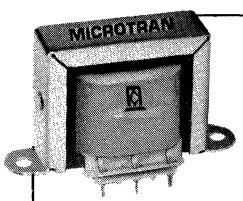


FIG. E — 8 Pins FIG. F — 10 Pins



PC6600 &
PC6700 Series

PCT6600 &
PCT6700 Series

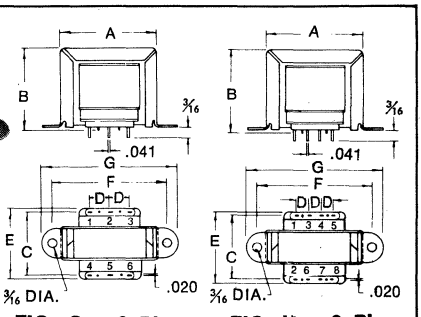
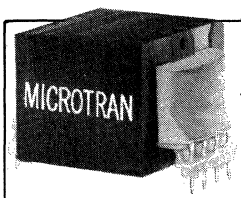


FIG. G — 6 Pins FIG. H — 8 Pins

Series	Fig.	A	B	C	D	E	F	G	Wt. Oz.
PC6600	G	1 45/64	1 7/16	1.10	.400	1 1/4	2	2 3/8	6.5
PC6700	G	1 61/64	1 11/16	1.30	.400	1 15/32	2 3/8	2 13/16	9.5
PCT6600	H	1 45/64	1 7/16	1.10	.250	1 1/4	2	2 3/8	6.5
PCT6700	H	1 61/64	1 11/16	1.30	.250	1 15/32	2 3/8	2 13/16	9.5



PC6900 Series
PCT6900 Series
Wt. 12 Oz.
Slip-on Mounting Bracket Available See Fig. L

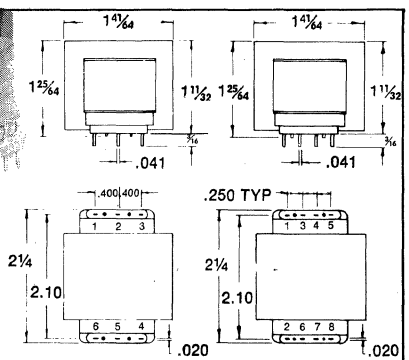


FIG. J — 6 Pins FIG. K — 8 Pins

SLIP-ON BRACKET

For PC6900 Series
See Fig. J & K

Order as Part No. PC6900-FB
Mounted height over bracket 1 7/16" max.

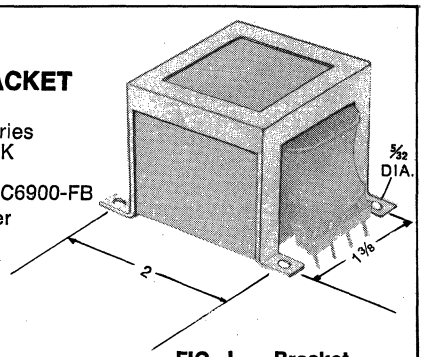
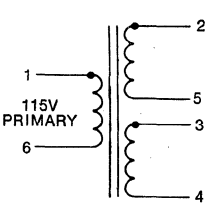
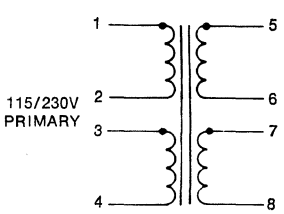


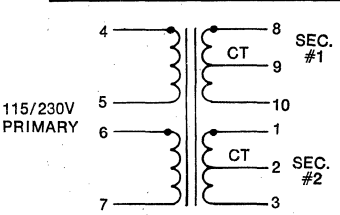
FIG. L — Bracket



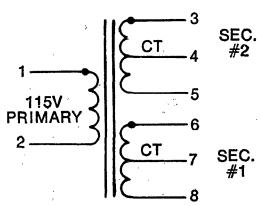
SCHEMATIC #1



SCHEMATIC #2



SCHEMATIC #3



SCHEMATIC #4

CONVERTER TRANSFORMERS POWER TRANSFORMERS

MICROTRAN company, Inc.

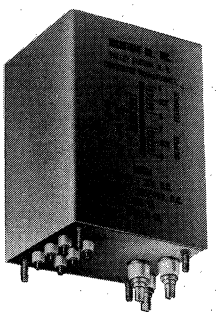


FIG. A

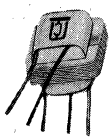


FIG. B

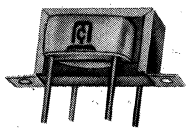


FIG. C

FIG. E

FIG. F

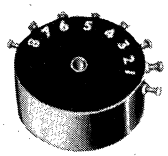


FIG. D

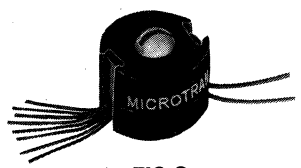


FIG.G

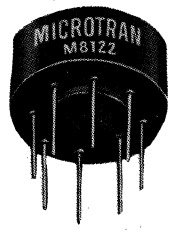


FIG. H

DC-DC CONVERTER TRANSFORMERS

Permits conversion of low-voltage DC to higher voltages for operating mobile equipment or for DC isolation. Supplied with schematic and component values.

Select the Unit That Meets Your Power & Size Requirements	Part No.	Total VA Output‡	DC Input Volts	DC Output¶ Bridge Volts	Bridge mA	CT Full Wave Volts	CT Full Wave mA	Switching Freq. Hz (approx.)	Dimensions D x W x H	Mtg. Cont. MD	Mtg. Cont. MW	Type of Construction	Fig.	Approx. Wt. Oz.
High Voltage Low Power Miniature Design	**M8149**	25 mW	3	1,000*	25 μA	—	—	400	1 1/64 x 61/64 x 27/32	—	—	Plug-in	E	1.2
	M8050	25 mW	1	1,000*	25 μA	—	—	400	1 1/16 x 1 3/16 x 27/32	1 3/8	—	Open Frame with Leads	C	1.25
	M8051	25 mW	3	1,000*	25 μA	—	—	400	1 x 1 x 1 3/8	1 1/8	—	MIL — AG	F	2.4
	M8073	25 mW	4	425-500*	50 μA	—	—	50-3K†	3/8 x 3/8 x 3/8	—	—	Open Frame	B	.1
	M8074	50 mW	3	535*	90 μA	—	—	400	1 1/16 x 1 3/16 x 27/32	1 3/8	—	Open Frame	C	1.25
	M8072	190 mW	2.7	480*	400 μA	—	—	800	1 1/16 x 1 3/16 x 27/32	1 3/8	—	Open Frame	C	1.25
	M8120	190 mW	28	480*	400 μA	—	—	3.5K	1 1/16 x 1 3/16 x 27/32	1 3/8	—	Open Frame	C	1.25
For Displays Nixie-Panaplex	**M8121**	3	5	190	15	—	—	20K	5/16D x 11/32H			Open Frame	G	.3
5 VA High Voltage Low Profile Encapsulated	**M8115**	5	13.8	±250 or 500§	10	250	20	6K	1 1/4 D x 3/4 H—.140 Cl. Hole			Toroidal	D	1.1
	M8117	5	28	±250 or 500§	10	250	20	6K	1 1/4 D x 3/4 H—.140 Cl. Hole			Toroidal	D	1.1
	M8122	5	5	±15 or 30	175	15	350	20K	7/8 D x 17/32 H—.140 Cl. Hole			Toroidal	H	1.1
High Frequency Encapsulated	**M8132**	30	13.8	±15 or 30§	1,000	15	2,000	20K	1 1/4 D x 3/4 H—.140 Cl. Hole			Toroidal	D	1.1
	M8133	30	28	±15 or 30§	1,000	15	2,000	20K	1 1/4 D x 3/4 H—.140 Cl. Hole			Toroidal	D	1.1
Medium Power Low Profile Encapsulated	**M8113**	50	13.8	±14 or 28§	1,750	14	3,500	2.5K	2 1/8 D x 1 1/4 H—.170 Cl. Hole			Toroidal	D	6
	M8114	50	28	±14 or 28§	1,750	14	3,500	2.5K	2 1/8 D x 1 1/4 H—.170 Cl. Hole			Toroidal	D	6
	M8116	50	13.8	±35 or 70§	700	35	1,400	2.5K	2 1/8 D x 1 1/4 H—.170 Cl. Hole			Toroidal	D	6
	M8118	50	28	±35 or 70§	700	35	1,400	2.5K	2 1/8 D x 1 1/4 H—.170 Cl. Hole			Toroidal	D	6

‡ Full-wave and CT loads may be simultaneously drawn, but for continuous duty, total VA output should not be exceeded. † Frequency depends on load and bias conditions. ¶ Based on approximately 1 volt drop per rectifier. § For positive and negative voltage supply as utilized in op-amp and similar circuitry.

400 Hz PLUG-IN P.C. POWER

Compact design for miniature solid state circuitry. Precision spaced molded-in terminals. Dual secondaries may be connected in series or parallel. 115V Primary.

Part No.	Secondary - Parallel	Secondary - Series
PC4304	3.15V @ .1A	6.3V CT @ .05A
PC4312	12.6V @ .026A	25.2V CT @ .013A
PC4316	28V @ .012A	56V CT @ .006A
PC4320	35V @ .01A	70V CT @ .005A
PC4408	6.3V @ 0.60A	12.6V CT @ .30A
PC4412	12.6V @ 0.30A	25.2V CT @ .15A
PC4416	28V @ 0.14A	56V CT @ .07A
PC4424	40V @ 0.10A	80V CT @ .05A
PC4428	58V @ .066A	116V CT @ .033A
PC4432	115V @ .010A, 12.6V @ .150A	

DIMENSIONS

Series	W	D	H	Fig.	Wt. Oz.
PC4300	49/64	11/16	23/32	E	.5
PC4400	1 1/64	61/64	27/32	E	1.2

400 Hz TOROIDAL P.C. POWER

For Applications Requiring Minimum Size and Weight. Epoxy molded. Printed circuit pins can be bent for chassis mounting. .170 Clearance Hole for #8 Screw. Primary 115 Volts, MIL Designation TF5S03ZZ.

Part No.	Secondary AC Volts	Secondary RMS mA	VA	Dimensions OD	Dimensions Height	Fig.	Wt. Oz.
M8106	28 CT	320	9	1 5/32	1 1/8	H	2
M8107	28 CT	710	20	1 1/2	1 1/4	H	4
M8108	56 CT	160	9	1 5/32	1 1/8	H	2
M8109	56 CT	356	20	1 1/2	1 1/4	H	4
M8110	115 CT	78	9	1 5/32	1 1/8	H	2
M8111	115 CT	170	20	1 1/2	1 1/4	H	4

MICROTRAN company, inc.

MINIATURIZED AUDIO TRANSFORMERS

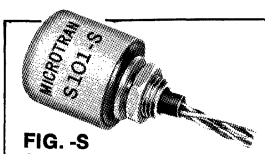


FIG. -S
SINGLE THREADED STUD MOUNTING
Double Mu-metal shielding. 3" color coded leads. 5/16"D. stud provided with nut. 5/8"D x 13/16" H. Wt. 0.55 oz.

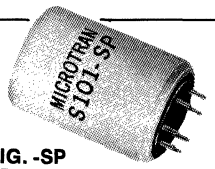


FIG. -SP
PRINTED CIRCUIT MOUNTED
Double Mu-metal shielded. 3/4" D x 1 1/16"H. 7-.040 pins 1/8" H. Wt. 0.62 oz.

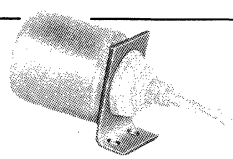
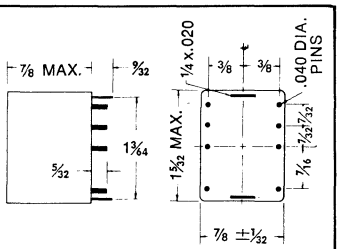
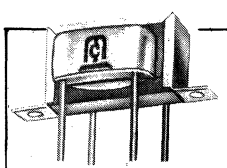


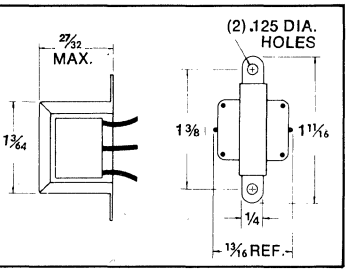
FIG. -FB
RIGHT ANGLE MOUNTING BRACKET
For mounting of -S series transformers. M.C. 3/8".

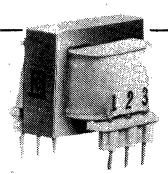
MOLDED M-M
To order add -M to Part No. For plug-in printed circuit applications. Epoxy resin provides resistance to extremes of ambient. Wt. 1.75 oz.



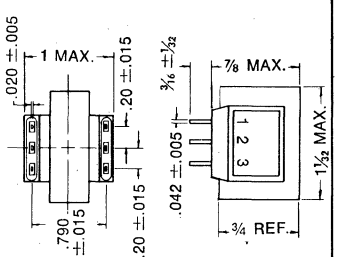


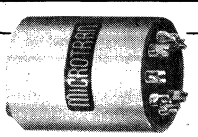
OPEN FRAME WITH CHANNEL M-FB
To order add -FB to Part No. Leads 4" long. #28 PVC Wt. 1.13 oz.



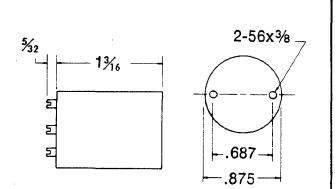


OPEN FRAME PRINTED CIRCUIT M-PC
To order add -PC to Part No. Units with more than 6 pins have 7 or 8 — .025 x .015 pins on .150 centers. Wt. 1.2 oz.





ALUMINUM CASED M-A
To order add -A to Part No. Supplied with 2-56 screws. Wt. 1.25 oz.



MICROPHONE/TRANSDUCER INPUT

FOR: PROFESSIONAL SOUND STUDIOS — BROADCAST MIXING CONSOLES — CONTROL AND INSTRUMENT AMPLIFIERS

EQUIVALENT TO IMPORTED EUROPEAN STUDIO GRADE TRANSFORMERS

- WIDE BANDWIDTH — BROAD FREQUENCY RESPONSE
- EXTREMELY LOW DISTORTION
- NEGLIGIBLE HUM PICK UP
- SUBMINIATURE SIZE
- EASE OF MOUNTING AND ORIENTATION
- POLARIZING VOLTAGE CONNECTION FOR CONDENSER MICROPHONES
- LOW MICROPHONICS
- ELECTROSTATIC SHIELDING

Part No.	Nom. Turns Ratio Pri:Sec	Nominal Impedance Ratio Primary	Nominal Impedance Ratio Secondary	Typ. Open Circuit Primary Impedance @ 50 Hz†	Frequency Response	Fig.	Replaces Beyer Part No.
S101-S	1:20	12.5	5,000	100	30-15,000 Hz ±1 dB	-S	TR-BV35704
S101-SP	1:20	12.5	5,000	100	30-15,000 Hz ±1 dB	-SP	STR-BV37704
S105-S	1:15	200	45,000	2,000	30-15,000 Hz ±1 dB	-S	351.015.006
S105-SP	1:15	200	45,000	2,000	30-15,000 Hz ±1 dB	-SP	370.015.006
S107-S	1:15	200/50 split	45,000	2,000	30-15,000 Hz ±1 dB	-S	351.215.006
S107-SP	1:15	200/50 split	45,000	2,000	30-15,000 Hz ±1 dB	-SP	370.215.006
S108-S	1:10	200	20,000	2,000	30-15,000 Hz ±1 dB	-S	351.010.005
S108-SP	1:10	200	20,000	2,000	30-15,000 Hz ±1 dB	-SP	370.010.005
S111-S	1:7.1	200	10,000	2,000	30-15,000 Hz ±1 dB	-S	351.007.004
S111-SP	1:7.1	200	10,000	2,000	30-15,000 Hz ±1 dB	-SP	370.007.004
S116-S	1:5	200	5,000	2,000	30-15,000 Hz ±1 dB	-S	351.005.003
S116-SP	1:5	200	5,000	2,000	30-15,000 Hz ±1 dB	-SP	370.005.003
S118-S	1:5	200/50 split	5,000	2,000	30-15,000 Hz ±1 dB	-S	351.205.003
S118-SP	1:5	200/50 split	5,000	2,000	30-15,000 Hz ±1 dB	-SP	370.205.003
S126-S	1:1	600 CT	600	3,750	30-20,000 Hz ±.5 dB	-S	TR145/BV35508
S126-SP	1:1	600 CT	600	3,750	30-20,000 Hz ±.5 dB	-SP	STR-145/BV37508
S130-S	1:1	10,000	10,000	100,000	30-15,000 Hz ±1 dB	-S	TR-145/BV35590
S130-SP	1:1	10,000	10,000	100,000	30-15,000 Hz ±1 dB	-SP	STR-145/BV37590
S100-FB	Right angle mounting bracket for S100-S series.					-FB	

† Designed for optional bridging termination use to provide additional 6 dB output voltage gain.
‡ Frequency response measured with source equal to nominal primary impedance and with unloaded secondary except 100k load on S105 and S107 series.

MINIATURE AUDIO M & MT SERIES

All items shown in charts below are available in any of the mechanical packages shown. These units can be used as input, interstage, output, isolation and other impedance matching applications. Primary and secondary windings may be interchanged to obtain required impedance matching. Also available in hermetic construction.

Part No.*	Primary Impedance	Secondary Impedance	Primary Unbalance mA DC	Operating Level dBm	Frequency Response ±2 dB
M3-(*)•	7.5/30	50,000	0	5	20-20,000
M12-(*)	50/250 CT	50/250/600 CT	0	8	20-20,000
M1-(*)•	50/250/600 CT	50,000	0	5	20-20,000
M1-S	Same as M1 above — with dual nickel alloy shield				
M2-(*)•	50/250/600 CT	50,000 CT	0	5	20-20,000
M14-(*)	200	½ Megohm	0	9	80-3,000
M15-(*)	10,000	1 Megohm	0	11	100-2,500
M8-(*)	15,000	50/250/600 CT	0	8	20-20,000
M9-(*)	15,000	50/250/600 CT	4	21	150-20,000
M4-(*)	15,000	60,000	0	6	20-15,000
M5-(*)	15,000	60,000	4	14	200-20,000
M6-(*)	15,000	95,000 CT	0	5	20-15,000
M7-(*)	15,000	95,000 CT	4	11	200-20,000
M10-(*)•	30,000 CT	50/250/600 CT	0	8	30-50,000
M11-(*)•	50,000	50/250/600 CT	0	5	20-20,000
M13-(*)	Reactor 300 hy. 0 DC	50 hy. @ 3 mA		6000Ω D.C.R.	
M90	Magnetic Shield Mu-Metal slip on can for M-A Series 25 dB shielding				
MT2-(*)	100	10 CT/40 CT	100	27	200-20,000
MT30-(*)	250 CT	500	10	30	200-15,000
MT23-(*)	250 CT	1000	10	30	200-15,000
MT14-(*)	400	10	50	25	200-20,000
MT15-(*)	500 CT	210	30	27	300-20,000
MT1-(*)	600	600	10	23	200-15,000
MT35-(*)‡	600	600 CT & 600 CT	0	5	40-20,000
MT36-(*)†	600 CT	600 CT	0	15	50-15,000
MT26-(*)	600 CT	600 CT	20	23	200-15,000
MT9-(*)	600 CT	1,200 CT	4	23	200-15,000
MT33-(*)	600/150 Split	600/150 Split	20	23	200-20,000
MT22-(*)	600/150 Split	1,200 CT	4	23	200-15,000
MT29-(*)	1600 CT	450	15	30	200-15,000
MT12-(*)	2,000	3.4	10	32	200-15,000
MT24-(*)	2,500	600 CT	10	32	200-15,000
MT13-(*)	4,000 CT	3.4	3	32	200-15,000
MT11-(*)	4,000 CT	600 CT	3	32	200-15,000
MT21-(*)	4,000 CT	600/150 Split	3	32	200-15,000
MT25-(*)	7,500 CT	600 CT	8	32	200-15,000
MT34-(*)	10,000/2500 Split	2000/500 Split	4	20	200-20,000
MT10-(*)•	25,000	600	3	22	200-15,000
MT7-(*)•	25,000	1,200 CT	3	22	200-15,000
MT18-(*)•	25,000 CT	1,200 CT	6	22	200-15,000
MT5-(*)•	50,000	6	3	20	300-15,000
MT3-(*)	50,000	600	3	20	300-15,000
MT8-(*)•	50,000 CT	1,200 CT	3	20	300-15,000
MT20-(*)•	50,000 CT	1200/300 Split	3	20	300-15,000
MT6-(*)•	100,000	1,200 CT	1.4	17	200-15,000

* Add -M, -PC, -A, or -FB to Part No. to designate construction.
• These items not available in -PC construction.
‡ For telephone line coupling or hybrid telephone line.
† Broadcast fidelity line matching transformer. Frequency response ±0.5 dB.

TELEPHONE INTERCONNECT TRANSFORMERS

MICROTRAN company, inc.

line coupling-hybrid-holding coils

FOR INTERCONNECT OF VOICE/DATA MODEM TERMINALS TO TELEPHONE LINES

Provides line isolation and matching — Prevents line imbalance — Wide dynamic signal capability — Low distortion
Permits Optimum use of Voice-Grade Telephone Lines for Broadband Data Signals — Designed to meet FCC Part 68

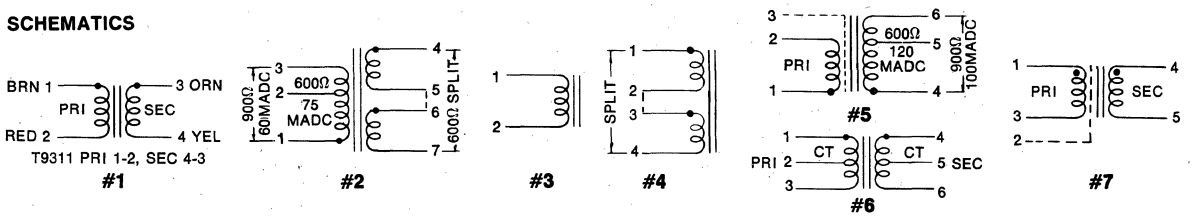
- Frequency Response: 300-3500 Hz ±0.5 dB
- Longitudinal Balance: Per FCC 68.310
- Impedance Matching: ±10% over entire frequency range
- Level: −45 dBm to +7 dBm
- Distortion: 0.5% Max.
- Return Loss: 26 dB Min.

Part No.	Primary Impedance	Secondary Impedance	Unbalance mA DC	Schematic	Page	Fig.	Page	Application Notes
VOICE/DATA COUPLING								
PM32-F	600	600	1.5	1	A•2192	PM-F	A•2195	Freq. resp. 300 Hz — 100 kHz ±2 dB. Open frame 0.27" H.
PM34-F	600 CT	600 CT	3	14	A•2194	PM-F	A•2195	Freq. resp. 300 Hz — 100 kHz ±2 dB. Open frame 0.27" H.
PM32-M	600	600	1.5	1	A•2192	R	A•2194	Freq. resp. 300 Hz — 100 kHz ±2 dB. Molded construction.
PM34-M	600 CT	600 CT	3	14	A•2194	S	A•2194	Freq. resp. 300 Hz — 100 kHz ±2 dB. Molded construction.
T1104	600	600	0	1	A•2192	A	A•2193	Low profile.
T2104	600	600	0	1	A•2192	B	A•2193	
T2106	600 CT	600 CT	0	6	A•2192	E	A•2193	
T2108	600	900	0	1	A•2192	B	A•2193	
T2110	900	900	0	7	A•2192	C	A•2193	Electrostatic shield.
T2316	4000	600	0	1	A•2192	B	A•2193	For bridging applications.
T4113	900/600	600 split	60/75 Pri.	2	A•2192	J	A•2193	Level −15 to +7 dBm.
T5114	600	600 split	75	8	A•2193	K	A•2194	
T5115	600	600 split	120	9	A•2193	L	A•2194	
T6112	600	900/600	100/120 Sec.	5	A•2192	G	A•2193	Electrostatic shield.
T9116	600 CT	600 CT	80	16	A•2194	N	A•2194	Low profile. Low crosstalk.
T9117	600 CT	600 CT	80	17	A•2194	N	A•2194	Low profile. Low crosstalk. Return loss 23 dB @ 440Ω +0.035 μF load in parallel.
DATA MODEM COUPLING — NON-VOICE APPLICATION — FOR 300/1200/2400 BPS MODEM BOARD FOR MICROCOMPUTERS								
T2111	600	600	90	12	A•2193	Q	A•2194	Low profile. Freq. resp. ±1 dB 660 Hz — 3.5 kHz @ 0 dBm, 2 kHz ref.
T2112	600	600 CT	90	13	A•2193	Q	A•2194	Low profile. Freq. resp. ±1 dB 660 Hz — 3.5 kHz @ 0 dBm, 2 kHz ref.
T2113	600	600	90	12	A•2193	B	A•2193	Freq resp. ±1 dB 660 Hz — 3.5 kHz @ 0 dBm, 2 kHz. ref.
T2114	600	600 CT	90	13	A•2193	E	A•2193	Freq resp. ±1 dB 660 Hz — 3.5 kHz @ 0 dBm, 2 kHz. ref.
T9311	600	600	90	1	A•2192	O	A•2194	0.50" max. ht. Freq. resp. ± 1.3 dB 500 Hz −3.5 kHz, ±2.5 dB 300 Hz −3.5 kHz @ 0 dBm, Return loss 14 dB min. 1.8 kHz ref.
T9312	600	600 Split	90	8	A•2193	P	A•2194	0.50" max. ht. Freq. resp. ± 1.3 dB 500 Hz −3.5 kHz, ±2.5 dB 300 Hz −3.5 kHz @ 0 dBm, Return loss 14 dB min.1.8 kHz ref.
T9317	600	600 Split	50	8	A•2193	P	A•2194	0.50" max. ht. Freq. resp. ±0.7 dB 500 Hz −3.5 kHz, ±1.6 dB 300 Hz −3.5 kHz @ 0 dBm, Return loss 14 dB min. 1 kHz ref.
HOLDING COILS								
T4415	2.0 H/1.3 H		60/100	3	A•2192	H	A•2193	DCR 180Ω.
T5415	1.4 H ±20%		120	4	A•2192	K	A•2194	Split winding. Total DCR 180Ω.
T7410	1.0 H/0.8 H		0/25	3	A•2192	D	A•2193	DCR 225Ω. Toroidal construction. Low crosstalk.
T8410	1.0 H/0.8 H		0/40	3	A•2192	D	A•2194	DCR 113Ω. Toroidal construction. Low crosstalk.
HYBRID — TWO REQUIRED FOR CONVENTIONAL HYBRID OPERATION								
T2220	600 (4W)	600/600	0	10	A•2193	E	A•2193	Trans-hybrid loss 45 dB typical.
T3220	600 (4W)	600/600	0	10	A•2193	F	A•2193	Trans-hybrid loss 45 dB typical.
T4220	600 (4W)	600/600	60 (2W)	11	A•2193	J	A•2193	Electrostatic shield.
T5220	600 (4W)	600/600	100 (2W)	15	A•2194	M	A•2194	Trans-hybrid loss and long. bal. >60 dB. Max. level +20 dBm. Electrostatic shield.
T9220	600 (4W)	600/600	80 (2W)	18	A•2194	N	A•2194	Low profile. Low crosstalk.
T9320	600 (4W)	600/600	70 (2W)	10	A•2193	P	A•2194	0.50" max. ht. Freq. resp. ±0.7 dB 500 Hz −3.5 kHz, ±1.6 dB 300 Hz −3.5 kHz @ 0 dBm, Return loss 14 dB min. 1 kHz ref.

Available on special order with other ratings and constructions.

REQUEST ENGINEERING APPLICATION BULLETIN F232.

SCHEMATICS



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MICROTRAN company, inc.

TELEPHONE INTERCONNECT TRANSFORMERS

OUTLINE DRAWINGS AND SCHEMATICS FOR PAGE A•2192

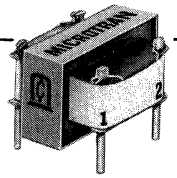
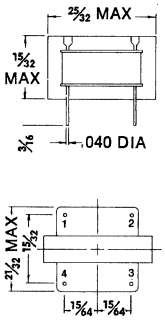


FIG. A



Plug-in printed circuit construction.
Vacuum varnish impregnated. Wt. 0.4 Oz.

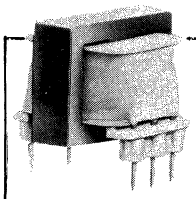


FIG. B

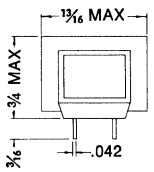
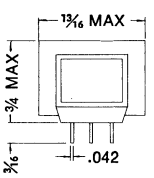
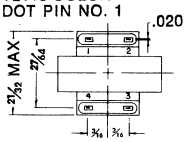


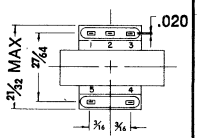
FIG. C



Plug-in printed circuit construction.
Vacuum varnish impregnated. Wt. 0.5 Oz.

T2113 COLOR DOT PIN NO. 1





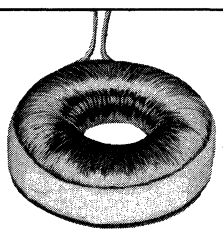
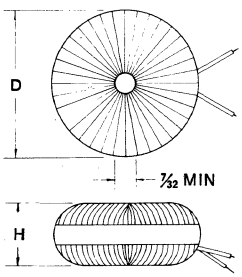


FIG. D



High-Q Toroid.
Microcrystalline wax impregnated.
Supplied with 4″ #28 leads.

Size Series	D	H	Wt. Oz.
T7400	1	13/32	3/4
T8400	1 1/4	5/8	2

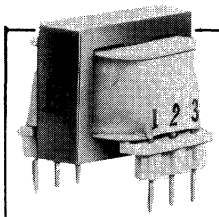


FIG. E
Wt. 0.5 Oz.

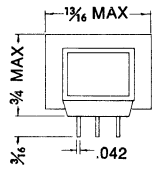
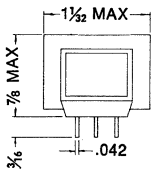
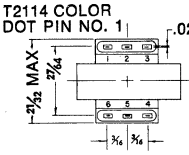


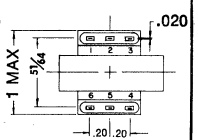
FIG. F
Wt. 1.2 Oz.



Plug-in printed circuit construction.
Vacuum varnish impregnated.

T2114 COLOR DOT PIN NO. 1





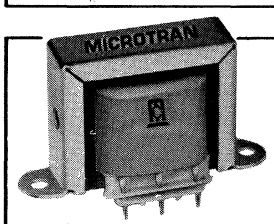
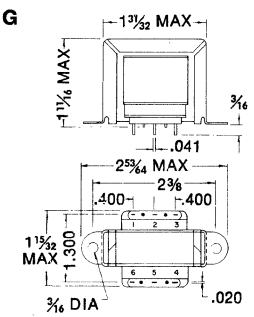


FIG. G



Plug-in printed circuit construction with mounting channel.
Vacuum varnish impregnated. Wt. 9.5 Oz.

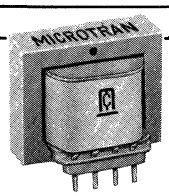


FIG. H

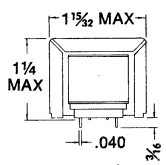
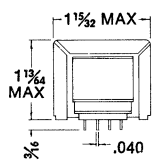
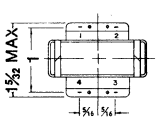


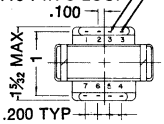
FIG. J



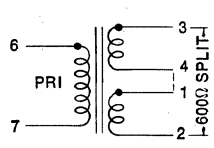
Plug-in printed circuit construction.
Vacuum varnish impregnated. Wt. 3.5 Oz.
Available with mounting flanges **on Special Order**.
3/16 Dia. holes, 1 3/4 mounting centers.
Add -FB to Part No.



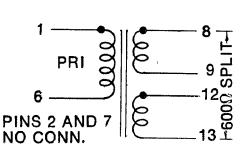
T4220 PIN 3 LOC.
T4113 PIN 3 LOC.



SCHEMATICS



#8
T9312 & T9317 PRI 1-6, SEC 2-5, 3-4



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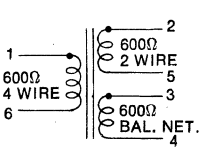

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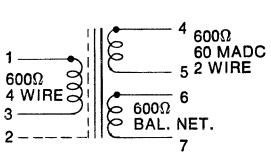

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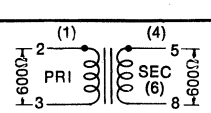
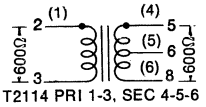


T2113 PRI 1-3, SEC 4-6

#12



T2114 PRI 1-3, SEC 4-5-6

#13

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TELEPHONE INTERCONNECT TRANSFORMERS

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OUTLINE DRAWINGS AND SCHEMATICS FOR PAGE A•2192

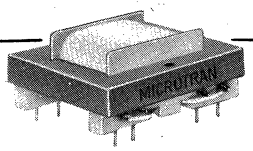
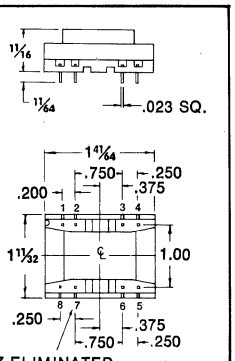


FIG. K



Flat Profile.
Plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 2.5 Oz.

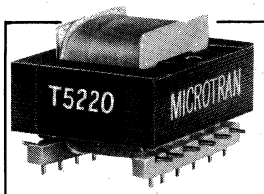


FIG. L

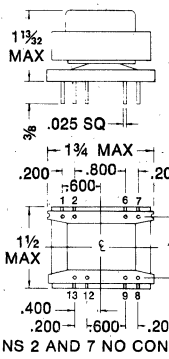
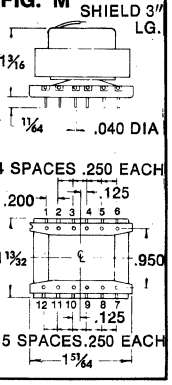


FIG. M



Plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 5.5 Oz.

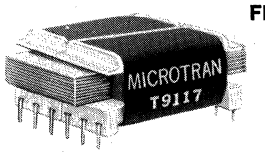
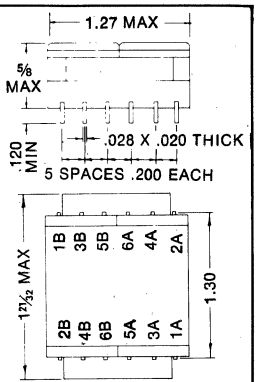


FIG. N



Low profile hum-bucking semi-toroidal construction.
High crosstalk attenuation.
Plug-in printed circuit construction. Vacuum varnish impregnated.
Wt. 2.2 Oz.

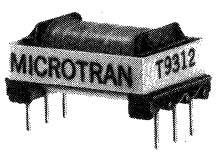


FIG. O

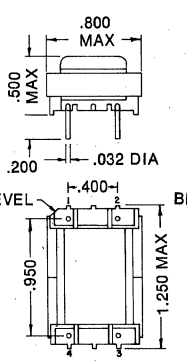
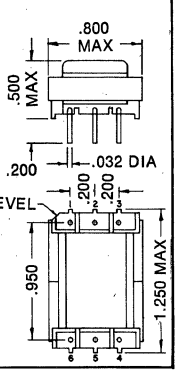


FIG. P



Very low profile plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 0.66 oz.

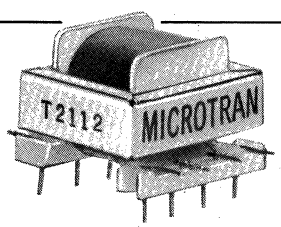
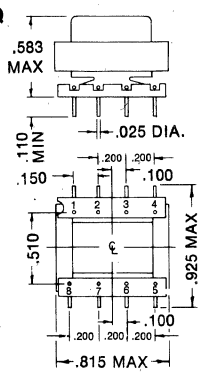


FIG. Q



Low-profile plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 0.5 Oz.

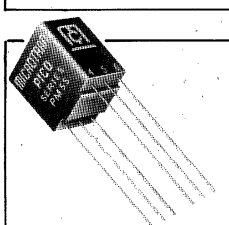


FIG. R

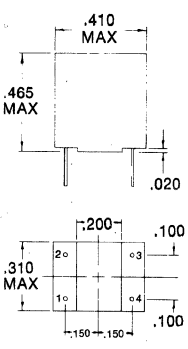
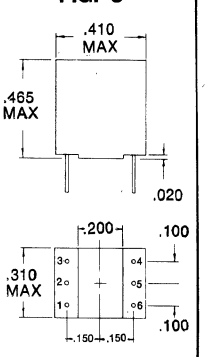
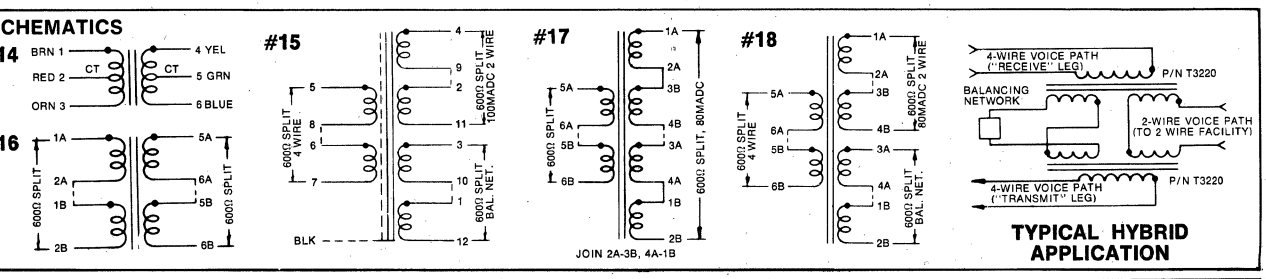


FIG. S



Pico miniature size.
Plug-in printed circuit construction. Epoxy molded to MIL-T-27 TF5R21ZZ. Gold plated nickel alloy leads 0.020 x ¾". Wt. 0.1 Oz.

SCHEMATICS



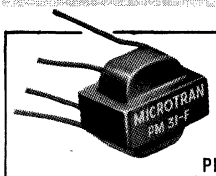
TYPICAL HYBRID APPLICATION

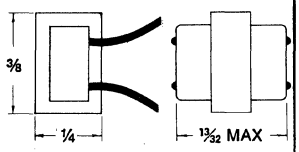
MICROTRAN company, inc.

MINIATURIZED AUDIO TRANSFORMERS

PICO—ULTRA VERI-MINIATURE

OPEN FRAME PM-F

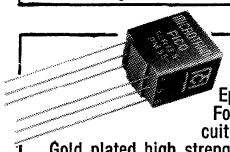


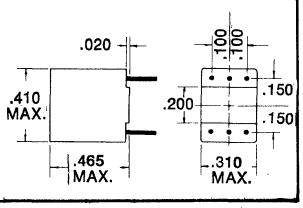


4 inch #30 Plastic color coded leads. Thorough resin impregnation and baking assures reliable life. To order add -F to Part No., i.e. PM33-F. Wt. .05 oz.

MIL Designation: TF6R21ZZ

MOLDED PM-M

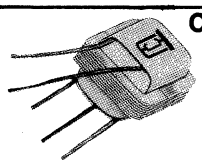


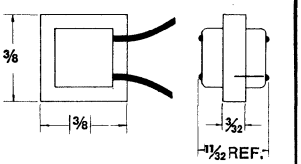


Epoxy molded. For printed circuit application. Gold plated high strength nickel alloy leads .020 x ¾" for reliable soldered joints and high-density welded lead packaging. Wt. .1 oz. To order add -M to Part No., i.e. PM12-M.

MIL Designation: TF5R21ZZ

OPEN FRAME UM-F

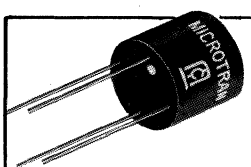


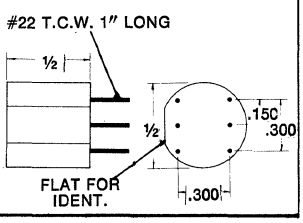


To order add -F to Part No., i.e. UM22-F. Wt. 0.08 oz. 4" color coded leads.

MIL Designation: TF6R21ZZ

MOLDED UM-M

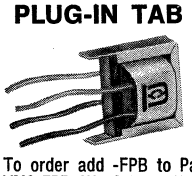


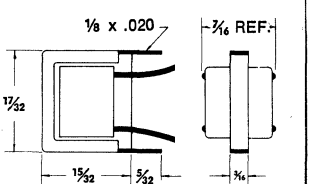


To order add -M to Part No., i.e. UM22-M. Wt. 0.14 oz.

MIL Designation: TF5R21ZZ

PLUG-IN TAB MOUNTED CHANNEL VM-FPB

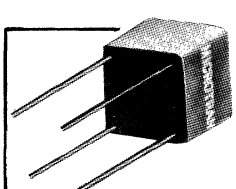


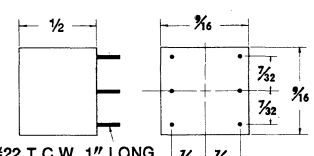


To order add -FPB to Part No., i.e. VM2-FPB. Wt. 0.2 oz. 4" color coded leads.

MIL Designation: TF6R21ZZ

MOLDED VM-M





Epoxy molded. Wt. 0.25 oz. To order add -M to Part No., i.e. VM2-M.

MIL Designation: TF5R21ZZ

PICO-MINIATURE — PM SERIES

Frequency Response ±2 dB 300 Hz to 100 kHz†

For maximum utilization of space in miniaturized printed circuit board applications. Manufactured per MIL-T-27.

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Pri. DCR	Sec. DCR	Power Level mW
PM37-(*)	120 CT	3.2	10	16	0.75	50
PM38-(*)	300 CT	600	7	41	98	50
PM35-(*)	500	50	3	60	8	50
PM36-(*)	500	500/125 split	3	72	85	50
PM32-(*)	600	600	3	75	105	50
PM34-(*)	600 CT	600 CT	3	75	105	50
PM33-(*)	1500 CT	600	3	170	95	50
PM31-(*)	2500	2500 CT	1	250	325	50
• PM29(*)	10,000 CT	500 CT	1	1050	80	50
PM27(*)	10,000	1200	0.5	1050	280	50
• PM23(*)	10,000 CT	1200 CT	1	1050	280	50
• PM25(*)	10,000	1200/300 split	0.5	1050	280	50
• PM19(*)	10,000 CT	2000 CT	1	1000	300	50
• PM21(*)	10,000	2000/500 split	0.5	1000	300	50
• PM17(*)	10,000 CT	10,000 CT	1	1000	1300	50
PM15(*)	25,000	1000	0.25	1700	110	40
• PM11(*)	25,000 CT	1000 CT	0.5	1700	110	40
• PM13(*)	25,000	1000/250 split	0.25	1700	110	40
• PM7(*)	50,000 CT	1000 CT	0	3300	75	10
• PM9(*)	50,000	1000/250 split	0	3300	75	10
• PM5(*)	200,000	1000	0	5300	110	10
• PM3(*)	200,000 CT	1000 CT	0	5300	110	10
PM41-(*)	Audio Choke	.3 H	4	43		
PM40-(*)	Audio Choke	3.5 H	2	700		
PM39-(*)	Audio Choke	6 H	2	1800		
PM90	Magnetic Shield Mu-metal slip-on can for PM-M series. 20dB shielding. 0.365" x 0.465" x 0.0500" high.					

• These items not available in open frame construction.
* Add either -F, -M to Part No. See photos figures PM-M & PM-F. Frequency response measured as stated power level above.
† PM3 and PM5 — 45 kHz.

ULTRA-MINIATURE — UM SERIES

Frequency Response ±2 dB 300 to 10,000 Hz

Measured at level stated for 300 Hz. Miniaturized design offers a relatively high power level and printed circuit packaging. Response measured at level stated for 300 Hz. Mfg. per MIL-T-27.

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Pri. DCR	Sec. DCR	Level mW @ 300 Hz	Level mW @ 1 kHz
UM26-(*)	400	11	3	35	1.5	15	500
UM27-(*)	400 CT	11	6	35	1.5	15	500
UM25-(*)	400	50	3	35	5	15	500
UM29-(*)	600 CT	600 CT	7	45	60	5	400
UM24-(*)	1000	50	3	65	10	5	500
UM33-(*)	1000 CT	600	6	80	65	5	500
UM32-(*)	1500 CT	600	5	135	65	5	500
UM39-(*)	2500 CT	600 CT	2	250	50	5	500
UM34-(*)	10,000 CT	600 CT	2	850	40	5	500
UM31-(*)	10,000 CT	1200 CT	2	850	120	5	500
UM37-(*)	10,000	2000 CT	1	850	200	5	500
UM35-(*)	15,000 CT	15,000 CT	1	930	1210	5	300
UM36-(*)	20,000 CT	800 CT	0.5	1100	80	5	500
UM22-(*)	20,000	1000	0.5	1100	100	5	300
UM23-(*)	20,000	1200 CT	0.5	1100	110	5	300
UM21-(*)	100,000	1000	0	1900	135	5	70
UM30-(*)	Choke	1.5 H (0 mA) 0.7 H (2 mA) 100 DCR					
UM28-(*)	Choke	10 H (0 mA) 8 H (0.5 mA) 650 DCR					
UM90	Magnetic Shield Mu-metal slip-on can for UM-M series. 20 dB shielding. 13/32"D x 9/16"H.						

* Add either -F, or -M to Part No. to designate construction. See Photos. Power levels shown are for 7½% maximum distortion.

VERI-MINIATURE — VM SERIES

Frequency Response ±2 dB 200 to 10,000 Hz

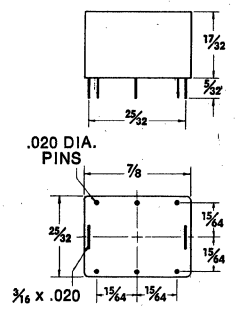
Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Pri. DCR	Sec. DCR	Level mW
VM1-(*)	50	600	5.5	7	90	15
VM7-(*)	500	3.4	3.5	50	0.5	15
VM16-(*)	500 CT	250 CT	7.5	50	25	15
VM14-(*)	600 CT	600 CT	7.0	50	65	15
VM8-(*)	1250	3.4	2.0	135	0.5	15
VM9-(*)	1250	50	2.0	135	6.5	15
VM10-(*)	2500	2500 CT	1.5	225	215	3
VM17-(*)	10,000 CT	5000 CT	0	400	300	5
VM12-(*)	20,000	1000	0.16	625	85	5
VM13-(*)	20,000	1000 CT	0.16	625	85	5
VM3-(*)	25,000	600	0.15	720	45	5
VM5-(*)	50,000	600	0.1	830	55	5
VM15-(*)	50,000 CT	50,000 CT	0	2000	2600	5
VM6-(*)	100,000	1200 CT	0.07	2000	150	5
VM2-(*)	200,000	600	0.05	3000	110	2.5
VM4-(*)	200,000	1200	0.035	3100	165	5
VM11-(*)	Choke	20 H (0 mA) 12 H (0.5 mA)			1000	
VM90	Magnetic Shield Mu-metal slip-on can for VM-M series. 20 dB shielding. 5/8" x 5/8" x 17/32" high.					

* Add either -FPB, or -M to Part No. to designate construction. See Photos.

145 EAST MINEOLA AVE., BOX 236, VALLEY STREAM, NY 11582-0236 • (516) 561-6050 • TELEX II 510-225-8412

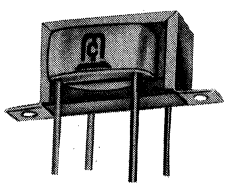
MINIATURIZED AUDIO TRANSFORMERS

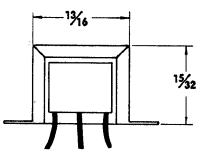
MICROTRAN company, inc.

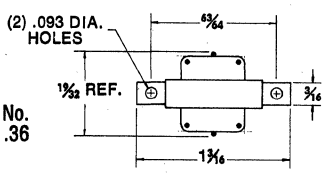


MOLDED MM-M

To order add -M to Part No. For plug-in printed circuit applications. Epoxy resin provides resistance to extremes of ambient. Wt. .5 oz.

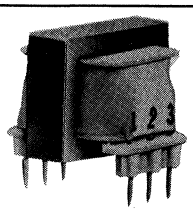


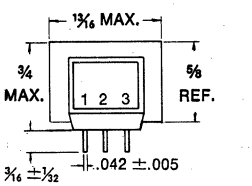


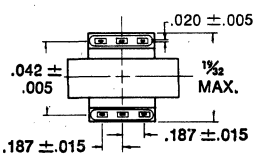


OPEN FRAME WITH CHANNEL MM-FB

To order add -FB to Part No. Leads #28 PVC 4" long. Wt. .36 oz.







PRINTED CIRCUIT — DCM SERIES

Industrial/Commercial grade miniature printed circuit transformers. Rigid terminals provide fixed mounting centers usually found in expensive molded transformers. Wt. .5 oz.

MICRO-MINIATURE TRANSFORMERS MM & MMT SERIES

Primary and secondary windings may be interchanged to obtain required impedance matching. These units can be used as input, interstage, output, isolation and other impedance matching requirements. Also available in hermetic construction.
The low profile design of this series makes them ideal for use on plug-in printed circuit boards.

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Oper. Level dBm	Frequency Response ±2 dB
MM1-(*)	200/50	250,000/62,500	0	4	200-10,000
MM3-(*)	10,000	200	3	20	150-10,000
MM2-(*)	10,000	90,000	0	4	150-10,000
MM4-(*)	30,000	50	1	20	150-10,000
MM7-(*)	30,000	1,200	0.5	20	200-10,000
MM6-(*)	100,000	60	0.5	20	250-10,000
MM5-(*)	Reactor 50H @ 1 mA DC 4,700 DCR				
MMT1-(*)	600	600	8	22	200-15,000
MMT26-(*)	600 CT	600 CT	16	22	200-15,000
MMT33-(*)	600 CT	600/150 Split	16	22	200-15,000
MMT9-(*)	600 CT	1,200 CT	16	22	200-15,000
MMT32-(*)	600 CT	1200/300 Split	16	22	200-15,000
MMT12-(*)	2,000	3.4	5	28	200-15,000
MMT31-(*)	2,000 CT	500 CT	10	28	200-15,000
MMT19-(*)	2,500	2,500 CT	2	23	200-15,000
MMT13-(*)	4,000 CT	3.4	5	28	200-15,000
MMT11-(*)	4,000 CT	600 CT	5	28	200-15,000
MMT21-(*)	4,000 CT	600/150-split	5	28	200-15,000
MMT25-(*)	7,500 CT	600 CT	4	22	200-15,000
MMT30-(*)	7,500 CT	1,200 CT	4	22	200-15,000
MMT35-(*)	10,000 CT	150/37.5 split	2	20	200-15,000
MMT17-(*)	10,000 CT	200 CT	6	20	200-15,000
MMT16-(*)	10,000	1,500 CT	1	20	200-15,000
MMT28-(*)	10,000 CT	1,500 CT	2	20	200-15,000
MMT29-(*)	10,000 CT	10,000	2	20	200-15,000
MMT10-(*)	25,000	600	1	20	200-15,000
MMT27-(*)	25,000 CT	600 CT	2	20	200-15,000
MMT7-(*)	25,000	1,200 CT	1	20	200-15,000
MMT18-(*)	25,000 CT	1,200 CT	2	20	200-15,000
MMT5-(*)	50,000	6	1	20	200-15,000
MMT3-(*)	50,000	600	0.7	20	200-15,000
MMT4-(*)	50,000 CT	600 CT	1.4	20	200-15,000
MMT8-(*)	50,000 CT	1,200 CT	1.4	20	200-15,000

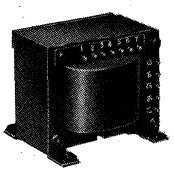
* Add either -M or -FB to Part No. to designate construction.

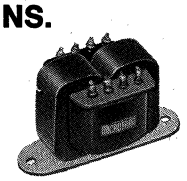
DECI-MINIATURE TRANSFORMERS DCM SERIES

FREQUENCY RESPONSE 200-15,000 Hz ±2 dB

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Operating Level dBm
DCM1-PC	25,000 CT	1,200 CT	2	18
DCM2-PC	15,000 CT	15,000 CT	3	19
DCM3-PC	15,000 CT	600 CT	3	19
DCM4-PC	10,000 CT	5,000 CT	4	20
DCM5-PC	10,000	2,500/625 Split	2	20
DCM6-PC	10,000 CT	1,500 CT	4	20
DCM7-PC	5,000 CT	80,000 CT	6	15
DCM8-PC	4,000 CT	1,200 CT	6	20
DCM9-PC	4,000 CT	600 CT	6	20
DCM10-PC	4,000	600/150 Split	3	20
DCM11-PC	2,500 CT	2,500 CT	8	20
DCM12-PC	2,500	2,500/625 Split	4	20
DCM13-PC	2,500 CT	625 CT	8	20
DCM14-PC	2,500 CT	200 CT	8	20
DCM18-PC	600 CT	50,000 CT	16	20
DCM19-PC	600	8000/2000 Split	8	20
DCM20-PC	600 CT	200 CT	16	20
DCM21-PC	600 CT	600 CT	16	20
DCM22-PC	250 CT	600 CT	25	20
DCM51-PC	Choke 10H @ 0 mA DC	5H @ 3 mA DC		300 DCR
DCM52-PC	Choke 5H @ 0 mA DC	2H @ 5 mA DC		155 DCR
DCM53-PC	Choke 2.5H @ 0 mA DC	1H @ 7 mA DC		75 DCR

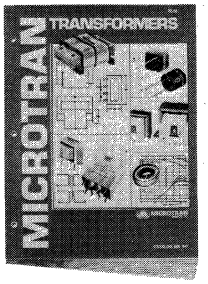
MODIFIED CATALOG ITEMS AND CUSTOM DESIGNS AVAILABLE ON SPECIAL ORDER. CALL US WITH YOUR SPECIFICATIONS.





IMMEDIATE DELIVERY OF CATALOG ITEMS AT FACTORY PRICES FROM AUTHORIZED DISTRIBUTORS.

Send for Complete Catalog



MICROTRAN company, inc.

PRICING

net price list

Prices, Mechanical Construction or Electrical Characteristics
Subject to Modification Without Notice — Effective 6/1/85

Part No.	Net Price 1-9†	Part No.	Net Price 1-9†	Part No.	Net Price 1-9†	Part No.	Net Price 1-9†	Part No.	Net Price 1-9†	Part No.	Net Price 1-9†	Part No.	Net Price 1-9†	Part No.	Net Price 1-9†
DCM1-PC	$ 9.00	M11-M	*23.75	MMT8-M	*19.50	MT6-P	*19.75	MT23-PC	8.25	PC3724	*13.00	PM29-M	24.75	T2220	9.25
DCM2-PC	9.25	M11-P	*22.75	MMT9-FB	9.75	MT7-A	*19.00	MT24-A	*18.75	PC3728	*13.00	PM31-F	13.00	T2316	7.25
DCM3-PC	8.75	M12-A	23.25	MMT9-H	19.25	MT7-AG	24.75	MT24-AG	*23.75	PC3732	*13.50	PM31-M	21.75	T3220	10.00
DCM4-PC	8.75	M12-AG	30.00	MMT9-M	17.25	MT7-FB	*10.25	MT24-FB	9.50	PC4304	8.75	PM32-F	11.25	T4113	10.50
DCM5-PC	8.25	M12-FB	13.00	MMT10-FB	9.00	MT7-H	*22.00	MT24-H	*21.25	PC4312	9.00	PM32-M	20.75	T4220	13.00
DCM6-PC	8.75	M12-H	26.00	MMT10-H	*16.50	MT7-M	*19.00	MT24-M	17.75	PC4316	9.00	PM33-F	*12.25	T4415	7.25
DCM7-PC	10.00	M12-M	23.75	MMT10-M	15.75	MT7-P	*19.25	MT24-P	*18.50	PC4320	*9.00	PM33-M	21.25	T5114	12.00
DCM8-PC	8.25	M12-P	*22.50	MMT11-FB	10.00	MT8-A	*21.00	MT24-PC	*8.25	PC4408	9.25	PM34-F	13.50	T5115	15.50
DCM9-PC	8.25	M12-PC	*10.75	MMT11-H	*19.50	MT8-AG	*26.25	MT25-A	20.00	PC4412	9.25	PM34-M	23.50	T5220	22.00
DCM10-PC	8.00	M13-A	*12.75	MMT11-M	17.50	MT6-FB	11.75	MT25-AG	*25.25	PC4416	9.50	PM35-F	*11.50	T5415	12.00
DCM11-PC	8.00	M13-AG	*18.00	MMT12-FB	*8.75	MT8-H	*24.50	MT25-FB	10.75	PC4424	9.50	PM35-M	19.00	T6112	19.50
DCM12-PC	8.00	M13-FB	*7.75	MMT12-H	*16.25	MT8-M	*22.00	MT25-H	*23.25	PC4428	9.50	PM36-F	*13.50	T7410	13.50
DCM13-PC	8.00	M13-H	*15.00	MMT12-M	*15.25	MT8-P	*21.50	MT25-M	*21.00	PC4432	*10.25	PM36-M	23.00	T8410	14.50
DCM14-PC	8.00	M13-M	14.00	MMT13-FB	*9.75	MT9-A	*20.00	MT25-P	*19.50	PC6205	12.75	PM37-F	*11.00	T9116	14.25
DCM18-PC	9.25	M13-P	*16.50	MMT13-H	*18.75	MT9-AG	*25.25	MT25-PC	8.50	PC6210	13.00	PM37-M	20.00	T9117	14.50
DCM19 PC	8.00	M13-PC	*7.25	MMT13-M	*16.75	MT9-FB	10.75	MT26-A	*19.50	PC6211	13.00	PM38-F	11.75	T9220	14.75
DCM20-PC	7.50	M14-A	*19.25	MMT16-FB	*9.75	MT9-H	*23.25	MT26-AG	24.75	PC6214	13.25	PM38-M	20.75	T9311	7.50
DCM21-PC	7.25	M14-AG	*25.00	MMT16-H	*18.75	MT9-M	21.00	MT26-FB	10.25	PC6505	10.00	PM39-F	*8.50	T9312	7.75
DCM22-PC	7.25	M14-FB	*11.50	MMT16-M	*16.75	MT9-P	19.50	MT26-H	23.25	PC6508	9.25	PM39-M	*15.25	T9317	9.00
DCM51-PC	5.25	M14-H	23.00	MMT17-FB	11.25	MT9-PC	8.75	MT26-M	20.50	PC6510	9.75	PM40-F	*8.00	T9320	9.00
DCM52-PC	*5.00	M14-M	*20.25	MMT17-H	*20.50	MT10-A	*17.25	MT26-P	19.00	PC6511	9.75	PM40-M	*14.75	UM21-F	9.75
DCM53-PC	5.00	M14-P	*19.25	MMT17-M	18.50	MT10-AG	*23.50	MT26-PC	8.00	PC6512	9.75	PM41-F	*7.50	UM21-M	*16.00
M1-A	23.50	M14-PC	*9.00	MMT18-FB	10.75	MT10-FB	9.25	MT29-A	*18.25	PC6514	9.75	PM41-M	*14.00	UM22-F	*9.50
M1-AG	*30.25	M15-A	*19.75	MMT18-H	*20.00	MT10-H	*20.00	MT29-AG	*23.75	PC6524	10.25	PM90	2.10	UM22-M	*15.75
M1-FB	13.25	M15-AG	*26.00	MMT18-M	17.75	MT10-M	*17.50	MT29-FB	*9.50	PC6528	10.50	PS-N	6.50/C	UM23-F	10.50
M1-H	26.50	M15-FB	*12.00	MMT19-FB	9.75	MT10-P	*18.00	MT29-H	*21.25	PC6605	11.50	PS-S	6.50/C	UM23-M	17.25
M1-M	*23.75	M15-H	*23.50	MMT19-H	*18.75	MT11-A	20.00	MT29-M	*17.75	PC6608	11.00	PSD2 (Any)	5.60	UM24-F	8.75
M1-P	*22.75	M15-M	*20.75	MMT19-M	*16.75	MT11-AG	*25.25	MT29-P	*18.50	PC6610	11.25	PSD3 (Any)	5.75	UM24-M	*14.50
M1-S	28.00	M15-P	*19.25	MMT21-FB	10.25	MT11-FB	10.75	MT29-PC	*8.00	PC6611	11.25	PSD4 (Any)	6.20	UM25-F	8.75
M2-A	*24.25	M15-PC	*9.25	MMT21-H	*20.00	MT11-H	*23.25	MT30-A	*18.50	PC6614	11.00	PSD5 (Any)	6.90	UM25-M	14.50
M2-AG	*31.00	M90	3.10	MMT21-M	18.75	MT11-M	21.00	MT30-AG	*24.00	PC6616	11.00	PSS2 (Any)	4.80	UM26-F	*8.00
M2-FB	14.00	M8050	13.25	MMT25-FB	10.50	MT11-P	*19.50	MT30-FB	*9.75	PC6624	11.00	PSS3 (Any)	4.90	UM26-M	*14.00
M2-H	*26.00	M8051	*27.00	MMT25-H	*19.50	MT11-PC	8.75	MT30-H	*21.25	PC6628	11.00	PSS4 (Any)	5.60	UM27-F	*8.75
M2-M	*24.75	M8072	16.00	MMT25-M	18.00	MT12-A	*17.25	MT30-M	*18.00	PC6632	11.25	PSS5 (Any)	6.20	UM27-M	*15.50
M2-P	*23.50	M8073	11.25	MMT26-FB	9.25	MT12-AG	*23.25	MT30-P	*18.75	PC6705	12.50	PW28-10	7.50	UM28-F	6.25
M3-A	23.00	M8074	12.25	MMT26-H	*18.50	MT12-FB	9.25	MT30-PC	*8.25	PC6708	11.50	PW28-10-230	7.75	UM28-M	*11.50
M3-AG	*29.50	M8106	32.50	MMT26-M	17.00	MT12-H	*20.00	MT33-A	*22.50	PC6710	12.00	PW28-16	7.50	UM29-F	10.25
M3-FB	*13.00	M8107	34.50	MMT27-FB	10.75	MT12-M	*17.50	MT33-AG	*28.00	PC6711	12.00	PW28-16-230	7.75	UM29-M	17.50
M3-H	*26.00	M8108	32.50	MMT27-H	*20.00	MT12-P	*18.00	MT33-FB	12.25	PC6712	11.50	PW28-24	7.50	UM30-F	*6.00
M3-M	*23.25	M8109	34.50	MMT27-M	*18.75	MT12-PC	8.25	MT33-H	25.50	PC6714	11.50	PW28-24-230	7.75	UM30-M	11.00
M3-P	*22.50	M8110	32.50	MMT28-FB	*10.00	MT13-A	*18.75	MT33-M	*23.00	PC6715	11.25	PW35-10	8.50	UM31-F	*11.75
M4-A	*18.50	M8111	34.50	MMT28-H	*19.50	MT13-AG	*23.75	MT33-P	22.00	PC6716	11.00	PW35-12	8.50	UM31-M	18.25
M4-AG	*24.75	M8112	*32.50	MMT28-M	*17.50	MT13-FB	10.00	MT33-PC	10.50	PC6724	11.00	PW35-16	8.50	UM32-F	9.50
M4-FB	10.75	M8113	75.00	MMT29-FB	10.25	MT13-H	*21.75	MT34-A	*22.75	PC6728	11.00	PW35-24	8.50	UM32-M	16.75
M4-H	22.25	M8114	75.00	MMT29-H	19.25	MT13-M	*18.75	MT34-AG	*28.25	PC6732	11.00	PW35-36	8.50	UM33-F	*9.50
M4-M	*19.50	M8115	42.00	MMT29-M	17.75	MT13-P	*19.00	MT34-FB	12.50	PC6900-FB	2.75	PW41-10	9.50	UM33-M	16.50
M4-P	*18.50	M8116	62.00	MMT30-FB	*10.75	MT13-PC	*8.50	MT34-H	*25.50	PC6905	16.50	PW41-12	9.50	UM34-F	11.00
M4-PC	9.25	M8117	42.50	MMT30-H	*19.50	MT14-A	*16.75	MT34-M	*23.00	PC6910	16.25	PW41-16	9.50	UM34-M	18.00
M5-A	*18.25	M8118	64.00	MMT30-M	*17.75	MT14-AG	23.00	MT34-P	*22.00	PC6911	16.50	PW41-24	9.50	UM35-F	11.75
M5-AG	*24.50	M8120	17.00	MM131-FB	9.75	MT14-FB	8.75	MT34-PC	*11.00	PC6914	15.25	PW41-36	9.50	UM35-M	19.50
M5-FB	10.50	M8121	14.75	MM131-H	*19.00	MT14-H	19.75	MT35-A	23.50	PCL6605	11.75	PW48-10	10.75	UM36-F	*11.25
M5-H	*22.00	M8122	40.00	MM131-M	*17.50	MT14-M	17.00	MT35-AG	*29.00	PCL6610	11.75	PW48-12	10.75	UM36-M	18.75
M5-M	*19.25	M8132	37.50	MMT32-FB	10.50	MT14-P	*17.25	MT35-FB	13.25	PCL6611	11.50	PW48-16	10.75	UM37-F	*10.50
M5-P	*18.25	M8133	37.50	MMT32-H	*20.00	MT14-PC	7.50	MT35-H	26.50	PCL6614	11.50	PW48-24	10.75	UM37-M	17.25
M5-PC	*9.00	M8149	12.75	MMT32-M	*18.75	MT15-A	*17.75	MT35-M	23.75	PCL6630	13.00	PW48-36	10.75	UM39-F	10.50
M6-A	20.75	MM1-FB	9.50	MMT33-FB	10.50	MT15-AG	*23.25	MT35-P	22.75	PCL6631	13.00	PW48-56	11.25	UM39-M	18.00
M6-AG	*26.75	MM1-H	*17.00	MMT33-H	*20.00	MT15-FB	*9.00	MT35-PC	11.25	PCT6230	15.50	PW54-10	12.75	UM90	3.50
M6-FB	11.50	MM1-M	*16.50	MMT33-M	18.75	MT15-H	*20.75	MT36-A	21.00	PCT6530	11.75	PW54-12	13.00	VM1-FPB	7.75
M6-H	*23.75	MM2-FB	*9.75	MMT35-FB	*10.50	MT15-M	17.50	MT36-AG	*26.25	PCT6531	11.75	PW54-16	13.00	VM1-M	13.50
M6-M	*21.50	MM2-H	*17.25	MMT35-H	*20.00	MT15-P	*17.75	MT36-FB	11.75	PCT6630	12.00	PW54-24	13.00	VM2-FPB	*9.25
M6-P	*20.50	MM2-M	*16.75	MMT35-M	*18.75	MT15-PC	*7.50	MT36-H	*24.50	PCT6631	12.00	PW54-36	13.25	VM2-M	15.25
M6-PC	10.25	MM3-FB	*9.25	MT1-A	16.75	MT18-A	*20.25	MT36-M	*22.00	PCT6730	13.25	PW54-56	13.50	VM3-FPB	*8.50
M7-A	*20.50	MM3-H	*16.75	MT1-AG	*23.00	MT18-AG	*25.50	MT36-P	*21.50	PCT6731	13.25	PWT54-1024	14.50	VM3-M	14.75
M7-AG	*26.50	MM3-M	*16.00	MT1-FB	8.75	MT18-FB	11.00	MT36-PC	9.00	PCT6930	16.75	PWT54-1633	14.50	VM4-FPB	*9.25
M7-FB	11.25	MM4-FB	*9.25	MT1-H	19.25	MT18-H	*23.50	PC2506	14.00	PCT6931	16.75	S100-FB	1.00	VM4-M	15.50
M7-H	*23.25	MM4-H	*16.75	MT1-M	*17.00	MT18-M	21.00	PC2512	15.00	PF6-10	7.10	S101-S	23.50	VM5-FPB	8.50
M7-M	*21.00	MM4-M	*16.00	MT1-P	*17.25	MT18-P	*19.75	PC2524	*15.25	PF6-12	7.10	S101-SP	30.50	VM5-M	14.75
M7-P	*20.00	MM5-FB	*8.50	MT1-PC	7.50	MT20-A	*21.75	PC2528	15.50	PF6-16	7.10	S1105-S	28.50	VM6-FPB	*9.75
M7-PC	*9.75	MM5-H	15.00	MT2-A	*21.00	MT20-AG	*26.75	PC2608	15.50	PF6-24	7.10	S105-SP	37.00	VM6-M	*16.75
M8-A	22.50	MM5-M	*14.00	MT2-AG	*25.75	MT20-FB	*12.25	PC2616	15.50	PF6-34	7.10	S107-S	31.00	VM7-FPB	8.00
M8-AG	*29.25	MM6-FB	*9.75	MT2-FB	11.25	MT20-H	*26.00	PC2624	*15.75	PF6-56	7.10	S107-SP	39.50	VM7-M	13.50
M8-FB	12.25	MM6-H	*17.00	MT2-H	*25.25	MT20-M	*23.00	PC2628	15.75	PF12-10	8.50	S108-S	26.00	VM8-FPB	8.00
M8-H	*25.50	MM6-M	*16.75	MT2-M	*21.75	MT20-P	*22.00	PC2632	*16.75	PF12-12	8.50	S108-SP	34.00	VM8-M	13.50
M8-M	*22.50	MM7-FB	*9.25	MT2-P	*21.25	MT21-A	*21.25	PC2708	17.00	PF12-16	8.50	S111-S	24.50	VM9-FPB	*8.00
M8-P	21.75	MM7-H	*16.00	MT2-PC	*9.25	MT21-AG	*26.00	PC2712	16.50	PF12-24	8.50	S111-SP	31.50	VM9-M	13.50
M8-PC	*10.00	MM7-M	*16.00	MT3-A	*17.75	MT21-FB	11.50	PC2715	16.50	PF12-34	8.50	S116-S	23.50	VM10-FPB	9.50
M9-A	*22.25	MMT1-FB	8.00	MT3-AG	*23.75	MT21-H	25.50	PC2716	16.50	PF12-56	8.60	S116-SP	31.00	VM10-M	16.25
M9-AG	*29.00	MMT1-H	*15.75	MT3-FB	9.75	MT21-M	22.00	PC2724	16.50	PFT12-35	10.25	S118-S	28.50	VM11-FPB	*6.50
M9-FB	12.00	MMT1-M	14.75	MT3-H	*20.50	MT21-P	*21.50	PC2728	16.50	PM3-M	26.50	S118-SP	37.00	VM11-M	*12.25
M9-H	*25.50	MMT3-FB	9.25	MT3-M	*18.00	MT21-PC	*9.75	PC2732	17.25	PM5-M	*23.50	S126-S	25.00	VM12-FPB	*8.50
M9-M	*22.25	MMT3-H	*16.75	MT3-P	*18.50	MT22-A	*21.25	PC3506	11.50	PM7-M	26.50	S126-SP	33.50	VM12-M	14.75
M9-P	*21.50	MMT3-M	*16.00	MT3-PC	8.50	MT22-AG	*26.00	PC3512	11.75	PM9-M	27.00	S130-S	25.00	VM13-FPB	*10.00
M9-PC	*9.75	MMT4-FB	11.50	MT5-A	*17.50	MT22-FB	*11.50	PC3524	*12.25	PM11-M	25.00	S130-SP	33.00	VM13-M	16.75
M10-A	*24.75	MMT4-H	*20.75	MT5-AG	*23.50	MT22-H	*25.50	PC3528	*11.50	PM13-M	25.50	T1104	9.25	VM14-FPB	10.00
M10-AG	*31.50	MMT4-M	19.50	MT5-FB	*9.50	MT22-M	*22.00	PC3608	11.75	PM15-F	13.25	T2104	6.75	VM14-M	16.25
M10-FB	14.50	MMT5-FB	9.25	MT5-H	*20.25	MT22-P	*21.50	PC3616	11.75	PM15-M	*21.50	T2106	7.50	VM15-FPB	12.00
M10-H	*27.50	MMT5-H	*16.75	MT5-M	*17.75	MT22-PC	*9.50	PC3624	12.00	PM17-M	25.00	T2108	7.25	VM15-M	19.50
M10-M	*25.50	MMT5-M	*16.00	MT5-P	*18.25	MT23-A	*18.25	PC3628	12.25	PM19-M	24.75	T2110	7.25	VM16-FPB	*10.00
M10-P	*24.00	MMT7-FB	10.25	MT6-A	*19.25	MT23-AG	*23.75	PC3632	13.00	PM21-M	25.00	T2111	6.50	VM16-M	16.25
M11-A	*23.50	MMT7-H	*19.00	MT6-AG	*24.75	MT23-FB	*9.50	PC3708	*13.25	PM23-M	24.75	T2112	6.50	VM17-FPB	11.00
M11-AG	*30.25	MMT7-M	17.25	MT6-FB	*10.50	MT23-H	*21.25	PC3712	13.25	PM25-M	25.50				
M11-FB	13.25	MMT8-FB	11.50	MT6-H	*22.25	MT23-M	*17.75	PC3715	12.75	PM27-F	13.50	T2113	6.25	VM17-M	17.25
M11-H	*26.50	MMT8-H	*20.25	MT6-M	*19.25	MT23-P	*18.50	PC3716	12.75	PM27-M	*21.50	T2114	6.25	VM90	2.70

* Not stocked. Available on special order. In 1-499 quantity, add $35.00 lot set-up charge. ~ Not subject to standard discounts.
† Quantity pricing schedule: 1-9 Net, 10-49 Net Less 10%, 50-99 Net Less 20%, 10-249 Net Less 26%, 250-499 Net Less 33⅓%. Contact Factory for quantities over 499 pieces.

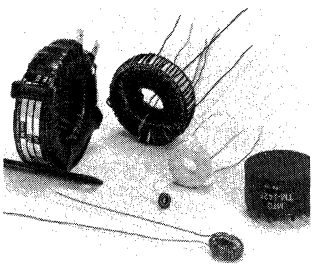
145 EAST MINEOLA AVE., BOX 236, VALLEY STREAM, NY 11582-0236 • (516) 561-6050 • TELEX II 510-225-8412

EEM PRODUCT SELECTION GUIDES

Use the EEM Product Selection Guides. There are 34 Guides in this edition of EEM. See page 2 (A•2, B•2, C•2, D•2) of each volume to locate the Product Selection Guides that pertain to your needs.

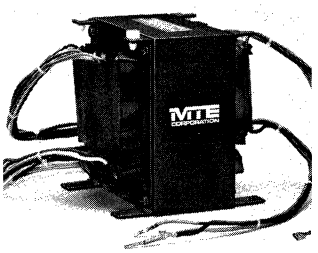
TRANSFORMERS

Toroidal



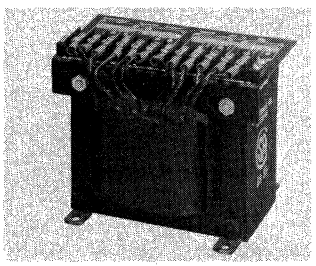
Power, inductor, reactor, current, audio.
Sizes from .125″ I.D. to 5.5″ O.D. automatic winding, larger sizes by special procedures.
High power to weight ratio.
Power to 100 VA.
Standard or custom core.
Impregnated, encapsulated.
Hermetically sealed.

Ferro-Resonant



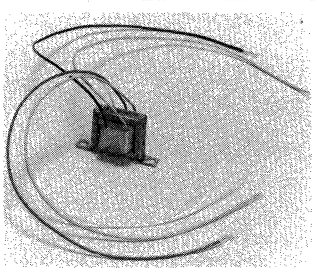
Excellent for DC power supplies.
Nearly square wave outputs.
Minimum additional components required for constant voltage output.
Open or closed construction.

Power

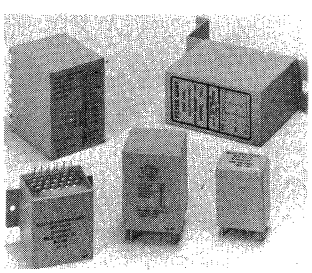


Single phase to 20 Kva. Three phase to 50 Kva.
Frequency up to 1000 Hz — Voltage to 5000 VAC
Multiple primaries and secondaries with or w/o Taps.
Electrostatic shielded windings available.
Thermal cut offs optional.
Choice of insulation, class or temperature rating.
PCB, encapsulated, open, or hermetically sealed.
U.L. to 5 Kva — CSA to 15 Kva.

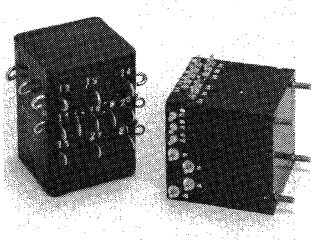
Audio



Frequencies from 25 Hz to 20,000 Hz.
For impedance matching, isolation, low-insertion loss, broad frequency response.
Interstaging and other custom designs to application.
PCB, encapsulated, open and hermetically sealed versions.



Power Supplies



Military Hi-Rel

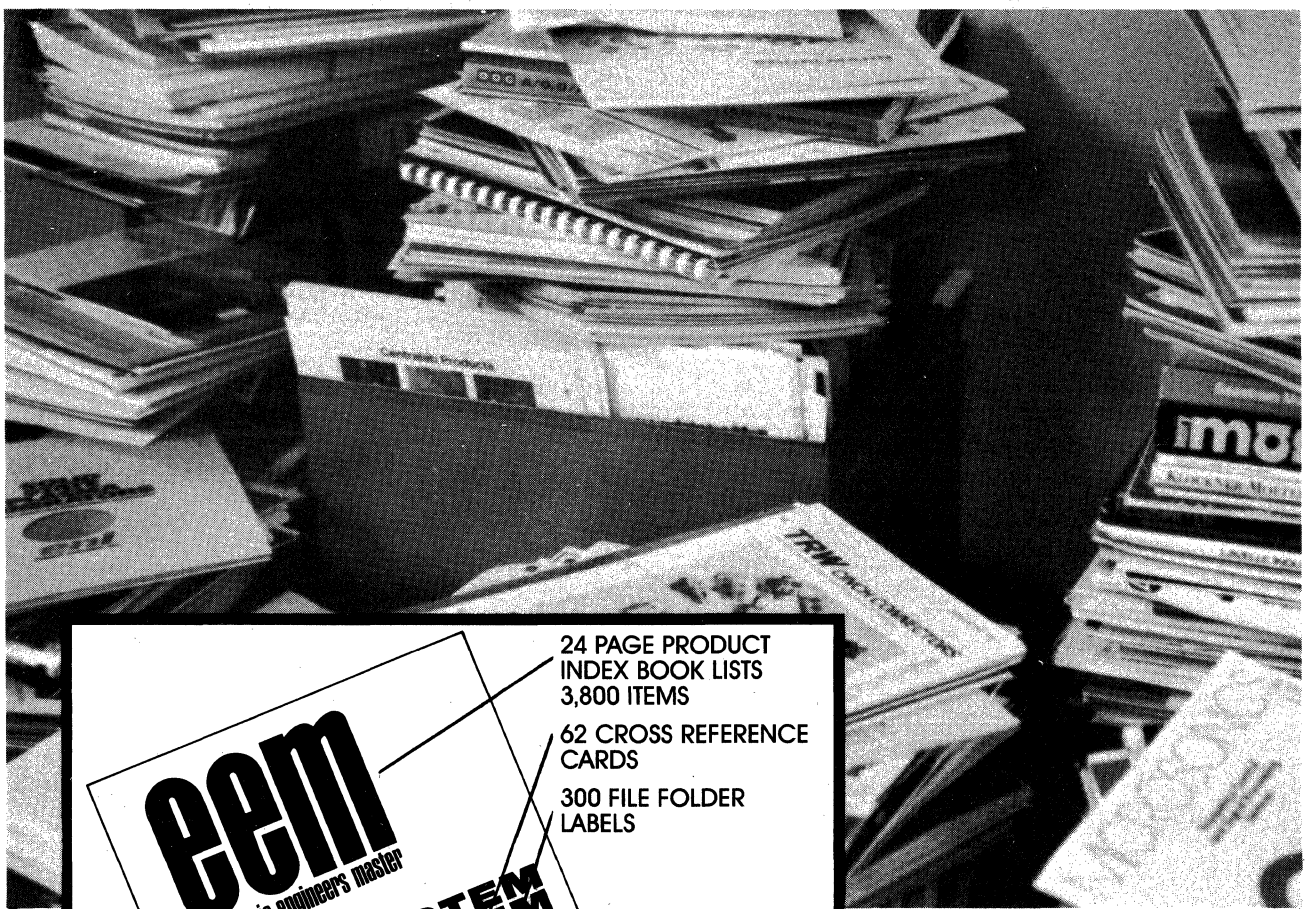
The 4700 Series "Hi-Pot" Tester is designed to stress the insulation under test to a predetermined voltage, and indicate a non-conforming condition.

Mec "Hi-Pot" Testers
Double as Bench Instruments

MTE CORPORATION

P.O. Box 23957
7901 W. Clinton Ave.
Milwaukee, WI 53223

Phone 414/358-5300



ALL NEW with this edition of EEM

GET ORGANIZED!

Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

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You say you want to file catalogs by type of product? That's easy to do with The System. But, what are you going to do when there are multiple products in one catalog? Take Mallory for example. There are all kinds of products in the Mallory Short Form Catalog. With the EEM File System all you do is file the catalog under "M" for Mallory and refer to it on all of the cross reference cards that apply.

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MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 85/86 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1166, **B**•1012, **C**•1028, **D**•1016
ASCII Code ..... **D**•1087
Batteries, Product Selection Guide ..... **D**•1413
Batteries & Fuel Cells, Characteristics ..... **D**•1430
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide ..... **A**•1003
Circuit Boards (Printed) Product Selection Guide ..... **C**•1099
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1205
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1863
Connectors, Miniglossary ..... **C**•1129
Connectors, Terminals, & Sockets, Product Selection Guide ..... **C**•1105
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Gude ..... **A**•1309
Delay Lines, Product Selection Guide ..... **A**•1459
Discrete Semiconductors, Product Selection Guide ..... **A**•2067
Displays, Readouts, Lamps, & Lights, Product Selection Guide ..... **B**•1015
EBCDIC Code ..... **D**•1092
Encapsulation, Miniglossary ..... **C**•1086
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide .. **C**•1623
Filters, Product Selection Guide ..... **A**•1583
Instruments, Graphic Recording Product Selection Guide ..... **D**•1401
Instruments, Panel Meters, Product Selection Guide ..... **D**•1329
Instruments, Test & Measuring Product Selection Guide ..... **D**•1175
Interconnection Systems, Product Selection Guide ..... **C**•1699
Keyboards & Keypads, Product Selection Guide ..... **B**•1705
Logofinder & Trademark Directories ..... **B**•901
Microwave Components, Product Selection Guide ..... **A**•1701
Military Qualified Products Lists ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1129
Opto Semiconductors, Miniglossary ..... **B**•1214
Oscilloscopes, Product Selection Guide ..... **D**•1385
Panel Hardware, Product Selection Guide ..... **C**•1589
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide ..... **A**•1991
Power Supplies, Miniglossary ..... **D**•1462
Power Supplies, AC, Product Selection Guide ..... **D**•1877
Power Supplies, DC, Product Selection Guide ..... **D**•1447
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide .... **B**•1225
Relay Contact Forms ..... **B**•1317
Relays, Electromechanical, Miniglossary ..... **B**•1308
Relays, Product Selection Guide ..... **B**•1261
Resistor Color Codes ..... **A**•1828
Resistors, Product Selection Guide ..... **A**•1785
Servo Components, Miniglossary ..... **D**•1985
Solenoids, Product Selection Guide ..... **B**•1463
Switches, Product Selection Guide ..... **B**•1477
Thermal Components, Product Selection Guide ..... **B**•1741
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1744
Thyristors/High Power Diodes, Miniglossary ..... **A**•2076
Transducers & Encoders, Product Selection Guide ..... **B**•1777
Transformers, Product Selection Guide ..... **A**•2099
Wire & Cable, Product Selection Guide ..... **C**•1743
Wire Gauges—Diameter, Area, Copper Weight ..... **C**•1844

Multi Products International

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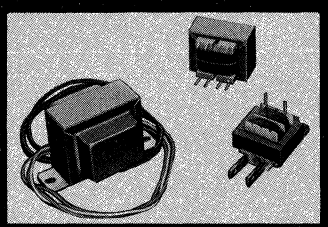
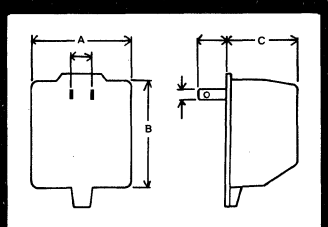
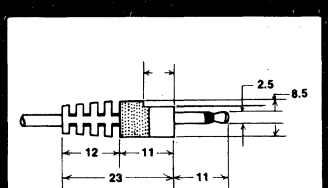
MPI is one of the most reliable suppliers, on a large scale, of transformer and magnetic components to the computer, data processing, communications & medical and recreational electronics OEMS. All units meet MPI's stringent QC standards and are UL CSA & VDE listed as required.

The product categories below provide general specification information for our basic product lines. However, our ability to design and manufacture custom components, to your specs, makes us the industry's true "super source".

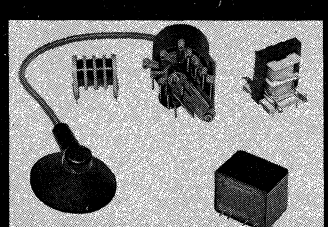
Call today! – **(201) 239-8183 • Telex 219289**

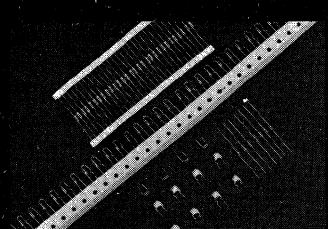






OUTPUT PLUG





POWER TRANSFORMERS

Typical Input For All Transformers
100 ~ 120V
220 ~ 240V
50 ~ 60Hz

METRIC SIZE	OUTPUT	METRIC SIZE	OUTPUT
EI-24	0.5VA	EI-66	50VA
EI-28	1 VA	EI-76	80VA
EI-35	1.8VA	EI-86	150VA
EI-41	5.0VA	EI-96	200VA
EI-48	12 VA	EI-105	300VA
EI-54	15 VA	EI-115	400VA
EI-57	25 VA	EI-133	1000VA

WALL PLUG-IN UNITS

AC/AC ADAPTERS

INPUT: 120 Vac 60 Hertz

OUTPUT: Part Number:	Volts AC (NL)	Volts AC	Curr. Ma	Case Size (mm) A	B	C
W41A-G1000-2/1	9.4	8.0	1000	50.6	50.6	43.0
W41A-J700-2/1	14.5	12.0	700	50.6	50.6	43.0
W41A-N500-2/1	21.0	18.0	500	50.6	50.6	43.0
W48A-Q700-2/1	26.7	24.0	700	60.0	58.0	47.7

AC/DC ADAPTERS

INPUT: 120 Vac 60 Hertz

OUTPUT: Part Number:	Volts DC (NL)	Volts DC	Curr. Ma	Case Size (mm) A	B	C
W35D-E500-2/1	10.5	6.0	500	44.0	57.0	36.0
W41D-E900-2/1	10.5	6.0	900	50.0	60.0	39.0
W35D-H300-2/1	12.5	9.0	300	44.0	57.0	36.0
W41D-H600-2/1	12.5	9.0	600	50.0	60.0	39.0
W41D-J500-2/1	16.5	12.0	500	50.0	60.0	39.0
W48D-J1000-2/1	16.5	12.0	1000	61.5	66.1	47.0
W41D-L400-2/1	20.7	15.0	400	50.0	60.0	39.0
W48D-L900-2/1	20.7	15.0	900	61.5	66.1	47.0
W48D-Q500-2/1	32.0	24.0	500	61.5	66.1	47.0

All above items in stock & UL listed. Others available as special order.

SPECIALTY ITEMS

- IF and RF Transformers
- Antenna Coils and Assemblies
- Pin cushion Transformers
- Switch Mode Transformers
- Pulse Transformers
- Ballast Transformers
- Deflection Yokes
- Flyback Transformers
- P.C. Board Assemblies
- Delay Lines
- Coil Windings
- Ignition Coils

INDUCTORS

PEAKING COIL AL TYPE

Style ..... Axial lead
Temperature rise ..... 20°C
Ambient temperature.. 80°C
Temperature range.... −20°C to +100°C
Terminal tensile strength ..... 2.5kg.
Inductance range .... 0.22μH – 1000μH

PEAKING COIL EL TYPE

Style ..... Radial lead
Temperature rise ..... 20°C
Ambient temp ..... 80°C
Temperature range.... −20°C to +100°C
Terminal tensile strength ..... 1.5Kg.
Inductance range .... 0.22μH – 1000μH

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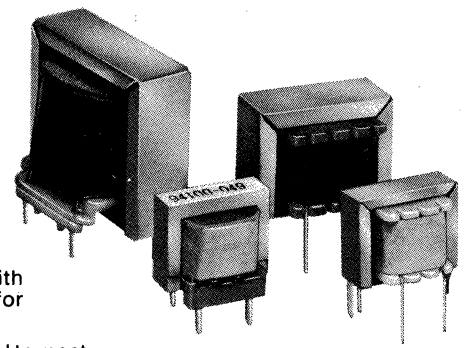
AUDIO/MATCHING TRANSFORMERS



MPI's miniature audio transformers are highly reliable and extraordinarily economical. All can be supplied vacuum epoxy impregnated with either standard leads or plug-in printed circuit construction. There are several standard bobbins with various pin spacings permitting optimum use of voice-grade telephone lines for broadband data signals.

Our newest line of extremely small telephone coupling transformers were designed to meet FCC Part 68 specifications for use with telephone equipment, modems and a variety of communications products.

They feature a frequency response of 300-3500 Hz ± 0.5dB; wide dynamic signal level of -45dBm to +7dBm; low distortion (0.5% max.); impedance matching of ± 10% over entire range; return loss of 16 dB min.

Depending on your requirements, any of several standard cores can be used in the construction of specific high quality designs.

Custom designs for your special requirements necessitating other ratings and construction can be met by our MPI design engineers.

Part No.	Impedance Pri	Impedance Sec	DC Resist. Pri	DC Resist. Sec	Max. Power	Insert. Loss	DC Current	FIG.	Sch.
*A10N-HH-1A/1	600	600	55	69	+7dBm	1.0dB	2mA	3	1A
*A14N-HH-1A/1	600	600	60	46	+6dBm	1.4dB	0mA	3	1A
A16N-HH-1A/1	600	600	52	48	+7dBm	1.2dB	0mA	3	1A
*A19S-HH-1A/1	600	600	35	25	+7dBm	1.1dB	0mA	3	1A
*A19S-MH-1A/2	1500	600	78	67	+5dBm	1.2dB	0mA	3	1A
A19F-HH-1A/1	600	600	45	45	+7dBm	1.0dB	2mA	4	1A
A19H-CC-1A/1	150	150	25	35	+7dBm	1.0dB	2mA	1	1A
A19H-HC-1A/1	600	150	45	35	+7dBm	1.0dB	2mA	1	1A
A19H-MH-1A/1	1500	600	78	67	0dBm	1.7dB	0mA	1	1A
A19H-HK-1A/1	600	900	45	55	+7dBm	1.0dB	2mA	1	1A
A19H-HH-1A/2	600	600	180	80	+1dBm	2.5dB	80mA	1	1A
*A19H-HH-1A/1	600	600	69	95	0dBm	1.9dB	120mA	1	1A
A19H-HH-1C/1	600	600	25	40	+7dBm	1.0dB	2mA	1	1C
*A19H-HH-4C/1	600	600	65	86	+9dBm	2.4dB	100mA	1	4C
A19N-HH-1A/1	600	600	65	85	+7dBm	2.5dB	100mA	3	1A
*A19N-HH-1A/6	600	600	35	45	+7dBm	2.0dB	0mA	3	1A
*A19M-HH-1A/3	600	600	65	86	+9dBm	2.4dB	100mA	2	1A
*A19N-HH-1A/2	600	600	180	75	+5dBm	3.5dB	80mA	3	1A
*A19N-HH-5C/1	600	600	19	26	+6dBm	1.0dB	10mA	3	5C
A28H-HH-1A/1	600	600	36	28	+27dBm	1.0dB	120mA	1	1A

*Indicates stocked items (others available as special order)

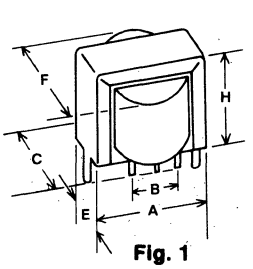


Fig. 1

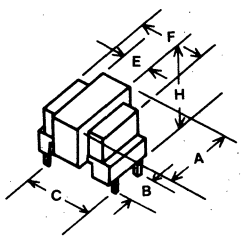


Fig. 2

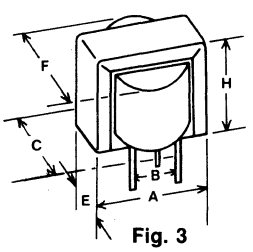


Fig. 3

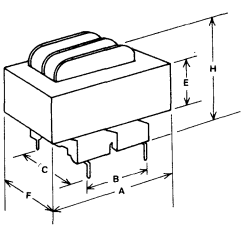
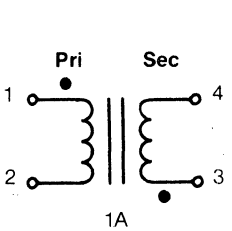


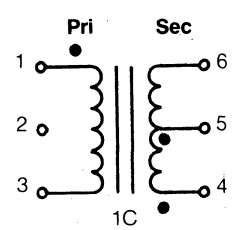
Fig. 4

DIMENSIONS (in millimeters)

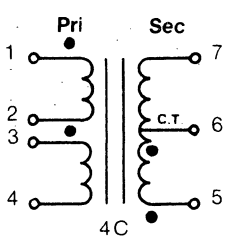
CASE	A	B	C	E	F	H
10N	10.5	4.0	8.4	4.2	11.0	8.5
14N	14.5	5.8	12.0	5.5	13.4	11.0
16N	17.0	6.0	13.0	5.5	17.0	14.7
19S	19.5	7.4	15.0	5.4	14.5	11.5
19F	20.0	15.2	13.0	6.5	16.5	17.5
19N	19.5	9.5	10.7	6.5	17.5	17.5
19M	*19.5*	*9.5*	*16.3*	*6.5*	*17.5*	*17.5*
19H	20.3	8.0	14.5	6.8	15.8	16.0
28N	29.5	12.0	23.5	12.5	28.0	26.5



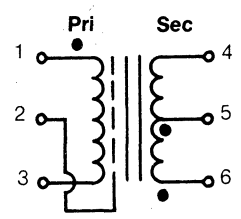
1A



1C



4C



5C

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K
kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L
LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microforad
MHz megahertz
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOSIGT metal-oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM nuclear instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLL phased lock loop
PPI plan position indicator
PROM programmable read only memory
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

high voltage components

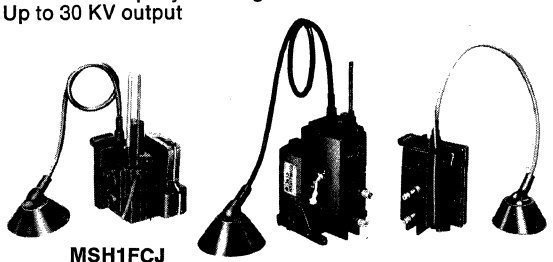
MURATA ERIE NORTH AMERICA, INC.

Miniature Flyback Transformers

For 14″-20″ color TV and data display

FEATURES

- Integral HV multiplier circuitry
- Small size
- HV resistant epoxy moldings
- Up to 30 KV output

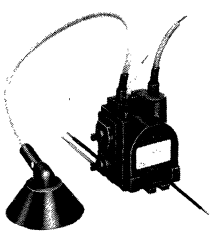


MSH1FCJ MSH1FBM MSH1FBT

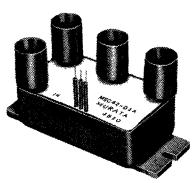
FBT, High Voltage Capacitor and Focus Adjusting Resistor Integrated type.

High Voltage CR Blocks & Multipliers

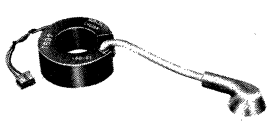
MSC26-01 (for CRT Display)



MSC42-01 (for Projection TV)



MSL4539 (for TV Camera)



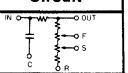
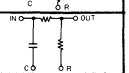
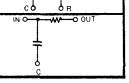
TYPICAL SPECIFICATIONS

Part Number	Max. Ratings (KV/0mA)	Max. Horizontal Frequency (KHz)	Applications	
			B/W Display	CTV & Display
MSH1ABF □□	18	31.5	14″	6″
MSH1FBM □□	30	31.5	—	22″
MSH1FBT □□	30	65	—	20″
MSH1FBU □□	30	31.5	—	20″
MSH1FBW □□	26	15.75	—	14″
MSH1FCE □□	27	15.75	—	20″
MSH1FCF □□	27	15.75	—	20″
MSH1FCJ □□	26	31.5	—	14″

• Other Kinds of Flyback Transformers are also available on request.

TYPICAL SPECIFICATIONS

MSC26~37 Series CR Block for CRT display

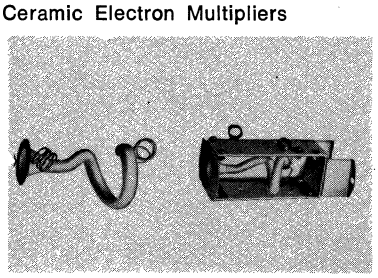
Part Number		Capacitance		Circuit
Wire Input (Series)	Connector Input (Series)	30 KV Type (pF)	20 KV Type (pF)	
MSC26	MSC27	1500	2200	
MSC32	MSC33	3000	4300	
MSC28	MHC29	1500	2200	
MSC34	MSC35	3000	4300	
MSC30	MSC31	1500	2200	
MSC36	MSC37	3000	4300	

MSL/MSR Series Multiplier

Part Number	Max. Rating Volt.		Rated Output	Application
	Input (KVpp)	Output (KV)		
MSL2553	12	18	15.5KV/20μA	B/W Display
MSL3568	6.3	15	10KV/50μA	Oscilloscope (Anode)
MSL3574	12	36	27KV/1.5mA	Color Display
MSL4533	1.6	9	6KV/50μA	TV Camera
MSL4539	1.6	9	5KV/5μA	TV Camera
MSL7507	1.6	−10.5	−7KV/50μA	Image Intensifier
MSL8508	3(60Hz)	13.5 (Triggering)	7mA (Operating)	Gas Laser
MSR4501	3	20	12KV/200μA	B/W Display
MSR8506	7	21	14KV/25μA	Oscilloscope (Anode & Cathode)

CERATRON

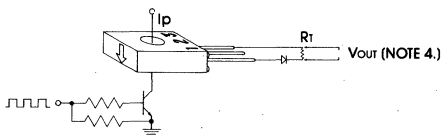
Ceramic Electron Multipliers

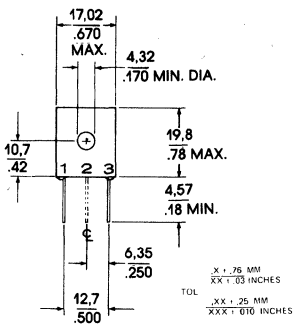


These units are completely solid-state and may be substituted for standard vacuum-type electron multipliers in a variety of applications including ion, gamma ray, electron, photon and soft x-ray detection. They offer high gains to 10^6 min. and are extremely linear at up to 1 microamp. Noise figures are very low.

MURATA ERIE NORTH AMERICA, INC. 1148 Franklin Rd., S.E., Marietta, Georgia 30067 Tel: (404) 952-9777 Telex: 54-2329 TWX: 810-766-1531

CURRENT SENSE TRANSFORMER





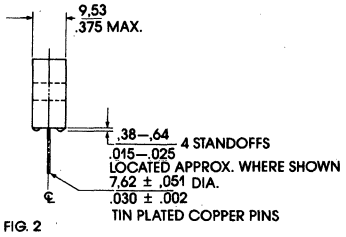
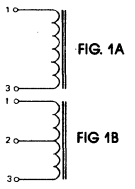


FIG. 2



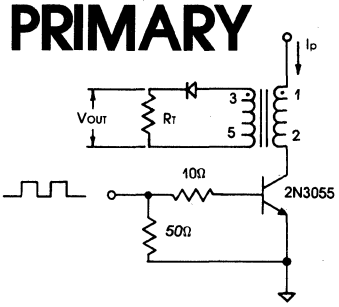
Part Number	Schematic Figure	Turns ± 5% (Ns)	Inductance (1-3) MH Min.	Inductance Test Voltage at 20 KHZ	DC Resistance (1-3) Ohms Max.	Terminating Resistance (Rt)
NP-4600	1A	50	5.0	.50	.70	50Ω
NP-4601	1A	100	20.0	1.00	1.40	100Ω
NP-4602	1A	200	80.0	2.00	4.50	200Ω
NP-4603	1B	50 CT	5.0	.50	.70	50Ω
NP-4604	1B	100 CT	20.0	1.00	1.40	100Ω
NP-4605	1B	200 CT	80.0	2.00	4.50	200Ω

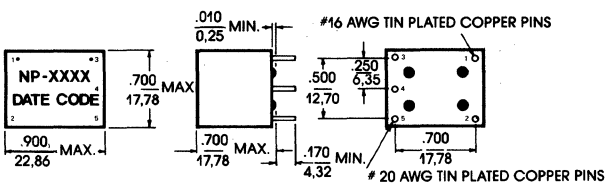
NOTES: 1. Electrical specifications are at 25°C.
2. Operating Range: Sense Current = 20 APK Max. @ 40% Duty Cycle, 10 KHZ - 100 KHZ.
3. Output: 1 Volt per amp with rated terminating resistance.

Ns = Turns (1-3)
Ip = Primary (Sense) Current
RT = Terminating Resistance

$$V_{OUT} = \frac{Ip\ (Rt)}{Ns}$$

CURRENT SENSE TRANSFORMER WITH PRIMARY





SCHEMATIC

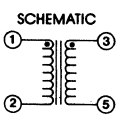


FIG. 1A

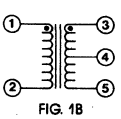


FIG. 1B

NOTES: 1) Dimensions are in $\frac{\text{Inches}\ \ .XXX \pm .010}{\text{mm}\ \ .XX \pm .25}$
2) Encapsulated construction with terminal pins for printed circuit board mounting
3) Dielectric strength: 3750 VRMS PRI to SEC.
4) Frequency range: 10 KHZ plus
5) Designed for switching power supply application

Part Number	Schematic Figure	Secondary Turns	Secondary Inductance (mH Min.)	Test Voltage @ 15.75 KHZ	Secondary DCR (3-5) Ohms Max.	Primary Unipolar Amp μSec. (Max.)	Terminating Resistance RT Ohms (Nom.)
NP-4944	1A	50	5.0	0.5	0.70	150	50
NP-4945	1A	100	20.0	1.0	1.40	300	100
NP-4946	1A	200	80.0	2.0	4.50	600	200
NP-4947	1A	300	180.0	3.0	11.00	900	300
NP-4948	1B	50 CT	5.0	0.5	0.70	150	50
NP-4949	1B	100 CT	20.0	1.0	1.40	300	100
NP-4950	1B	200 CT	80.0	2.0	4.50	600	200
NP-4951	1B	300 CT	180.0	3.0	11.00	900	300

NOTES: 1) Electrical specifications are at 25°C.
2) Amp-micro second (A μSEC) rating of primary equals Volts- Micro Second (V μSEC) rating of secondary when secondary is terminated in rated resistance
3) Maximum operating temperature 130°C
4) Peak sense current = 20 A max. @ 40% duty cycle

5) $V_{OUT} = \frac{Ip\ (Rt)}{Ns}$

Ip = Primary current
TT = Terminating Resistance
NS = Secondary Turns

NANO PULSE INDUSTRIES, INC.
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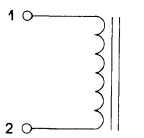
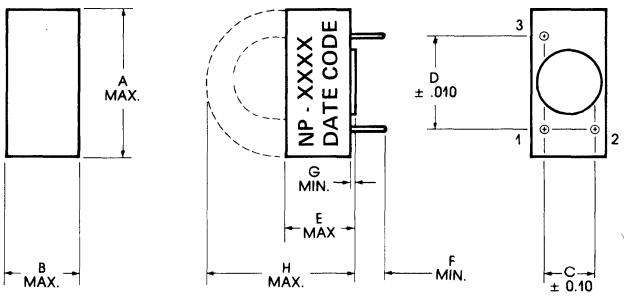
TOROID POWER INDUCTOR

SCHEMATIC





Package	A	B	C	D	E	F	G	H
1	1.20 30,48	0.60 15,24	0.400 10,16	0.800 20,32	0.45 11,43	0.20 5,08	0.015 0.38	1.20 30,48
2	1.44 36,58	0.80 20,32	0.600 15.24	0.900 22,86	0.70 17,78	0.20 5.08	0.03 0.76	1.44 36.58
3	1.60 40,64	0.80 20,32	0.600 15,24	0.900 22,86	0.70 17,78	0.20 5.08	0.03 0.76	1.72 43,69
4	1.95 49,53	0.91 23,11	0.700 17,78	1.200 30,48	0.90 22,86	0.20 5.08	0.03 0.76	2.00 50,80
5	2.30 58,42	1.11 28,19	0.900 22,86	1.500 38,10	1.00 25,40	0.20 5.08	0.03 0.76	2.30 58,42

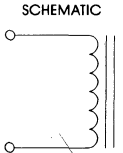
NOTES: 1) Dimensions are in Inches/mm
2) Manufactured to operate at 130°C max. (Ambient + Rise)
3) Semi-encapsulated construction
4) 2:1 inductance swing from zero to max. current

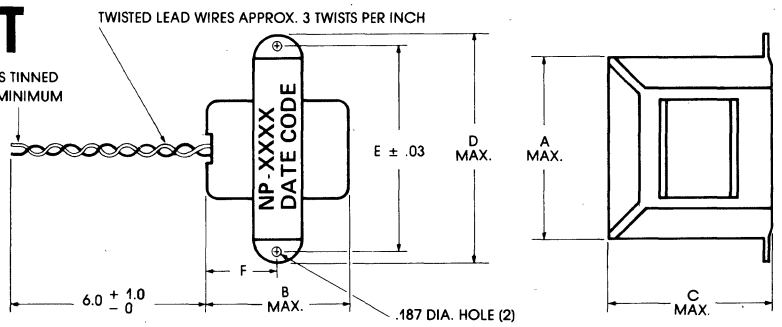
Part Number	Inductance with No D.C. Bias (μH Min.)	Test Level Volts RMS @ 15.75 kHz	Inductance @ Rated D.C. Current (μH Min.)	Rated D.C. Current (Amps.)	D.C. Resistance (Ohms Max.)	Package Designation	Lead Dia. (Inches) ± .005	MIN. Energy Storage (μJ)	Rated E.T. (V-μS) 20 kHz	Rated E.T. (V-μS) 40 kHz
NP-6000	40.0	1.10	17.0	17.0	0.0065	3	0.081	2460	190	130
NP-6001	74.0	2.20	32.0	16.0	0.0092	4	0.081	4100	290	200
NP-6002	125.0	3.90	60.0	16.0	0.012	5	0.081	7700	390	270
NP-6003	27.0	0.60	14.0	10.0	0.009	1	0.057	700	135	95
NP-6004	46.0	1.10	23.0	11.0	0.012	2	0.057	1400	170	120
NP-6005	90.0	1.70	43.0	10.0	0.018	3	0.057	2150	280	195
NP-6006	165.0	3.20	78.0	10.0	0.025	4	0.057	3900	430	300
NP-6007	275.0	5.70	144.0	10.0	0.032	5	0.057	7200	570	400
NP-6008	64.0	0.85	32.0	6.5	0.025	1	0.040	675	200	140
NP-6009	97.0	1.50	52.0	7.0	0.032	2	0.040	1275	230	160
NP-6010	185.0	2.40	98.0	6.0	0.048	3	0.040	1765	400	280
NP-6011	330.0	4.60	175.0	6.0	0.068	4	0.040	3150	620	425
NP-6012	600.0	8.50	335.0	6.0	0.095	5	0.040	6030	840	580

NOTES: 1) Electrical requirements are at 25°C.
2) Nominal inductance swing from zero to max. Rated current gives improved protection against current discontinuities at light loading.
3) Energy storage = $\frac{LI^2}{2}$ (μJ) L = Inductance in microhenries, I = D.C. current amps

LAMINATED OUTPUT INDUCTORS

SCHEMATIC





Part Number	A	B	C	D	E	F	Lead Size
NP-6200	1.50 38,10	1.12 28,45	1.25 31,75	2.13 54,10	1.76 44,70	0.65 16,51	2 × 16 Awg
NP-6204							18 Awg
NP-6208							21 Awg
NP-6201	1.72 43,69	1.37 34,80	1.47 37,34	2.42 61,47	2.00 50,80	0.81 20,57	4 × 16 Awg
NP-6205							2 × 18 Awg
NP-6209							18 Awg
NP-6202	2.00 50,80	1.56 39,62	1.69 42,93	2.88 73,15	2.38 60,45	0.85 21,59	10 × 18 Awg
NP-6206							6 × 20 Awg
NP-6210							2 × 18 Awg
NP-6203	2.37 60,20	1.81 45,97	2.03 51,56	3.31 84,07	2.83 71,88	1.10 27,94	15 × 16 Awg
NP-6207							5 × 16 Awg
NP-6211							2 × 15 Awg

NOTES: 1) Dimensions are in $\frac{\text{Inches}}{\text{Millimeters}}$ ± .010 / ± 0.25
2) Supplied without sleeving or terminal. Both items are available as options.

Part Number	Effective Inductance (μH + 20%, − 10%)	Test Voltage at 20 kHz	Rated D.C. Current (Amps)	D.C.R. (Ohms Max.)	Max. E.T. (VμS)	Rated Temp. Rise (Deg. Cent.)	MIN. Energy Storage (μJ)
NP-6200	65	0.40	12.5	0.0130	85	40	4550
NP-6201	32	0.40	25.0	0.0050	85	40	9000
NP-6202	19	0.40	50.0	0.0025	85	60	21375
NP-6203	8	0.40	100.0	0.0009	85	60	36000
NP-6204	590	1.00	4.0	0.100	255	40	4240
NP-6205	275	1.00	8.0	0.035	255	40	7900
NP-6206	155	1.00	15.0	0.015	255	50	15650
NP-6207	80	1.00	27.0	0.0056	255	50	26225
NP-6208	2350	2.00	2.0	0.400	510	40	4225
NP-6209	1100	2.00	4.0	0.135	510	40	7900
NP-6210	590	2.00	7.5	0.052	510	50	14900
NP-6211	310	2.00	14.0	0.020	510	50	27300

NOTES: 1) Electrical specifications are at 25°C. L = Inductance in microhenries I = D.C. current in amps 2) Energy storage = $\frac{LI^2}{2}$ (μJ)

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WIDEBAND BALUN TRANSFORMERS

North Hills

Baluns, consisting of one unbalanced primary and one DC-isolated center-tapped balanced secondary winding, transfer power bi-directionally and are matched in both directions.

North Hills' baluns are precision-engineered for low insertion and return losses. Bandwidths extend from low-frequency cut-off (LCO), where response is down no more than 3 dB with respect to that at mid-band to high-frequency cut-off (HCO), where the VSWR does not exceed 1.25. Mid-band insertion loss < 0.5 dB.

LOW POWER SERIES (1 W)

Series		Extended Video		Video Frequency		Medium Frequency		Radio Frequency	
Cases		PB		LA, LB		BA, BB		BA, BB, HB	
LCO		20 Hz		1 kHz		10 kHz		100 kHz	
Impedance Unb.	Bal.	Type No.	HCO MHz	Type No.	HCO MHz	Type No.	HCO MHz	Type No.	HCO MHz
50	50	0014	6	0009	25	0010	80	0001	125
	75	0113	6	0104	25	0111	80	0101	125
	90			0203	20	0202	60	0200	125
	100	0315		0311	20	0301	60	0300	100
	124	0316	6	0306	20	0302	60	0307	100
	135			0303	18	0312	60	0310	100
	150			0415	15	0401	60	0400	100
	200	0522	4	0511	15	0520	60	0500	100
	300			0517	12	0521	50	0501	100
	450			0603	10	0602	40	0600	65
	600			0706	8	0703	32	0700	65
	800			0802	7	0801	25	0800	60
	1200			0904	6	0902	15	0900	30
75	50	1003	6	1002	25	1001	60	1000	100
	75	1111	6	1102	25	1112	60	1100	100
	90			1202	20	1201	60	1200	100
	100			1314	20	1310	60	1300	100
	110	1307	6	1318	20	1319	60	1320	100
	124	1309	10	1301	20	1311	60	1302	100
	135			1312	20	1315	60	1317	100
	150	1408	6	1404	16	1405	60	1400	100
	200			1516	15	1513	60	1500	100
	300	1520	4	1502	15	1514	60	1501	100
	450			1602	12	1601	40	1600	60
	600			1704	10	1707	32	1700	60
	800			1802	10	1801	20	1800	30
	1200			1902	9	1905	15	1900	30
	1875			1903	6	1901	8	1906	15

HIGH POWER SERIES

Power Level	10 W	25 W	25 W	100 W	1 kW
Cases	HB	BA, BB	BA, BB	BA, BB	KA
MHz Range	.1-30	.1-30	30-80	.5-30	2-32
Unb./Bal. (Ω)	Type No.	Type No.	Type No.	Type No.	Type No.
50:50	0008	0011		0012	0013
50:75	0108	0109	0106	0105	0107
50:100	0309	0308	0305	0304	0314
50:150	0406	0402	0403	0404	0407
50:200	0519	0512	0507	0516	0515
50:300	0514	0518		0506	0513
50:450	0604	0605		0606	0601
50:600	0705	0701		0704	0702
75:75	1105	1110		1118	1108
75:100	1306	1304	1303	1305	1316
75:150	1406	1401	1402	1403	1407
75:200	1517	1519		1512	1518
75:300	1515	1510	1509	1505	1511
75:450	1603	1604		1605	1606
75:600	1709	1703		1708	1705

SUBMINIATURE SERIES

Power Level		0.5 W-2 W
Case		NA
Bandwidth (MHz)		0.1-300
In/Out (Ω)	Type No.	Characteristics
50:50 75:75 90:90	0003 1106 2200	Unbalanced to unbalanced, phase reversing, DC coupled
50:50 75:75 90:90	0007 1107 2201	Unbalanced to unbalanced, phase reversing, DC isolated
50:12.5 50:200 75:300	0002 0508 1506	Unbalanced to unbalanced, non-inverting, DC coupled
50:50 50:200 75:75 75:300 100:100	0004 0509 1101 1507 2202	Unbalanced to unbalanced, DC coupled
50:200 75:300	0510 1508	Balanced to balanced, DC coupled

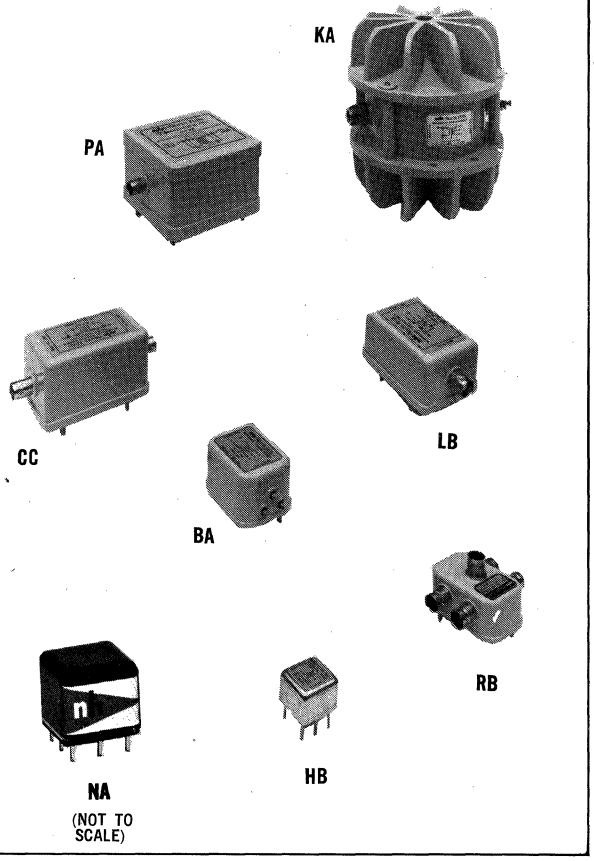
APPLICATIONS

- Impedance matching between balanced and unbalanced circuits
- Measurement/test system load matching
- Computer Local Area Network
- Cable impedance matching
- Antenna coupling
- DC isolation and common-mode noise rejection

FEATURES

- Extremely wide, flat frequency response
- Broadest selection of products available from stock
- 120 dB isolation at power frequencies
- Low VSWR (< 1.25) and flat loss (< 0.5 dB)

CASE STYLES



OVERALL DIMENSIONS (INCHES) INCLUDES CONNECTORS

Case	L	W	H
BA	2.3	1.3	1.2
BB	2.6	1.3	1.2
CC	3.5	1.7	1.6
HB	0.9	0.9	0.7
JA	1.7	0.8	0.8
JB	2.0	0.8	0.8
JC	2.3	0.8	0.8
JD	2.0	0.8	0.8
KA	5.4	4.6	5.5
LA	2.9	1.7	1.3
LB	3.2	1.7	1.3
NA	0.6	0.6	0.4
PA	3.0	4.0	2.0
PB	3.0	3.6	2.0

FOR MORE INFORMATION, PLEASE CALL OR WRITE SALES ENGINEERING AT:

North Hills Electronics, INC.
1 ALEXANDER PLACE, GLEN COVE, NY 11542-3796 / TELEX: 46-6886 / TEL. (516) 671-5700

WIDEBAND ISOLATION TRANSFORMERS

North Hills

UNBALANCED TO UNBALANCED TRANSFORMERS FOR COAXIAL SYSTEMS

Type No.	Impedance Ohms	Bandwidth
0017-CC	50:50	10 Hz — 5 MHz
0016-PA	50:50	20 Hz — 20 MHz
0005-CC	50:50	1 kHz — 25 MHz
1121-TC	75:75	3.5 Hz — 8 MHz
1117-CC	75:75	10 Hz — 5 MHz
1116-PA	75:75	20 Hz — 20 MHz
1103-CC	75:75	1 kHz — 25 MHz
0112-CC	50:75	1 kHz — 25 MHz

10 kV ISOLATION TRANSFORMERS FOR PUBLIC UTILITY DATA TRANSMISSION

Type No.	Impedance Ohms	Bandwidth
1115-CD	75 Unb.: 75 Unb.	0.5 kHz — 8 MHz
1313-CD	75 Unb.: 124 Bal.	0.5 kHz — 8 MHz

HUMBUCKING TRANSFORMERS

- Flat response down to dc
- Ultra-wide bandwidths

Type No.	Impedance Ohms	Bandwidth	Isolation at 60 Hz
0019-PA	50:50	dc — 20 MHz	50 dB
0020-CC	50:50	dc — 25 MHz	40 dB
1119-PA	75:75	dc — 20 MHz	50 dB
1120-CC	75:75	dc — 25 MHz	40 dB

CALL US ABOUT YOUR SPECIAL APPLICATIONS OR WRITE FOR OUR FULL CATALOG

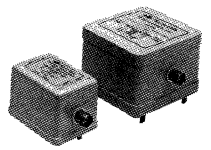
APPLICATIONS

- Studio and remote video lines
- Security systems/CCTV
- Industrial process control systems
- Computer data lines
- Local Area Networks
- Medical equipment

FEATURES

- Eliminates data/video transmission line problems due to:
  - — induced common-mode noise (hum)
  - — differences in ground potentials
- Extremely wide bandwidth
- Insulated BNC connectors standard
- 120 dB isolation at power frequencies
- 500 Vrms withstanding voltage, winding to winding to case
- Flat frequency and linear phase response

CASE STYLES



NEW!

FULL LINE OF MIL-1553 DATA BUS COUPLERS

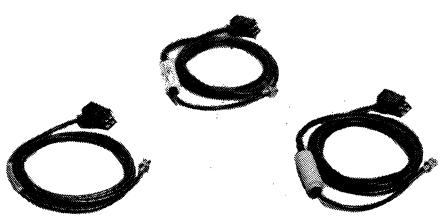
CUSTOM IN-LINE UNIT

WIDEBAND COAXIAL IMPEDANCE ADAPTERS

North Hills

Imp. Ratio	Model No.	50 Ohms M	50 Ohms F	75 Ohms M	75 Ohms F	90 Ohms M	90 Ohms F	Bandwidth (MHz)
50:75	0102-JA		•		•			.05-300
	0102-JB	•			•			.05-300
	0102-JC	•		•				.05-300
	0102-JD		•	•				.05-300
	0114-JA		•		•			5-1000
	0114-JB	•			•			5-1000
	0114-JC	•		•				5-1000
	0114-JD		•	•				5-1000
50:90	0201-JA		•				•	.05-300
	0201-JB	•					•	.05-300
	0201-JC	•				•		.05-300
	0201-JD		•			•		.05-300
75:90	1203-JA				•		•	.2-300
	1203-JB			•			•	.2-300
	1203-JC			•		•		.2-300
	1203-JD				•	•		.2-300

SPECIAL IBM CABLING SYSTEM BALUNS



APPLICATIONS

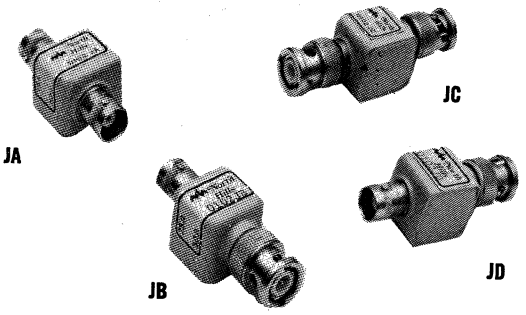
Low insertion loss interconnection of coaxial cables of different impedances:

- Data transmission cabling/LANs
- Communications systems
- Test/measurement instrumentation

FEATURES

- Small size
- Standard BNC conectors in any combination of male/female
- Bi-directional matching and power transfer
- 5-Watt power capacity
- Phase reversing available
- Special 93:124 ohm models available for telecommunication/data line interfacing

CASE STYLES



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1 ALEXANDER PLACE, GLEN COVE, NY 11542-3796 / TELEX: 46-6886 / TEL. (516) 671-5700

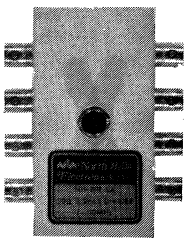
WIDEBAND POWER DIVIDERS/COMBINERS, HYBRID TRANSFORMERS, & TERMINATIONS

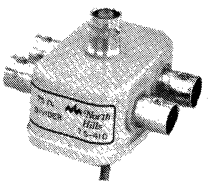
North Hills

POWER DIVIDERS/COMBINERS

0.2 - 110 and 30 - 225 MHz
2, 4, and 8-way
50 and 75 ohms

Series 01 and 10 Power Dividers are designed for low power applications in the 0.2 to 110 and 30 to 225 MHz frequency ranges.
Hybrid Junction Techniques are employed to assure superior isolation and minimal insertion loss. VSWR is optimized at all ports.
50 and 75 ohm impedances are standard. Other impedances available on special order.





	2-WAY				4-WAY				8-WAY			
Model	50-201RA	75-201RA	50-210RA	75-210RA	50-401RB	75-401RB	50-410RB	75-410RB	50-801SA	75-801SA	50-810SA	75-810SA
Impedance (Ω)	50	75	50	75	50	75	50	75	50	75	50	75
Frequency Range (MHz)	0.2 - 110		30 - 225		0.2 - 110		30 - 225		0.2 - 110		30 - 225	
Insertion Loss (dB)	0.5		1.0		0.5		1.0		1.0		1.5	
Isolation (dB min)	30		30		30		30		30		30	
Amplitude Balance (± dB)	0.5		0.5		0.5		0.5		1.0		0.5	
Phase Balance (± °)	0.5		2.0		1.0		2.0		0.5		2.0	
Input VSWR	1.1		1.25		1.1		1.25		1.1		1.25	
Input Power (watts)	5		3		5		3		5		3	
Case Style	RA		RA		RB		RB		SA		SA	
Weight (gm)	50		50		65		65		160		160	

HYBRID TRANSFORMERS

SUM & DIFFERENCE (4-port)

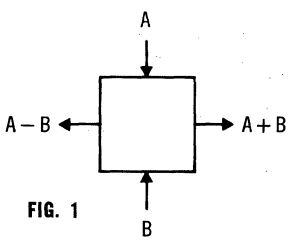


FIG. 1

Port Impedance Type	50Ω 50-212RE	75Ω 75-212RE
Frequency Range	0.2 - 110 MHz	
Insertion Loss	1 dB max	
Isolation	30 dB min	
Amplitude Balance	±.3 dB	
Phase Balance	1° max	
VSWR	1.20 max	
Power	0.5 watt max	

DIFFERENCE DIVIDER (3-port)

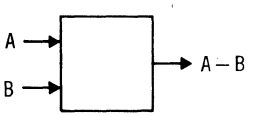


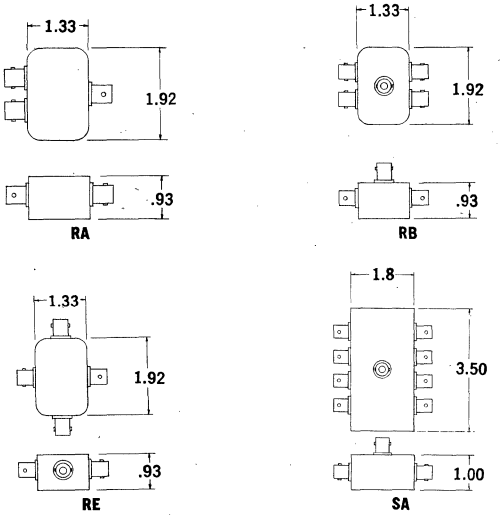
FIG. 2

Port Impedance Type	50Ω 50-221RA	75Ω 75-221RA
Frequency Range	.2 - 110 MHz	
Insertion Loss	1 dB max	
Isolation	30 dB min	
Null	40 dB min	
VSWR	1.20 max	
Power	0.5 watt max	

TERMINATIONS

Model	Impedance	Frequency Range	VSWR	Connector
R50-101	50 Ω	DC - 1 GHz	1.06 max.	BNC Male
R75-101	75 Ω	DC - 1 GHz	1.06 max.	BNC Male

CASE STYLES



BNC Connectors are standard. Other connectors available on special order. Stud mounting standard.

Different case styles, including printed circuit types with solder terminals, available on special order.

SPECIAL UNITS — 10 Hz to 1 GHz

In addition to our standard lines, North Hills custom designs to specific requirements. Examples of these include:

- Active unity – or high-gain power splitters, adders and combiners.
- High power dividers.
- Resistive dividers from dc to 500 MHz
- Power dividers for video applications with response down to 1 kHz.
- Non-standard impedances.

North Hills Electronics, INC.
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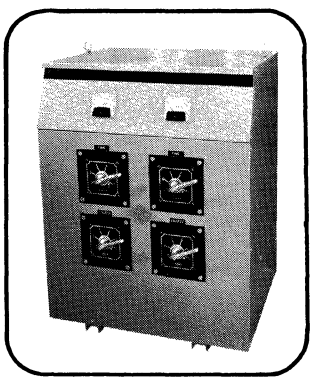
NWL ...the source for industrial and electronic transformers

FROM WATTS to MEGAWATTS

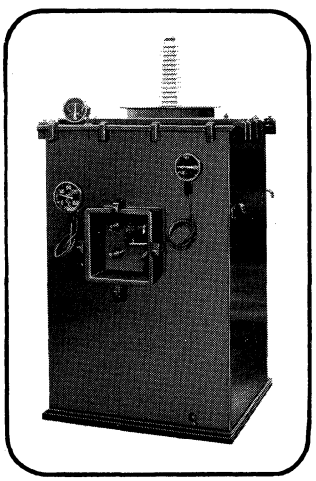
Since 1929, NWL has consistently been in the forefront of transformer design and manufacture.

High voltage, high frequency and high current transformers are particular strengths at NWL — whether for prototype, standard or special applications.

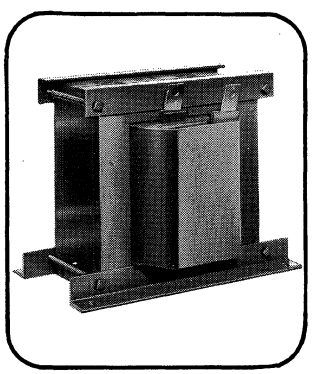
There's another reason you should look to NWL for solutions to your specific transformer problems. We've never hesitated to tackle the tough design problems head-on. In fact, NWL's technological superiority is a recognized fact in the precipitator, furnace, desalting, nuclear, and other fields requiring high technology.



Heating transformers for resistance and induction furnaces

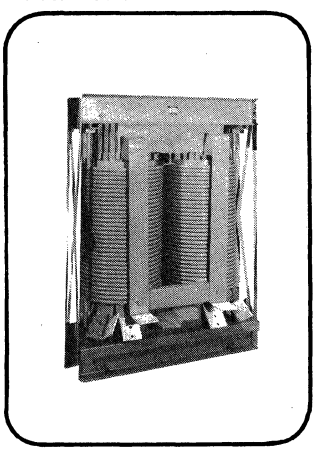


Oil-filled, high voltage Transformer/Rectifier Sets

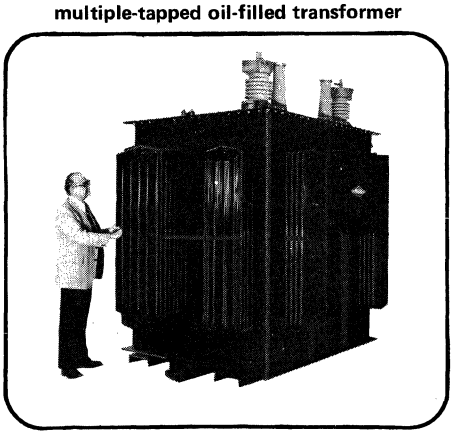


Current limiting reactors

High power and high current water cooled transformers



15 KV Class, 3,000 KVA-equivalent multiple-tapped oil-filled transformer



NWL ...the source for:

TRANSFORMERS ● Furnace ● Filament ● Heating ● Lighting ● SCR Controls ● Plate ● High Frequency ● Instrument ● Phase Changing ● Welding ● High Voltage ● Testing ● High Reactance ● Output ● Constant Voltage

PLUS ● Saturable Core Reactors ● Chokes ● Packaged Controls ● AC Reactors ● Air Core Reactors

MANUFACTURING RANGE

Up to 200 KV
1 ma to 50,000 AMP
4 Hz to 50 kHz
1 VA to 6,000 KVA
Dry, Oil-Filled, Silicone Fluid-Filled, Water Cooled, and Epoxy Cast Units Available.

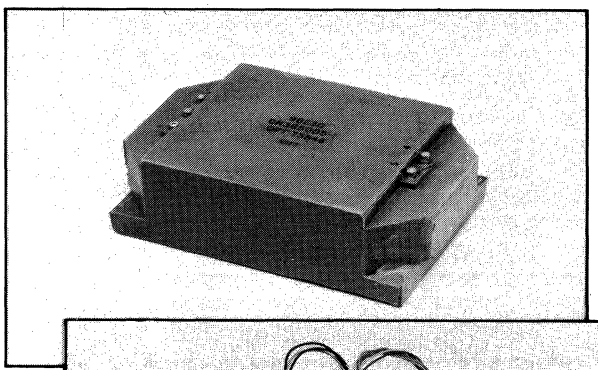
NWL TRANSFORMERS

Rising Sun Road ● P.O. Box 358
Bordentown, N.J. 08505
(609) 298-7300 ● TWX: 510-685-3645
Call us for quote or specs

NWL also designs and manufactures custom built AC/DC power supplies, laboratory and industrial types. See our ad under DC POWER SOURCES.

opt INDUSTRIES INC.
300 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865 • (201) 454-2600 • TWX 510-235-2920

CUSTOM MILITARY INDUSTRIAL HIGH-TECH TRANSFORMERS



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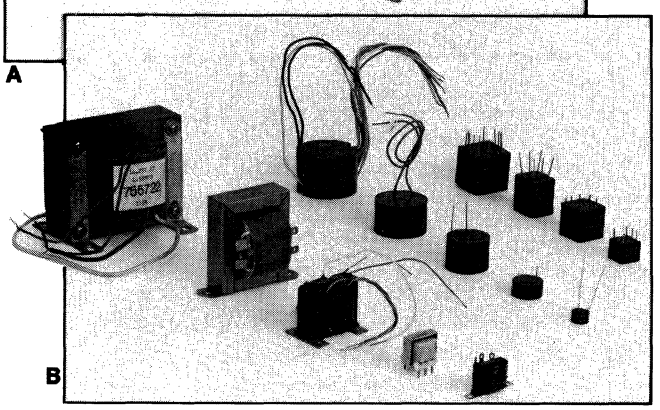


B

A Encapsulated C-Core MIL-T-27 Grade 5 Transformer utilizing silastic compound

B Grade 5 Encapsulated Transformers

IF YOUR MAGNETICS APPLICATIONS INCLUDE:

MILITARY

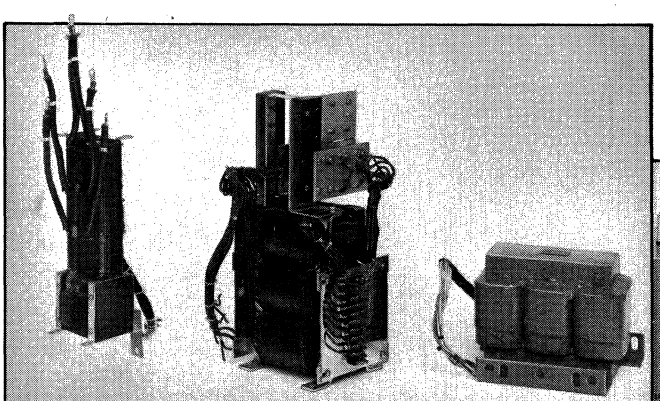
- Ground Communications
- Airborne Communications
- Electronic Counter Measures
- Sonar
- Secure Communications
- Space Applications

INDUSTRIAL

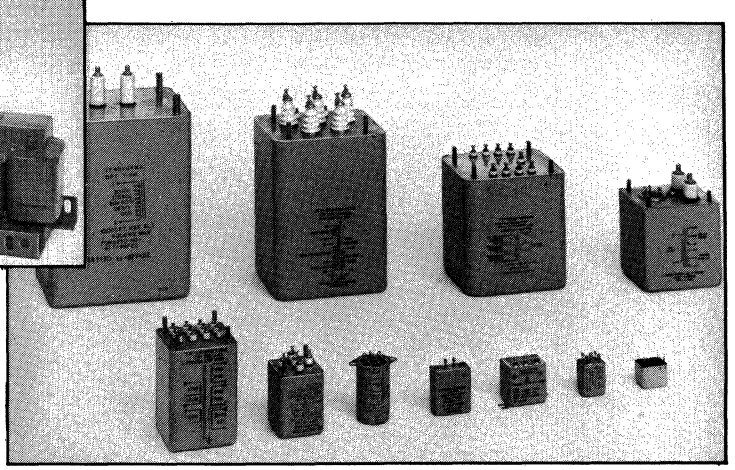
- Computer
- Computer Peripheral
- Industrial Control Equipment
- High-rel Power Supply
- Satellite Communications
- Local Area Networking

OPT Industries is ready to serve you with its experienced engineering and manufacturing staff. Modern facilities having the latest manufacturing and test equipment, are supported by our engineering staff utilizing CAD optimization techniques combined with the experience acquired as a result of approximately 3500 prior designs. Our experience in designing product to meet the requirements of MIL-T-27, MIL-STD-981, UL/CSA and VDE specifications are your assets.

OPT specializes in designing and building both low and high frequency transformers for severe environmental and service applications utilizing state of the art polymer and silastic encapsulating/potting materials technology.



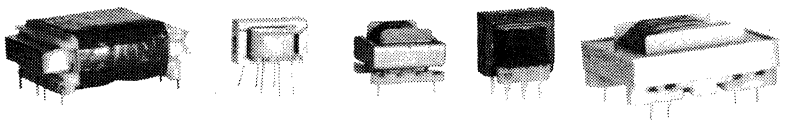
Computer and Computer Peripheral Transformers



Grade 4 Hermetically Sealed Transformers

TTC SERIES
COUPLING TRANSFORMERS - HYBRID TRANSFORMERS - HOLDING COILS

The **TTC SERIES** has been developed to meet telephone interconnect, coupling, matching and bridging requirements for use in voice, instrumentation and modem applications. **This series meets FCC PART 68 requirements.**

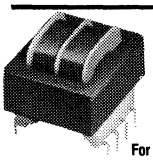


For Details See A-2214 & A-2215

DP SERIES
ENCAPSULATED AUDIO TRANSFORMERS

The **DP SERIES** is cost effective for applications involving severe environments. This series is tested to the requirements of **MIL-T-27** and several part numbers meet **FCC PART 68.**

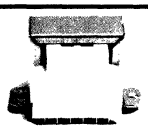
For Details See A-2216



3-FLANGE BOBBIN POWER TRANSFORMERS
UL CLASS B INSULATION SYSTEM
UL CLASS II & CLASS III TRANSFORMERS - FILE #E95844
UL GENERAL PURPOSE TRANSFORMERS - FILE #E91239

The **3F SERIES** offers 2500V RMS dielectric breakdown testing primary-to-secondary (side-by-side winding type).

For Details See A-2219

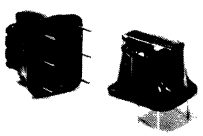


PEP SERIES
UL-1411 RECOGNIZED POWER TRANSFORMERS

This series complies with the safety requirements of most **WORLDWIDE AGENCIES** (UL, CSA, Europe-IEC 65 and Japan-MITI) including 4000V RMS dielectric breakdown testing primary-to-secondary.

FILE NUMBER
E59673
TAMRADIO

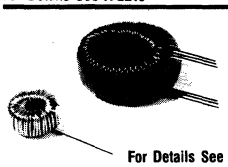
For Details See A-2218



STT SERIES
ENCAPSULATED SCR AND TRIAC TRIGGER TRANSFORMERS

The **STT SERIES** provides line isolation in SCR and Triac controlled circuits. **STT TRIGGER** transformers pass **2600V RMS** dielectric breakdown testing and are completely encapsulated for applications involving severe environments.

For Details See A-2216



POWER AND NOISE ABSORBING INDUCTORS

The **SKC SERIES** of toroidal power inductors are gapped for energy storage circuits with DC ratings from **5 to 50A DC.**

The **SKL SERIES** is functionally gapped for circuits requiring high "L" at low DC amps and nominal "L" at rated DC amps.

The **SKP SERIES** is designed on powered iron toroidal cores for RFI and EMI filtering and noise absorbing applications.

For Details See A-1265

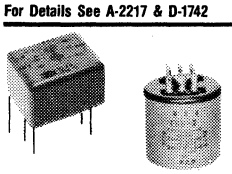
WALL PLUG-IN AC TO DC POWER SOURCES

This series of wall plug-in AC-to-DC battery chargers, battery eliminators and power supplies are available in a complete variety of input plug-in styles and comply with worldwide safety agency requirements.

AC-to-AC Wall Plug-in Transformers Are Available

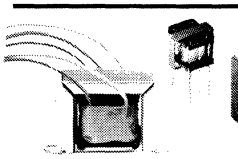
FILE NUMBERS
UL E82180
CSA LR36236
VDE F-7969-331
TAMRADIO

For Details See A-2217 & D-1742



PROFESSIONAL AUDIO TRANSFORMER SERIES

This series is widely used in high performance applications and meets most requirements of communications, broadcasting, recording and measuring apparatus. Available in solder lug, lead and printed circuit mounting styles; these transformers are metal cased. Several part numbers are electrostatic and MU-metal shielded.

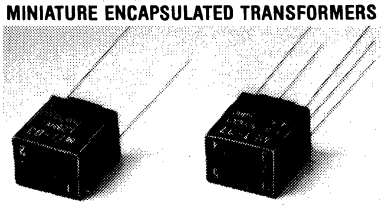


ATT SERIES
AUDIO TRANSFORMERS

These cost effective, volume produced transformers are available for impedance matching circuits and sound distribution systems. They are available as printed circuit, solder lug and lead styles.

Quality magnetic components at competitive prices . . . including COILS, POWER & AUDIO TRANSFORMERS, INDUCTORS, PULSE TRANSFORMERS, NOISE SUPPRESSION COILS, DC-DC CONVERTER TRANSFORMERS, PLUG-IN BATTERY CHARGERS and SWITCH-MODE POWER SUPPLY TRANSFORMERS & INDUCTORS. Our diversified manufacturing facilities are located in Taiwan, Malaysia and Japan. For details on standard and special requirement products, pricing and delivery—contact our headquarters.

MINIATURE ENCAPSULATED TRANSFORMERS



Small Size . . . . . 0.310" x 0.410" X 0.465"
Gold Plated Leads . . . . . 0.020" Nickel
Response . . . . . ±2dB, 300 Hz to 100 KHz
Impedance Range . . . . . 3.2 to 200K Ohms
Meets Requirements of MIL-T-27 as TF5S21ZZ

TRANSFORMERS-MET SERIES

PART NO.	MATCHING IMPEDANCE		DCMA (Max)
	Primary	Secondary	Primary
MET-01	200KCT	1KCT	0
MET-02	100KCT	1KCT	0
MET-03	50KCT	1KCT	0
MET-04	50K	1KCT or 250*	0
MET-05	25KCT	1KCT	0.5
MET-06	25K	1KCT or 250*	0.25
MET-07	25KCT	600CT	0.5
MET-08	20KCT	800CT	0.5
MET-09	10KCT	10KCT	1.0
MET-10	10KCT	4KCT	1.0
MET-11	10KCT	2KCT	1.0
MET-12	10K	2KCT or 500*	0.5
MET-13	10KCT	1.5KCT	1.0
MET-14	10KCT	1.2KCT	1.0
MET-15	10K	1.2KCT or 300*	0.5
MET-16	10KCT	600CT	1.0
MET-17	10KCT	500CT	1.0
MET-18	10KCT	4.0	1.0
MET-19	10K	3.2	0.5
MET-20	8KCT	3.2	1.0
MET-21	5KCT	2KCT	1.0
MET-22	2.5KCT	2.5KCT	1.0
MET-23	1.6KCT	3.2	2.5
MET-24	1.5KCT	600	3.0
MET-25	1.2KCT	3.2	3.0
MET-26	1KCT	1KCT	3.0
MET-27	1KCT	600CT	3.0
MET-28	1K	50	3.0
MET-29+	900CT	600	3.0
MET-30	800CT	3.2	3.0
MET-31+	600CT	600CT	3.0
MET-32+	600	600CT or 150*	3.0
MET-33	600CT	250CT	3.0
MET-34	600CT	12	4.5
MET-35	600CT	8	4.5
MET-36	600CT	3.2	4.5
MET-37	500CT	600	3.0
MET-38	500	500CT or 125*	3.0
MET-39	500	50	3.0
MET-40	320CT	3.2	6.0
MET-41	300CT	600	7.0
MET-42	150	12	10.0
MET-43	120CT	3.2	10.0
MET-44	300CT	12.0	7.0
MET-45	10K	10KCT or 2.5K*	1.0
MET-46+	600	600	3.0
MET-48	200K	1K	0
METC-99	Mu-Metal Magnetic Shield		

*As parallel or split winding connection
+Meets **FCC PART 68** requirements and 1000V RMS Pri to Sec Hipot Test

INDUCTORS-MEI SERIES

PART NO.	INDUCTANCE Hy @ 300Hz	DCR ohms	DCMA
MEI-01	6 at 15V	1800	2.0
MEI-02	3.5 at 5V	1200	2.0
MEI-03	1.25 at 3V	180	2.0
MEI-04	0.3 at 3V	40	4.0
MEI-05	0.1 at 3V	15	5.0

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TTC SERIES — MEETS FCC PART 68 FOR TELECOMMUNICATION APPLICATIONS
COUPLING TRANSFORMERS - HYBRID TRANSFORMERS - HOLDING COILS

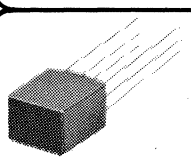


FIG. 1

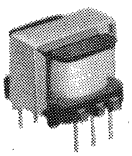


FIG. 2, 3, 4

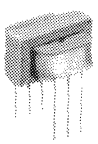


FIG. 5 & 6M

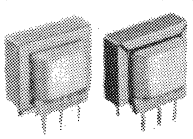


FIG. 6

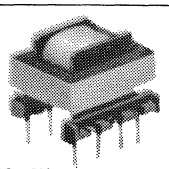


FIG. 6H

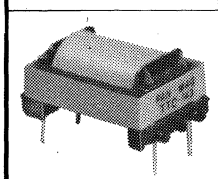


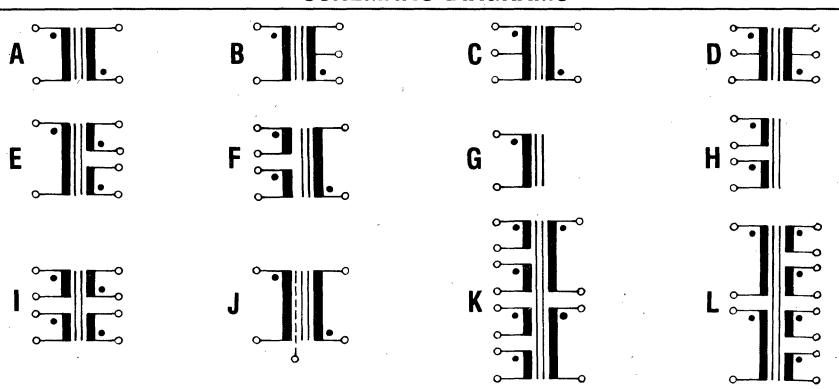
FIG. 7H

PERFORMANCE SELECTOR — CALL PAN-MAG FOR COMPLETE SPECIFICATIONS

STYLE FIG.	MODEL NUMBER	IMPEDANCE (OHMS) PRI : SEC	MADC UNBAL.	I.L. dB	F.R. ±dB	CKT. DIA.	FEATURES (CROSS REF.)
1	MET-46	600:600	3	1.5	1.0	A	1500V RMS HIPOT
1	MET-32	600:600CT*	3	1.5	1.2	E	300Hz TO 100KHz
1	MET-31	600CT:600CT	3	1.5	1.0	D	(TRIAD SP-67)
1	MET-29	900CT:600	3	1.5	1.0	C	—
1	METC-99	MU METAL SHIELD				—	EMI SLIP-ON CAN
2	TTC-170	600:600	0	1.7	0.7	A	0.385" TYP. HT.
2	TTC-170-2	600:600CT*	0	1.7	0.7	E	—
2	TTC-170-1	600CT:600CT	0	1.7	0.7	D	—
3	TTC-171	600:600	0	2.0	1.0	A	0.490" TYP. HT.
3	TTC-172	600:600CT	0	1.2	0.3	B	1 TO 1CT TURNS RATIO
3	TTC-135	600:S:600	0	1.3	0.3	J	W/STATIC SHIELD
3	TTC-171-1	600CT:600CT	0	2.0	1.0	D	—
3	TTC-152	600CT:1200CT	0	1.2	0.3	D	W/PC MTG FRAME**
3	TTC-167	10K:10K	0	1.4	0.7	A	—
4	TTC-173	600:600	0	1.5	0.7	A	0.630" TYP. HT.
4	TTC-173-1	600CT:600CT	0	1.5	0.7	D	—
5	TTC-02	600:600	0	1.2	0.4	A	0.490" MAX. HT.
5	TTC-118	600:600	0	0.8	0.3	A	(MICROTRAN T1104)
5	TTC-177	600:S:600	0	0.8	0.5	J	—
5	TTC-03	600CT:600CT	0	0.8	0.3	D	(STANCOR TTPC-03)
5	TTC-04	600:900	0	1.0	0.3	A	—
5	TTC-05	4000:600	0	1.0	0.3	A	BRIDGING CIRCUIT
5	TTC-06	10KCT:10KCT	0	1.0	0.3	D	—
6M	TTC-180	600:S:600	0	0.8	0.2	J	0.630" MAX. HT.
6M	TTC-161	600:S:600CT	0	0.7	0.2	J	SEC. AS IN DIA. B
6M	TTC-103	600:600CT*	0	1.1	0.3	E	—
6M	TTC-103-1	600CT:600CT	0	1.1	1.4	D	LOW COST
6M	TTC-100-1	600CT:600CT	0	0.7	0.2	D	—
6M	TTC-100	600CT:600CT*	0	0.7	0.2	E	PRI. AS IN DIA. C
6	TTC-110	600:600	0	0.8	0.3	A	(MIDCOM 671-0064)
6	TTC-114	600:600	0	1.2	0.3	A	—
6	TTC-145	600:600	100	2.3	3.0	A	(MPI A19N-HH-1A/1)
6	TTC-105	600:600	90	2.0	3.0	A	LOW COST
6	TTC-105-1	600:600CT	90	2.0	3.0	B	FOR SMART MODEM
6	TTC-113-1	600CT:S:600	0	0.6	0.2	J	—
6	TTC-108	600CT:600CT	0	1.2	0.3	D	LOW COST
6	TTC-09	600CT:600CT	0	0.8	0.3	D	(DALE TA10-04)
6	TTC-140	600CT*:600	100	2.3	3.0	F	—
6	TTC-10	600:600/600	0	1.0	0.2	E	SINGLE HYBRID**
6	TTC-112	600:900	0	0.9	0.2	A	(JAMES 13648)
6	TTC-13	4000:600	0	0.9	0.3	A	(TRIAD TY-303P)
6H	TTC-175	600:600	0	1.2	0.3	A	0.055" TYP. HT.
6H	TTC-109	600:600	90	2.0	3.0	A	—
6H	TTC-109-1	600:600CT	90	2.0	3.0	C	(MICROTRAN T2112)
6H	TTC-109-2	600:600CT*	90	2.0	3.0	E	(STANCOR TTPC-13)
6H	TTC-175-1	600CT:600	0	1.0	0.3	F	(PREM SPT-131)
7H	TTC-142	600:600	90	1.8	2.0	A	0.500" MAX. HT.
7H	TTC-143	600:600	90	1.6	1.8	A	FOR HI-SPEED MODEM
7H	TTC-158	600:600	0	1.1	0.3	A	3750V Hipot for Europe
7H	TTC-178	600:S:600	90	2.0	2.0	J	—
7H	TTC-142-2	600:600CT*	90	1.8	2.0	E	—
7H	TTC-143-2	600:600CT*	90	1.6	1.8	E	—
7H	TTC-176-2	600:600CT*	50	1.0	1.4	E	(MICROTRAN T9317)
7H	TTC-142-1	600CT:600CT	90	1.8	2.0	D	—
7H	TTC-143-1	600CT:600CT	90	1.6	1.8	D	—
7H	TTC-174	600:600/600	50	1.0	1.4	E	SINGLE HYBRID**
7H	TTCC-7H	MU METAL SHIELD				—	EMI SLIP-ON CAN

Data, dimensions and cross references are offered as a guide only. Contact Pan-Mag for detailed specifications & samples to determine suitability for a particular application.

SCHEMATIC DIAGRAMS



DIMENSIONS MM

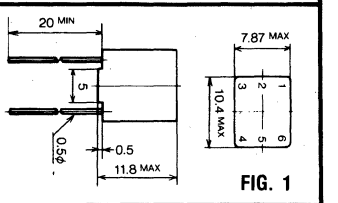


FIG. 1

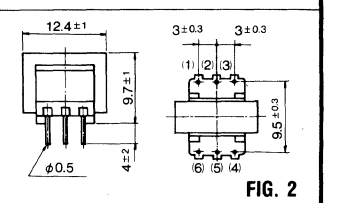


FIG. 2

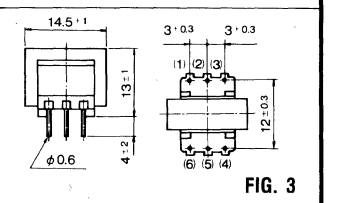


FIG. 3

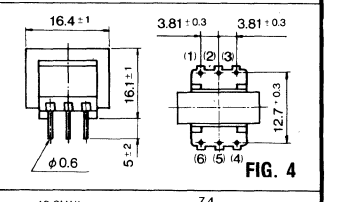


FIG. 4

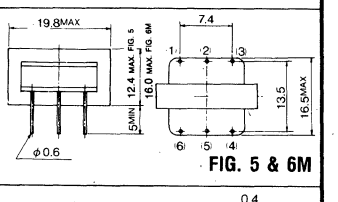


FIG. 5 & 6M

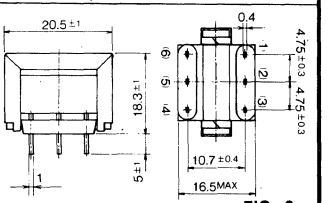


FIG. 6

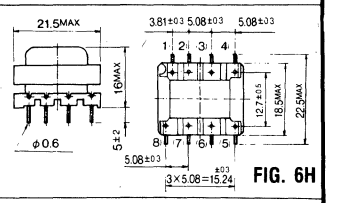


FIG. 6H

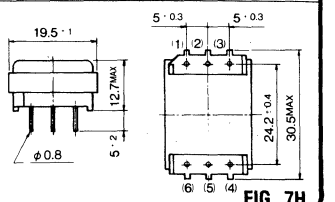


FIG. 7H

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TTC SERIES — MEETS FCC PART 68 FOR TELECOMMUNICATION APPLICATIONS
COUPLING TRANSFORMERS - HYBRID TRANSFORMERS - HOLDING COILS

DIMENSIONS MM

FIG. 8M

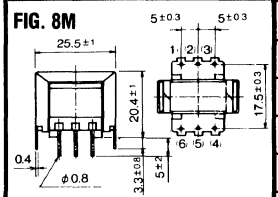


FIG. 8MH

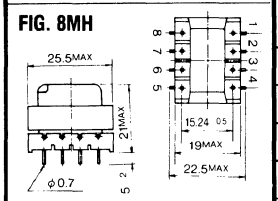


FIG. 9H2

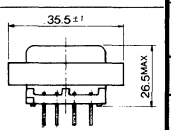
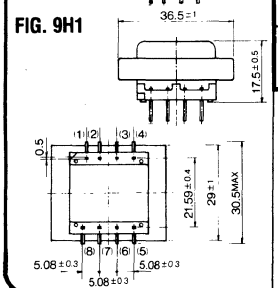


FIG. 9H1



PERFORMANCE SELECTOR — CALL PAN-MAG FOR COMPLETE SPECIFICATIONS

STYLE FIG.	MODEL NUMBER	IMPEDANCE (OHMS) PRI : SEC	MADC UNBAL	I.L. dB	F.R. ±dB	CKT. DIA.	FEATURES (CROSS REF.)
8	**TTC-101**	600:600/600	0	0.8	0.3	E	(TRIAD TY302P)**
8	**TTC-168**	600:600/600	0	0.6	0.1	E	(MIDCOM 671-0256)**
8H	**TTC-128**	PRI:1200-600-150CT SEC:600CT	3	0.7	0.1	Contact Factory	CENTRAL OFFICE LINE MATCHING
8M	**TTC-181-2**	600CT:600CT	0	1.0	0.2	D	
8M	**TTC-115**	600CT:600/600	0	0.9	0.4	E	LOW COST-SINGLE HYB.**
8MH	**TTC-182-2**	600CT*:600CT*	0	1.0	0.2	I	
8MH	**TTC-183-1**	600:600CT*	50	2.2	0.4	E	
9H1	**TTC-130**	600:600	90	1.8	0.3	A	HIGH SPEED MODEM
9H1	**TTC-164**	600:S:600	0	0.9	0.2	J	EUROPE BI-DIRECTIONAL
9H1	**TTC-131**	600:S:600	90	1.8	0.3	J	
9H2	**TTC-111-1**	600:600	0	0.7	0.3	A	F.R. @ 40Hz to 20KHz
9H2	**TTC-126-2**	600:600	90	0.8	0.6	A	
9H2	**TTC-126-3**	600:600/600	50	0.8	0.3	E	HI-PERFORM. HYBRID**
9H2	**TTC-126**	600CT*:600CT*	90	0.8	0.6	I	
9V	**TTC-119**	1.3HY HOLDING 2.0HY COIL	100 60			H	(DALE TA12-01) (TRIAD TY350P)
11H1	**TTC-122**	600:600	80	0.9	0.5	A	(PREM SPT-109)
11H1	**TTC-121**	600:600CT*	80	0.9	0.5	E	(MTC T5514)
11H1	**TTC-123**	900:600	80	0.9	0.6	A	(PREM SPT-111)
11H1	**TTC-127**	600CT*:600CT*	80	1.1	0.4	I	
11H1	**TTC-120**	1.4HY INDUCTOR	120			H	(MIDCOM 671-4031)
11H3	**TTC-160**	600:S:600	120	1.3	0.5	A	(PREM SPT-185)
11H4	**TTC-156**	600CT*:600	100	2.0	0.3	F	MINIMUM CROSSTALK
25H2	**TTC-125**	600:600	80	1.8	0.3	I	(PREM SPT-101)
25H2	**TTC-124**	600CT*:600	80	1.3	0.4	K	(PREM SPT-125)
25H3	**TTC-129**	600:600/600	80	1.5	0.4	L	HI-PERFORM. HYBRID**

NOTES: I.L. is typical insertion loss in dB measured at rated unbalanced MADC, 0dBm & 1000Hz.
F.R. is typ. freq. response in ±dB, 300 to 3500 Hz relative to 1000 Hz, at rated MADC & 0dBm.
CT* winding can be connected as a centertapped winding or as two isolated windings.
**Add 3dB to I.L. for single hybrid use with balancing network on two wire side.

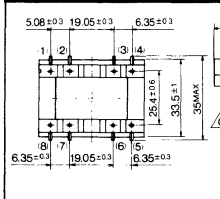


FIG. 11H1

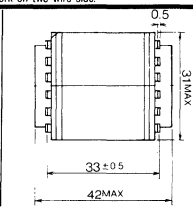
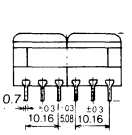


FIG. 25H2



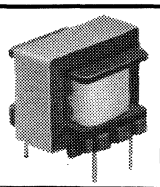


FIG. 8M

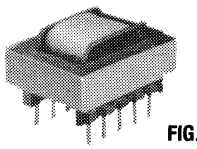


FIG. 8H

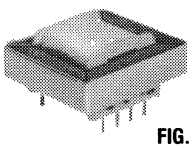


FIG. 9H1

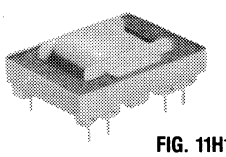


FIG. 11H1

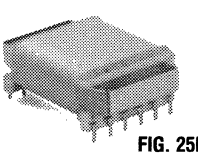


FIG. 25H2

FIG. 2F

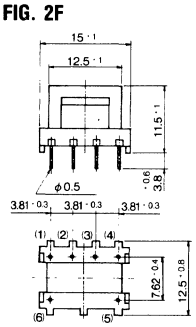
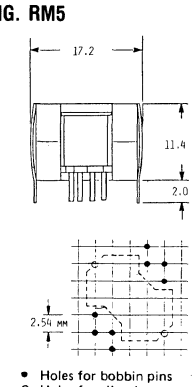


FIG. RM5



WIDE BAND & PULSE TRANSFORMERS FOR DATA, T-1 & DIGITAL CIRCUITS

STYLE FIG.	MODEL NUMBER	PRIMARY OCL	TURNS RATIO	PRI CPF	SEC LμH	DCR OHMS	CKT. DIA.	FEATURES (CROSS REF.)
G5	**G5J111P**	800μH	1:1:1	20	0.4	1.4:1.4:1.4	E	(PE 5762)
G5	**G52J21CP**	800μH	1:2CT	22	0.5	1.4:2.8	B	0.25" HT.
G5	**G53J21CP**	2.5MH	2:1CT	30	3.8	2.4:1.2	B	ENCAPSULATED
G5	**PHT-019**	2.5MH	2:1:1	14	1.5	1.2:0.8:0.8	E	(PE 5768)
G5	**G53E111P**	2.5MH	1:1:1	35	0.8	2.4:2.4:2.4	E	
G5	**PHT-027**	4.0MH	1CT:1CT	21	0.8	1.0:1.0	D	(TECHNITROL T1553-21)
G5	**PHT-036**	4.0MH	1CT:1.41CT	24	0.9	1.0:1.4	D	(TECHNITROL T1553-22)
G7	**G73H111P**	5.0MH	1:1:1	60	1.6	4.0:4.0:4.0	E	0.35" HT.
2F	**PHT-015**	600μH	4:1:4	12	19	0.6:0.2:0.6	E	
2F	**PHT-022**	650μH	1:1	20	0.8	0.7:0.7	A	(PE 2227X)
2F	**PHT-035**	2.5MH	1:1	8	40	3.5:3.5	A	
2F	**PHT-034**	2.5MH	1:1:1	30	5.0	2.0:2.0:2.0	E	(PE 2229X)
2F	**PHT-018**	5.0MH	1:1	27	14	7.0:8.0	A	
2F	**PHT-032**	7.0MH	1CT:1CT	30	19	2.4:2.8	D	
RM5	**PHT-023**	2.5MH	2.6CT:1	17	1.2	0.37:0.08	C	
RM5	**PHT-025**	12.5MH	1:1CT*	11	5.0	1.2:1.2	E	
EP7	**PHT-030**	11.0MH	1CT:2	8	10	1.6:3.8	C	
EP10	**PHT-031**	40.0MH	1:4	15	350	7.3:23	A	2500VAC HIPOT
2H	**TTC-165**	18.0MH	1CT*:1	10	4.0	2.5:2.6	F	
2H	**TTC-166**	18.0MH	1CT*:1.5	10	5.0	2.5:4.0	F	
3	**PHT-029**	1.7MH	1.2:1	80	4.0	0.28:0.13	A	
3	**TTC-157**	4.0MH	1CT:1	15	14	1.5:1.8	C	
6M	**TTC-169**	68.0MH	1CT:2	3	170	1.5:1.5	C	150CT TO 600 OHMS

NOTES: OCL=Primary typical open circuit inductance, i.e. on LC meter.
PRI/SEC CPF = Primary winding to secondary winding is capacitance in picofarad.
PRI/SEC LμH = Primary winding with secondary(s) shorted, leakage inductance in μH.

FIG. EP10

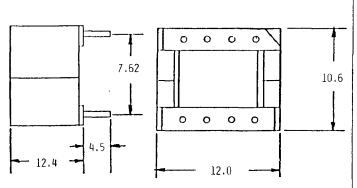
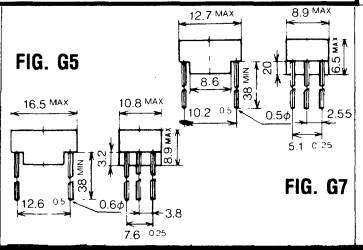


FIG. G5

FIG. G7



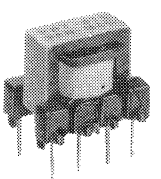


FIG. 2F

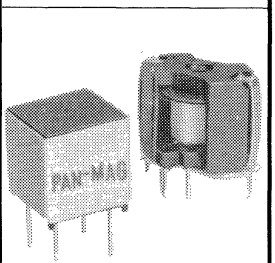


FIG. EP10 & RM5

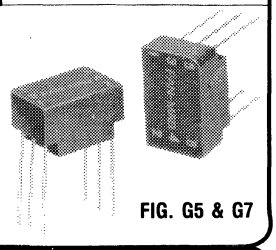
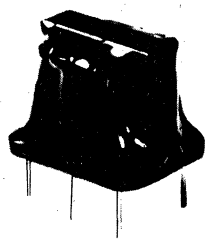


FIG. G5 & G7

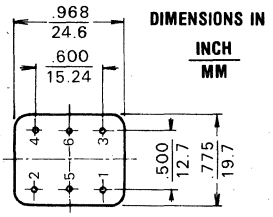
PAN-MAGNETICS INTERNATIONAL, INC.
455-A CARSON PLAZA DRIVE, CARSON, CA 90746 • (213) 532-1790 • TELEX: 664759 (PAN-MAG CRSN)

STT SERIES
ENCAPSULATED SCR & TRIAC TRIGGER TRANSFORMERS

The **STT SERIES TRIGGER TRANSFORMERS** are designed for low cost source isolation in half and full wave **SCR** or **TRIAC** control circuits. The **STT TRIGGER TRANSFORMERS** are encapsulated for environmental protection and pass **2600 V RMS** dielectric breakdown testing.



PART NUMBER	TURNS RATIO	PRIMARY "L" MH	LEAKAGE "L" μH	WDG. "C" PF	E.T. V-μSEC	D.C.R. OHMS (Max.)	DIA. NO.
STT-101	1:1	> 1.0	< 15	80	> 90	2.5/2.5	1
STT-102	1:1	> 5.0	< 50	80	>200	5.0/5.0	1
STT-103	1:1	>10.0	<100	80	>280	7.0/7.0	1
STT-104	1:1:1	> 1.0	< 25	80	> 90	2.5/2.5/2.5	2
STT-105	1:1:1	> 5.0	<100	80	>200	5.0/5.0/5.0	2
STT-106	1:1:1	>10.0	<200	80	>280	7.0/7.0/7.0	2
STT-107	2:1	> 1.0	< 20	80	> 90	2.5/1.5	1
STT-108	2:1	> 5.0	< 60	80	>200	5.0/2.5	1
STT-109	2:1	>10.0	<130	80	>280	7.0/3.5	1
STT-110	2:1:1	> 1.0	< 30	80	> 90	2.5/1.5/1.5	2
STT-111	2:1:1	> 5.0	<130	80	>200	5.0/2.5/2.5	2
STT-112	2:1:1	>10.0	<200	80	>280	7.0/3.5/3.5	2



MAX. HT. = .775 / 19.7

DIAGRAM 1

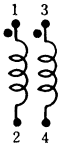
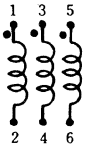


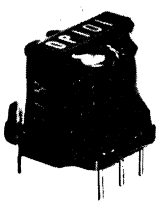
DIAGRAM 2



DP SERIES ENCAPSULATED AUDIO TRANSFORMERS

The **DP SERIES** of encapsulated audio transformers are cost effective for applications involving severe environments. Completely encapsulated, these small audio transformers eliminate environmental and board washing problems associated with open style transformers. The environmental quality of the **DP SERIES** is established through testing for humidity, immersion, solvent resistance and temperature cycling to the exacting reqirements of MIL-T-27. Several part numbers meet the requirements of **FCC PART 68** for telephone or modem applications. All **DP SERIES** audio transformers have frequency response characteristics within ±2dB from 200 Hz to 20 KHz.

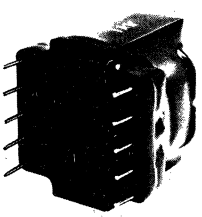
EI 19 DP SERIES



+ Meets requirements of **FCC PART 68**
*Insertion loss 0.9db typical and frequency response ±0.1db, 300 to 3400 Hz and with electrostatic shield.

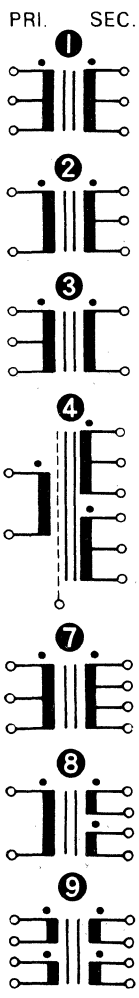
PART NUMBER	IMPEDANCE (Ω) PRI	IMPEDANCE (Ω) SEC	D.C.R. (Ω) PRI	D.C.R. (Ω) SEC	LEVEL (MAX.)	DCMA (MAX.)	REFER FIG	REFER DIA
DP-101+	600CT	600CT	38	48	15dbm	5	A	1
DP-103	600CT	1.2KCT	38	84	15dbm	5	A	1
DP-105+	4KCT	600CT	277	35	15dbm	1	A	1
DP-107	300	600CT	19	48	15dbm	5	A	2
DP-108+	600	600CT	38	48	15dbm	5	A	2
DP-111	1K	2KCT	53	152	15dbm	2	A	2
DP-114	2.5K	2.5KCT	172	220	15dbm	2	A	2
DP-116	4K	2KCT	277	160	15dbm	1	A	2
DP-118	8K	2KCT	500	143	15dbm	0.5	A	2
DP-119	10K	600CT	370	90	15dbm	0.5	A	2
DP-122	10K	10KCT	695	900	15dbm	0.5	A	2
DP-124	20K	4KCT	1900	305	15dbm	0.5	A	2
DP-126	1KCT	8	55	0.62	15dbm	2	A	3
DP-128+	600	600CT×2	37	42×2	15dbm	0	B	4
DP-129+*	600CT	600CT	26	34	15dbm	0	B	1*

EI 28 DP SERIES

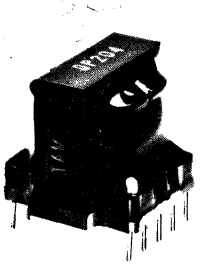


PART NUMBER	IMPEDANCE (Ω) PRI	IMPEDANCE (Ω) SEC	D.C.R. (Ω) PRI	D.C.R. (Ω) SEC	LEVEL (MAX.)	DCMA (MAX.)	REFER FIG	REFER DIA
DP-204+	600	600CT	36	50	28dbm	10	C	2
DP-208	4K	2KCT	250	145	28dbm	3	C	2
DP-210	200CT	4, 8, 16	10	0.4, 0.5, 0.7	28dbm	10	C	7
DP-214	600CT	4, 8, 16	32	0.4, 0.5, 0.7	28dbm	10	C	7
DP-220	1.3K	600/150	72	19×2	28dbm	6	C	8
DP-222+	500/125	500/125	19×2	22×2	28dbm	10	C	9
DP-222+	600/150	600/150	19×2	22×2	28dbm	10	C	9
DP-225+	4K/1K	600/150	63×2	20×2	28dbm	3	C	9
DP-226+	600	600CT×2	41	36×2	28dbm	0	C	4

SCHEMATIC DIAGRAMS



DP SERIES MECHANICAL DIAGRAMS



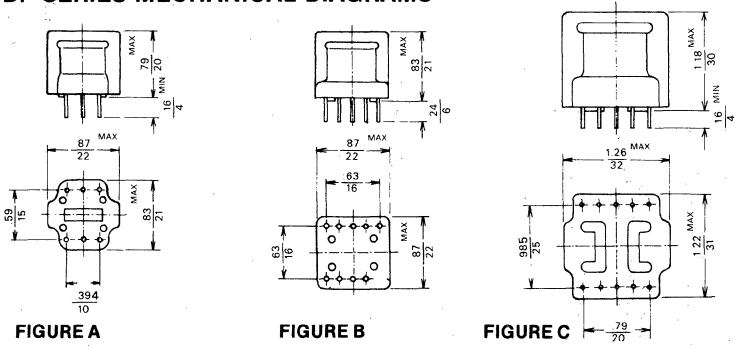


FIGURE A FIGURE B FIGURE C

PAN-MAGNETICS INTERNATIONAL, INC.
455-A CARSON PLAZA DRIVE, CARSON, CA 90746 • (213) 532-1790 • TELEX: 664759 (PAN-MAG CRSN)

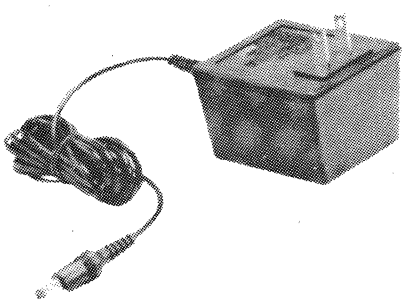
WALL PLUG-IN POWER SOURCES
AC-DC REGULATED OR UNREGULATED & AC-AC MODELS

UL-CSA UNREGULATED SERIES

INPUT: 120V 60Hz (ALL MODELS)

UL MODEL NUMBER	RATED OUTPUT VDC	RATED OUTPUT MADC	CSA
212A2212	3.0	150	LISTED
310A2210	3.0	200	LISTED
318A2213	3.0	600	COMPLY
416A2214	3.0	1000	LISTED
212A2143	3.3	300	LISTED
212A2220	4.5	150	LISTED
216A4222	4.5	350	COMPLY
318A4221	4.5	550	LISTED
416A2219	4.5	600	LISTED
820A2656	4.5	1500	COMPLY
825A2611	4.5	2000	N/A
212A2226	6.0	100	LISTED
310A2223	6.0	200	LISTED
318A2226	6.0	300	LISTED
318A4227	6.0	400	LISTED
416A2226	6.0	600	LISTED
420A4338	6.0	800	LISTED
820A4660	6.0	1200	COMPLY
825A2617	6.0	2000	N/A
521A4318	7.0	1200	LISTED
310A2223	7.5	100	LISTED
216A2134	7.5	200	COMPLY
420A2128	7.5	500	LISTED
212A2144	8.3	120	LISTED
318A4248	8.5	100	LISTED
212A2136	9.0	100	LISTED
318A2138	9.0	150	LISTED
216A4139	9.0	200	LISTED
420A2128	9.0	300	LISTED
416A4136	9.0	500	LISTED
820A4465	9.0	900	COMPLY
825A4620	9.0	1200	N/A
420A4246	10.0	500	LISTED
216A2045	12.0	100	COMPLY
318A2045	12.0	150	LISTED
318A4146	12.0	200	LISTED
416A2141	12.0	300	LISTED
420A4147	12.0	400	LISTED
420A4141	12.0	500	LISTED
820A4470	12.0	700	COMPLY
825A4425	12.0	900	N/A
521A4317	12.0	1000	LISTED
420A2249	14.0	350	LISTED
310A1941	18.0	50	LISTED
416A2045	18.0	100	COMPLY
420A4143	20.0	280	LISTED
318A4049	24.0	50	LISTED
811A4212	*	300	LISTED

*5 Switched Output Voltages: 3.0 - 4.5 - 6.0 - 7.5 - 9.0 VDC and Universal Output Plug



UL-CSA REGULATED SERIES

REGULATED TO LINE & LOAD CHANGES

UL MODEL NUMBER	RATED OUTPUT VDC	RATED OUTPUT REG	RATED OUTPUT MADC	CSA
420AR4301	3.0	0.5	400	COMPLY
416AR4242	4.5	0.5	400	LISTED
816AR4205	4.5	0.2	500	COMPLY
420AR4203	5.0	0.5	350	COMPLY
816AR4201	5.0	0.2	600	COMPLY
NEWAR4201	5.2	0.2	1000	COMPLY
420AR4204	6.0	0.5	300	COMPLY
420AR4207	6.0	0.5	400	COMPLY
816AR4202	6.0	0.2	500	COMPLY
420AR4008	7.5	0.5	600	LISTED
420AR4105	9.0	0.5	250	COMPLY
816AR4103	9.0	0.2	400	COMPLY
420AR4106	12.0	0.5	200	COMPLY
816AR4104	12.0	0.2	300	COMPLY
NEWAR4101	+12.0 / −12.0	0.2 / 0.2	250 / 250	COMPLY
NEWAR4102	+15.0 / −15.0	0.2 / 0.2	200 / 200	COMPLY

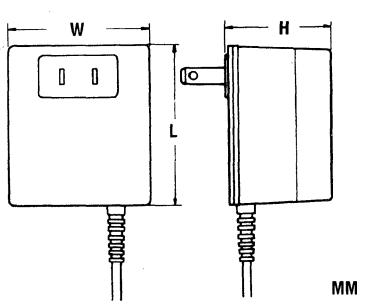
REG=TYPICAL OUTPUT DC VOLTAGE CHANGE AT 108V OR 132V INPUT LINE CONDITION

UL-CSA AC-AC SERIES CLASS II TRANSFORMERS

INPUT: 120V 60Hz (ALL MODELS)

UL MODEL NUMBER	RATED OUTPUT VAC	RATED OUTPUT MA RMS	CSA
310A0001	2.5	500	LISTED
420A0003	9.0	800	COMPLY
825A0004	9.0	1700	N/A
420A0001	11.0	600	LISTED
310A0002	12.0	110	COMPLY
825A0001	12.0	1300	N/A
NEWA5701	12.0	2000	N/A
NEWA6601	12.0	3300	N/A
816A0001	14.0	500	LISTED
420A0002	14.0	770	LISTED
825A0005	15.0	1000	N/A
818A0001	17.0CT	500	LISTED
825A0002	18.0	880	N/A
NEWA6602	18.0	2200	N/A
420A0004	24.0	300	COMPLY
420A0005	24.0	450	COMPLY
825A0003	24.0	660	N/A
NEWA5702	24.0	1000	N/A
NEWA6603	24.0	1670	N/A

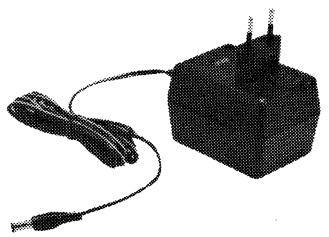
UL-CSA SERIES DIMENSIONS



MM

MODEL SERIES	L	W	H
212A, 216A	53	36	38
310A, 316A	60	45	42
416A, 420A	61	55	41
816A	81	59	52
820A, 825A	82	60	48

EUROPEAN VDE SERIES



VDE UNREGULATED SERIES

INPUT: 220V 50Hz (ALL MODELS)

VDE MODEL NUMBER	RATED OUTPUT VDC	RATED OUTPUT MADC	VDE
416F4211	3.0	300	COMPLY
818F4311	3.0	1000	COMPLY
310F2102	3.5	200	LISTED
310F2104	4.5	200	LISTED
416F4212	4.5	300	COMPLY
818F4315	4.5	1000	COMPLY
310F4107	6.0	200	LISTED
416F4215	6.0	300	COMPLY
818F4225	6.0	400	LISTED
818F4217	6.0	800	COMPLY
416F4117	7.5	300	COMPLY
818F4119	7.5	700	COMPLY
416F4119	9.0	300	COMPLY
818F4120	9.0	500	LISTED
818F4121	9.0	600	COMPLY
416F4020	12.0	200	COMPLY
818F4124	12.0	500	LISTED

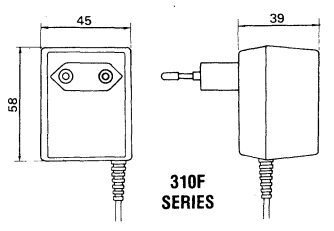
VDE REGULATED MODELS

818FR4202	3.0	1000	LISTED
818FR4103	4.5	500	LISTED
818FR4104	6.0	400	LISTED
818FR4106	7.5	400	LISTED
818FR4107	9.0	300	LISTED
818FR4109	12.0	250	LISTED

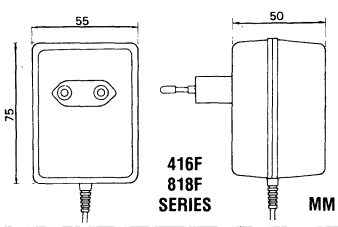
VDE AC-AC MODELS

VDE MODEL NUMBER	RATED OUTPUT VAC	RATED OUTPUT MA RMS	VDE
310F0001	4.5	300	LISTED
310F0002	6.0	250	LISTED
310F0006	9.5	150	LISTED
310F0007	12.0	100	LISTED

EUROPEAN SERIES DIMENSIONS



310F SERIES



416F
818F
SERIES

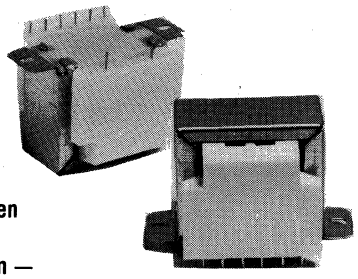
MM

PAN-MAGNETICS INTERNATIONAL, INC.
455-A CARSON PLAZA DRIVE, CARSON, CA 90746 • (213) 532-1790 • TELEX: 664759 (PAN-MAG CRSN)

PRINTED CIRCUIT BOARD POWER TRANSFORMERS THAT MEET INTERNATIONAL AND U.S. SAFETY REQUIREMENTS

PEP Series

FILE NO. TAMRADIO E59673



- UL 1411 Recognized.
- Meets IEC-65 & VDE Safety Standards.
- Physical Barriers Between Primary and Secondary.
- Double Protection System — 4000V Hipot.

PEP Series • 115V/230V • 50/60Hz Primary

FOR USE IN CONTROL AND POWER SUPPLY APPLICATIONS

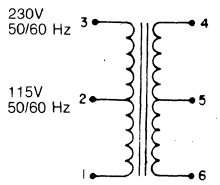
PART NO.	SECONDARY				CIRCUIT NO.	FIG. NO.
	PARALLEL CONNECTED		SERIES CONNECTED			
	V AC	A RMS	V AC	A RMS		
PEP28 x 0.7 VA SERIES						
10A006	(Single Secondary)		10.0 CT	.050	1-115V*	A
10A009			10.0 CT	.050	1-230V*	
10A007			16.0 CT	.031	1-115V*	
10A010			16.0 CT	.031	1-230V*	
10A008			24.0 CT	.021	1-115V*	
10A011			24.0 CT	.021	1-230V*	
PEP35 x 2.0 VA SERIES						
10B004	(Single Secondary)		10.0 CT	.110	1	A
10B005			12.6 CT	.090		
10B006			16.0 CT	.070		
11B001H			24.0 CT	.046		
11B002H			36.0 CT	.031		
PEP41 x 5.0 VA SERIES						
10C009	(Single Secondary)		10.0 CT	.350	1	B
10C010			12.6 CT	.280		
10C011			16.0 CT	.220		
10C012			24.0 CT	.150		
11C005H			36.0 CT	.100		
PEP48 x 9.5 VA SERIES						
11D014H	5.0	1.900	10.0 CT	.950	2	B
11D015H	6.3	1.500	12.6 CT	.750		
11D016H	8.0	1.200	16.0 CT	.600		
11D017H	12.0	.800	24.0 CT	.400		
11D018H	18.0	.520	36.0 CT	.260		
11D019H	28.0	.340	56.0 CT	.170		
PEP54 x 15 VA SERIES						
11E006H	5.0	2.500	10.0 CT	1.250	2	C
11E007H	6.3	2.000	12.6 CT	1.000		
11E008H	8.0	1.560	16.0 CT	.780		
11E009H	12.0	1.040	24.0 CT	.520		
11E010H	17.0	.700	36.0 CT	.350		
11E011H	28.0	.446	56.0 CT	.223		

PEP54 SERIES FOR 3-OUTPUT REGULATED AND UNREGULATED POWER SUPPLIES

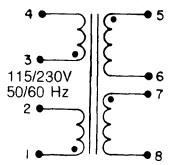
PART NO.	SECONDARY 1		SECONDARY 2		DC OUTPUT 1		DC OUTPUT 2		CIR. NO.	FIG. NO.
	V AC	A RMS	V AC	A RMS	CTFW Vdc	I mAdc	CTFW Vdc	I mAdc		
11E012H	9 CT	.800	24 CT	.300	+5	670	±15	170	3	C
11E013H	16 CT	.550	33 CT	.180	+9†	470	±21†	120	4	C

† +9Vdc and ±21 Vdc outputs are for input to +5 Vdc and ±15 Vdc IC Voltage Regulation (See Circuit 4)

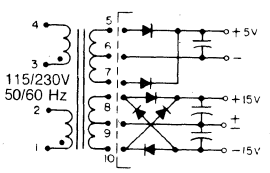
CIRCUIT SCHEMATICS



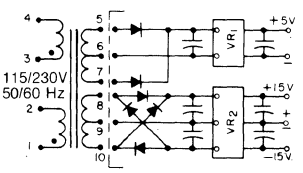
CIRCUIT 1



CIRCUIT 2



CIRCUIT 3



CIRCUIT 4

DIMENSIONS

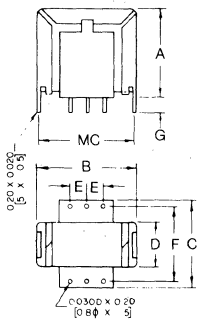


FIGURE A

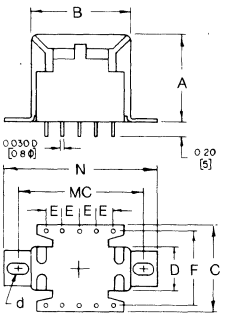


FIGURE B

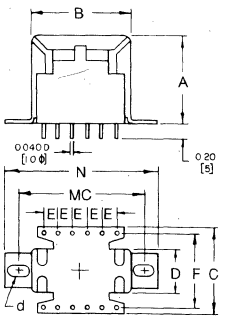


FIGURE C

DIMENSIONS • Inches (mm) WT • Oz. (Gm)

TYPE	A	B	C	MC	D	E	F	G	N	WT.
10A	1.10 (28)	1.16 (29.5)	1.32 (33.5)	1.12 (28.5)	0.50 (12.5)	.197 (5)	0.984 (25)	0.20 (5)	--	2.5 (70)
10B OR 11B	1.26 (32)	1.44 (36.5)	1.69 (43)	1.40 (35.5)	0.61 (15.5)	.295 (7.5)	1.380 (35)	0.24 (6)	--	4.5 (130)
10C OR 11C	1.42 (36)	1.67 (42.5)	1.91 (48.5)	2.05 (52)	0.85 (21.5)	.394 (10)	1.575 (40)	--	2.36 (60)	8 (230)
11D	1.69 (43)	1.99 (50.5)	2.05 (52)	2.32 (59)	1.08 (27.5)	.295 (7.5)	1.772 (45)	--	2.72 (69)	16 (450)
11E	1.93 (49)	2.22 (56.5)	2.09 (53)	2.72 (69)	1.08 (27.5)	.295 (7.5)	1.772 (45)	--	3.15 (80)	19 (540)

Note: d=PEP41 Series; 0.138 x 0.177 (3.5 x 4.5)
d=PEP48 and PEP54 Series; 0.177 x 0.256 (4.5 x 6.5)

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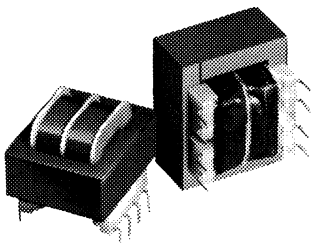
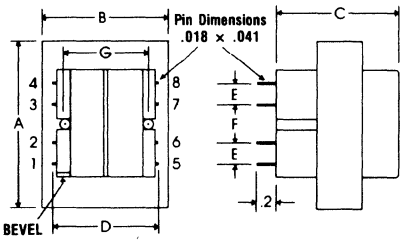
3F SERIES — 3 FLANGE BOBBIN PRINTED CIRCUIT BOARD POWER TRANSFORMERS

The **3F SERIES POWER TRANSFORMERS** are designed to include the most desirable features required for printed circuit board mounted applications. The 3F Series is constructed on a three flanged bobbin which is molded with UL listed material providing low capacitive coupling without electro-static shielding.



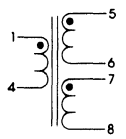
- **UL 1585 Class II & III Transformers — File No. E95844.**
- **UL General Purpose Transformers — File No. E91239.**
- **UL Class B Insulation System**

. . .**2500 VAC Hipot, Primary to Secondary Isolation**
. . .**115V Single or 115/230V Dual Primary**
. . .**Terminal Numbers are Molded on Bobbin.**
. . .**Complies with Most UL Safety Standards.**

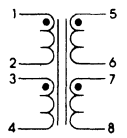


NOTE: #4 Clearance Hole — 2 Places

SCHEMATIC S
115V 50/60Hz



SCHEMATIC D
115/230V 50/60Hz



Note:
Pins 2 & 3 Omitted

3F SERIES PART NUMBER	DIMENSIONS							
	A	B	C	D	E	F	G	WT
3F(*)-2XX	1.38 / 35.0	1.16 / 29.5	0.94 / 23.9	1.200 / 30.48	0.250 / 6.350	0.250 / 6.350	N/A	0.17LB / 77.4GM
3F(*)-3XX	1.38 / 35.0	1.16 / 29.5	1.18 / 30.0	1.200 / 30.48	0.250 / 6.350	0.25 / 6.35	N/A	0.25LB / 114GM
3F(*)-4XX	1.62 / 41.0	1.31 / 33.0	1.31 / 33.3	1.280 / 32.51	0.250 / 6.350	0.350 / 8.890	1.062 / 26.97	0.44LB / 200GM
3F(*)-5XX	1.89 / 48.0	1.58 / 40.0	1.44 / 36.6	1.410 / 35.81	0.300 / 7.62	0.400 / 10.16	1.250 / 31.75	0.70LB / 319GM

DIMENSIONS SHOWN IN: INCH / MM

PART NUMBER	SECONDARY RATINGS - R.M.S.		VA
	SERIES	PARALLEL	
3F(*)-210	10.0VCT @ 0.110A	5.0V @ 0.220A	1.1
3F(*)-310	10.0VCT @ 0.250A	5.0V @ 0.500A	2.4
3F(*)-410	10.0VCT @ 0.600A	5.0V @ 1.200A	6.0
3F(*)-510	10.0VCT @ 1.200A	5.0V @ 2.400A	12.0
3F(*)-212	12.6VCT @ 0.090A	6.3V @ 0.180A	1.1
3F(*)-312	12.6VCT @ 0.200A	6.3V @ 0.400A	2.4
3F(*)-412	12.6VCT @ 0.500A	6.3V @ 1.000A	6.0
3F(*)-512	12.6VCT @ 1.000A	6.3V @ 2.000A	12.0
3F(*)-216	16.0VCT @ 0.070A	8.0V @ 0.140A	1.1
3F(*)-316	16.0VCT @ 0.150A	8.0V @ 0.300A	2.4
3F(*)-416	16.0VCT @ 0.400A	8.0V @ 0.800A	6.0
3F(*)-516	16.0VCT @ 0.800A	8.0V @ 1.600A	12.0
3F(*)-220	20.0VCT @ 0.055A	10.0V @ 0.110A	1.1
3F(*)-320	20.0VCT @ 0.120A	10.0V @ 0.240A	2.4
3F(*)-420	20.0VCT @ 0.300A	10.0V @ 0.600A	6.0
3F(*)-520	20.0VCT @ 0.600A	10.0V @ 1.200A	12.0
3F(*)-224	24.0VCT @ 0.045A	12.0V @ 0.090A	1.1
3F(*)-324	24.0VCT @ 0.100A	12.0V @ 0.200A	2.4
3F(*)-424	24.0VCT @ 0.250A	12.0V @ 0.500A	6.0
3F(*)-524	24.0VCT @ 0.500A	12.0V @ 1.000A	12.0
3F(*)-228	28.0VCT @ 0.040A	14.0V @ 0.080A	1.1
3F(*)-328	28.0VCT @ 0.085A	14.0V @ 0.170A	2.4
3F(*)-428	28.0VCT @ 0.200A	14.0V @ 0.400A	6.0
3F(*)-528	28.0VCT @ 0.420A	14.0V @ 0.840A	12.0
3F(*)-236	36.0VCT @ 0.030A	18.0V @ 0.060A	1.1
3F(*)-336	36.0VCT @ 0.065A	18.0V @ 0.130A	2.4
3F(*)-436	36.0VCT @ 0.170A	18.0V @ 0.340A	6.0
3F(*)-536	36.0VCT @ 0.350A	18.0V @ 0.700A	12.0
3F(*)-248	48.0VCT @ 0.023A	24.0V @ 0.046A	1.1
3F(*)-348	48.0VCT @ 0.050A	24.0V @ 0.100A	2.4
3F(*)-448	48.0VCT @ 0.125A	24.0V @ 0.250A	6.0
3F(*)-548	48.0VCT @ 0.250A	24.0V @ 0.500A	12.0
3F(*)-256	56.0VCT @ 0.020A	28.0V @ 0.040A	1.1
3F(*)-356	56.0VCT @ 0.045A	28.0V @ 0.090A	2.4
3F(*)-456	56.0VCT @ 0.110A	28.0V @ 0.220A	6.0
3F(*)-556	56.0VCT @ 0.220A	28.0V @ 0.440A	12.0
3F(*)-2120	120.0VCT @ 0.010A	60.0V @ 0.020A	1.1
3F(*)-3120	120.0VCT @ 0.020A	60.0V @ 0.040A	2.4
3F(*)-4120	120.0VCT @ 0.050A	60.0V @ 0.100A	6.0
3F(*)-5120	120.0VCT @ 0.100A	60.0V @ 0.200A	12.0

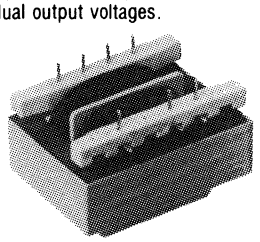
NOTE (*) Insert S for Single Primary 3F Series Transformer
Insert D for Double Primary 3F Series Transformer

3 FLANGE BOBBIN TRANSFORMER FOR UNREGULATED & REGULATED POWER SUPPLIES

The **LPP SERIES LOW-PROFILE PLUG-IN POWER TRANSFORMERS** offer the circuit designer a variety of options including dual output which may be connected in series or parallel, secondary voltages for unregulated or regulated power supplies, and dual output voltages.

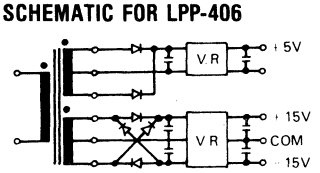
PART NUMBER	SECONDARY RATINGS - R.M.S.		DC OUTPUT	
	SERIES	PARALLEL	VDC	mADC
LPP-401	9.00VCT @ 0.50A	4.5V @ 1.00A	+5.0	600*
LPP-402	15.50VCT @ 0.33A	7.75V @ 0.66A	+5.0	380**
LPP-403	27.00VCT @ 0.19A	13.5V @ 0.38A	±15.0	115*
LPP-404	36.00VCT @ 0.14A	18.0V @ 0.28A	±15.0	70**
LPP-405	9.00VCT @ 0.24A	—	+5.0	200*
	24.00VCT @ 0.08A	—	±15.0	50*
LPP-406	15.50VCT @ 0.14A	—	+5.0	100**
	34.00VCT @ 0.06A	—	±15.0	25**
LPP-408†	15.50VCT @ 0.33A	7.75V @ 0.66A	—	—
LPP-411‡	11.00V @ 0.15A	(Single Secondary)	—	—
LPP-426‡	26.00V @ 0.10A	(Single Secondary)	—	—

*Unregulated DC Output **Regulated DC Output (MADC, typ., depends on regulator efficiency).
†115/230V-Series/Parallel Primary Winding.
‡115V input-connect line to Primary 1 with Primary 2 Open.
‡230V input-connect line across Primary 1 and 2 with Primary 1 and 2 in series.
‡These part numbers have thermal fuse internally connected to Primary 1.



TYPICAL SCHEMATIC FOR LPP-406

PRIMARY
115V ±10%
50/60Hz



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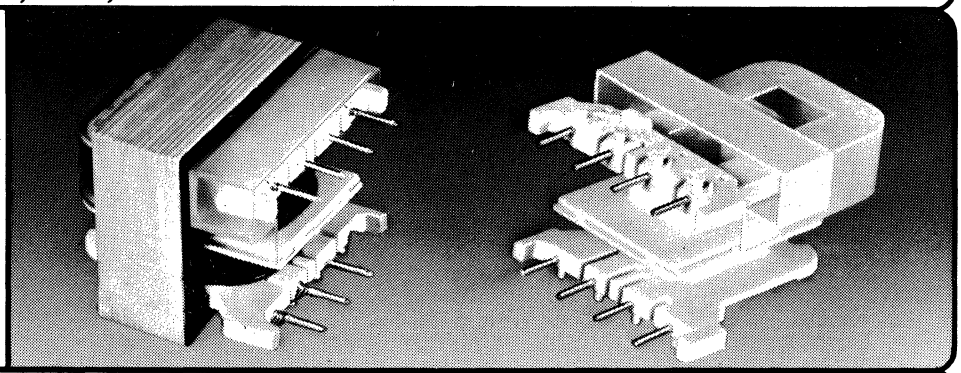
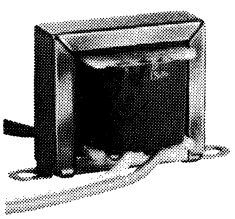
CUSTOM DESIGNED AUDIO AND POWER TRANSFORMERS
UL RECOGNIZED, CSA, EUROPEAN AND JAPANESE SAFETY STANDARDS

FILE NO.
TAMRADIO
E59673



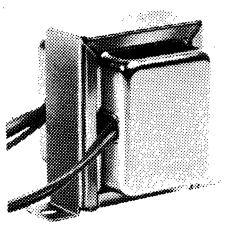
UL RECOGNIZED POWER TRANSFORMERS

PEY Series



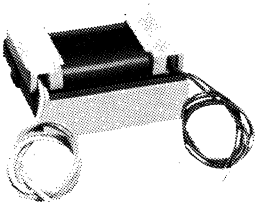
- Ratings — 1 to 80 VA
- Mounting Style
  - . . . Vertical Type
  - . . . Horizontal Type

PEWT Series



- Ratings — 2 to 35 VA
- Enclosed Construction with Metal End Bells

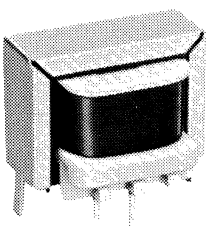
PMZF Series



- 10 to 80 VA
- Minimum Flux Field for CRT Applications
- Low Profile

AUDIO TRANSFORMERS

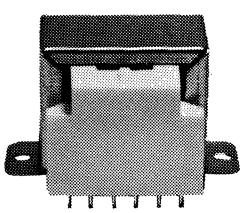
EPH Series



- Double Protection System
- 3500 VAC HiPot
- Isolation for TV Audio and Video External Connections

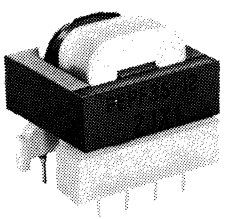
INTERNATIONAL POWER TRANSFORMERS — CSA — IEC — MITI — VDE — UL RECOGNIZED

PEP Series



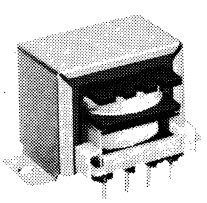
- Ratings — 0.7 to 15 VA
- 4000 VAC HiPot
- 30 P/Ns Stocked

PEPF Series



- Ratings — 0.7 to 6 VA

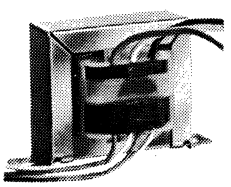
PEPY Series



- Ratings — 4 to 20 VA

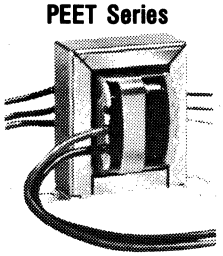
- Physical Barrier Between Primary, Secondary and Core

PEE Series



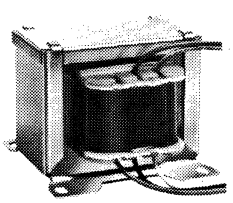
- Ratings — 0.7 to 40 VA
- 8mm Creepage
- 4000 VAC HiPot

PEET Series



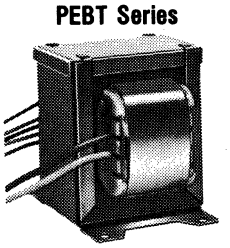
- Ratings — 0.7 to 40 VA
- 8mm Creepage
- 4000 VAC HiPot

PEB Series



- Horizontal Mounting

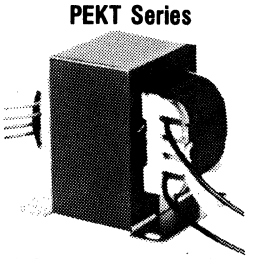
PEBT Series



- Vertical Mounting

- Ratings — 70 to 300 VA
- CU Flux Shorting Band
- Concentric Wound Coils "CY Type" Bobbin Construction

PEKT Series



- Ratings — 70 to 200 VA
- Welded Stack
- Shielded Core to Reduce Stray Field

PAN-MAGNETICS INTERNATIONAL, INC.
455-A CARSON PLAZA DRIVE, CARSON, CA 90746 • (213) 532-1790 • TELEX: 664759 (PAN-MAG CRSN)

PARALINE
TRANSFORMER SPECIALISTS

PARALINE SS SERIES

THE PARALINE SS SERIES PROVIDES YOU WITH A WIDE RANGE OF SELECTION IN SMALL 117V PRIMARY POWER TRANSFORMERS (50-60 Hz) FROM SHELF STOCK.

AVAILABLE VOLTAGES CENTER TAPPED AND CURRENT RATINGS IN AMPS OF ALL SERIES SS TRANSFORMERS

VOLTS C/T	AMPERES						
	SIZE 3	SIZE 4	SIZE 5	SIZE 6	SIZE 7	SIZE 8	SIZE 9
4	.100	.50	1.2	2.8	5.2	10	14
6.3	.060	.32	.80	1.7	3.5	7.0	10
8	.050	.28	.60	1.4	2.8	5.0	7.0
10	.045	.20	.50	1.0	2.0	4.0	5.6
12.6	.040	.17	.40	.90	1.7	3.6	4.5
14	.040	.15	.35	.80	1.5	3.2	4.0
16	.038	.13	.32	.70	1.3	3.0	3.7
18	.035	.12	.30	.60	1.2	2.8	3.5
20	.032	.11	.27	.55	1.1	2.6	3.2
22	.030	.10	.25	.50	1.0	2.4	3.0
24	.027	.095	.22	.45	.95	2.2	2.7
26	.025	.090	.20	.40	.90	2.0	2.5
28	.022	.080	.18	.38	.85	1.8	2.2
30	.020	.070	.17	.36	.80	1.7	2.0
32	.018	.065	.16	.34	.75	1.6	1.9
34	.017	.060	.15	.32	.70	1.5	1.8
36	.016	.055	.14	.30	.65	1.4	1.7
40	.015	.050	.13	.27	.55	1.3	1.6
44	.014	.050	.12	.25	.50	1.2	1.5
48	.013	.045	.11	.22	.47	1.1	1.3
52	.012	.040	.10	.20	.45	1.0	1.2
56	.011	.040	.09	.19	.42	.90	1.1
60	.010	.035	.08	.18	.40	.80	1.0
66	.009	.030	.077	.17	.37	.75	.90
72	.008	.027	.070	.15	.35	.70	.85
80	.007	.025	.066	.14	.28	.65	.80
88	.007	.024	.060	.13	.25	.60	.70
96	.006	.022	.055	.11	.23	.55	.65
104	.006	.020	.050	.10	.22	.50	.60
120	.005	.017	.040	.09	.20	.40	.50
140		.014	.035	.08	.17	.35	.40
160		.012	.030	.07	.14	.30	.35
180		.011	.260	.06	.12	.26	.30
200		.010	.022	.05	.11	.22	.28
230		.010	.020	.05	.10	.20	.26

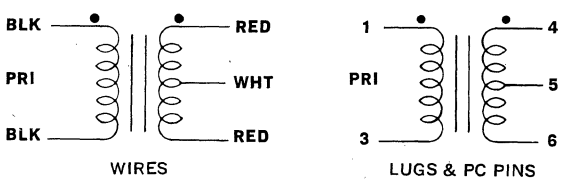
Case A Available in sizes 4, 5, 6, 7, 8 & 9 (Lead Wires)
Case B Available in sizes 4, 5 & 6 (Lugs)
Case C Available in sizes 3, 4, 5 & 6 (6 Pin P.C.)
Case D Available in sizes 4, 5 & 6 (Lugs)

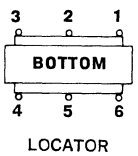
SS SERIES DIMENSIONAL DATA

CASE	SIZE	WIDTH (A)	LENGTH (B)	HEIGHT (C)	MOUNTING CENTERS (D)	PIN CENTERS (JXK)
A	4	1.20	2.10	1.19	1.75	
A	5	1.37	2.38	1.38	2.00	
A	6	1.42	2.83	1.63	2.38	
A	7	1.70	3.25	1.94	2.83	
A	8	2.00	3.88	2.25	3.13	
B	4	1.07	1.83	1.42	1.50	
B	5	1.25	2.00	1.68	1.72	
B	6	1.38	2.38	1.93	2.00	
C	3	0.93	1.10	0.88		.78x.40
C	4	1.15	1.38	1.19		1.0x.63
C	5	1.25	1.63	1.38		1.1x.80
C	6	1.44	1.88	1.63		1.3x.80
D	4	1.07	2.10	1.19	1.75	
D	5	1.25	2.38	1.38	2.00	
D	6	1.38	2.83	1.63	2.38	

REFER TO SS SERIES TRANSFORMERS BY PART NUMBERS. CASES ARE ILLUSTRATED ON LAST PAGE.
SAMPLE: SS-A-4-12.6

SCHEMATICS





PARALINE DS SERIES

THE PARALINE DS SERIES PROVIDES YOU WITH GOOD OFF THE SHELF SELECTION OF 115/230 VOLT 50-60 Hz POWER TRANSFORMERS WITH DUAL SECONDARIES.

AVAILABLE TOTAL SERIES VOLTAGES AND CURRENT RATINGS OF SECONDARIES

VOLTS (SERIES)	AMPERES					
	SIZE 8	SIZE 9	SIZE 10	SIZE 11	SIZE 12	SIZE 13
8	6.0	8.5	12	17	24	30
10	5.0	7.0	10	14	20	24
12.6	4.0	5.6	8.0	11	16	19
14	3.5	5.0	7.0	10	14	17
16	3.0	4.4	6.2	8.7	12	15
18	2.8	3.9	5.5	7.7	11	13
20	2.5	3.5	5.0	7.0	10	12
22	2.3	3.2	4.5	6.3	9.0	11
24	2.0	2.9	4.1	5.8	8.3	10
26	1.9	2.7	3.8	5.4	7.8	9.2
28	1.8	2.5	3.6	5.0	7.1	8.5
30	1.7	2.3	3.3	4.6	6.6	8.0
32	1.6	2.2	3.1	4.3	6.2	7.5
34	1.5	2.0	2.9	4.1	5.8	7.0
36	1.4	1.9	2.7	3.8	5.5	6.6
40	1.3	1.7	2.5	3.5	5.0	6.0
44	1.1	1.6	2.2	3.1	4.5	5.4
48	1.0	1.4	2.1	2.9	4.1	5.0
52	1.0	1.3	1.9	2.7	3.8	4.6
56	.90	1.2	1.8	2.5	3.5	4.2
60	.80	1.1	1.7	2.3	3.3	4.0
66	.75	1.0	1.5	2.1	3.0	3.6
72	.70	1.0	1.4	1.9	2.7	3.3
80	.63	.90	1.2	1.7	2.5	3.0
88	.56	.80	1.1	1.6	2.2	2.7
96	.52	.70	1.0	1.4	2.0	2.5
104	.48	.66	.95	1.3	1.9	2.3
120	.42	.58	.83	1.1	1.6	2.0
140	.36	.50	.71	1.0	1.4	1.7
160	.31	.43	.62	.87	1.2	1.5
180	.28	.38	.55	.77	1.1	1.3
200	.25	.35	.50	.70	1.0	1.2
230	.22	.30	.43	.60	.86	1.0

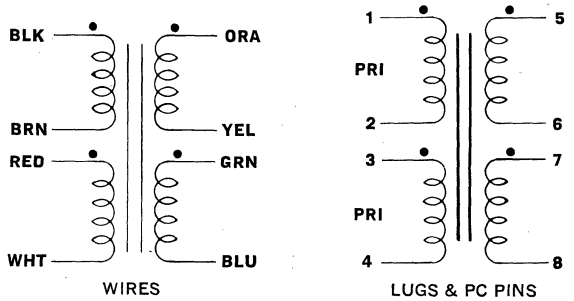
DS SERIES TRANSFORMER SIZES 8 AND 9 ARE AVAILABLE IN STYLES:
"A" (with lead wires)
"B" (with lugs)
"D" (with lugs)

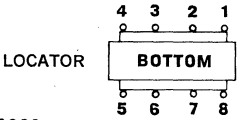
DS SERIES TRANSFORMER SIZES 10 THRU 13 ARE AVAILABLE IN STYLES:
"F" (with lead wires)
"G" (with lugs)
"H" (with lugs)

DS SERIES DIMENSIONAL DATA

CASE	SIZE	A	B	C	D	E	F	G
A	8	2.00	3.70	2.25	3.13		2.70	.19
A	9	2.30	4.00	2.56	3.56		3.06	.19
B	8	2.00	3.13	2.70	2.81		2.27	.19
B	9	2.30	3.56	3.06	3.13		2.56	.19
D	8	2.00	3.70	2.25	3.13		2.70	.19
D	9	2.30	4.00	2.56	3.56		3.06	.19
F	10	3.38	2.50	2.81	2.81	2.13	2.69	.2x.37
F	11	3.75	2.80	3.13	3.13	2.25	2.81	.2x.37
F	12	4.13	3.00	3.44	3.44	2.38	2.94	.2x.37
F	13	4.50	3.30	3.75	3.75	2.50	3.06	.2x.37
G	10	2.81	2.50	3.38	2.25	2.13	2.69	.2x.37
G	11	3.13	2.80	3.75	2.50	2.25	2.81	.2x.37
G	12	3.44	3.00	4.13	2.75	2.38	2.94	.2x.37
G	13	3.75	3.30	4.50	3.00	2.50	3.06	.2x.37
H	10	3.38	2.50	2.81	2.81	2.13	2.69	.2x.37
H	11	3.75	2.80	3.13	3.13	2.25	2.81	.2x.37
H	12	4.13	3.00	3.44	3.44	2.38	2.94	.2x.37
H	13	4.50	3.30	3.75	3.75	2.50	3.06	.2x.37

SCHEMATICS





PARALINE, 511 South Palm Avenue, Alhambra, CA 91803 • Telephone (818) 281-0222

PARALINE
TRANSFORMER SPECIALISTS

PARALINE DS SERIES

THE PARALINE DS SERIES IS AVAILABLE IN SIZES 4, 5, & 6 WITH DUAL PRIMARY AND DUAL SECONDARY 8 PIN PRINTED CIRCUIT CONFIGURATION.

AVAILABLE TOTAL SERIES VOLTAGES AND CURRENT RATINGS OF SECONDARIES.

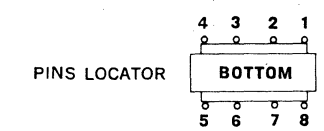
VOLTS (SERIES)	AMPERES		
	SIZE 4	SIZE 5	SIZE 6
4	.50	1.2	2.8
6.3	.32	.80	1.7
8	.28	.60	1.4
10	.20	.50	1.0
12.6	.17	.40	.90
14	.15	.35	.80
16	.13	.32	.70
18	.12	.30	.60
20	.11	.27	.55
22	.10	.25	.50
24	.095	.22	.45
26	.090	.20	.40
28	.080	.18	.38
30	.070	.17	.36
32	.065	.16	.34
34	.060	.15	.32
36	.055	.14	.30
40	.050	.13	.27
44	.050	.12	.25
48	.045	.11	.22
52	.040	.10	.20
56	.040	.09	.19
60	.035	.08	.18
66	.030	.077	.17
72	.027	.070	.15
80	.025	.066	.14
88	.024	.060	.13
96	.022	.055	.11
104	.020	.050	.10
120	.017	.040	.09
140	.014	.035	.08
160	.012	.030	.07
180	.011	.026	.06
200	.010	.022	.05
230	.010	.020	.05

DS SERIES DIMENSIONAL DATA

CASE	SIZE	A	C	F	H	J	K
C	4	1.15	1.19	1.38	.20	1.0	.60
C	5	1.25	1.38	1.63	.25	1.1	.75
C	6	1.44	1.63	1.88	.25	1.3	.75

REFER TO DS SERIES TRANSFORMERS BY PART NUMBERS.

SAMPLE: DS — C — 4 — 12.6
SERIES
STYLE
SIZE
TOTAL SERIES VOLTS



Paraline manufactures a wide variety of power transformers. They are stocked in 11 different sizes with 32 available secondary voltages totaling over 1600 different types.

There are five general series designations, each series designed to suit the requirements of your particular application.

A brief description of each series is as follows:

- The "SS" series has a single 115V primary and a single center-tapped secondary. Also available with a 230V primary.
- The "CS" series has a single 115V primary and two identical and separate secondaries. Also available with a 230V primary.
- The "DS" series has dual primaries for 115V or 230V operation and two identical and separate secondaries.
- The "MS" series has dual primaries for 115V or 230V operation and two center-tapped secondaries designed for 5V and 15V logic and OP amp power supplies.
- The "TT" series includes a number of coupling transformers, holding coils, and telephone associated devices for use in interconnective data modem terminals.

All Paraline stock power transformers may be used for 50 Hz or 60 Hz applications.

PARALINE CS SERIES

THE PARALINE CS SERIES WITH STANDARD 117V (50-60 Hz) PRIMARIES IS AVAILABLE FROM STOCK WITH SINGLE PRIMARY AND DUAL SECONDARY 6 PIN PRINTED CIRCUIT CONFIGURATION.

AVAILABLE TOTAL SERIES VOLTAGES AND CURRENT RATINGS OF SECONDARIES

VOLTS (SERIES)	AMPERES		
	SIZE 4	SIZE 5	SIZE 6
4	.50	1.2	2.8
6.3	.32	.80	1.7
8	.28	.60	1.4
10	.20	.50	1.0
12.6	.17	.40	.90
14	.15	.35	.80
16	.13	.32	.70
18	.12	.30	.60
20	.11	.27	.55
22	.10	.25	.50
24	.095	.22	.45
26	.090	.20	.40
28	.080	.18	.38
30	.070	.17	.36
32	.065	.16	.34
34	.060	.15	.32
36	.055	.14	.30
40	.050	.13	.27
44	.050	.12	.25
48	.045	.11	.22
52	.040	.10	.20
56	.040	.09	.19
60	.035	.08	.18
66	.030	.077	.17
72	.027	.070	.15
80	.025	.066	.14
88	.024	.060	.13
96	.022	.055	.11
104	.020	.050	.10
120	.017	.040	.09
140	.014	.035	.08
160	.012	.030	.07
180	.011	.026	.06
200	.010	.022	.05
230	.010	.020	.05

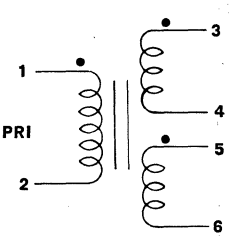
CS SERIES DIMENSIONAL DATA

CASE	SIZE	A	C	F	H	J	K
C	4	1.15	1.19	1.38	.31	1.0	.63
C	5	1.25	1.38	1.63	.40	1.1	.80
C	6	1.44	1.63	1.88	.40	1.3	.80

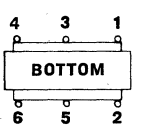
REFER TO CS SERIES TRANSFORMERS BY PART NUMBERS.

SAMPLE: CS — C — 4 — 12.6
SERIES
STYLE
SIZE
TOTAL SERIES VOLTS

SCHEMATIC



PINS



PINS LOCATOR

PARALINE TRANSFORMER SPECIALISTS

PARALINE MS SERIES

8 PIN P.C. WITH SINGLE 120V PRIMARY. (Fig. 1)

PART NUMBER	SEC. #1 V/CT	MA.	SEC. #2 V/CT	MA.
MSC4-924	9.0	70	24	30
MSC5-924	9.0	240	24	70
MSC6-924	9.0	480	24	150
MSC4-1632	16	50	32	18
MSC5-1632	16	140	32	55
MSC6-1632	16	280	32	100

12 PIN P.C. LOW PROFILE DUAL 120V PRIMARIES WITH 100V TAPS. (Fig. 2)

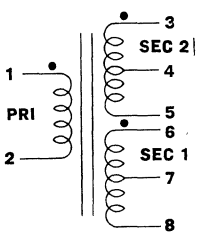
PART NUMBER	SEC. #1 V/CT	MA.	SEC. #2 V/CT	MA.
MSL4-9024	9.0	70	24	28
MSL5-9024	9.0	240	24	70
MSL6-9024	9.0	480	24	150
MSL7-9024	9.0	800	24	280
MSL4-16032	16	50	32	18
MSL5-16032	16	140	32	55
MSL6-16032	16	280	32	100
MSL7-16032	16	500	32	180

12 LUGS CASE 'H' DUAL 120V PRIMARIES WITH 100V TAPS. (Fig. 3)

PART NUMBER	SEC. #1 V/CT	AMPS	SEC. #2 V/CT	AMPS
MSH10-16032	16	3.8	32	1.2
MSH11-16032	16	5.0	32	1.8
MSH12-16032	16	7.0	32	2.5
MSH13-16032	16	9.0	32	3.0

SCHEMATICS

FIG. 1



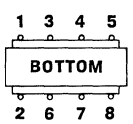
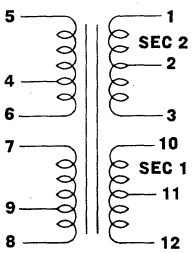


FIG. 2



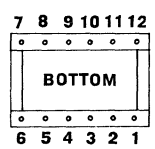
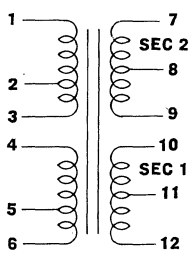
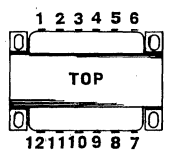


FIG. 3





PARALINE TT SERIES

TRANSFORMERS FOR DATA MODEM TERMINALS DESIGNED TO EXCEED 1200 VAC BREAKDOWN REQUIREMENTS.
FREQUENCY RESPONSE: 300-3500 Hz (TOL. 0.5 DB)
LEVEL: −45DBM TO +7DBM
DISTORTION: 0.4% MAX.
IMPEDANCE: ±10%
RETURN LOSS: 26 DB MIN.

PART NUMBER	PRI. IMP.	SEC. IMP.	FIG.
TTC2-07	600	600	1
TTC3-6549	600	600	1
TTC3-7222	600	600 +900	2
TTC4-7226	600	600	1
TTC4-7657	600	600 +900	2
TTC4-18	Holding Coil 1.3 Hy. @ 100 MA. DC.		—

WIDE RANGE AUDIO MATCHING TRANSFORMERS.
FREQUENCY RESPONSE: 20 Hz (TOL. 2 DB)
LEVEL: 5DBM

PART NUMBER	PRI. IMP.	SEC. IMP.	FIG.
TTC2-8746	400	40K	3
TTC2-8750	200	40K	1
TTC2-8758	200/CT/50	50K	3
TTC2-8761	600/CT/150	50K	3
TTC2-8762	250/CT/62	50K	3
TTC2-8763	50/CT/12	50K	3
TTC2-8772	150	60K	1

SCHEMATICS

FIG. 1

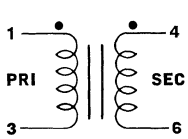


FIG. 2

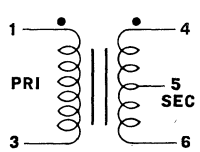
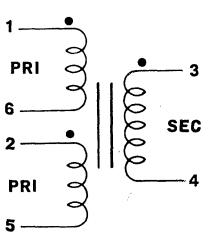
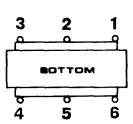
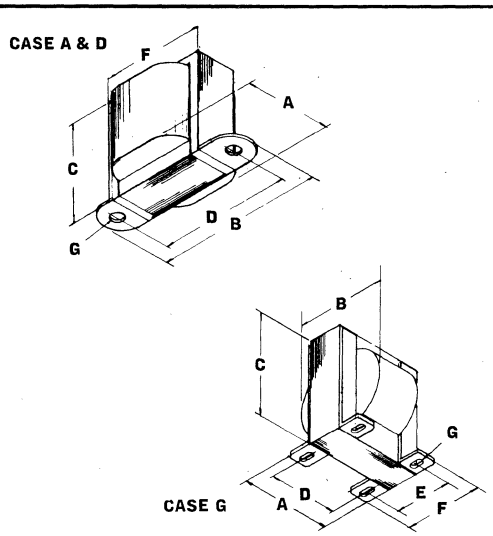


FIG. 3





PINS LOCATOR



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PARALINE
TRANSFORMER SPECIALISTS

The Paraline DLP & MLP Series are available in sizes 4, 5, & 6 with dual primary and dual secondary 12 pin printed circuit configuration. All have 2 separate center tap secondaries.

Available total series voltages and current ratings of secondaries.

DLP SERIES

VOLTS (Series)	AMPERES		
	Size 4	Size 5	Size 6
5	.46	1.10	2.3
6.3	.36	.87	1.8
8	.28	.68	1.4
10	.23	.55	1.1
12.6	.18	.43	.91
14	.16	.39	.82
16	.14	.34	.71
18	.12	.30	.63
20	.11	.27	.57
22	.10	.25	.52
24	.095	.22	.47
26	.088	.21	.44
28	.082	.19	.41
30	.076	.18	.38
32	.071	.17	.35
34	.067	.16	.33
36	.063	.15	.31
40	.057	.13	.28
44	.052	.12	.26
48	.047	.11	.23
52	.044	.10	.22
56	.041	.098	.20
60	.038	.091	.19
66	.034	.083	.17
72	.031	.076	.15
80	.028	.068	.14
88	.026	.062	.13
96	.023	.057	.11
104	.022	.052	.11
120	.019	.045	.095
140	.016	.039	.082
160	.014	.034	.071
180	.012	.030	.063
200	.011	.027	.057
230	.010	.023	.050

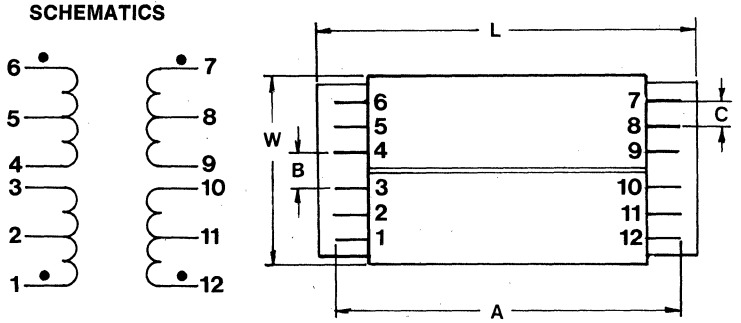
MLP SERIES

Part #	Sec. #1 V/CT	MA.	Sec. #2 V/CT	MA.
MLP4-9024	9.0	.12	24	.047
MLP5-9024	9.0	.30	24	.11
MLP6-9024	9.0	.63	24	.23
MLP4-1632	16	.071	32	.035
MLP5-1632	16	.17	32	.085
MLP6-1632	16	.35	32	.17

DLP & MLP DIMENSIONAL DATA

Size	L	W	H	A	B	C	Lbs.
4	1.875	1.562	.650	1.60	.375	.187	.29
5	1.875	1.562	.850	1.60	.375	.187	.43
6	2.50	2.0	1.065	2.0	.500	.250	.67

SCHEMATICS



DOT INDICATES LIKE POLARITY

100 VOLT PRIMARY CENTER TAPS AVAILABLE UPON REQUEST.
ALL PARALINE TRANSFORMERS MAY BE USED FOR 50 OR 60 HZ APPLICATIONS.

PARALINE
TRANSFORMER SPECIALISTS

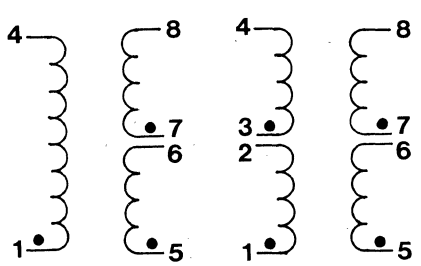
The Paraline HP & DHP Series are available in sizes 3, 4, 5, 6, 7, & 8 with single or dual primaries and dual secondaries on an 8 pin printed circuit format.

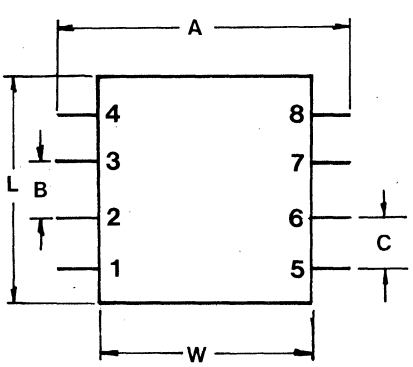
Available total series voltages and current ratings of secondaries.

HP & DHP SERIES

Volts*	AMPERES					
	Size 3	Size 4	Size 5	Size 6	Size 7	Size 8
5	.20	.46	1.16	2.3	3.8	7.0
6.3	.15	.36	.92	1.8	3.0	5.5
8	.12	.28	.72	1.4	2.3	4.3
10	.10	.23	.58	1.1	1.9	3.5
12	.079	.18	.46	.97	1.5	2.9
14	.071	.16	.41	.83	1.3	2.5
16	.062	.14	.36	.73	1.1	2.1
18	.055	.12	.32	.65	1.0	1.9
20	.050	.11	.29	.58	.95	1.7
22	.045	.10	.26	.53	.86	1.5
24	.041	.095	.24	.48	.79	1.4
26	.038	.088	.22	.45	.73	1.3
28	.035	.082	.20	.41	.67	1.2
30	.033	.076	.19	.39	.63	1.1
32	.031	.071	.18	.36	.59	1.0
34	.029	.067	.17	.34	.55	1.0
36	.027	.063	.16	.32	.52	.97
40	.025	.057	.14	.29	.47	.87
44	.022	.052	.13	.26	.43	.79
48	.020	.047	.12	.24	.39	.72
52	.019	.044	.11	.22	.36	.67
56	.017	.041	.10	.20	.33	.62
60	.016	.038	.096	.19	.31	.58
66	.015	.034	.087	.17	.28	.53
72	.013	.031	.080	.16	.26	.48
80	.012	.028	.072	.14	.23	.43
88	.011	.026	.065	.13	.21	.39
96	.010	.023	.060	.12	.19	.36
104	.009	.022	.055	.11	.18	.33
120	.008	.019	.048	.097	.15	.29
140	.007	.016	.041	.083	.13	.25
160	.006	.014	.036	.073	.11	.21
180	.005	.012	.032	.065	.10	.19
200	.005	.011	.029	.058	.095	.17
230	.004	.010	.025	.050	.082	.15

* HP Series—Volts C/T
DHP Series—Total Series Volts





HP & DHP DIMENSIONAL DATA

Sizes	L	W	Ht	A	B	C	Wt
3	1.375	1.125	.937	1.20	.250	.250	.17
4	1.375	1.125	1.187	1.20	.250	.250	.25
5	1.625	1.312	1.312	1.28	.350	.250	.44
6	1.875	1.562	1.437	1.41	.400	.300	.70
7	2.250	1.875	1.437	1.60	.400	.300	.80
8	2.625	2.187	1.562	1.85	.400	.400	1.10

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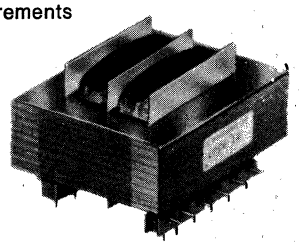
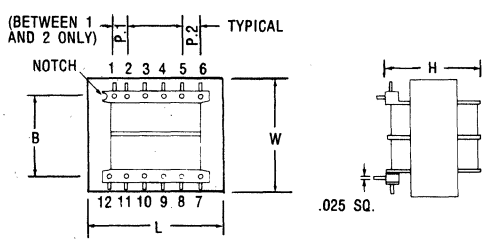
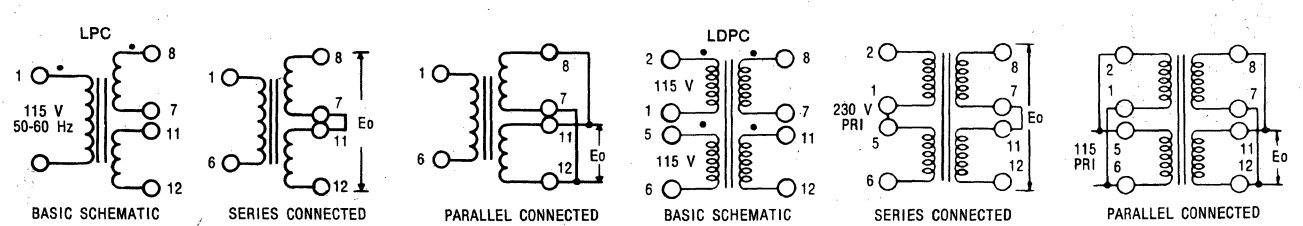
- Low profile — allows closer printed circuit board stacking
- Split bobbin construction — center flange insulation barrier provides 2500 VRMs Hipot — non concentric coil winding results in low interwinding capacitance, eliminates need for electro-static shielding.
- Class S (130°C) insulation system
- Single 115V and dual 115V/230V primaries are standard.
- Dual secondaries for variety of utilization
- 12 pin bobbin design increases available options for multi-winding special orders
- Low regulation
- **Units are inspected and tested 100%**
- **Low prices — no minimum quantity requirements**



PRIMARY 50/60HZ		R.M.S. SECONDARY RATINGS			
Single 115V	Dual 115V/230V	Series	Parallel	SIZE	VA
LPC3- 12	LDPC3- 12	12.6VCT @ 105MA	6.3V @ 210MA	3	1.25
LPC3- 16	LDPC3- 16	16 VCT @ 80MA	8 V @ 160MA	3	1.25
LPC3- 20	LDPC3- 20	20 VCT @ 65MA	10 V @ 130MA	3	1.25
LPC3- 24	LDPC3- 24	24 VCT @ 55MA	12 V @ 110MA	3	1.25
LPC3- 34	LDPC3- 34	34 VCT @ 35MA	17 V @ 70MA	3	1.25
LPC3- 40	LDPC3- 40	40 VCT @ 30MA	20 V @ 60MA	3	1.25
LPC3- 56	LDPC3- 56	56 VCT @ 20MA	28 V @ 40MA	3	1.25
LPC3-120	LDPC3-120	120 VCT @ 10MA	60 V @ 20MA	3	1.25
LPC4- 12	LDPC4- 12	12.6VCT @ 360MA	6.3V @ 720MA	4	4.50
LPC4- 16	LDPC4- 16	16 VCT @ 280MA	8 V @ 560MA	4	4.50
LPC4- 20	LDPC4- 20	20 VCT @ 225MA	10 V @ 450MA	4	4.50
LPC4- 24	LDPC4- 24	24 VCT @ 185MA	12 V @ 370MA	4	4.50
LPC4- 34	LDPC4- 34	34 VCT @ 130MA	17 V @ 260MA	4	4.50
LPC4- 40	LDPC4- 40	40 VCT @ 110MA	20 V @ 220MA	4	4.50
LPC4- 56	LDPC4- 56	56 VCT @ 80MA	28 V @ 160MA	4	4.50
LPC4-120	LDPC4-120	120 VCT @ 40MA	60 V @ 80MA	4	4.50
LPC5- 12	LDPC5- 12	12.6VCT @ 795MA	6.3V @ 1.59A	5	10.0
LPC5- 16	LDPC5- 16	16 VCT @ 625MA	8 V @ 1.25A	5	10.0
LPC5- 20	LDPC5- 20	20 VCT @ 500MA	10 V @ 1.00A	5	10.0
LPC5- 24	LDPC5- 24	24 VCT @ 415MA	12 V @ 930MA	5	10.0
LPC5- 34	LDPC5- 34	34 VCT @ 295MA	17 V @ 590MA	5	10.0
LPC5- 40	LDPC5- 40	40 VCT @ 250MA	20 V @ 500MA	5	10.0
LPC5- 56	LDPC5- 56	56 VCT @ 180MA	28 V @ 360MA	5	10.0
LPC5-120	LDPC5-120	120 VCT @ 85MA	60 V @ 170MA	5	10.0
LPC6- 12	LDPC6- 12	12.6VCT @ 1.9A	6.3V @ 3.8A	6	24.0
LPC6- 16	LDPC6- 16	16 VCT @ 1.5A	8 V @ 3.0A	6	24.0
LPC6- 20	LDPC6- 20	20 VCT @ 1.2A	10 V @ 2.4A	6	24.0
LPC6- 24	LDPC6- 24	24 VCT @ 1.0A	12 V @ 2.0A	6	24.0
LPC6- 34	LDPC6- 34	34 VCT @ 705MA	17 V @ 1.4A	6	24.0
LPC6- 40	LDPC6- 40	40 VCT @ 600MA	20 V @ 1.2A	6	24.0
LPC6- 56	LDPC6- 56	56 VCT @ 430MA	28 V @ 860MA	6	24.0
LPC6-120	LDPC6-120	120 VCT @ 200MA	60 V @ 400MA	6	24.0



LPC, LDPC SIZE	VA	L″	W″	H″	P-1	P-2	B	WT. (oz.)
3	1.25	1⅜	1 5/16	1 1/16	.150	.200	.862	3
4	4.50	1⅝	1⅜	1 3/16	.200	.250	.950	5
5	10.0	1⅞	1⅝	1 5/16	.200	.300	1.100	9
6	24 0	2¼	1⅞	1 5/16	.200	.300	1.300	14



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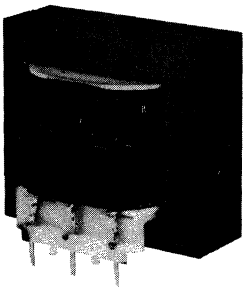

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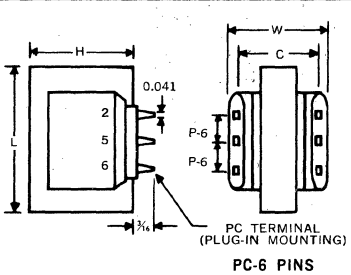
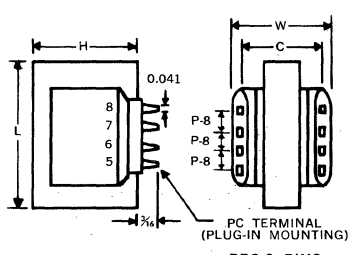
PLUG-IN PRINTED CIRCUIT POWER TRANSFORMERS

- Packaging flexibility
- Miniaturized construction
- Precision spaced molded-in terminals
- Low prices — no minimum quantity requirements
- 105°C insulation system
- 1000V Hipot
- Low regulation
- Single 115V and dual 115V/230V primaries are standard
- Dual secondaries for variety of utilization
- Units are inspected and tested 100%

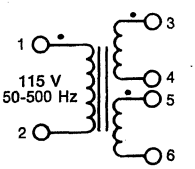
PRIMARY 50/400HZ		R.M.S. SECONDARY RATINGS			
Single 115V	Dual 115V/230V	Series	Parallel	SIZE	VA
PC2- 12	DPC2- 12	12.6VCT @ 70MA	6.3V @ 140MA	2	1.0
PC2- 16	DPC2- 16	16 VCT @ 55MA	8 V @ 110MA	2	1.0
PC2- 20	DPC2- 20	20 VCT @ 45MA	10 V @ 90MA	2	1.0
PC2- 24	DPC2- 24	24 VCT @ 35MA	12 V @ 70MA	2	1.0
PC2- 34	DPC2- 34	34 VCT @ 25MA	17 V @ 50MA	2	1.0
PC2- 40	DPC2- 40	40 VCT @ 20MA	20 V @ 40 MA	2	1.0
PC2- 56	DPC2- 56	56 VCT @ 15MA	28 V @ 30MA	2	1.0
PC3- 12	DPC3- 12	12.6VCT @ 105MA	6.3V @ 210MA	3	1.25
PC3- 16	DPC3- 16	16 VCT @ 80MA	8 V @ 160MA	3	1.25
PC3- 20	DPC3- 20	20 VCT @ 65MA	10 V @ 130MA	3	1.25
PC3- 24	DPC3- 24	24 VCT @ 55MA	12 V @ 110MA	3	1.25
PC3- 34	DPC3- 34	34 VCT @ 35MA	17 V @ 70MA	3	1.25
PC3- 40	DPC3- 40	40 VCT @ 30MA	20 V @ 60MA	3	1.25
PC3- 56	DPC3- 56	56 VCT @ 20MA	28 V @ 40MA	3	1.25
PC3-120	DPC3-120	120 VCT @ 10MA	60 V @ 20MA	3	1.25
PC4- 12	DPC4- 12	12.6VCT @ 360MA	6.3V @ 720MA	4	4.50
PC4- 16	DPC4- 16	16 VCT @ 280MA	8 V @ 560MA	4	4.50
PC4- 20	DPC4- 20	20 VCT @ 225MA	10 V @ 450MA	4	4.50
PC4- 24	DPC4- 24	24 VCT @ 185MA	12 V @ 370MA	4	4.50
PC4- 34	DPC4- 34	34 VCT @ 130MA	17 V @ 260MA	4	4.50
PC4- 40	DPC4- 40	40 VCT @ 110MA	20 V @ 220MA	4	4.50
PC4- 56	DPC4- 56	56 VCT @ 80MA	28 V @ 160MA	4	4.50
PC4-120	DPC4-120	120 VCT @ 40MA	60 V @ 80MA	4	4.50
PC5- 12	DPC5- 12	12.6VCT @ 795MA	6.3V @ 1.59A	5	10.0
PC5- 16	DPC5- 16	16 VCT @ 625MA	8 V @ 1.25A	5	10.0
PC5- 20	DPC5- 20	20 VCT @ 500MA	10 V @ 1.00A	5	10.0
PC5- 24	DPC5- 24	24 VCT @ 415MA	12 V @ 930MA	5	10.0
PC5- 34	DPC5- 34	34 VCT @ 295MA	17 V @ 590MA	5	10.0
PC5- 40	DPC5- 40	40 VCT @ 250MA	20 V @ 500MA	5	10.0
PC5- 56	DPC5- 56	56 VCT @ 180MA	28 V @ 360MA	5	10.0
PC5-120	DPC5-120	120 VCT @ 85MA	60 V @ 170MA	5	10.0
PC6- 12	DPC6- 12	12.6VCT @ 1.9A	6.3V @ 3.8A	6	24.0
PC6- 16	DPC6- 16	16 VCT @ 1.5A	8 V @ 3.0A	6	24.0
PC6- 20	DPC6- 20	20 VCT @ 1.2A	10 V @ 2.4A	6	24.0
PC6- 24	DPC6- 24	24 VCT @ 1.0A	12 V @ 2.0A	6	24.0
PC6- 34	DPC6- 34	34 VCT @ 705MA	17 V @ 1.4A	6	24.0
PC6- 40	DPC6- 40	40 VCT @ 600MA	20 V @ 1.2A	6	24.0
PC6- 56	DPC6- 56	56 VCT @ 430MA	28 V @ 860MA	6	24.0
PC6-120	DPC6-120	120 VCT @ 200MA	60 V @ 400MA	6	24.0



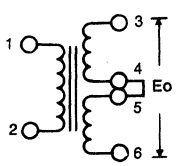
PC-6 PINS



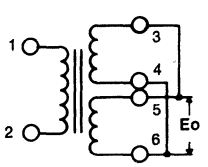
DPC-8 PINS



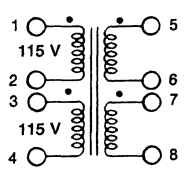
BASIC SCHEMATIC



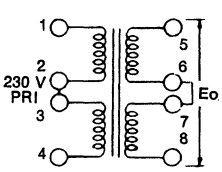
SERIES CONNECTED



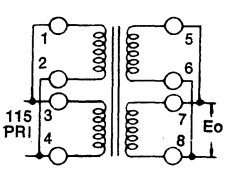
PARALLEL CONNECTED



BASIC SCHEMATIC



SERIES CONNECTED



PARALLEL CONNECTED

SIZE	VA	L	W	H	P-6 PIN	P-8 PIN	C	WT. (oz.)
2	1.0	1	1⅜	0.83	.250	.200	1.200	2.5
3	1.25	1⅜	1⅛	1⅜₆	.312	.200	1.000	3
4	4.50	1⅝	1¼	1⅜	.400	.250	1.100	5
5	10.0	1⅞	1⁷⁄₁₆	1⅝	.400	.250	1.300	9
6	24.0	1⅝	2¼	1⅜	.400	.250	2.100	12

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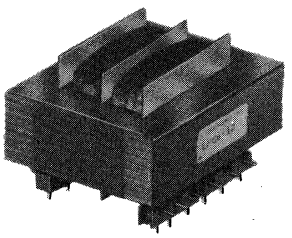
64D NANCY ST. / WEST BABYLON, NY 11704 / (516) 491-3300

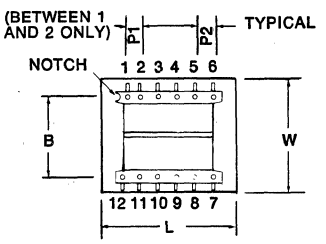
**OUR SPECIALTY!
ONE WEEK DELIVERY
FOR CUSTOM PROTOTYPES**

LOW PROFILE SPLIT BOBBIN MICROPROCESSOR PRINTED CIRCUIT POWER TRANSFORMERS

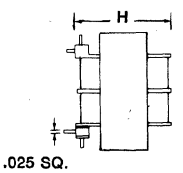
- Low profile — allows closer printed circuit board stacking
- Split bobbin construction—center flange insulation barrier provides 2500 VRMs Hipot—non concentric coil winding results in low inter-winding capacitance, eliminates need for electro-static shielding
- Class S (130°C) insulation system
- Single 115V and dual 115V/230V primaries are standard
- DC output combinations — ±12 and 5V or ±15 and 5V rated at the regulator output with allowance for line variations up to ±13%
- Packaging Flexibility
- Units are inspected and tested 100%
- Low prices — no minimum quantity requirements



Primary 50/60 Hz		Regulated DC Ratings		
Single 115V	Dual 115V/230V	IC1	IC2	Size
LM4-12	LDM4-12	5VDC@185mA	±12VDC@35mA	4
LM5-12	LDM5-12	5VDC@365mA	±12VDC@60mA	5
LM6-12	LDM6-12	5VDC@850mA	±12VDC@150mA	6
LM4-15	LDM4-15	5VDC@185mA	±15VDC@30mA	4
LM5-15	LDM5-15	5VDC@365mA	±15VDC@50mA	5
LM6-15	LDM6-15	5VDC@850mA	±15VDC@130mA	6



LM, LDM Size	L″	W″	H″	P-1	P-2	B	WT. (oz.)
4	1⅝	1⅜	1 3/16	.200	.250	.950	5
5	1⅞	1⅝	1 5/16	.200	.300	1.100	9
6	2¼	1⅞	1 5/16	.200	.300	1.300	14

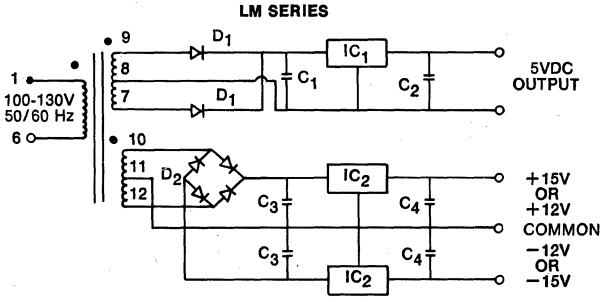


RECOMMENDED COMPONENTS

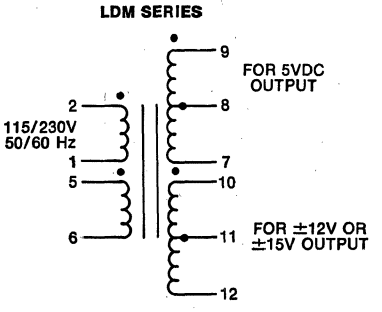
	C_1		C_2		C_3		C_4					
Part Number	MFD	V	MFD	V	MFD	V	MFD	V	D_1(2)	D_2(4)	IC_1	IC_2
LM4-12/LDM4-12	1000	20	2.7	20	150	50	10	20	1N4001	1N4002	LM342P-5.0	LM326N
LM4-15/LDM4-15	1000	20	2.7	20	150	50	10	20	1N4001	1N4002	LM342P-5.0	LM325N
LM5-12/LDM5-12	2100	30	2.7	20	250	50	10	20	1N4001	1N4002	LM341P-5.0	LM326N
LM5-15/LDM5-15	2100	30	2.7	20	250	50	10	20	1N4001	1N4002	LM341P-5.0	LM325N
LM6-12/LDM6-12	4000	20	2.7	20	1000	50	2.7	20	1N4001	1N4002	LM340K-5.0	LM326N
LM6-15/LDM6-15	4000	20	2.7	20	1000	50	2.7	20	1N4001	1N4002	LM340K-5.0	LM325N

SCHEMATIC DIAGRAMS

LM SERIES



LDM SERIES

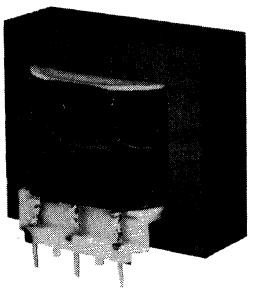


PC TRANSFORMER CORP.

64D NANCY ST. / WEST BABYLON, NY 11704 / (516) 491-3300

**OUR SPECIALTY!
ONE WEEK DELIVERY
FOR CUSTOM PROTOTYPES**

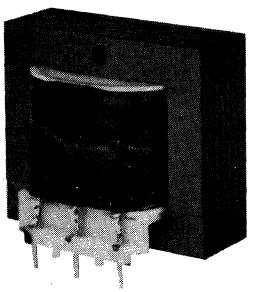
PLUG-IN PRINTED CIRCUIT AUDIO TRANSFORMERS



Designed for Input, Interstage, Output and Isolation Circuits. ±2db 200 Hz-15,000 Hz Frequency Response and 20dbm Power Rating for Entire Series.

P/N	PRI Z	Sec Z	Idc	Schematic
APC1-1	600Ω	600Ω	8mA	1
APC1-2	600Ω C.T.	600Ω C.T.	16mA	2
APC1-3	600Ω	8000/2000Ω Split	8mA	4
APC1-4	2500Ω	600Ω	4mA	1
APC1-5	2500Ω C.T.	600Ω C.T.	8mA	2
APC1-6	2500Ω C.T.	2500Ω C.T.	8mA	2
APC1-7	4000Ω	600Ω/150Ω Split	3mA	4
APC1-8	4000Ω C.T.	600Ω C.T.	6mA	2
APC1-9	4000Ω C.T.	1200Ω C.T.	6mA	2

PLUG-IN PRINTED CIRCUIT TELEPHONE COUPLING TRANSFORMERS

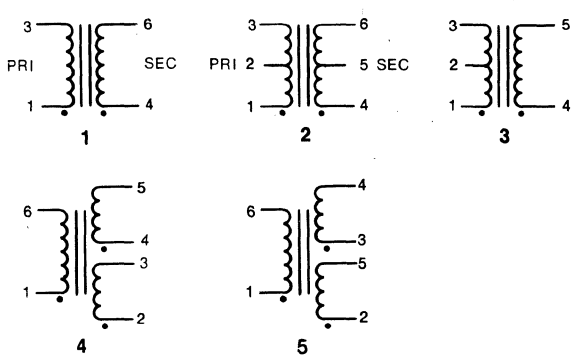


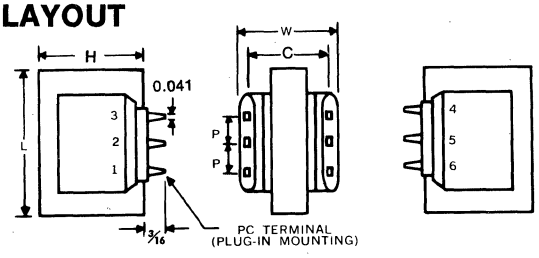
Designed for Interconnection of Voice/Data Modem Terminals to Telephone Lines.

- Frequency response ±0.5dB 300Hz-3500Hz
- Power level −45dbm to +7dbm
- Longitudinal balance — per FCC Part 68
- Distortion — 0.5% max.
- Impedance matching ±10% over frequency range
- Return loss — 26dB min.
- Units are inspected and tested 100%
- Low prices — no minimum quantity requirements

P/N	PRI Z	Sec Z	Application	Schematic
TPC1-1	600Ω	600Ω	Coupling	1
TPC1-2	600Ω C.T.	600Ω C.T.	Coupling	2
TPC1-3	600Ω	900Ω	Coupling	1
TPC1-4	900Ω	900Ω	Coupling	1
TPC1-5	900Ω/600Ω	600Ω	Coupling	3
TPC1-6	4000Ω	600Ω	Bridging	1
TPC1-7	600Ω (4W)	600Ω/600Ω	Hybrid (2) Req'd	5

APC & TPC SCHEMATICS AND MECHANICAL LAYOUT





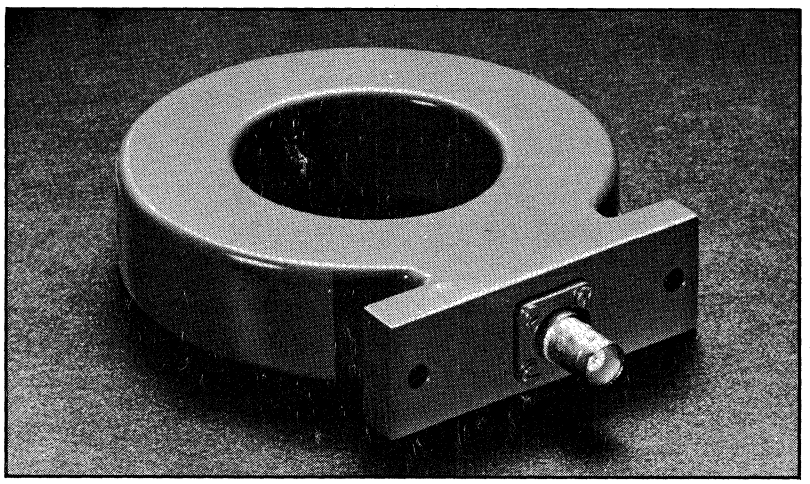
PC-6 PINS

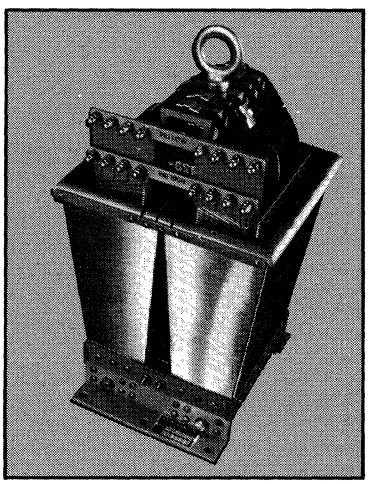
L	W	H	P	C	Wt. (oz.)
13/16	19/32	3/4	.187	.420	.5

Other ratings and configurations are available on special order for your custom requirements.

OVER 25 YEARS OF DESIGN EXPERTISE IS AVAILABLE TO ASSIST YOU WITH YOUR CUSTOM DESIGN AND APPLICATION REQUIREMENTS.

PEARSON ELECTRONICS, INC.





Wide Band, Precision Current Monitor Transformers

With a Pearson current monitor and an oscilloscope, you can measure pulse or ac currents from milliamperes to kiloamperes, in any conductor or beam of charged particles, at any voltage level up to a million volts, at frequencies up to 250 MHz or down to below 1 Hz.

The monitor is physically isolated from the circuit. It is a current transformer capable of highly precise measurement of pulse amplitude and waveshape. The one shown above, for example, offers pulse-amplitude accuracy of + 1%, − 0% (typical of all Pearson current monitors), 20 nanosecond rise time, and droop of only 0.5% per millisecond. Three db bandwidth is 1 Hz to 35 MHz. Whether you wish to measure current in a conductor, an electron device or a particle accelerator, it is likely that one of our off-the-shelf models (ranging from ½" to 10¾" ID) will do the job. In addition to our standard models, we build many custom designed current transformers to meet special needs and applications.

Very High Voltage & Very High Current

Pulse Transformers

Pearson Electronics specializes in the development, design and manufacture of high and super high voltage pulse transformers. Typical of the applications for which we have designed and manufactured pulse transformers are units for supplying beam power to high power microwave tubes such as klystrons and traveling wave tubes, units providing pulse voltage to particle accelerator injection systems, pulsed x-ray tubes and high power lasers.

Pearson Current Monitor Transformers

Model Number	Output † (volts/amp.)	Hole Dia. (inches)	Maximum Peak Curr. (amps)	Maximum RMS Curr. (amps)	Droop (%/microsec.)	Useable Rise Time (nanosec.)	IT Max. (amp-sec.)	Approx. Low Freq. 3db pt. (Hz)	I/f (peak amps/ Hz)	Connector
2877	1.0	0.25	100	2.5	0.2	2	0.0004	320	0.0025	SMA
4100	1.0	0.5	500	5	0.09	10	0.002**	140	0.006	UG-290A/U
2100	1.0	2	500	7.5	0.08	20	0.005**	125	0.017	UG-290A/U
3100	1.0	3.5	500	12	0.02	50	0.03**	40	0.096	SO-239
150	0.5	2	1,000	15	0.02	20	0.02**	40	0.067	UG-290A/U
325	0.25	3.5	2,000	60	0.1	30	0.09	160	0.58	SO-239
2878	0.1	0.25	400	10	0.02	5	0.004	32	0.025	SMA
410	0.1	0.5	5,000	50	0.06	20	0.27	120	1.7	UG-290A/U
411	0.1	0.5	5,000	50	0.0009	20	0.19**	1	0.59	UG-290A/U
110	0.1	2	5,000	65	0.0008	20	0.49**	1	1.5	UG-290A/U
110A	0.1	2	10,000	65	0.0008	20	0.49**	1	1.5	UG-568/U
310*	0.1	3.5	5,000	140	0.02	40	0.58	40	3.6	SO-239
1010*	0.1	10.75	5,000	120	0.25	50	0.7	400	4.4	SO-239
1025	0.025	2	20,000	100	0.1	100	0.5	160	3.1	UG-290A/U
3025*	0.025	3.5	20,000	325	0.004	100	3.2	7	20	SO-239
2879	0.01	0.25	2,000	25	0.002	20	0.04	3	0.25	SMA
301X*	0.01	3.5	50,000	400	0.003	200	22.	5	138	SO-239

† Initial pulse response with one megohm in parallel with 20 pF load impedance. A 50 ohm termination will cut the output in half.
* Double shielded. ** May need small bias current through secondary for maximum rating.

Contact us and we will send you engineering data.

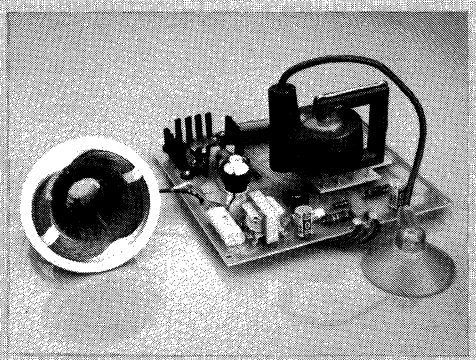
PEARSON ELECTRONICS, INC.
1860 Embarcadero Road, Palo Alto, California 94303 U.S.A. Telephone (415)494-6444 Telex 171-412

The New

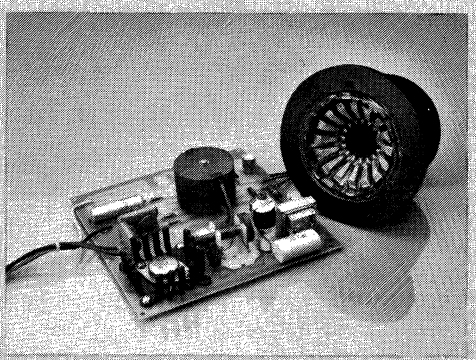
PENN-TRAN

Penn-Tran reaches beyond mere component manufacturing by creating High Voltage Modules (Horizontal Drive Boards) of matched magnetic components. These two examples package the Flyback Transformer, Yoke, Width Coil, Linearity Coil and Drive Transformer. The addition of an appropriate Penn-Tran High Voltage Power Supply, featured in EEM Section 4000, completes the system. Also see our stator yokes in EEM Section 1800.

Let our component teams and our 39 years of deflection experience save time, money and the difficulty of matching random components from multiple manufacturers. All we need is the parameters of your display's horizontal drive section. Penn-Tran engineering does the rest.

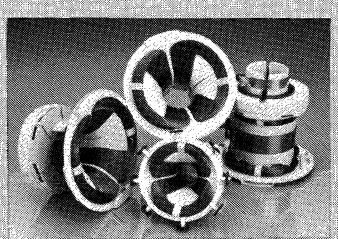


Style #1

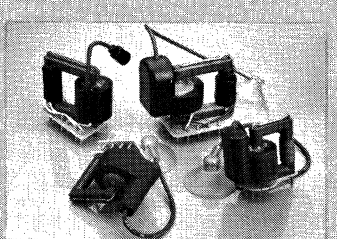


Style #2

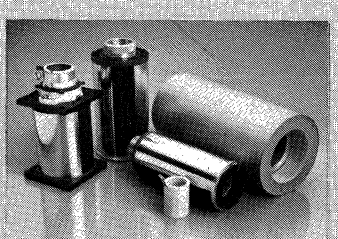
Style #1	Freq. (Hz)	CRT	B+	HV(KV)	Sec	Sec	Sec
HVM-40	15,750	20mm/90°	12	10.0	800	40	– 150
HVM-41	15,750	20mm/90°	12	13.0	870	65	– 150
HVM-42	18,600	20mm/90°	18	12.0	700	150	– 150
HVM-43	25,000	20mm/90°	24	13.0	485	240	– 115
HVM-44	31,000	20mm/90°	12	12.0	575	85	– 40
HVM-45	15,750	29mm/110°	24	18.6	700	50	– 180
HVM-46	19,400	29mm/110°	24	18.6	700	50	– 215
HVM-47	30,000	29mm/110°	40	17.5	860	580	– 180
HVM-48	53,000	29mm/110°	80	17.0	50	–	– 165
Style #2							
HVM-49	30,000	20mm/90°	12	—	575	150	– 115
HVM-50	48,000	29mm/110°	80	—	860	580	– 180



Saddle Yokes



Flybacks



Camera Yokes

Type	CRT Size	HOR L (mh)	HOR R (ohms)	HOR I (amps)	VERT L (mh)	VERT R (ohms)	VERT I (amps)
175-13	29mm/110°	0.1	0.17	4.46	0.1	0.13	4.50
175-13 A	29mm/110°	.5	0.9	1.99	10.0	5.0	0.45
211-13	29mm/110°	0.1	0.17	4.32	0.1	0.11	4.00
211-13 A	29mm/110°	.5	0.9	1.94	10.0	10.0	0.40
217-13	36mm/90°	0.1	0.15	4.06	0.1	0.1	3.50
217-13 A	36mm/90°	0.5	0.70	1.83	10.0	9.75	0.35
1994-13	20mm/90°	0.1	0.20	3.22	0.1	0.13	3.44
1994-13A	20mm/90°	0.5	0.98	1.44	10.0	5.0	0.33

Inductances shown above typical. Coils can be wound to fit your circuit. All units UL approved. Other size yokes available. Call for full information.

PENN-TRAN

Penn-Tran Corporation, Route 144 North, P.O. Box 1321, Wingate, PA 16880
814-355-1521 Telex 706473

PERKIN-ELMER

PRECISION TOROIDAL TRANSFORMERS

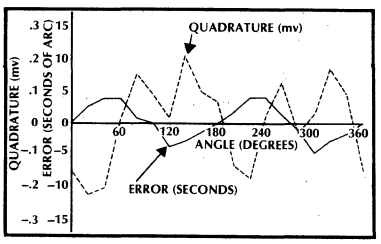
- INPUT SCOTT T
- REFERENCE ISOLATION
- OUTPUT SCOTT T
- DIGITALLY TAPPED
- COMBINATION
- PRECISION RATIO
- RESOLVER ISOLATION
- CUSTOM DESIGNS

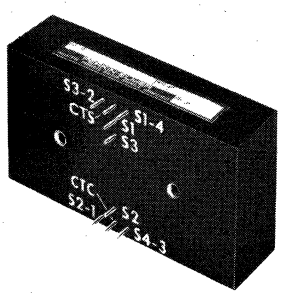
The Electronic Products Department of the Perkin-Elmer Corporation is in a unique position to provide Custom Precision Signal Transformers as a result of 20 years of experience designing and manufacturing very special transformers for the Vernistat® a.c. potentiometer and allied products. **High Performance in small size has always been a successful objective.** Our State of The Art Winding Equipment and Techniques enable close control of turns and taps for close matching of windings and repeatibility of product.

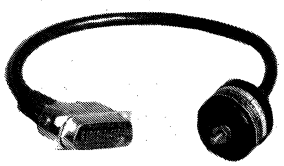
Perkin-Elmer can provide Custom Signal Transformers with high accuracies over the full MIL temperature range. For example, exponential function units with 80 taps to an accuracy of ±0.003% can be provided. SCOTT T Transformers have been built to an accuracy of 5 seconds of arc with a null of 0.1 millivolt. The transformers are fully encapsulated toroidal units and are available with contact pins for PC board mounting. They are manufactured in accordance with MIL-T-27C Grade 5. High input impedance and low output impedance can be matched to specifications. Operating frequency can also be per specifications.

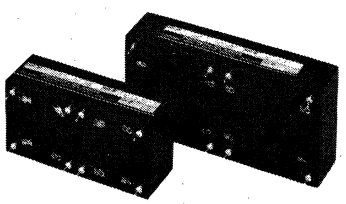
SCOTT T TRANSFORMERS

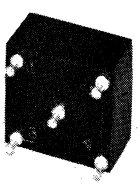
The SCOTT T input transformers converts 3 wire synchro inputs to 4 wire resolver outputs (sin θ and cos θ) with high transformation accuracy and minimum quadrature. SCOTT T Transformers for converting 4 wire resolver inputs to 3 wire synchro outputs can also be supplied. Our output SCOTT T Transformers maintain high accuracies even under heavy load conditions. These units are useful in solid state synchro to digital and digital to synchro converter applications and are particularly applicable in multiplexed conversion systems.











INPUT SCOTT T TRANSFORMERS (SYNCHRO TO RESOLVER)

Input V rms L-L	Output V rms	Load K Ω	Trans. Accuracy Arc. Sec.	Output Quadrature Null mV	Z in K Ω	Z out Ω	Dimensions L x W x H	Mount	Part Number
11.8	2.5	25	45	1.0	40	8	2x1x.625	PC 2x6-32	403-2187
	5.0	20	30	1.0	50	75	2x1x.6	PC 2x4-40	403-2064
	7.2 CT	10 to CT	60	1.0	20	10 to CT	2x1x.6	PC 2x4-40	403-2065
	10.2	10	60	2.0	50	50	2x1x.6	PC 2-4-40	403-2066
12	7.5	10	15	1.0	50	75	2x1x.6	PC 2x4-40	403-2055
90	1.1	10	15	0.03	300	1	2x1x1.1	PC 2x4-40	403-2078
	4.25	10	30	1.0	1000	11	2.5x1.25x.65	PC 2x4-40	403-2034
	4.25 CT	10	30	1.0	1000	11	2.78x1.41x.8	PC 2x4-40	403-2033
	17.8 CT	2.3 to CT	30	.7	100	12 to CT	2.78x1.41x.8	PC 2x4-40	403-2019
	26.0 CT	10 to CT	30	1.4	100	15 to CT	2.78x1.41x.8	PC 2x4-40	403-2051
90 (60 Hz)	14 CT	100 to CT	360	12.0	45	15 to CT	4x2.25x1.15	2x6-32	403-2058
96	14.4 CT	10 to CT	15	.25	200	12 to CT	2.78x1.41x.8	PC 2x4-40	403-2067
			45	.75	200	12 to CT	2.78x1.41x.8	PC 2x4-40	403-2068
			180	5.0	30	12 to CT	2.78x1.41x.8	PC 2x4-40	403-2069
	20 CT	10 to CT	15	.25	200	10 to CT	2.78x1.41x.8	PC 2x4-40	403-2007

COMBINATION INPUT SCOTT T TRANSFORMERS

11.8 2 channel	5.0	20	30	1.0	50	45	2x1x.8	PC 2x4-40	403-2042
11.8 3 channel	3.2	300	45	.5	50	20	2.94x1.06x.8	PC 2x4-40	403-2048

COMBINATION SCOTT T / RESOLVER ISOLATION

Scott T 11.8	6.0	20	30	1.0	35	20	2x1x.6	PC 2x4-40	403-2070
OR									
Resolver 26	6.0	20	30	1.0	300	20			

OUTPUT SCOTT T TRANSFORMERS (RESOLVER TO SYNCHRO)

Output V rms	Input V rms L-L	Load Ω L-L	Trans. Accuracy Arc. Min.	Output Quadrature Null mV	Z in K Ω	Z out Ω	Dimensions L x W x H	Mount	Part Number
11.8	4.7	150	1	15	.25	7	2.78x1.41x.8	PC 2x4-40	403-2027
	6	150	2	8	.5	8	2.78x1.41x.61	PC 2x4-40	403-2071
	5 F.B. 2.5	100	3	8	.35	8	2.78x1.41x.61	PC 2x4-40	403-2075
	11.8 F.B. 6 CT	25	6	12	.8	2	2.78x1.41x.61	PC 2x4-40	403-2056
90	7	6000	1.5	50	3.0	600	2x1x1.1	PC 2x4-40	403-2077
	F.B. 2.8	6000	1.5	80	3.0	500	2.3x1.3x1	PC 4x4-40	403-2176

F.B. = Feedback winding.

RESOLVER ISOLATION TRANSFORMERS

Output V rms L-L	Input V rms L-L	Load K Ω L-L	Trans. Accuracy Arc. Sec.	Output Quadrature Null mV	Z in K Ω	Z out Ω	Dimensions L x W x H	Mount	Part Number
7	7 (5 KHz)	10	.5	2	50	25	2x1x.6	PC 2x4-40	403-2072
9 CT	11.8	25 to CT	.3	1	80	50 to CT	1.63x.81x.5	PC	403-2063
11.1	6	.4	2	36	6	14	2.5x1.25x.65	PC 2x4-40	403-2003
26	6	6	3	36	.2	10	2.78x1.41x.61	PC 2x4-40	403-2073

PRECISION REFERENCE ISOLATION TRANSFORMERS

Output V rms	Input V rms	Load K Ω	Trans. Accuracy %	Output Quadrature Null mV	Z in K Ω	Z out Ω	Dimensions L x W x H	Mount	Part Number
3	115	90	.05	2.5	40	.7	1.5x1.5x.75	PC 1x6-32	403-2061
	26			5	4.5				
	115	10	.1	1.3	180	2.75	.814x.814x.5	PC	403-2166
5	26	.4	.1	1	100	5.5	1x1x.58	PC	403-2026
		20	2	6	100	30	.813x.813x.5	PC	403-2189
6	26	10	.01	2.5	70	15	1x1x.58	PC	403-2040
			.02	2.5	70	15	1x1x.58	PC	403-2041
6 CT	26	45 to CT	.1	1.5	100	4 to CT	1.25x1.25x.5	PC	403-2015
20	20	5	.2	2	50	140	1x1x.5	PC	403-2062
30	7.5	50	.2	200	.5	225	.88x.88x.88	2x2-56	403-2047

Operating Temperature Range −55°C to +125°C.
Frequencies 400 Hz except as otherwise stated.

Manufactured in accordance with MIL-T-27 Grade 5.
Specified transformation accuracies are with stated load.

For information on price, delivery and other standard or custom designed transformers call or write
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MINIATURIZED POWER INDUCTORS

EMI COMMON MODE SUPPRESSION INDUCTORS

MINIATURE HIGH "Q" INDUCTORS

Description	Page
1/4" X 1/4"; 2 OHM TO 30K OHM; 400 Hz TO 250 KHz 100 MILLIWATT AT 1 KHz	A•2234, A•2235
.35" X .32"; 2 OHM TO 40K OHM; 400 Hz TO 100 KHz 400 MILLIWATT AT 1 KHz	A•2236, A•2237
.35" X .46"; 2 OHM TO 100K OHM; 300 Hz TO 100 KHz 600 MILLIWATT AT 1 KHz	A•2238, A•2239
.5" X .35"; 2 OHM TO 100K OHM; 300 Hz TO 75 KHz 600 MILLIWATT AT 1 KHz	A•2240, A•2241
.5" X .5"; 2 OHM TO 250K OHM; 150 Hz TO 75 KHz 1 WATT AT 1 KHz	A•2242, A•2243
.75" X .375"; 2 OHM TO 135K OHM; 75 Hz TO 30 KHz 1.5 WATT AT 1 KHz	A•2244, A•2245
.75" X .52"; 2 OHM TO 135K OHM; 50 Hz TO 30KHz 2 WATT AT 1 KHz	A•2246, A•2247
.75" X .82"; 2 OHM TO 80K OHM; 20 Hz TO 25 KHz 3 WATT AT 1 KHz	A•2248, A•2249
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400 Hz POWER TRANSFORMERS. PRIMARY VOLTAGES OF 115V OR 26V. PLUG-IN CONSTRUCTION. ULTRA- MINIATURE SIZE.	A•2255

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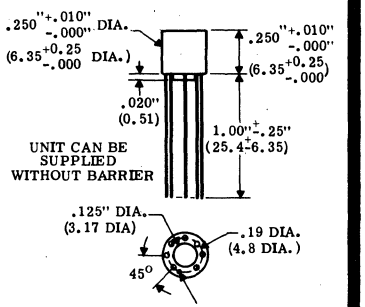
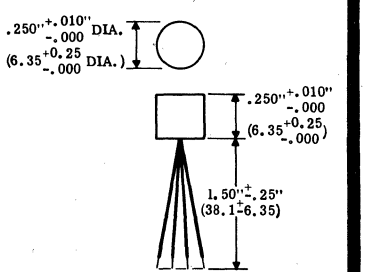
1/4"x1/4" PICO's ultra-miniature transformers

F SERIES Plug-In



G SERIES Insulated Leads



PART NUMBER		PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER MILLIWATTS		PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PRICES 1-9 ***	
F Series Plug-In	G Series Insulated Leads		SER	PAR	1 KHz and higher	400 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	F-Series	G-Series
F-28003	G-29003	10 ct	10 ct	2.5	125	20	11.5	1.1	1.35	.34	1:1	2:1	18.77	17.85
F-28005	G-29005	20 ct	8 ct	2	125	20	8	2.1	1.28	.32	1.58:1	3.16:1	18.77	17.85
F-28010	G-29010	20 ct	20 ct	5	125	20	8	2.1	2.56	.64	1:1	2:1	18.77	17.85
F-28015	G-29015	32 ct	32 ct	8	125	20	6.5	3.52	4.32	1.08	1:1	2:1	18.77	17.85
F-28020	G-29020	40 ct	40 ct	10	125	20	5.6	4	4.77	1.19	1:1	2:1	18.82	17.85
F-28025	G-29025	48 ct	16 ct	4	125	20	5.2	4.3	2.3	.58	1.73:1	3.46:1	17.06	16.25
F-28030	G-29030	50 ct	50 ct	12.5	125	20	5	5.5	6.6	1.65	1:1	2:1	17.06	16.25
F-28035	G-29035	80 ct	32 ct	8	125	20	4	8.5	4.25	1.06	1.58:1	3.16:1	18.82	16.25
F-28040	G-29040	100 ct	40 ct	10	125	20	3.6	12.1	4.85	1.21	1.58:1	3.16:1	18.82	16.25
F-28045	G-29045	100 ct	100 ct	25	125	20	3.6	12.1	12	3	1:1	2:1	17.06	13.25
F-28050	G-29050	120 ct	12.8 ct	3.2	125	20	3.3	13.2	1.6	.4	3.06:1	6.12:1	17.06	16.25
F-28055	G-29055	120 ct	60 ct	15	125	20	3.3	13.2	7.3	1.83	1.41:1	2.83:1	20.40	16.25
F-28060	G-29060	120 ct	120 ct	30	125	20	3.3	13.2	16	4	1:1	2:1	20.40	19.36
F-28065	G-29065	150 ct	12 ct	3	125	20	3	15	1.56	.39	3.54:1	7.07:1	19.74	17.64
F-28070	G-29070	150 ct	50 ct	12.5	125	20	3	15	6.6	1.65	1.73:1	3.46:1	20.40	17.64
F-28075	G-29075	150 ct	100 ct	25	125	20	3	15	14.5	3.63	1.22:1	2.45:1	20.40	19.35
F-28080	G-29080	150 ct	150 ct	37.5	125	20	3	15	18.3	4.58	1:1	2:1	20.40	19.36
F-28085	G-29085	150 ct	600 ct	150	125	20	3	15	72	18	1:2	1:1	20.40	19.36
F-28090	G-29090	200 ct	200 ct	50	125	20	2.5	22	26.8	6.7	1:1	2:1	20.40	19.36
F-28095	G-29095	300 ct	12 ct	3	125	20	2	33	1.56	.39	5:1	10:1	20.40	19.36
F-28100	G-29100	300 ct	50 ct	12.5	125	20	2	33	6.6	1.65	2.45:1	4.9:1	20.40	19.36
F-28105	G-29105	300 ct	150 ct	37.5	125	20	2	33	18.3	4.58	1.41:1	2.83:1	20.40	19.36
F-28110	G-29110	300 ct	300 ct	75	125	20	2	33	40.3	10.08	1:1	2:1	20.40	19.36
F-28115	G-29115	300 ct	600 ct	150	125	20	2	33	72	18	1:1.41	1.41:1	18.54	17.64
F-28120	G-29120	320 ct	12.8ct	3.2	125	20	2	34	1.6	0.4	5:1	10:1	21.87	20.77
F-28125	G-29125	400 ct	40 ct	10	125	20	1.8	49	4.7	1.18	3.16:1	6.32:1	21.87	20.77
F-28130	G-29130	400 ct	120 ct	30	125	20	1.8	49	16.3	4.08	1.83:1	3.65:1	21.87	20.77
F-28135	G-29135	400 ct	200 ct	50	125	20	1.8	49	27.3	6.83	1.41:1	2.83:1	21.87	20.77
F-28140	G-29140	400 ct	400 ct	100	125	20	1.8	49	49	12.25	1:1	2:1	19.88	18.92
F-28145	G-29145	400 ct	1000 ct	250	125	20	1.8	49	120	30	1:1.58	1.26:1	21.87	20.77
F-28150	G-29150	400 ct	2000 ct	500	125	20	1.8	49	270	67.5	1:2.24	1:1.12	21.87	20.77
F-28155	G-29155	400 ct	4000 ct	1000	125	20	1.8	49	476	119	1:3.16	1:1.58	21.87	20.77
F-28160	G-29160	500 ct	12.8ct	3.2	125	20	1.6	54	1.6	0.4	6.25:1	12.5:1	19.88	18.92
F-28165	G-29165	500 ct	16 ct	4	125	20	1.6	54	2.3	0.58	5.6:1	11.2:1	19.88	18.92
F-28170	G-29170	500 ct	50 ct	12.5	125	20	1.6	54	6.6	1.65	3.16:1	6.32:1	19.88	18.92
F-28175	G-29175	500 ct	150 ct	37.5	125	20	1.6	54	18.3	4.58	1.83:1	3.65:1	19.88	18.92
F-28180	G-29180	500 ct	500 ct	125	125	20	1.6	54	65	16.3	1:1	2:1	21.87	20.77
F-28185	G-29185	*500 ct	500 ct	-	125	20	1.6	54	65	-	1:1	-	21.87	20.77
F-28190	G-29190	500 ct	600 ct	150	125	20	1.6	54	72	18	1:1.1	1.83:1	21.87	20.77
F-28195	G-29195	600 ct	12.8 ct	3.2	125	20	1.5	59	1.6	0.4	6.85:1	13.7:1	21.87	20.77
F-28200	G-29200	600 ct	30 ct	7.5	125	20	1.5	59	4.1	1.03	4.47:1	8.94:1	19.88	18.92
F-28205	G-29205	600 ct	48 ct	12	125	20	1.5	59	5.2	1.3	3.54:1	7.07:1	19.88	18.92
F-28210	G-29210	600 ct	200 ct	50	125	20	1.5	59	26.5	6.63	1.73:1	3.46:1	19.88	18.92
F-28215	G-29215	600 ct	600 ct	150	125	20	1.5	59	72	18	1:1	2:1	19.88	18.92
F-28220	G-29220	*600 ct	600 ct	-	125	20	1.5	59	72	-	1:1	-	21.87	20.77
F-28225	G-29225	600 ct	1200 ct	300	125	20	1.5	59	160	40	1:1.41	1.41:1	19.88	18.92
F-28230	G-29230	640 ct	12.8 ct	3.2	125	20	1.5	62	1.6	0.4	7.07:1	14.14:1	19.88	18.92
F-28235	G-29235	700 ct	100 ct	25	125	20	1.35	65	12	3	2.65:1	5.29:1	19.88	18.92
F-28240	G-29240	800 ct	12.8 ct	3.2	125	20	1.3	88	16	4	7.9:1	15.8:1	21.87	20.77
F-28245	G-29245	800 ct	48 ct	12	125	20	1.3	88	6.7	1.68	4.08:1	8.16:1	20.40	19.42
F-28250	G-29250	800 ct	800 ct	200	125	20	1.3	88	106	26.5	1:1	2:1	20.40	19.42
F-28255	G-29255	900 ct	600 ct	150	125	20	1.2	93	74	18.5	1.22:1	2.45:1	20.40	19.42
F-28260	G-29260	1000 ct	12 ct	3	125	20	1.2	120	1.55	0.39	9.13:1	18.3:1	22.44	21.31
F-28265	G-29265	1000 ct	50 ct	12.5	125	20	1.2	120	6.6	1.65	4.47:1	8.94:1	22.44	21.31
F-28270	G-29270	1000 ct	1000 ct	250	125	20	1.2	120	120	30	1:1	2:1	20.40	19.42
F-28275	G-29275	1060 ct	12.8 ct	3.2	125	20	1.2	125	1.6	0.4	9.1:1	18.2:1	22.44	21.31
F-28280	G-29280	1200 ct	12.8 ct	3.2	125	20	1	133	1.6	0.4	9.68:1	19.4:1	22.44	21.31
F-28285	G-29285	1200 ct	500 ct	125	125	20	1	133	65	16.25	1.55:1	3.1:1	22.44	21.31
F-28290	G-29290	1200 ct	1200 ct	300	125	20	1	133	160	40	1:1	2:1	22.44	21.31
F-28295	G-29295	*1200 ct	1200 ct	-	125	20	1	133	160	-	1:1	-	22.44	21.31
F-28300	G-29300	1500 ct	12 ct	3	125	20	1	180	1.55	0.39	11.2:1	22.4:1	22.44	21.31
F-28305	G-29305	1500 ct	500 ct	125	125	20	1	180	65	16.3	1.73:1	3.46:1	20.40	19.42
F-28310	G-29310	*1500 ct	600 ct	-	125	20	1	180	73	-	1.58:1	-	20.40	19.42
F-28315	G-29315	*1500 ct	1500 ct	-	125	20	1	180	215	-	1:1	-	22.44	21.31
F-28320	G-29320	1600 ct	12.8 ct	3.2	125	20	1	190	1.6	0.4	11.2:1	22.4:1	22.44	21.31
F-28325	G-29325	2000 ct	8 ct	2	125	20	0.8	218	1	.25	15.8:1	31.6:1	22.44	21.31
F-28330	G-29330	2000 ct	2000 ct	500	125	20	0.8	218	260	65	1:1	2:1	22.44	21.31
F-28335	G-29335	*2000 ct	2000 ct	-	125	20	0.8	218	260	-	1:1	-	22.44	21.31
F-28340	G-29340	2000 ct	8000 ct	2000	125	20	0.8	218	830	207.5	1:2	1:1	21.87	20.82

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SPECIFICATIONS

- **MIL-T-27:** . . . . . All Units Meet MIL-T-27, Military Designation is TF5R21ZZ for Transformers, TF5R20ZZ for Inductors.
- **FREQUENCY RESPONSE:** . . . . -3dB, 400 Hz-250 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:** . . . . 5% With Rated Power Level at 1 KHz and 400 Hz.
- **DIELECTRIC STRENGTH:** . . . All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** . . . Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** . . . . . 1.1 Grams.
- **OPERATING TEMPERATURE:** . . -55°c to +105°c (All Units Can Be Supplied to Class S Requirements, +130°c).
- **TERMINALS:** . . . . . Solid .012 Diameter Conductor. Conductor is copper clad steel, Tinned 100%. Electroplated Per MIL-T-10727A and ASTM CCS B452.
- **THERMAL SHOCK:** . . . . . 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

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PART NUMBER F Series Plug-In	PART NUMBER G Series Insulated Leads	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER MILLIWATTS 1 KHz and higher	POWER MILLIWATTS 400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PRICES 1-9 *** F-Series	PRICES 1-9 *** G-Series
F-28345	G-29345	2500 ct	2500 ct	625	125	20	0.75	280	280	70	1:1	2:1	21.87	20.82
F-28350	G-29350	3000 ct	3000 ct	725	125	20	0.65	330	330	82.5	1:1	2:1	21.87	20.82
F-28355	G-29355	*3000 ct	3000 ct	-	125	20	0.65	330	330	-	1:1	-	22.44	21.31
F-28360	G-29360	3600 ct	3600 ct	900	125	20	0.6	370	450	112.5	1:1	2:1	21.87	20.82
F-28365	G-29365	4000 ct	16 ct	4	125	20	0.57	400	2.3	0.58	15.8:1	31.6:1	21.87	20.82
F-28370	G-29370	4000 ct	600 ct	150	125	20	0.57	400	73	18.25	2.58:1	5.16:1	21.87	20.82
F-28375	G-29375	4000 ct	1000 ct	250	125	20	0.57	400	120	30	2:1	4:1	21.87	20.82
F-28380	G-29380	*4000 ct	8000 ct	-	125	20	0.57	400	1070	-	1:1.41	-	24.05	22.85
F-28385	G-29385	5000 ct	500 ct	125	125	20	0.5	540	65	16.25	3.16:1	6.32:1	21.87	20.82
F-28390	G-29390	5000 ct	5000 ct	1250	125	20	0.5	540	650	162.5	1:1	2:1	24.05	22.85
F-28395	G-29395	7500 ct	50 ct	12.5	125	20	0.5	835	6.6	1.65	12.2:1	24.5:1	24.05	22.85
F-28400	G-29400	7500 ct	100 ct	25	125	20	0.4	835	12	3	8.66:1	17.3:1	22.38	21.31
F-28405	G-29405	7500 ct	600 ct	150	125	20	0.4	835	72	18	3.54:1	7.07:1	22.38	21.31
F-28410	G-29410	7500 ct	2500 ct	625	125	20	0.4	835	280	70	1.73:1	3.46:1	22.38	21.31
F-28415	G-29415	*7500 ct	7500 ct	-	125	20	0.4	835	1020	-	1:1	-	22.38	21.31
F-28420	G-29420	8000 ct	12.8 ct	3.2	125	20	0.4	865	1.6	0.4	25:1	50:1	24.05	22.85
F-28425	G-29425	8000 ct	1000 ct	250	125	20	0.4	865	120	30	2.83:1	5.66:1	24.05	22.85
F-28430	G-29430	*8000 ct	1200 ct	-	125	20	0.4	865	160	-	2.58:1	-	24.05	22.85
F-28435	G-29435	*9000 ct	9000 ct	-	125	20	0.4	1160	1160	-	1:1	-	24.05	22.85
F-28440	G-29440	10,000 ct	12.8 ct	3.2	125	20	0.36	1200	1.6	0.4	28:1	56:1	24.05	22.85
F-28445	G-29445	10,000 ct	16 ct	4	125	20	0.36	1200	1.77	0.44	25:1	50:1	22.38	21.31
F-28450	G-29450	10,000 ct	100 ct	25	125	20	0.36	1200	12	3	10:1	20:1	22.38	21.31
F-28455	G-29455	10,000 ct	200 ct	50	125	20	0.36	1200	27	6.75	7.07:1	14.14:1	22.38	21.31
F-28460	G-29460	10,000 ct	500 ct	125	125	20	0.36	1200	65	16.25	4.47:1	8.94:1	22.38	21.31
F-28465	G-29465	10,000 ct	600 ct	150	125	20	0.36	1200	72	18	4.08:1	8.16:1	22.38	21.31
F-28470	G-29470	10,000 ct	1000 ct	250	125	20	0.36	1200	120	30	3.16:1	6.32:1	22.38	21.31
F-28475	G-29475	10,000 ct	1200 ct	300	125	20	0.36	1200	160	40	2.88:1	5.77:1	22.38	21.31
F-28480	G-29480	10,000 ct	1500 ct	375	125	20	0.36	1200	215	53.8	2.58:1	5.16:1	22.44	22.85
F-28485	G-29485	10,000 ct	2000 ct	500	125	20	0.36	1200	260	65	2.24:1	4.47:1	22.44	21.31
F-28490	G-29490	10,000 ct	5000 ct	1250	125	20	0.36	1200	650	162.5	1.41:1	2.83:1	22.44	21.31
F-28495	G-29495	10,000 ct	7500 ct	1875	125	20	0.36	1200	1020	255	1.15:1	2.3:1	22.44	21.31
F-28500	G-29500	10,000 ct	10,000 ct	2500	125	20	0.36	1200	1200	300	1:1	2:1	20.40	19.42
F-28505	G-29505	*10,000 ct	10,000 ct	-	125	20	0.36	1200	1440	-	1:1	-	24.05	22.85
F-28510	G-29510	15,000 ct	400 ct	100	100	15	0.35	1420	43	10.75	6.12:1	12.24:1	22.44	21.31
F-28515	G-29515	15,000 ct	500 ct	125	100	15	0.35	1420	49	12.25	5.48:1	10.95:1	22.44	21.31
F-28520	G-29520	15,000 ct	600 ct	150	100	15	0.35	1420	68	17	5:1	10:1	22.44	21.31
F-28525	G-29525	15,000 ct	10,000 ct	2500	100	15	0.35	1420	1100	275	1.22:1	2.45:1	22.44	21.31
F-28530	G-29530	*15,000 ct	15,000 ct	-	100	15	0.35	1420	1730	-	1:1	-	24.05	22.85
F-28535	G-29535	15,000 ct	15,000 ct	3750	100	15	0.35	1420	1730	433	1:1	2:1	22.44	21.31
F-28540	G-29540	16,000 ct	1000 ct	250	100	15	0.35	1500	115	28.75	4:1	8:1	22.44	21.31
F-28545	G-29545	20,000 ct	500 ct	125	100	15	0.3	1600	60	15	6.33:1	12.65:1	24.05	22.85
F-28550	G-29550	20,000 ct	600 ct	150	100	15	0.3	1600	66	16.5	5.77:1	11.55:1	24.05	22.85
F-28555	G-29555	20,000 ct	800 ct	200	100	15	0.3	1600	94	23.5	5:1	10:1	24.05	22.85
F-28560	G-29560	20,000 ct	1000 ct	250	100	15	0.3	1600	106	26.5	4.47:1	8.94:1	24.05	22.85
F-28565	G-29565	20,000 ct	5000 ct	1250	100	15	0.3	1600	600	150	2:1	4:1	24.05	22.85
F-28570	G-29570	20,000 ct	10,000 ct	2500	100	15	0.3	1600	1100	275	1.41:1	2.83:1	24.05	22.85
F-SHIELD		MU-METAL SHIELD .285" d X .268" h (7.24 mm d X 6.73 mm h) SINGLE SHIELD											2.04	
FYY-SHIELD		MU-METAL SHIELD .315" d X .275" h (8.0 mm d X 6.99 mm h) USE WITH F-SHIELD FOR DOUBLE SHIELDING											2.04	
G-SHIELD		MU-METAL SHIELD .285" d X .335" h (7.24 mm d X 8.51 mm h) SINGLE SHIELD												2.04
GYY-SHIELD		MU-METAL SHIELD .315" d X .40" h (8.00 mm d X 10.16 mm h) USE WITH G-SHIELD FOR DOUBLE SHIELDING												2.04
GXX-SHIELD		MU-METAL SHIELD .35" d X .465" h (8.89 mm d X 11.81 mm h) USE WITH G-SHIELD AND GYY SHIELD FOR TRIPLE SHIELDING												2.04

*INCLUDES ELECTROSTATIC SHIELD

*** **Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%**
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

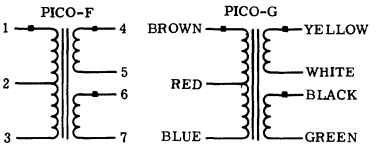
INDUCTORS

PART NUMBER F-SERIES	PART NUMBER G-SERIES	INDUCTANCE HENRIES	DC CURRENT ma	DC RESISTANCE OHMS	PRICES 1-9*** F SERIES	PRICES 1-9*** G SERIES
F-5825	G-6125	SERIES 10.0	0	2250	18.54	17.64
		SERIES 2.75	2			
		PARALLEL 2.5	0	560		
		PARALLEL .65	4			
F-5830	G-6130	SERIES 5.5	0	1000	18.54	17.64
		SERIES 1.5	2			
		PARALLEL 1.3	0	250		
		PARALLEL .40	4			
F-5835	G-6135	SERIES .85	1	240	18.54	17.64
		SERIES .25	6			
		PARALLEL .21	2	60		
		PARALLEL .06	12			
F-5840	G-6140	SERIES .6	0	144	18.54	17.64
		SERIES .15	5			
		PARALLEL .15	0	36		
		PARALLEL .04	10			

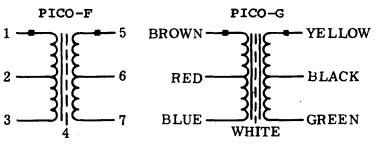
F SERIES Plug-In

G SERIES Insulated Leads

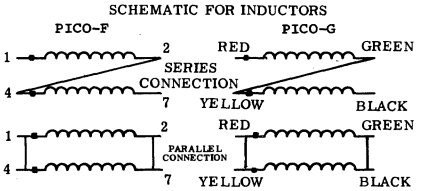
SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



SCHEMATIC FOR INDUCTORS



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- 5 MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

This Product is Patented

INDUCTORS

ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS. TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF D.C. CURRENT, ARE LISTED FOR EACH INDUCTOR.

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

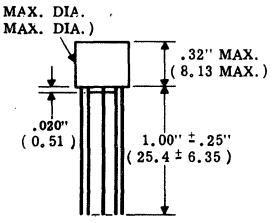
Delivery—stock to one week

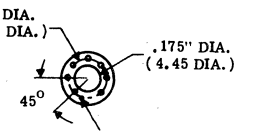
PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • TWX 7105620113

PICO's ultra-miniature transformers

W SERIES Plug-In





WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM PIN #1

DIMENSIONS ARE IN INCHES (MM)

PICO PART NUMBER W Series Plug-In	PRIMARY IMPED OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIM DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1-9 *** W-Series
W-26003	10 ct	10 ct	2.5	.4	.075	31.6	1.1	1.3	.33	1:1	2:1	13.85
W-26005	20 ct	8 ct	2	.4	.075	22.3	2.2	1	.25	1.58:1	3.16:1	13.85
W-26010	20 ct	20 ct	5	.4	.075	22.3	2.2	2.6	.65	1:1	2:1	13.85
W-26015	32 ct	32 ct	8	.4	.075	17.6	3.5	4.2	1.05	1:1	2:1	13.85
W-26020	40 ct	40 ct	10	.4	.075	15.8	4	4.5	1.2	1:1	2:1	13.85
W-26025	48 ct	16 ct	4	.4	.075	14.4	5.3	1.9	.48	1.73:1	3.46:1	14.69
W-26030	50 ct	50 ct	12.5	.4	.075	14.1	5.6	6.5	1.6	1:1	2:1	14.69
W-26035	80 ct	32 ct	8	.4	.075	11.1	8	4	1	1.58:1	3.16:1	17.44
W-26040	100 ct	40 ct	10	.4	.075	10	10	4.5	1.2	1.58:1	3.16:1	14.69
W-26045	100 ct	100 ct	25	.4	.075	10	10	12	3	1:1	2:1	14.69
W-26050	120 ct	12.8 ct	3.2	.4	.075	9.1	12	1.5	.38	3.06:1	6.12:1	13.21
W-26055	120 ct	60 ct	15	.4	.075	9.1	12	7.2	1.8	1.41:1	2.83:1	17.44
W-26060	120 ct	120 ct	30	.4	.075	9.1	12	14.5	3.6	1:1	2:1	17.44
W-26065	150 ct	12 ct	3	.4	.075	8.2	15	1.5	.38	3.54:1	7.08:1	13.21
W-26070	150 ct	50 ct	12.5	.4	.075	8.2	15	6	1.5	1.73:1	3.46:1	14.69
W-26075	150 ct	100 ct	25	.4	.075	8.2	15	12	3	1.22:1	2.45:1	14.69
W-26080	150 ct	150 ct	37.5	.4	.075	8.2	15	16.8	4.2	1:1	2:1	17.44
W-26085	150 ct	600 ct	150	.4	.075	8.2	15	70	17.5	1:2	1:1	14.69
W-26090	200 ct	200 ct	50	.4	.075	7	20	24	6	1:1	2:1	14.69
W-26095	300 ct	12 ct	3	.4	.075	5.8	30	1.5	.38	5:1	10:1	13.21
W-26100	300 ct	50 ct	12.5	.4	.075	5.8	30	6	1.5	2.45:1	4.9:1	14.69
W-26105	300 ct	150 ct	37.5	.4	.075	5.8	30	18	4.5	1.41:1	2.83:1	14.69
W-26110	300 ct	300 ct	75	.4	.075	5.8	30	36	9	1:1	2:1	17.44
W-26115	300 ct	600 ct	150	.4	.075	5.8	30	72	18	1:1.41	1.41:1	13.21
W-26120	320 ct	12.8 ct	3.2	.4	.075	5.6	32	1.5	.38	5:1	10:1	13.21
W-26125	400 ct	40 ct	10	.4	.075	5	40	4.5	1.1	3.16:1	6.32:1	17.44
W-26130	400 ct	120 ct	30	.4	.075	5	40	14	3.5	1.83:1	3.65:1	17.44
W-26135	400 ct	200 ct	50	.4	.075	5	40	24	6	1.41:1	2.83:1	14.69
W-26140	400 ct	400 ct	100	.4	.075	5	40	48	12	1:1	2:1	17.44
W-26145	400 ct	1000 ct	250	.4	.075	5	40	120	30	1:1.58	1.26:1	20.01
W-26150	400 ct	2000 ct	500	.4	.075	5	40	240	60	1:2.24	1:1.12	20.01
W-26155	400 ct	4000 ct	1000	.4	.075	5	40	480	120	1:3.16	1:1.58	18.07
W-26160	500 ct	12.8 ct	3.2	.4	.075	4.5	50	1.5	.38	6.25:1	12.5:1	15.31
W-26165	500 ct	16 ct	4	.4	.075	4.5	50	2	.5	5.6:1	11.2:1	15.31
W-26170	500 ct	50 ct	12.5	.4	.075	4.5	50	6	1.5	3.16:1	6.32:1	15.31
W-26175	500 ct	150 ct	37.5	.4	.075	4.5	50	18	4.5	1.83:1	3.65:1	15.31
W-26180	500 ct	500 ct	125	.4	.075	4.5	50	60	15	1:1	2:1	15.31
W-26185	*500 ct	500 ct	-	.4	.075	4.5	50	60	-	1:1	-	15.31
W-26190	500 ct	600 ct	150	.4	.075	4.5	50	72	18	1:1.1	1.83:1	15.31
W-26195	600 ct	12.8 ct	3.2	.4	.075	4.1	60	1.5	.38	6.85:1	13.7:1	13.21
W-26200	600 ct	30 ct	7.5	.4	.075	4.1	60	3.6	.9	4.47:1	8.94:1	13.85
W-26205	600 ct	48 ct	12	.4	.075	4.1	60	5.8	1.45	3.54:1	7.07:1	13.85
W-26210	600 ct	200 ct	50	.4	.075	4.1	60	24	6	1.73:1	3.46:1	13.85
W-26215	600 ct	600 ct	150	.4	.075	4.1	60	72	18	1:1	2:1	13.85
W-26220	*600 ct	600 ct	-	.4	.075	4.1	60	72	-	1:1	-	15.31
W-26225	600 ct	1200 ct	300	.4	.075	4.1	60	144	36	1:1.41	1.41:1	13.85
W-26230	640 ct	12.8 ct	3.2	.4	.075	3.9	64	1.5	.38	7.07:1	14.14:1	13.85
W-26235	700 ct	100 ct	25	.4	.075	3.8	70	12	3	2.65:1	5.29:1	13.85
W-26240	800 ct	12.8 ct	3.2	.4	.075	3.5	80	1.5	.38	7.9 :1	15.8:1	13.85
W-26245	800 ct	48 ct	12	.4	.075	3.5	80	5.8	1.45	4.08:1	8.16:1	20.66
W-26250	800 ct	800 ct	200	.4	.075	3.5	80	96	24	1:1	2:1	13.85
W-26255	900 ct	600 ct	150	.4	.075	3.3	90	72	18	1.22:1	2.45:1	13.85
W-26260	1000 ct	12 ct	3	.4	.075	3.2	100	1.5	.38	9.13:1	18.3:1	13.85
W-26265	1000 ct	50 ct	12.5	.4	.075	3.2	100	6	1.5	4.47:1	8.94:1	15.31
W-26270	1000 ct	1000 ct	250	.4	.075	3.2	100	120	30	1:1	2:1	15.31
W-26275	1060 ct	12.8 ct	3.2	.4	.075	3.1	106	1.5	.38	9.1:1	18.2:1	13.85
W-26280	1200 ct	12.8 ct	3.2	.4	.075	2.9	120	1.5	.38	9.68:1	19.4:1	12.47
W-26285	1200 ct	500 ct	125	.4	.075	2.9	120	60	15	1.55:1	3.1:1	12.47
W-26290	1200 ct	1200 ct	300	.4	.075	2.9	120	140	35	1:1	2:1	12.47
W-26295	*1200 ct	1200 ct	-	.4	.075	2.9	120	140	-	1:1	-	17.05
W-26300	1500 ct	12 ct	3	.4	.075	2.6	150	1.5	.38	11.2:1	22.4:1	13.85
W-26305	1500 ct	500 ct	125	4	.075	2.6	150	60	15	1.73:1	3.46:1	15.31
W-26310	*1500 ct	600 ct	-	.4	.075	2.6	150	72	-	1.58:1	-	15.31
W-26315	*1500 ct	1500 ct	-	.4	.075	2.6	150	180	-	1:1	-	15.31
W-26320	1600 ct	12.8 ct	3.2	.4	.075	2.5	160	1.5	.38	11.2:1	22.4:1	13.85
W-26325	2000 ct	8 ct	2	.4	.075	2.2	200	1	.25	15.8:1	31.6:1	18.07
W-26330	2000 ct	2000 ct	500	.4	.075	2.2	200	240	60	1:1	2:1	18.07
W-26335	*2000 ct	2000 ct	-	.4	.075	2.2	200	240	-	1:1	-	20.01
W-26340	2000 ct	8000 ct	2000	.4	.075	2.2	200	960	240	1:2	1:1	18.07
W-26345	2500 ct	2500 ct	625	.4	.075	2	250	300	75	1:1	2:1	18.07

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

*INCLUDES ELECTROSTATIC SHIELD

SPECIFICATIONS

- MIL-T-27: . . . . . All Units Meet MIL-T-27. Military Designation is TF5R21ZZ for Transformers, TF5R20ZZ for Inductors.
- FREQUENCY RESPONSE: . . . . . ±3dB, 400 Hz-100 KHz at 1.0 Milliwatt.
- MAXIMUM DISTORTION: . . . . 5% With Rated Power Level at 1 KHz and 400 Hz.
- DIELECTRIC STRENGTH: . . . . All Units Tested at 200 V RMS.

INSULATION RESISTANCE: . . . Greater Than 10,000 Megohms at 300 V DC.

- WEIGHT: . . . . . 2.5 Grams.
- OPERATING TEMPERATURE: . . -55°c to $+105^{\circ}$c (All Units Can Be Supplied to Class S Requirements, $+130^{\circ}$c)
- TERMINALS: . . . . . Solid .016 Diameter Conductor. Conductor is Copper Clad Steel. Tinned 100%. Electroplated Per MIL-T-10727A and ASTM CCS B452.
- THERMAL SHOCK: . . . . . 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

Delivery— stock to one week

For immediate engineering assistance or to place an order— ***Call Toll Free 800-431-1064***

PICO Electronics, Inc.
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • TWX 7105620113

PICO PART NUMBER W Series Plug-In	PRIMARY IMPED OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIM DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9*** W-Series
W-26350	3000 ct	3000 ct	725	.4	.075	1.8	300	360	90	1:1	2:1	14.69
W-26355	*3000 ct	3000 ct	-	.4	.075	1.8	300	360	-	1:1	-	20.01
W-26360	3600 ct	3600 ct	900	.4	.075	1.7	360	432	108	1:1	2:1	14.69
W-26365	4000 ct	16 ct	4	.4	.075	1.6	400	1.9	.47	15.8:1	31.6:1	18.07
W-26370	4000 ct	600 ct	150	.4	.075	1.6	400	72	18	2.58:1	5.16:1	18.07
W-26375	4000 ct	1000 ct	250	.4	.075	1.6	400	120	30	2:1	4:1	20.01
W-26380	*4000 ct	8000 ct	-	.4	.075	1.6	400	960	-	1:1.41	-	20.01
W-26385	5000 ct	500 ct	125	.4	.075	1.4	500	60	15	3.16:1	6.32:1	15.31
W-26390	5000 ct	5000 ct	1250	.4	.075	1.4	500	600	150	1:1	2:1	15.31
W-26395	7500 ct	50 ct	12.5	.33	.075	1.2	750	6	1.5	12.2:1	24.5:1	15.31
W-26400	7500 ct	100 ct	25	.33	.075	1.2	750	12	3	8.66:1	17.3:1	15.31
W-26405	7500 ct	600 ct	150	.33	.075	1.2	750	72	18	3.54:1	7.07:1	17.05
W-26410	7500 ct	2500 ct	625	.33	.075	1.2	750	300	75	1.73:1	3.46:1	17.05
W-26415	*7500 ct	7500 ct	-	.33	.075	1.2	750	900	-	1:1	-	20.01
W-26420	8000 ct	12.8 ct	3.2	.3	.075	1.1	800	1.5	.38	25:1	50:1	15.31
W-26425	8000 ct	1000 ct	250	.3	.075	1.1	800	120	30	2.83:1	5.66:1	17.05
W-26430	*8000 ct	1200 ct	-	.3	.075	1.1	800	144	-	2.58:1	-	20.01
W-26435	*9000 ct	9000 ct	-	.27	.075	1.1	900	1080	-	1:1	-	20.01
W-26440	10,000 ct	12.8 ct	3.2	.25	.075	1.0	1000	1.5	.38	28:1	56:1	13.85
W-26445	10,000 ct	16 ct	4	.25	.075	1.0	1000	1.92	.48	25:1	50:1	13.85
W-26450	10,000 ct	100 ct	25	.25	.075	1.0	1000	12	3	10:1	20:1	15.31
W-26455	10,000 ct	200 ct	50	.25	.075	1.0	1000	24	6	7.07:1	14.14:1	15.31
W-26460	10,000 ct	500 ct	125	.25	.075	1.0	1000	60	15	4.47:1	8.94:1	15.31
W-26465	10,000 ct	600 ct	150	.25	.075	1.0	1000	72	18	4.08:1	8.16:1	15.31
W-26470	10,000 ct	1000 ct	250	.25	.075	1.0	1000	120	30	3.16:1	6.32:1	15.31
W-26475	10,000 ct	1200 ct	300	.25	.075	1.0	1000	144	36	2.89:1	5.77:1	18.07
W-26480	10,000 ct	1500 ct	375	.25	.075	1.0	1000	180	45	2.58:1	5.16:1	18.07
W-26485	10,000 ct	2000 ct	500	.25	.075	1.0	1000	240	60	2.24:1	4.47:1	17.70
W-26490	10,000 ct	5000 ct	1250	.25	.075	1.0	1000	600	150	1.41:1	2.83:1	18.02
W-26495	10,000 ct	7500 ct	1875	.25	.075	1.0	1000	900	225	1.15:1	2.3:1	18.07
W-26500	10,000 ct	10,000 ct	2500	.25	.075	1.0	1000	1200	300	1:1	2:1	17.44
W-26505	*10,000 ct	10,000 ct	-	.25	.075	1.0	1000	1200	-	1:1	-	20.01
W-26510	15,000 ct	400 ct	100	.16	.075	.82	1500	48	12	6.12:1	12.24:1	17.44
W-26515	15,000 ct	500 ct	125	.16	.075	.82	1500	60	15	5.48:1	10.95:1	17.44
W-26520	15,000 ct	600 ct	150	.16	.075	.82	1500	72	18	5:1	10:1	17.44
W-26525	15,000 ct	10,000 ct	2500	.16	.075	.82	1500	1200	300	1.22:1	2.45:1	17.44
W-26530	*15,000 ct	15,000 ct	-	.16	.075	.82	1500	1800	-	1:1	-	20.01
W-26535	15,000 ct	15,000 ct	3750	.16	.075	.82	1500	1800	450	1:1	2:1	18.07
W-26540	16,000 ct	1,000 ct	250	.15	.075	.8	1600	120	30	4:1	8:1	16.07
W-26545	20,000 ct	500 ct	125	.125	.075	.7	2000	60	15	6.33:1	12.65:1	17.44
W-26550	20,000 ct	600 ct	150	.125	.075	.7	2000	72	18	5.77:1	11.55:1	17.44
W-26555	20,000 ct	800 ct	200	.125	.075	.7	2000	96	24	5:1	10:1	15.94
W-26560	20,000 ct	1000 ct	250	.125	.075	.7	2000	120	30	4.47:1	8.94:1	20.01
W-26565	20,000 ct	5000 ct	1250	.125	.075	.7	2000	600	150	2:1	4:1	17.44
W-26570	20,000 ct	10,000 ct	2500	.125	.075	.7	2000	1200	300	1.41:1	2.83:1	17.44
W-26575	*20,000 ct	20,000 ct	-	.125	.075	.7	2000	2400	-	1:1	-	20.01
W-26580	25,000 ct	500 ct	125	.1	.075	.63	2500	60	15	7.07:1	14.14:1	16.07
W-26585	25,000 ct	1000 ct	250	.1	.075	.63	2500	120	30	5:1	10:1	18.07
W-26590	30,000 ct	50 ct	12.5	.083	.075	.58	3000	6	1.5	24.5:1	49:1	18.07
W-26595	30,000 ct	1200 ct	300	.083	.075	.58	3000	144	36	5:1	10:1	18.07
W-26600	30,000 ct	500 ct	125	.083	.075	.58	3000	60	15	7.75:1	15.5:1	18.07
W-26605	30,000 ct	200 ct	50	.083	.075	.58	3000	24	6	12.25:1	24.5:1	18.07
W-26610	30,000 ct	5,000 ct	1250	.083	.075	.58	3000	600	150	2.45:1	4.9:1	18.07
W-26615	30,000 ct	10,000 ct	2500	.083	.075	.58	3000	1200	300	1.73:1	3.46:1	18.07
W-26620	*30,000 ct	30,000 ct	-	.083	.075	.58	3000	3600	-	1:1	-	20.01
W-26625	40,000 ct	400 ct	100	.062	.062	.5	4000	48	12	10:1	20:1	20.01
W-SHIELD	MU-METAL SHIELD .37"D x .32"H (9.4mmD x 8.1mmH) SINGLE SHIELD											2.05
WXX-SHIELD	MU-METAL SHIELD .395"D x .33"H (10mmD x 8.4mmH) USE WITH W SHIELD FOR DOUBLE SHIELDING											2.05

*INCLUDES ELECTROSTATIC SHIELD

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

INDUCTORS

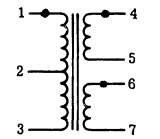
ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS. TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF D.C. CURRENT, ARE LISTED FOR EACH INDUCTOR.

PICO PART NUMBER	INDUCTANCE HENRIES	DC CURRENT ma	DC RESISTANCE OHMS	PRICE*** 1-9
W-26705	SERIES 0.1	4	25	13.85
	SERIES .08	10		
	PARALLEL .025	8	6.5	
	PARALLEL .02	20		
W-26710	SERIES 0.9	2	105	13.85
	SERIES 0.5	6		
	PARALLEL .23	4	26	
	PARALLEL .13	12		
W-26715	SERIES 2.5	2	630	13.85
	SERIES 0.9	4		
	PARALLEL 0.6	4	160	
	PARALLEL 0.23	8		
W-26720	SERIES 4.5	2	2300	14.70
	SERIES 1.2	4		
	PARALLEL 1.1	4	575	
	PARALLEL 0.3	8		

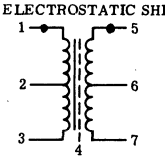
PICO's ultra-miniature transformers

W SERIES Plug-In

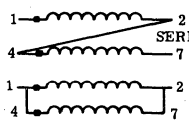
SCHEMATICS FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



SCHEMATIC FOR INDUCTORS



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

This Product is Patented

Delivery— stock to one week

For immediate engineering assistance or to place an order— Call Toll Free 800-431-1064

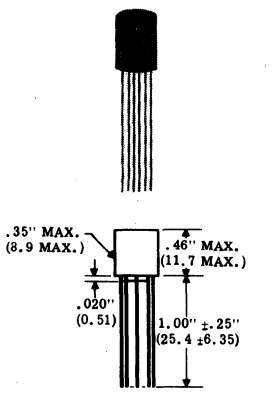
PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

914-699-5514
TWX 7105620113

PICO's ultra-miniature transformers

Y SERIES Plug-In



DIMENSIONS ARE IN INCHES (MM)

SPECIFICATIONS

- MIL-T-27: . . . . . All Units Meet MIL-T-27, Military Designation is TF5R21ZZ, for Transformers, TFR20ZZ for Inductors.
- FREQUENCY RESPONSE: . . . ±3db, 300 Hz - 100 KHz at 1.0 Milliwatt.
- MAXIMUM DISTORTION: . . . . 5% With Rated Power Level at 1 KHz, 400 Hz and 300 Hz.
- DIELECTRIC STRENGTH: . . . All Units Tested at 200 V RMS.
- INSULATION RESISTANCE: . . . Greater Than 10,000 Megohms at 300 V DC.
- WEIGHT: . . . . . 3 Grams
- OPERATING TEMPERATURE: . -55°c to +105°c (All Units Can Be Supplied to Class S Requirements, +130°C).
- TERMINALS: . . . . . Solid .016 Diameter Conductor. Conductor is Copper Clad Steel, Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452.
- THERMAL SHOCK: . . . . . 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

For immediate engineering assistance or to place an order—
Call Toll Free 800-431-1064

PICO Electronics, Inc.

453 North Mac Questen Pkwy.
Mt. Vernon, New York 10552

914-699-5514 • TWX 7105620113

Delivery— stock to one week

PICO PART NUMBER Y Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	400 Hz and higher	300 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 *** Y-Series
Y-27003	10 ct	10 ct	2.5	.6	.2	.1	31.6	1	1.25	.32	1:1	2:1	13.65
Y-27005	20 ct	8 ct	2	.6	.2	.1	22.3	2	.9	.23	1.58:1	3.16:1	13.85
Y-27010	20 ct	20 ct	5	.6	.2	.1	22.3	2.1	2.25	.56	1:1	2:1	13.85
Y-27015	32 ct	32 ct	8	.6	.2	.1	17.6	3.4	4	1	1:1	2:1	13.85
Y-27020	40 ct	40 ct	10	.6	.2	.1	15.8	4.2	4.5	1.13	1:1	2:1	13.85
Y-27025	48 ct	16 ct	4	.6	.2	.1	14.4	5	1.8	.45	1.73:1	3.46:1	13.85
Y-27030	50 ct	50 ct	12.5	.6	.2	.1	14.1	5.25	5.6	1.4	1:1	2:1	13.85
Y-27035	80 ct	32 ct	8	.6	.2	.1	11.1	8.4	4	1	1.58:1	3.16:1	17.43
Y-27040	100 ct	40 ct	10	.6	.2	.1	10	10	4.5	1.13	1.58:1	3.16:1	17.43
Y-27045	100 ct	100 ct	25	.6	.2	.1	10	11	11.25	2.8	1:1	2:1	17.43
Y-27050	120 ct	12.8 ct	3.2	.6	.2	.1	9.1	14.4	1.8	.45	3.06:1	6.12:1	13.21
Y-27055	120 ct	60 ct	15	.6	.2	.1	9.1	14.4	8.4	2.1	1.41:1	2.83:1	17.43
Y-27060	120 ct	120 ct	30	.6	.2	.1	9.1	14.4	16.8	4.2	1:1	2:1	17.43
Y-27065	150 ct	12 ct	3	.6	.2	.1	8.2	15	1.5	.38	3.54:1	7.08:1	13.21
Y-27070	150 ct	50 ct	12.5	.6	.2	.1	8.2	15	6	1.5	1.73:1	3.46:1	14.68
Y-27075	150 ct	100 ct	25	.6	.2	.1	8.2	15	12	3	1.22:1	2.45:1	14.68
Y-27080	150 ct	150 ct	37.5	.6	.2	.1	8.2	15	18	4.5	1:1	2:1	17.31
Y-27085	150 ct	600 ct	150	.6	.2	.1	8.2	15	72	18	1:2	1:1	14.68
Y-27090	200 ct	200 ct	50	.6	.2	.1	7	22	24	6	1:1	2:1	14.68
Y-27095	300 ct	12 ct	3	.6	.2	.1	5.8	30	1.4	.35	5:1	10:1	13.21
Y-27100	300 ct	50 ct	12.5	.6	.2	.1	5.8	30	6	1.5	2.45:1	4.9:1	14.68
Y-27105	300 ct	150 ct	37.5	.6	.2	.1	5.8	30	18	4.5	1.41:1	2.83:1	14.68
Y-27110	300 ct	300 ct	75	.6	.2	.1	5.8	30	36	9	1:1	2:1	17.43
Y-27115	300 ct	600 ct	150	.6	.2	.1	5.8	30	72	18	1:1.41	1.41:1	13.85
Y-27120	320 ct	12.8 ct	3.2	.6	.2	.1	5.6	36	1.8	.45	5:1	10:1	13.21
Y-27125	400 ct	40 ct	10	.6	.2	.1	5	40	4.8	1.2	3.16:1	6.32:1	17.43
Y-27130	400 ct	120 ct	30	.6	.2	.1	5	40	14.5	3.6	1.83:1	3.65:1	17.43
Y-27135	400 ct	200 ct	50	.6	.2	.1	5	40	24	6	1.4:1	2.83:1	14.68
Y-27140	400 ct	400 ct	100	.6	.2	.1	5	40	48	12	1:1	2:1	17.43
Y-27145	400 ct	1000 ct	250	.6	.2	.1	5	40	125	31	1:1.58	1.26:1	20.00
Y-27150	400 ct	2000 ct	500	.6	.2	.1	5	40	240	60	1:2.24	1:1.12	20.00
Y-27155	400 ct	4000 ct	1000	.6	.2	.1	5	40	480	120	1:3.16	1:1.58	18.06
Y-27160	500 ct	12.8 ct	3.2	.6	.2	.1	4.5	50	1.5	.38	6.25:1	12.5:1	15.51
Y-27165	500 ct	16 ct	4	.6	.2	.1	4.5	50	1.9	.48	5.6:1	11.2:1	15.51
Y-27170	500 ct	50 ct	12.5	.6	.2	.1	4.5	50	6	1.5	3.16:1	6.32:1	15.51
Y-27175	500 ct	150 ct	37.5	.6	.2	.1	4.5	50	18	4.5	1.83:1	3.65:1	15.51
Y-27180	500 ct	500 ct	125	.6	.2	.1	4.5	50	60	15	1:1	2:1	15.51
Y-27185	*500 ct	500 ct	-	.6	.2	.1	4.5	50	60	-	1:1	-	15.51
Y-27190	500 ct	600 ct	150	.6	.2	.1	4.5	50	72	18	1:1.1	1.83:1	13.85
Y-27195	600 ct	12.8 ct	3.2	.6	.2	.1	4.1	60	1.5	.38	6.85:1	13.7:1	12.47
Y-27200	600 ct	30 ct	7.5	.6	.2	.1	4.1	60	3.6	.9	4.47:1	8.94:1	13.05
Y-27205	600 ct	48 ct	12	.6	.2	.1	4.1	60	5.8	1.45	3.54:1	7.07:1	13.05
Y-27210	600 ct	200 ct	50	.6	.2	.1	4.1	60	24	6	1.73:1	3.46:1	13.05
Y-27215 **	600 ct	600 ct	150	.6	.2	.1	4.1	60	72	18	1:1	2:1	13.05
Y-27220**	*600 ct	600 ct	-	.6	.2	.1	4.1	60	72	-	1:1	-	13.05
Y-27225 **	600 ct	1200 ct	300	.6	.2	.1	4.1	60	144	36	1:1.41	1.41:1	13.05
Y-27230	640 ct	12.8 ct	3.2	.6	.2	.1	3.9	64	1.5	.38	7.07:1	14.14:1	13.05
Y-27235	700 ct	100 ct	25	.6	.2	.1	3.8	70	12	3	2.65:1	5.29:1	13.05
Y-27240	800 ct	12.8 ct	3.2	.6	.2	.1	3.5	80	1.5	.38	7.9:1	15.8:1	13.05
Y-27245	800 ct	48 ct	12	.6	.2	.1	3.5	80	5.8	1.45	4.08:1	8.16:1	15.51
Y-27250	800 ct	800 ct	200	.6	.2	.1	3.5	80	96	24	1:1	2:1	15.51
Y-27255	900 ct	600 ct	150	.6	.2	.1	3.3	90	72	18	1.22:1	2.45:1	13.85
Y-27260	1000 ct	12 ct	3	.6	.2	.1	3.2	100	1.4	.35	9.13:1	18.3:1	13.85
Y-27265	1000 ct	50 ct	12.5	.6	.2	.1	3.2	100	6	1.5	4.47:1	8.94:1	15.51
Y-27270	1000 ct	1000 ct	250	.6	.2	.1	3.2	100	120	30	1:1	2:1	15.51
Y-27275	1060 ct	12.8 ct	3.2	.6	.2	.1	3.1	106	1.5	.38	9.1:1	18.2:1	13.85
Y-27280	1200 ct	12.8 ct	3.2	.6	.2	.1	2.9	120	1.5	.38	9.68:1	19.4:1	12.47
Y-27285	1200 ct	500 ct	125	.6	.2	.1	2.9	120	60	15	1.55:1	3.1:1	12.47
Y-27290	1200 ct	1200 ct	300	.6	.2	.1	2.9	120	144	36	1:1	2:1	12.47
Y-27295	*1200 ct	1200 ct	-	.6	.2	.1	2.9	120	144	-	1:1	-	13.85
Y-27300	1500 ct	12 ct	3	.6	.2	.1	2.6	150	1.44	.36	11.2:1	22.4:1	13.85
Y-27305	1500 ct	500 ct	125	.6	.2	.1	2.6	150	60	15	1.73:1	3.46:1	15.51
Y-27310	*1500 ct	600 ct	-	.6	.2	.1	2.6	150	72	-	1.58:1	-	20.00
Y-27315	*1500 ct	1500 ct	-	.6	.2	.1	2.6	150	180	-	1:1	-	15.51
Y-27320	1600 ct	12.8 ct	3.2	.6	.2	.1	2.5	160	1.5	.38	11.2:1	22.4:1	13.85
Y-27325	2000 ct	8 ct	2	.6	.2	.1	2.2	200	.96	.24	15.8:1	31.6:1	15.51
Y-27330	2000 ct	2000 ct	500	.6	.2	.1	2.2	200	240	60	1:1	2:1	18.06
Y-27335	*2000 ct	2000 ct	-	.6	.2	.1	2.2	200	240	-	1:1	-	20.00
Y-27340	2000 ct	8000 ct	2000	.6	.2	.1	2.2	200	960	240	1:2	1:1	18.06
Y-27345	2500 ct	2500 ct	625	.6	.2	.1	2	250	300	75	1:1	2:1	18.06
Y-27350	3000 ct	3000 ct	725	.6	.2	.1	1.8	300	360	90	1:1	2:1	14.53
Y-27355	*3000 ct	3000 ct	-	.6	.2	.1	1.8	300	360	-	1:1	-	20.00
Y-27360	3600 ct	3600 ct	900	.6	.2	.1	1.7	360	432	108	1:1	2:1	18.06
Y-27365	4000 ct	16 ct	4	.6	.2	.1	1.6	400	1.92	.48	15.8:1	31.6:1	18.06
Y-27370**	4000 ct	600 ct	150	.6	.2	.1	1.6	400	72	18	2.58:1	5.16:1	18.06
Y-27375	4000 ct	1000 ct	250	.6	.2	.1	1.6	400	120	30	2:1	4:1	18.06
Y-27380	*4000 ct	8000 ct	-	.6	.2	.1	1.6	400	960	-	1:1.41	-	18.06
Y-27385	5000 ct	500 ct	125	.5	.2	.1	1.4	500	60	15	3.16:1	6.32:1	14.53
Y-27390	5000 ct	5000 ct	1250	.5	.2	.1	1.4	500	600	150	1:1	2:1	14.53
Y-27395	7500 ct	50 ct	12.5	.33	.2	.1	1.2	750	6	1.5	12.2:1	24.5:1	14.53
Y-27400	7500 ct	100 ct	25	.33	.2	.1	1.2	750	12	3	8.66:1	17.3:1	15.51
Y-27405	7500 ct	600 ct	150	.33	.2	.1	1.2	750	72	18	3.54:1	7.07:1	17.04

***Discount Prices: 1-9 Net:
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50-99 less 23%: 100-499 less 30%

Ordering Instructions:
No minimum. Net 30 days
F.O.B. Mt. Vernon, New York

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

PICO PART NUMBER Y Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	400 Hz and higher	300 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 *** Y-Series
Y-27410	7500 ct	2500 ct	625	.33	.2	.1	1.2	750	300	75	1.73:1	3.46:1	17.04
Y-27415	*7500 ct	7500 ct	-	.33	.2	.1	1.2	750	900	-	1:1	-	20.00
Y-27420	8000 ct	12.8 ct	3.2	.3	.2	.1	1.1	800	1.5	.38	25:1	50:1	14.53
Y-27425	8000 ct	1000 ct	250	.3	.2	.1	1.1	800	120	30	2.83:1	5.66:1	17.04
Y-27430	*8000 ct	1200 ct	-	.3	.2	.1	1.1	800	144	-	2.58:1	-	18.06
Y-27435	*9000 ct	9000 ct	-	.27	.2	.1	1.1	900	1080	-	1:1	-	18.78
Y-27440	10,000 ct	12.8 ct	3.2	.25	.2	.1	1.0	1000	1.5	.38	28:1	56:1	13.85
Y-27445	10,000 ct	16 ct	4	.25	.2	.1	1.0	1000	1.92	.48	25:1	50:1	15.30
Y-27450	10,000 ct	100 ct	25	.25	.2	.1	1.0	1000	12	3	10:1	20:1	15.30
Y-27455	10,000 ct	200 ct	50	.25	.2	.1	1.0	1000	24	6	7.07:1	14.14:1	15.30
Y-27460	10,000 ct	500 ct	125	.25	.2	.1	1.0	1000	60	15	4.47:1	8.94:1	15.30
Y-27465	10,000 ct	600 ct	150	.25	.2	.1	1.0	1000	72	18	4.08:1	8.16:1	15.30
Y-27470	10,000 ct	1000 ct	250	.25	.2	.1	1.0	1000	120	30	3.16:1	6.32:1	15.30
Y-27475	10,000 ct	1200 ct	300	.25	.2	.1	1.0	1000	144	36	2.89:1	5.77:1	15.30
Y-27480	10,000 ct	1500 ct	375	.25	.2	.1	1.0	1000	180	45	2.58:1	5.16:1	16.69
Y-27485	10,000 ct	2000 ct	500	.25	.2	.1	1.0	1000	240	60	2.24:1	4.47:1	16.69
Y-27490	10,000 ct	5000 ct	1250	.25	.2	.1	1.0	1000	600	150	1.41:1	2.83:1	17.86
Y-27495	10,000 ct	7500 ct	1875	.25	.2	.1	1.0	1000	900	225	1.15:1	2.3:1	17.86
Y-27500	10,000 ct	10,000 ct	2500	.25	.2	.1	1.0	1000	1200	300	1:1	2:1	17.43
Y-27505	*10,000 ct	10,000 ct	-	.25	.2	.1	1.0	1000	1200	-	1:1	-	19.43
Y-27510	15,000 ct	400 ct	100	.16	.16	.1	.82	1500	48	12	6.12:1	12.24:1	17.43
Y-27515	15,000 ct	500 ct	125	.16	.16	.1	.82	1500	60	15	5.48:1	10.95:1	17.43
Y-27520	15,000 ct	600 ct	150	.16	.16	.1	.82	1500	72	18	5:1	10:1	17.43
Y-27525	15,000 ct	10,000 ct	2500	.16	.16	.1	.82	1500	1200	300	1.22:1	2.45:1	19.43
Y-27530	*15,000 ct	15,000 ct	-	.16	.16	.1	.82	1500	1800	-	1:1	-	19.43
Y-27535	15,000 ct	15,000 ct	3750	.16	.16	.1	.82	1500	1800	450	1:1	2:1	19.43
Y-27540	16,000 ct	1000 ct	250	.15	.15	.1	.8	1600	120	30	4:1	8:1	16.06
Y-27545	20,000 ct	500 ct	125	.125	.125	.1	.7	2000	60	15	6.33:1	12.65:1	17.43
Y-27550	20,000 ct	600 ct	150	.125	.125	.1	.7	2000	72	18	5.77:1	11.55:1	17.43
Y-27555	20,000 ct	800 ct	200	.125	.125	.1	.7	2000	96	24	5:1	10:1	13.85
Y-27560	20,000 ct	1000 ct	250	.125	.125	.1	.7	2000	120	30	4.47:1	8.94:1	17.43
Y-27565	20,000 ct	5000 ct	1250	.125	.125	.1	.7	2000	600	150	2:1	4:1	17.43
Y-27570	20,000 ct	10,000 ct	2500	.125	.125	.1	.7	2000	1200	300	1.41:1	2.83:1	17.43
Y-27575	*20,000 ct	20,000 ct	-	.125	.125	.1	.7	2000	2400	-	1:1	-	17.43
Y-27580	25,000 ct	500 ct	125	.1	.1	.1	.63	2500	60	15	7.07:1	14.14:1	17.43
Y-27585	25,000 ct	1000 ct	250	.1	.1	.1	.63	2500	120	30	5:1	10:1	17.43
Y-27590	30,000 ct	50 ct	12.5	.08	.08	.08	.58	3000	6	1.5	24.5:1	49:1	17.43
Y-27595	30,000 ct	1200 ct	300	.08	.08	.08	.58	3000	144	36	5:1	10:1	17.43
Y-27600	30,000 ct	500 ct	125	.08	.08	.08	.58	3000	60	15	7.75:1	15.5:1	17.43
Y-27605	30,000 ct	200 ct	50	.08	.08	.08	.58	3000	24	6	12.25:1	24.5:1	17.43
Y-27610	30,000 ct	5000 ct	1250	.08	.08	.08	.58	3000	600	150	2.45:1	4.9:1	19.43
Y-27615	30,000 ct	10,000 ct	2500	.08	.08	.08	.58	3000	1200	300	1.73:1	3.46:1	19.43
Y-27620	*30,000 ct	30,000 ct	-	.08	.08	.08	.58	3000	3600	-	1:1	-	19.43
Y-27625	40,000 ct	400 ct	100	.06	.06	.06	.5	4000	48	12	10:1	20:1	19.43
Y-27630	40,000 ct	2,000 ct	500	.06	.06	.06	.5	4000	240	60	4.47:1	8.94:1	19.43
Y-27635	40,000 ct	4,000 ct	1000	.06	.06	.06	.5	4000	480	120	3.16:1	6.32:1	20.16
Y-27640	40,000 ct	20,000 ct	5000	.06	.06	.06	.5	4000	2400	600	1.41:1	2.83:1	19.43
Y-27645	*40,000 ct	40,000 ct	-	.06	.06	.06	.5	4000	4800	-	1:1	-	19.43
Y-27650	50,000 ct	200 ct	50	.05	.05	.05	.45	5000	24	6	15.8:1	31.6:1	20.16
Y-27655	50,000 ct	500 ct	125	.05	.05	.05	.45	5000	60	15	10:1	20:1	20.16
Y-27660	50,000 ct	600 ct	150	.05	.05	.05	.45	5000	72	18	9.13:1	18.26:1	20.16
Y-27665	60,000 ct	15,000 ct	3750	.04	.04	.04	.41	6000	1800	450	2:1	4:1	20.16
Y-27670	62,500 ct	50 ct	12.5	.04	.04	.04	.4	6250	6	1.5	35.4:1	70.7:1	20.16
Y-27675	80,000 ct	15,000 ct	3750	.03	.03	.03	.35	8000	1800	450	2.3:1	4.6:1	20.16
Y-27680	90,000 ct	10,000 ct	2500	.028	.028	.028	.33	9000	1200	300	3:1	6:1	20.16
Y-27685	95,000 ct	15,000 ct	3750	.026	.026	.026	.32	9500	1800	450	2.52:1	5.03:1	20.16
Y-27690	100,000 ct	60 ct	15	.025	.025	.025	.31	10,000	7.2	1.8	40.8:1	81.6:1	22.30
Y-27695	100,000 ct	100 ct	25	.025	.025	.025	.31	10,000	12	3	31.6:1	63.2:1	22.30
Y-27700	100,000 ct	500 ct	125	.025	.025	.025	.31	10,000	60	15	14.1:1	28.3:1	22.30
Y-27705	100,000 ct	10,000 ct	2500	.025	.025	.025	.31	10,000	1200	300	3.16:1	6.32:1	22.30
Y-SHIELD	MU-METAL SHIELD .37" DIA. X .46" HT. (9.4MM DIA. X 11.7MM HT.) SINGLE SHIELD												2.04
YXX-SHIELD	MU-METAL SHIELD .395" DIA. X .47" HT. (10.1MM DIA. X 11.9"MM HT.) USE WITH Y-SHIELD FOR DOUBLE SHIELDING												2.04

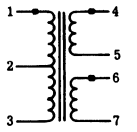
***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

* INCLUDES ELECTROSTATIC SHIELD

PICO's ultra-miniature transformers

Y SERIES Plug-In

SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



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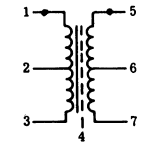

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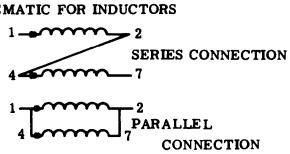

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
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- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS

This Product is Patented

Delivery— stock to one week

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INDUCTORS

ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS.

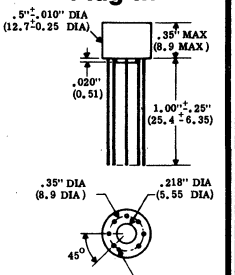
TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF DC CURRENT, ARE LISTED FOR EACH INDUCTOR.

Y-Series Plug-In	INDUCTANCE HENRIES	DC CURRENT ma	DC RESISTANCE OHMS	PRICES 1-9***
Y-27750	SERIES .075 / .06	10 / 30	10.5	13.22
	PARALLEL .018 / .015	20 / 60	2.6	
Y-27760	SERIES .3 / .15	4 / 20	25	14.69
	PARALLEL .075 / .04	8 / 40	6.2	
Y-27770	SERIES 3.5 / 1.0	2 / 5	560	14.69
	PARALLEL 0.9 / 0.25	4 / 10	140	
Y-27780	SERIES 6.0 / 1.5	2 / 5	2100	14.69
	PARALLEL 1.5 / 0.38	4 / 10	525	
Y-27790	SERIES 20 / 8	1 / 3	5100	18.06
	PARALLEL 5 / 2	2 / 6	1275	

For immediate engineering assistance or to place an order— Call Toll Free 800-431-1064

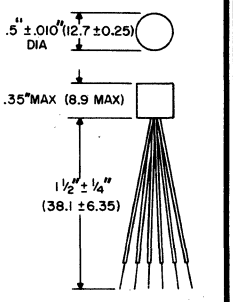
PICO's ultra-miniature transformers

L SERIES Plug-In



WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM PIN #1

P SERIES Insulated Leads



Dimensions are in inches (MM)

PICO PART NUMBER L-Series Plug-In	PICO PART NUMBER P-Series Insulated Leads	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 400 Hz and higher	POWER WATTS 300 Hz and higher	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1-9 *** L-Series	PICO PRICES 1-9 *** P-Series
L-8203	P-9203	20 ct	8 ct	2	.6	.4	.3	30.0	2	1.2	.3	1.58:1	3.16:1	16.45	15.90
L-8205	P-9205	20 ct	20 ct	5	.6	.4	.3	30.0	2	2.8	.7	1:1	2:1	16.45	15.90
L-8210	P-9210	32 ct	32 ct	8	.6	.4	.3	23.0	3.3	4.5	1.13	1:1	2:1	16.45	15.90
L-8215	P-9215	40 ct	40 ct	10	.6	.4	.3	21.0	3.7	5	1.25	1:1	2:1	16.45	15.90
L-8218	P-9218	48 ct	16 ct	4	.6	.4	.3	19.0	3.75	3	.75	1.73:1	3.46:1	16.45	15.90
L-8220	P-9220	50 ct	50 ct	12.5	.6	.4	.3	19.0	5	7	1.75	1:1	2:1	16.45	15.90
L-8225	P-9225	80 ct	32 ct	8	.6	.4	.3	15.0	7.5	4.3	1.13	1.58:1	3.16:1	16.45	15.90
L-8228	P-9228	100 ct	40 ct	10	.6	.4	.3	13.0	10.8	5	1.25	1.58:1	3.16:1	16.45	15.90
L-8230	P-9230	100 ct	100 ct	25	.6	.4	.3	13.0	10.8	12	3	1:1	2:1	16.45	15.90
L-8235	P-9235	120 ct	12.8 ct	3.2	.6	.4	.3	12.0	9.3	2.2	.55	3.06:1	6.12:1	16.45	15.90
L-8240	P-9240	120 ct	60 ct	15	.6	.4	.3	12.0	9	7.2	1.8	1.41:1	2.83:1	16.45	15.90
L-8245	P-9245	120 ct	120 ct	30	.6	.4	.3	12.0	11.6	13	3.3	1:1	2:1	16.45	15.90
L-8250	P-9250	150 ct	12 ct	3	.6	.4	.3	11.0	11.2	2.2	.55	3.54:1	7.08:1	16.45	15.90
L-8255	P-9255	150 ct	50 ct	12.5	.6	.4	.3	11.0	13	6.8	1.7	1.73:1	3.46:1	16.45	15.90
L-8260	P-9260	150 ct	100 ct	25	.6	.4	.3	11.0	13	11.8	3	1.22:1	2.45:1	16.45	15.90
L-8265	P-9265	150 ct	150 ct	37.5	.6	.4	.3	11.0	13	18.3	4.6	1:1	2:1	16.45	15.90
L-8270	P-9270	150 ct	600 ct	150	.6	.4	.3	11.0	13	75	19	1:2	1:1	16.45	15.90
L-8275	P-9275	200 ct	200 ct	50	.6	.4	.3	10.0	19	21.3	5.4	1:1	2:1	16.45	15.90
L-8280	P-9280	300 ct	12 ct	3	.6	.4	.3	8.0	24	1.7	.43	5:1	10:1	16.45	15.90
L-8285	P-9285	300 ct	50 ct	12.5	.6	.4	.3	8.0	30	6.8	1.7	2.45:1	4.9:1	16.45	15.90
L-8290	P-9290	300 ct	150 ct	37.5	.6	.4	.3	8.0	30	18	4.6	1.41:1	2.83:1	16.45	15.90
L-8295	P-9295	300 ct	300 ct	75	.6	.4	.3	8.0	30	34	8.5	1:1	2:1	16.45	15.90
L-8300	P-9300	300 ct	600 ct	150	.6	.4	.3	8.0	30	60	15	1:1.41	1.41:1	16.45	15.90
L-8305	P-9305	320 ct	12.8 ct	3.2	.6	.4	.3	7.5	31	1.7	.43	5:1	10:1	16.45	15.90
L-8310	P-9310	400 ct	40 ct	10	.6	.4	.3	7.0	41	4.5	1.13	3.16:1	6.32:1	16.45	15.90
L-8315	P-9315	400 ct	120 ct	30	.6	.4	.3	7.0	41	12	3	1.83:1	3.65:1	16.45	15.90
L-8320	P-9320	400 ct	200 ct	50	.6	.4	.3	7.0	41	21.3	5.4	1.41:1	2.83:1	16.45	15.90
L-8325	P-9325	400 ct	400 ct	100	.6	.4	.3	7.0	41	37.5	9.4	1:1	2:1	16.45	15.90
L-8330	P-9330	400 ct	1000 ct	250	.6	.4	.3	7.0	41	96	24	1:1.58	1.26:1	13.45	15.90
L-8335	P-9335	400 ct	2000 ct	500	.6	.4	.3	7.0	41	212	53	1:2.24	1:1.12	13.45	15.90
L-8340	P-9340	400 ct	4000 ct	1000	.6	.4	.3	7.0	41	375	94	1:3.16	1:1.58	16.45	15.90
L-8342	P-9342	500 ct	12.8 ct	3.2	.6	.4	.3	6.0	48	1.7	.43	6.25:1	12.5:1	16.45	15.90
L-8344	P-9344	500 ct	16 ct	4	.6	.4	.3	6.0	48	1.9	.5	5.6:1	11.2:1	16.45	15.90
L-8345	P-9345	500 ct	50 ct	12.5	.6	.4	.3	6.0	39	6.8	1.7	3.16:1	6.32:1	16.45	15.90
L-8347	P-9347	500 ct	150 ct	37.5	.6	.4	.3	6.0	48	18	4.6	1.83:1	3.65:1	16.45	15.90
L-8350	P-9350	500 ct	500 ct	125	.6	.4	.3	6.0	48	54	13.5	1:1	2:1	16.45	15.90
L-8355	P-9355	*500 ct	500 ct	-	.6	.4	.3	6.0	48	68	-	1:1	-	17.14	16.45
L-8360	P-9360	500 ct	600 ct	150	.6	.4	.3	6.0	48	59	15	1:1.1	1.83:1	16.45	16.45
L-8365	P-9365	600 ct	12.8 ct	3.2	.6	.4	.3	5.5	53	1.7	.43	6.85:1	13.7:1	13.45	16.45
L-8367	P-9367	600 ct	30 ct	7.5	.6	.4	.3	5.5	53	4.2	1.1	4.47:1	8.94:1	13.45	16.45
L-8370	P-9370	600 ct	48 ct	12	.6	.4	.3	5.5	53	6.8	1.7	3.54:1	7.07:1	16.45	16.45
L-8375	P-9375	600 ct	200 ct	50	.6	.4	.3	5.5	53	21.3	5.3	1.73:1	3.46:1	16.45	15.90
L-8380**	P-9380	600 ct	600 ct	150	.6	.4	.3	5.5	57	79	20	1:1	2:1	16.45	15.90
L-8385**	P-9385	*600 ct	600 ct	-	.6	.4	.3	5.5	53	75	-	1:1	-	17.14	16.45
L-8387**	P-9387	600 ct	1200 ct	300	.6	.4	.3	5.5	53	105	26	1:1.41	1.41:1	16.45	15.90
L-8390	P-9390	640 ct	12.8 ct	3.2	.6	.4	.3	5.5	66	1.7	.43	7.07:1	14.14:1	16.45	15.90
L-8395	P-9395	700 ct	100 ct	25	.6	.4	.3	5.0	69	12	3	2.65:1	5.29:1	16.45	15.90
L-8400	P-9400	800 ct	12.8 ct	3.2	.6	.4	.3	5.0	75	1.7	.43	7.9:1	15.8:1	13.45	15.90
L-8405	P-9405	800 ct	48 ct	12	.6	.4	.3	5.0	75	6.8	1.7	4.08:1	8.16:1	13.45	15.90
L-8410	P-9410	800 ct	800 ct	200	.6	.4	.3	5.0	75	105	26	1:1	2:1	16.45	15.90
L-8415	P-9415	900 ct	600 ct	150	.6	.4	.3	4.5	79	75	19	1.22:1	2.45:1	16.45	15.90
L-8420	P-9420	1000 ct	12 ct	3	.6	.4	.3	4.5	103	1.6	.4	9.13:1	18.3:1	16.45	15.90
L-8425	P-9425	1000 ct	50 ct	12.5	.6	.4	.3	4.5	103	6.4	1.6	4.47:1	8.94:1	16.45	15.90
L-8430	P-9430	1000 ct	1000 ct	250	.6	.4	.3	4.5	103	115	29	1:1	2:1	16.45	15.90
L-8435	P-9435	1060 ct	12.8 ct	3.2	.6	.4	.3	4.0	108	1.7	.43	9.1:1	18.2:1	16.45	15.90
L-8440	P-9440	1200 ct	12.8 ct	3.2	.6	.4	.3	4.0	113	1.7	.43	9.68:1	19.4:1	16.45	15.90
L-8445	P-9445	1200 ct	500 ct	125	.6	.4	.3	4.0	113	54	13.5	1.55:1	3.1:1	16.45	15.90
L-8450	P-9450	1200 ct	1200 ct	300	.6	.4	.3	4.0	113	126	31.6	1:1	2:1	16.45	15.90
L-8455	P-9455	*1200 ct	1200 ct	-	.6	.4	.3	4.0	111	125	-	1:1	-	17.14	16.45
L-8460	P-9460	1500 ct	12 ct	3	.6	.4	.3	3.5	126	1.6	.4	11.2:1	22.4:1	16.45	15.90
L-8465	P-9465	1500 ct	500 ct	125	.6	.4	.3	3.5	126	68	17	1.73:1	3.46:1	16.45	15.90
L-8470	P-9470	*1500 ct	600 ct	-	.6	.4	.3	3.5	126	94	-	1.58:1	-	17.14	16.45
L-8475	P-9475	*1500 ct	1500 ct	-	.6	.4	.3	3.5	126	176	-	1:1	-	17.14	16.45
L-8480	P-9480	1600 ct	12.8 ct	3.2	.6	.4	.3	3.5	130	1.7	.43	11.2:1	22.4:1	16.45	15.90
L-8483	P-9483	2000 ct	8 ct	2	.6	.4	.3	3.0	210	1.2	.3	15.8:1	31.6:1	16.45	15.90
L-8485	P-9485	2000 ct	2000 ct	500	.6	.4	.3	3.0	198	218	55	1:1	2:1	16.45	15.90
L-8490	P-9490	*2000 ct	2000 ct	-	.6	.4	.3	3.0	198	218	-	1:1	-	16.45	15.90
L-8495	P-9495	2000 ct	8000 ct	2000	.6	.4	.3	3.0	198	850	213	1:2	1:1	16.45	15.90
L-8497	P-9497	2500 ct	2500 ct	625	.6	.4	.3	2.5	220	305	76	1:1	2:1	16.45	15.90
L-8500	P-9500	3000 ct	3000 ct	750	.6	.4	.3	2.5	243	335	84	1:1	2:1	16.45	15.90

SPECIFICATIONS

- **MIL-T-27** . . . . . All Units Meet MIL-T-27 and are Hermetically Sealed in a Metal Case. Audio Transformers are Type TF5R21ZZ.
- **FREQUENCY RESPONSE:** . . . . ±3db, 300 Hz - 75 KHz At 1.0 Milliwatt
- **MAXIMUM DISTORTION:** . . . . . 5% With Rated Power Level at 1 KHz, 400 Hz and 300 Hz
- **DIELECTRIC STRENGTH:** . . . . All Units Tested at 200 V RMS
- **INSULATION RESISTANCE:** . . . Greater than 10,000 Megohms at 300 V DC
- **WEIGHT:** . . . . . 5 Grams
- **OPERATING TEMPERATURE:** . . -55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c maximum)
- **TERMINALS:** . . . . . Solid .016 Diameter Conductor. Conductor is Copper Clad Steel, Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452.
- **THERMAL SHOCK:** . . . . . 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

This Product is Patented

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

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**MINIATURIZED TELEPHONE COUPLING APPLICATION

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PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • TWX 7105620113

PICO PART NUMBER L-Series Plug-in	P-Series Insulated Leads	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	400 Hz and higher	300 Hz and higher	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 *** L-Series	P-Series
L-8505	P-9505	*3000 ct	3000 ct	-	.6	.4	.3	2.5	304	335	-	1:1	-	17.14	16.45
L-8510	P-9510	3600 ct	3600 ct	900	.6	.4	.3	2.5	330	366	92	1:1	2:1	16.45	15.90
L-8512	P-9512	4000 ct	16 ct	4	.6	.4	.3	2.0	350	3	.75	15.8:1	31.6:1	16.45	15.90
L-8514	P-9514	4000 ct	600 ct	150	.6	.4	.3	2.0	350	76	19	2.58:1	5.16:1	16.45	15.90
L-8515	P-9515	4000 ct	1000 ct	250	.6	.4	.3	2.0	350	115	29	2:1	4:1	16.45	15.90
L-8520	P-9520	*4000 ct	8000 ct	-	.6	.4	.3	2.0	350	1062	-	1:1.41	-	17.14	16.45
L-8525	P-9525	5000 ct	500 ct	125	.6	.4	.3	2.0	350	67	17	3.16:1	6.32:1	16.45	15.90
L-8530	P-9530	5000 ct	5000 ct	1250	.6	.4	.3	2.0	390	538	135	1:1	2:1	16.45	15.90
L-8535	P-9535	7500 ct	50 ct	12.5	.6	.4	.3	1.5	600	7	1.75	12.2:1	24.5:1	16.26	17.72
L-8540	P-9540	7500 ct	100 ct	25	.6	.4	.3	1.5	600	12	3	8.66:1	17.3:1	16.26	17.72
L-8545	P-9545	7500 ct	600 ct	150	.6	.4	.3	1.5	600	78	19.5	3.54:1	7.07:1	16.26	17.72
L-8550	P-9550	7500 ct	2500 ct	625	.6	.4	.3	1.5	600	305	77	1.73:1	3.46:1	16.26	17.72
L-8555	P-9555	*7500 ct	7500 ct	-	.6	.4	.3	1.5	750	828	-	1:1	-	19.55	16.25
L-8560	P-9560	8000 ct	12.8 ct	3.2	.6	.4	.3	1.5	750	1.7	.43	25:1	50:1	16.26	17.72
L-8565	P-9565	8000 ct	1000 ct	250	.6	.4	.3	1.5	750	115	29	2.83:1	5.66:1	16.26	17.72
L-8570	P-9570	*8000 ct	1200 ct	-	.6	.4	.3	1.5	750	158	-	2.58:1	-	19.55	16.25
L-8575	P-9575	*9000 ct	9000 ct	-	.6	.4	.3	1.4	796	1100	-	1:1	-	19.55	16.25
L-8580	P-9580	10,000 ct	12.8 ct	3.2	.6	.4	.3	1.4	1048	1.7	.43	28:1	56:1	16.26	17.72
L-8585	P-9585	10,000 ct	16 ct	4	.6	.4	.3	1.4	1048	3	.75	25:1	50:1	16.26	17.72
L-8590	P-9590	10,000 ct	100 ct	25	.6	.4	.3	1.4	839	12	3	10:1	20:1	16.26	17.72
L-8595	P-9595	10,000 ct	200 ct	50	.6	.4	.3	1.4	839	27	6.7	7.07:1	14.14:1	16.26	17.72
L-8600	P-9600	10,000 ct	500 ct	125	.6	.4	.3	1.4	850	67	17	4.47:1	8.94:1	16.26	17.72
L-8605	P-9605	10,000 ct	600 ct	150	.6	.4	.3	1.4	850	74	18.5	4.08:1	8.16:1	16.26	17.72
L-8610	P-9610	10,000 ct	1000 ct	250	.6	.4	.3	1.4	850	115	29	3.16:1	6.32:1	16.26	17.72
L-8615	P-9615	10,000 ct	1200 ct	300	.6	.4	.3	1.4	850	158	39.5	2.89:1	5.77:1	16.26	17.72
L-8620	P-9620	10,000 ct	1500 ct	375	.6	.4	.3	1.4	850	177	44	2.58:1	5.16:1	16.26	17.72
L-8625	P-9625	10,000 ct	2000 ct	500	.6	.4	.3	1.4	850	255	64	2.24:1	4.47:1	16.26	17.72
L-8630	P-9630	10,000 ct	5000 ct	1250	.6	.4	.3	1.4	850	630	158	1.41:1	2.83:1	16.26	17.72
L-8635	P-9635	10,000 ct	7500 ct	1875	.6	.4	.3	1.4	850	772	193	1.15:1	2.3:1	16.26	17.72
L-8640	P-9640	10,000 ct	10,000 ct	2500	.6	.4	.3	1.4	866	1215	304	1:1	2:1	16.26	17.72
L-8645	P-9645	*10,000 ct	10,000 ct	-	.6	.4	.3	1.4	1060	1215	-	1:1	-	19.55	16.25
L-8650	P-9650	15,000 ct	400 ct	100	.6	.4	.3	1.0	1305	47	12	6.12:1	12.24:1	16.26	17.72
L-8652	P-9652	15,000 ct	500 ct	125	.6	.4	.3	1.0	1305	53	13	5.48:1	10.95:1	16.26	17.72
L-8655	P-9655	15,000 ct	600 ct	150	.6	.4	.3	1.0	1305	72.5	18	5:1	10:1	16.26	17.72
L-8660	P-9660	15,000 ct	10,000 ct	2500	.6	.4	.3	1.0	1305	1215	304	1.22:1	2.45:1	16.26	17.72
L-8665	P-9665	*15,000 ct	15,000 ct	-	.6	.4	.3	1.0	1305	1800	-	1:1	-	19.55	16.25
L-8670	P-9670	15,000 ct	15,000 ct	3750	.6	.4	.3	1.0	1305	1800	450	1:1	2:1	16.26	17.72
L-8675	P-9675	16,000 ct	1000 ct	250	.6	.4	.3	1.0	1343	115	29	4:1	8:1	16.26	17.72
L-8680	P-9680	20,000 ct	500 ct	125	.5	.4	.3	1.0	1560	68	17	6.33:1	12.65:1	19.55	16.25
L-8685	P-9685	20,000 ct	600 ct	150	.5	.4	.3	1.0	1560	75	19	5.77:1	11.55:1	19.55	16.25
L-8690	P-9690	20,000 ct	800 ct	200	.5	.4	.3	1.0	1560	108	27	5:1	10:1	19.55	16.25
L-8695	P-9695	20,000 ct	1000 ct	250	.5	.4	.3	1.0	1560	121	30.5	4.47:1	8.94:1	19.55	16.25
L-8700	P-9700	20,000 ct	5000 ct	1250	.5	.4	.3	1.0	1560	672	168	2:1	4:1	19.55	16.25
L-8705	P-9705	20,000 ct	10,000 ct	2500	.5	.4	.3	1.0	1560	1520	380	1.41:1	2.83:1	19.55	16.25
L-8710	P-9710	*20,000 ct	20,000 ct	-	.5	.4	.3	1.0	1560	2727	682	1:1	-	20.33	19.55
L-8715	P-9715	25,000 ct	500 ct	125	.4	.4	.3	0.8	2170	68	17	7.07:1	14.14:1	19.55	16.25
L-8720	P-9720	25,000 ct	1000 ct	250	.4	.4	.3	0.8	2170	120	30	5:1	10:1	19.55	16.25
L-8725	P-9725	30,000 ct	50 ct	12.5	.33	.33	.3	0.8	2400	7	1.75	24.5:1	49:1	20.33	19.55
L-8730	P-9730	30,000 ct	1200 ct	300	.33	.33	.3	0.8	2400	156	39	5:1	10:1	20.33	19.55
L-8732	P-9732	30,000 ct	500 ct	125	.33	.33	.3	0.8	2400	68	17	7.75:1	15.5:1	20.33	19.55
L-8734	P-9734	30,000 ct	200 ct	50	.33	.33	.3	0.8	2400	29	7.2	12.25:1	24.5:1	20.33	19.55
L-8735	P-9735	30,000 ct	5000 ct	1250	.33	.33	.3	0.8	2400	673	169	2.45:1	4.9:1	20.33	19.55
L-8740	P-9740	30,000 ct	10,000 ct	2500	.33	.33	.3	0.8	2400	1520	380	1.73:1	3.46:1	20.33	19.55
L-8745	P-9745	*30,000 ct	30,000 ct	-	.33	.33	.3	0.8	3000	3310	-	1:1	-	21.83	20.53
L-8750	P-9750	40,000 ct	400 ct	100	.25	.25	.25	0.7	3400	57	14.3	10:1	20:1	21.83	20.53
L-8755	P-9755	40,000 ct	2000 ct	500	.25	.25	.25	0.7	3400	268	67	4.47:1	8.94:1	21.83	20.53
L-8760	P-9760	40,000 ct	4000 ct	1000	.25	.25	.25	0.7	3400	476	119	3.16:1	6.32:1	21.83	20.53
L-8765	P-9765	40,000 ct	20,000 ct	5000	.25	.25	.25	0.7	3400	2700	675	1.41:1	2.83:1	21.83	20.53
L-8770	P-9770	*40,000 ct	40,000 ct	-	.25	.25	.25	0.7	3400	4750	-	1:1	-	24.34	23.28
L-8775	P-9775	50,000 ct	200 ct	50	.2	.2	.2	0.6	4850	27	6.7	15.8:1	31.6:1	24.34	23.28
L-8777	P-9777	50,000 ct	500 ct	125	.2	.2	.2	0.6	4850	68	17	10:1	20:1	24.34	23.28
L-8779	P-9779	50,000 ct	600 ct	150	.2	.2	.2	0.6	4850	75	18.5	9.13:1	18.26:1	24.34	23.28
L-8780	P-9780	60,000 ct	15,000 ct	3750	.16	.16	.16	0.5	5275	2250	563	2:1	4:1	26.25	25.60
L-8785	P-9785	62,500 ct	50 ct	12.5	.16	.16	.16	0.5	5445	8.7	2.2	35.4:1	70.7:1	26.25	25.60
L-8787	P-9787	80,000 ct	15,000 ct	3750	.12	.12	.12	0.4	6130	2250	563	2.3:1	4.6:1	26.25	25.60
L-8790	P-9790	90,000 ct	10,000 ct	2500	.1	.1	.1	0.4	8140	1520	380	3:1	6:1	27.57	26.57
L-8795	P-9795	95,000 ct	15,000 ct	3750	.1	.1	.1	0.4	8400	2250	563	2.52:1	5.03:1	27.57	26.57
L-8800	P-9800	100,000 ct	60 ct	15	.1	.1	.1	0.4	8750	9.2	2.3	40.8:1	81.6:1	27.57	26.57
L-8805	P-9805	100,000 ct	100 ct	25	.1	.1	.1	0.4	8750	15	3.8	31.6:1	63.2:1	27.57	26.57
L-8810	P-9810	100,000 ct	500 ct	125	.1	.1	.1	0.4	8750	68	17	14.1:1	28.3:1	27.57	26.57
L-8815	P-9815	100,000 ct	10,000 ct	2500	.1	.1	.1	0.4	8750	1535	385	3.16:1	6.32:1	27.57	26.57
L-SHIELD	MU-METAL SHIELD .53" d X .41" h (13.46 mm d X 10.41 mm h)													2.05	
P-SHIELD	MU-METAL SHIELD .53" d X .41" h (13.46 mm d X 10.41 mm h)														2.04

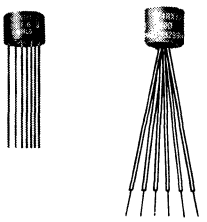
*INCLUDES ELECTROSTATIC SHIELD

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

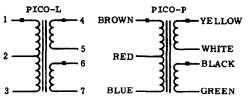
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

L SERIES Plug-In

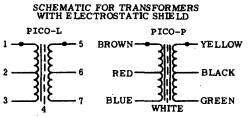
P SERIES Insulated Leads



SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

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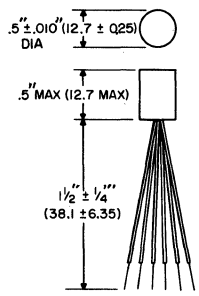
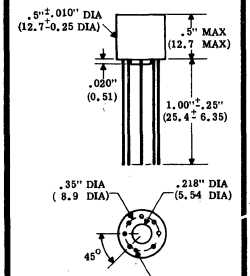
PICO's ultra-miniature transformers

K SERIES Insulated Leads



N SERIES Plug-In



Dimensions are in inches (MM)

PICO PART NUMBER			SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS					SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9 ***	
K-Series Insulated Leads	N-Series Plug-in	PRIMARY IMPEDANCE OHMS	SER	PAR	1KHz and higher	400 Hz and higher	150 Hz and higher	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	K-Series	N-Series
K-7203	N-6203	20 ct	8 ct	2	1.0	.75	.11	22.0	1.75	1.0	.25	1.58:1	3.16:1	15.90	16.46
K-7205	N-6205	20 ct	20 ct	5	1.0	.75	.11	22.0	1.75	2.5	.63	1:1	2:1	15.90	16.46
K-7210	N-6210	32 ct	32 ct	8	1.0	.75	.11	18.0	2.7	3.7	.93	1:1	2:1	15.90	16.46
K-7215	N-6215	40 ct	40 ct	10	1.0	.75	.11	16.0	3	5.2	1.3	1:1	2:1	15.90	16.46
K-7218	N-6218	48 ct	16 ct	4	1.0	.75	.11	13.0	4.5	2.4	.6	1.73:1	3.46:1	15.90	16.46
K-7220	N-6220	50 ct	50 ct	12.5	1.0	.75	.11	13.0	4.5	6.2	1.6	1:1	2:1	15.90	16.46
K-7225	N-6225	80 ct	32 ct	8	1.0	.75	.11	11.0	6.6	3.7	.93	1.58:1	3.16:1	15.90	16.46
K-7228	N-6228	100 ct	40 ct	10	1.0	.75	.11	10.0	9.7	5.6	1.4	1.58:1	3.16:1	15.90	16.46
K-7230	N-6230	100 ct	100 ct	25	1.0	.75	.11	10.0	9.7	11	2.8	1:1	2:1	15.90	16.46
K-7235	N-6235	120 ct	12.8 ct	3.2	1.0	.75	.11	9.0	10.8	1.6	.4	3.06:1	6.12:1	15.90	16.46
K-7240	N-6240	120 ct	60 ct	15	1.0	.75	.11	9.0	10.8	8.5	2.2	1.41:1	2.83:1	15.90	16.46
K-7245	N-6245	120 ct	120 ct	30	1.0	.75	.11	9.0	10.8	15	3.8	1:1	2:1	15.90	16.46
K-7250	N-6250	150 ct	12 ct	3	1.0	.75	.11	8.0	13.5	1.75	.44	3.54:1	7.08:1	15.90	16.46
K-7255	N-6255	150 ct	50 ct	12.5	1.0	.75	.11	8.0	12	5.8	1.5	1.73:1	3.46:1	15.90	16.46
K-7260	N-6260	150 ct	100 ct	25	1.0	.75	.11	8.0	12	13	3.3	1.22:1	2.44:1	15.90	16.46
K-7265	N-6265	150 ct	150 ct	37.5	1.0	.75	.11	8.0	12	20	5	1:1	2:1	15.90	16.46
K-7270	N-6270	150 ct	600 ct	150	1.0	.75	.11	8.0	12	82	20.5	1:2	1:1	15.90	16.46
K-7275	N-6275	200 ct	200 ct	50	1.0	.75	.11	7.0	17	24	6.0	1:1	2:1	15.90	16.46
K-7280	N-6280	300 ct	12 ct	3	1.0	.75	.11	5.0	30	1.75	.44	5:1	10:1	15.90	16.46
K-7285	N-6285	300 ct	50 ct	12.5	1.0	.75	.11	5.0	27	6.2	1.6	2.45:1	4.9:1	15.90	16.46
K-7290	N-6290	300 ct	150 ct	37.5	1.0	.75	.11	5.0	26	21	5.3	1.41:1	2.83:1	15.90	16.46
K-7295	N-6295	300 ct	300 ct	75	1.0	.75	.11	5.0	27	38	9.5	1:1	2:1	15.90	16.46
K-7300	N-6300	300 ct	600 ct	150	1.0	.75	.11	5.0	27	66	17	1:1.41	1.41:1	15.90	16.46
K-7305	N-6305	320 ct	12.8 ct	3.2	1.0	.75	.11	5.0	30	1.75	.44	5:1	10:1	15.90	16.46
K-7310	N-6310	400 ct	40 ct	10	1.0	.75	.11	5.0	39	4.3	1.1	3.16:1	6.32:1	15.90	16.46
K-7315	N-6315	400 ct	120 ct	30	1.0	.75	.11	5.0	30	14	3.5	1:83:1	3.65:1	15.90	16.46
K-7320	N-6320	400 ct	200 ct	50	1.0	.75	.11	5.0	39	24	6	1.41:1	2.83:1	15.90	16.46
K-7325	N-6325	400 ct	400 ct	100	1.0	.75	.11	5.0	39	42	10.5	1:1	2:1	15.90	16.46
K-7330	N-6330	400 ct	1000 ct	250	1.0	.75	.11	5.0	39	109	28	1:1.58	1.26:1	15.90	16.46
K-7335	N-6335	400 ct	2000 ct	500	1.0	.75	.11	5.0	39	198	49	1:2.24	1:1.12	15.90	16.46
K-7340	N-6340	400 ct	4000 ct	1000	1.0	.75	.11	5.0	39	436	109	1:3.16	1:1.58	15.90	16.46
K-7342	N-6342	500 ct	12.8 ct	3.2	1.0	.75	.11	4.5	43	1.6	.4	6.25:1	12.5:1	15.90	16.46
K-7344	N-6344	500 ct	16 ct	4	1.0	.75	.11	4.5	43	2.3	.56	5.6:1	11.2:1	15.90	16.46
K-7345	N-6345	500 ct	50 ct	12.5	1.0	.75	.11	4.5	43	5.8	1.5	3.16:1	6.32:1	15.90	16.46
K-7347	N-6347	500 ct	150 ct	37.5	1.0	.75	.11	4.5	43	19.8	5	1.83:1	3.65:1	15.90	16.46
K-7350	N-6350	500 ct	500 ct	125	1.0	.75	.11	4.5	43	60	15	1:1	2:1	15.90	16.46
K-7355	N-6355	*500 ct	500 ct	-	1.0	.75	.11	4.5	43	60	-	1:1	-	16.45	17.14
K-7360	N-6360	500 ct	600 ct	150	1.0	.75	.11	4.5	43	66	17	1:1.1	1.83:1	15.90	16.46
K-7365	N-6365	600 ct	12.8 ct	3.2	1.0	.75	.11	4.0	68	1.75	.44	6.85:1	13.7:1	15.90	16.46
K-7367	N-6367	600 ct	30 ct	7.5	1.0	.75	.11	4.0	60	3.7	.93	4.47:1	8.94:1	15.90	16.46
K-7370	N-6370	600 ct	48 ct	12	1.0	.75	.11	4.0	60	5.9	1.5	3.54:1	7.07:1	15.90	16.46
K-7375	N-6375	600 ct	200 ct	50	1.0	.75	.11	4.0	60	25	6.3	1.73:1	3.46:1	15.90	16.46
K-7380**	N-6380**	600 ct	600 ct	150	1.0	.75	.11	4.0	60	66	17	1:1	2:1	15.90	16.46
K-7385**	N-6385**	*600 ct	600 ct	-	1.0	.75	.11	4.0	60	68	-	1:1	-	16.45	17.14
K-7386**	N-6386**	*600 ct	900 ct	-	1.0	.75	.11	4.0	60	104	-	1:1.22	-	16.45	17.14
K-7387**	N-6387**	600 ct	1200 ct	300	1.0	.75	.11	4.0	60	116	29	1:1.41	1.41:1	15.90	16.46
K-7390	N-6390	640 ct	12.8 ct	3.2	1.0	.75	.11	4.0	69	1.75	.44	7.07:1	14.14:1	15.90	16.46
K-7395	N-6395	700 ct	100 ct	25	1.0	.75	.11	4.0	62	10.6	2.7	2.65:1	5.29:1	15.90	16.46
K-7400	N-6400	800 ct	12.8 ct	3.2	1.0	.75	.11	3.5	78	1.75	.44	7.91:1	15.8:1	15.90	16.46
K-7405	N-6405	800 ct	48 ct	12	1.0	.75	.11	3.5	74	6	1.5	4.08:1	8.16:1	15.90	16.46
K-7410	N-6410	800 ct	800 ct	200	1.0	.75	.11	3.5	74	102	26	1:1	2:1	15.90	16.46
K-7415	N-6415	900 ct	600 ct	150	1.0	.75	.11	3.0	90	66	17	1.23:1	2.45:1	15.90	16.46
K-7417**	N-6417**	*900 ct	900 ct	-	1.0	.75	.11	3.0	90	102	-	1:1	-	16.45	17.14
K-7420	N-6420	1000 ct	12 ct	3	1.0	.75	.11	3.0	115	1.75	.44	9.13:1	18.26:1	15.90	16.46
K-7425	N-6425	1000 ct	50 ct	12.5	1.0	.75	.11	3.0	100	5.8	1.5	4.47:1	8.94:1	15.90	16.46
K-7430	N-6430	1000 ct	1000 ct	250	1.0	.75	.11	3.0	75	103	26	1:1	2:1	15.90	16.46
K-7435	N-6435	1060 ct	12.8 ct	3.2	1.0	.75	.11	3.0	115	1.75	.44	9.1:1	18.2:1	15.90	16.46
K-7440	N-6440	1200 ct	12.8 ct	3.2	1.0	.75	.11	3.0	122	1.75	.44	9.68:1	19.4:1	15.90	16.46
K-7445	N-6445	1200 ct	500 ct	125	1.0	.75	.11	3.0	113	63	16	1.55:1	3.1:1	15.90	16.46
K-7450	N-6450	1200 ct	1200 ct	300	1.0	.75	.11	3.0	113	155	39	1:1	2:1	15.90	16.46
K-7455	N-6455	*1200 ct	1200 ct	-	1.0	.75	.11	3.0	109	150	-	1:1	-	16.45	17.14
K-7460	N-6460	1500 ct	12 ct	3	1.0	.75	.11	2.5	140	1.75	.44	11.18:1	22.36:1	15.90	16.46
K-7465	N-6465	1500 ct	500 ct	125	1.0	.75	.11	2.5	150	60	15	1.73:1	3.46:1	15.90	16.46
K-7470	N-6470	*1500 ct	600 ct	-	1.0	.75	.11	2.5	150	66	-	1.58:1	-	16.45	17.14
K-7475	N-6475	*1500 ct	1500 ct	-	1.0	.75	.11	2.5	150	168	-	1:1	-	16.45	17.14
K-7480	N-6480	1600 ct	12.8 ct	3.2	1.0	.75	.11	2.5	140	1.75	.44	11.18:1	22.36:1	15.90	16.46
K-7483	N-6483	2000 ct	8 ct	2	1.0	.75	.11	2.0	250	1.0	.25	15.8:1	31.6:1	15.90	16.46
K-7485	N-6485	2000 ct	2000 ct	500	1.0	.75	.11	2.0	185	255	64	1:1	2:1	15.90	16.46
K-7490	N-6490	*2000 ct	2000 ct	-	1.0	.75	.11	2.0	175	240	-	1:1	-	16.45	17.14
K-7495	N-6495	2000 ct	8000 ct	2000	1.0	.75	.11	2.0	185	1015	254	1:2	1:1	15.90	16.46
K-7497	N-6497	2500 ct	2500 ct	625	1.0	.75	.11	2.0	245	268	68	1:1	2:1	15.90	16.46
K-7500	N-6500	3000 ct	3000 ct	750	1.0	.75	.11	1.8	267	295	74	1:1	2:1	15.90	16.46
K-7505	N-6505	*3000 ct	3000 ct	-	1.0	.75	.11	1.8	267	368	-	1:1	-	16.45	17.14
K-7510	N-6510	3600 ct	3600 ct	900	1.0	.75	.11	1.5	300	413	103	1:1	2:1	15.90	16.46
K-7512	N-6512	4000 ct	16 ct	4	1.0	.75	.11	1.5	395	2.5	.65	15.8:1	31.6:1	15.90	16.46
K-7514**	N-6514**	4000 ct	600 ct	150	1.0	.75	.11	1.5	395	66	17	2.58:1	5.16:1	15.90	16.46

SPECIFICATIONS

- **MIL-T-27** . . . . . All Units Meet MIL-T-27, and Are Hermetically Sealed in a Metal Case, Audio Transformers Are Type TF5R21ZZ.
- **FREQUENCY RESPONSE:** . . . ±3 db, 150 Hz - 75 KHz at 1.0 Milliwatt (When Primary Impedance ≥ 50K Ohms, ±3 db 150 Hz to 20 KHz)
- **MAXIMUM DISTORTION:** . . . . 5% With Rated Power Level at 1 KHz 400 Hz and 150 Hz
- **DIELECTRIC STRENGTH:** . . . . All Units Tested at 200 V RMS
- **INSULATION RESISTANCE:** . . . Greater Than 10,000 Megohms at 300 V DC
- **WEIGHT:** . . . . . 7.5 Grams
- **OPERATING TEMPERATURE:** . . -55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c maximum)
- **TERMINALS:** . . . . . Solid .016 Diameter Conductor. Conductor is Copper Clad Steel, Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452.
- **THERMAL SHOCK:** . . . . . 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

Delivery: Stock to one week

This Product is Patented

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

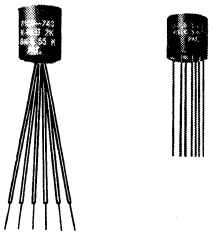
*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

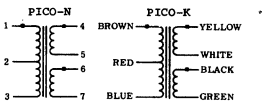
PICO PART NUMBER K-Series Insulated Leads	PICO PART NUMBER N-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 400 Hz and higher	POWER WATTS 150 Hz and higher	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1-9 * * * K-Series	PICO PRICES 1-9 * * * N-Series
K-7515	N-6515	4000 ct	1000 ct	250	1.0	.75	.11	1.5	395	108	27	2:1	4:1	15.90	16.46
K-7520	N-6520	*4000 ct	8000 ct	-	1.0	.75	.11	1.5	390	955	-	1:1.41	-	16.45	17.14
K-7525	N-6525	5000 ct	500 ct	125	1.0	.75	.11	1.3	450	62	16	3.16:1	6.32:1	15.90	16.46
K-7530	N-6530	5000 ct	5000 ct	1250	1.0	.75	.11	1.3	450	620	155	1:1	2:1	15.90	16.46
K-7535	N-6535	7500 ct	50 ct	12.5	1.0	.75	.11	1.0	670	6	1.5	12.25:1	24.5:1	17.72	18.26
K-7540	N-6540	7500 ct	100 ct	25	1.0	.75	.11	1.0	670	11	2.8	8.66:1	17.32:1	17.72	18.26
K-7545	N-6545	7500 ct	600 ct	150	1.0	.75	.11	1.0	670	66	16.5	3.54:1	7.07:1	17.72	18.26
K-7550	N-6550	7500 ct	2500 ct	625	1.0	.75	.11	1.0	670	268	67	1.73:1	3.46:1	17.72	18.26
K-7555	N-6555	*7500 ct	7500 ct	-	1.0	.75	.11	1.0	670	925	-	1:1	-	18.25	20.13
K-7560	N-6560	8000 ct	12.8 ct	3.2	1.0	.75	.11	1.0	765	1.75	.44	25:1	50:1	17.72	18.26
K-7565	N-6565	8000 ct	1000 ct	250	1.0	.75	.11	1.0	695	106	26.5	2.83:1	5.66:1	17.72	18.26
K-7570	N-6570	*8000 ct	1200 ct	-	1.0	.75	.11	1.0	715	153	-	2.58:1	-	18.25	20.13
K-7575	N-6575	*9000 ct	9000 ct	-	1.0	.75	.11	1.0	925	1020	-	1:1	-	18.25	20.13
K-7580	N-6580	10,000 ct	12.8 ct	3.2	1.0	.75	.11	1.0	768	1.6	.4	28:1	56:1	17.72	18.26
K-7585	N-6585	10,000 ct	16 ct	4	1.0	.75	.11	1.0	756	1.7	.43	25:1	50:1	17.72	18.26
K-7590	N-6590	10,000 ct	100 ct	25	1.0	.75	.11	1.0	780	10	2.5	10:1	20:1	17.72	18.26
K-7595	N-6595	10,000 ct	200 ct	50	1.0	.75	.11	1.0	780	24	6	7.07:1	14.14:1	17.72	18.26
K-7600	N-6600	10,000 ct	500 ct	125	1.0	.75	.11	1.0	780	60	15	4.47:1	8.94:1	17.72	18.26
K-7605	N-6605	10,000 ct	600 ct	150	1.0	.75	.11	1.0	780	83	21	4.08:1	8.16:1	17.72	18.26
K-7610	N-6610	10,000 ct	1000 ct	250	1.0	.75	.11	1.0	780	106	27	3.16:1	6.32:1	17.72	18.26
K-7615	N-6615	10,000 ct	1200 ct	300	1.0	.75	.11	1.0	780	145	36	2.89:1	5.77:1	17.72	18.26
K-7620	N-6620	10,000 ct	1500 ct	375	1.0	.75	.11	1.0	780	160	40	2.58:1	5.16:1	17.72	18.26
K-7625	N-6625	10,000 ct	2000 ct	500	1.0	.75	.11	1.0	780	300	75	2.24:1	4.47:1	17.72	18.26
K-7630	N-6630	10,000 ct	5000 ct	1250	1.0	.75	.11	1.0	780	610	153	1.41:1	2.83:1	17.72	18.26
K-7635	N-6635	10,000 ct	7500 ct	1875	1.0	.75	.11	1.0	780	932	233	1.16:1	2.31:1	17.72	18.26
K-7640	N-6640	10,000 ct	10,000 ct	2500	1.0	.75	.11	1.0	780	1075	269	1:1	2:1	17.72	18.26
K-7645	N-6645	*10,000 ct	10,000 ct	-	1.0	.75	.11	1.0	715	985	-	1:1	-	18.25	20.13
K-7650	N-6650	15,000 ct	400 ct	100	.66	.66	.11	0.8	1165	52	13	6.12:1	12.25:1	17.72	18.26
K-7652	N-6652	15,000 ct	500 ct	125	.66	.66	.11	0.8	1165	60	15	5.48:1	10.95:1	17.72	18.26
K-7655	N-6655	15,000 ct	600 ct	150	.66	.66	.11	0.8	1165	80	20	5:1	10:1	17.72	18.26
K-7660	N-6660	15,000 ct	10,000 ct	2500	.66	.66	.11	0.8	1165	1050	263	1.22:1	2.45:1	17.72	18.26
K-7665	N-6665	*15,000 ct	15,000 ct	-	.66	.66	.11	0.8	1165	1600	-	1:1	-	18.25	20.13
K-7670	N-6670	15,000 ct	15,000 ct	3750	.66	.66	.11	0.8	1165	1600	400	1:1	2:1	17.72	18.26
K-7675	N-6675	16,000 ct	1000 ct	250	.62	.62	.11	0.8	1560	108	27	4:1	8:1	17.72	18.26
K-7680	N-6680	20,000 ct	500 ct	125	.5	.5	.11	0.7	1750	60	15	6.32:1	12.65:1	16.25	20.13
K-7685	N-6685	20,000 ct	600 ct	150	.5	.5	.11	0.7	1750	82	20.5	5.77:1	11.55:1	18.25	20.13
K-7690	N-6690	20,000 ct	800 ct	200	.5	.5	.11	0.7	1750	98	24.5	5.1	10.1	18.25	20.13
K-7695	N-6695	20,000 ct	1000 ct	250	.5	.5	.11	0.7	1750	135	34	4.47:1	8.94:1	18.25	20.13
K-7700	N-6700	20,000 ct	5000 ct	1250	.5	.5	.11	0.7	1750	610	153	2:1	4:1	18.25	20.13
K-7705	N-6705	20,000 ct	10,000 ct	2500	.5	.5	.11	0.7	1750	1075	269	1.41:1	2.83:1	18.25	20.13
K-7710	N-6710	*20,000 ct	20,000 ct	-	.5	.5	.11	0.7	1715	2370	-	1:1	-	19.55	20.33
K-7715	N-6715	25,000 ct	500 ct	125	.4	.4	.11	0.6	2470	60	15	7.07:1	14.14:1	18.25	20.13
K-7720	N-6720	25,000 ct	1000 ct	250	.4	.4	.11	0.6	2470	106	27	5:1	10:1	18.25	20.13
K-7725	N-6725	30,000 ct	50 ct	12.5	.33	.33	.11	0.5	2730	6.2	1.6	24.5:1	49:1	19.55	20.33
K-7730	N-6730	30,000 ct	1200 ct	300	.33	.33	.11	0.5	2815	156	39	5:1	10:1	19.55	20.33
K-7732	N-6732	30,000 ct	500 ct	125	.33	.33	.11	0.5	2730	61	15.3	7.7:1	15.5:1	19.55	20.33
K-7734	N-6734	30,000 ct	200 ct	50	.33	.33	.11	0.5	2730	24	6	12.2:1	24.5:1	19.55	20.33
K-7735	N-6735	30,000 ct	5000 ct	1250	.33	.33	.11	0.5	2730	620	155	2.45:1	4.9:1	19.55	20.33
K-7740	N-6740	30,000 ct	10,000 ct	2500	.33	.33	.11	0.5	2730	1090	272	1.73:1	3.46:1	19.55	20.33
K-7745	N-6745	*30,000 ct	30,000 ct	-	.33	.33	.11	0.5	2730	3740	-	1:1	-	20.53	21.63
K-7750	N-6750	40,000 ct	400 ct	100	.25	.25	.11	0.5	3150	53	13	10:1	20:1	20.53	21.83
K-7755	N-6755	40,000 ct	2000 ct	500	.25	.25	.11	0.5	3150	300	75	4.47:1	8.94:1	20.53	21.83
K-7760	N-6760	40,000 ct	4000 ct	1000	.25	.25	.11	0.5	3150	548	137	3.16:1	6.32:1	20.53	21.83
K-7765	N-6765	40,000 ct	20,000 ct	5000	.25	.25	.11	0.5	3150	3075	769	1.41:1	2.83:1	20.53	21.83
K-7770	N-6770	*40,000 ct	40,000 ct	-	.25	.25	.11	0.5	3940	4350	-	1:1	-	23.28	24.34
K-7775	N-6775	50,000 ct	200 ct	50	.2	.2	.11	0.4	4275	24	6	15.8:1	31.6:1	23.28	24.34
K-7777	N-6777	50,000 ct	500 ct	125	.2	.2	.11	0.4	4275	60	15	10:1	20:1	23.26	24.34
K-7778	N-6778	50,000 ct	600 ct	150	.2	.2	.11	0.4	4275	82	21	9.13:1	18.26:1	23.28	24.34
K-7779	N-6779	50,000 ct	50,000 ct	12,500	.2	.2	.11	0.4	4500	6270	1568	1:1	2:1	23.28	24.34
K-7780	N-6780	60,000 ct	15,000 ct	3750	.16	.16	.11	0.4	5960	1650	412	2:1	4:1	25.60	26.35
K-7785	N-6785	62,500 ct	50 ct	12.5	.16	.16	.11	0.4	5960	6	1.5	35.4:1	70.7:1	25.60	26.35
K-7787	N-6787	80,000 ct	15,000 ct	3750	.12	.12	.11	0.3	7200	1690	423	2.3:1	4.6:1	25.60	26.35
K-7789	N-6789	80,000 ct	80,000 ct	20,000	.12	.12	.11	0.3	7200	9920	2480	1:1	2:1	25.60	26.35
K-7790	N-6790	90,000 ct	10,000 ct	2500	.11	.11	.11	0.3	7500	1350	338	3:1	6:1	29.06	27.57
K-7795	N-6795	95,000 ct	15,000 ct	3750	.1	.1	.10	0.3	9550	1635	410	2.5:1	5:1	29.06	27.57
K-7800	N-6800	100,000 ct	60 ct	15	.1	.1	.10	0.3	10,000	8.5	2.2	40.8:1	81.6:1	29.06	27.57
K-7805	N-6805	100,000 ct	100 ct	25	.1	.1	.10	0.3	10,000	14	3.5	31.6:1	63.2:1	29.06	27.57
K-7810	N-6810	100,000 ct	500 ct	125	.1	.1	.10	0.3	10,000	62	15.5	14.1:1	28.3:1	29.06	27.57
K-7813	N-6813	100,000 ct	1000 ct	250	.1	.1	.10	0.3	10,000	140	35	10:1	20:1	29.06	27.57
K-7814	N-6814	100,000 ct	2000 ct	500	.1	.1	.10	0.3	10,000	248	62	7.07:1	14.14:1	29.06	27.57
K-7815	N-6815	100,000 ct	10,000 ct	2500	.1	.1	.10	0.3	10,000	1075	270	3.16:1	6.32:1	29.06	27.57
K-7820	N-6820	135,000 ct	82 ct	20.5	.074	.074	.074	0.25	13,700	9.5	2.4	40.6:1	81.2:1	27.99	28.81
K-7823	N-6823	200,000 ct	500 ct	125	.05	.05	.05	0.2	17,340	75	19	20:1	40:1	27.99	28.81
K-7825	N-6825	200,000 ct	1000 ct	250	.05	.05	.05	0.2	17,340	133	33	14.1:1	28.3:1	27.99	28.81
K-7830	N-6830	200,000 ct	10,000 ct	2500	.05	.05	.05	0.2	17,340	1350	336	4.47:1	8.94:1	27.99	28.81
K-7835	N-6835	200,000 ct	20,000 ct	5000	.05	.05	.05	0.2	17,340	3000	750	3.16:1	6.32:1	27.99	28.81
K-7837	N-6837	250,000 ct	200 ct	50	.04	.04	.04	0.2	17,340	28	7	35.4:1	70.7:1	28.81	29.55
K-7840	N-6840	250,000 ct	1000 ct	250	.04	.04	.04	0.2	17,340	118	30	15.8:1	31.6:1	28.81	29.55
K-SHIELD	MU-METAL SHIELD .53" d X .56" h (13.46 mm d X 14.22 mm h)													2.04	
N-SHIELD	MU-METAL SHIELD .53" d X .56" h (13.46 mm d X 14.22 mm h)														2.05

K SERIES Insulated Leads

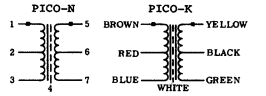
N SERIES Plug-In



SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

914-699-5514
TWX 7105620113

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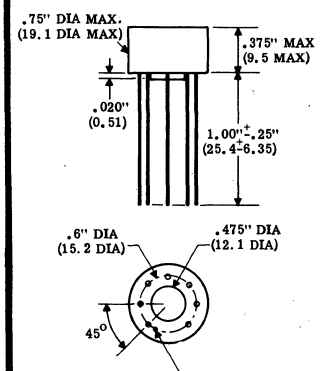
Call Toll Free 800-431-1064

PICO's ultra-miniature transformers

R SERIES Plug-In



Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27: . . . . . All Units Meet MIL-T-27 And Are Hermetically Sealed in a Metal Case, Audio Transformers Are Type TF5R21ZZ.
- FREQUENCY RESPONSE: . . . ± 3 db, 75 Hz - 30 KHz at 1.0 Milliwatt.
- MAXIMUM DISTORTION: . . . 5% With Rated Power Level at 1 KHz, 300 Hz and 75 Hz
- DIELECTRIC STRENGTH: . . . All Units Tested at 200 V RMS.
- INSULATION RESISTANCE: . . Greater Than 10,000 Megohms at 300 V DC.
- WEIGHT: . . . . . 12 Grams
- OPERATING TEMPERATURE: -55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c Maximum).
- TERMINALS: . . . . . Solid .016 Diameter Conductor. Conductor is Copper Clad Steel, Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452.
- THERMAL SHOCK: . . . . . 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

This Product is Patented

Delivery— stock to one week

PICO PART NUMBER R-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	300 Hz and higher	75 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9*** R-Series
R-20003	20 ct	8 ct	2	1.5	.9	.03	22	1.6	.76	.19	1.58:1	3.16:1	19.72
R-20005	20 ct	20 ct	5	1.5	.9	.03	22	1.6	1.9	.48	1:1	2:1	19.72
R-20010	32 ct	32 ct	8	1.5	.9	.03	17.5	2.56	3	.75	1:1	2:1	19.72
R-20015	40 ct	40 ct	10	1.5	.9	.03	16	3.2	3.8	.95	1:1	2:1	19.72
R-20018	48 ct	16 ct	4	1.5	.9	.03	14.5	3.84	1.52	.38	1.73:1	3.46:1	19.72
R-20020	50 ct	50 ct	12.5	1.5	.9	.03	14	4	4.75	1.19	1:1	2:1	19.72
R-20025	80 ct	32 ct	8	1.5	.9	.03	11	6.4	3	.75	1.58:1	3.16:1	19.72
R-20028	100 ct	40 ct	10	1.5	.9	.03	10	8	3.8	.95	1.58:1	3.16:1	19.72
R-20030	100 ct	100 ct	25	1.5	.9	.03	10	8	9.5	2.38	1:1	2:1	19.72
R-20035	120 ct	12.8 ct	3.2	1.5	.9	.03	9	9.6	1.22	.3	3.06:1	6.12:1	19.72
R-20040	120 ct	60 ct	15	1.5	.9	.03	9	9.6	5.7	1.4	1.41:1	2.83:1	19.72
R-20045	120 ct	120 ct	30	1.5	.9	.03	9	9.6	11.4	2.85	1:1	2:1	19.72
R-20050	150 ct	12 ct	3	1.5	.9	.03	8	12	1.14	.29	3.54:1	7.08:1	19.72
R-20055	150 ct	50 ct	12.5	1.5	.9	.03	8	12	4.75	1.19	1.73:1	3.46:1	19.72
R-20060	150 ct	100 ct	25	1.5	.9	.03	8	12	9.5	2.38	1.22:1	2.44:1	19.72
R-20065	150 ct	150 ct	37.5	1.5	.9	.03	8	12	14.3	3.56	1:1	2:1	19.72
R-20070	150 ct	600 ct	150	1.5	.9	.03	8	12	57	14.3	1:2	1:1	19.72
R-20075	200 ct	200 ct	50	1.5	.9	.03	7	16	19	4.75	1:1	2:1	19.72
R-20080	300 ct	12 ct	3	1.5	.9	.03	5.5	24	1.14	.29	5:1	10:1	19.72
R-20085	300 ct	50 ct	12.5	1.5	.9	.03	5.5	24	4.75	1.19	2.45:1	4.9:1	19.72
R-20090	300 ct	150 ct	37.5	1.5	.9	.03	5.5	24	14.25	3.56	1.41:1	2.83:1	19.72
R-20095	300 ct	300 ct	75	1.5	.9	.03	5.5	24	28.5	7.13	1:1	2:1	19.72
R-20100	300 ct	600 ct	150	1.5	.9	.03	5.5	24	57	14.25	1:1.41	1.41:1	19.72
R-20105	320 ct	12.8 ct	3.2	1.5	.9	.03	5.5	25.6	1.22	.3	5:1	10:1	19.72
R-20110	400 ct	40 ct	10	1.5	.9	.03	5	32	3.8	.95	3.16:1	6.32:1	19.72
R-20115	400 ct	120 ct	30	1.5	.9	.03	5	32	11.4	2.85	1.83:1	3.65:1	19.72
R-20120	400 ct	200 ct	50	1.5	.9	.03	5	32	19	4.75	1.41:1	2.83:1	19.72
R-20125	400 ct	400 ct	100	1.5	.9	.03	5	32	38	9.5	1:1	2:1	19.72
R-20130	400 ct	1000 ct	250	1.5	.9	.03	5	32	95	23.8	1:1.58	1.26:1	19.72
R-20135	400 ct	2000 ct	500	1.5	.9	.03	5	32	190	47.5	1:2.24	1:1.12	19.72
R-20140	400 ct	4000 ct	1000	1.5	.9	.03	5	32	380	95	1:3.16	1:1.58	19.72
R-20142	500 ct	12.8 ct	3.2	1.5	.9	.03	4.5	40	1.22	.3	6.25:1	12.5:1	19.72
R-20144	500 ct	16 ct	4	1.5	.9	.03	4.5	40	1.52	.38	5.6:1	11.2:1	19.72
R-20145	500 ct	50 ct	12.5	1.5	.9	.03	4.5	40	4.75	1.19	3.16:1	6.32:1	19.72
R-20147	500 ct	150 ct	37.5	1.5	.9	.03	4.5	40	14.25	3.56	1.83:1	3.65:1	19.72
R-20150	500 ct	500 ct	125	1.5	.9	.03	4.5	40	47.5	11.88	1:1	2:1	19.72
R-20155	*500 ct	500 ct	-	1.5	.9	.03	4.5	40	47.5	-	1:1	-	20.54
R-20160	500 ct	600 ct	150	1.5	.9	.03	4.5	40	57	14.25	1:1.1	1.83:1	19.72
R-20165	600 ct	12.8 ct	3.2	1.5	.9	.03	4	48	1.22	.3	6.85:1	13.7	19.72
R-20167	600 ct	30 ct	7.5	1.5	.9	.03	4	48	2.85	.71	4.47:1	8.94:1	19.72
R-20170	600 ct	48 ct	12	1.5	.9	.03	4	48	4.56	1.14	3.54:1	7.07:1	19.72
R-20175	600 ct	200 ct	50	1.5	.9	.03	4	48	19	4.75	1.73:1	3.46:1	19.72
R-20180**	600 ct	600 ct	150	1.5	.9	.03	4	48	57	14.25	1:1	2:1	19.72
R-20185**	*600 ct	600 ct	-	1.5	.9	.03	4	48	57	-	1:1	-	20.54
R-20186**	*600 ct	900 ct	-	1.5	.9	.03	4	48	85.5	-	1:1.22	-	20.54
R-20187**	600 ct	1200 ct	300	1.5	.9	.03	4	48	114	28.5	1:1.41	1.41:1	19.72
R-20190	640 ct	12.8 ct	3.2	1.5	.9	.03	4	51.2	1.22	.3	7.07:1	14.14:1	19.72
R-20195	700 ct	100 ct	25	1.5	.9	.03	3.5	56	9.5	2.38	2.65:1	5.29:1	19.72
R-20200	800 ct	12.8 ct	3.2	1.5	.9	.03	3.5	64	1.22	.3	7.91:1	15.8:1	19.72
R-20205	800 ct	48 ct	12	1.5	.9	.03	3.5	64	4.56	1.14	4.08:1	8.16:1	19.72
R-20210	800 ct	800 ct	200	1.5	.9	.03	3.5	64	76	19	1:1	2:1	19.72
R-20215	900 ct	600 ct	150	1.5	.9	.03	3	72	57	14.3	1.23:1	2.45:1	19.72
R-20217**	*900 ct	900 ct	-	1.5	.9	.03	3	72	85.5	-	1:1	-	20.54
R-20220	1000 ct	12 ct	3	1.5	.9	.03	3	80	1.14	.29	9.13:1	18.26:1	19.72
R-20225	1000 ct	50 ct	12.5	1.5	.9	.03	3	80	4.75	1.19	4.47:1	8.94:1	19.72
R-20230	1000 ct	1000 ct	250	1.5	.9	.03	3	80	95	23.8	1:1	2:1	19.72
R-20235	1060 ct	12.8 ct	3.2	1.5	.9	.03	3	85	1.22	.3	9.1:1	18.2:1	19.72
R-20240	1200 ct	12.8 ct	3.2	1.5	.9	.03	3	96	1.22	.3	9.68:1	19.4:1	19.72
R-20245	1200 ct	500 ct	125	1.5	.9	.03	3	96	47.5	11.88	1.55:1	3.1:1	19.72
R-20250	1200 ct	1200 ct	300	1.5	.9	.03	3	96	114	28.5	1:1	2:1	19.72
R-20255	*1200 ct	1200 ct	-	1.5	.9	.03	3	96	114	-	1:1	-	20.54
R-20260	1500 ct	12 ct	3	1.5	.9	.03	2.5	120	1.14	.29	11.18:1	22.36:1	19.72
R-20265	1500 ct	500 ct	125	1.5	.9	.03	2.5	120	47.5	11.88	1.73:1	3.46:1	19.72
R-20270	*1500 ct	600 ct	-	1.5	.9	.03	2.5	120	57	-	1.58:1	-	20.54
R-20275	*1500 ct	1500 ct	-	1.5	.9	.03	2.5	120	142	-	1:1	-	20.54
R-20280	1600 ct	12.8 ct	3.2	1.5	.9	.03	2.5	128	1.22	3	11.18:1	22.36:1	19.72
R-20283	2000 ct	8 ct	2	1.5	.9	.03	2.2	160	.76	.19	15.8:1	31.6:1	19.72
R-20285	2000 ct	2000 ct	500	1.5	.9	.03	2.2	160	190	47.5	1:1	2:1	19.72
R-20290	*2000 ct	2000 ct	-	1.5	.9	.03	2.2	160	190	-	1:1	-	20.54
R-20295	2000 ct	8000 ct	2000	1.5	.9	.03	2.2	160	760	190	1:2	1:1	19.72
R-20297	2500 ct	2500 ct	625	1.5	.9	.03	2	200	238	59.5	1:1	2:1	19.72
R-20300	3000 ct	3000 ct	750	1.5	.9	.03	1.8	240	285	71.3	1:1	2:1	19.72
R-20305	*3000 ct	3000 ct		1.5	.9	.03	1.8	240	285	-	1:1	-	20.54

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

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PICO PART NUMBER R-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	300 Hz and higher	75 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9*** R-Series
R-20310	3600 ct	3600 ct	900	1.5	.9	.03	1.7	288	342	86	1:1	2:1	19.72
R-20312	4000 ct	16 ct	4	1.5	.9	.03	1.6	320	1.52	.38	15.8:1	31.6:1	19.72
R-20314**	4000 ct	600 ct	150	1.5	.9	.03	1.6	320	57	14.3	2.58:1	5.16:1	19.72
R-20315	4000 ct	1000 ct	250	1.5	.9	.03	1.6	320	95	23.8	2:1	4:1	19.72
R-20320	*4000 ct	8000 ct	-	1.5	.9	.03	1.6	320	760	-	1:1.41	-	20.54
R-20325	5000 ct	500 ct	125	1.5	.9	.03	1.4	400	47.5	11.88	3.16:1	6.32:1	19.72
R-20330	5000 ct	5000 ct	1250	1.5	.9	.03	1.4	400	475	119	1:1	2:1	19.72
R-20335	7500 ct	50 ct	12.5	1.3	.9	.03	1.2	600	4.75	1.19	12.25:1	24.5:1	21.89
R-20340	7500 ct	100 ct	25	1.3	.9	.03	1.2	600	9.5	2.38	8.66:1	17.32:1	21.89
R-20345	7500 ct	600 ct	150	1.3	.9	.03	1.2	600	57	14.3	3.54:1	7.07:1	21.89
R-20350	7500 ct	2500 ct	625	1.3	.9	.03	1.2	600	238	59.5	1.73:1	3.46:1	21.89
R-20355	*7500 ct	7500 ct	-	1.3	.9	.03	1.2	600	713	-	1:1	-	23.43
R-20360	8000 ct	12.8 ct	3.2	1.2	.9	.03	1.1	640	1.22	.3	25:1	50:1	21.89
R-20365	8000 ct	1000 ct	250	1.2	.9	.03	1.1	640	95	23.8	2.83:1	5.66:1	21.89
R-20370	*8000 ct	1200 ct	-	1.2	.9	.03	1.1	640	114	-	2.58:1	-	23.43
R-20375	*9000 ct	9000 ct	-	1.1	.9	.03	1.1	720	855	-	1:1	-	23.43
R-20380	10,000 ct	12.8 ct	3.2	1.0	.9	.03	1	800	1.22	.3	28:1	56:1	21.89
R-20385	10,000 ct	16 ct	4	1.0	.9	.03	1	800	1.52	.38	25:1	50:1	21.89
R-20390	10,000 ct	100 ct	25	1.0	.9	.03	1	800	9.5	2.38	10:1	20:1	21.89
R-20395	10,000 ct	200 ct	50	1.0	.9	.03	1	800	19	4.75	7.07:1	14.14:1	21.89
R-20400	10,000 ct	500 ct	125	1.0	.9	.03	1	800	47.5	11.88	4.47:1	8.94:1	21.89
R-20405	10,000 ct	600 ct	150	1.0	.9	.03	1	800	57	14.25	4.08:1	8.16:1	21.89
R-20410	10,000 ct	1000 ct	250	1.0	.9	.03	1	800	95	23.8	3.16:1	6.32:1	21.89
R-20415	10,000 ct	1200 ct	300	1.0	.9	.03	1	800	114	28.5	2.89:1	5.77:1	21.89
R-20420	10,000 ct	1500 ct	375	1.0	.9	.03	1	800	143	35.8	2.58:1	5.16:1	21.89
R-20425	10,000 ct	2000 ct	500	1.0	.9	.03	1	800	190	47.5	2.24:1	4.47:1	21.89
R-20430	10,000 ct	5000 ct	1250	1.0	.9	.03	1	800	475	119	1.41:1	2.83:1	21.89
R-20435	10,000 ct	7500 ct	1875	1.0	.9	.03	1	800	713	178	1.16:1	2.31:1	21.89
R-20440	10,000 ct	10,000 ct	2500	1.0	.9	.03	1	800	950	238	1:1	2:1	21.89
R-20445	*10,000 ct	10,000 ct	-	1.0	.9	.03	1	800	950	-	1:1	-	23.43
R-20450	15,000 ct	400 ct	100	.66	.66	.03	.8	1200	38	9.5	6.12:1	12.25:1	21.89
R-20452	15,000 ct	500 ct	125	.66	.66	.03	.8	1200	48	12	5.48:1	10.95:1	21.89
R-20455	15,000 ct	600 ct	150	.66	.66	.03	.8	1200	57	14.3	5:1	10:1	21.89
R-20460	15,000 ct	10,000 ct	2500	.66	.66	.03	.8	1200	950	238	1.22:1	2.45:1	21.89
R-20465	*15,000 ct	15,000 ct	-	.66	.66	.03	.8	1200	1430	-	1:1	-	23.43
R-20470	15,000 ct	15,000 ct	3750	.66	.66	.03	.8	1200	1430	357	1:1	2:1	21.89
R-20475	16,000 ct	1000 ct	250	.62	.62	.03	.8	1280	95	23.8	4:1	8:1	21.89
R-20480	20,000 ct	500 ct	125	.5	.5	.03	.7	1600	47.5	11.88	6.32:1	12.65:1	23.43
R-20485	20,000 ct	600 ct	150	.5	.5	.03	.7	1600	57	14.25	5.77:1	11.55:1	23.43
R-20490	20,000 ct	800 ct	200	.5	.5	.03	.7	1600	76	19	5:1	10:1	23.43
R-20495	20,000 ct	1000 ct	250	.5	.5	.03	.7	1600	95	23.8	4.47:1	8.94:1	23.43
R-20500	20,000 ct	5000 ct	1250	.5	.5	.03	.7	1600	475	119	2:1	4:1	23.43
R-20505	20,000 ct	10,000 ct	2500	.5	.5	.03	.7	1600	950	238	1.41:1	2.83:1	23.43
R-20510	*20,000 ct	20,000 ct	-	.5	.5	.03	.7	1600	1900	-	1:1	-	24.55
R-20515	25,000 ct	500 ct	125	.4	.4	.03	.6	2000	47.5	11.88	7.07:1	14.14:1	23.43
R-20520	25,000 ct	1000 ct	250	.4	.4	.03	.6	2000	95	23.8	5:1	10:1	23.43
R-20525	30,000 ct	50 ct	12.5	.33	.33	.03	.6	2400	4.75	1.19	24.5:1	49:1	24.35
R-20530	30,000 ct	1200 ct	300	.33	.33	.03	.6	2400	114	28.5	5:1	10:1	24.35
R-20532	30,000 ct	500 ct	125	.33	.33	.03	.6	2400	47.5	11.88	7.7:1	15.5:1	24.35
R-20534	30,000 ct	200 ct	50	.33	.33	.03	.6	2400	19	4.75	12.2:1	24.5:1	24.35
R-20535	30,000 ct	5000 ct	1250	.33	.33	.03	.6	2400	475	119	2.45:1	4.9:1	24.35
R-20540	30,000 ct	10,000 ct	2500	.33	.33	.03	.6	2400	950	238	1.73:1	3.46:1	24.35
R-20545	*30,000 ct	30,000 ct	-	.33	.33	.03	.6	2400	2850	-	1:1	-	26.17
R-20550	40,000 ct	400 ct	100	.25	.25	.03	.5	3200	38	9.5	10:1	20:1	26.17
R-20555	40,000 ct	2000 ct	500	.25	.25	.03	.5	3200	190	47.5	4.47:1	8.94:1	26.17
R-20560	40,000 ct	4000 ct	1000	.25	.25	.03	.5	3200	380	95	3.16:1	6.32:1	26.17
R-20565	40,000 ct	20,000 ct	5000	.25	.25	.03	.5	3200	1900	475	1.41:1	2.83:1	26.17
R-20570	*40,000 ct	40,000 ct	-	.25	.25	.03	.5	3200	3800	-	1:1	-	29.13
R-20575	50,000 ct	200 ct	50	.2	.2	.03	.4	4000	19	4.75	15.8:1	31.6:1	29.13
R-20577	50,000 ct	500 ct	125	.2	.2	.03	.4	4000	47.5	11.88	10:1	20:1	29.13
R-20578	50,000 ct	600 ct	150	.2	.2	.03	.4	4000	57	14.3	9.13:1	18.26:1	29.13
R-20579	50,000 ct	50,000 ct	12,500	.2	.2	.03	.4	4000	4750	1190	1:1	2:1	29.13
R-20580	60,000 ct	15,000 ct	3750	.16	.16	.03	.4	4800	1430	358	2:1	4:1	31.46
R-20585	62,500 ct	50 ct	12.5	.16	.16	.03	.4	5000	4.75	1.19	35.4:1	70.7:1	31.46
R-20587	80,000 ct	15,000 ct	3750	.12	.12	.03	.3	6400	1430	358	2.3:1	4.6:1	31.46
R-20590	90,000 ct	10,000 ct	2500	.11	.11	.03	.3	7200	950	238	3:1	6:1	33.02
R-20595	95,000 ct	15,000 ct	3750	.1	.1	.03	.3	7600	1430	358	2.5:1	5:1	33.02
R-20600	100,000 ct	60 ct	15	.1	.1	.03	.3	8000	5.7	1.43	40.8:1	81.6:1	33.02
R-20605	100,000 ct	100 ct	25	.1	.1	.03	.3	8000	9.5	2.38	31.6:1	63.2:1	33.02
R-20610	100,000 ct	500 ct	125	.1	.1	.03	.3	8000	47.5	11.88	14.1:1	28.3:1	33.02
R-20613	100,000 ct	1000 ct	250	.1	.1	.03	.3	8000	95	23.8	10:1	20:1	33.02
R-20614	100,000 ct	2000 ct	500	.1	.1	.03	.3	8000	190	47.5	7.07:1	14.14:1	33.02
R-20615	100,000 ct	10,000 ct	2500	.1	.1	.03	.3	8000	950	238	3.16:1	6.32:1	33.02
R-20620	135,000 ct	82 ct	20.5	.07	.07	.03	.2	10,800	7.8	1.9	40.6:1	81.2:1	34.50

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

PICO's ultra-miniature transformers

R SERIES Plug-In

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

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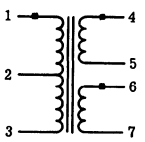
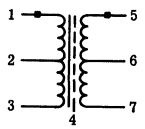


SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



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453 N. MacQuesten Pkwy.
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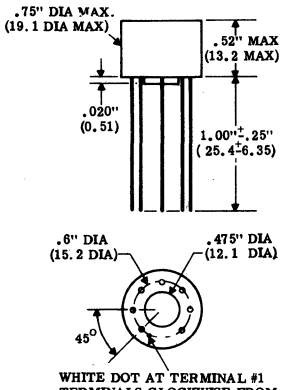
Delivery— stock to one week

PICO's ultra-miniature transformers

S SERIES Plug-In



Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27: . . . . . All Units Meet MIL-T-27 And Are Hermetically Sealed in a Metal Case, Audio Transformers Are Type TF5R21ZZ.
- FREQUENCY RESPONSE: . . . ± 3 db, 50 Hz - 30 KHz at 1.0 Milliwatt. (±0.5 db, 300 Hz-5 KHz)
- MAXIMUM DISTORTION: . . . 5% With Rated Power Level at 1 KHz, 300 Hz and 50 Hz.
- DIELECTRIC STRENGTH: . . . All Units Tested at 200 V RMS.
- INSULATION RESISTANCE: . . Greater Than 10,000 Megohms at 300 V DC.
- WEIGHT: . . . . . 17 Grams
- OPERATING TEMPERATURE: . -55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c Maximum).
- TERMINALS: . . . . . Solid .020 Conductor, Copper Clad Steel Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452
- THERMAL SHOCK: . . . . . 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

This Product is Patented

PICO PART NUMBER S-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	300 Hz and higher	50 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9*** S-Series
S-21003	20 ct	8 ct	2	2.0	1.5	.05	22	1.6	.88	.22	1.58:1	3.16:1	18.04
S-21005	20 ct	20 ct	5	2.0	1.5	.05	22	1.6	2.2	.55	1:1	2:1	18.04
S-21010	32 ct	32 ct	8	2.0	1.5	.05	17.5	2.56	3.52	.88	1:1	2:1	18.04
S-21015	40 ct	40 ct	10	2.0	1.5	.05	16	3.2	4.4	1.1	1:1	2:1	18.04
S-21018	48 ct	16 ct	4	2.0	1.5	.05	14.5	3.84	1.76	.44	1.73:1	3.46:1	18.04
S-21020	50 ct	50 ct	12.5	2.0	1.5	.05	14	4	5.5	1.38	1:1	2:1	18.04
S-21025	80 ct	32 ct	8	2.0	1.5	.05	11	6.4	3.52	.88	1.58:1	3.16:1	18.04
S-21028	100 ct	40 ct	10	2.0	1.5	.05	10	8	4.4	1.1	1.58:1	3.16:1	18.04
S-21030	100 ct	100 ct	25	2.0	1.5	.05	10	8	11	2.75	1:1	2:1	18.04
S-21035	120 ct	12.8 ct	3.2	2.0	1.5	.05	9	9.6	1.41	.35	3.06:1	6.12:1	18.04
S-21040	120 ct	60 ct	15	2.0	1.5	.05	9	9.6	6.6	1.65	1.41:1	2.83:1	18.04
S-21045	120 ct	120 ct	30	2.0	1.5	.05	9	9.6	13.2	3.3	1:1	2:1	18.04
S-21050	150 ct	12 ct	3	2.0	1.5	.05	8	12	1.32	.33	3.54:1	7.08:1	18.04
S-21055	150 ct	50 ct	12.5	2.0	1.5	.05	8	12	5.5	1.38	1.73:1	3.46:1	18.04
S-21060	150 ct	100 ct	25	2.0	1.5	.05	8	12	11	2.75	1.22:1	2.44:1	18.04
S-21065	150 ct	150 ct	37.5	2.0	1.5	.05	8	12	16.5	4.13	1:1	2:1	18.04
S-21070	150 ct	600 ct	150	2.0	1.5	.05	8	12	66	16.5	1:2	1:1	18.04
S-21075	200 ct	200 ct	50	2.0	1.5	.05	7	16	22	5.5	1:1	2:1	18.04
S-21080	300 ct	12 ct	3	2.0	1.5	.05	5.5	24	1.32	.33	5:1	10:1	18.04
S-21085	300 ct	50 ct	12.5	2.0	1.5	.05	5.5	24	5.5	1.38	2.45:1	4.9:1	18.04
S-21090	300 ct	150 ct	37.5	2.0	1.5	.05	5.5	24	16.5	4.13	1.41:1	2.83:1	18.04
S-21095	300 ct	300 ct	75	2.0	1.5	.05	5.5	24	33	8.25	1:1	2:1	18.04
S-21100	300 ct	600 ct	150	2.0	1.5	.05	5.5	24	66	16.5	1:1.41	1.41:1	18.04
S-21105	320 ct	12.8 ct	3.2	2.0	1.5	.05	5.5	25.6	1.41	.35	5:1	10:1	18.04
S-21110	400 ct	40 ct	10	2.0	1.5	.05	5	32	4.4	1.1	3.16:1	6.32:1	18.04
S-21115	400 ct	120 ct	30	2.0	1.5	.05	5	32	13.2	3.3	1.83:1	3.65:1	18.04
S-21120	400 ct	200 ct	50	2.0	1.5	.05	5	32	22	5.5	1.41:1	2.83:1	18.04
S-21125	400 ct	400 ct	100	2.0	1.5	.05	5	32	44	11	1:1	2:1	18.04
S-21130	400 ct	1000 ct	250	2.0	1.5	.05	5	32	110	27.5	1:1.58	1.26:1	18.04
S-21135	400 ct	2000 ct	500	2.0	1.5	.05	5	32	220	55	1:2.24	1:1.12	18.04
S-21140	400 ct	4000 ct	1000	2.0	1.5	.05	5	32	440	110	1:3.16	1:1.58	18.04
S-21142	500 ct	12.8 ct	3.2	2.0	1.5	.05	4.5	40	1.41	.35	6.25:1	12.5:1	18.04
S-21144	500 ct	16 ct	4	2.0	1.5	.05	4.5	40	1.76	.44	5.6:1	11.2:1	18.04
S-21145	500 ct	50 ct	12.5	2.0	1.5	.05	4.5	40	5.5	1.38	3.16:1	6.32:1	18.04
S-21147	500 ct	150 ct	37.5	2.0	1.5	.05	4.5	40	16.5	4.13	1.83:1	3.65:1	18.04
S-21150	500 ct	500 ct	125	2.0	1.5	.05	4.5	40	55	13.75	1:1	2:1	18.04
S-21155	*500 ct	500 ct	-	2.0	1.5	.05	4.5	40	55	-	1:1	-	18.78
S-21160	500 ct	600 ct	150	2.0	1.5	.05	4.5	40	66	16.5	1:1.1	1.83:1	18.04
S-21165	600 ct	12.8 ct	3.2	2.0	1.5	.05	4	48	1.41	.35	6.85:1	13.7	18.04
S-21167	600 ct	30 ct	7.5	2.0	1.5	.05	4	48	3.3	.83	4.47:1	8.94:1	18.04
S-21170	600 ct	48 ct	12	2.0	1.5	.05	4	48	5.28	1.37	3.54:1	7.07:1	18.04
S-21175	600 ct	200 ct	50	2.0	1.5	.05	4	48	22	5.5	1.73:1	3.46:1	18.04
S-21180**	600 ct	600 ct	150	2.0	1.5	.05	4	48	66	16.5	1:1	2:1	18.04
S-21185**	*600 ct	600 ct	-	2.0	1.5	.05	4	48	66	-	1:1	-	18.78
S-21186**	*600 ct	900 ct	-	2.0	1.5	.05	4	48	99	-	1:1.22	-	18.78
S-21187**	600 ct	1200 ct	300	2.0	1.5	.05	4	48	132	33	1:1.41	1.41:1	18.04
S-21190	640 ct	12.8 ct	3.2	2.0	1.5	.05	4	51	1.41	.35	7.07:1	14.14:1	18.04
S-21195	700 ct	100 ct	25	2.0	1.5	.05	3.5	56	11	2.75	2.65:1	5.29:1	18.04
S-21200	800 ct	12.8 ct	3.2	2.0	1.5	.05	3.5	64	1.41	.35	7.91:1	15.8:1	18.04
S-21205	800 ct	48 ct	12	2.0	1.5	.05	3.5	64	5.28	1.32	4.08:1	8.16:1	18.04
S-21210	800 ct	800 ct	200	2.0	1.5	.05	3.5	64	88	22	1:1	2:1	18.04
S-21215	900 ct	600 ct	150	2.0	1.5	.05	3	72	66	16.5	1.23:1	2.45:1	18.04
S-21217**	*900 ct	900 ct	-	2.0	1.5	.05	3	72	99	-	1:1	-	18.78
S-21220	1000 ct	12 ct	3	2.0	1.5	.05	3	80	1.32	.33	9.13:1	18.26:1	18.04
S-21225	1000 ct	50 ct	12.5	2.0	1.5	.05	3	80	5.5	1.38	4.47:1	8.94:1	18.04
S-21230	1000 ct	1000 ct	250	2.0	1.5	.05	3	80	110	27.5	1:1	2:1	18.04
S-21235	1060 ct	12.8 ct	3.2	2.0	1.5	.05	3	85	1.41	.35	9.1:1	18.2:1	18.04
S-21240	1200 ct	12.8 ct	3.2	2.0	1.5	.05	3	96	1.41	.35	9.68:1	19.4:1	18.04
S-21245	1200 ct	500 ct	125	2.0	1.5	.05	3	96	55	13.75	1.55:1	3.1:1	18.04
S-21250	1200 ct	1200 ct	300	2.0	1.5	.05	3	96	132	33	1:1	2:1	18.04
S-21255	*1200 ct	1200 ct	-	2.0	1.5	.05	3	96	132	-	1:1	-	18.78
S-21260	1500 ct	12 ct	3	2.0	1.5	.05	2.5	120	1.32	.33	11.18:1	22.36:1	18.04
S-21265	1500 ct	500 ct	125	2.0	1.5	.05	2.5	120	55	13.75	1.73:1	3.46:1	18.04
S-21270	*1500 ct	600 ct	-	2.0	1.5	.05	2.5	120	66	-	1.58:1	-	18.78
S-21275	*1500 ct	1500 ct	-	2.0	1.5	.05	2.5	120	165	-	1:1	-	18.78
S-21280	1600 ct	12.8 ct	3.2	2.0	1.5	.05	2.5	128	1.41	.35	11.18:1	22.36:1	18.04
S-21283	2000 ct	8 ct	2	2.0	1.5	.05	2.2	160	.88	.22	15.8:1	31.6:1	18.04
S-21285	2000 ct	2000 ct	500	2.0	1.5	.05	2.2	160	220	55	1:1	2:1	18.04
S-21290	*2000 ct	2000 ct	-	2.0	1.5	.05	2.2	160	220	-	1:1	-	18.78
S-21295	2000 ct	8000 ct	2000	2.0	1.5	.05	2.2	160	880	220	1:2	1:1	18.78
S-21297	2500 ct	2500 ct	625	2.0	1.5	.05	2	200	275	69	1:1	2:1	18.78
S-21300	3000 ct	3000 ct	750	2.0	1.5	.05	1.8	240	330	83	1:1	2:1	18.78
S-21305	*3000 ct	3000 ct	-	2.0	1.5	.05	1.8	240	330	-	1:1	-	18.78

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

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PICO PART NUMBER S-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	300 Hz and higher	50 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9*** S-Series
S-21310	3600 ct	3600 ct	900	2.0	1.5	.05	1.7	288	396	99	1:1	2:1	18.78
S-21312	4000 ct	16 ct	4	2.0	1.5	.05	1.6	320	1.76	.44	15.8:1	31.6:1	18.78
S-21314**	4000 ct	600 ct	150	2.0	1.5	.05	1.6	320	66	16.5	2.58:1	5.16:1	18.78
S-21315	4000 ct	1000 ct	250	2.0	1.5	.05	1.6	320	110	27.5	2:1	4:1	18.78
S-21320	*4000 ct	8000 ct	-	2.0	1.5	.05	1.6	320	880	-	1:1.41	-	18.78
S-21325	5000 ct	500 ct	125	2.0	1.5	.05	1.4	400	55	13.8	3.16:1	6.32:1	18.04
S-21330	5000 ct	5000 ct	1250	2.0	1.5	.05	1.4	400	550	138	1:1	2:1	18.04
S-21335	7500 ct	50 ct	12.5	1.3	1.3	.05	1.2	600	5.5	1.38	12.25:1	24.5:1	20.00
S-21340	7500 ct	100 ct	25	1.3	1.3	.05	1.2	600	11	2.75	8.66:1	17.32:1	20.00
S-21345	7500 ct	600 ct	150	1.3	1.3	.05	1.2	600	66	16.5	3.54:1	7.07:1	20.00
S-21350	7500 ct	2500 ct	625	1.3	1.3	.05	1.2	600	275	69	1.73:1	3.46:1	20.00
S-21355	*7500 ct	7500 ct	-	1.3	1.3	.05	1.2	600	825	-	1:1	-	21.43
S-21360	8000 ct	12.8 ct	3.2	1.2	1.2	.05	1.1	640	1.4	.35	25:1	50:1	20.00
S-21365	8000 ct	1000 ct	250	1.2	1.2	.05	1.1	640	110	27.5	2.83:1	5.66:1	20.00
S-21370	*8000 ct	1200 ct	-	1.2	1.2	.05	1.1	640	132	-	2.58:1	-	21.43
S-21375	*9000 ct	9000 ct	-	1.1	1.1	.05	1.1	720	990	-	1:1	-	21.43
S-21380	10,000 ct	12.8 ct	3.2	1.0	1.0	.05	1	800	1.4	.35	28:1	56:1	20.00
S-21385	10,000 ct	16 ct	4	1.0	1.0	.05	1	800	1.76	.44	25:1	50:1	20.00
S-21390	10,000 ct	100 ct	25	1.0	1.0	.05	1	800	11	2.75	10:1	20:1	20.00
S-21395	10,000 ct	200 ct	50	1.0	1.0	.05	1	800	22	5.5	7.07:1	14.14:1	20.00
S-21400	10,000 ct	500 ct	125	1.0	1.0	.05	1	800	55	13.75	4.47:1	8.94:1	20.00
S-21405	10,000 ct	600 ct	150	1.0	1.0	.05	1	800	66	16.5	4.08:1	8.16:1	20.00
S-21410	10,000 ct	1000 ct	250	1.0	1.0	.05	1	800	110	27.5	3.16:1	6.32:1	20.00
S-21415	10,000 ct	1200 ct	300	1.0	1.0	.05	1	800	132	33	2.89:1	5.77:1	20.00
S-21420	10,000 ct	1500 ct	375	1.0	1.0	.05	1	800	165	41.3	2.58:1	5.16:1	20.00
S-21425	10,000 ct	2000 ct	500	1.0	1.0	.05	1	800	220	55	2.24:1	4.47:1	20.00
S-21430	10,000 ct	5000 ct	1250	1.0	1.0	.05	1	800	550	138	1.41:1	2.83:1	20.00
S-21435	10,000 ct	7500 ct	1875	1.0	1.0	.05	1	800	825	206	1.16:1	2.31:1	20.00
S-21440	10,000 ct	10,000 ct	2500	1.0	1.0	.05	1	800	1100	275	1:1	2:1	20.00
S-21445	*10,000 ct	10,000 ct	-	1.0	1.0	.05	1	800	1100	-	1:1	-	21.43
S-21450	15,000 ct	400 ct	100	.65	.65	.05	.8	1200	44	11	6.12:1	12.25:1	20.00
S-21452	15,000 ct	500 ct	125	.65	.65	.05	.8	1200	55	13.8	5.48:1	10.95:1	20.00
S-21455	15,000 ct	600 ct	150	.65	.65	.05	.8	1200	66	16.5	5:1	10:1	20.00
S-21460	15,000 ct	10,000 ct	2500	.65	.65	.05	.8	1200	1100	275	1.22:1	2.45:1	20.00
S-21465	*15,000 ct	15,000 ct	-	.65	.65	.05	.8	1200	1650	-	1:1	-	21.43
S-21470	15,000 ct	15,000 ct	3750	.65	.65	.05	.8	1200	1650	413	1:1	2:1	20.00
S-21475	16,000 ct	1000 ct	250	.62	.62	.05	.8	1280	110	27.5	4:1	8:1	20.00
S-21480	20,000 ct	500 ct	125	.5	.5	.05	.7	1600	55	13.8	6.32:1	12.65:1	21.43
S-21485	20,000 ct	600 ct	150	.5	.5	.05	.7	1600	66	16.5	5.77:1	11.55:1	21.43
S-21490	20,000 ct	800 ct	200	.5	.5	.05	.7	1600	88	22	5:1	10:1	21.43
S-21495	20,000 ct	1000 ct	250	.5	.5	.05	.7	1600	110	27.5	4.47:1	8.94:1	21.43
S-21500	20,000 ct	5000 ct	1250	.5	.5	.05	.7	1600	550	138	2:1	4:1	21.43
S-21505	20,000 ct	10,000 ct	2500	.5	.5	.05	.7	1600	1100	275	1.41:1	2.83:1	21.43
S-21510	*20,000 ct	20,000 ct	-	.5	.5	.05	.7	1600	2200	-	1:1	-	22.27
S-21515	25,000 ct	500 ct	125	.4	.4	.05	.6	2000	55	13.8	7.07:1	14.14:1	21.43
S-21520	25,000 ct	1000 ct	250	.4	.4	.05	.6	2000	110	27.5	5:1	10:1	21.43
S-21525	30,000 ct	50 ct	12.5	.33	.33	.05	.6	2400	5.5	1.38	24.5:1	49:1	22.27
S-21530	30,000 ct	1200 ct	300	.33	.33	.05	.6	2400	132	33	5:1	10:1	22.27
S-21532	30,000 ct	500 ct	125	.33	.33	.05	.6	2400	55	13.8	7.7:1	15.5:1	22.27
S-21534	30,000 ct	200 ct	50	.33	.33	.05	.6	2400	22	5.5	12.2:1	24.5:1	22.27
S-21535	30,000 ct	5000 ct	1250	.33	.33	.05	.6	2400	550	137.5	2.45:1	4.9:1	22.27
S-21540	30,000 ct	10,000 ct	2500	.33	.33	.05	.6	2400	1100	275	1.73:1	3.46:1	22.27
S-21545	*30,000 ct	30,000 ct	-	.33	.33	.05	.6	2400	3300	-	1:1	-	23.93
S-21550	40,000 ct	400 ct	100	.25	.25	.05	.5	3200	44	11	10:1	20:1	23.93
S-21555	40,000 ct	2000 ct	500	.25	.25	.05	.5	3200	220	55	4.47:1	8.94:1	23.93
S-21560	40,000 ct	4000 ct	1000	.25	.25	.05	.5	3200	440	110	3.16:1	6.32:1	23.93
S-21565	40,000 ct	20,000 ct	5000	.25	.25	.05	.5	3200	2200	550	1.41:1	2.83:1	23.93
S-21570	*40,000 ct	40,000 ct	-	.25	.25	.05	.5	3200	4400	-	1:1	-	26.64
S-21575	50,000 ct	200 ct	50	.2	.2	.05	.4	4000	22	5.5	15.8:1	31.6:1	26.64
S-21577	50,000 ct	500 ct	125	.2	.2	.05	.4	4000	55	13.8	10:1	20:1	26.64
S-21578	50,000 ct	600 ct	150	.2	.2	.05	.4	4000	66	16.5	9.13:1	18.26:1	26.64
S-21579	50,000 ct	50,000 ct	12,500	.2	.2	.05	.4	4000	5500	1380	1:1	2:1	26.64
S-21580	60,000 ct	15,000 ct	3750	.16	.16	.05	.4	4800	1650	413	2:1	4:1	28.77
S-21585	62,500 ct	50 ct	12.5	.16	.16	.05	.4	5000	5.5	1.38	35.4:1	70.7:1	28.77
S-21587	80,000 ct	15,000 ct	3750	.12	.12	.05	.3	6400	1650	413	2.3:1	4.6:1	28.77
S-21590	90,000 ct	10,000 ct	2500	.11	.11	.05	.3	7200	1100	275	3:1	6:1	30.20
S-21595	95,000 ct	15,000 ct	3750	.1	.1	.05	.3	7600	1650	413	2.5:1	5:1	30.20
S-21600	100,000 ct	60 ct	15	.1	.1	.05	.3	8000	6.6	1.65	40.8:1	81.6:1	30.20
S-21605	100,000 ct	100 ct	25	.1	.1	.05	.3	8000	11	2.75	31.6:1	63.2:1	30.20
S-21610	100,000 ct	500 ct	125	.1	.1	.05	.3	8000	55	13.8	14.1:1	28.3:1	30.20
S-21613	100,000 ct	1000 ct	250	.1	.1	.05	.3	8000	110	27.5	10:1	20:1	30.20
S-21614	100,000 ct	2000 ct	500	.1	.1	.05	.3	8000	220	55	7.07:1	14.14:1	30.20
S-21615	100,000 ct	10,000 ct	2500	.1	.1	.05	.3	8000	1100	275	3.16:1	6.32:1	30.20
S-21620	135,000 ct	82 ct	20.5	.07	.07	.05	.2	10,800	9	2.25	40.6:1	81.2:1	31.55

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

PICO's ultra-miniature transformers

S SERIES Plug-In

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
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- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

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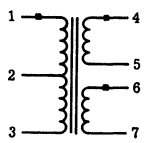

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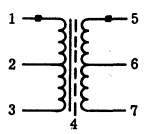

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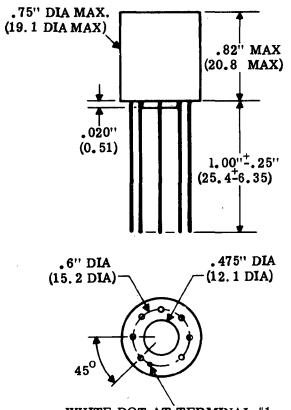
Delivery—stock to one week

PICO's ultra-miniature transformers

T SERIES Plug-In



Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27: . . . . . All Units Meet MIL-T-27 And Are Hermetically Sealed in a Metal Case, Audio Transformers Are Type TF5R21ZZ.
- FREQUENCY RESPONSE: . . . ± 3 db, 20 Hz - 25 KHz at 1.0 Milliwatt.
- MAXIMUM DISTORTION: . . . 5% With Rated Power Level at 1 KHz and 300 Hz. 10% Distortion at 20 Hz.
- DIELECTRIC STRENGTH: . . . All Units Tested at 200 V RMS.
- INSULATION RESISTANCE: . . Greater Than 10,000 Megohms at 300 V DC.
- WEIGHT: . . . . . 28 Grams
- OPERATING TEMPERATURE: . -55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c Maximum).
- TERMINALS: . . . . . Solid .020 Conductor, Copper Clad Steel Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452
- THERMAL SHOCK: . . . . . 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

This Product is Patented

Delivery— stock to one week

PICO PART NUMBER T-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	300 Hz and higher	20 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 *** T-Series
T-22003	20 ct	8 ct	2	3.0	2.0	.006	22	1.6	.8	.2	1.58:1	3.16:1	19.82
T-22005	20 ct	20 ct	5	3.0	2.0	.006	22	1.6	2	.5	1:1	2:1	19.82
T-22010	32 ct	32 ct	8	3.0	2.0	.006	17.5	2.56	3.2	.8	1:1	2:1	19.82
T-22015	40 ct	40 ct	10	3.0	2.0	.006	16	3.2	4	1	1:1	2:1	19.82
T-22018	48 ct	16 ct	4	3.0	2.0	.006	14.5	3.84	1.6	.4	1.73:1	3.46:1	19.82
T-22020	50 ct	50 ct	12.5	3.0	2.0	.006	14	4	5	1.25	1:1	2:1	19.82
T-22025	80 ct	32 ct	8	3.0	2.0	.006	11	6.4	3.2	.8	1.58:1	3.16:1	19.82
T-22028	100 ct	40 ct	10	3.0	2.0	.006	10	8	4	1	1.58:1	3.16:1	19.82
T-22030	100 ct	100 ct	25	3.0	2.0	.006	10	8	10	2.5	1:1	2:1	19.82
T-22035	120 ct	12.8 ct	3.2	3.0	2.0	.006	9	9.6	1.3	.32	3.06:1	6.12:1	19.82
T-22040	120 ct	60 ct	15	3.0	2.0	.006	9	9.6	6	1.5	1.41:1	2.83:1	19.82
T-22045	120 ct	120 ct	30	3.0	2.0	.006	9	9.6	12	3	1:1	2:1	19.82
T-22050	150 ct	12 ct	3	3.0	2.0	.006	8	12	1.2	.3	3.54:1	7.08:1	19.82
T-22055	150 ct	50 ct	12.5	3.0	2.0	.006	8	12	5	1.25	1.73:1	3.46:1	19.82
T-22060	150 ct	100 ct	25	3.0	2.0	.006	8	12	10	2.5	1.22:1	2.44:1	19.82
T-22065	150 ct	150 ct	37.5	3.0	2.0	.006	8	12	15	3.75	1:1	2:1	19.82
T-22070	150 ct	600 ct	150	3.0	2.0	.006	8	12	60	15	1:2	1:1	19.82
T-22075	200 ct	200 ct	50	3.0	2.0	.006	7	16	20	5	1:1	2:1	19.82
T-22080	300 ct	12 ct	3	3.0	2.0	.006	5.5	24	1.2	.3	5:1	10:1	19.82
T-22085	300 ct	50 ct	12.5	3.0	2.0	.006	5.5	24	5	1.25	2.45:1	4.9:1	19.82
T-22090	300 ct	150 ct	37.5	3.0	2.0	.006	5.5	24	15	3.75	1.41:1	2.83:1	19.82
T-22095	300 ct	300 ct	75	3.0	2.0	.006	5.5	24	30	7.5	1:1	2:1	19.82
T-22100	300 ct	600 ct	150	3.0	2.0	.006	5.5	24	60	15	1:1.41	1.41:1	19.82
T-22105	320 ct	12.8 ct	3.2	3.0	2.0	.006	5.5	25.6	1.3	.32	5:1	10:1	19.82
T-22110	400 ct	40 ct	10	3.0	2.0	.006	5	32	4	1	3.16:1	6.32:1	19.82
T-22115	400 ct	120 ct	30	3.0	2.0	.006	5	32	12	3	1.83:1	3.65:1	19.82
T-22120	400 ct	200 ct	50	3.0	2.0	.006	5	32	20	5	1.41:1	2.83:1	19.82
T-22125	400 ct	400 ct	100	3.0	2.0	.006	5	32	40	10	1:1	2:1	19.82
T-22130	400 ct	1000 ct	250	3.0	2.0	.006	5	32	100	25	1:1.58	1.26:1	19.82
T-22135	400 ct	2000 ct	500	3.0	2.0	.006	5	32	200	50	1:2.24	1:1.12	19.82
T-22140	400 ct	4000 ct	1000	3.0	2.0	.006	5	32	400	100	1:3.16	1:1.58	19.82
T-22142	500 ct	12.8 ct	3.2	3.0	2.0	.006	4.5	40	1.3	.32	6.25:1	12.5:1	19.82
T-22144	500 ct	16 ct	4	3.0	2.0	.006	4.5	40	1.6	.4	5.6:1	11.2:1	19.82
T-22145	500 ct	50 ct	12.5	3.0	2.0	.006	4.5	40	5	1.25	3.16:1	6.32:1	19.82
T-22147	500 ct	150 ct	37.5	3.0	2.0	.006	4.5	40	15	3.75	1.83:1	3.65:1	19.82
T-22150	500 ct	500 ct	125	3.0	2.0	.006	4.5	40	50	12.5	1:1	2:1	19.82
T-22155	*500 ct	500 ct	-	3.0	2.0	.006	4.5	40	50	-	1:1	-	20.66
T-22160	500 ct	600 ct	150	3.0	2.0	.006	4.5	40	60	15	1:1.1	1.83:1	19.82
T-22165	600 ct	12.8 ct	3.2	3.0	2.0	.006	4	48	1.3	.32	6.85:1	13.7:1	19.82
T-22167	600 ct	30 ct	7.5	3.0	2.0	.006	4	48	3	.75	4.47:1	8.94:1	19.82
T-22170	600 ct	48 ct	12	3.0	2.0	.006	4	48	4.8	1.2	3.54:1	7.07:1	19.82
T-22175	600 ct	200 ct	50	3.0	2.0	.006	4	48	20	5	1.73:1	3.46:1	19.82
T-22180**	600 ct	600 ct	150	3.0	2.0	.006	4	48	60	15	1:1	2:1	19.82
T-22185**	*600 ct	600 ct	-	3.0	2.0	.006	4	48	60	-	1:1	-	20.66
T-22186**	*600 ct	900 ct	-	3.0	2.0	.006	4	48	90	-	1:1.22	-	20.66
T-22187**	600 ct	1200 ct	300	3.0	2.0	.006	4	48	120	30	1:1.41	1.41:1	19.82
T-22190	640 ct	12.8 ct	3.2	3.0	2.0	.006	4	51	1.3	.32	7.07:1	14.14:1	19.82
T-22195	700 ct	100 ct	25	3.0	2.0	.006	3.5	56	10	2.5	2.65:1	5.29:1	19.82
T-22200	800 ct	12.8 ct	3.2	3.0	2.0	.006	3.5	64	1.3	.32	7.91:1	15.8:1	19.82
T-22205	800 ct	48 ct	12	3.0	2.0	.006	3.5	64	4.8	1.2	4.08:1	8.16:1	19.82
T-22210	800 ct	800 ct	200	3.0	2.0	.006	3.5	64	80	20	1:1	2:1	19.82
T-22215	900 ct	600 ct	150	3.0	2.0	.006	3	72	60	15	1.22:1	2.45:1	19.82
T-22217**	*900 ct	900 ct	-	3.0	2.0	.006	3	72	90	-	1:1	-	20.66
T-22220	1000 ct	12 ct	3	3.0	2.0	.006	3	80	1.2	.3	9.13:1	18.26:1	19.82
T-22225	1000 ct	50 ct	12.5	3.0	2.0	.006	3	80	5	1.25	4.47:1	8.94:1	19.82
T-22230	1000 ct	1000 ct	250	3.0	2.0	.006	3	80	100	25	1:1	2:1	19.82
T-22235	1060 ct	12.8 ct	3.2	3.0	2.0	.006	3	85	1.3	.32	9.1:1	18.2:1	19.82
T-22240	1200 ct	12.8 ct	3.2	3.0	2.0	.006	3	96	1.3	.32	9.68:1	19.4:1	19.82
T-22245	1200 ct	500 ct	125	3.0	2.0	.006	3	96	50	12.5	1.55:1	3.1:1	19.82
T-22250	1200 ct	1200 ct	300	3.0	2.0	.006	3	96	120	30	1:1	2:1	19.82
T-22255	*1200 ct	1200 ct	-	3.0	2.0	.006	3	96	120	-	1:1	-	20.66
T-22260	1500 ct	12 ct	3	3.0	2.0	.006	2.5	120	1.2	.3	11.18:1	22.36:1	19.82
T-22265	1500 ct	500 ct	125	3.0	2.0	.006	2.5	120	50	12.5	1.73:1	3.46:1	19.82
T-22270	*1500 ct	600 ct	-	3.0	2.0	.006	2.5	120	60	-	1.58:1	-	20.66
T-22275	*1500 ct	1500 ct	-	3.0	2.0	.006	2.5	120	150	-	1:1	-	20.66
T-22280	1600 ct	12.8 ct	3.2	3.0	2.0	.006	2.5	128	1.3	.32	11.18:1	22.36:1	19.82
T-22283	2000 ct	8 ct	2	3.0	2.0	.006	2.2	160	.8	.2	15.8:1	31.6:1	19.82
T-22285	2000 ct	2000 ct	500	3.0	2.0	.006	2.2	160	200	50	1:1	2:1	19.82
T-22290	*2000 ct	2000 ct	-	3.0	2.0	.006	2.2	160	200	-	1:1	-	20.66
T-22295	2000 ct	8000 ct	2000	3.0	2.0	.006	2.2	160	800	200	1:2	1:1	19.82
T-22297	2500 ct	2500 ct	625	3.0	2.0	.006	2	200	250	63	1:1	2:1	19.82
T-22300	3000 ct	3000 ct	750	3.0	2.0	.006	1.8	240	300	75	1:1	2:1	19.82
T-22305	*3000 ct	3000 ct	-	3.0	2.0	.006	1.8	240	300	-	1:1	-	19.82

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

PICO PART NUMBER T-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 300 Hz and higher	POWER WATTS 20 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1-9*** T-Series
T-22310	3600 ct	3600 ct	900	2.7	2.0	.006	1.7	288	360	90	1:1	2:1	19.82
T-22312	4000 ct	16 ct	4	2.5	2.0	.006	1.6	320	1.6	.4	15.8:1	31.6:1	19.82
T-22314**	4000 ct	600 ct	150	2.5	2.0	.006	1.6	320	60	15	2.58:1	5.16:1	19.82
T-22315	4000 ct	1000 ct	250	2.5	2.0	.006	1.6	320	100	25	2:1	4:1	19.82
T-22320	*4000 ct	8000 ct	-	2.5	2.0	.006	1.6	320	800	-	1:1.41	-	20.66
T-22325	5000 ct	500 ct	125	2.0	2.0	.006	1.4	400	50	12.5	3.16:1	6.32:1	19.82
T-22330	5000 ct	5000 ct	1250	2.0	2.0	.006	1.4	400	500	125	1:1	2:1	19.82
T-22335	7500 ct	50 ct	12.5	1.3	1.3	.006	1.2	600	5	1.25	12.25:1	24.5:1	21.99
T-22340	7500 ct	100 ct	25	1.3	1.3	.006	1.2	600	10	2.5	8.66:1	17.32:1	21.99
T-22345	7500 ct	600 ct	150	1.3	1.3	.006	1.2	600	60	15	3.54:1	7.07:1	21.99
T-22350	7500 ct	2500 ct	625	1.3	1.3	.006	1.2	600	250	63	1.73:1	3.46:1	21.99
T-22355	*7500 ct	7500 ct	-	1.3	1.3	.006	1.2	600	750	-	1:1	-	23.57
T-22360	8000 ct	12.8 ct	3.2	1.2	1.2	.006	1.1	640	1.3	.32	25:1	50:1	21.99
T-22365	8000 ct	1000 ct	250	1.2	1.2	.006	1.1	640	100	25	2.83:1	5.66:1	21.99
T-22370	*8000 ct	1200 ct	-	1.2	1.2	.006	1.1	640	120	-	2.58:1	-	23.57
T-22375	*9000 ct	9000 ct	-	1.1	1.1	.006	1.1	720	900	-	1:1	-	23.57
T-22380	10,000 ct	12.8 ct	3.2	1.0	1.0	.006	1	800	1.3	.32	28:1	56:1	21.99
T-22385	10,000 ct	16 ct	4	1.0	1.0	.006	1	800	1.6	.4	25:1	50:1	21.99
T-22390	10,000 ct	100 ct	25	1.0	1.0	.006	1	800	10	2.5	10:1	20:1	21.99
T-22395	10,000 ct	200 ct	50	1.0	1.0	.006	1	800	20	5	7.07:1	14.14:1	21.99
T-22400	10,000 ct	500 ct	125	1.0	1.0	.006	1	800	50	12.5	4.47:1	8.94:1	21.99
T-22405	10,000 ct	600 ct	150	1.0	1.0	.006	1	800	60	15	4.08:1	8.16:1	21.99
T-22410	10,000 ct	1000 ct	250	1.0	1.0	.006	1	800	100	25	3.16:1	6.32:1	21.99
T-22415	10,000 ct	1200 ct	300	1.0	1.0	.006	1	800	120	30	2.89:1	5.77:1	21.99
T-22420	10,000 ct	1500 ct	375	1.0	1.0	.006	1	800	150	38	2.58:1	5.16:1	21.99
T-22425	10,000 ct	2000 ct	500	1.0	1.0	.006	1	800	200	50	2.24:1	4.47:1	21.99
T-22430	10,000 ct	5000 ct	1250	1.0	1.0	.006	1	800	500	125	1.41:1	2.83:1	21.99
T-22435	10,000 ct	7500 ct	1875	1.0	1.0	.006	1	800	750	188	1.16:1	2.31:1	21.99
T-22440	10,000 ct	10,000 ct	2500	1.0	1.0	.006	1	800	1000	250	1:1	2:1	21.99
T-22445	*10,000 ct	10,000 ct	-	1.0	1.0	.006	1	800	1000	-	1:1	-	23.57
T-22450	15,000 ct	400 ct	100	.66	.66	.006	.8	1200	40	10	6.12:1	12.25:1	21.99
T-22452	15,000 ct	500 ct	125	.66	.66	.006	.8	1200	50	12.5	5.48:1	10.95:1	21.99
T-22455	15,000 ct	600 ct	150	.66	.66	.006	.8	1200	60	15	5:1	10:1	21.99
T-22460	15,000 ct	10,000 ct	2500	.66	.66	.006	.8	1200	1000	250	1.22:1	2.45:1	21.99
T-22465	*15,000 ct	15,000 ct	-	.66	.66	.006	.8	1200	1500	-	1:1	-	23.57
T-22470	15,000 ct	15,000 ct	3750	.66	.66	.006	.8	1200	1500	375	1:1	2:1	21.99
T-22475	16,000 ct	1000 ct	250	.62	.62	.006	.8	1280	100	25	4:1	8:1	21.99
T-22480	20,000 ct	500 ct	125	.5	.5	.006	.7	1600	50	12.5	6.32:1	12.65:1	23.57
T-22485	20,000 ct	600 ct	150	.5	.5	.006	.7	1600	60	15	5.77:1	11.55:1	23.57
T-22490	20,000 ct	800 ct	200	.5	.5	.006	.7	1600	80	20	5:1	10:1	23.57
T-22495	20,000 ct	1000 ct	250	.5	.5	.006	.7	1600	100	25	4.47:1	8.94:1	23.57
T-22500	20,000 ct	5000 ct	1250	.5	.5	.006	.7	1600	500	125	2:1	4:1	23.57
T-22505	20,000 ct	10,000 ct	2500	.5	.5	.006	.7	1600	1000	250	1.41:1	2.83:1	23.57
T-22510	*20,000 ct	20,000 ct	-	.5	.5	.006	.7	1600	2000	-	1:1	-	24.49
T-22515	25,000 ct	500 ct	125	.4	.4	.006	.6	2000	50	12.5	7.07:1	14.14:1	23.57
T-22520	25,000 ct	1000 ct	250	.4	.4	.006	.6	2000	100	25	5:1	10:1	23.57
T-22525	30,000 ct	50 ct	12.5	.33	.33	.006	.6	2400	5	1.25	24.5:1	49:1	24.49
T-22530	30,000 ct	1200 ct	300	.33	.33	.006	.6	2400	120	30	5:1	10:1	24.49
T-22532	30,000 ct	500 ct	125	.33	.33	.006	.6	2400	50	12.5	7.7:1	15.5:1	24.49
T-22534	30,000 ct	200 ct	50	.33	.33	.006	.6	2400	20	5	12.2:1	24.5:1	24.49
T-22535	30,000 ct	5000 ct	1250	.33	.33	.006	.6	2400	500	125	2.45:1	4.9:1	24.49
T-22540	30,000 ct	10,000 ct	2500	.33	.33	.006	.6	2400	1000	250	1.73:1	3.46:1	24.49
T-22545	*30,000 ct	30,000 ct	-	.33	.33	.006	.6	2400	3000	-	1:1	-	26.27
T-22550	40,000 ct	400 ct	100	.25	.25	.006	.5	3200	40	10	10:1	20:1	26.27
T-22555	40,000 ct	2000 ct	500	.25	.25	.006	.5	3200	200	50	4.47:1	8.94:1	26.27
T-22560	40,000 ct	4000 ct	1000	.25	.25	.006	.5	3200	400	100	3.16:1	6.32:1	26.27
T-22565	40,000 ct	20,000 ct	5000	.25	.25	.006	.5	3200	2000	500	1.41:1	2.83:1	26.27
T-22570	*40,000 ct	40,000 ct	-	.25	.25	.006	.5	3200	4000	-	1:1	-	29.30
T-22575	50,000 ct	200 ct	50	.2	.2	.006	.4	4000	20	5	15.8:1	31.6:1	29.30
T-22577	50,000 ct	500 ct	125	.2	.2	.006	.4	4000	50	12.5	10:1	20:1	29.30
T-22578	50,000 ct	600 ct	150	.2	.2	.006	.4	4000	60	15	9.13:1	18.26:1	29.30
T-22579	50,000 ct	50,000 ct	12,500	.2	.2	.006	.4	4000	5000	1250	1:1	2:1	29.30
T-22580	60,000 ct	15,000 ct	3750	.16	.16	.006	.4	4800	1500	375	2:1	4:1	31.63
T-22585	62,500 ct	50 ct	12.5	.16	.16	.006	.4	5000	5	1.25	35.4:1	70.7:1	31.63
T-22587	80,000 ct	15,000 ct	3750	.12	.12	.006	.3	6400	1500	375	2.3:1	4.6:1	31.63

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

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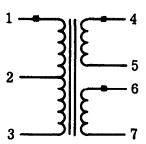
PICO's ultra-miniature transformers

T SERIES Plug-In

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



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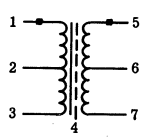

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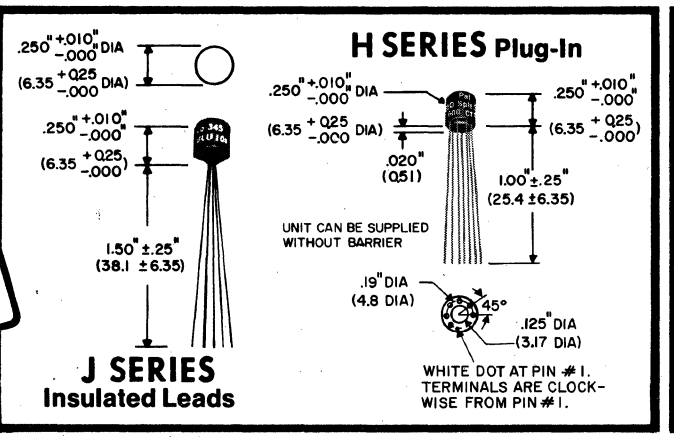
Delivery— stock to one week

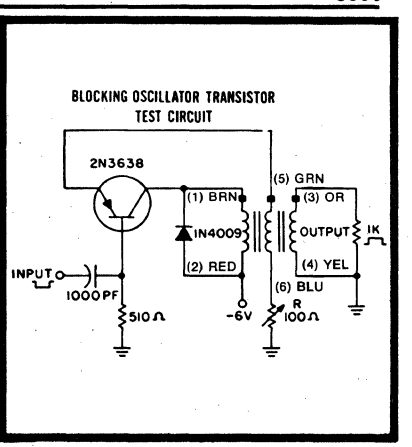
PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • TWX 7105620113

PICO's ultra-miniature PULSE transformers

1/4" x 1/4"





Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-21038: Units Meet MIL-T-21038 and are Hermetically Sealed in a Metal Case
- DIELECTRIC STRENGTH: All Units tested at 200 V RMS
- INSULATION RESISTANCE: Greater than 10,000 Megohms at 300 V DC
- WEIGHT: 1.1 Grams
- OPERATING TEMPERATURE: -55°c to 105°c (All Units Can be Supplied to Class S Requirements 130°c maximum)
- **TERMINALS: . . . . . Solid .012 Diameter Conductor. Conductor is copper clad steel, Tinned 100%. Electroplated Per MIL-T-10727A and ASTM CCS B452.**
- THERMAL SHOCK: 25 Cycles, Method 107C, MIL-STD-202D. Test Conduction A-1

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- BUILT TO MIL-T-21038
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

This Product is Patented

MILITARY DESIGNATION TP7RX4410CZ TURNS RATIO 4:4:1

PICO PART NUMBER		COUPLING CIRCUIT CHARACTERISTICS							BLOCKING OSCILLATOR CIRCUIT					PICO PRICES 1-9 *	
H-Series Plug-In	J-Series Insulated Leads	P Width μSec	Volt Out	Rise Time	% Over Shoot	Droop %	% Back Swing	Imp* in/out,	P Width μSec	Rise Time	% Over Shoot	Droop %	% Back Swing	H-Series	J-Series
H-5400	J-5600	0.05	0.2	0.01	0	0	20	50	0.05	0.01	0	0	35	15.56	13.87
H-5405	J-5605	0.1	0.5	0.015	0	0	20	50	0.1	0.012	0	0	25	15.56	13.87
H-5410	J-5610	0.2	1.2	0.02	0	0	20	100	0.2	0.02	0	0	15	15.56	13.87
H-5415	J-5615	0.5	1.5	0.023	0	5	25	100	0.5	0.023	0	5	15	15.56	13.87
H-5420	J-5620	1	1.5	0.025	0	20	28	100	1	0.03	0	10	15	15.56	13.87
H-5425	J-5625	2	1.5	0.028	0	15	23	100	2	0.035	0	10	15	15.56	13.87
H-5430	J-5630	3	1.5	0.030	0	15	28	100	3	0.04	0	10	15	15.56	13.87
H-5435	J-5635	5	2	0.035	0	20	20	200	5	0.040	0	15	15	15.56	13.87
H-5440	J-5640	10	2	0.05	0	25	25	200	10	0.060	0	15	10	15.56	13.87
H-5445	J-5645	15	2	0.06	0	25	18	200	15	0.07	0	15	15	15.56	13.87
H-5450	J-5650	25	3	0.1	0	30	30	500	25	0.08	0	15	15	15.56	13.87
H-5455	J-5655	50	3	0.3	0	20	20	500	50	0.2	0	10	5	15.56	13.87
H-5460	J-5660	100	6	0.4	0	15	18	500	100	0.35	0	10	15	15.56	13.87

Coupling circuit measurements made with (1) BRN–(2) RED as input and (3) 0R–(4) YEL as output, (5) GRN–(6) BLU winding is open: Input Voltage = 1 V

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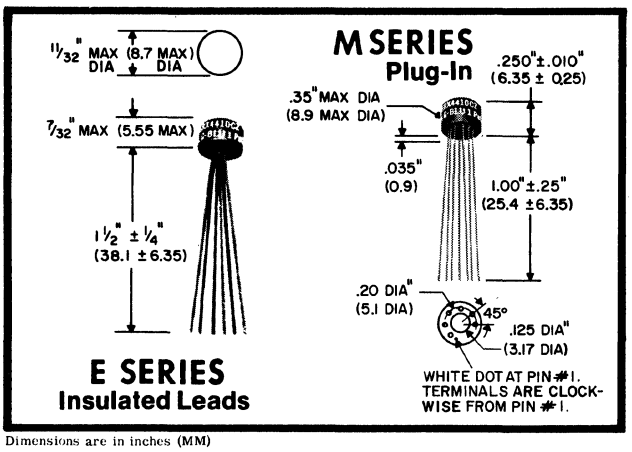

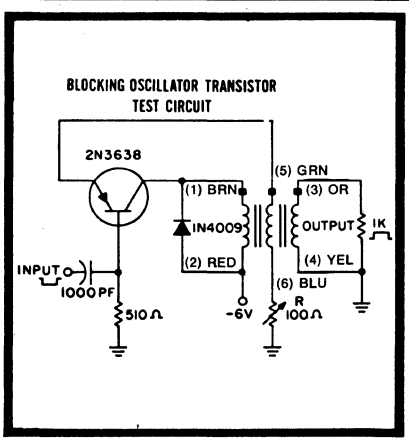

PICO's ultra-miniature PULSE transformers

Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-21038: All Units Meet MIL-T-21038 and are Hermetically Sealed in a Metal Case
- DIELECTRIC STRENGTH: All Units tested at 200 V RMS
- INSULATION RESISTANCE: Greater than 10,000 Megohms at 300 V DC
- WEIGHT: 1/20 Ounce
- OPERATING TEMPERATURE: -55°c to 105°c (All Units Can be Supplied to Class S Requirements 130°c maximum)
- **TERMINALS: . . . . . Solid .012 Diameter Conductor. Conductor is copper clad steel, Tinned 100%. Electroplated Per MIL-T-10727A and ASTM CCS B452.**
- THERMAL SHOCK: 25 Cycles, Method 107C, MIL-STD-202D. Test Conduction A-1

This Product is Patented

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- BUILT TO MIL-T-21038
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- ELECTROSTATIC SHIELDING CAN BE ADDED
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MILITARY DESIGNATION TP6RX4410CZ TURNS RATIO 4:4:1

PICO PART NUMBER		COUPLING CIRCUIT CHARACTERISTICS								BLOCKING OSCILLATOR CIRCUIT					D.C. RESISTANCE			PICO PRICES 1-9 *	
E-Series Insulated Leads	M-Series Plug-In	P. WIDTH μ SEC.	VOLT OUT	RISE TIME μ SEC.	% OVER SHOOT	DROOP %	% BACK SWING	IMP IN/OUT	FREQ RESP. WITHIN 2DB	P. WIDTH μ SEC.	RISE TIME μ SEC.	% OVER SHOOT	DROOP %	% BACK SWING	4 TNS BRN RED	4 TNS OR YEL	1 TURN GRN BLU	E-Series	M-Series
E5020	M5300	0.05	10	0.018	0	0	10	50	150 KHz-30 MHz	0.05	0.02	0	0	35	0.21	0.23	0.13	10.81	11.99
E5040	M5305	0.1	10	0.02	0	0	5	50	100 KHz-17 MHz	0.1	0.025	0	0	25	0.47	0.56	0.17	10.81	11.99
E5060	M5310	0.2	8	0.035	0	0	5	100	16 KHz-10 MHz	0.2	0.030	0	0	15	1.0	1.25	0.37	10.81	11.99
E5080	M5315	0.5	8	0.06	0	0	0	100	7 KHz-3.3 MHz	0.5	0.05	0	0	15	1.5	1.80	0.54	10.81	11.99
E5100	M5320	1	8	0.15	0	0	5	100	7 KHz-2.3 MHz	1	0.08	0	0	15	2.5	3.1	0.9	10.81	11.99
E5120	M5325	2	8	0.17	0	0	10	100	2.2 KHz-1.3 MHz	2	0.10	0	0	15	3.0	3.7	1.1	10.81	11.99
E5140	M5330	3	8	0.20	0	0	10	100	1.7 KHz-1.5 MHz	3	0.20	0	0	15	4.9	6.0	1.8	10.81	11.99
E5160	M5335	5	8	0.20	0	15	25	200	1.8 KHz-1.5 MHz	5	0.30	0	0	3	8.0	9.7	2.9	10.81	11.99
E5180	M5340	10	8	0.4	0	15	20	200	1.5 KHz-1.2 MHz	10	0.35	0	5	10	13.0	15.8	4.7	10.81	11.99

MILITARY DESIGNATION TP6RX5310CZ TURNS RATIO 5:3:1

															5 TURNS	3 TURNS	1 TURN		
E5200	M5345	0.1	8	0.01	0	0	5	140/50	170 KHz-32 MHz	0.1	0.01	0	0	20	0.55	0.40	0.15	10.81	11.99
E5220	M5350	1	8	0.05	0	6	10	280/100	12.5 KHz-3.3 MHz	1	0.02	5	5	5	3.0	2.2	0.9	10.81	11.99
E5240	M5355	5	8	0.09	0	12	25	560/200	15 KHz-4 MHz	5	0.05	0	10	10	9.5	7.0	2.6	10.81	11.99

MILITARY DESIGNATION TP6RX4440CZ TURNS RATIO 4:4:4

PICO PART NUMBER		COUPLING CIRCUIT CHARACTERISTICS											PICO PRICES 1-9 *	
E-Series Insulated Leads	M-Series Plug-In	P. WIDTH μ SEC.	VOLT OUT	RISE TIME μ SEC.	% OVER SHOOT	DROOP %	% BACK SWING	IMP IN OUT	FREQ RESP. WITHIN 2DB	4 TNS BRN RED	4 TNS OR YEL	4 TURNS GRN BLU	E-Series	M-Series
E5181	M-5356	0.05	10	0.018	0	0	10	50	150 KHz-30 MHz	0.21	0.23	0.25	11.99	11.99
E5182	M-5357	0.1	10	0.02	0	0	5	50	100 KHz-17 MHz	0.47	0.56	0.67	11.99	11.99
E5183	M-5358	0.2	8	0.035	0	0	5	100	16 KHz-10 MHz	1.0	1.25	1.56	11.99	11.99
E5184	M-5359	0.5	8	0.06	0	0	0	100	7 KHz-3.3 MHz	1.5	1.80	2.2	11.99	11.99
E5185	M-5360	1	8	0.15	0	0	5	100	7 KHz-2.3 MHz	2.5	3.1	3.9	11.99	11.99
E5186	M-5361	2	8	0.17	0	0	10	100	2.2 KHz-1.3 MHz	3.0	3.7	4.6	11.99	11.99
E5187	M-5362	3	8	0.20	0	0	10	100	1.7 KHz-1.5 MHz	4.9	6.0	7.4	11.99	11.99
E5188	M-5363	5	8	0.20	0	15	25	200	1.8 KHz-1.5 MHz	8.0	9.7	11.8	11.99	11.99
E5189	M-5364	10	8	0.4	0	15	20	200	1.5 KHz-1.2 MHz	13.0	15.8	19.2	11.99	11.99

Coupling circuit measurements made with (1) BRN—(2) RED as input and (3) OR—(4) YEL as output, (5) GRN—(6) BLU winding is open: Input Voltage = 1V

* Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

Delivery— stock to one week

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

PICO Electronics, Inc.
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • 914-699-5514 • TWX 7105620113

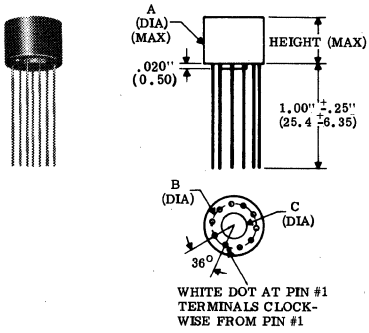
Ultra Miniature DC-DC Converter Transformers

Input Voltages of: 5V, 12V, 24V and 48V

Power Levels up to 40 Watts

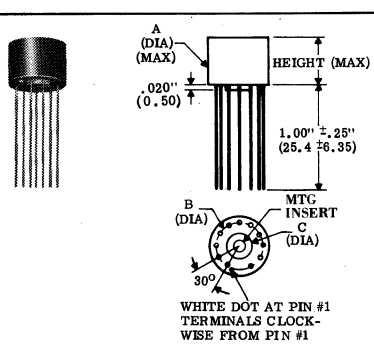
All units are magnetically shielded

All units can be supplied with higher or lower output voltages. Delivery- stock to one week, special voltages 9 days.



Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off
1	.280 (7.11)	.410 (10.41)	.260 (6.6)	.160 (4.06)
2	.340 (8.63)	.500 (12.7)	.350 (8.89)	.250 (6.35)
3	.415 (10.54)	.630 (16.0)	.440 (11.17)	.340 (8.64)

All dimensions are in inches, ( ) = MM



Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off	Mtg. Insert
4	.500 (12.7)	.800 (20.32)	.560 (14.22)	.460 (11.68)	-
5	.650 (16.51)	.950 (24.13)	.670 (17.0)	.570 (14.48)	6-32 UNC 8 Threads Deep
6	.745 (18.92)	1.125 (28.57)	.800 (20.32)	.700 (17.78)	6-32 UNC 8 Threads Deep

All dimensions are in inches, ( ) = MM
Note: Sizes 5 and 6 - pins 5, 8 and 9 are omitted

FEATURES

1) Units can be used as self-saturating or for linear switching applications. Operation over ambient temperature range from −55°c to +105°c. All units meet the requirements of MIL-T-27 (TF5S40ZZ)
2) All units can be supplied with higher or lower secondary voltages at the same power levels.
3) Secondary can be connected for full-wave bridge or dual bridge.
4) All units are magnetically shielded.

INPUT 5 VOLTS

PART NUMBER	D.C. OUT VOLTS FULL WAVE BRIDGE	D.C. OUT VOLTS DUAL BRIDGE	MAX. POWER OUT -55°c-+105°c	MAX. POWER OUT -55°c -+70°c	APPROX. SWITCH FREQ. SELF-SATURATED	APPROX. SWITCH FREQ. SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31020	10	±5	1.5W	3W	15K	30K TO 60K	1	25.61
31040	12	±6	1.5W	3W	15K	30K TO 60K	1	25.61
31060	28	±14	1.5W	3W	15K	30K TO 60K	1	25.61
31080	48	±24	1.5W	3W	20K	40K TO 60K	1	25.61
31100	100	±50	1.5W	3W	20K	40K TO 60K	1	25.61
32105	10	±5	3W	4.5W	15K	30K TO 60K	2	25.61
32125	12	±6	3W	4.5W	15K	30K TO 60K	2	25.61
32145	28	±14	3W	4.5W	15K	30K TO 60K	2	25.61
32165	48	±24	3W	4.5W	20K	40K TO 60K	2	25.61
32185	100	±50	3W	4.5W	20K	40K TO 60K	2	25.61
32188	150	±75	3W	-	10K	30K TO 60K	2	29.50
32191	200	±100	3W	-	10K	30K TO 60K	2	29.50
32194	300	±150	3W	-	10K	30K TO 60K	2	29.50
33103	10	±5	5W	7.5W	10K	20K TO 50K	3	25.61
33123	12	±6	5W	7.5W	10K	20K TO 50K	3	25.61
33143	28	±14	5W	7.5W	10K	20K TO 50K	3	25.61
33163	48	±24	5W	7.5W	10K	20K TO 50K	3	25.61
33183	100	±50	5W	7.5W	10K	20K TO 50K	3	25.61
33186	150	±75	5W	-	10K	30K TO 60K	3	29.50
33189	200	±100	5W	-	10K	30K TO 60K	3	29.50
33192	300	±150	5W	-	10K	30K TO 60K	3	29.50
34500	10	±5	10W	14W	10K	20K TO 40K	4	25.61
34520	28	±14	10W	14W	10K	20K TO 40K	4	25.61
34540	40	±24	10W	14W	10K	20K TO 40K	4	25.61

** Lower switching frequency may be used at lower output power.

INPUT 12 VOLTS

PART NUMBER	D.C. OUT VOLTS FULL WAVE BRIDGE	D.C. OUT VOLTS DUAL BRIDGE	MAX. POWER OUT -55°c-+105°c	MAX. POWER OUT -55°c -+70°c	APPROX. SWITCH FREQ. SELF-SATURATED	APPROX. SWITCH FREQ. SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31120	12	±6	1.5W	3W	15K	30K TO 60K	1	25.61
31140	24	±12	1.5W	3W	15K	30K TO 60K	1	25.61
31160	28	±14	1.5W	3W	15K	30K TO 60K	1	25.61
31180	48	±24	1.5W	3W	20K	40K TO 60K	1	25.61
31200	100	±50	1.5W	3W	20K	40K TO 60K	1	25.61
32205	12	±6	3W	4.5W	15K	30K TO 60K	2	25.61
32225	24	±12	3W	4.5W	15K	30K TO 60K	2	25.61
32245	28	±14	3W	4.5W	15K	30K TO 60K	2	25.61
32265	48	±24	3W	4.5W	20K	40K TO 60K	2	25.61
32265	100	±50	3W	4.5W	20K	40K TO 60K	2	25.61
32288	150	±75	3W	-	10K	30K TO 60K	2	29.50
32291	200	±100	3W	-	10K	30K TO 60K	2	29.50
32294	300	±150	3W	-	10K	30K TO 60K	2	29.50
33203	12	±6	5W	7.5W	15K	30K TO 60K	3	25.61
33223	28	±14	5W	7.5W	15K	30K TO 60K	3	25.61
33243	48	±24	5W	7.5W	20K	40K TO 60K	3	25.61
33263	100	±50	5W	7.5W	20K	40K TO 60K	3	25.61
33266	150	±75	5W	-	10K	30K TO 60K	3	29.50
33269	200	±100	5W	-	10K	30K TO 60K	3	29.50
33272	300	±150	5W	-	10K	30K TO 60K	3	29.50
34560	24	±12	10W	14W	15K	30K TO 50K	4	25.61
34580	28	±14	10W	14W	15K	30K TO 50K	4	25.61
34600	48	±24	10W	14W	15K	30K TO 50K	4	25.61
34603	100	±50	7.5W	-	10K	30K TO 60K	4	29.50
34606	150	±75	7.5W	-	10K	30K TO 60K	4	29.50
34609	200	±100	7.5W	-	10K	30K TO 60K	4	29.50
34612	300	±150	7.5W	-	10K	30K TO 60K	4	29.50
35110	24	±12	17W	25W	-	30K TO 60K	5	38.42
35130	28	±14	17W	25W	-	30K TO 60K	5	38.42
35150	48	±24	17W	25W	-	30K TO 60K	5	38.42

**Lower switching frequency may be used at lower output power.

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

INPUT 24 VOLTS

PART NUMBER	D.C. OUT VOLTS BRIDGE	FULL WAVE	DUAL BRIDGE	MAX. POWER OUT -55°c-+105°c	-55°c-+70°c	APPROX. SWITCH FREQ. SELF-SATURATED	SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31220	10	5	±5	1.5W	3W	15K	30K TO 60K	1	25.61
31240	28	14	±14	1.5W	3W	15K	30K TO 60K	1	25.61
31260	48	24	±24	1.5W	3W	20K	40K TO 60K	1	25.61
31280	100	50	±50	1.5W	3W	20K	40K TO 60K	1	25.61
32305	10	5	±5	3W	4.5W	15K	30K TO 60K	2	25.61
32325	28	14	±14	3W	4.5W	15K	30K TO 60K	2	25.61
32345	48	24	±24	3W	4.5W	20K	40K TO 60K	2	25.61
32365	100	50	±50	3W	4.5W	20K	40K TO 60K	2	25.61
32368	150	75	±75	3W	-	10K	30K TO 60K	2	29.50
32371	200	100	±100	3W	-	10K	30K TO 60K	2	29.50
32374	300	150	±150	3W	-	10K	30K TO 60K	2	29.50
33283	10	5	±5	5W	7.5W	15K	30K TO 60K	3	25.61
33303	28	14	±14	5W	7.5W	15K	30K TO 60K	3	25.61
33323	48	24	±24	5W	7.5W	20K	40K TO 60K	3	25.61
33343	100	50	±50	5W	7.5W	20K	40K TO 60K	3	25.61
33346	150	75	±75	5W	-	10K	30K TO 60K	3	29.50
33349	200	100	±100	5W	-	10K	30K TO 60K	3	29.50
33352	300	150	±150	5W	-	10K	30K TO 60K	3	29.50
34620	28	14	±14	10W	14W	15K	30K TO 50K	4	25.61
34640	48	24	±24	10W	14W	15K	30K TO 50K	4	25.61
34643	100	50	±50	7.5W	-	10K	30K TO 60K	4	29.50
34646	150	75	±75	7.5W	-	10K	30K TO 60K	4	29.50
34649	200	100	±100	7.5W	-	10K	30K TO 60K	4	29.50
34652	300	150	±150	7.5W	-	10K	30K TO 60K	4	29.50
35170	24	12	±12	17W	25W	-	30K TO 60K	5	38.42
35190	28	14	±14	17W	25W	-	30K TO 60K	5	38.42
35210	48	24	±24	17W	25W	-	30K TO 60K	5	38.42
36710	48	24	±24	25W	40W	-	30K TO 60K	6	44.33
36730	56	28	±28	25W	40W	-	30K TO 60K	6	44.33

** Lower switching frequency may be used at lower output power.

INPUT 48 VOLTS

PART NUMBER	D.C. OUT VOLTS BRIDGE	FULL WAVE	DUAL BRIDGE	MAX. POWER OUT -55°c-+105°c	-55°c-+70°c	APPROX. SWITCH FREQ. SELF-SATURATED	SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31300	24	12	±12	1.5W	3W	15K	30K TO 60K	1	25.61
31320	48	24	±24	1.5W	3W	20K	40K TO 60K	1	25.61
31340	100	50	±50	1.5W	3W	20K	40K TO 60K	1	25.61
31360	150	75	±75	1.5W	3W	20K	40K TO 60K	1	25.61
32385	24	12	±12	3W	4.5W	15K	30K TO 60K	2	25.61
32405	48	24	±24	3W	4.5W	20K	40K TO 60K	2	25.61
32425	100	50	±50	3W	4.5W	20K	40K TO 60K	2	25.61
32445	150	75	±75	3W	4.5W	20K	40K TO 60K	2	25.61
32448	200	100	±100	3W	4.5W	10K	30K TO 60K	2	29.50
32451	300	150	±150	3W	4.5W	10K	30K TO 60K	2	29.50
33363	24	12	±12	5W	7.5W	15K	30K TO 60K	3	25.61
33383	48	24	±24	5W	7.5W	20K	40K TO 60K	3	25.61
33403	100	50	±50	5W	7.5W	20K	40K TO 60K	3	25.61
33423	150	75	±75	5W	7.5W	20K	40K TO 60K	3	25.61
33426	200	100	±100	5W	-	10K	30K TO 60K	3	29.50
33429	300	150	±150	5W	-	10K	30K TO 60K	3	29.50
34660	24	12	±12	10W	14W	15K	30K TO 50K	4	25.61
34680	48	24	±24	10W	14W	15K	30K TO 50K	4	25.61
34700	56	28	±28	10W	14W	15K	30K TO 50K	4	25.61
34703	100	50	±50	7.5W	-	10K	30K TO 60K	4	29.50
34706	150	75	±75	7.5W	-	10K	30K TO 60K	4	29.50
34709	200	100	±100	7.5W	-	10K	30K TO 60K	4	29.50
34712	300	150	±150	7.5W	-	10K	30K TO 60K	4	29.50
35230	24	12	±12	17W	25W	-	30K TO 60K	5	38.42
35250	48	24	±24	17W	25W	-	30K TO 60K	5	38.42
35270	56	28	±28	17W	25W	-	30K TO 60K	5	38.42
36750	48	24	±24	25W	40W	-	30K TO 60K	6	44.33
36770	56	28	±28	25W	40W	-	30K TO 60K	6	44.33
36790	100	50	±50	25W	40W	-	30K TO 60K	6	44.33

** Lower switching frequency may be used at lower output power.

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

SCHEMATIC FOR SIZES 1, 2 & 3 USING TRANSFORMERS AS SELF-SATURATING

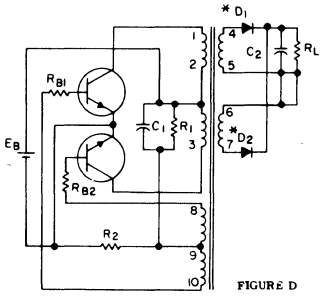


FIGURE D

SCHEMATIC FOR SIZES 1, 2, AND 3 USING TRANSFORMERS AS LINEAR SWITCHING

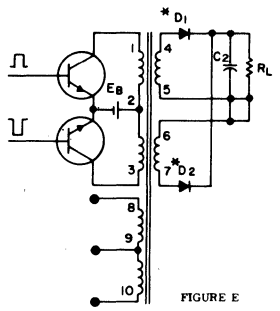


FIGURE E

* D1 AND D2 USE SCHOTTKY OR FAST SWITCHING DIODES

SCHEMATIC FOR SIZE 4 USING TRANSFORMER AS SELF-SATURATING

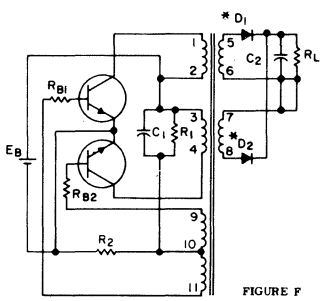


FIGURE F

SCHEMATIC FOR SIZE 4 USING TRANSFORMERS AS LINEAR SWITCHING.

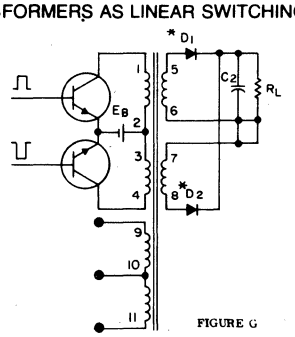


FIGURE G

*D1 & D2 USE SCHOTTKY OR FAST SWITCHING DIODES

SCHEMATIC FOR SIZES 5 & 6 USING TRANSFORMERS AS LINEAR SWITCHING.

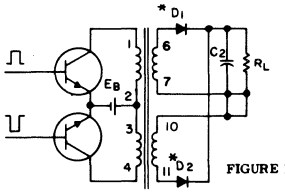


FIGURE H

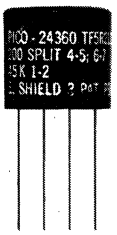
*D1 & D2 USE SCHOTTKY OR FAST SWITCHING DIODES

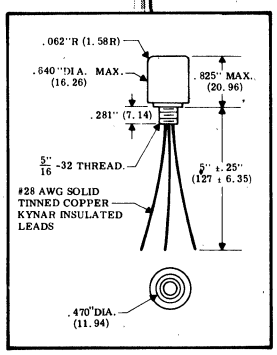
PICO Electronics, Inc. 453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552

PICO Microphone/Transducer Audio Input Transformers

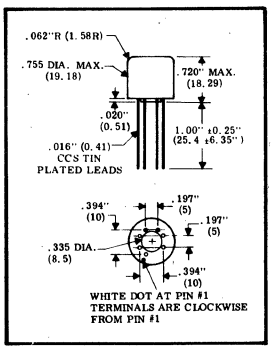
Used for Professional Sound Studios/Broadcast Mixing Consoles/Control and Instrument Amplifiers.

Interchangeable with transformers made by Beyer Dynamic of Germany.





NOTE:
ALL DIMENSIONS ARE IN INCHES, ( ) = MM



NOTES:
ALL DIMENSIONS ARE IN INCHES, ( )-MM.
CCS-COPPER CLAD STEEL, TINNED 100% ELECTROPLATED PER MIL-T-10727A AND ASTM CCS B452.

- ***Large step-up ratios with flat frequency response over the entire audio range.***
- ***Gapless laminations provide wide bandwidth with extremely low distortion. Use of two magnetic shields made with extra thick mu-metal and gapless core provide negligible hum pick up. All units provided with electrostatic shield.***
- ***Your choice of two package styles, stud mounting with flying leads or low profile plug-in. Identical electrical performance regardless of package style.***
- ***Frequency response ±1 dB, 30 Hz – 15 kHz.***
- ***Low profile plug-in (24000 series) meets MIL-T-27D (TF5R21ZZ).***
- ***Because of gapless laminations, unbalanced DC current should be avoided.***
- ***Typical distortion of 1% at power level of 0 dBm (1 Milliwatt), 30 Hz – 15 kHz. If the low frequency is raised, the power level for 1% distortion is as follows:***

50 Hz - 3 Milliwatts (4.7 dBm)
100 Hz - 10 Milliwatts (10 dBm)
300 Hz - 150 Milliwatts (21.7 dBm)

For immediate engineering assistance or to place an order—
Call Toll Free 800-431-1064

All units have two extra thick mu-metal shields.

Delivery-Stock to 1 week

Modification of standards 9 days!

This Product is Patented

PART NUMBER		IMPEDANCE OHMS		TURNS RATIO PRIM/SEC		D.C. RESISTANCE			TYPICAL PRIM OPEN CIRCUIT IMPEDANCE AT 50 Hz	REPLACES BEYER/GERMANY PART NUMBER		PRICES 1-9***	
COMMERCIAL STUD MOUNTING	MILITARY PLUG-IN	PRIM	SEC	PRIM SERIES CONN	PRIM PAR CONN	PRIM SERIES CONN	PRIM PAR CONN	SEC		STUD MOUNTING (23000 SERIES)	PLUG-IN (24000 SERIES)	COMMERCIAL STUD MOUNTING	MILITARY PLUG-IN
23120	24120	12.5	5K	1:20	-	4.6	-	1K	125	TR-BV35704	STR-BV37704	20.50	24.62
23140	24140	200	200	1:1	-	50	-	75	2K	351 001 001	370 001 001	19.40	22.62
23160	24160	200 ct/50 SPLIT	200	1:1	1:2	50	12.5	75	2K	351 201 001	370 201 001	19.12	23.25
23180	24180	200	2K	1:3.16	-	50	-	580	2K	351 003 002	370 003 002	19.40	22.62
23200	24200	200 ct/50 SPLIT	2K	1:3.16	1:6.33	50	12.5	580	2K	351 203 002	370 203 002	19.12	23.25
23220	24220	200	5K	1:5	-	50	-	1.45K	2K	351 005 003	370 005 003	19.40	22.62
23240	24240	200 ct/50 SPLIT	5K	1:5	1:10	50	12.5	1.45K	2K	351 205 003	370 205 003	19.40	25.37
23260	24260	200	10K	1:7.07	-	50	-	3.45K	2K	351 007 004	370 007 004	19.12	23.25
23280	24280	200 ct/50 SPLIT	10K	1:7.07	1:14.14	50	12.5	3.45K	2K	351 207 004	370 207 004	21.87	26.00
23300	24300	200	20K	1:10	-	85	-	4.75K	2K	351 010 005	370 010 005	19.89	24.00
23320	24320	200 ct/50 SPLIT	20K	1:10	1:20	85	21	4.75K	2K	351 210 005	370 210 005	22.62	26.75
23340	24340	200	45K	1:15	-	85	-	10.4 K	2K	351 015 006	370 015 006	23.25	27.37
23360	24360	200 ct/50 SPLIT	45K	1:15	1:30	85	21	10.4 K	2K	351 215 006	370 215 006	26.00	30.11
23380	24380	200	80K	1:20	-	115	-	13.5 K	2K	351 020 007	370 020 007	24.62	28.73
23400	24400	200 ct/50 SPLIT	80K	1:20	1:40	115	29	13.5 K	2K	351 220 007	370 220 007	27.37	31.48
23420	24420	600 ct	600	1:1	-	140	-	190	6K	TR-145/BV35508 351 101 031	STR-145/BV37508 370 101 031	19.12	23.25
23440	24440	600 ct/150 SPLIT	600	1:1	1:2	140	35	190	6K	351 201 031	370 201 031	20.50	24.62
23460	24460	600 ct/150 SPLIT	2.4K	1:2	1:4	140	35	575	6K	351 202 032	370 202 032	21.87	26.00
23480	24480	600 ct/150 SPLIT	6K	1:3.16	1:6.33	140	35	1.45K	6K	351 203 033	370 203 033	23.25	27.37
23500	24500	600 ct/150 SPLIT	15K	1:5	1:10	140	35	3.9 K	6K	351 205 034	370 205 034	24.62	28.73
23520	24520	600 ct/150 SPLIT	30K	1:7.07	1:14.14	140	35	7.05K	6K	351 207 035	370 207 035	26.00	30.11
23540	24540	600 ct/150 SPLIT	60K	1:10	1:20	199	50	11 K	6K	351 210 036	370 210 036	27.37	31.48
23560	24560	1.2K ct/300 SPLIT	1.2K	1:1	1:2	310	78	430	12K	351 201 061	370 201 061	20.50	24.62
23580	24580	1.2K ct/300 SPLIT	5K	1:2.04	1:4.08	310	78	1.4 K	12K	351 202 062	370 202 062	21.87	26.00
23600	24600	1.2K ct/300 SPLIT	12K	1:3.16	1:6.33	310	78	3.75K	12K	351 203 063	370 203 063	23.25	27.37
23620	24620	1.2K ct/300 SPLIT	30K	1:5	1:10	475	119	8.45K	12K	351 205 064	370 205 064	24.62	28.73
23640	24640	10K	10K	1:1	-	2.5 K	-	3.1 K	100K	TR-145/BV35590	STR-145/BV37590	19.40	22.62

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

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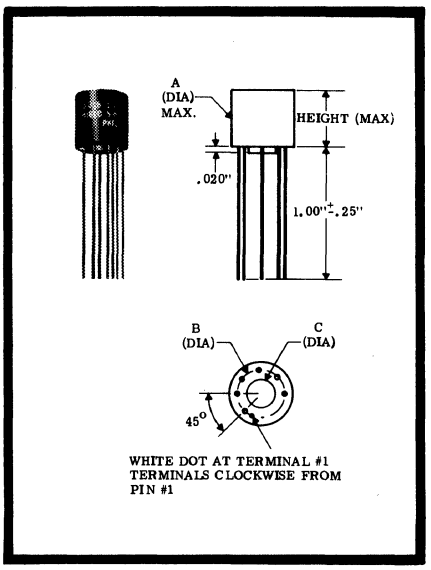
PICO's miniature 400 Hz transformers

115V/26V Primary Printed Circuit Construction



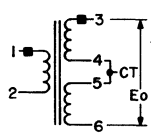
CASE SIZE	HEIGHT (MAX)	A (DIA) MAX	B (DIA)	C (DIA)
L	.35	.51	.35	.218
N	.5	.51	.35	.218
R	.375	.75	.6	.475
S	.52	.75	.6	.475
T	.82	.75	.6	.475

FEATURES

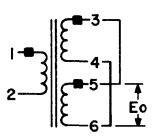
- 400 Hz Aerospace Application
- Smallest Possible Size
- Printed Circuit Plug-In Construction
- Secondary Has Split Winding (Secondary can Be Used at Half Voltage Twice the Current.)

SPECIFICATIONS

- MIL-T-27D (TF5S03ZZ)
- 90 °c Ambient
- Input Primary 115v-400 Hz ±20 Hz or 26V-400HZ-±20 Hz (Your Choice-Just Choose The Proper Part No.)
- Regulation is 24% (T Units Have Regulation of 17%)
- Secondary Voltage Adjusted to Nominal Value at Half Load.



SERIES CONNECTED SECONDARY



PARALLEL CONNECTED SECONDARY

This Product is Patented

SEC/ VOLT	SEC/ CURRENT ma	SIZE	MODEL NUMBER 115V PRIMARY	MODEL NUMBER 26V PRIMARY	PICO PRICES 1-9*
5.0 CT	75	L	L-8948	L-8951	21.83
	150	N	N-6948	N-6951	21.83
	204	R	R-20650	R-20815	28.74
	338	S	S-21650	S-21815	28.68
	480	T	T-22650	T-22815	29.89
6.3 CT	59.5	L	L-8947	L-8952	21.83
	119	N	N-6947	N-6952	21.83
	162	R	R-20655	R-20820	28.74
	268	S	S-21655	S-21820	28.68
	381	T	T-22655	T-22820	29.89
8.0 CT	47	L	L-8946	L-8953	21.83
	94	N	N-6946	N-6953	21.83
	128	R	R-20660	R-20825	28.74
	211	S	S-21660	S-21825	28.68
	300	T	T-22660	T-22825	29.89
10 CT	37.5	L	L-8945	L-8954	21.83
	75	N	N-6945	N-6954	21.83
	102	R	R-20665	R-20830	28.74
	169	S	S-21665	S-21830	28.68
	240	T	T-22665	T-22830	29.89
12.8 CT	29	L	L-8940	L-8956	21.83
	58.6	N	N-6940	N-6956	21.83
	79.7	R	R-20670	R-20835	28.74
	132	S	S-21670	S-21835	28.68
	188	T	T-22670	T-22835	29.89
14 CT	26.8	L	L-8937	L-8957	21.83
	53.6	N	N-6937	N-6957	21.83
	72.9	R	R-20675	R-20840	28.74
	121	S	S-21675	S-21840	28.68
	171	T	T-22675	T-22840	29.89
16 CT	23	L	L-8935	L-8958	21.83
	47	N	N-6935	N-6958	21.83
	63.8	R	R-20680	R-20845	28.74
	106	S	S-21680	S-21845	28.68
	150	T	T-22680	T-22845	29.89
18 CT	20.8	L	L-8934	L-8959	21.83
	41.7	N	N-6934	N-6959	21.83
	56.7	R	R-20685	R-20850	28.74
	93.9	S	S-21685	S-21850	28.68
	133	T	T-22685	T-22850	29.89
20 CT	18.8	L	L-8933	L-8961	21.83
	37.5	N	N-6933	N-6961	21.83
	51	R	R-20690	R-20855	28.74
	84.5	S	S-21690	S-21855	28.68
	120	T	T-22690	T-22855	29.89
22 CT	17	L	L-8932	L-8962	21.83
	34	N	N-6932	N-6962	21.83
	46.4	R	R-20695	R-20860	28.74
	76.8	S	S-21695	S-21860	28.68
	109	T	T-22695	T-22860	29.89
24 CT	15.5	L	L-8930	L-8963	21.83
	31	N	N-6930	N-6963	21.83
	42.5	R	R-20700	R-20865	28.74
	70.4	S	S-21700	S-21865	28.68
	100	T	T-22700	T-22865	29.89
28 CT	13.4	L	L-8929	L-8964	21.83
	26.8	N	N-6929	N-6964	21.83
	36.4	R	R-20705	R-20870	28.74
	60.4	S	S-21705	S-21870	28.68
	85.7	T	T-22705	T-22870	29.89
31 CT	12	L	L-8927	L-8966	21.83
	24	N	N-6927	N-6966	21.83
	32.9	R	R-20710	R-20875	28.74
	54.5	S	S-21710	S-21875	28.68
	77.4	T	T-22710	T-22875	29.89
36 CT	10.4	L	L-8925	L-8967	21.83
	20.8	N	N-6925	N-6967	21.83
	28.3	R	R-20715	R-20880	28.74
	46.9	S	S-21715	S-21880	28.68
	66.7	T	T-22715	T-22880	29.89
39 CT	9.6	L	L-8924	L-8968	21.83
	19.2	N	N-6924	N-6968	21.83
	26.2	R	R-20720	R-20885	28.74
	43.3	S	S-21720	S-21885	28.68
	61.5	T	T-22720	T-22885	29.89

SEC/ VOLT	SEC/ CURRENT ma	SIZE	MODEL NUMBER 115V PRIMARY	MODEL NUMBER 26V PRIMARY	PICO PRICES 1-9*
43 CT	8.7	L	L-8923	L-8969	21.83
	17.4	N	N-6923	N-6969	21.83
	23.7	R	R-20725	R-20890	28.74
	39.3	S	S-21725	S-21890	28.68
	55.8	T	T-22725	T-22890	29.89
48 CT	7.8	L	L-8922	L-8971	21.83
	15.6	N	N-6922	N-6971	21.83
	21.1	R	R-20730	R-20895	28.74
	35.2	S	S-21730	S-21895	28.68
	50	T	T-22730	T-22895	29.89
56 CT	6.6	L	L-8920	L-8972	21.83
	13.2	N	N-6920	N-6972	21.83
	18.2	R	R-20735	R-20900	28.74
	30.2	S	S-21735	S-21900	28.68
	42.9	T	T-22735	T-22900	29.89
63 CT	6	L	L-8917	L-8973	21.83
	11.9	N	N-6917	N-6973	21.83
	16.2	R	R-20740	R-20905	28.74
	26.9	S	S-21740	S-21905	28.68
	38.2	T	T-22740	T-22905	29.89
68 CT	5.5	L	L-8915	L-8974	21.83
	11	N	N-6915	N-6974	21.83
	15	R	R-20745	R-20910	28.74
	24.9	S	S-21745	S-21910	28.68
	35.3	T	T-22745	T-22910	29.89
80 CT	4.6	L	L-8910	L-8976	21.83
	9.	N	N-6910	N-6976	21.83
	12.1	R	R-20750	R-20915	28.74
	21.1	S	S-21750	S-21915	28.68
	30	T	T-22750	T-22915	29.89
88 CT	4.2	L	L-8905	L-8977	21.83
	8.5	N	N-6905	N-6977	21.83
	11.6	R	R-20755	R-20920	28.74
	19.2	S	S-21755	S-21920	28.68
	27.3	T	T-22755	T-22920	29.89
100 CT	3.7	L	L-8902	L-8978	21.83
	8.5	N	N-6902	N-6978	21.83
	10.2	R	R-20760	R-20925	28.74
	16.9	S	S-21760	S-21925	28.68
	24	T	T-22760	T-22925	29.89
115 CT	3.2	L	L-8900	L-8979	21.83
	6.5	N	N-6900	N-6979	21.83
	8.9	R	R-20765	R-20930	28.74
	14.7	S	S-21765	S-21930	28.68
	20.9	T	T-22765	T-22930	29.89
123 CT	8.3	R	R-20770	R-20935	28.74
	13.7	S	S-21770	S-21935	28.68
	19.5	T	T-22770	T-22935	29.89
138 CT	7.4	R	R-20775	R-20940	28.74
	12.2	S	S-21775	S-21940	28.68
	17.4	T	T-22775	T-22940	29.89
157 CT	6.5	R	R-20780	R-20945	28.74
	10.8	S	S-21780	S-21945	28.68
	15.3	T	T-22780	T-22945	29.89
175 CT	5.8	R	R-20785	R-20950	28.74
	9.6	S	S-21785	S-21950	28.68
	13.7	T	T-22785	T-22950	29.89
200 CT	5.1	R	R-20790	R-20955	28.74
	8.4	S	S-21790	S-21955	28.68
	12	T	T-22790	T-22955	29.89
220 CT	7.7	S	S-21795	S-21960	30.13
	10.9	T	T-22795	T-22960	31.40
250 CT	6.8	S	S-21800	S-21965	31.55
	9.6	T	T-22800	T-22965	32.89
275 CT	6.1	S	S-21805	S-21970	33.12
	8.7	T	T-22805	T-22970	38.64
310 CT	5.4	S	S-21810	S-21975	34.43
	7.7	T	T-22810	T-22975	35.90

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

* Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%, 50-99 less 23%; 100-499 less 30%

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

Delivery— stock to one week

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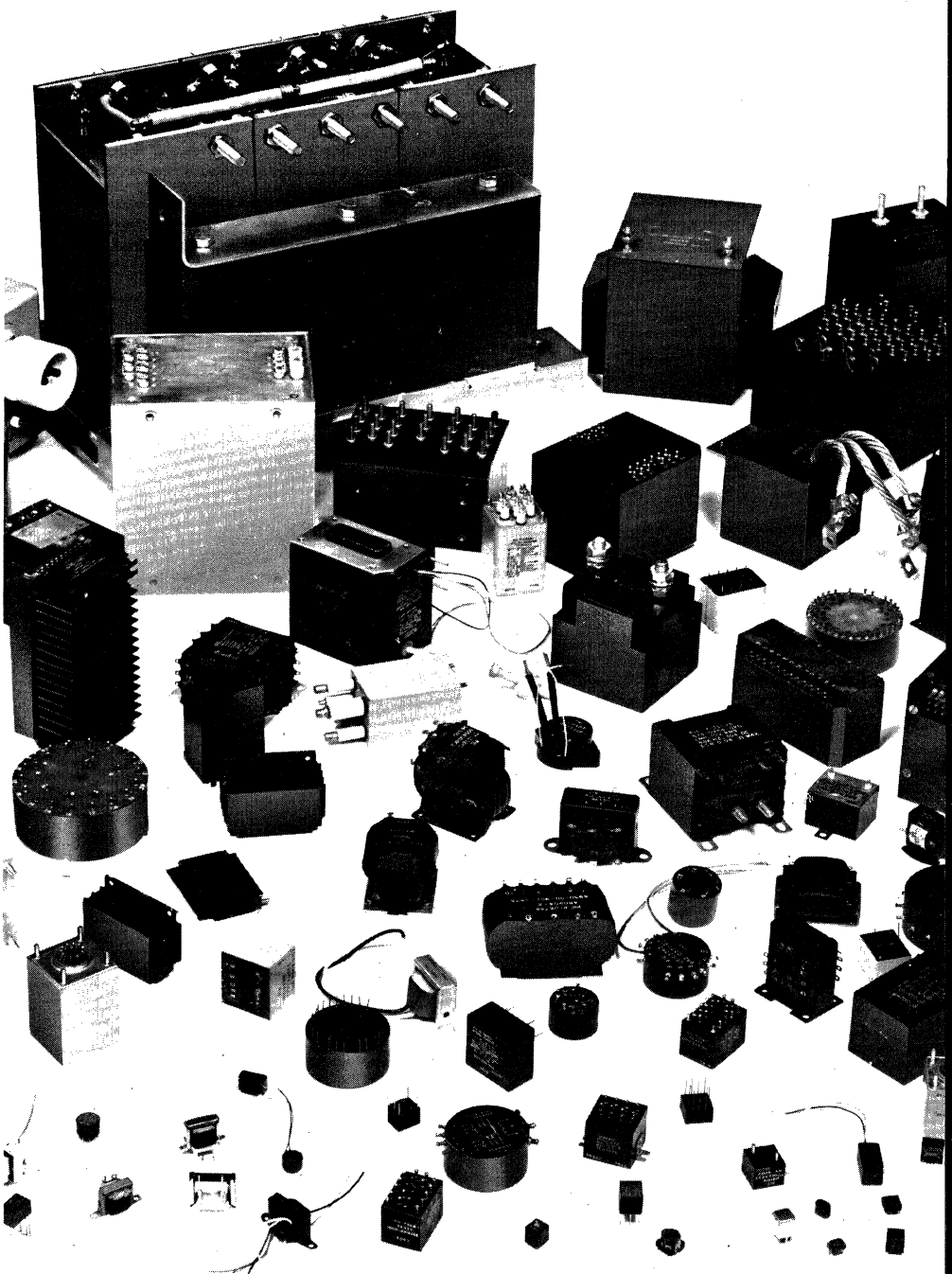
magnetic components for modern circuits



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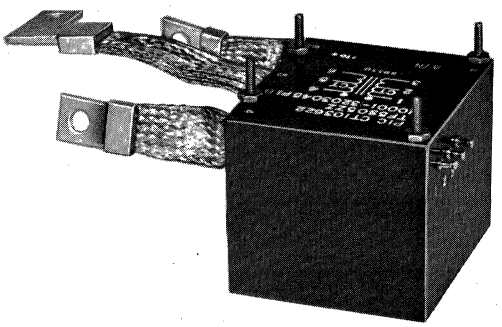
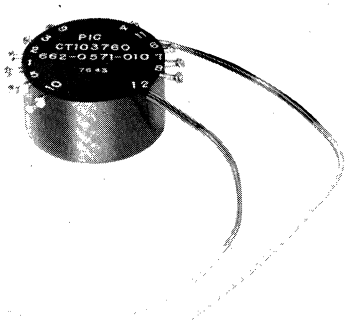
converter transformers

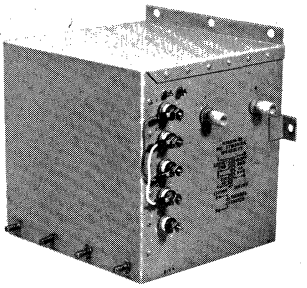
SOME SPECIFIC DESIGN EXAMPLES



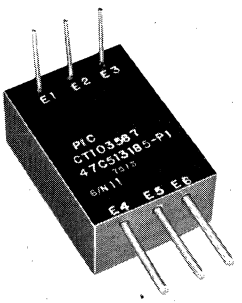
Designed for use in a fire control system for a fleet ballistic missile, PIC CT103622 is driven by a pair of Darlingtons from a 130 VDC line at 25 K Hz. The secondary is full wave rectified with Schottky rectifiers to supply a 100 ADC load at 5 VDC. Ambient temperature is between 0° and 85° C. Cooling is by conduction and by natural radiation and convection. The transformer measures 2.28″ x 2.53″ x 2.09″ (58 x 64 x 53) and weighs 1.6 pounds (.73 kg).



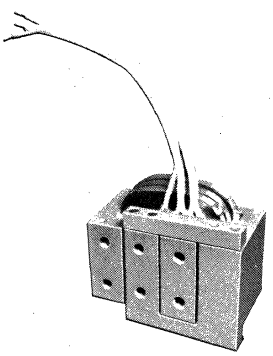
This transformer, PIC CT103760, is used in airborne equipment. It is driven by a pair of transistors from a 15 VDC line at 8 K Hz. The secondaries supply, after rectification, 5 VDC at 0.8A, −15 VDC at 0.1 A, −65 VDC at 10 MA, and +1750 VDC at 10 MA. In addition, a heater load of 5.7 VRMS at 1 A is accommodated. Ambient temperature range is from −55° C. to +71° C. Operating altitude is 55,000 feet maximum. The transformer measures 1.63″ dia. x .75″ high (41ϕ x 19) and weighs 3.5 ounces (0.1 kg).



Used in a Klystron power supply for a satellite communications system, PIC CT103412 accepts input from a rectified 3-phase power line (200 VDC to 800 VDC) via bridge connected transistor banks. The secondary voltage is bridge rectified, L-C filtered. The resultant DC output voltage is 8.5 KV at 1A. The power supply uses pulse width control at a switching frequency of 20 K Hz. The transformer is oil-filled. Dimensions are 7.5″ x 7.5″ x 7″ (191 x 191 x 178).



A typical example of Converter Transformer using gapped nickel-alloy core, PIC CT103567 was designed for use with radiation hardened semi conductors in a major defense missile system. The converter in which this transformer is used operates from a 22 VDC source and delivers 6 VDC at 25 A. Operating frequency is 20 K Hz. Size is 1.60″ x 2.25″ x 1.00″ (40 x 57 x 25.4). Weight is 7.2 oz. (.205 kg).



Pushing the state of the art to the extreme, PIC CT103508, is the result of close co-operation between PIC engineering and its customer. This transformer, when used with sophisticated drive circuitry (pulse-width modulation at high frequency), delivers via Schottky rectifier banks and inductor input filter, 5 VDC at 700 A.

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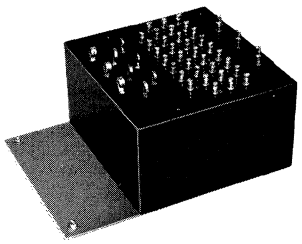
rectifier transformers

TYPICAL EXAMPLES



Designed for an airborne application, PIC R103806 is a 400 Hz rectifier transformer of a most complex kind:

Input: aircraft 3-phase power per MIL-STD-704 category B

Output: 14 isolated, 3-phase secondaries to supply a multiplicity of 3-phase bridge rectifiers to yield various DC voltages, with DC current ranging from 0.2 A to 30 A.

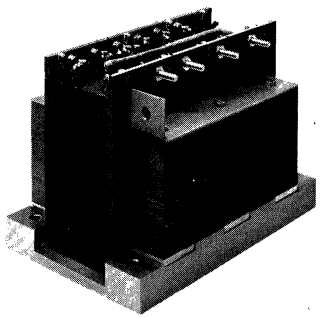
VA rating: 2.1 KVA

Size: 5″ x 5¼″ x 3⅛″ (127 x 140 x 80)

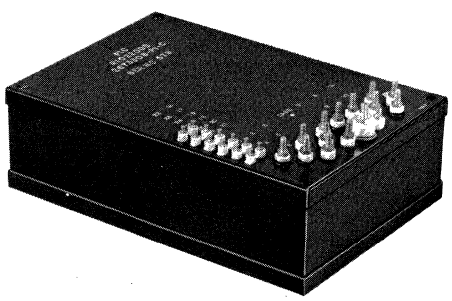
Weight: 10 lbs. (4.54 Kg)

Efficiency: 96%

Cooling: by conduction through bottom plate, aided by radiation & natural convection.



PIC R103994 is a 3-phase rectifier transformer used in a shipboard application. It operates from 440 V., 3-phase, 60 Hz line to deliver, via 6-phase, half-wave SCR's, 150 VDC @ 80 A into a high performance DC motor. Major cooling is by conduction through the base plate. Carefully placed thermal shunts in the windings enable its use in an enclosed cabinet without forced air. Size is 16″ x 10″ x 11″ (406 x 254 x 280). Weight is 270 lbs. (122Kg.)



The PIC R102200A was designed for use on a nuclear submarine. It is an example of a "12-pulse" circuit:

Input: 115V, 400 Hz, 3-phase

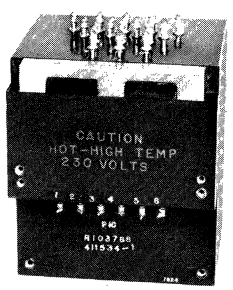
Output: 12-phase quadruple zig-zag WYE with three built-in interphase transformers, to supply, via half-wave rectifiers, 32 VDC at 20 A.

VA rating: 880VA

Size: 5½″ x 8″ x 2½″ (140 x 203 x 84)

Weight: 14.3 lbs. (6.5 Kg)

Cooling: by natural means



An airborne application required the design of a PIC R103786. This is an example of a parallel double WYE circuit:

Input: 400 Hz 3-phase power per MIL-STD-704 category B

Output: Parallel double-WYE with two built-in interphase transformer, to supply, via twelve rectifiers, 9 VDC at 110 A. Note that each rectifier has to handle only 30 A peak repetitive and 10 A average current.

Size: 3¾″ x 3¾″ x 4½″ (95 x 95 x 115)

Weight: 5.4 lbs. (2.45 Kg)

Cooling: by conduction through bottom plate, aided by natural means

PIC's experience in rectifier transformers ranges from very routine industrial types delivering a few watts—to high powered, SCR controlled applications supplying 50 KW of peak power, including highly sophisticated, high-reliability, high-performance airborne units.

Backgrounding PIC's success in rectifier transformer design are versatile computer aided design programs, developed and constantly up-dated by our own engineers, custom fitted to our type of business. Many of our customers consult with us for such design services as size and weight estimates, feasibility studies, weighing of alternatives, etc. This service can result in significant savings of your engineering time. Unless your application is very simple there is no reason to search through catalogues for a "standard" when the "custom" solution is only a phone call away.

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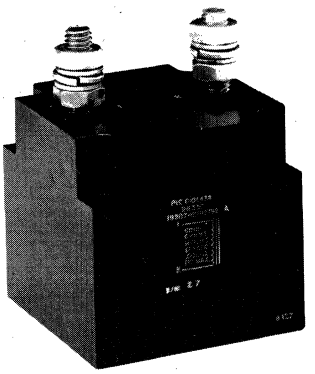
inductors

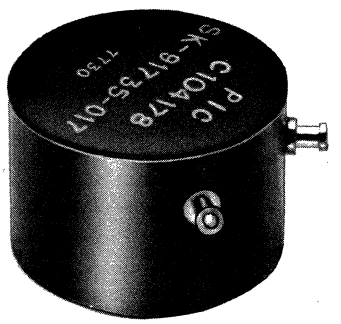
Polyphase can furnish one of the widest selections of custom inductor designs available to the electronic industry. These are just a few of the major types used in modern circuits:

- Power inductors, smoothing and swinging, for rectifier circuits
- Ripple filter inductors for DC-DC converters
- Energy storage inductors for switching regulators
- Integrating inductors for pulse-width modulated DC-DC converters
- Surge limiting inductor for DC-DC converters
- Tuning Power inductors for power filters and switching type DC-AC inverters
- Charging inductors for line type pulser
- High current, line inductors (EMI protection)
- Audio frequency inductors for use in precision filters

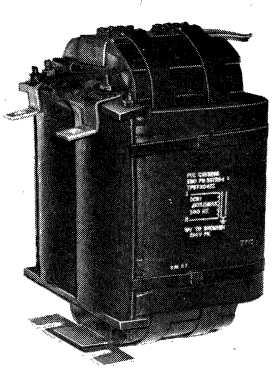
The following examples illustrate some of the many specialty applications we have designed:



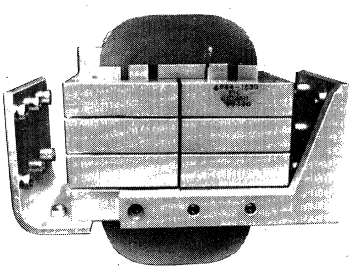
PIC C104438 is a 50uH filter inductor of heavy duty construction to MIL-T-27 grade 5, Class T for use in combat vehicles. It is rated at 120 ADC continuous duty, with DCR of 1.5 m Ω max. Cooling is by natural means, aided by conduction through an aluminum base plate. Size is 3″ x 3″ x 3″ (76 mm x 76mm x 76mm), excluding the terminals.



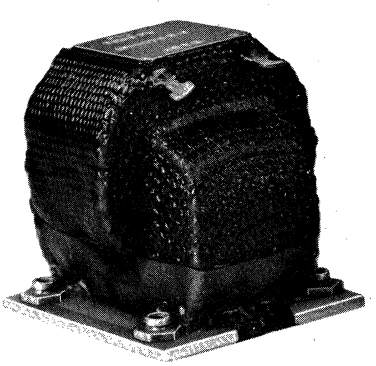
PIC C104178 is a toroidal inductor with superior energy storage capacity specially designed for use in pulse-width modulated DC-to-DC converter circuit. The inductance is 570 μh at 4 ADC with DC resistance of 0.03Ω max. Size is 1.375″ diameter x .875″ high (35ϕ x 22.2). Weight: 2.8 oz (80 gm).



A sonar system uses a PIC C103269 as a filter inductor capable of delivering 1000A peak current at 10% duty. Inductance of this inductor is 80 μh.



Made for use with CT103508 converter transformer, PIC C103511 is an integrating choke used in a pulse width modulator DC-DC converter. Inductance is 16 μh at 20KHz, 600 ADC. DCR: 150 μΩ. The coils are made from light weight aluminum alloy.



Used in a vehicular application, PIC C101929 is a routine filter inductor. It is manufactured with a proprietary technique using a glass-reinforced conformal coating, capable of surviving severe thermal shock.

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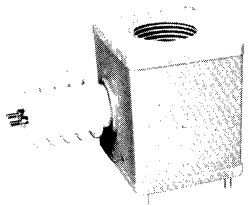
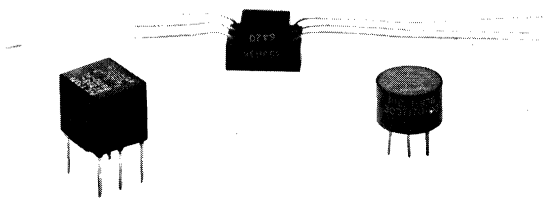
pulse transformers

EXAMPLES OF PULSE DESIGNS

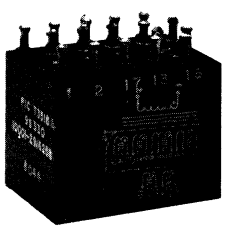


PULSE ISOLATION TRANSFORMERS: used in the ground portion of a TACAN System, PIC PL103044 is a high-fidelity pulse isolation transformer used to couple a couplex pulse train from a ground-level source to a high voltage platform sitting at 26KV DC. The signal consists of 1 to 2.6 μs pulses which must be transmitted with less than 2% degradation in amplitude under a variety of pulse bust conditions. This transformer is oil-filled with an expansion bellows.

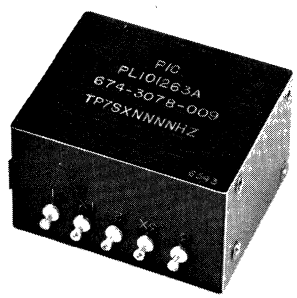


PULSE TRANSFORMERS

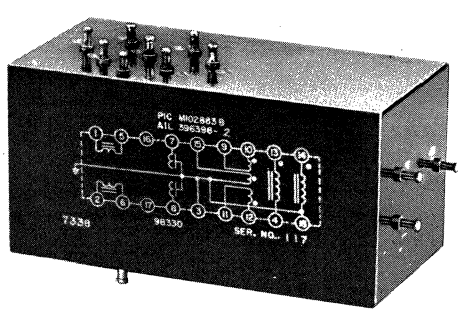
Polyphase pioneered in the design and development of custom, miniature, low voltage pulse transformers. These are available in three standard case styles (shown here) engineered to your requirements.



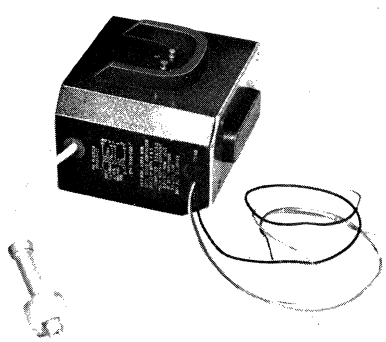
PIC T3516A is a blocking oscillator transformer used to provide auxiliary power to a sophisticated shipboard power supply. It operates in the fly-back mode, with tightly controlled primary inductance. Nominal operating frequency is 30kHz; energy storage per cycle is 1.2 MJ; MIL-T-27 grade 5 class T. Size is 1″ × 1.4″ × 1.25″ (25.4mm × 35.6mm × 31.8mm). Weight is 75 gm.



PULSE FORMING TRANSFORMER: used in an airborne TACAN, PIC PL101263A generates pseudo-gaussian pulse pairs when used with appropriate energy storage capacitors and SCR's. The output pulses measure 2200 V in amplitude, 4-μsec wide; peak power is 4.8 KW. Pulse amplitudes of the pairs are matched to within 2% of each other.



PULSE FORMING PACKAGE: used in an instrument landing system, PIC M102883, which contains two charging chokes, two pulse forming networks and a pulse modulation transformer, delivers 3600V, 0.3 μs pulse bursts into a magnetron. Peak power is 10 KW. Pulse duty cycle is from 0.3 to 0.5%.



PULSE MODULATION TRANSFORMER: used in an airborne radar, PIC PL103126, delivers 8 KV, 3 μs pulses into the cathode of an L-3890-A magnetron. Peak power is 66 KW. It is corona-free at 50,000 feet. A proprietary casting method was used to minimize problems often encountered at insulation interfaces.

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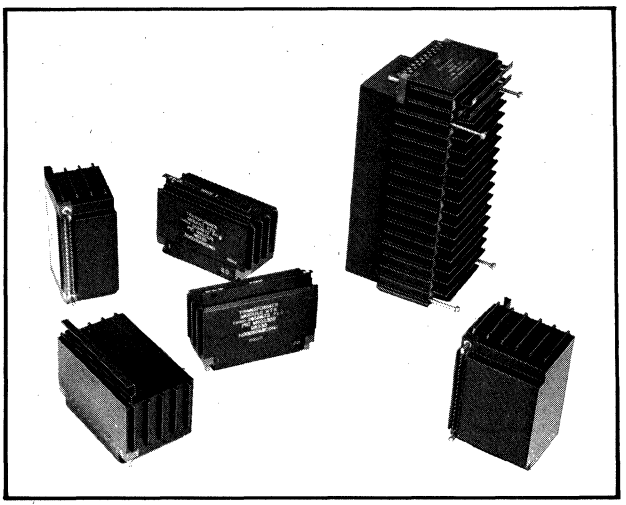
sem modules



PRECISION PACKAGING FOR TRANSFORMERS FILTERS & NETWORKS

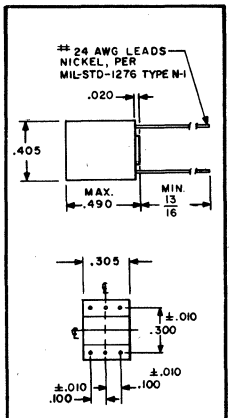
Many of Polyphase custom engineered SEM Modules have been JAN-certified to MIL-M-28787. As a pioneer Vendor on the Standard Hardware Program, Polyphase has packaged Filters, Transformers, Inductors and Networks in the SEM configuration for Poseidon, Trident, Dimus, SAMAC, etc. We can design your specified magnetic component to utilize one of the many standard module sizes available in our tooling. MIL-STD-1389, MIL-STD-1378, and MIL-HDBK-239 are the key reference documents to the Standard Hardware Program.

audio and wide band transformers

Unless the circuit designer is looking for maximum power transfer from a linear transducer or similar device with a definitive internal impedance, or he is working from or into a transmission line, the traditional way of specifying transformers, by impedance ratio, does not mean much.

Because of the availability of low cost semi-conductor devices, the use of transformers for coupling purposes should be restricted to circuits where nearly absolute isolation is needed; or where passive impedance transformation is a must. Most of the low level coupling applications we have seen during the past few years work from an emitter follower or an IC op-amp, where the source impedance is low. We have also found that circuit designers are much more concerned with phase and/or group delay characteristics, in addition to frequency response. Our new JM series is rated with modern users in mind.

This listing is designed to show what can be available. We stock the materials necessary for quick delivery of sample quantities so that the circuit designer can have a custom unit made to fit his application.



JM CASE

Type	Turns Ratio	L(PRI) HY	DC R(Ω) PRI	DC R(Ω) Sec	L_L (mH) ref. to PRI	Max. PRI Voltage (f in KHz)	Max. Load (MA)	Series Resonance (MHz)	Min.* Load Resistance
JM 11	1:1	3.2	340	450	5.0	13.5 f or 50 V	7	.38	6 K
JM 12	1:1	0.8	85	110	1.3	6.7 f or 25 V	15	.67	4 K
JM 13	1:1	0.2	22	28	.31	3.4 f or 13 V	30	1.2	2 K
JM 14	1:1	.05	5.5	7	.08	1.7 f or 3 V	60	2.0	1 K
JM 21	2:1	3.2	340	110	5	13.5 f or 50 V	15		
JM 22	2:1	0.8	85	28	1.3	6.7 f or 25 V	30		
JM 23	2:1	0.2	22	7	.31	3.4 f or 13 V	60		
JM 24	2:1	.05	5.5	2	.08	1.7 f or 3 V	120		

All values are typical.
*Min. load resistance will restrict peaking at series resonance to within 3 DB of mid-band response

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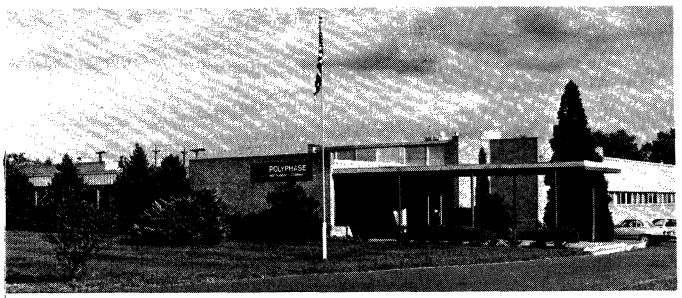
a closer view



engineering

Polyphase is that rare vendor who can help you with both effective engineering design and unique manufacturing techniques, involving magnetic components for power conversion and/or regulation; A source a step beyond the commonplace in capability to serve you within the following parameters:

Power: microwatts to over 20-kw
Voltage: a few volts to 20-kv
Current: microamperes to 700 A
Frequency: power line to above 100 KHz
Size: IC-compatible to large oil-filled units
Environment: space, airborne, shipboard and industrial

Our broad engineering capability has qualified us as a vendor on major space, defense, and industrial programs since 1948. The credibility Polyphase has earned with design engineers throughout the electronic industry, for effective answers to magnetic component circuit problems, insures your satisfaction. At Polyphase, authoritative, computer-aided engineering and prototype service is the heart of the company.

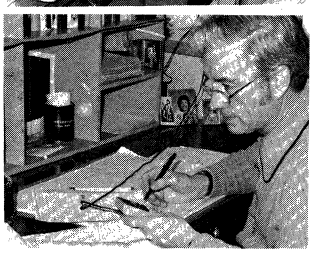
quality control

Polyphase manufactures MIL, NASA and U/L quality magnetic components—assured quality and reliability are a must. Our quality standards are governed by MIL-Q-9858, NHB 3400.4(1c), MIL-I-45208, MIL-T-27, MIL-T-21038 and MIL-F-18327. An approved Quality Control Manual blueprints procedures and standards to be followed. All products are monitored and controlled by this system from incoming materials through production tests, to the final Quality Assurance check at the time of shipment. The plant is completely equipped with the latest test instrumentation. Our calibration system conforms to MIL-C-45662. A DLA inspector is available.

production

Our concentration on quality-demanding programs dictates an efficient production department staffed by quality-minded people. Over 40,000 square feet, (of a total of 43,000 square feet of floor space), is our production area, with the balanced capability to handle large or small orders.

As all our products are custom designed to your specifications this Guide is formatted, as a discussion and illustration of some key magnetic components used in modern electronic circuits.

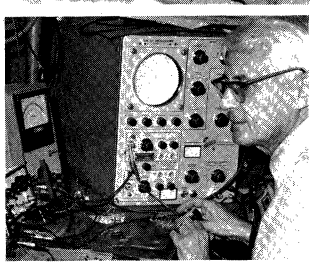


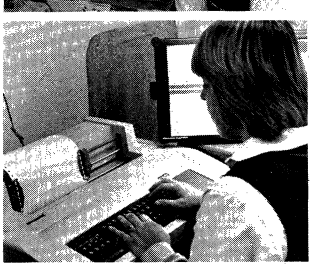
WARRANTY

Supplier warrants products of its own manufacture against faulty workmanship or the use of defective materials for a period of one year from the date of shipment. This warranty is the only warranty made by the supplier, and is in lieu of all other warranties, expressed or implied, and can be amended only by a written instrument signed by an officer of the Supplier. The liability of the Supplier under this warranty is limited solely to replacing, repairing, or issuing credit (at Supplier's discretion) for any products which are returned by Buyer during the warranty period provided that (a) Supplier is promptly notified in writing upon discovery of such defects by Buyer, (b) the defective unit is returned to Supplier, transportation charges prepaid by Buyer, and (c) Supplier's examination of such unit shall disclose, to it's satisfaction, that such defects have not been caused by misuse, neglect, improper installation, repair, alteration or accident. In no event shall Supplier be liable to Buyer for loss of profits, loss of use, or damages of any kind based upon a breach of warranty.

polyphase products

Chokes, AF
Chokes, Filter
Chokes, Power
Coils, Toroidal
Filters, Active
Filters, Band Elimination
Filters, Band Pass
Filters, Dual - ILS
Filters, High Pass
Filters, Line
Filters, Low Pass
Filters, Octave
Filters, Power 400 Hz
Inductors, Toroid
Modules, Encapsulated Circuit
Modules, SHP
Networks, Pulse-Custom
Reactors, Saturable
Transformers, Audio
Transformers, Converter DC-DC & AC-DC
Transformers, Current
Transformers, Current Limiting
Transformers, Discriminator
Transformers, Driver
Transformers, Filament
Transformers, High Voltage, Corona Free
Transformers, Input
Transformers, Instrument
Transformers, Interstage
Transformers, Isolation
Transformers, Line
Transformers, Linear
Transformers, Matching
Transformers, MIL Type
Transformers, Miniature & Subminiature
Transformers, Mixing
Transformers, Modulation
Transformers, Output
Transformers, Phase Conversion
Transformers, Plate
Transformers, Power
Transformers, Printed Circuit
Transformers, Pulse
Transformers, Precision Ratio
Transformers, Rectifier
Transformers, Saturable
Transformers, SCR Trigger
Transformers, Step-down and Step-up
Transformers, Toroidal
Transformers, Transistor Circuit
Transformers, Wide Band





For your Delay Line requirements please see Kappa Networks in Section 2350

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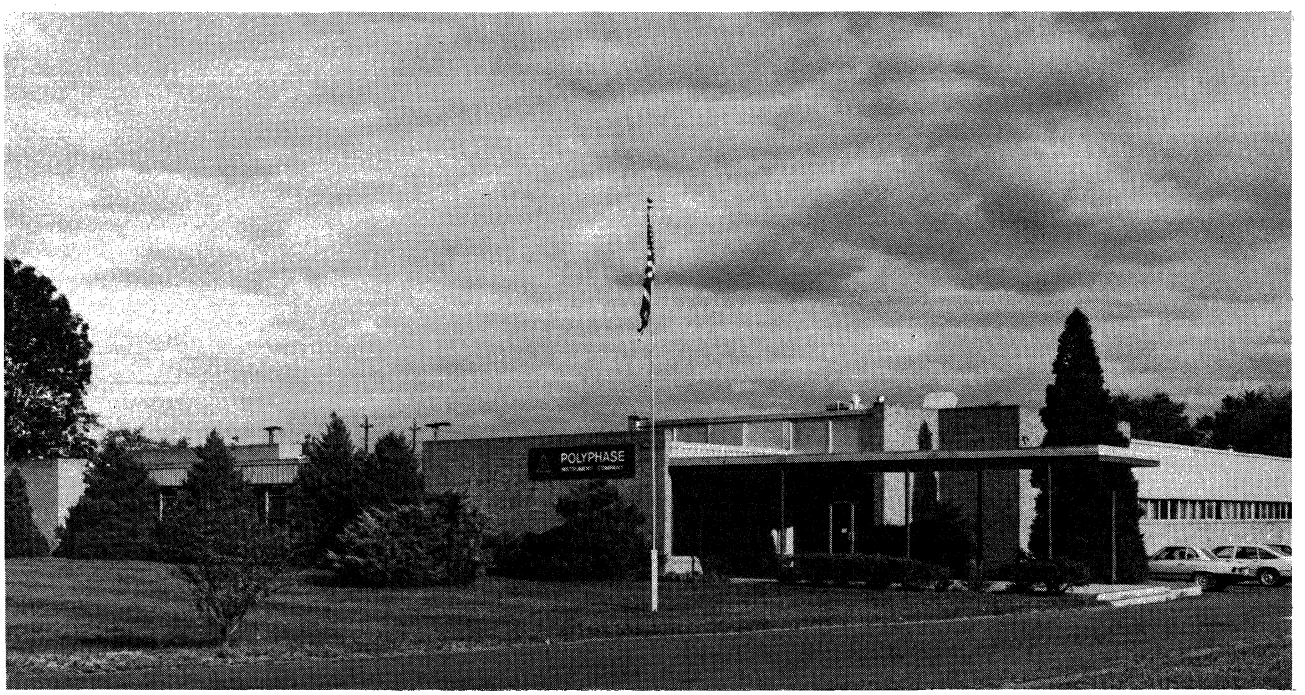

polyphase products

Chokes, AF
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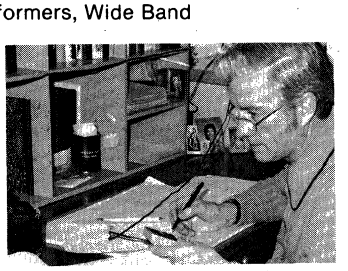

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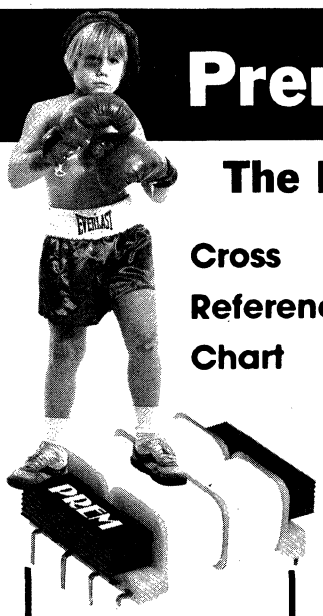

Prem PC Power Transformers

The New Kid on the Board is a Price Fighter

Cross Reference Chart

PREM	EWC	MICROTRAN	TRIAD	SIGNAL
SPW-050	LP 10-250B23	N/A	N/A	LP 10-250
SPW-051	LP 12-200B24	N/A	N/A	LP 12-200
SPW-052	LP 16-150B25	N/A	N/A	LP 16-150
SPW-053	LP 20-125B26	N/A	N/A	LP 20-125
SPW-054	LP 24-100B27	N/A	N/A	LP 24-100
SPW-055	LP 34-75B28	N/A	N/A	LP 34-75
SPW-056	LP 40-60B29	N/A	N/A	LP 40-60
SPW-057	LP 56-45B30	N/A	N/A	LP 56-45
SPW-058	LP 88-28B31	N/A	N/A	LP 88-28
SPW-059	LP 120-20B32	N/A	N/A	LP 120-20
SPW-060	LP 230-10B33	N/A	N/A	LP 230-10
SPW-061	N/A	N/A	N/A	LP 30-85
SPW-100	LP 10-600B1	PF 6-10	FP 10-600	LP 10-600
SPW-101	LP 12-450B3	PF 6-12	FP 12-475	LP 12-450
SPW-102	LP 16-350B5	PF 6-16	FP 16-375	LP 16-350
SPW-103	LP 20-300B7	N/A	FP 20-300	LP 20-300
SPW-104	LP 24-250B9	PF 6-24	FP 24-250	LP 24-250
SPW-105	LP 34-170B11	PF 6-34	FP 34-170	LP 34-170
SPW-106	LP 40-150B13	N/A	FP 40-150	LP 40-150
SPW-107	LP 56-100B15	PF 6-56	FP 56-100	LP 56-100
SPW-108	LP 88-65B17	N/A	FP 88-65	LP 88-65
SPW-109	LP 120-50B19	N/A	FP 120-50	LP 120-50
SPW-110	LP 230-25B21	N/A	FP 230-25	LP 230-25
SPW-111	N/A	N/A	FP 30-200	LP 30-200
SPW-300	LP 10-1200B2	PF 12-10	FP 10-1200	LP 10-1200
SPW-301	LP 12-900B4	PF 12-12	FP 12-950	LP 12-900
SPW-302	LP 16-700B6	PF 12-16	FP 16-750	LP 16-700
SPW-303	LP 20-600B8	N/A	FP 20-600	LP 20-600
SPW-304	LP 24-500B10	PF 12-24	FP 24-500	LP 24-500
SPW-305	LP 34-340B12	PF 12-34	FP 34-340	LP 34-340
SPW-306	LP 40-300B14	N/A	FP 40-300	LP 40-300
SPW-307	LP 56-200B16	PF 12-56	FP 56-200	LP 56-200
SPW-308	LP 88-130B18	N/A	FP 88-130	LP 88-130
SPW-309	LP 120-100B20	N/A	FP 120-100	LP 120-100
SPW-310	LP 230-50B22	N/A	FP 230-50	LP 230-50
SPW-311	N/A	N/A	FP 30-200	LP 30-400
SPW-350-S/D	ST/DST 2-10B41	PSS/PSD 2-10	N/A	ST/DST 2-10
SPW-351-S/D	ST/DST 2-12B42	PSS/PSD 2-12	N/A	ST/DST 2-12
SPW-352-S/D	ST/DST 2-16B43	PSS/PSD 2-16	N/A	ST/DST 2-16
SPW-353-S/D	ST/DST 2-20B44	PSS/PSD 2-20	N/A	ST/DST 2-20
SPW-354-S/D	ST/DST 2-24B45	PSS/PSD 2-24	N/A	ST/DST 2-24
SPW-355-S/D	ST/DST 2-28B46	PSS/PSD 2-28	N/A	ST/DST 2-28
SPW-356-S/D	ST/DST 2-36B47	PSS/PSD 2-36	N/A	ST/DST 2-36
SPW-357-S/D	ST/DST 2-48B48	PSS/PSD 2-48	N/A	ST/DST 2-48
SPW-358-S/D	ST/DST 2-56B49	PSS/PSD 2-56	N/A	ST/DST 2-56
SPW-359-S/D	ST/DST 2-120B50	PSS/PSD 2-120	N/A	ST/DST 2-120
SPW-400-S/D	ST/DST 3-10B1	PSS/PSD 3-10	F/FS 10-250	ST/DST 3-10
SPW-401-S/D	ST/DST 3-12B5	PSS/PSD 3-12	F/FS 12-200	ST/DST 3-12
SPW-402-S/D	ST/DST 3-16B9	PSS/PSD 3-16	F/FS 16-150	ST/DST 3-16
SPW-403-S/D	ST/DST 3-20B13	PSS/PSD 3-20	F/FS 20-120	ST/DST 3-20
SPW-404-S/D	ST/DST 3-24B17	PSS/PSD 3-24	F/FS 24-100	ST/DST 3-24
SPW-405-S/D	ST/DST 3-28B21	PSS/PSD 3-28	F/FS 28-85	ST/DST 3-28
SPW-406-S/D	ST/DST 3-36B25	PSS/PSD 3-36	F/FS 36-65	ST/DST 3-36
SPW-407-S/D	ST/DST 3-48B29	PSS/PSD 3-48	N/A	ST/DST 3-48
SPW-408-S/D	ST/DST 3-56B33	PSS/PSD 3-56	N/A	ST/DST 3-56
SPW-409-S/D	ST/DST 3-120B37	PSS/PSD 3-120	N/A	ST/DST 3-120
SPW-500-S/D	ST/DST 4-10B2	PSS/PSD 4-10	F/FS 10-600	ST/DST 4-10
SPW-501-S/D	ST/DST 4-12B6	PSS/PSD 4-12	F/FS 12-500	ST/DST 4-12
SPW-502-S/D	ST/DST 4-16B10	PSS/PSD 4-16	F/FS 16-400	ST/DST 4-16
SPW-503-S/D	ST/DST 4-20B14	PSS/PSD 4-20	F/FS 20-300	ST/DST 4-20
SPW-504-S/D	ST/DST 4-24B18	PSS/PSD 4-24	F/FS 24-250	ST/DST 4-24
SPW-505-S/D	ST/DST 4-28B22	PSS/PSD 4-28	F/FS 28-200	ST/DST 4-28
SPW-506-S/D	ST/DST 4-36B26	PSS/PSD 4-36	F/FS 36-170	ST/DST 4-36
SPW-507-S/D	ST/DST 4-48B30	PSS/PSD 4-48	N/A	ST/DST 4-48
SPW-508-S/D	ST/DST 4-56B34	PSS/PSD 4-56	N/A	ST/DST 4-56
SPW-509-S/D	ST/DST 4-120B38	PSS/PSD 4-120	N/A	ST/DST 4-120
SPW-600-S/D	ST/DST 5-10B3	PSS/PSD 5-10	F/FS 10-1200	ST/DST 5-10
SPW-601-S/D	ST/DST 5-12B7	PSS/PSD 5-12	F/FS 12-1000	ST/DST 5-12
SPW-602-S/D	ST/DST 5-16B11	PSS/PSD 5-16	F/FS 16-800	ST/DST 5-16
SPW-603-S/D	ST/DST 5-20B15	PSS/PSD 5-20	F/FS 20-600	ST/DST 5-20
SPW-604-S/D	ST/DST 5-24B19	PSS/PSD 5-24	F/FS 24-500	ST/DST 5-24
SPW-605-S/D	ST/DST 5-28B23	PSS/PSD 5-28	F/FS 28-420	ST/DST 5-28
SPW-606-S/D	ST/DST 5-36B27	PSS/PSD 5-36	F/FS 36-350	ST/DST 5-36
SPW-607-S/D	ST/DST 5-48B31	PSS/PSD 5-48	N/A	ST/DST 5-48
SPW-608-S/D	ST/DST 5-56B35	PSS/PSD 5-56	N/A	ST/DST 5-56
SPW-609-S/D	ST/DST 5-120B39	PSS/PSD 5-120	N/A	ST/DST 5-120
SPW-610-S/D	ST/DST 6-10B4	N/A	N/A	ST/DST 6-10
SPW-611-S/D	ST/DST 6-12B8	N/A	N/A	ST/DST 6-12
SPW-612-S/D	ST/DST 6-16B12	N/A	N/A	ST/DST 6-16
SPW-613-S/D	ST/DST 6-20B16	N/A	N/A	ST/DST 6-20
SPW-614-S/D	ST/DST 6-24B20	N/A	N/A	ST/DST 6-24
SPW-615-S/D	ST/DST 6-28B24	N/A	N/A	ST/DST 6-28
SPW-616-S/D	ST/DST 6-36B28	N/A	N/A	ST/DST 6-36
SPW-617-S/D	ST/DST 6-48B32	N/A	N/A	ST/DST 6-48
SPW-618-S/D	ST/DST 6-56B36	N/A	N/A	ST/DST 6-56
SPW-619-S/D	ST/DST 6-120B40	N/A	N/A	ST/DST 6-120
SPW-620-S/D	ST/DST 7-10B51	N/A	N/A	ST/DST 7-10
SPW-621-S/D	ST/DST 7-12B52	N/A	N/A	ST/DST 7-12
SPW-622-S/D	ST/DST 7-16B53	N/A	N/A	ST/DST 7-16
SPW-623-S/D	ST/DST 7-20B54	N/A	N/A	ST/DST 7-20
SPW-624-S/D	ST/DST 7-24B55	N/A	N/A	ST/DST 7-24
SPW-625-S/D	ST/DST 7-28B56	N/A	N/A	ST/DST 7-28
SPW-626-S/D	ST/DST 7-36B57	N/A	N/A	ST/DST 7-36
SPW-627-S/D	ST/DST 7-48B58	N/A	N/A	ST/DST 7-48
SPW-628-S/D	ST/DST 7-56B59	N/A	N/A	ST/DST 7-56
SPW-629-S/D	ST/DST 7-120B60	N/A	N/A	ST/DST 7-120

N/A — To the best of our knowledge, these items are not available.

Prem has taken on the Ol' Boys head-to-head. And you come out the winner. Prem stocks the same low profile, three-flange designs and delivers fast with consistent, reliable quality. Why pay more? Check out Prem's prices today, you'll find it's nice to have someone in your corner for a change.

For further information and pricing, contact Prem's Customer Service Department.

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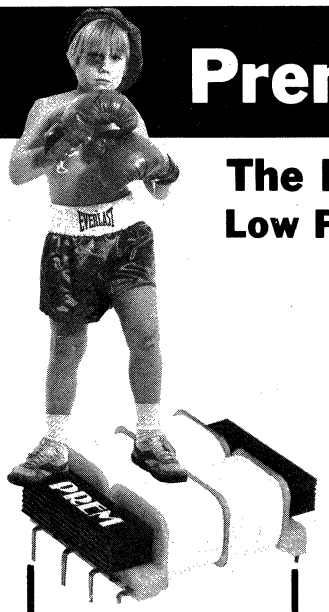
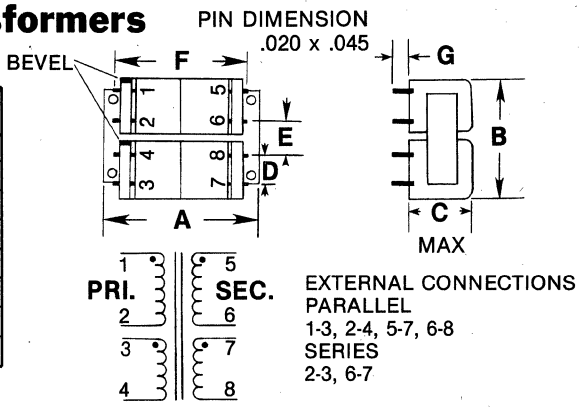


Prem PC Power Transformers

The New Kid on the Board is a Price Fighter

Low Profile Power Transformers

	SPW 050	SPW 100	SPW 300
VA	2.5	6	12
A	1.875	1.875	2.500
B	1.562	1.562	2.000
C	.660	.850	1.065
D	.375	.375	.500
E	.375	.375	.500
F	1.600	1.600	2.000
G	.200	.200	.200



EXTERNAL CONNECTIONS
PARALLEL
1-3, 2-4, 5-7, 6-8
SERIES
2-3, 6-7

Prem — the price leader in Low Profile Power Transformers.

- Low profile — .660" in 2.5 VA design
- ® Recognized Class B system*
- Three flange bobbin design — 1500 VRMS High-pot
- No electro-static shield needed

Other primary and secondary voltages may be custom-designed to your specifications. Since 12 terminals are available, tapped primaries or secondaries may also be utilized.

For further information and pricing, contact Prem's Customer Service Department.

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3521 North Chapel Hill Road
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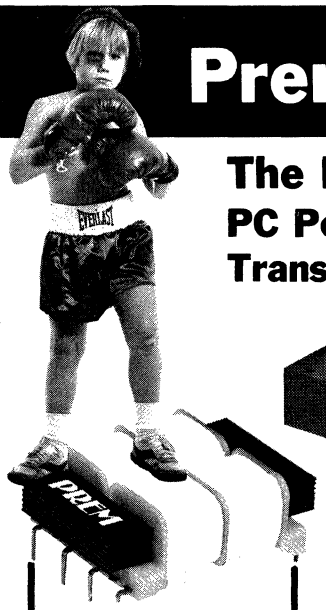
LOW PROFILE POWER TRANSFORMERS

115/230V DUAL PRIMARIES	SECONDARY	
Part No.	Parallel	Series
SPW-050	5V @ 500 mA	10V CT @ 250 mA
SPW-051	6.3V @ 400 mA	12.6V CT @ 200 mA
SPW-052	8V @ 300 mA	16V CT @ 150 mA
SPW-053	10V @ 250 mA	20V CT @ 125 mA
SPW-054	12V @ 200 mA	24V CT @ 100 mA
SPW-055	17V @ 150 mA	34V CT @ 75 mA
SPW-056	20V @ 120 mA	40V CT @ 60 mA
SPW-057	28V @ 90 mA	56V CT @ 45 mA
SPW-058	44V @ 56 mA	88V CT @ 28 mA
SPW-059	60V @ 40 mA	120V CT @ 20 mA
SPW-060	115V @ 20 mA	230V CT @ 10 mA
SPW-061	15V @ 170 mA	30V CT @ 85 mA
SPW-100	5V @ 1.2A	10V CT @ 600 mA
SPW-101	6.3V @ 900 mA	12.6V CT @ 450 mA
SPW-102	8V @ 700 mA	16V CT @ 350 mA
SPW-103	10V @ 600 mA	20V CT @ 300 mA
SPW-104	12V @ 500 mA	24V CT @ 250 mA
SPW-105	17V @ 340 mA	34V CT @ 170 mA
SPW-106	20V @ 300 mA	40V CT @ 150 mA
SPW-107	28V @ 200 mA	56V CT @ 100 mA
SPW-108	44V @ 130 mA	88V CT @ 65 mA
SPW-109	60V @ 100 mA	120V CT @ 50 mA
SPW-110	115V @ 50 mA	230V CT @ 25 mA
SPW-111	15V @ 400 mA	30V CT @ 200 mA
SPW-300	5V @ 2.4A	10V CT @ 1.2A
SPW-301	6.3V @ 1.8A	12.6V CT @ 900 mA
SPW-302	8V @ 1.4A	16V CT @ 700 mA
SPW-303	10V @ 1.2A	20V CT @ 600 mA
SPW-304	12V @ 1.0A	24V CT @ 500 mA
SPW-305	17V @ 680 mA	34V CT @ 340 mA
SPW-306	20V @ 600 mA	40V CT @ 300 mA
SPW-307	28V @ 400 mA	56V CT @ 200 mA
SPW-308	44V @ 260 mA	88V CT @ 130 mA
SPW-309	60V @ 200 mA	120V CT @ 100 mA
SPW-310	115V @ 100 mA	230V CT @ 50 mA
SPW-311	15V @ 800 mA	30V CT @ 400 mA

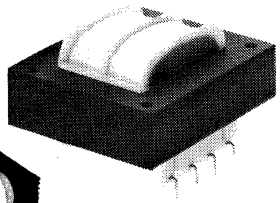
*Recognized under the component program of Underwriters Laboratory, Inc., under file #E85315, yellow card available upon request.

Prem PC Power Transformers

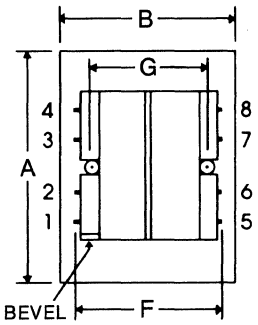


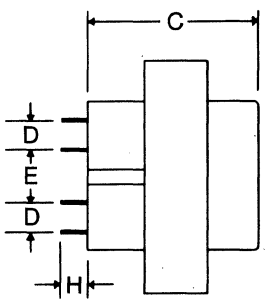
The New Kid on the Board is a Price Fighter

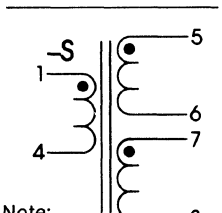
PC Power Transformers



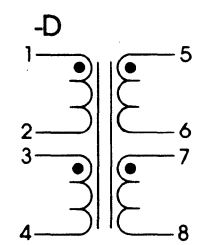
PIN DIMENSION
.020 x .041







Note:
Pins 2 & 3 Omitted



Prem — the price leader in PC Power Transformers

- Small board area — $1^3/_8$" x $1^1/_8$" in 2.4 VA design
- ® Recognized Class B system*
- Three flange bobbin design — 1500 VRMS High-pot

*Recognized under the component program of Underwriters Laboratory, Inc., under file #E85315, yellow card available upon request.

For further information and pricing, contact Prem's Customer Service Department.

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	SPW-350	SPW-400	SPW-500	SPW-600	SPW-610	SPW-620
VA	1.1	2.4	6.0	12.0	20.0	36.0
A	1.375	1.375	1.625	1.875	2.250	2.625
B	1.125	1.125	1.312	1.5625	1.875	2.187
C	.9375	1.187	1.290	1.4375	1.410	1.562
D	.250	.250	.250	.300	.300	.400
E	.250	.250	.350	.400	.400	.400
F	1.200	1.200	1.270	1.410	1.600	1.850
G	N/A	N/A	1.0625	1.250	1.50	NOTE
H	.28	.20	.20	.20	.20	.20

PC Power Transformers

Part No.	Parallel Secondaries	Series Secondaries
SPW-350-*	5V @ 220 mA	10V CT @ 110 mA
SPW-351-	6.3V @ 180 mA	12.6V CT @ 90 mA
SPW-352-	8V @ 140 mA	16V CT @ 70 mA
SPW-353-	10V @ 110 mA	20V CT @ 55 mA
SPW-354-	12V @ 90 mA	24V CT @ 45 mA
SPW-355-	14V @ 80 mA	28V CT @ 40 mA
SPW-356-	18V @ 60 mA	36V CT @ 30 mA
SPW-357-	24V @ 46 mA	48V CT @ 23 mA
SPW-358-	28V @ 40 mA	56V CT @ 20 mA
SPW-359-	60V @ 20 mA	120V CT @ 10 mA
SPW-400-	5V @ 500 mA	10V CT @ 250 mA
SPW-401-	6.3V @ 400 mA	12.6V CT @ 200 mA
SPW-402-	8V @ 300 mA	16V CT @ 150 mA
SPW-403-	10V @ 240 mA	20V CT @ 120 mA
SPW-404-	12V @ 200 mA	24V CT @ 100 mA
SPW-405-	14V @ 170 mA	28V CT @ 85 mA
SPW-406-	18V @ 130 mA	36V CT @ 65 mA
SPW-407-	24V @ 100 mA	48V CT @ 50 mA
SPW-408-	28V @ 90 mA	56V CT @ 45 mA
SPW-409-	60V @ 40 mA	120V CT @ 20 mA
SPW-500-	5V @ 1.2A	10V CT @ 600 mA
SPW-501-	6.3V @ 1.0A	12.6V CT @ 500 mA
SPW-502-	8V @ 800 mA	16V CT @ 400 mA
SPW-503-	10V @ 600 mA	20V CT @ 300 mA
SPW-504-	12V @ 500 mA	24V CT @ 250 mA
SPW-505-	14V @ 400 mA	28V CT @ 200 mA
SPW-506-	18V @ 340 mA	36V CT @ 170 mA
SPW-507-	24V @ 250 mA	48V CT @ 125 mA
SPW-508-	28V @ 220 mA	56V CT @ 110 mA
SPW-509-	60V @ 100 mA	120V CT @ 50 mA
SPW-600-	5V @ 2.4A	10V CT @ 1.2A
SPW-601-	6.3V @ 2.0A	12.6V CT @ 1.0A
SPW-602-	8V @ 1.6A	16V CT @ 800 mA
SPW-603-	10V @ 1.2A	20V CT @ 600 mA
SPW-604-	12V @ 1.0A	24V CT @ 500 mA
SPW-605-	14V @ 840 mA	28V CT @ 420 mA
SPW-606-	18V @ 700 mA	36V CT @ 350 mA
SPW-607-	24V @ 500 mA	48V CT @ 250 mA
SPW-608-	28V @ 440 mA	56V CT @ 220 mA
SPW-609-	60V @ 200 mA	120V CT @ 100 mA
SPW-610-	5V @ 4.0A	10V CT @ 2.0A
SPW-611-	6.3V @ 3.2A	12.6V CT @ 1.6A
SPW-612-	8V @ 2.5A	16V CT @ 1.25A
SPW-613-	10V @ 2.0A	20V CT @ 1.0A
SPW-614-	12V @ 1.6A	24V CT @ 800 mA
SPW-615-	14V @ 1.4A	28V CT @ 700 mA
SPW-616-	18V @ 1.1A	36V CT @ 550 mA
SPW-617-	24V @ 800 mA	48V CT @ 400 mA
SPW-618-	28V @ 700 mA	56V CT @ 350 mA
SPW-619-	60V @ 320 mA	120V CT @ 160 mA
SPW-620-	5V @ 7.2A	10V CT @ 3.6A
SPW-621-	6.3V @ 5.7A	12.6V CT @ 2.85A
SPW-622-	8V @ 4.5A	16V CT @ 2.25A
SPW-623-	10V @ 3.6A	20V CT @ 1.8A
SPW-624-	12V @ 3.0A	24V CT @ 1.5A
SPW-625-	14V @ 2.6A	28V CT @ 1.3A
SPW-626-	18V @ 2.0A	36V CT @ 1.0A
SPW-627-	24V @ 1.5A	48V CT @ 750 mA
SPW-628-	28V @ 1.3A	56V CT @ 650 mA
SPW-629-	60V @ 600 mA	120V CT @ 300 mA

***Primary Voltage — S (115V) — D (115/230V)**

NOTE: 4 corner mounting holes 2.187 x 1.750 centers clearance for #6 screw on SPW-620 series.

RENCO ELECTRONICS, INC.

Custom Transformers AT STANDARD PRICES For Your Switching Power Supplies RL 1287

The driver, interstage, and inverter transformers in all switching power supplies should be custom designed by experts. If they're not, they're apt to be overrated, bulky, and difficult to manufacture.

Custom design, however, is usually expensive. And takes time.

That's why we developed the Renco SC&B (Standard Core & Bobbin) System, which enables us to give you custom transformers at the prices you'd pay for standards. And deliver them almost as fast as we deliver our standard products.

After extensive research, we selected six standard ferrite "E" cores which are good for most applications at all popular switching frequencies; and glass filled nylon bobbins, which have excellent rigidity and high temperature performance, and can easily be mounted on printed circuit boards.

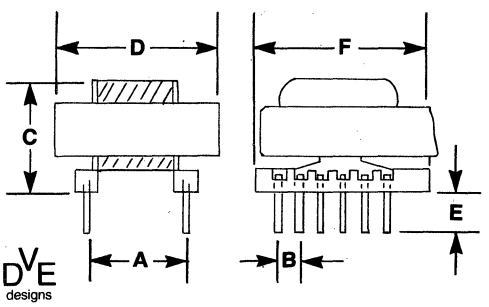
With these cores and bobbins we can custom-design your transformers, and normally ship prototypes to you within ten days. Since we always have large stocks of cores and bobbins on hand, you'll get fast delivery on your complete order. And since we buy in volume, you're never charged a premium, even for small quantity orders.

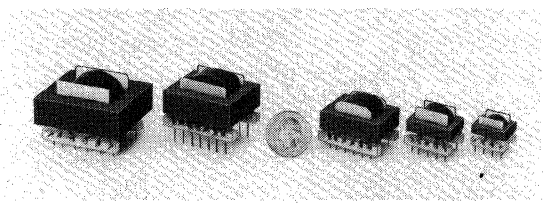
And your transformers are wound on custom engineered equipment that ensures conformance to requirements.

Other companies have copied this system. But none offer nearly as much engineering assistance as we do. All you have to do is give us your bare specs, and we'll translate them into transformers.

And none have nearly as much experience as we do. We've been exclusively engaged in the design and manufacture of coil wound products for over 30 years. So when you come to us you can be certain that your transformers will be exactly right for your application.

Just call our Engineering Hotline (800-645-5828 outside of New York State; in New York, call 516-586-5566) and tell us your requirements. Note: a small charge may be required on some designs.





RL-1287-6 not shown in photo.

Recognized under the Component Program of Underwriters Laboratories Inc. Insulation Class B

STYLE NUMBER	TYPICAL DIMENSIONS							TERMINAL
	A	B	C	D	E	F	NO.	SIZE
RL-1287-1	.515	.200	.660	.650	.175	.780	8*	.025 SQ.
RL-1287-2	.630	.200	.830	.770	.175	1.030	10*	.025 SQ.
RL-1287-3	.800	.200	.915	1.140	.175	1.375	12*	.025 SQ.
RL-1287-4	1.000	.200	1.050	1.325	.375	1.700	14	.025 SQ.
RL-1287-5	1.100	.300	1.300	1.700	.185	2.000	12*	.025 SQ.
RL-1287-6	1.300	.300	1.500	2.000	.250	2.300	12*	.025 SQ.

All Dimensions in Inches *Pin 1 — 2 spacing is less for polarity

DESIGN NOTES:

1 - Primary to secondary isolation 1500V RMS Min.
2 - All designs meet Class B requirements (130°C).
3 - Encapsulation available.
4 - Winding to core isolation 2500V RMS Min.
5 - Higher isolation voltages available.
6 - Higher temperature classes available.

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RENCO ELECTRONICS, INC.

FREE SAMPLES!
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LARGE-ORDER TREATMENT FOR SMALL ORDERS!

These are the kinds of services that have helped us become probably the leading firm exclusively in the business of making coil-wound products.

FREE SAMPLES just for the asking.

Think you could use any of the chokes described on pages A•1274-A•1276? Then call our TOLL-FREE engineering Hot-Line (800-645-5828 outside of New York State; in New York State call 516-586-5566) and tell us your specs — and we'll send you a free sample. If your specs hit squarely on one of our standards (and since our line has 1428 standard values, they frequently do), we'll ship out your sample the same day.

If your specs do not exactly match any of our standards — in fact, even if they're nowhere near any of our standards — give us a call and we'll make up a custom sample. We have a special prototype and sampling laboratory that does nothing but make up custom samples. So unless you need something exceptionally complex, we'll ship your sample within 10 days.

Our Engineering Hotline is for you!

800• 645• 5828

Please feel free to use it even if you have no intention of giving us an order.

Use it if, for example, you're having any kind of problem with any coil wound product — ours or anyone else's. We have, after all, been making chokes, inductors, toroids, and transformers for 29 years now, so we have considerable expertise in that line. When you call the Hotline you'll be talking to an expert who won't try to sell you a thing. He'll just be helping you work out a solution to your problem, and if that solution involves a competitor's product, that's fine, too!

Even if you don't have a problem; even if there's just something you'd like to know about magnetics; or if there's something you'd like to tell us — we'd be delighted to hear from you. We actually established the Hotline because we've found, over the years, that a vital factor in our growth has been the continuous exchange of ideas with engineers who are using chokes and transformers.

Small orders get large order treatment.

Don't hesitate to call us even if you only want to order a few chokes or transformers. You'll get the same attention — and your order will go out just as fast — as if you were ordering thousands.

The reason is that we have a separate, completely independent small order department, staffed with people who are capable of handling orders for just about any kind of coil-wound product. If you order any of our standard products, our small order people go into the stockroom, take your order off the shelf, and ship it out. And if it's a special, they'll make it themselves, no matter how complex or unusual it may be.

They're really a little factory within a factory. They can read drawings. They have the machines and equipment they need to do their own winding, soldering, and testing (and years of experience in using them). When they finish your order all they have to do is bring your finished parts to QC for a final AQL, and ship it out.

And because we're set up this way, you don't have to pay a penalty for ordering small!

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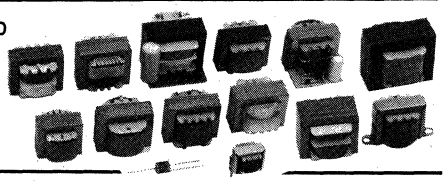


UL 1411 RECOGNIZED POWER TRANSFORMERS

The products illustrated and listed are only a small representation of the full range of items available.

POWER TRANSFORMER CORE SIZES RANGE FROM EI-28 TO EI-86 AND ARE UL APPROVED TO STANDARD 1411. TRANSFORMERS ARE ALSO AVAILABLE TO CSA, SAA, VDE, BSI AND THIRTEEN UL STANDARDS. CUSTOM DESIGNED POWER TRANSFORMERS ARE ALSO AVAILABLE TO YOUR SPECIFICATIONS. UL CATALOG NUMBERS WILL BE ASSIGNED TO CUSTOM TRANSFORMERS FALLING WITHIN UL RANGES. GROUP 1, 3, 5, 7, 9, 11 NON-HAZARDOUS OUTPUT, GROUP 2, 4, 6, 8, 10, 12 HAZARDOUS OUTPUT.

Cat. No. Series	Primary Input (V)	Schematic Diagram Pri.	Schematic Diagram Sec.	No. of Secondary	Total Output VA	Bobbin Material	Type of Mounting	Enclosure	Connections
28-1	120/240	A-F	1-21	1-4	0.4 Min.	Nylon 66 or PBT or Phenolic	Channel Frame	With Endbell	UL Recognized AWM
35-1	120/240	A-F	1-21	1-4					
41-1	120/240	A-F	1-21	1-4					
48-1	120/240	A-F	1-21	1-4	9.54 Max.				
28-2	120/240	A-F	1-21	1-4	0.4 Min.	Nylon 66 or PBT or Phenolic	Channel Frame	With Endbell	UL Recognized AWM
35-2	120/240	A-F	1-21	1-4					
41-2	120/240	A-F	1-21	1-4					
48-2	120/240	A-F	1-21	1-4	13.2 Max.				
54-2	120/240	A-F	1-21	1-4	8.0 Min.	Phenolic	Channel Frame	With Endbell	UL Recognized AWM
57-2	120/240	A-F	1-21	1-4					
60-2	120/240	A-F	1-21	1-4					
66-2	120/240	A-F	1-21	1-4					
70-2	120/240	A-F	1-21	1-4					
86-2	120/240	A-F	1-21	1-4	100 Max.				
28-3	120/240	A-F	1-21	1-4	0.5 Min.	Nylon 66 or PBT or Phenolic	Channel Frame or PCB Mtg.	Without Endbell	UL Recognized AWM or Terminals or Pins
35-3	120/240	A-F	1-21	1-4					
41-3	120/240	A-F	1-21	1-4					
48-3	120/240	A-F	1-21	1-4	5.0 Max.				
28-4	120/240	A-F	1-21	1-4	0.5 Min.	Nylon 66 or PBT or Phenolic	Channel Frame or PCB Mtg.	Without Endbell	UL Recognized AWM or Terminals or Pins
35-4	120/240	A-F	1-21	1-4					
41-4	120/240	A-F	1-21	1-4					
48-4	120/240	A-F	1-21	1-4					
54-4	120/240	A-F	1-21	1-4					
57-4	120/240	A-F	1-21	1-4	30 Max.				
35-5	120/240	A-D	1-3A	1-2	0.6 VA	Nylon 66 or PBT	PCB	None	Pins
41-5	120/240	A-D	1-3A	1-2					
48-5	120/240	A-D	1-3A	1-2	5.1 VA				
35-6	120/240	A-D	1-3A	1-2	0.6 Min.	Nylon 66 or PBT	PCB	None	Pins
41-6	120/240	A-D	1-3A	1-2					
48-6	120/240	A-D	1-3A	1-2	9.0 Max.				

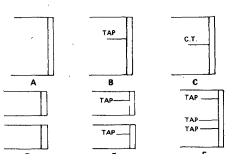
Cat. No. Series	Primary Input (V)	Schematic Diagram Pri.	Schematic Diagram Sec.	No. of Secondary	Total Output VA	Bobbin Material	Type of Mounting	Enclosure	Connections
28-7	120/240	A-F	1-21	1-4	0.5 Min.	Nylon 66 or PBT	Channel Frame or PCB	None	UL Recognized AWM or Terminals or Pins
35-7	120/240	A-F	1-21	1-4					
41-7	120/240	A-F	1-21	1-4					
48-7	120/240	A-F	1-21	1-4	5.1 Max.				
28-8	120/240	A-F	1-21	1-4	0.5 Min.	Nylon 66 or PBT	Channel Frame or PCB	None	UL Recognized AWM or Terminals or Pins
35-8	120/240	A-F	1-21	1-4					
41-8	120/240	A-F	1-21	1-4					
48-8	120/240	A-F	1-21	1-4					
54-8	120/240	A-F	1-21	1-4					
57-8	120/240	A-F	1-21	1-4	14 Max.				
28-9	120/240	A-F	1-21	1-4	0.5 Min.	Nylon 66 or PBT	Channel Frame	With Endbell	UL Recognized AWM
35-9	120/240	A-F	1-21	1-4					
41-9	120/240	A-F	1-21	1-4					
48-9	120/240	A-F	1-21	1-4	5.1 Max.				
28-10	120/240	A-F	1-21	1-4	0.5 Min.	Nylon 66 or PBT or Phenolic	Optional Channel Frame	With Endbell	UL Recognized AWM
35-10	120/240	A-F	1-21	1-4					
41-10	120/240	A-F	1-21	1-4					
48-10	120/240	A-F	1-21	1-4					
54-10	120/240	A-F	1-21	1-4					
57-10	120/240	A-F	1-21	1-4	14 Max.				
28-11	120/240	A-D	1-3A	1-2	0.5 Min.	Nylon 66 or PBT	PCB	None	Pins
35-11	120/240	A-D	1-3A	1-2					
41-11	120/240	A-D	1-3A	1-2	5.0 Max.				
28-12	120/240	A-D	1-3A	1-2	0.5 Min.	Nylon 66 or PBT	PCB	None	Pins
35-12	120/240	A-D	1-3A	1-2					
41-12	120/240	A-D	1-3A	1-2					
48-12	120/240	A-D	1-3A	1-2	9.0 Max.				

UL RECOGNIZED DOUBLE PROTECTION POWER TRANSFORMERS

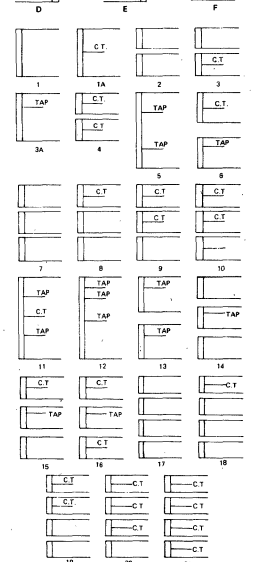
TRANSFORMERS CONFORM WITH UL 1411 SEVEN (7) HOURS CONSTRUCTION AND ABNORMAL TEST REQUIREMENTS. 3500 V DIELECTRIC TEST VOLTAGE.

Cat. No. Series	Pri. Voltage	Schematic Diagram Pri.	Schematic Diagram Sec.	Cold Resistance (Ohms) Pri.	Cold Resistance (Ohms) Sec. 1	Cold Resistance (Ohms) Sec. 2	Sec.1 Rating A	Sec.1 Rating V	Sec.1 Rating O.C.V.	Sec. 2 Rating A	Sec. 2 Rating V	Sec. 2 Rating O.C.V.	Core Size (mm) L	Core Size (mm) W	Core Size (mm) H
28-A	120	A	2	29.7	1.7	0.79	0.36	19.95	20.95	0.4	9.55	10.03	76.2	63.5	13
28-B	120	A	2	29.7	1.7	0.79	0.58	20.0	21.8	0.115	9.48	9.8	76.2	63.5	13
28-C	120	A	2	22.3	0.73	0.86	1.0	20.3	22.1	0.38	10.3	11.1	76.2	63.5	15

PRIMARY SCHEMATIC DIAGRAMS



SECONDARY SCHEMATIC DIAGRAMS



70.7 VOLT, 25 VOLT LINE MATCHING TRANSFORMERS

Model No.	Max. Power Level	Primary Impedance Ohms	Secondary Impedance Ohms	Core Size	Dimensions mm A	Dimensions mm B	Dimensions mm C	Dimensions mm D	Dimensions mm E	Line Volts
SH-39A	4W	40K/20K/10K/5K/2.5K/1.25K	8	EI-41 x 17	43.5	35.5	19.5	50.8	62	70.7
SH-39B	4W	5K/2.5K/1.25K/625/312/156	8	EI-41 x 17	43.5	35.5	19.5	50.8	62	25.0
SH-39C	2W	40K/20K/10K/5K/2.5K	8	EI-48 x 18	51.0	42.5	19.8	60.0	70	70.7
SH-39D	4W	20K/10K/5K/2.5K/1.25K	8	EI-48 x 18	51.0	42.5	19.8	60.0	70	70.7
SH-39E	16W	2.5K/1.25K/6.25/312	8	EI-66 x 22	69.0	58.9	25.0	79.5	95	70.7
SH-39F	16W	312/126/78/39	8	EI-66 x 22	69.0	58.9	25.0	79.5	95	25.0
SH-39G	4W	40K/20K/10K/5K/2.5K/1.25K	8	EI-48 x 13	51.0	42.5	15.0	60.0	72	70.0

Model No.	Core Size	Frequency Response	DC Bias mA	Impedance Ohms Primary	Impedance Ohms Secondary	Insertion Loss at 1 KHz	Dimensions mm A	Dimensions mm B	Dimensions mm C	Dimensions mm D	Dimensions mm E	Dimensions mm F
SH-32	EI-25.4 x 10	300-3500Hz ±3dB	45	430 Min. 700 Max.	600	1dB Max.	26.5	20	23	12.5	20	3.5
SH-38	EI-19 x 17	300-3500Hz ±3dB		600 ±10%	600	1dB Max.	19.5	15.5	15.5	9.0	13	
SH-39A	EI-19 x 5	300-3500Hz ±3dB		900 ±10%	900	1dB Max.	19.5	17.8	18	9.0	13	
SH-39B	EI-25.4 x 6.7	300-3500Hz ±3dB		500 ±10%	500	1.5dB Max.	26	22	20	13	19	
SH-39C	EI-19 x 5	300-3000Hz ±3dB	30	600 ±10%	600	1.5dB Max.	19.5	15.5	15.5	9.0	11	
SH-39D	EI-35 x 12	300-3500Hz ±3dB	100	600 ±10%	600	1.5dB Max.	36.5	31.5	33.0	12	25	4
SH-39E	EI-24 x 7	300-3500Hz ±3dB	60	600 ±10%	600	1.5dB Max.	25.5	19.5	19.5	9.5	18.5	2.5
SH-40	EI-19 x 5	300-3500Hz ±3dB		600 ±10%	600	1dB Max.	19.5	15.5	15.5	9.0	11	

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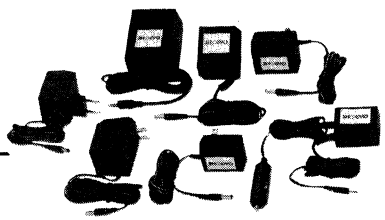


UL/CSA APPROVED PLUG-IN TRANSFORMERS

The plug-in transformers listed here represent only a small selection from our full line of transformers. Any input/output voltage and current ratings may be ordered. A wide variety of terminations, mating connectors and jacks as well as custom designs to your specifications are also available. Please see our section in EEM on Connectors and Terminals.

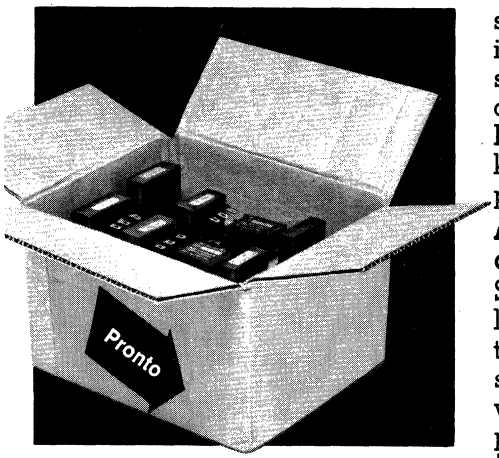
Model No.	Input Rating	Output Rating	Output Cord Type	End Use Marking Terms	Approval UL	Approval CSA
058-0	120V 60Hz 19W	16.2VAC 995mA	UL x T/CSA P x T AWG #20	Class 2 Transformer	●	
058-P	120V 60Hz 19W	16.2VAC 995mA	UL x T/CSA P x T AWG #20	Class 2 Transformer		●
SH-A1	120V 60Hz 5W	17VDC 1.5VA	UL 2468 AWG #24	Class 2 Transformer	●	
SH-A2	120V 60Hz 10W	12VAC 600mA	PVC Insulation AWG #24	Power Supply for Use With Receiver	●	

UL 1310 APPROVED DIRECT PLUG-IN POWER SUPPLY

FOR USE WITH CALCULATORS, CLOCKS, COMPUTERS, TV, RECEIVERS, RADIOS, CASSETTE RECORDERS ETC.

Model	SH-35A	SH-35B	SH-35C	SH-35D	SH-35E	SH-35F	SH-35G	SH-35H	SH-35J	SH-35K	
Input	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	
Output Rating	3VDC 100mA	3VDC 200mA	3VDC 300 mA	3VDC 400mA	3VDC 500mA	3VDC 600mA	3VDC 700mA	3VDC 800mA	3VDC 900mA	3VDC 1 Amp	
Output Watt.	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	
Model	**SH-35A1**	**SH-35B1**	**SH-35C1**	**SH-35D1**	**SH-35E1**	**SH-35F1**	**SH-35G1**	**SH-35H1**	**SH-35J1**		
Input	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz		
Output Rating	4.5VDC 100mA	4.5VDC 200mA	4.5VDC 300mA	4.5VDC 400mA	4.5VDC 500mA	4.5VDC 600mA	6VDC 100mA	6VDC 200mA	6VDC 300mA		
Output Watt.	0.45	0.9	1.35	1.8	2.25	2.7	0.6	1.2	1.8		
Model	**SH-35A2**	**SH-35B2**	**SH-35C2**	**SH-35D2**	**SH-35E2**	**SH-35F2**	**SH-35G2**	**SH-35H2**	**SH-35J2**		
Input	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz		
Output Rating	6VDC 400mA	6VDC 500mA	7.5VDC 100mA	7.5VDC 200mA	7.5VDC 300mA	7.5VDC 400mA	8VDC 200mA	8VDC 300mA	9VDC 100mA		
Output Watt.	2.4	3.0	0.75	1.5	2.25	3.0	1.6	2.4	0.9		
Model	**SH-35A3**	**SH-35B3**	**SH-35C3**	**SH-35D3**	**SH-35E3**	**SH-35F3**	**SH-35G3**	**SH-35H3**	**SH-35J3**		
Input	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz		
Output Rating	9VDC 200mA	9VDC 300mA	12VDC 100mA	12VDC 200mA	15VDC 100mA	15VDC 200mA	18VDC 100mA	21VDC 100mA	24VDC 100mA		
Output Watt.	1.8	2.7	1.2	2.4	1.5	3.0	1.8	2.1	2.4		
Model	**SH-41A**	**SH-41B**	**410407**	**SH-41D**	**SH-41E**	**SH-41F**	**SH-41G**	**SH-41H**	**SH-41J**	**SH-41K**	**SH-41L**
Input	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz
Output Rating	4.5VDC 500mA	4.5VDC 600mA	4.5VDC 700mA	4.5VDC 800mA	4.5VDC 900mA	4.5VDC 1Amp	6VDC 500mA	6VDC 600mA	6VDC 700mA	6VDC 800mA	6VDC 900mA
Output Watt.	2.25	2.7	3.15	3.6	4.05	4.5	3.0	3.6	4.2	4.8	5.4
Model	**SH-41A1**	**SH-41B1**	**SH-41C1**	**SH-41D1**	**SH-41E1**	**SH-41F1**	**SH-41G1**	**SH-41H1**	**SH-41J1**	**SH-41K1**	**SH-41L1**
Input	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz
Output Rating	7VDC 1Amp	7.5VDC 500mA	7.5VDC 600mA	7.5VDC 700mA	7.5VDC 800mA	9VDC 300mA	9VDC 400mA	9VDC 500mA	9VDC 600mA	12VDC 300mA	12VDC 400mA
Output Watt.	6.0	3.75	4.5	5.25	6.0	2.7	3.6	4.5	5.4	3.6	4.8
Model	**SH-41A2**	**SH-41B2**	**SH-41C2**	**SH-41D2**	**SH-41E2**	**SH-41F2**	**SH-41G2**	**SH-41H2**	**SH-41J2**	**SH-41K2**	
Input	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	
Output Rating	12VDC 500mA	15VDC 200mA	15VDC 300mA	15VDC 400mA	18VDC 200mA	18VDC 300mA	21VDC 100mA	21VDC 200mA	24VDC 100mA	24VDC 200mA	
Output Watt.	6.0	3.0	4.5	6.0	3.6	5.4	2.1	4.2	2.4	4.8	
Model	**SH-48A**	**SH-48B**	**SH-48C**	**SH-48D**	**SH-48E**	**SH-48F**	**SH-48G**	**SH-48H**	**SH-48J**	**SH-48K**	**SH-48L**
Input	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz
Output Rating	6VDC 900mA	6VDC 1Amp	6VDC 1.2Amp	6VDC 1.5Amp	7.5VDC 800mA	7.5VDC 900mA	7.5VDC 1Amp	7.5VDC 1.2Amp	7.5VDC 1.4Amp	7.5VDC 1.5Amp	7.5VDC 1.7Amp
Output Watt.	5.4	6.0	7.2	9.0	6.0	6.75	7.5	9.0	10.5	11.25	12.75
Model	**SH-48A1**	**SH-48B1**	**SH-481C**	**SH-48D1**	**SH-48E1**	**SH-48F1**	**SH-48G1**	**SH-48H1**	**SH-48J1**	**SH-48K1**	**SH-48L1**
Input	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz
Output Rating	9VDC 600mA	9VDC 700mA	9VDC 800mA	9VDC 900mA	9VDC 1Amp	9VDC 1.2Amp	9VDC 1.4Amp	12VDC 500mA	12VDC 700mA	12VDC 800mA	12VDC 900mA
Output Watt.	5.4	6.3	7.2	8.1	9.0	10.8	12.6	6.0	8.4	9.6	10.8
Model	**SH-48A2**	**SH-48B2**	**SH-48C2**	**SH-48D2**	**SH-48E2**	**SH-48F2**	**SH-48G2**	**SH-48H2**	**SH-48J2**	**SH-48K2**	**SH-48L2**
Input	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz
Output Rating	12VDC 1Amp	15VDC 400mA	15VDC 500mA	15VDC 600mA	15VDC 700mA	15VDC 800mA	15VDC 900mA	16VDC 400mA	16VDC 500mA	16VDC 600mA	16VDC 700mA
Output Watt.	12.0	6.0	7.5	9.0	10.5	12.0	13.5	6.4	8.0	9.6	11.2
Model	**SH-48A3**	**SH-48B3**	**SH-48C3**	**SH-48D3**	**SH-48E3**	**SH-48F3**	**SH-48G3**	**SH-48H3**	**SH-48J3**	**SH-48K3**	**SH-48L3**
Input	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz
Output Rating	16VDC 800mA	16VDC 900mA	18VDC 300mA	18VDC 400mA	18VDC 500mA	18VDC 600mA	18VDC 700mA	18VDC 800mA	20VDC 400mA	20VDC 500mA	20VDC 600mA
Output Watt.	12.8	14.4	5.4	7.2	9.0	10.8	12.6	14.4	8.0	10.0	12.0
Model	**SH-48A4**	**SH-48B4**	**SH-48C4**	**SH-48D4**	**SH-48E4**	**SH-48F4**	**SH-48G4**	**SH-48H4**	**SH-48J4**	**SH-48K4**	
Input	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	120V 50/60Hz	
Output Rating	21VDC 300mA	21VDC 400mA	21VDC 500mA	21VDC 600mA	24VDC 300mA	24VDC 400mA	24VDC 500mA	24VDC 600mA	12VDC 600mA	20VDC 700mA	
Output Watt.	6.3	8.4	10.5	12.6	7.2	9.6	12.6	14.4	7.2	14.0	

THE SIGNAL WAY OF DOING BUSINESS



PRONTO 48-Hour Shipment

We have long recognized that, in most instances, engineers and buyers need immediate delivery of transformers and chokes. To meet this challenge, Signal maintains an extensive inventory of every item in this catalog – over 1,000 different transformers and chokes. More importantly, we're dedicated to shipping out each and every order (moderate quantities) within 48 hours: and we can usually fill your entire order. We call this service "PRONTO."

Last year we shipped over 10,000 such orders and we didn't disappoint anyone.

How and Why We Are Able to Maintain Our Low Price Policy

At Signal, we sell direct. There are no salesmen or distributors – no middlemen, no extra mark-ups. We pass the savings on to you. We answer your questions directly. There is no chance of misinterpretation and you get fast, accurate answers. We maintain larger inventories than any distributors could. We're able to react to your order requirements more quickly and efficiently. These savings have enabled us to install modern machinery, specify better materials and continuously invest in new R & D. In this manner, our prices are kept as low as possible. We both profit from this policy.

Advanced Technology and Innovation

Signal has always been the leader in recognizing future trends in the industry. And have successfully pioneered the development of revolutionary new products such as:

■ **SPLIT/TRAN®** Split bobbin PC Board Transformers featuring non-concentric windings

■ **FLATHEAD®** Low profile, split bobbin designs for low height and closer board stacking

■ **2-4-1 Series** Lower cost/more efficient power transformers

All of these have subsequently become industry standards. Now we are pleased and proud to announce two new series of transformers designed to meet all international standards as well as the new, emerging generation of UL standards.

Our **ONE-4-ALL™** Series uses dual bobbins and an insulating shroud to meet international standards. It withstands a 4,000 VRMS test voltage and gives even better isolation and performance than our previous split bobbin types. At lower cost.

The same principle has been extended to our **MORE-4-LESS™** line featured on the opposite page.

Our FLATHEAD Series has been expanded to higher power levels to accommodate the demand for higher PC board power densities.

All of this is renewed confirmation of Signal's leadership in setting the standards for the entire electronic transformer industry.

Custom Requirements Are Welcome

We also recognize that no matter how hard we try, it is impossible to anticipate everyone's needs. Therefore, we are eager to discuss and evaluate your transformer and choke requirements. If we can't recommend a standard product that will do the job and save you money and time, we'll gladly quote on your requirement. Many times all that is needed is a modification of one of our standards. Again, you will get consistently high quality and very competitive prices, whether your order is for 10 or 10,000 pieces.

We don't have anyone out in the field telling you how good we are. We have to prove it to you by deed. Thank you for considering Signal.

CONTENTS (See Following Pages)

New International Series with Lower Cost & Better Performance
More-4-Less® High Power
One-4-All® International
P.C. Board Power Transformer
SPLIT/TRAN® – High Isolation
FLATHEAD® – Low Profile
Standard Miniature
Lightweight/Low-Cost Small Power Transformers (2-4-1" Series)
Rectifier Power Transformers
Chokes
Filter
Dual
Step-down Auto Transformers
Industrial Grade Power Isolation Transformers
Transformers for Triple-Output Regulated DC Supplies

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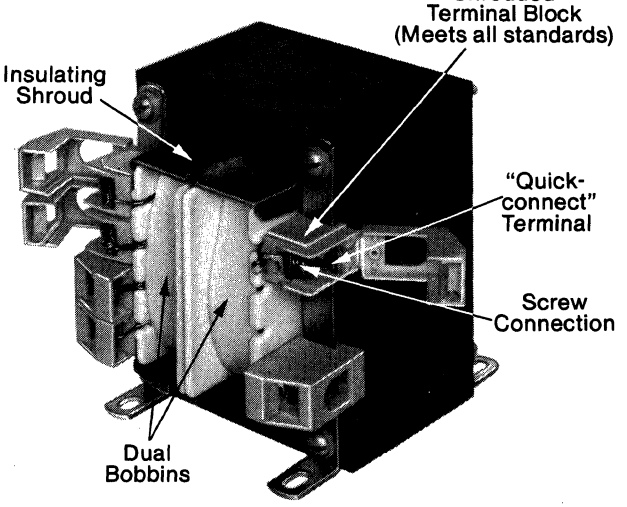
GET MUCH MORE PERFORMANCE IN LESS SPACE WITH
more-4-less™ high power transformers

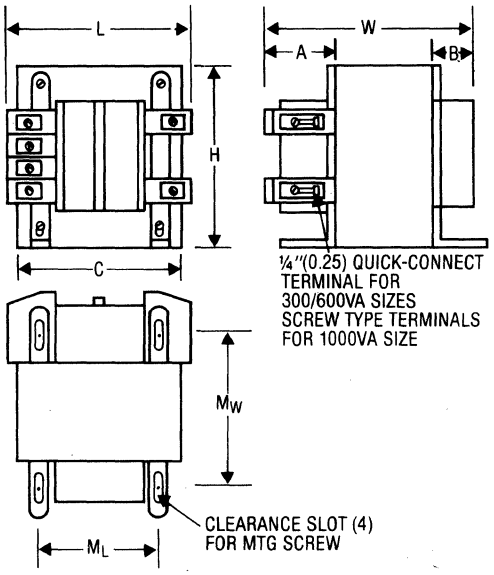


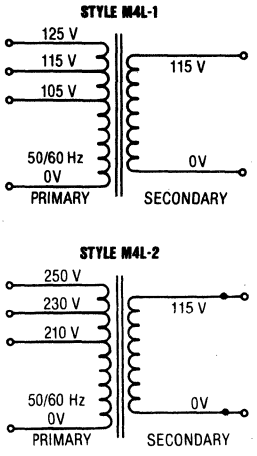
Signal's M4L Line is designed with the following "ingredients":
- Grain-Oriented Low Loss, High Saturation Steel
- High Temperature Magnet Wire
- Dual High Temperature Bobbins & Insulating Shroud
- Rugged Dual Terminals (Screw or Quick-Connect) that have international approvals (VDE, IEC, etc.) **AND**
- **Superior Electrical & Manufacturing Engineering to meet UL, CSA, VDE, IEC and all international standards.**

Which accomplish further savings by:
- Reducing the amount of steel and copper required for a given power rating
- Eliminating hand applied tapes, pads or cross-over insulation
- Reducing winding & lead terminating time.

All of which leads to more:
- ■Efficiency
- ■Isolation (4000v RMS TEST)
- ■Safety Standards (designed to meet UL, VDE, IEC, etc.)

AND Approximately ⅓ less space & weight. Hence, we call it the More-4-Less Series.





Part Number* 115V Nominal	Part Number* 230V Nominal	VA	Secondary RMS Rating	L	W	H	A	B	C	Mtg. ML	Mtg. MW	Mtg. Screw	Lbs.
M4L-1-3	M4L-2-3	300	115V @ 2.6A	3½	3⅞	3¾	1⅛	⅝	3⅛	2½	3⅛	#10	7.0
M4L-1-6	M4L-2-6	600	115V @ 5.2A	3⅞	4 15/16	4½	1 3/16	¾	3¾	3	4 1/16	#10	14.3
M4L-1-10	M4L-2-10	1000	115V @ 8.7A	5⅜	5⅞	5¼	1½	⅞	4⅜	3½	4 1/16	¼	22.0

*Less expensive versions with wire leads that do not meet VDE are available on special order.

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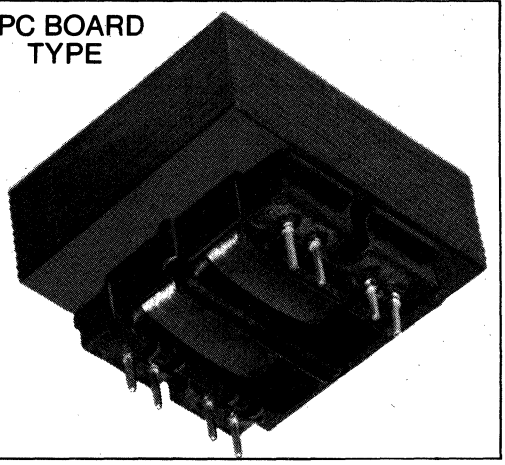
one-4-all™ international

DESIGNED TO MEET UL, VDE, IEC, CSA AND COST & BETTER PERFORMANCE THAN

PC BOARD TYPE



Signal's International Series of transformers is designed and constructed to meet all U.S. and international standards such as UL, VDE, IEC and CSA. This is accomplished by two factors:

1. The dual bobbin construction including an overall insulating shroud as indicated in the exploded view of constructional details.
2. The use of highly stable, high temperature material which more than meets UL flammability requirements.

The insulation system results in very high isolation between primary and secondary windings and from either to the core (or ground). **Hipot Test is 4000v RMS.** The dual bobbin non-concentric design reduces capacitance and eliminates the need for an electrostatic-shield.

These parts are available in both PC Board and Chassis Mount types from 2.5 to 175 va. Coil winding and wire termination are simplified by the bobbin construction and the method of winding. The dual windings are wound "bifilar" so that **all anchor and insulating tapes are eliminated.**

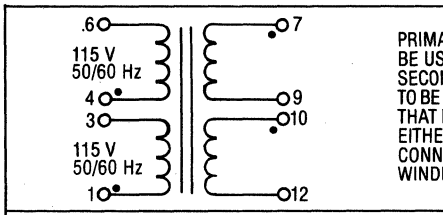
Also, since the windings are electrically balanced, there are no primary circulating currents and, if the secondaries are series-connected for a FWCT rectifier, the balance makes filtering easier.

The bobbin wall slots allow for all leads to be brought out of the winding area for termination. As a result, **all wire crossovers and insulating pads are eliminated.** The insulating shroud positions both bobbins accurately for core stacking and also provides the barriers for the 4000v RMS Test Voltage.

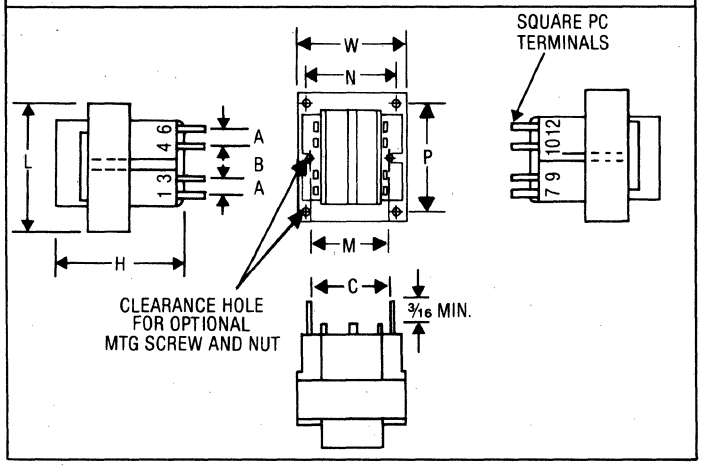
These design improvements lower manufacturing costs. As a result, the series is truly universal and can be sold at lower prices than previous "split bobbin" and "PC" types.

Again, Signal is there first - with the best - and at lower cost.

Part No.	VA (Size)	Secondary RMS Rating	
		Series	Parallel
14A-2.5-10	2.5	10V C.T. @ 0.25A	5V @ 0.5A
14A-5.0-10	5.0	10V C.T. @ 0.5A	5V @ 1.0A
14A-10-10	10.0	10V C.T. @ 1.0A	5V @ 2.0A
14A-20-10	20.0	10V C.T. @ 2.0A	5V @ 4.0A
14A-30-10	30.0	10V C.T. @ 3.0A	5V @ 6.0A
14A-56-10	56.0	10V C.T. @ 5.6A	5V @ 11.2A
14A-2.5-12	2.5	12.6V C.T. @ 0.2A	6.3V @ 0.4A
14A-5.0-12	5.0	12.6V C.T. @ 0.4A	6.3V @ 0.8A
14A-10-12	10.0	12.6V C.T. @ 0.8A	6.3V @ 1.6A
14A-20-12	20.0	12.6V C.T. @ 1.6A	6.3V @ 3.2A
14A-30-12	30.0	12.6V C.T. @ 2.4A	6.3V @ 4.8A
14A-56-12	56.0	12.6V C.T. @ 4.4A	6.3V @ 8.8A
14A-2.5-16	2.5	16V C.T. @ 0.15A	8V @ 0.3A
14A-5.0-16	5.0	16V C.T. @ 0.31A	8V @ 0.62A
14A-10-16	10.0	16V C.T. @ 0.62A	8V @ 1.25A
14A-20-16	20.0	16V C.T. @ 1.25A	8V @ 2.5A
14A-30-16	30.0	16V C.T. @ 1.9A	8V @ 3.8A
14A-56-16	56.0	16V C.T. @ 3.5A	8V @ 7.0A
14A-2.5-20	2.5	20V C.T. @ 0.12A	10V @ 0.24A
14A-5.0-20	5.0	20V C.T. @ 0.25A	10V @ 0.5A
14A-10-20	10.0	20V C.T. @ 0.5A	10V @ 1.0A
14A-20-20	20.0	20V C.T. @ 1.0A	10V @ 2.0A
14A-30-20	30.0	20V C.T. @ 1.5A	10V @ 3.0A
14A-56-20	56.0	20V C.T. @ 2.8A	10V @ 5.6A
14A-2.5-24	2.5	24V C.T. @ 0.1A	12V @ 0.2A
14A-5.0-24	5.0	24V C.T. @ 0.21A	12V @ 0.42A
14A-10-24	10.0	24V C.T. @ 0.42A	12V @ 0.84A
14A-20-24	20.0	24V C.T. @ 0.83A	12V @ 1.66A
14A-30-24	30.0	24V C.T. @ 1.25A	12V @ 2.50A
14A-56-24	56.0	24V C.T. @ 2.33A	12V @ 4.66A
14A-2.5-28	2.5	28V C.T. @ 0.09A	14V @ 0.18A
14A-5.0-28	5.0	28V C.T. @ 0.18A	14V @ 0.36A
14A-10-28	10.0	28V C.T. @ 0.36A	14V @ 0.72A
14A-20-28	20.0	28V C.T. @ 0.72A	14V @ 1.44A
14A-30-28	30.0	28V C.T. @ 1.06A	14V @ 2.12A
14A-56-28	56.0	28V C.T. @ 2.0A	14V @ 4.0A
14A-2.5-36	2.5	36V C.T. @ 0.07A	18V @ 0.14A
14A-5.0-36	5.0	36V C.T. @ 0.14A	18V @ 0.28A
14A-10-36	10.0	36V C.T. @ 0.28A	18V @ 0.56A
14A-20-36	20.0	36V C.T. @ 0.56A	18V @ 1.12A
14A-30-36	30.0	36V C.T. @ 0.82A	18V @ 1.64A
14A-56-36	56.0	36V C.T. @ 1.56A	18V @ 3.12A



PRIMARIES ARE DESIGNED TO BE USED SIMULTANEOUSLY. SECONDARIES ARE DESIGNED TO BE USED SIMULTANEOUSLY. THAT IS, THEY MUST BE USED EITHER SERIES OR PARALLEL CONNECTED (AS ONE WINDING).



Dimensions							Pin	Mtg.			Mtg. Screw		
VA	L	W	H	A	B	C	Dimensions	M	N	P	Size	Quantity	Lbs.
2.5	1 5/8	1 5/16	1 1/8	.200	.250	1.000	0.025SQ	1 1/16	—	—	#4	2	0.25
5.0	1 5/8	1 5/16	1 3/8	.200	.400	1.000	0.025SQ	1 1/16	—	—	#4	2	0.37
10.0	1 7/8	1 9/16	1 3/8	.200	.400	1.140	0.038SQ	1 1/4	—	—	#4	2	0.53
20.0	2 1/4	1 7/8	1 5/8	.400	.400	1.460	0.038SQ	1 1/2	—	—	#4	2	0.90
30.0	2 5/8	2 3/16	1 9/16	.275	.275	1.680	0.045SQ	—	1 3/4	2 3/16	#6	4	1.15
56.0	3	2 1/2	1 13/16	.300	.300	1.900	0.045SQ	—	2	2 1/2	#6	4	1.70

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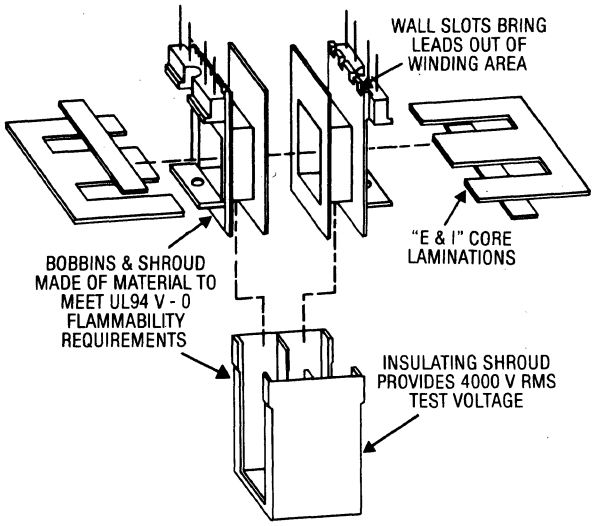
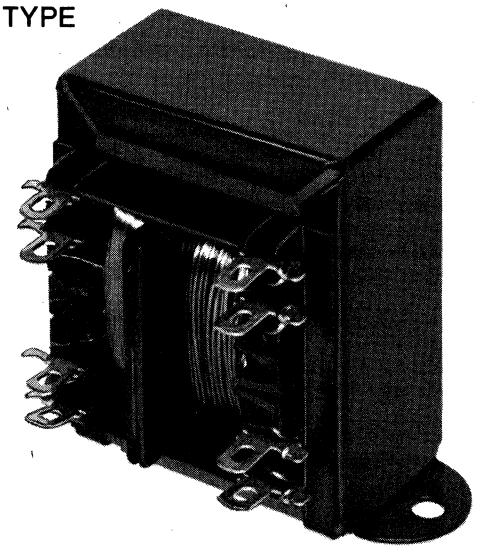
...series transformers

ALL INTERNATIONAL STANDARDS AT LOWER EXISTING SPLIT-BOBBIN TYPES!

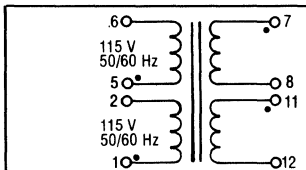
EXPLODED VIEW OF CONSTRUCTION



CHASSIS MOUNT TYPE



Part No.	VA (Size)	Secondary RMS Rating	
		Series	Parallel
A41-25-10	25	10V C.T. @ 2.5A	5V @ 5.0A
A41-43-10	43	10V C.T. @ 4.3A	5V @ 8.6A
A41-80-10	80	10V C.T. @ 8.0A	5V @ 16.0A
A41-130-10	130	10V C.T. @ 13.0A	5V @ 26.0A
A41-175-10	175	10V C.T. @ 17.5A	5V @ 35.0A
A41-25-12	25	12.6V C.T. @ 2.0A	6.3V @ 4.0A
A41-43-12	43	12.6V C.T. @ 34A	6.3V @ 6.8A
A41-80-12	80	12.6V C.T. @ 6.3A	6.3V @ 12.6A
A41-130-12	130	12.6V C.T. @ 10.3A	6.3V @ 20.6A
A41-175-12	175	12.6V C.T. @ 14.0A	6.3V @ 28.0A
A41-25-16	25	16V C.T. @ 1.6A	8V @ 3.2A
A41-43-16	43	16V C.T. @ 2.7A	8V @ 5.4A
A41-80-16	80	16V C.T. @ 5.0A	8V @ 10.0A
A41-130-16	130	16V C.T. @ 8.1A	8V @ 16.2A
A41-175-16	175	16V C.T. @ 11.0A	8V @ 22.0A
A41-25-20	25	20V C.T. @ 1.25A	10V @ 2.5A
A41-43-20	43	20V C.T. @ 2.2A	10V @ 4.4A
A41-80-20	80	20V C.T. @ 4.0A	10V @ 8.0A
A41-130-20	130	20V C.T. @ 6.5A	10V @ 13.0A
A41-175-20	175	20V C.T. @ 8.8A	10V @ 17.6A
A41-25-24	25	24V C.T. @ 1A	12V @ 2A
A41-43-24	43	24V C.T. @ 1.8A	12V @ 3.6A
A41-80-24	80	24V C.T. @ 3.3A	12V @ 6.6A
A41-130-24	130	24V C.T. @ 5.4A	12V @ 10.8A
A41-175-24	175	24V C.T. @ 7.3A	12V @ 14.6A
A41-25-28	25	28V C.T. @ 0.9A	14V @ 1.86A
A41-43-28	43	28V C.T. @ 1.5A	14V @ 3.0A
A41-80-28	80	28V C.T. @ 2.8A	14V @ 5.6A
A41-130-28	130	28V C.T. @ 4.6A	14V @ 9.2A
A41-175-28	175	28V C.T. @ 6.25A	14V @ 12.5A
A41-25-36	25	36V C.T. @ 0.7A	18V @ 1.4A
A41-43-36	43	36V C.T. @ 1.2A	18V @ 2.4A
A41-80-36	80	36V C.T. @ 2.2A	18V @ 4.4A
A41-130-36	130	36V C.T. @ 3.6A	18V @ 7.2A
A41-175-36	175	36V C.T. @ 4.8A	18V @ 9.6A
A41-25-230	25	230V C.T. @ 0.11A	115V @ 0.22A
A41-43-230	43	230V C.T. @ 0.19A	115V @ 0.38A
A41-80-230	80	230V C.T. @ 0.35A	115V @ 0.7A
A41-130-230	130	230V C.T. @ 0.57A	115V @ 1.14A
A41-175-230	175	230V C.T. @ 0.76A	115V @ 1.52A



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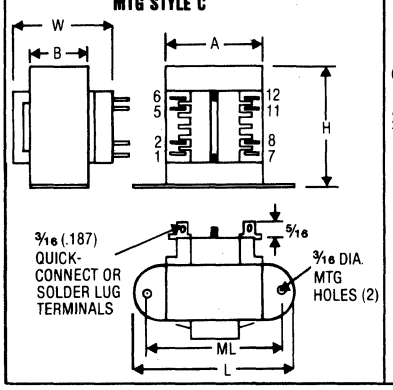
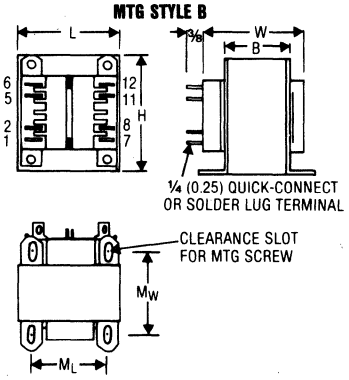
ON CUSTOM VARIATIONS ALL SIZES ARE AVAILABLE WITH 6 TERMINALS ON PRIMARY AND 6 ON SECONDARY.

MTG STYLE C



MTG STYLE B



Dimensions						Mtg. Style	Mtg.		Mtg. Screw	Lbs.
VA	L	W	H	A	B		ML	MW		
25	2 13/16	1 7/8	2 5/16	2	1 1/8	C	2 3/8	—	#6	1.25
43	3 1/8	2 1/16	2 11/16	2 1/4	1 1/8	C	2 13/16	—	#6	1.6
80	3 9/16	2 3/8	3 1/16	2 5/8	1 5/16	C	3 1/8	—	#6	2.6
130	2 13/16	2 7/8	3 3/8	—	1 5/8	B	2 1/4	2 1/2	#8	4.1
175	3 1/8	2 7/8	3 3/4	—	1 5/8	B	2 1/2	2 1/2	#8	6.5

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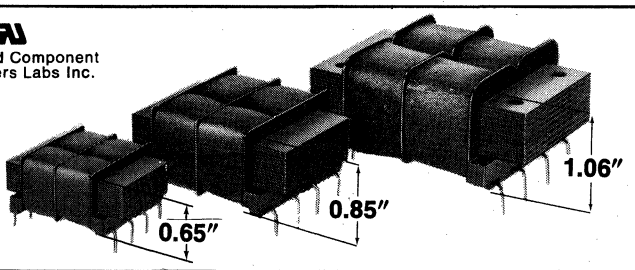
flathead® plug in power transformers

FOR PRINTED CIRCUIT APPLICATIONS

ORIGINAL SIZES
- 3 — 2.5VA — 0.650 inches high
- 6VA — 0.850 inches high
- 12VA — 1.065 inches high

Recognized Component Underwriters Labs Inc.



LOW PROFILE: Allows ¾" card spacing for 2.5va units, 1 inch card spacing for 6va units, or 1¼" inch card spacing for 12va units.

DUAL PRIMARIES: 115/230v, 50/60 Hz.

NON-CONCENTRIC WINDING: Where secondary is wound alongside primary rather than directly over it. This added isolation reduces inter-winding capacitance and **eliminates the need for an electro-static shield.**

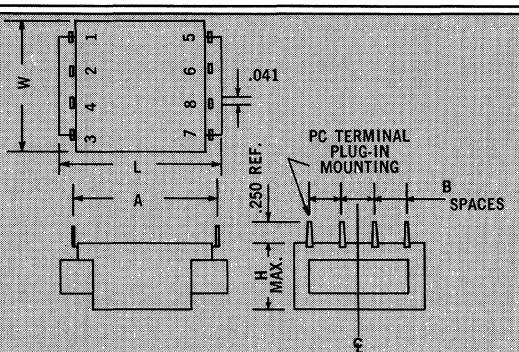
1500V. RMS HIPOT: Is standard because of the advantage of non-concentric windings.

HUM-BUCKING CONSTRUCTION: (Semi-toroidal) results in reduced radiated magnetic field and balanced windings.

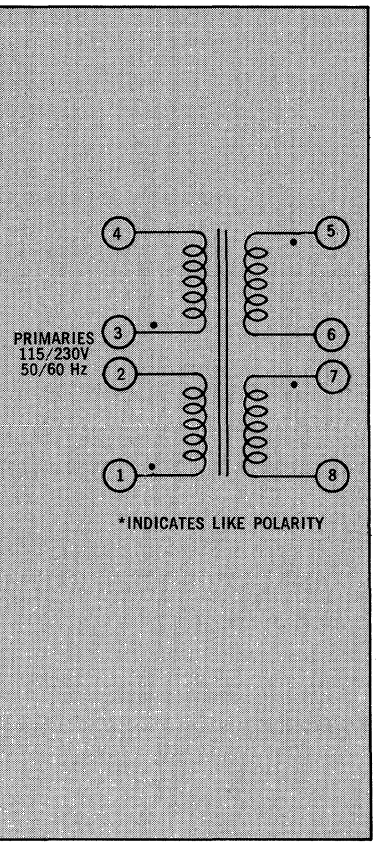
The LP line of transformers is ideal for low height, critical pc board power applications in semi-conductor control and instrumentation. They are used extensively in single or dual output dc supplies and isolated control circuit and reference supplies.

Part No.	Size	SECONDARY* Series	SECONDARY* Parallel
LP 10-250	2	10V C.T. @ 250MA	5V @ 500MA
LP 10-600	6	10V C.T. @ 600MA	5V @ 1.2A
LP 10-1200	12	10V C.T. @ 1200MA	5V @ 2.4A
LP 12-200	2	12.6V C.T. @ 200MA	6.3V @ 400MA
LP 12-450	6	12.6V C.T. @ 450MA	6.3V @ 900MA
LP 12-900	12	12.6V C.T. @ 900MA	6.3V @ 1.8A
LP 16-150	2	16V C.T. @ 150MA	8V @ 300MA
LP 16-350	6	16V C.T. @ 350MA	8V @ 700MA
LP 16-700	12	16V C.T. @ 700MA	8V @ 1.4A
LP 20-125	2	20V C.T. @ 125MA	10V @ 250MA
LP 20-300	6	20V C.T. @ 300MA	10V @ 600MA
LP 20-600	12	20V C.T. @ 600MA	10V @ 1.2A
LP 24-100	2	24V C.T. @ 100MA	12V @ 200MA
LP 24-250	6	24V C.T. @ 250MA	12V @ 500MA
LP 24-500	12	24V C.T. @ 500MA	12V @ 1A
LP 30-85	2	30V C.T. @ 85MA	15V @ 170MA
LP 30-200	6	30V C.T. @ 200MA	15V @ 400MA
LP 30-400	12	30V C.T. @ 400MA	15V @ 800MA
LP 34-75	2	34V C.T. @ 75MA	17V @ 150MA
LP 34-170	6	34V C.T. @ 170MA	17V @ 340MA
LP 34-340	12	34V C.T. @ 340MA	17V @ 680MA
LP 40-60	2	40V C.T. @ 60MA	20V @ 120MA
LP 40-150	6	40V C.T. @ 150MA	20V @ 300MA
LP 40-300	12	40V C.T. @ 300MA	20V @ 600MA
LP 56-45	2	56V C.T. @ 45MA	28V @ 90MA
LP 56-100	6	56V C.T. @ 100MA	28V @ 200MA
LP 56-200	12	56V C.T. @ 200MA	28V @ 400MA
LP 88-28	2	88V C.T. @ 28MA	44V @ 56MA
LP 88-65	6	88V C.T. @ 65MA	44V @ 130MA
LP 88-130	12	88V C.T. @ 130MA	44V @ 260MA
LP 120-20	2	120V C.T. @ 20MA	60V @ 40MA
LP 120-50	6	120V C.T. @ 50MA	60V @ 100MA
LP 120-100	12	120V C.T. @ 100MA	60V @ 200MA
LP 230-10	2	230V C.T. @ 10MA	115V @ 20MA
LP 230-25	6	230V C.T. @ 25MA	115V @ 50MA
LP 230-50	12	230V C.T. @ 50MA	115V @ 100MA

* Regulation of Size 2 and 6 units is 30%, i.e., no load-secondary voltage is 30% higher than full load. Regulation of Size 12 units is 20%.



Size	L	W	H	A	B	Oz.
2	1⅞	1⅜	0.650	1.600	0.375	5
6	1⅞	1⅜	0.850	1.600	0.375	7
12	2½	2	1.065	2.000	0.500	11



Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

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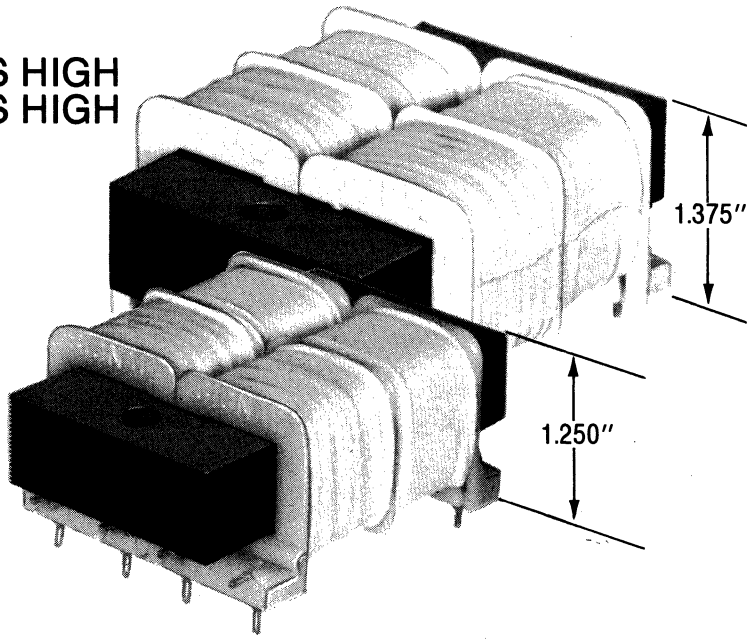
...in 2 new larger sizes

24 VA - 1.250 INCHES HIGH
48 VA - 1.375 INCHES HIGH

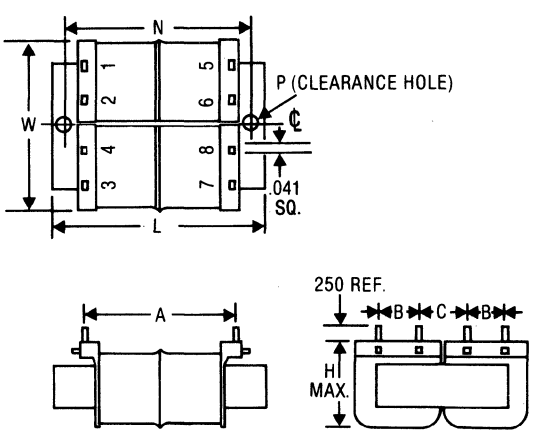
Signal has expanded its Flathead® Series because of the trend toward higher power usage on PC boards. Two new sizes (24 and 48 VA) are described on this page.

Basic design, layout and construction specifications have not changed. The only exception is that more rugged plug-in pins, using square wire, have been incorporated in order to properly handle the weights and currents required.



Part No.	Size	Secondary* Series	Secondary* Parallel
LP 10-2400	24	10V C.T. @ 2.40A	5V @ 4.80A
LP 10-4800	48	10V C.T. @ 4.80A	5V @ 9.60A
LP 12-1900	24	12.6V C.T. @ 1.90A	6.3V @ 3.80A
LP 1-3800	48	12.6V C.T. @ 3.80A	6.3V @ 7.60A
LP 16-1500	24	16V C.T. @ 1.50A	8V @ 3.00A
LP 16-3000	48	16V C.T. @ 3.00A	8V @ 6.00A
LP 20-1200	24	20V C.T. @ 1.20A	10V @ 2.40A
LP 20-2400	48	20V C.T. @ 2.40A	10V @ 4.80A
LP 24-1000	24	24V C.T. @ 1.00A	12V @ 2.00A
LP 24-2000	48	24V C.T. @ 2.00A	12V @ 4.00A
LP 30- 800	24	30V C.T. @ 800 MA	15V @ 1.60A
LP 30-1600	48	30V C.T. @ 1.60A	15V @ 3.20A
LP 34- 700	24	34V C.T. @ 700MA	17V @ 1.40A
LP 34-1400	48	34V C.T. @ 1.40A	17V @ 2.80A
LP 40- 600	24	40V C.T. @ 600MA	20V @ 1.20A
LP 40-1200	48	40V C.T. @ 1.20A	20V @ 2.40A
LP 56- 425	24	56V C.T. @ 425MA	28V @ 850MA
LP 56- 850	48	56V C.T. @ 850MA	28V @ 1.70A

*Regulation of size 24 and 48 units is 15% i.e. no load-secondary voltage is 15% higher than full load.



Size	A	B	C	L	W	H	N	P	Oz.
24	1.900	.600	.530	2.87	2.25	1.250	2.41	CLEARANCE HOLE FOR #4 SCREW	15
48	2.180	.600	.660	3.12	2.50	1.375	2.62	CLEARANCE HOLE FOR #6 SCREW	21

Special variations of stock items are available upon request.

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p.c. board transformers for triple-output regulated supplies

IDEAL FOR MICROPROCESSOR APPLICATIONS

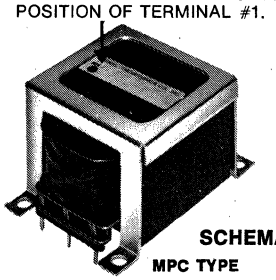
"MP" types have been developed specifically for use in triple-output regulated DC supplies that are commonly used in **Microprocessor Circuits** and other logic, op-amp combinations. Two output combinations have been provided, namely 5V and ±12V, and 5V and ±15V.

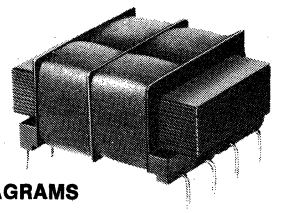
All "MP" units are rated in terms of the final **DC** output after a standard three terminal IC regulator. They are designed to provide these outputs with AC line inputs of 100 to 130V 50/60 Hz (or 200 to 260V for nominal 230V lines).

Two basic mechanical configurations are available. Standard PC types (MPC or DMPC) are tested to pass 1500V RMS hipot. Optional mounting brackets are available. MPL types are based on Signal's "flat-head" style and feature low profile, 115/230V primaries, hum-bucking construction, 1500V RMS hipot and the advantages of non-concentric winding (low inter-winding capacitance, high isolation, and no need for an electro-static shield).

All MP's are stocked in depth for immediate delivery. In addition, special variations can be supplied with reasonable delivery times.

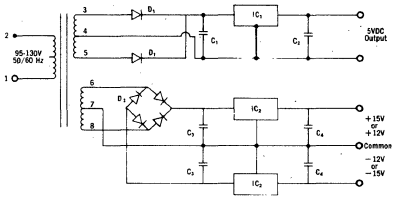
BLACK DOT ON LABEL INDICATES POSITION OF TERMINAL #1.



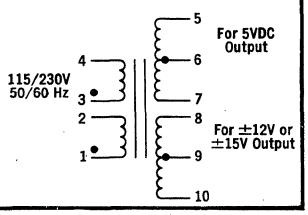


SCHEMATIC DIAGRAMS

MPC TYPE



DMPC & MPL TYPES

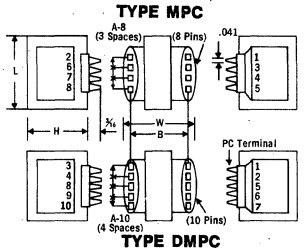


MPC & DMPC TYPES

PART NUMBER PRIMARY 50/60 Hz		DC OUTPUT			SUGGESTED COMPONENTS							
115V (8 Pin)	115/230V (10 Pin)	Regulator I	Regulator II	Size	C_1	C_2	C_3	C_4	D_1(2)	D_2(4)	IC_1*	IC_2*
MPC-X-12	DMPC-X-12	5VDC 360ma	±12VDC 60ma	X	2100MFD 30V	2.7MFD 20V	250MFD 50V	10MFD 20V	1N4001	1N4002	LM341P-5.0	LM326N
MPC-X-15	DMPC-X-15	5VDC 360ma	±15VDC 50ma	X	2100MFD 30V	2.7MFD 20V	250MFD 50V	10MFD 20V	1N4001	1N4002	LM341P-5.0	LM325N
MPC-Y-12	DMPC-Y-12	5VDC 835ma	±12VDC 150ma	Y	4000MFD 20V	2.7MFD 20V	1000MFD 50V	2.7MFD 20V	1N4001	1N4002	LM340K-5.0	LM326N
MPC-Y-15	DMPC-Y-15	5VDC 835ma	±15VDC 130ma	Y	4000MFD 20V	2.7MFD 20V	1000MFD 50V	2.7MFD 20V	1N4001	1N4002	LM340K-5.0	LM325N
MPL TYPES (Dual 115/230V Primary is Standard)												
MPL- 6-12		5VDC 135ma	±12VDC 40ma	6	1000MFD 20V	2.7MFD 20V	150MFD 50V	10MFD 20V	1N4001	1N4002	LM342P-5.0	LM326N
MPL- 6-15		5VDC 135ma	±15VDC 35ma	6	1000MFD 20V	2.7MFD 20V	150MFD 50V	10MFD 20V	1N4001	1N4002	LM342P-5.0	LM325N
MPL-12-12		5VDC 270ma	±12VDC 85ma	12	2100MFD 30V	2.7MFD 20V	250MFD 50V	10MFD 20V	1N4001	1N4002	LM341P-5.0	LM326N
MPL-12-15		5VDC 270ma	±15VDC 70ma	12	2100MFD 30V	2.7MFD 20V	250MFD 50V	10MFD 20V	1N4001	1N4002	LM341P-5.0	LM325N

*National Semiconductor

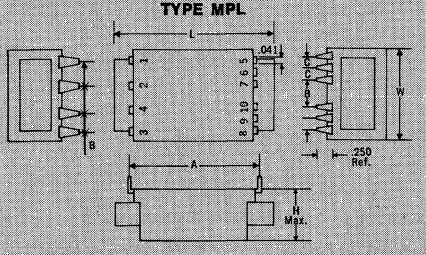
TYPE MPC



TYPE DMPC

Size	L	W	H	A-8 (8 Pin)	A-10 (10 Pin)	B	Lbs.	Optional Bracket No.	MW	MD
X	1⅞	1 1/16	1⅝	.250	.200	1.300	.56	10-BR	1 43/64	1⅛
Y	1⅝	2¼	1⅜	.250	.200	2.100	.75	24-BR	1⅜	2

TYPE MPL



Size	L	W	H	A	B	C	Lbs.
6	1⅞	1 1/16	0.850	1.600	0.375	0.187	.43
12	2½	2	1.065	2.000	0.500	0.250	.68

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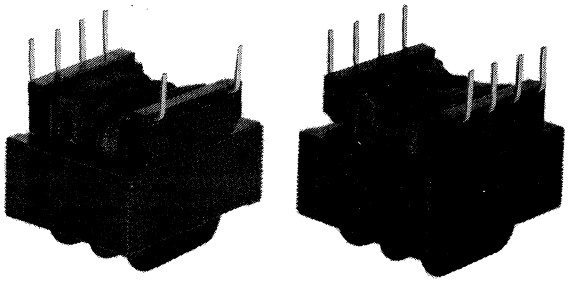
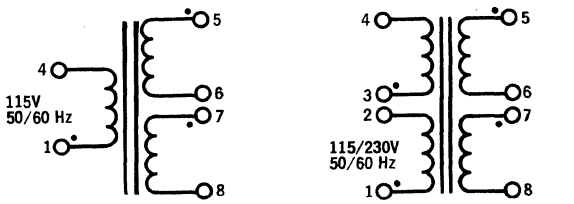
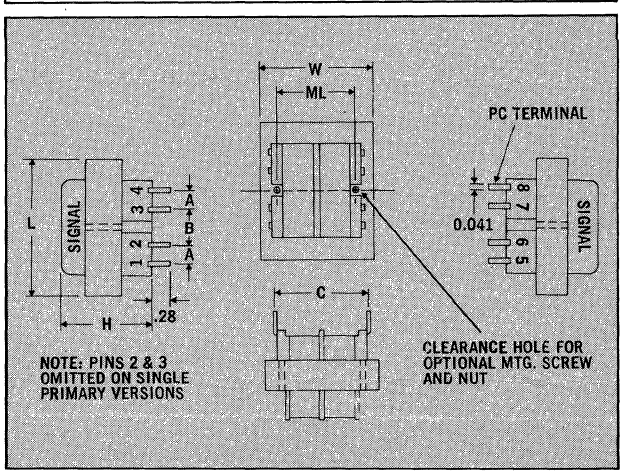
split/tran® p.c. board transformers

SPLIT BOBBIN—HIGHLY ISOLATED

Recognized Component
Underwriters Labs Inc.







Size	VA	L	W	H	ML	A	B	C	Optional Mtg. Screw & Nut*	Lbs.
2	1.1	1 3/8	1 1/8	15/16	—	.250	.250	1.200	None	0.17
3	2.4	1 3/8	1 1/8	1 3/16	—	.250	.250	1.200	None	0.25
4	6	1 5/8	1 5/16	1 5/16	1 1/16	.250	.350	1.280	4-40 x 1 3/8 Nylon	0.44
5	12	1 7/8	1 9/16	1 7/16	1 1/4	.300	.400	1.410	4-40 x 1 3/8 Nylon	0.70
6	20	2 1/4	1 7/8	1 7/16	1 1/2	.300	.400	1.600	4-40 x 1 3/8 Nylon	0.80
7	36	2 5/8	2 3/16	1 9/16	†	.400	.400	1.850	†	1.1

* Available from Signal: Part No. ST-MS (Screw) & Part No. ST-MN (Nut).
† Size 7 has 4 mtg. holes on 2 3/16 x 1 3/4 centers for a #6 screw. Need not be nylon.

"Split-Tran" transformers combine the best features of our "2-4-1" Series and Signal's pioneering line of pc board miniature transformers.

The use of a "split bobbin" allows the primaries and secondaries to be wound non-concentrically, i.e., side by side rather than one over the other. This results in cost savings and superior performance, namely:

- High isolation — **2500V** hipot is standard.
- Low capacitive coupling — no electro-static shield necessary.
- Less manufacturing time — no cross-overs of primary and secondary leads.
- PC pins — allow direct insertion in PC boards.
- Class S insulation — 130°C.

Each transformer is available with single 115V or dual 115/230V primaries. In addition, secondaries are split so that they can be series or parallel connected.

Special variations will be quoted and shipped promptly.

PART NUMBER*		SECONDARY RMS RATING	
Single 115V 6 Pin	Dual 115/230V 8 Pin	Series	Parallel
ST 2-10	DST 2-10	10V C.T. @ 0.11A	5V @ 0.22A
ST 3-10	DST 3-10	10V C.T. @ 0.25A	5V @ 0.5A
ST 4-10	DST 4-10	10V C.T. @ 0.6A	5V @ 1.2A
ST 5-10	DST 5-10	10V C.T. @ 1.2A	5V @ 2.4A
ST 6-10	DST 6-10	10V C.T. @ 2A	5V @ 4A
ST 7-10	DST 7-10	10V C.T. @ 3.6A	5V @ 7.2A
ST 2-12	DST 2-12	12.6V C.T. @ 0.09A	6.3V @ 0.18A
ST 3-12	DST 3-12	12.6V C.T. @ 0.2A	6.3V @ 0.4A
ST 4-12	DST 4-12	12.6V C.T. @ 0.5A	6.3V @ 1.0A
ST 5-12	DST 5-12	12.6V C.T. @ 1.0A	6.3V @ 2.0A
ST 6-12	DST 6-12	12.6V C.T. @ 1.6A	6.3V @ 3.2A
ST 7-12	DST 7-12	12.6V C.T. @ 2.85A	6.3V @ 5.7A
ST 2-16	DST 2-16	16V C.T. @ 0.07A	8V @ 0.14A
ST 3-16	DST 3-16	16V C.T. @ 0.15A	8V @ 0.3A
ST 4-16	DST 4-16	16V C.T. @ 0.4A	8V @ 0.8A
ST 5-16	DST 5-16	16V C.T. @ 0.8A	8V @ 1.6A
ST 6-16	DST 6-16	16V C.T. @ 1.25A	8V @ 2.5A
ST 7-16	DST 7-16	16V C.T. @ 2.25A	8V @ 4.5A
ST 2-20	DST 2-20	20V C.T. @ 0.055A	10V @ 0.11A
ST 3-20	DST 3-20	20V C.T. @ 0.12A	10V @ 0.24A
ST 4-20	DST 4-20	20V C.T. @ 0.3A	10V @ 0.6A
ST 5-20	DST 5-20	20V C.T. @ 0.6A	10V @ 1.2A
ST 6-20	DST 6-20	20V C.T. @ 1A	10V @ 2A
ST 7-20	DST 7-20	20V C.T. @ 1.8A	10V @ 3.6A
ST 2-24	DST 2-24	24V C.T. @ 0.045A	12V @ 0.09A
ST 3-24	DST 3-24	24V C.T. @ 0.1A	12V @ 0.2A
ST 4-24	DST 4-24	24V C.T. @ 0.25A	12V @ 0.5A
ST 5-24	DST 5-24	24V C.T. @ 0.5A	12V @ 1.0A
ST 6-24	DST 6-24	24V C.T. @ 0.8A	12V @ 1.6A
ST 7-24	DST 7-24	24V C.T. @ 1.5A	12V @ 3.0A
ST 2-28	DST 2-28	28V C.T. @ 0.04A	14V @ 0.08A
ST 3-28	DST 3-28	28V C.T. @ 0.085A	14V @ 0.17A
ST 4-28	DST 4-28	28V C.T. @ 0.2A	14V @ 0.4A
ST 5 28	DST 5-28	28V C.T. @ 0.42A	14V @ 0.84A
ST 6-28	DST 6-28	28V C.T. @ 0.7A	14V @ 1.4A
ST 7-28	DST 7-28	28V C.T. @ 1.3A	14V @ 2.6A
ST 2-36	DST 2-36	36V C.T. @ 0.03A	18V @ 0.06A
ST 3-36	DST 3-36	36V C.T. @ 0.065A	18V @ 0.13A
ST 4-36	DST 4-36	36V C.T. @ 0.17A	18V @ 0.34A
ST 5-36	DST 5-36	36V C.T. @ 0.35A	18V @ 0.7A
ST 6-36	DST 6-36	36V C.T. @ 0.55A	18V @ 1.1A
ST 7-36	DST 7-36	36V C.T. @ 1A	18V @ 2A
ST 2-48	DST 2-48	48V C.T. @ 0.023A	24V @ 0.046A
ST 3-48	DST 3-48	48V C.T. @ 0.05A	24V @ 0.1A
ST 4-48	DST 4-48	48V C.T. @ 0.125A	24V @ 0.25A
ST 5-48	DST 5-48	48V C.T. @ 0.25A	24V @ 0.5A
ST 6-48	DST 6-48	48V C.T. @ 0.4A	24V @ 0.8A
ST 7-48	DST 7-48	48V C.T. @ 0.75A	24V @ 1.5A
ST 2-56	DST 2-56	56V C.T. @ 0.02A	28V @ 0.04A
ST 3-56	DST 3-56	56V C.T. @ 0.045A	28V @ 0.09A
ST 4-56	DST 4-56	56V C.T. @ 0.11A	28V @ 0.22A
ST 5-56	DST 5-56	56V C.T. @ 0.22A	28V @ 0.44A
ST 6-56	DST 6-56	56V C.T. @ 0.35A	28C @ 0.7A
ST 7-56	DST 7-56	56V C.T. @ 0.65A	28V @ 1.3A
ST 2-120	DST 2-120	120V C.T. @ 0.01A	60V @ 0.02A
ST 3-120	DST 3-120	120V C.T. @ 0.02A	60V @ 0.04A
ST 4-120	DST 4-120	120V C.T. @ 0.05A	60V @ 0.1A
ST 5-120	DST 5-120	120V C.T. @ 0.1A	60V @ 0.2A
ST 6-120	DST 6-120	120V C.T. @ 0.16A	60V @ 0.32A
ST 7-120	DST 7-120	120V C.T. @ 0.3A	60V @ 0.6A

* Explanation of Part Number: Series - ST; Size 4; Series Secondary Volts - 36

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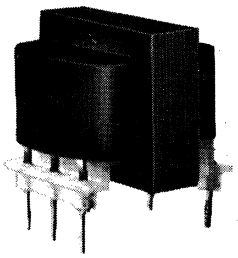
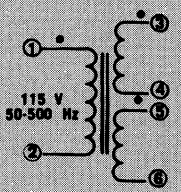
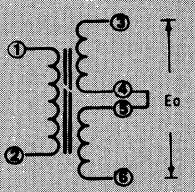
miniature plug in power transformers

SINGLE 115V PRIMARY TYPE PC 6 PINS

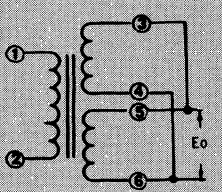




BASIC SCHEMATIC

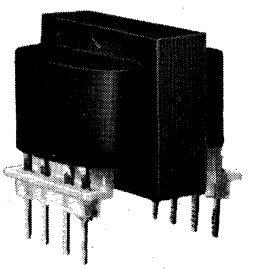


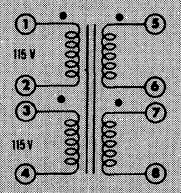
SERIES CONNECTED



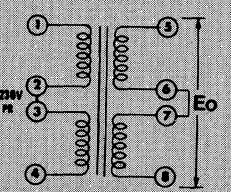
PARALLEL CONNECTED

DUAL 115/230V PRIMARY TYPE DPC 8 PINS

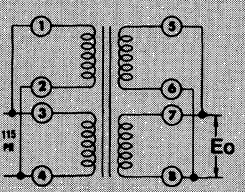




BASIC SCHEMATIC



SERIES CONNECTED



PARALLEL CONNECTED

PRIMARY 50/500 Hz		SECONDARY RMS RATING*		Size (VA)
Single 115V (6 Pin)	Dual 115/230V (8 Pin)	Series	Parallel	
PC 10-90	DPC 10-90	10V C.T. @ 90MA	5V @ 180MA	1.0
PC 10-120	DPC 10-120	10V C.T. @ 120MA	5V @ 240MA	1.2
PC 10-440	DPC 10-440	10V C.T. @ 440MA	5V @ 880MA	4.4
PC 10-1000	DPC 10-1000	10V C.T. @ 1A	5V @ 2A	10
PC 10-2400	DPC 10-2400	10V C.T. @ 2.4A	5V @ 4.8A	24
PC 12-70	DPC 12-70	12.6V C.T. @ 70MA	6.3V @ 140MA	1.0
PC 12-100	DPC 12-100	12.6V C.T. @ 100MA	6.3V @ 200MA	1.2
PC 12-350	DPC 12-350	12.6V C.T. @ 350MA	6.3V @ 700MA	4.4
PC 12-800	DPC 12-800	12.6V C.T. @ 800MA	6.3V @ 1.6A	10
PC 12-2000	DPC 12-2000	12.6V C.T. @ 2A	6.3V @ 4A	24
PC 16-55	DPC 16-55	16V C.T. @ 55MA	8V @ 110MA	1.0
PC 16-75	DPC 16-75	16V C.T. @ 75MA	8V @ 150MA	1.2
PC 16-260	DPC 16-260	16V C.T. @ 260MA	8V @ 520MA	4.4
PC 16-640	DPC 16-640	16V C.T. @ 640MA	8V @ 1.28A	10
PC 16-1500	DPC 16-1500	16V C.T. @ 1.5A	8V @ 3A	24
PC 20-45	DPC 20-45	20V C.T. @ 45MA	10V @ 90MA	1.0
PC 20-60	DPC 20-60	20V C.T. @ 60MA	10V @ 120MA	1.2
PC 20-220	DPC 20-220	20V C.T. @ 220MA	10V @ 440MA	4.4
PC 20-500	DPC 20-500	20V C.T. @ 500MA	10V @ 1A	10
PC 20-1200	DPC 20-1200	20V C.T. @ 1.2A	10V @ 2.4A	24
PC 24-35	DPC 24-35	24V C.T. @ 35MA	12V @ 70MA	1.0
PC 24-50	DPC 24-50	24V C.T. @ 50MA	12V @ 100MA	1.2
PC 24-180	DPC 24-180	24V C.T. @ 180MA	12V @ 360MA	4.4
PC 24-450	DPC 24-450	24V C.T. @ 450MA	12V @ 900MA	10
PC 24-1000	DPC 24-1000	24V C.T. @ 1A	12V @ 2A	24
PC 28-30	DPC 28-30	28V C.T. @ 30MA	14V @ 60MA	1.0
PC 28-40	DPC 28-40	28V C.T. @ 40MA	14V @ 80MA	1.2
PC 28-160	DPC 28-160	28V C.T. @ 160MA	14V @ 320MA	4.4
PC 28-360	DPC 28-360	28V C.T. @ 360MA	14V @ 720MA	10
PC 28-800	DPC 28-800	28V C.T. @ 800MA	14V @ 1.6A	24
PC 34-25	DPC 34-25	34V C.T. @ 25MA	17V @ 50MA	1.0
PC 34-35	DPC 34-35	34V C.T. @ 35MA	17V @ 70MA	1.2
PC 34-125	DPC 34-125	34V C.T. @ 125MA	17V @ 250MA	4.4
PC 34-300	DPC 34-300	34V C.T. @ 300MA	17V @ 600MA	10
PC 34-700	DPC 34-700	34V C.T. @ 700MA	17V @ 1.4A	24
PC 40-20	DPC 40-20	40V C.T. @ 20MA	20V @ 40MA	1.0
PC 40-30	DPC 40-30	40V C.T. @ 30MA	20V @ 60MA	1.2
PC 40-110	DPC 40-110	40V C.T. @ 110MA	20V @ 220MA	4.4
PC 40-250	DPC 40-250	40V C.T. @ 250MA	20V @ 500MA	10
PC 40-600	DPC 40-600	40V C.T. @ 600MA	20V @ 1.2A	24
PC 56-15	DPC 56-15	56V C.T. @ 15MA	28V @ 30MA	1.0
PC 56-20	DPC 56-20	56V C.T. @ 20MA	28V @ 40MA	1.2
PC 56-80	DPC 56-80	56V C.T. @ 80MA	28V @ 160MA	4.4
PC 56-180	DPC 56-180	56V C.T. @ 180MA	28V @ 360MA	10
PC 56-420	DPC 56-420	56V C.T. @ 420MA	28V @ 840MA	24
PC 120-8	DPC 120-8	120V C.T. @ 8MA	60V @ 16MA	1.0
PC 120-10	DPC 120-10	120V C.T. @ 10MA	60V @ 20MA	1.2
PC 120-35	DPC 120-35	120V C.T. @ 35MA	60V @ 70MA	4.4
PC 120-85	DPC 120-85	120V C.T. @ 85MA	60V @ 170MA	10
PC 120-200	DPC 120-200	120V C.T. @ 200MA	60V @ 400MA	24

* See Table on opposite page for method of determining RMS Secondary Current.

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. . . for printed circuits applications

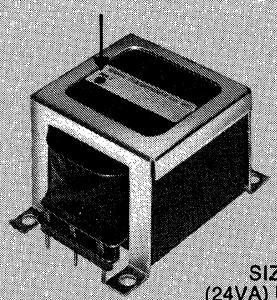
Signal has the most complete and diversified selection of miniature plug-in power transformers.

Primary ratings of 115V (Style PC - 6 Pin) or Dual 115/230V (Style DPC -8 Pin) are standard for the entire line. 1500V. Hipot is standard.

Size 1.0 is used extensively where height is a limiting factor since its height of 0.83 inches allows 1 inch spacing of PC boards. Size 24 is unusual since 24 watt PC transformers are not readily available, especially with a height of 1⅜ inches.

The RMS current ratings are based on a load regulation of 15-20% and not on temperature rise (except for the largest item, size 24). Therefore, these ratings may be exceeded without overheating, if the additional drop in full load voltage is acceptable. There is, of course, a limit and it would be best to check with our engineering department on specific units.

BLACK DOT ON LABEL INDICATES POSITION OF TERMINAL #1.



SIZE 24 (24VA) UNIT WITH 24-BR SLIDE-ON MOUNTING BRACKET

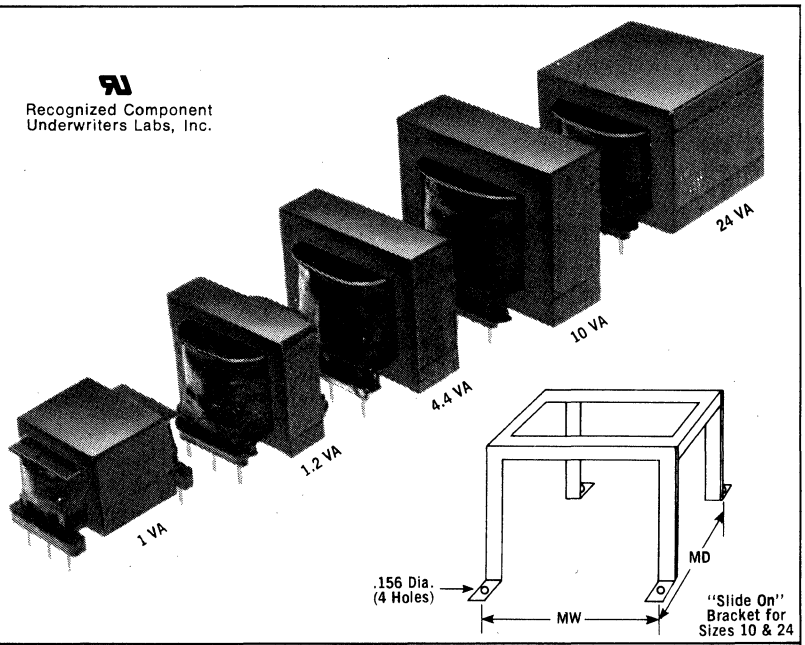
METHOD OF DETERMINING SECONDARY CURRENT RATINGS

The secondary currents shown in the tables are RMS ratings. Depending upon rectifier circuit configurations, the RMS secondary current is different than the DC output current. This is indicated in the chart below:

Rectifier Type	Filter Type	RMS Secondary Current Is
Full Wave Center-Tap	Choke Input	= 0.7 x DC Amps
Full Wave Center-Tap	Capacitor Input	= 1 to 1.2 x DC Amps
Full Wave Bridge	Choke Input	= DC Amps
Full Wave Bridge	Capacitor Input	= 1.6 to 1.8 x DC Amps

For example, in a F.W. Bridge circuit with a capacitive filter, if the load is 1 Amp DC, the RMS Secondary current is 1.6 to 1.8 Amp RMS.

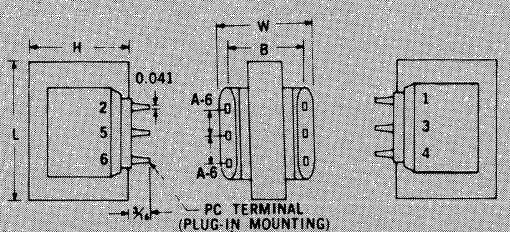
Recognized Component
Underwriters Labs, Inc.



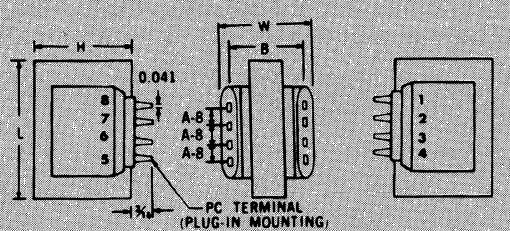
DIMENSIONS

Size (VA)	L	W	H	A-6 (6 Pin)	A-8 (8 Pin)	B	WT. (oz.)	OPTIONAL BRACKET* No.	MW	MD
1.0	1	1⅜	0.83	0.250	0.200	1.200	2.5	—	—	—
1.2	1⅜	1⅛	1 3/16	0.312	0.200	1.000	3	—	—	—
4.4	1⅝	1¼	1⅜	0.400	0.250	1.100	5	—	—	—
10	1⅞	1 1/16	1⅝	0.400	0.250	1.300	9	10-BR	1 41/64	1⅛
24	1⅝	2¼	1⅜	0.400	0.250	2.100	12	24-BR	1⅜	2

* An optional "Slide On" Mounting Bracket is available for sizes 10 and 24. The brackets do not use up any extra "Floor Space" but add 1/32" to the height of the transformer.



TYPE PC 6 PINS



TYPE DPC 8 PINS

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cut size and weight with "2-4-1".....

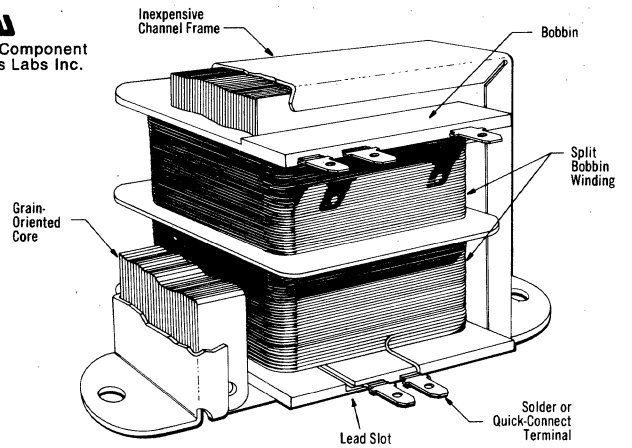
The 2-4-1 series is an illustration of the use of creative design applied to small power transformers. The result is a line where, for a given va rating, size and weight are reduced almost 50%. Hence the name "241" series.

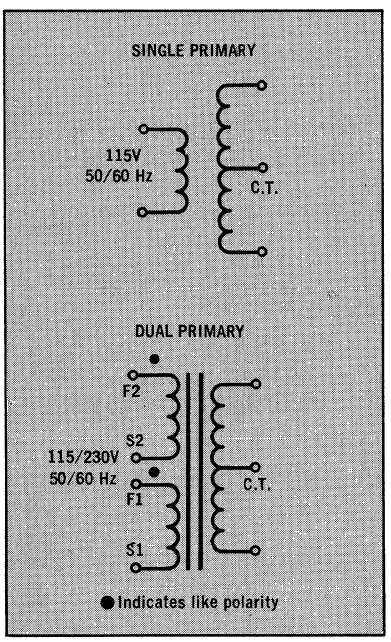
- GRAIN ORIENTED CORE — High Saturation Density — Lower Core Loss — Less Steel and Copper.
- BOBBIN WOUND — Maximum Utilization of Winding Area — Space and Size Reduced.
- SPLIT BOBBIN — NON-CONCENTRIC WINDING — Lower Capacitance — Better Insulation — 2500V RMS Hipot — No need for Electro-Static Shield — High Isolation and Insulation Resistance. No Cross-Overs of Primary and Secondary Leads.
- SPECIAL TERMINAL — Solder or Quick-Connect.

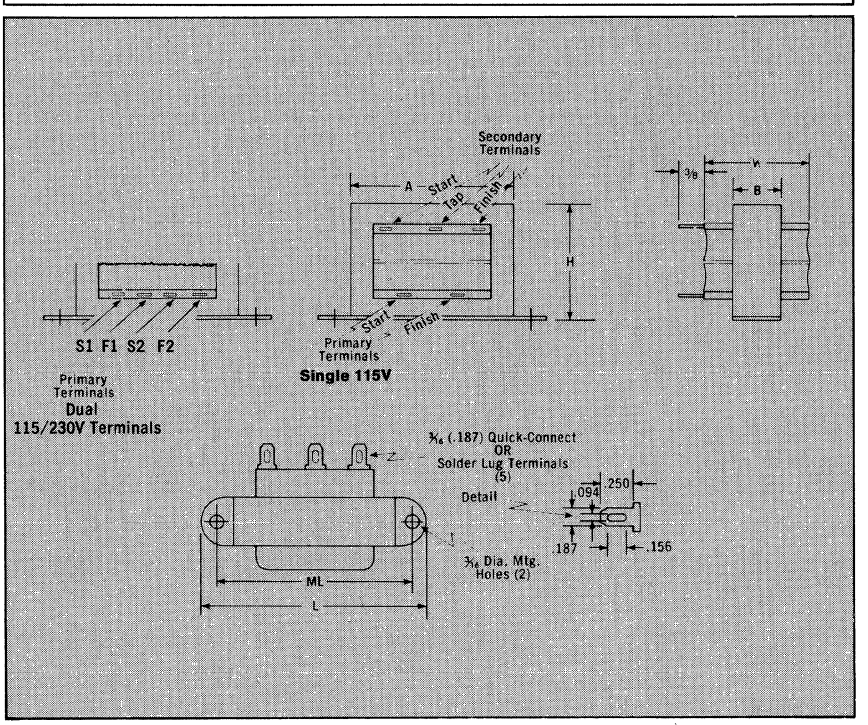
The series is available with single 115V or dual 115/230V primary, rated 50/60 Hz. Class S insulation is used for a maximum total temperature rating of 130°C continuous.

AVAILABLE WITH SINGLE (115V) OR DUAL (115/230V) PRIMARIES

Recognized Component Underwriters Labs Inc.







DIMENSIONS

Size	VA	L	W	H	A	B	ML	Lbs.
3	2.4	2 1/16	1 1/16	1 3/16	1 5/8	9/16	1 3/4	0.25
4	6	2 3/8	1 1/4	1 3/8	1 11/16	11/16	2	0.44
5	12	2 13/16	1 3/8	1 5/8	1 13/16	13/16	2 3/8	0.7
6	30	3 1/4	1 11/16	1 15/16	2 5/16	1 1/16	2 13/16	1.1
7	56	3 11/16	1 13/16	2 1/4	2 11/16	1 1/16	3 1/8	1.7
8	100	4 1/32	2 1/4	2 9/16	3 1/16	1 5/16	3 5/16	2.75

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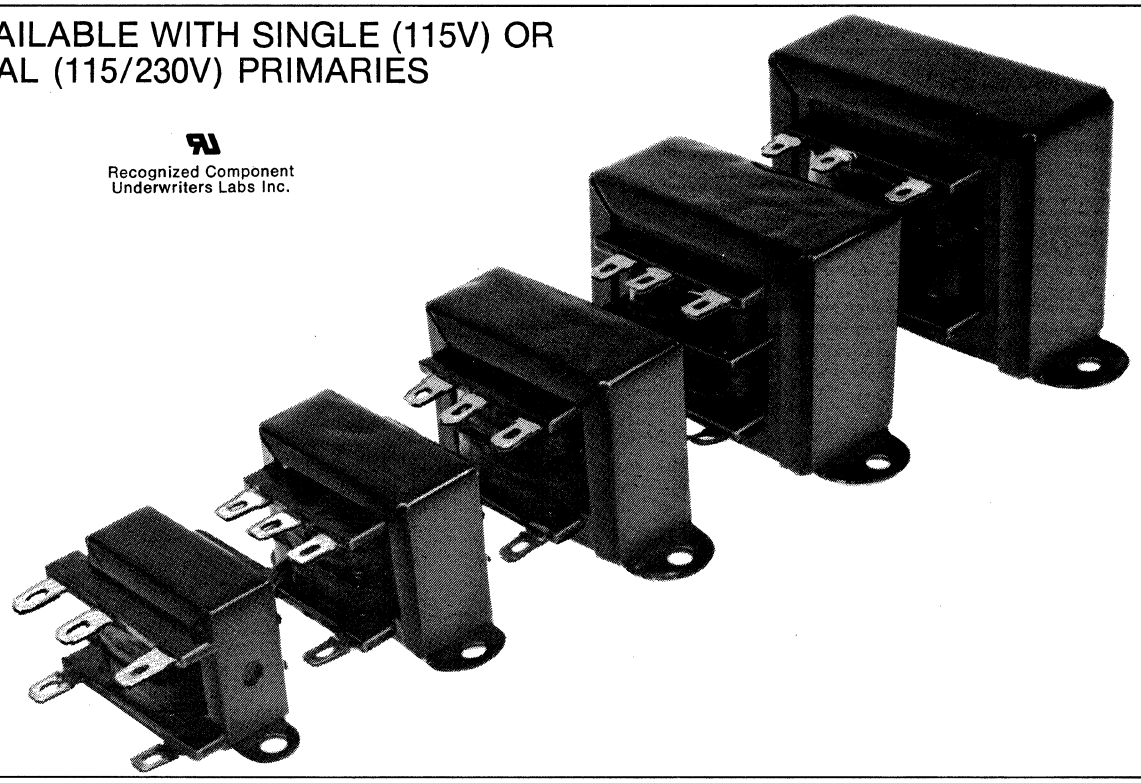
series of small power transformers

AVAILABLE WITH SINGLE (115V) OR DUAL (115/230V) PRIMARIES

Recognized Component
Underwriters Labs Inc.



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Full Wave Bridge	Capacitor Input	= 1.6 to 1.8 x DC Amps

For example, in a F. W. Bridge circuit with a capacitive filter, if the load is 1 Amp DC, the RMS Secondary current is 1.6 to 1.8 Amp RMS.

CUSTOM VARIATIONS

Signal is equipped to quote on Custom Variations of "241" types. The secondary combinations are restricted by the number of secondary terminals available, as follows:

Size	Maximum Number of Secondary Terminals	VA Rating
3	3	2.4
4	4	6
5	4	12
6	5	30
7	5	56
8	5	100

We answer requests promptly and can deliver prototypes in one to three weeks. Production lead times can be scheduled with very reasonable lead times.

Part Number		Secondary RMS Ratng	Part Number		Secondary RMS Rating
Single 115V	Dual 115/230V		Single 115V	Dual 115/230V	
241-3-10	Not Available	10V C.T. @ 0.25A	241-3-28	Not Available	28V C.T. @ 0.085A
241-4-10	DP 241-4-10	10V C.T. @ 0.6A	241-4-28	DP 241-4-28	28V C.T. @ 0.2A
241-5-10	DP 241-5-10	10V C.T. @ 1.2A	241-5-28	DP 241-5-28	28V C.T. @ 0.42A
241-6-10	DP 241-6-10	10V C.T. @ 3.0A	241-6-28	DP 241-6-28	28V C.T. @ 1.1A
241-7-10	DP 241-7-10	10V C.T. @ 5.0A	241-7-28	DP 241-7-28	28V C.T. @ 2.0A
241-8-10	DP 241-8-10	10V C.T. @ 10A	241-8-28	DP 241-8-28	28V C.T. @ 3.6A
241-3-12	Not Available	12.6V C.T. @ 0.2A	241-3-36	Not Available	36V C.T. @ 0.065A
241-4-12	DP 241-4-12	12.6V C.T. @ 0.5A	241-4-36	DP 241-4-36	36V C.T. @ 0.17A
241-5-12	DP 241-5-12	12.6V C.T. @ 1.0A	241-5-36	DP 241-5-36	36V C.T. @ 0.35A
241-6-12	DP 241-6-12	12.6V C.T. @ 2.5A	241-6-36	DP 241-6-36	36V C.T. @ 0.85A
241-7-12	DP 241-7-12	12.6V C.T. @ 4.0A	241-7-36	DP 241-7-36	36V C.T. @ 1.5A
241-8-12	DP 241-8-12	12.6V C.T. @ 8.0A	241-8-36	DP 241-8-36	36V C.T. @ 2.8A
241-3-16	Not Available	16V C.T. @ 0.15A	241-3-48	Not Available	48V C.T. @ 0.05A
241-4-16	DP 241-4-16	16V C.T. @ 0.4A	241-4-48	DP 241-4-48	48V C.T. @ 0.125A
241-5-16	DP 241-5-16	16V C.T. @ 0.8A	241-5-48	DP 241-5-48	48V C.T. @ 0.25A
241-6-16	DP 241-6-16	16V C.T. @ 2.0A	241-6-48	DP 241-6-48	48V C.T. @ 0.63A
241-7-16	DP 241-7-16	16V C.T. @ 3.5A	241-7-48	DP 241-7-48	48V C.T. @ 1.2A
241-8-16	DP 241-8-16	16V C.T. @ 6.25A	241-8-48	DP 241-8-48	48V C.T. @ 2.0A
241-3-20	Not Available	20V C.T. @ 0.12A	241-3-56	Not Available	56V C.T. @ 0.045A
241-4-20	DP 241-4-20	20V C.T. @ 0.3A	241-4-56	DP 241-4-56	56V C.T. @ 0.11A
241-5-20	DP 241-5-20	20V C.T. @ 0.6A	241-5-56	DP 241-5-56	56V C.T. @ 0.22A
241-6-20	DP 241-6-20	20V C.T. @ 1.5A	241-6-56	DP 241-6-56	56V C.T. @ 0.54A
241-7-20	DP 241-7-20	20V C.T. @ 2.8A	241-7-56	DP 241-7-56	56V C.T. @ 1.0A
241-8-20	DP 241-8-20	20V C.T. @ 5.0A	241-8-56	DP 241-8-56	56V C.T. @ 1.8A
241-3-24	Not Available	24V C.T. @ 0.1A	241-3-120	Not Available	120V C.T. @ 0.02A
241-4-24	DP 241-4-24	24V C.T. @ 0.25A	241-4-120	DP 241-4-120	120V C.T. @ 0.05A
241-5-24	DP 241-5-24	24V C.T. @ 0.5A	241-5-120	DP 241-5-120	120V C.T. @ 0.1A
241-6-24	DP 241-6-24	24V C.T. @ 1.25A	241-6-120	DP 241-6-120	120V C.T. @ 0.25A
241-7-24	DP 241-7-24	24V C.T. @ 2.4A	241-7-120	DP 241-7-120	120V C.T. @ 0.5A
241-8-24	DP 241-8-24	24V C.T. @ 4.0A	241-8-120	DP 241-8-120	120V C.T. @ 0.85A

Explanation of part number series 241 Size-4 Sec. Volts - 36 Prefix "DP" used for dual primary versions

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rectifier power transformers

CHOICE OF SINGLE 115V OR DUAL 115/230V PRIMARIES

Primary 50/60 Hz		Secondary RMS Rating*									
Single 115V.	Dual* 115/230V.	Series	Parallel	Mtg. Style	L	W	H	ML	MW	Mtg. Screw	Approx. Lbs.
10-1	DL 10-1	10V C.T. @ 1A	5V C.T. @ 2A	C	2 7/8	1 3/4	2 5/16	2 3/8	—	#8	1.0
10-2	DL 10-2	10V C.T. @ 2A	5V C.T. @ 4A	C	3 1/8	2 1/8	2 3/4	2 13/16	—	#8	1.5
10-4	DL 10-4	10V C.T. @ 4A	5V C.T. @ 8A	C	3 5/16	2 3/8	3 1/16	3 1/8	—	#8	2.3
10-6	DL 10-6	10V C.T. @ 6A	5V C.T. @ 12A	B	3 3/8	2 3/4	2 13/16	2 13/16	2 1/8	#8	3.3
10-8	DL 10-8	10V C.T. @ 8A	5V C.T. @ 16A	B	3 3/8	3 1/8	2 13/16	2 13/16	2 1/2	#8	4.0
10-12	DL 10-12	10V C.T. @ 12A	5V C.T. @ 24A	B	3 3/4	3 1/4	3 1/8	3 1/8	2 1/2	#8	5.0
10-25	DL 10-25	10V C.T. @ 25A	5V C.T. @ 50A	B	4 1/2	3 3/4	3 3/4	3 3/4	2 3/4	#10	8.7
10-50‡	DL 10-50	10V C.T. @ 50A	5V C.T. @ 100A	B	5 1/4	5 1/2	4 3/8	4 3/8	3 5/8	1/4	17.0
10-100‡	DL 10-100	10V C.T. @ 100A	5V C.T. @ 200A	B	6 3/8	7 1/4	5 5/16	5 5/16	4 3/8	1/4	34.5
12.8-1	DL 12.8-1	12.8V C.T. @ 1A	6.4V C.T. @ 2A	C	2 7/8	2	2 5/16	2 3/8	—	#8	1.2
12.8-2	DL 12.8-2	12.8V C.T. @ 2A	6.4V C.T. @ 4A	B	3	2 1/2	2 1/2	2 1/2	2	#8	2.3
12.8-4	DL 12.8-4	12.8V C.T. @ 4A	6.4V C.T. @ 8A	B	3	2 7/8	2 1/2	2 1/2	2 3/8	#8	2.8
12.8-6	DL 12.8-6	12.8V C.T. @ 6A	6.4V C.T. @ 12A	B	3 3/8	3 1/16	2 13/16	2 13/16	2 1/2	#8	4.0
12.8-8	DL 12.8-8	12.8V C.T. @ 8A	6.4V C.T. @ 16A	B	3 3/4	3 1/8	3 1/8	3 1/8	2 1/4	#8	4.5
12.8-12	DL 12.8-12	12.8V C.T. @ 12A	6.4V C.T. @ 24A	B	4 1/8	3 1/4	3 7/16	3 7/16	2 3/8	#10	6.0
12.8-25	DL 12.8-25	12.8V C.T. @ 25A	6.4V C.T. @ 50A	B	5 1/4	4 1/4	4 3/8	4 3/8	2 7/8	#10	12.5
12.8-50‡	DL 12.8-50	12.8V C.T. @ 50A	6.4V C.T. @ 100A	B	5 1/4	6	4 3/8	4 3/8	4 1/8	1/4	20.7
12.8-100‡	DL 12.8-100	12.8V C.T. @ 100A	6.4V C.T. @ 200A	B	6 3/8	7 1/4	5 5/16	5 5/16	4 3/8	1/4	34.5
16-1	DL 16-1	16V C.T. @ 1A	8V C.T. @ 2A	C	2 7/8	2	2 5/16	2 3/8	—	#8	1.2
16-2	DL 16-2	16V C.T. @ 2A	8V C.T. @ 4A	C	3 1/8	2 1/4	2 3/4	2 13/16	—	#8	1.7
16-4	DL 16-4	16V C.T. @ 4A	8V C.T. @ 8A	B	3 3/8	2 3/4	2 13/16	2 13/16	2 1/8	#8	3.3
16-6	DL 16-6	16V C.T. @ 6A	8V C.T. @ 12A	B	3 3/4	3 1/8	3 1/8	3 1/8	2 1/4	#10	4.5
16-8	DL 16-8	16V C.T. @ 8A	8V C.T. @ 16A	B	3 3/4	3 1/2	3 1/8	3 1/8	2 5/8	#10	5.4
16-12	DL 16-12	16V C.T. @ 12A	8V C.T. @ 24A	B	4 1/8	3 7/8	3 7/16	3 7/16	3	#10	7.9
16-25	DL 16-25	16V C.T. @ 25A	8V C.T. @ 50A	B	4 1/2	5 3/8	3 3/4	3 3/4	4	#10	14.5
16-50‡	DL 16-50	16V C.T. @ 50A	8V C.T. @ 100A	B	6 3/8	5 3/4	5 5/16	5 5/16	3 3/4	1/4	26.5
16-100‡	DL 16-100	16V C.T. @ 100A	8V C.T. @ 200A	B	7 1/2	7 1/2	6 3/8	6 3/4	4 5/8	1/4	50.0
24-1	DL 24-1	24V C.T. @ 1A	12V C.T. @ 2A	B	3	2 1/2	2 1/2	2 1/2	2	#8	2.3
24-2	DL 24-2	24V C.T. @ 2A	12V C.T. @ 4A	B	3	2 7/8	2 1/2	2 1/2	2 3/8	#8	2.9
24-4	DL 24-4	24V C.T. @ 4A	12V C.T. @ 8A	B	3 3/4	3 1/8	3 1/8	3 1/8	2 1/4	#8	4.5
24-6	DL 24-6	24V C.T. @ 6A	12V C.T. @ 12A	B	4 1/8	3 1/4	3 7/16	3 7/16	2 3/8	#10	5.8
24-8	DL 24-8	24V C.T. @ 8A	12V C.T. @ 16A	B	4 1/8	3 7/8		3 7/16	3	#10	7.9
24-12‡	DL 24-12	24V C.T. @ 12A	12V C.T. @ 24A	B	4 1/2	4 1/2	3 3/4	3 3/4	3 3/8	#10	11.0
24-20‡	DL 24-20	24V C.T. @ 20A	12V C.T. @ 40A	B	5 1/4	4 3/4	4 3/8	4 3/8	3 3/8	1/4	15.3
24-25‡	DL 24-25	24V C.T. @ 25A	12V C.T. @ 50A	B	5 1/4	5 5/8	4 3/8	4 3/8	4 1/8	1/4	19.5
24-50‡	DL 24-50	24V C.T. @ 50A	12V C.T. @ 100A	B	6 3/8	6 1/4	5 5/16	5 5/16	4 3/8	1/4	31.3
——	24-100 △	24V C.T. @ 100A	12V C.T. @ 200A	B	7 1/2	7	6 3/8	6 3/4	4 1/8	1/4	43.0
36-1	DL 36-1	36V C.T. @ 1A	18V C.T. @ 2A	B	3	2 3/4	2 1/2	2 1/2	2 1/4	#8	2.6
36-2	DL 36-2	36V C.T. @ 2A	18V C.T. @ 4A	B	3 3/8	2 15/16	2 13/16	2 13/16	2 3/8	#8	3.8
36-4	DL 36-4	36V C.T. @ 4A	18V C.T. @ 8A	B	4 1/8	3 3/8	3 7/16	3 7/16	2 5/8	#10	6.8
36-6	DL 36-6	36V C.T. @ 6A	18V C.T. @ 12A	B	4 1/2	3 3/4	3 3/4	3 3/4	2 3/4	#10	8.7
36-8‡	DL 36-8	36V C.T. @ 8A	18V C.T. @ 16A	B	4 1/2	4 1/2	3 3/4	3 3/4	3 3/8	#10	11.0
36-12‡	DL 36-12	36V C.T. @ 12A	18V C.T. @ 24A	B	5 1/4	5	4 3/8	4 3/8	3 3/8	1/4	15.0
36-20‡	DL 36-20	36V C.T. @ 20A	18V C.T. @ 40A	B	6 3/8	5 3/8	5 5/16	5 5/16	3 3/8	1/4	22.8
36-25‡	DL 36-25	36V C.T. @ 25A	18V C.T. @ 50A	B	6 3/8	5 3/4	5 5/16	5 5/16	3 3/4	1/4	26.5
36-30‡	DL 36-30	36V C.T. @ 30A	18V C.T. @ 60A	B	6 3/8	6	5 5/16	5 5/16	4 3/8	1/4	31.5
——	36-50△	36V C.T. @ 50A	18V C.T. @ 100A	B	6 3/8	7 1/4	5 5/16	5 5/16	5 1/8	1/4	40.0
56-1	DL 56-1	56V C.T. @ 1A	28V C.T. @ 2A	B	3 3/8	2 7/8	2 13/16	2 13/16	2 1/4	#8	3.5
56-2	DL 56-2	56V C.T. @ 2A	28V C.T. @ 4A	B	3 3/4	3 1/4	3 1/8	3 1/8	2 1/2	#8	5.0
56-4	DL 56-4	56V C.T. @ 4A	28V C.T. @ 8A	B	4 1/8	3 3/4	3 7/16	3 7/16	3	#10	7.7
56-6	DL 56-6	56V C.T. @ 6A	28V C.T. @ 12A	B	5 1/4	4 1/4	4 3/8	4 3/8	2 7/8	#10	12.0
56-8‡	DL 56-8	56V C.T. @ 8A	28V C.T. @ 16A	B	5 1/4	5	4 3/8	4 3/8	3 5/8	1/4	17.0
56-12†	DL 56-12	56V C.T. @ 12A	28V C.T. @ 24A	B	6 3/8	5 1/4	5 5/16	5 5/16	3 3/8	1/4	22.0
56-25‡	DL 56-25	56V C.T. @ 25A	28V C.T. @ 50A	B	6 3/8	7 1/8	5 5/16	5 5/16	5 1/8	1/4	38.0
——	56-50△	56V C.T. @ 50A	28V C.T. @ 100A	B	7 1/2	7 1/2	6 1/4	6 3/4	4 7/8	1/4	56.3
68-1	DL 68-1	68V C.T. @ 1A	34V C.T. @ 2A	B	3 3/8	2 15/16	2 13/16	2 13/16	2 3/8	#8	3.8
68-2	DL 68-2	68V C.T. @ 2A	34V C.T. @ 4A	B	4 1/8	3 3/8	3 7/16	3 7/16	2 5/8	#10	6.8
68-4	DL 68-4	68V C.T. @ 4A	34V C.T. @ 8A	B	4 1/2	4 1/2	3 3/4	3 3/4	3 3/8	#10	11.5
68-6‡	DL 68-6	68V C.T. @ 6A	34V C.T. @ 12A	B	5 1/4	5	4 3/8	4 3/8	3 3/8	1/4	15.0
68-8‡	DL 68-8	68V C.T. @ 8A	34V C.T. @ 16A	B	5 1/4	5 1/2	4 3/8	4 3/8	3 7/8	1/4	19.0
68-12‡	DL 68-12	68V C.T. @ 12A	34V C.T. @ 24A	B	6 3/8	5 3/4	5 5/16	5 5/16	3 3/4	1/4	26.5
——	68-25△	68V C.T. @ 25A	34V C.T. @ 50A	B	6 3/8	7 1/4	5 5/16	5 5/16	5 1/8	1/4	39.7
80-1	DL 80-1	80V C.T. @ 1A	40V C.T. @ 2A	B	3 3/8	3 1/16	2 13/16	2 13/16	2 1/2	#8	4.0
80-2	DL 80-2	80V C.T. @ 2A	40V C.T. @ 4A	B	4 1/8	3 3/8	3 7/16	3 7/16	2 5/8	#10	6.8
80-4	DL 80-4	80V C.T. @ 4A	40V C.T. @ 8A	B	5 1/4	4 1/4	4 3/8	4 3/8	2 7/8	1/4	12.3
80-6‡	DL 80-6	80V C.T. @ 6A	40V C.T. @ 12A	B	5 1/4	5 1/2	4 3/8	4 3/8	3 7/8	1/4	19.0
80-8‡	DL 80-8	80V C.T. @ 8A	40V C.T. @ 16A	B	6 3/8	5 1/4	5 5/16	5 5/16	3 1/4	1/4	20.5
80-12‡	DL 80-12	80V C.T. @ 12A	40V C.T. @ 24A	B	6 3/8	6	5 5/16	5 5/16	4 1/8	1/4	29.0
——	80-25△	80V C.T. @ 25A	40V C.T. @ 50A	B	7 1/2	6 1/2	6 1/4	6 3/4	3 7/8	1/4	40.3

△Available with dual primary only. Therefore, prefix "DL" is not required.
‡ Nominal 115V primary has added taps, I.E., 105/115/125V, Dual (DL) version is 115/230V only.

Items shown in shaded area are not normally in stock. They are standard designs generally available in 3-4 weeks.

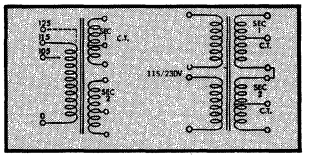
All transformers are designed conservatively and are rated for 50/60 Hz. Only prime raw materials are used. Units are thoroughly impregnated and baked with Signal's own high gloss varnish. The transformers and chokes are rugged in construction, well insulated, and have a consistently uniform appearance. All ratings are at full load current continuous operation. Hipot rating of 1500V RMS is standard.

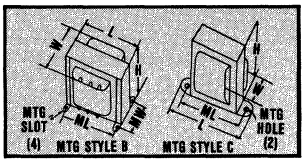
Electrical ratings have been chosen to cover a wide range of applications. All transformers have two center-tapped secondary windings, which may be series or parallel connected as indicated in rating chart.

*The secondary currents shown in the tables are RMS ratings. Depending upon rectifier circuit configurations, the RMS secondary current is different than the DC output current. This is indicated in the chart below:

Rectifier Type	Filter Type	RMS Secondary Current Is
Full Wave Center-Tap	Choke Input	= 0.7 x DC Amps
Full Wave Center-Tap	Capacitor Input	= 1 to 1.2 x DC Amps
Full Wave Bridge	Choke Input	= DC Amps
Full Wave Bridge	Capacitor Input	= 1.6 to 1.8 x DC Amps

For example, in a F.W. Bridge circuit with a capacitive filter, if the load is 1 Amp DC, the RMS Secondary current is 1.6 to 1.8 Amp RMS.





An Insilco Company Dept. EM, 500 Bayview Ave., Inwood, NY 11696 Telephone: (516) 239-5777 signal TRANSFORMER

filter chokes

1.0 TO 200 AMPS

Signal's line of filter chokes is the most extensive available. It is designed to complement the selection of Rectifier Power Transformers so that a set may be specified for power supplies using inductive filters.

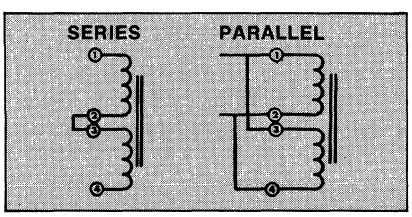
The inductance ratings given are minimum values guaranteed at full DC current. All resistance ratings are maximum values. Special variations or intermediate values of inductance, current, or resistance can be supplied promptly and accurately.

FOR MECHANICAL DIMENSIONS REFER TO TRANSFORMER OUTLINES ON PREVIOUS PAGE

Part No.	Inductance (MHY)	Current (Amps)	Resistance (Ohms)	Mtg. Style	L	W	H	ML	MW	Mtg. Screw	Approx. Lbs.
CH-1	100	1	1.5	B	3	2½	2½	2½	2	#8	2.3
CH-2	70	2	0.9	B	3⅜	2¾	2⅞	2 13/16	2⅛	#8	3.2
CH-4	70	4	0.6	B	3¾	3⅛	3¼	3⅛	2½	#8	5.3
CH-6	40	6	0.4	B	3¾	3⅝	3¼	3⅛	3	#8	6.5
CH-8	30	8	0.3	B	4⅛	3⅝	3½	3 1/16	3	#10	8
CH-12	15	12	0.1	B	5¼	4	4 1/16	4⅜	3⅛	#10	13.7
CH-16	15	16	0.08	B	5¼	4⅝	4 1/16	4⅜	3⅝	#10	17.5
CH-20	7	20	0.05	B	5¼	4	4 1/16	4⅜	3⅛	#10	13.3
CH-25	5	25	0.025	B	5¼	4¾	4 1/16	4⅜	3⅞	#10	17.8
CH-30	4	30	0.01	B	6⅜	5	5⅜	5 5/16	3⅜	¼	24.4
CH-50	1.4	50	0.01	B	6⅜	5¼	5⅜	5 5/16	3¾	¼	26.7
CH-100	0.5	100	0.005	B	6⅜	6¼	5⅜	5 5/16	4⅛	¼	31.4
CH-200	0.3	200	0.001	B	7½	7½	6¼	6¾	4⅛	¼	48.0

dual chokes

FOR LOWER INDUCTANCE APPLICATIONS

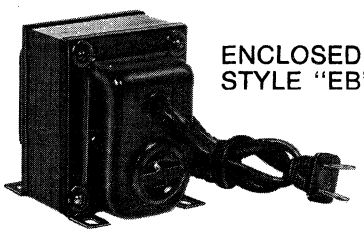


Part No.	Series Connected Ind. (MHY)	Series Connected Curr. (Amps)	Series Connected Res. Ω	Parallel Connected Ind. (MHY)	Parallel Connected Curr. (Amps)	Parallel Connected Res. Ω	Mtg. Style	Dimensions L	W	H	ML	MW	Mtg. Screw	Appr. Lbs.
CL-1-2	72	1	1.4	18	2	0.35	C	2⅞	1¾	2 5/16	2⅜	—	#8	0.9
CL-2-4	40	2	0.7	10	4	0.18	C	3⅛	2⅛	2¾	2 13/16	—	#8	1.5
CL-4-8	20	4	0.3	5	8	0.075	B	3	2⅞	2½	2½	2½	#8	3.0
CL-6-12	12	6	0.15	3	12	0.038	B	3⅜	3 1/16	2 13/16	2 13/16	2½	#8	4.0
CL-12-24	4.8	12	0.052	1.2	24	0.013	B	3⅜	3 1/16	2 13/16	2 13/16	3	#8	5.3
CL-25-50	1.2	25	0.012	0.3	50	0.003	B	3¾	3⅜	3⅜	3⅛	2¾	#8	6.0
CL-50-100	0.5	50	0.0043	0.12	100	0.0011	B	4½	3¾	3¾	3¾	2½	#8	8.0

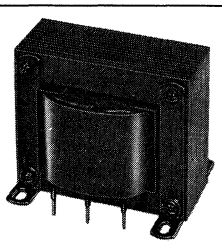
Signal's Dual Chokes are supplied with 2 windings which may be series or parallel connected with rating shown on chart. This line is basically designed for application requiring lower inductance value at high currents, such as low voltage, DC supplies or SCR filters.

step down auto transformers

50/60 Hz 100-2000 VA — 230/115V



ENCLOSED STYLE "EB"



OPEN FRAME STYLE "OF"

(May be used step-up or step-down)

UL APPROVED 2 PRONG LINE CORD RECEPTACLE — LOW REGULATION
BLACK ENAMEL FINISH

VA	Cat. No.	Width	Depth	Height	Mtg. Centers	Lbs.
100	110	1⅞	2⅜	2½	1½ x 1 1/16	1.5
120	112	2⅛	2⅛	3½	2¼ x 1¾	3.0
150	115	2⅞	3⅜	3½	2¼ x 2	3.5
200	120	2⅞	3½	3½	2¼ x 2⅛	4.0
250	125	2⅞	3⅞	3½	2¼ x 2½	4.8
300	130	3¼	3⅞	3⅞	2½ x 2 7/16	5.5
500	150	3¼	4⅞	3⅞	2½ x 3 7/16	8
750	175	3¼	5⅞	3⅞	2½ x 4 7/16	11
1000	1100	4½	5⅛	5½	3½ x 3½	14
1500	1150	4½	6⅛	5½	3½ x 4½	20
2000	1200	4½	7⅛	5½	3½ x 5½	26

BLACK ENAMEL FINISH. 8" LEADS
INEXPENSIVE VERSION FOR USE IN EQUIPMENT

VA	Cat. No.	Width	Depth	Height	Mtg. Centers	Lbs.
100	110-OF	2¼	2	1 15/16	2 13/16*	1.3
120	112-OF	3⅜	2½	2⅞	2 13/16 x 1⅞	2.5
150	115-OF	3⅜	2¾	2⅞	2 13/16 x 2⅛	3.0
200	120-OF	3⅜	2⅞	2⅞	2 13/16 x 2¼	3.5
250	125-OF	3⅜	3¼	2⅞	2 13/16 x 2⅝	4.2
300	130-OF	3¾	3¼	3⅛	3⅛ x 2½	5.0
500	150-OF	3¾	4¼	3⅛	3⅛ x 3½	8.0
750	175-OF	3¾	5¼	3⅛	3⅛ x 4½	11
1000	1100-OF	5¼	4½	4⅜	4⅜ x 3⅛	14
1500	1150-OF	5¼	5½	4⅜	4⅜ x 4⅛	19
2000	1200-OF	5¼	6½	4⅜	4⅜ x 5⅛	25

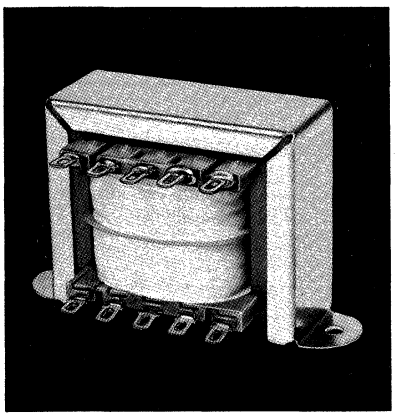
* Part 110-OF is mounted by means of a channel with 2 mtg. tabs.

Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

signal TRANSFORMER

Dept. EM, 500 Bayview Ave., Inwood, N.Y. 11696
Tel.: (516) 239-5777
An Insilco Company

"2-4-1" style split-bobbin transformers for triple-output (μp) applications (type MT)



Signal has extended its line of triple-output transformers for microprocessor applications with three new sizes rated to 100VA (35 watts DC regulated). Similar to the split-bobbin design used in Signal's "2-4-1" series, the chassis-mounted style allows for these new higher power applications.

Two output combinations are provided: 5V and ±12V; and 5V and ±15V. Designated "MT" (single primary) and "DMT" (dual primary), these transformers are rated in terms of the final DC output after a 3-terminal IC regulator. They are designed to provide these outputs with AC line inputs of 100-130V, 50/60 Hz (or 200-260V for nominal 230V lines). All auxiliary components required to complete the DC supply are tabulated.

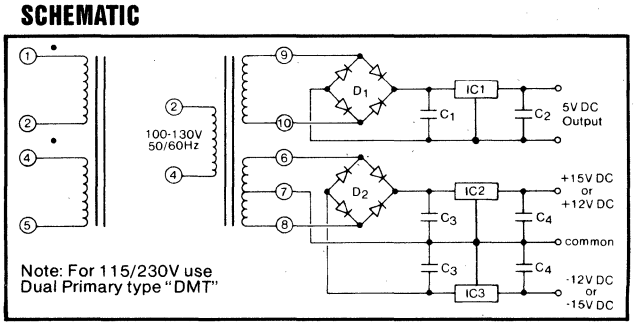
All MT types are stocked in depth for immediate delivery. In addition, custom variations can be supplied with minimal turnaround time.

Specifications

PART NUMBER PRIMARY 50/60Hz		DC OUTPUT		SIZE	SUGGESTED COMPONENTS C_2, C_4 See Note ①						
115V	115/230V	Regulator 1	Regulator 2		C_1	C_3	IC1③	IC2③	IC3③	D1④	D2④
MT-6-12	DMT-6-12	5V @ 1.75A	±12V @ 210MA	6	10 KMFD @ 20V DC	1.5 KMFD @ 50V DC	LM-323K-5	LM-340K-12	LM-320K-12	3N253	3N247
MT-6-15	DMT-6-15	5V @ 1.75A	±15V @ 175MA	6			LM-323K-5	LM-340K-15	LM-320K-15	3N253	3N247
MT-7-12	DMT-7-12	5V @ 2.8A	±12V @ 350MA	7	15 KMFD @ 20V DC	2 KMFD @ 50V DC	LM-323K-5	LM-340K-12	LM-320K-12	MDA-400	3N247
MT-7-15	DMT-7-15	5V @ 2.8A	±15V @ 280MA	7			LM-323K-5	LM-340K-15	LM-320K-15	MDA-400	3N247
MT-8-12	DMT-8-12	5V @ 4A	±12V @ 600MA	8	26 KMFD @ 20V DC	3.1 KMFD @ 50V DC	LM-338②	LM-340K-12	LM-320K-12	MDA-800	3N247
MT-8-15	DMT-8-15	5V @ 4A	±15V @ 500MA	8			LM-338②	LM-340K-15	LM-320K-15	MDA-800	3N247

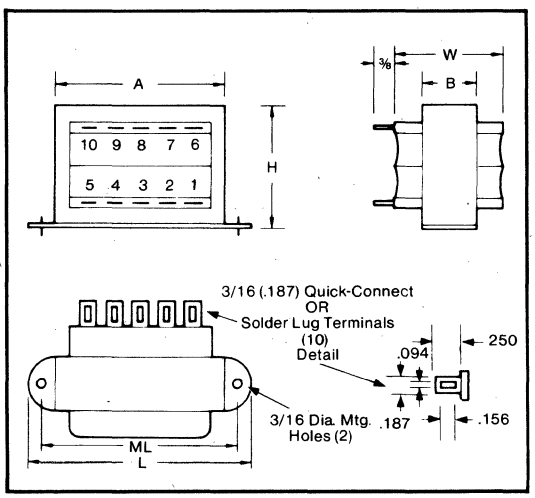
Note ① : Output capacitors C_2 and C_4 are required to stabilize regulators. Values can be 1 MFD min. tantalum or 10 MFD min. electrolytic, 20V min.
Note ② : LM-338 is an adjustable regulator and MFR's specifications (National Semiconductor) should be consulted for values of external components.
Note ③ : All IC's are National Semiconductor types.
Note ④ : All diodes are Motorola types.

SCHEMATIC



DIMENSIONS

Size	L	W	H	A	B	ML	Lbs.
6	3 1/4	1 3/4	1 15/16	2 5/16	1 1/16	2 13/16	1.1
7	3 11/16	1 13/16	2 1/4	2 11/16	1 1/16	3 1/8	1.7
8	4 1/32	2 1/4	2 9/16	3 1/16	1 5/16	3 9/16	2.75



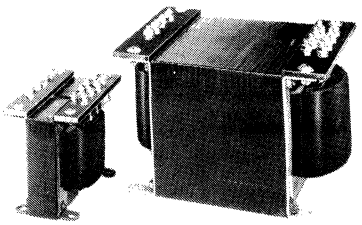
Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

signal TRANSFORMER

Dept. EM, 500 Bayview Ave., Inwood, N.Y. 11696
Tel.: (516) 239-5777
An Insilco Company

power isolation transformers

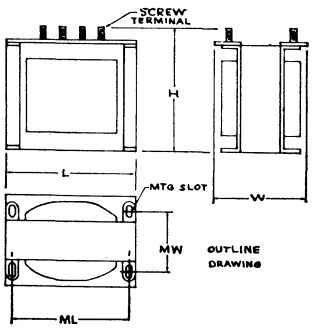
INDUSTRIAL GRADE/STEP-UP OR STEP-DOWN. MANY POSSIBLE VOLTAGE RATINGS.



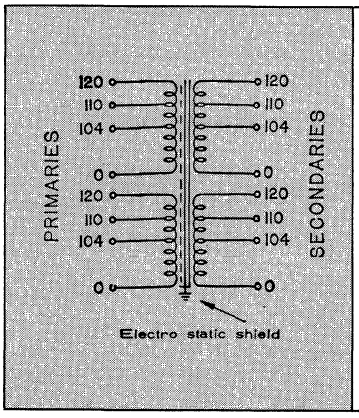
AVAILABLE FROM STOCK FOR IMMEDIATE SHIPMENT

The "DU" and "SU" lines are designed for a maximum of 55°C rise above ambient for use on standard power lines from 50 to 500 Cps. Only prime raw materials are used. Units are thoroughly impregnated and baked with Signal's own high gloss black baking varnish. The transformers are rugged in construction, well-insulated and have a consistently uniform appearance. All ratings are at full load current, continuous operation. 2500V. RMS Hipot is standard.

Heavy ¼ inch phenolic terminal boards are provided with plated brass screws and flat washers (10-32 on ¼ and ½ KVA, ¼-20 on larger sizes). Connections can be easily made with a nut driver. It is also simple to alter the interconnections to change transformer ratings. **Electro static shields are provided grounded to the core.** The connection is made with a lug to ground and may be opened if an ungrounded shield is desired.



DU SERIES 110/220 Dual Primary to 110/220V. Dual Sec. (Primary & Secondary may be reversed)

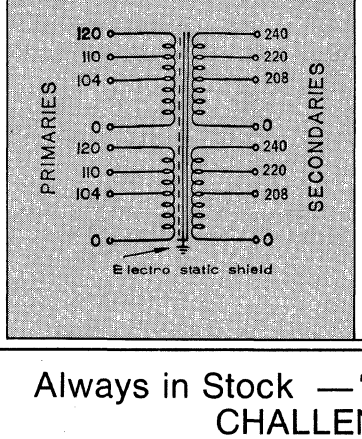


As shown on the schematic diagram the "DU" line is designed with dual primaries and secondaries. All four windings are identically rated at 0/104/110/120 volts. This permits series or parallel connections on either primary or secondary. Therefore, a nominal 110 to 110 volt, 220 to 220 volt, 110 to 220 volt, or 220 to 110 volt transformer can be set up. The winding taps permit intermediate series ratings such as 208, 214, or 230 volts. It is also possible to make auto-transformer connections by connecting a primary group in series with a secondary group. Such nominal ratings as 440 to 220 volts or 220 to 440 volts can be set-up, in addition to the standard ratings described above. A further advantage to auto-transformer connection is the fact that the KVA rating of a particular type is doubled.

		Series Secondaries		Parallel Secondaries		Mechanical Dimensions					Mtg. &	
Part No.	KVA	Volts	Max. Amps	Volts	Max. Amps	L *	W *	H *	ML †	MW ‡	Term. Screw	Appr. Lbs.
DU-¼	¼	0/208/220/240	1.1	0/104/110/120	2.2	5 5/16	4¼	5¼	4⅜	2½	#10	12
DU-½	½	0/208/220/240	2.3	0/104/110/120	4.6	5 5/16	5 5/16	5¼	4⅜	3⅝	#10	18
DU-1	1	0/208/220/240	4.5	0/104/110/120	9	7 5/16	6¼	7⅜	6¾	4⅛	¼	33
DU-2	2	0/208/220/240	9	0/104/110/120	18	7 5/16	8¼	7⅜	6¾	6	¼	56
DU-3	3	0/208/220/240	14	0/104/110/120	28	7 5/16	9¼	7⅜	6¾	7	¼	70
DU-5	5	0/208/220/240	23	0/104/110/120	46	7 5/16	10¾	7⅜	6¾	8½	¼	89
DU-7.5	7.5	0/208/220/240	31	0/104/110/120	62	9	10¾	8	7½	6½	¼	105
DU-10	10	0/208/220/240	41	0/104/110/120	83	9	13	8	7½	9	¼	150

* Maximum. † ±1/16 ‡ ±⅛

SU SERIES 110/220 Dual Primary to 220/440V. Dual Sec. (Primary & Secondary may be reversed)



"SU" transformers are similar to "DU" types except that a 220/240V secondary is provided.

		Series Secondaries		Parallel Secondaries		Mechanical Dimensions					Mtg. &	
Part No.	KVA	Volts	Max. Amps	Volts	Max. Amps	L *	W *	H *	ML †	MW ‡	Term. Screw	Appr. Lbs.
SU-¼	¼	0/416/440/480	0.55	0/208/220/240	1.1	5 5/16	4¼	5¼	4⅜	2½	#10	12
SU-½	½	0/416/440/480	1.15	0/208/220/240	2.3	5 5/16	5 5/16	5¼	4⅜	3⅝	#10	18
SU-1	1	0/416/440/480	2.25	0/208/220/240	4.5	7 5/16	6¼	7¼	6¾	4⅛	¼	33
SU-2	2	0/416/440/480	4.5	0/208/220/240	9	7 5/16	8¼	7¼	6¾	6	¼	56
SU-3	3	0/416/440/480	7	0/208/220/240	14	7 5/16	9¼	7¼	6¾	7	¼	70
SU-5	5	0/416/440/480	11.5	0/208/220/240	23	7 5/16	10¾	7¼	6¾	8½	¼	89
SU-7.5	7.5	0/416/440/480	15.5	0/208/220/240	31	9	10¾	8	7½	6½	¼	105
SU-10	10	0/416/440/480	20.5	0/208/220/240	41	9	13	8	7½	9	¼	150

* Maximum. † ±1/16 ‡ ±⅛

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signal TRANSFORMER

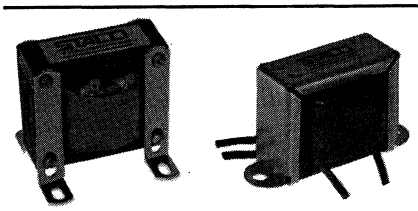
Dept. EM, 500 Bayview Ave., Inwood, N.Y. 11696
Tel.: (516) 239-5777
An Insilco Company

STACO TRANSPOWER® STANDARD-CUSTOM TRANSFORMERS

• AUDIOS • POWERS • CHOKES • CONTROLS • SWEEPS • IMPEDANCE • MINIATURES •

- **5 VA to 5 kVA, 1 ϕ & 3 ϕ**
- **CUSTOM SPECIALISTS FOR OVER 40 YEARS**
- **MEET UL, VDE, CSA & INTERNATIONAL SPECS**

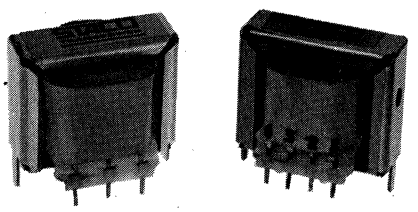
STACO transformers and chokes are available in a wide variety of standard styles and ratings to meet most normal requirements. However, STACO is also a custom specialist with nearly a half century of reliable service. It is easy to specify custom transformers or chokes to meet your specific needs. Simply send your specs to STACO, our design engineers will design a product to fit your needs. Ask for copies of the STACO Specification sheet and the current catalog. They are yours for the asking.



STYLE B STYLE C

RECTIFIER POWER

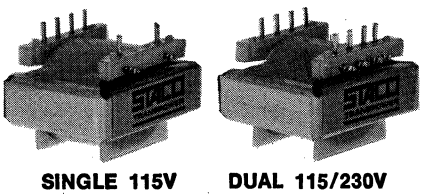
For single or dual output DC power supplies. Max. temp. rise above ambient 45°C. Standard units for single (115V) or dual (115/230V) inputs. (Some available with 105/115/125V). Outputs from 5V to 230V and from 1 to 4000 VA. Connect series or parallel. STACO type SP01A & SP01B.



SINGLE 6 PIN DUAL 8-PIN

MINIATURE P/C POWER

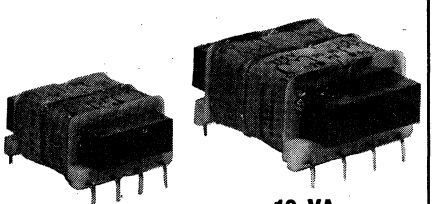
For P/C applications where between board spacing is critical. 63 standards in single (6 pin) and 63 in dual (8 pin). Ratings based on load regulation. Outputs from 5 to 230 VAC in 5 ranges from 1 to 24 VA. Connect series or parallel. STACO type SP02A & SP02B.



SINGLE 115V DUAL 115/230V

MULTI-SECTION BOBBIN P/C

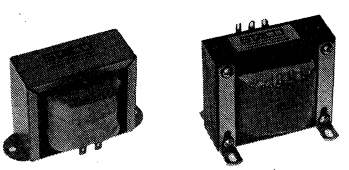
For high isolation (2500V hipot) and low capacitive coupling with superior performance at lowest cost. 60 duals and 60 singles standard in 6 VA ratings (1.1, 2.4, 6, 12, 20, 36 VA). Connect series or parallel for outputs from 5 to 120V. 6, 12, & 20 VA avail. with mtg. screw. STACO type SP03A & SP03B.



6 VA 12 VA

LOW PROFILE P/C POWER

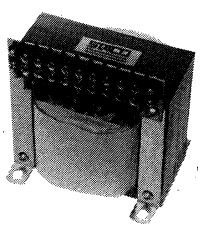
Ultra low profile in 6 & 12 VA types. 6 VA only 0.850″ high, 12 VA is 1.065″. 11 standard ratings in each for outputs from 5 to 230 V. Connect in series or parallel. Multi-section bobbin non-concentric winding eliminates need for shielding. STACO type SP04B.



SINGLE DUAL

SMALL POWER TRANSFORMERS

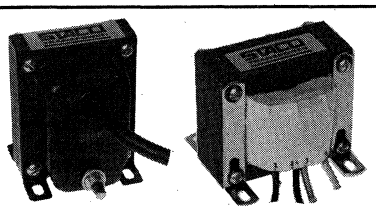
Made with grain oriented core lamination for maximum efficiency at least weight and size for low cost. 110 standard ratings in single or dual outputs from 10 to 120V CT and 2.5 to 100 VA. Choice of solder or QC terminals. For operation to 130°C. Hipot 2500V RMS. STACO SP05A SP05B.



BARRIER STRIP TERMINAL

POWER ISOLATION

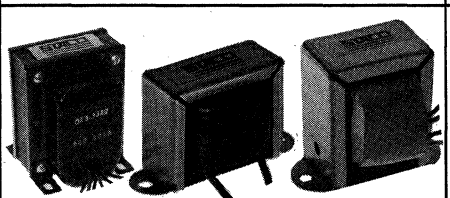
Step up or down industrial grade. Output .25 to 10 kVA. Either 110/220 dual primary to 110/220 secondary or 110/220 to 220/440 secondary (primary may be reversed). Supplied with rugged barrier block terminals. Hipot 2500V RMS. Tapped windings 104/110/120 and 208/220/240. STACO types SP06 & SP07.



ENCLOSED OPEN

STEP DOWN AUTOTRANSFORMERS

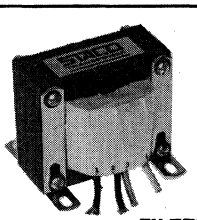
Enclosed, low regulation (ST01) or open frame (ST02) styles to 2 kVA are standard. Heavy duty to 6 kVA. Heavy duty may be used step-up or down. ST01 may be supplied with UL approved line cord and receptacle. ST02 and ST03 have 6″ leads.



A B C

AUDIO TRANSFORMERS

A wide variety of audio transformers is available from STACO. Although designed primarily for solid state applications, all models may be used in tube circuits for maximum reliability. There are 3 standard configurations as shown above plus plug in P/C models (see min. P/C above). STACO types SA01 to SA08.



FILTER

FILTER CHOKES

Both single and dual models are standard. Singles handle 0.5 to 1000 Amps, duals handle 1.0 to 50A and may be connected in series or parallel. Available in two mounting styles. 24 ratings are standard, but specials are readily available. Call for details. STACO types SC01 & SC02.

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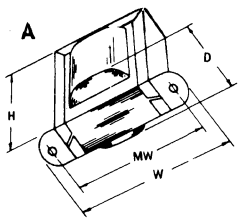
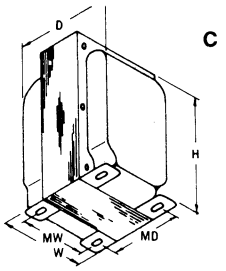
STANCOR

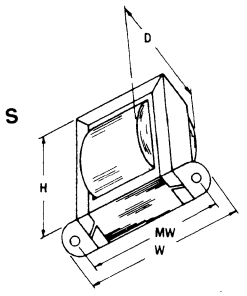
TRANSFORMERS

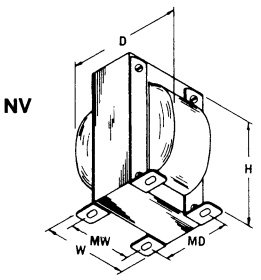
RECTIFIER, CONTROL AND FILAMENT TRANSFORMERS

WITH SINGLE SECONDARY: ALL PRIMARIES 50/60 Hz.§









SECT	STANCOR Part No.	Style	Secondary▲ Volts	Secondary▲ Amps.	Primary Volts	Insulation Test RMS Volts*	Termination Pri.	Termination Sec.	Dimensions-Inches Case H	Case W	Case D	Mounting MW	Mounting MD	Wt. Lbs.
A	P-8628	A	2.5C.T.	0.3	117	1500	Leads	Leads	1 1/4	2 1/8	1 5/16	1 3/4	—	.3
	P-8629	A	2.5	1.0	117	1500	Leads	Leads	1 3/8	2 3/8	1 3/8	2	—	.4
	P-4026	A	2.5	1.5	117	2500	Leads	Leads	1 5/8	2 7/8	1 5/8	2 3/8	—	.7
	P-6133†	S	2.5C.T.	5.0	117	7500	Leads	Leads	2 3/4	3 1/8	2 1/4	2 13/16	—	1.5
	P-3024†	C	2.5C.T.	10.0	117/107	2500	Leads	Leads	3 1/8	2 1/2	2 3/4	2	1 3/4	2.5
	P-6454	S	2.5C.T.	10.0	117/107	7500	Leads	Leads	3 1/8	3 5/8	2 1/2	3 1/8	—	2.5
B	P-6467	A	5.0C.T.	3.0	117	2500	Leads	Leads	2	3 1/4	2 1/8	2 13/16	—	1.4
	P-6455	S	5.0C.T.	6.0	117/107	2000	Leads	Leads	2 3/4	3 1/8	2 1/8	2 13/16	—	2.0
	P-6135	NV	5.0C.T.	10.0	117	2500	Leads	Leads	3 1/8	2 1/2	2 3/4	2	2 3/8	3.0
	P-6433†	NV	5.0C.T.	15.0	117	2500	Leads	Leads	3 1/8	2 1/2	2 3/4	2	2 1/4	3.0
	P-6492	C	5.0C.T.	30.0	117	2500	Leads	Leads	4 11/16	3 3/4	4	3	2 13/16	7.5
	P-6468†	C	5.0C.T.	30.0	117/107	2500	Lugs	Lugs	4 1/4	3 7/16	3 7/8	2 3/4	2 11/16	6.3
C	P-8385	A	6.3C.T.	0.3	117	1500	Leads	Leads	1 1/4	2 1/8	1 3/8	1 3/4	—	.3
	P-6465	A	6.3C.T.	0.6	117	1500	Leads	Leads	1 3/8	2 3/8	1 1/2	2	—	.4
	P-8705	A	6.3C.T.	0.6	230	1500	Leads	Leads	1 3/8	2 3/8	1 1/2	2	—	.4
	P-8389	A	6.3	1.0	117	1500	Leads	Leads	1 5/8	2 7/8	1 5/8	2 3/8	—	.6
	P-6134	A	6.3C.T.	1.2	117	3000	Leads	Leads	1 5/8	2 7/8	1 7/8	2 3/8	—	.8
	P-8190	A	6.3	1.2	117	5000	Leads	Leads	2	3 1/4	1 7/8	2 13/16	—	1.0
	P-5014†	NV	6.3C.T.	3.0	117	2500	Lugs	Lugs	3 1/8	2 1/2	2 1/2	2	1 3/4	2.0
D	P-6466	A	6.3C.T.	3.0	117	2500	Leads	Leads	2	3 1/4	2 1/8	2 13/16	—	1.4
	P-6462	S	6.3	3.0	117/107	7000	Leads	Leads	3 1/8	3 5/8	2 3/8	3 1/8	—	2.0
	P-4019†	C	6.3C.T.	4.0	117/107	2500	Leads	Leads	3 1/8	2 1/2	2 3/4	2	1 3/4	2.7
	P-8648	A	6.3C.T.	4.0	117	1500	Leads	Leads	2 3/8	3 3/4	2 1/8	3 1/8	—	1.6
	P-8649	A	6.3C.T.	5.0	117	1500	Leads	Leads	2 3/8	3 3/4	2 1/8	3 1/8	—	1.8
	P-3064†	NV	6.3C.T.	6.0	117	2500	Lugs	Lugs	3 1/8	2 1/2	2 3/8	2	2	2.4
	P-6456	A	6.3C.T.	6.0	117/107	2000	Leads	Leads	2 3/8	3 3/4	2 3/8	3 1/8	—	2.0
	P-8651	A	6.3C.T.	8.0	117	1500	Leads	Leads	2 5/8	4	2 1/4	3 9/16	—	2.4
	P-6464	C	6.3C.T.	10.0	117	2000	Leads	Leads	3 1/2	2 13/16	3 1/4	2 1/4	2	3.5
	P-6308†	NV	6.3C.T.	10.0	117/107	2500	Leads	Leads	3 7/16	2 13/16	2 5/8	2 1/4	2 1/8	3.4
	P-8189	C	6.3C.T.	20.0	117	2500	Leads	Leads	3 7/8	3 1/8	4 1/4	2 1/2	3	6.9
	P-6309	NV	6.3C.T.	20.0	117/107	2500	Leads	Leads	4 9/16	3 3/4	3 3/8	3	2 3/8	6.7
E	P-5015†	NV	7.5C.T.	4.0	117	2500	Lugs	Lugs	3 1/8	2 1/2	2 1/4	2	2 1/8	2.7
	P-6138†	NV	7.5C.T.	8.0	117	2500	Leads	Leads	3 13/16	3 1/8	2 3/4	2 1/2	2 3/8	4.7
	P-6457	C	7.5C.T.	21.0	117/107	2000	Leads	Leads	4 5/8	3 3/4	4	3	2 3/4	8.0
F	P-8652	A	10.0C.T.	1.0	117	1500	Leads	Leads	2	3 1/4	1 5/8	2 13/16	—	.9
	P-8653	A	10.0C.T.	2.0	117	1500	Leads	Leads	2	3 1/4	2	2 13/16	—	1.3
	P-8380	A	10.0C.T.	3.0	117	1500	Leads	Leads	2 3/8	3 3/4	2 1/4	3 1/8	—	1.6
	P-8654	A	10.0C.T.	4.0	117	1500	Leads	Leads	2 5/8	4	2 1/8	3 9/16	—	2.3
	P-5016†	NV	10.0C.T.	4.0	117	2500	Lugs	Lugs	3 7/16	2 13/16	2 1/2	2 1/4	2	3.3
	P-6458	NV	10.0C.T.	5.0	117/107	2000	Leads	Leads	3 1/16	2 1/2	2 1/2	2 1/8	1 13/16	3.0
	P-4096†	C	10.0C.T.	5.0	117/107	2500	Leads	Leads	3 7/8	3 1/8	3 1/4	2 1/2	1 15/16	4.0

§May be operated from a 400 Hz. source with no change in output ratings. †Has electrostatic shield.
*Insulation Test Voltage: Twice allowable RMs working voltage plus 1000 volts. ▲R.M.S. values.

STANCOR PRODUCTS • 131 GODFREY ST. • LOGANSPORT, IN 46947 • PHONE 219/722-2244 • TWX 810-295-0699

RECTIFIER, CONTROL AND FILAMENT TRANSFORMERS

WITH SINGLE SECONDARY: ALL PRIMARIES 50/60 HZ.§ (cont'd.)

STANCOR

SECT	STANCOR Part No.	Style	Secondary▲ Volts	Secondary▲ Amps.	Primary Volts	Insulation Test RMS Volts*	Termination Pri.	Termination Sec.	Dimensions-Inches Case H	Case W	Case D	Mounting MW	Mounting MD	Wt. Lbs.
A	P-8655	NV	10.0C.T.	6.0	117	1500	Leads	Leads	3 1/8	2 1/2	2 3/4	2	2 5/16	3.1
	P-8656	NV	10.0C.T.	8.0	117	1500	Leads	Leads	3 7/16	2 13/16	3	2 1/4	2 1/2	4.1
	P-6139†	NV	10.0C.T.	8.0	117	2500	Leads	Leads	3 13/16	3 1/8	3	2 1/2	2 3/8	4.9
	P-4097†	C	10.0C.T.	8.0	117/107	2500	Leads	Leads	3 7/8	3 1/8	3 3/4	2 1/2	2 1/2	5.2
	P-6461	C	10.0C.T.	10.0	117	2000	Leads	Leads	3 7/8	3 1/4	3 9/16	2 1/2	2 11/16	5.0
B	P-8390	A	12.0	.150	117	1500	Leads	Leads	1 1/4	2 1/8	1 1/4	1 3/4	—	.25
	P-8391	A	12.0	.350	117	1500	Leads	Leads	1 3/8	2 3/8	1 3/8	2	—	.35
	P-8392	A	12.0	.700	117	1500	Leads	Leads	1 5/8	2 7/8	1 5/8	2 3/8	—	.60
	P-8393	A	12.0	1.200	117	1500	Leads	Leads	2	3 1/4	1 5/8	2 13/16	—	.85
	P-8657	A	12.0	2.0	117	1500	Leads	Leads	2	3 1/4	2 1/8	2 13/16	—	1.3
	P-8658	A	12.0	4.0	117	1500	Leads	Leads	2 5/8	4	2 1/4	3 9/16	—	2.3
	P-8659	NV	12.0	6.0	117	1500	Leads	Leads	3 7/16	2 13/16	2 5/8	2 1/4	2 1/8	3.4
	P-8660	NV	12.0	8.0	117	1500	Leads	Leads	3 13/16	3 1/8	2 3/4	2 1/2	2 1/8	4.3
C	P-8384	A	12.6C.T.	1.0	117	1500	Leads	Leads	2	3 1/4	1 3/4	2 13/16	—	.9
	√P-8550	A	12.6C.T.	1.5	115	1500	Leads	Leads	1 15/16	3 5/16	2	2 13/16	—	1.3
D	P-8130	A	12.6C.T.	2.0	117	1500	Leads	Leads	2	3 1/4	2 1/8	2 13/16	—	1.4
	P-8715	A	12.6C.T.	2.0	230	1500	Leads	Leads	2	3 1/4	2 1/8	2 13/16	—	1.4
	P-8358	A	12.6C.T.	3.0	117	1500	Leads	Leads	2 3/8	3 3/4	2 1/4	3 1/8	—	1.6
	P-8641	A	12.6C.T.	4.0	117	1500	Leads	Leads	2 5/8	4	2 3/8	3 9/16	—	2.3
	P-8642	C	12.6C.T.	6.0	117	1500	Leads	Leads	3 1/2	2 13/16	3 3/8	2 1/4	2 3/16	3.8
	P-8643	C	12.6C.T.	8.0	117	1500	Leads	Leads	3 7/8	3 1/8	3 5/8	2 1/2	2 3/8	5.0
	P-8644	C	12.6C.T.	10.0	117	1500	Leads	Leads	4 1/4	3 7/16	3 7/8	2 3/4	2 3/4	6.3
	P-8716	A	12.6C.T.	4.0	230	2500	Leads	Leads	2 5/8	4	2 3/8	3 9/16	—	2.3
E	√P-8577	A	14.0C.T.	.250	115/230	1500	Leads	Leads	1 3/8	2 3/8	1 1/2	2	—	.3
	√P-8553	A	14.0C.T.	.250	115	1500	Leads	Leads	1 3/8	2 3/8	1 3/8	2	—	.4
	√P-8555	A	14.0C.T.	1.0	115	1500	Leads	Leads	1 15/16	3 1/4	1 3/4	2 13/16	—	1.2
	√P-8556	A	14.0C.T.	2.0	115	1500	Leads	Leads	2 1/4	3 11/16	1 15/16	3 1/8	—	1.5
	√P-8557	NV	14.0C.T.	4.0	115	1500	Leads	Leads	3	2 1/2	2 7/16	2	2 1/4	3.0
	√P-8558	NV	14.0C.T.	6.0	115	1500	Leads	Leads	3 3/8	2 13/16	2 7/8	2 1/4	2 3/8	4.0
F	√P-8690	A	18.0C.T.	.750	115	1500	Leads	Leads	1 15/16	3 5/16	2	2 13/16	—	1.3
	√P-8691	A	18.0C.T.	1.0	115	1500	Leads	Leads	1 15/16	3 5/16	2 1/8	2 13/16	—	1.5
	√P-8692	A	18.0C.T.	1.5	115	1500	Leads	Leads	2 9/32	3 3/4	2 1/8	3 1/8	—	1.7
	√P-8693	A	18.0C.T.	2.0	115	1500	Leads	Leads	2 9/32	3 3/4	2 1/4	3 1/8	—	2.0
G	P-8500	A	20C.T.	.050	115/230	2500	Leads	Leads	1 1/4	2 1/8	1 1/4	1 3/4	—	.3
	P-8501	A	20C.T.	.100	115/230	2500	Leads	Leads	1 9/32	2 1/8	1 1/4	1 3/4	—	.4
	P-8502	A	20C.T.	.150	115/230	2500	Leads	Leads	1 9/32	2 1/8	1 1/4	1 3/4	—	.4
	P-8503	A	20C.T.	.200	115/230	2500	Leads	Leads	1 3/8	2 3/8	1 3/8	2	—	.4
	P-8504	A	20C.T.	.250	115/230	2500	Leads	Leads	1 3/8	2 3/8	1 3/8	2	—	.4
	P-8505	A	20C.T.	.300	115/230	2500	Leads	Leads	1 3/8	2 3/8	1 3/8	2	—	.6
	P-8506	A	20C.T.	.400	115/230	2500	Leads	Leads	1 5/8	2 7/8	1 1/2	2 3/8	—	.6
	P-8507	A	20C.T.	.500	115/230	2500	Leads	Leads	1 5/8	2 7/8	1 1/2	2 3/8	—	.8
	P-8508	A	20C.T.	1.0	115/230	2500	Leads	Leads	2	3 1/4	2 1/4	2 13/16	—	1.4
H	P-8604	A	20.0C.T.	1.0	117	1500	Leads	Leads	2	3 1/4	2 1/8	2 13/16	—	1.4
	√P-8559	NV	20.0C.T.	2.0	115	1500	Leads	Leads	2 9/16	4	2 1/4	3 9/16	—	2.5
	√P-8560	NV	20.0C.T.	4.0	115	1500	Leads	Leads	3 3/8	2 13/16	2 7/8	2 1/4	2 3/8	4.0
I	√P-8551#	A	24.0	1.0	115	1500	Leads	Leads	1 15/16	3 1/4	2 1/8	2 13/16	—	1.4
	√P-8694#	A	24.0	2.0	115	1500	Leads	Leads	2 9/16	4	2	3 9/16	—	2.3
J	P-8394	A	24.0C.T.	.085	117	1500	Leads	Leads	1 1/4	2 1/8	1 1/4	1 3/4	—	.25
	P-8720	A	24.0C.T.	.085	230	1500	Leads	Leads	1 1/4	2 1/8	1 1/4	1 3/4	—	.25
	P-8395	A	24.0C.T.	.200	117	1500	Leads	Leads	1 3/8	2 3/8	1 3/8	2	—	.35
	P-8721	A	24.0C.T.	.200	230	1500	Leads	Leads	1 3/8	2 3/8	1 3/8	2	—	.35
	√P-8578	A	24.0C.T.	.200	115/230	1500	Leads	Leads	1 3/8	2 3/8	1 1/2	2	—	.3
	P-8396	A	24.0C.T.	.400	117	1500	Leads	Leads	1 5/8	2 7/8	1 5/8	2 3/8	—	.60
	P-8722	A	24.0C.T.	.400	230	1500	Leads	Leads	1 5/8	2 7/8	1 1/2	2 3/8	—	.60
	P-8397	A	24.0C.T.	.700	117	1500	Leads	Leads	2	3 1/4	1 3/4	2 13/16	—	.85
	P-8723	A	24.0C.T.	.700	230	1500	Leads	Leads	2	3 1/4	1 5/8	2 13/16	—	.85
K	P-8661	A	24.0C.T.	1.0	117	1500	Leads	Leads	2	3 1/4	2 1/16	2 13/16	—	1.4
	√P-8575	A	24.0C.T.	1.0	115/230	1500	Leads	Leads	1 15/16	3 5/16	2	2 13/16	—	1.3
	P-8662	A	24.0C.T.	2.0	117	1500	Leads	Leads	2 5/8	4	2 3/8	3 9/16	—	2.3
	P-8663	NV	24.0C.T.	4.0	117	1500	Leads	Leads	3 13/16	3 1/8	2 13/16	2 1/2	2 1/8	4.0
	P-8664	NV	24.0C.T.	6.0	117	1500	Leads	Leads	4 3/16	3 7/16	2 13/16	2 3/4	2 1/4	5.7
	P-8665	NV	24.0C.T.	8.0	117	1500	Leads	Leads	4 3/16	3 7/16	3 3/8	2 3/4	2 3/4	7.3
	√P-8695	NV	24.0C.T.	10.0	115	1500	Leads	Leads	4 1/8	3 7/16	3 3/4	2 3/4	3	8.0
	P-8666	NV	24.0C.T.	12.0	117	1500	Leads	Leads	4 9/16	3 3/4	4 5/8	3	3 1/4	11.2

*Insulation Test Voltage Twice allowable RMS working voltage plus 1000 volts. †Has electrostatic shield. ▲R.M.S. values.
§May be operated from a 400 Hz source with no change in output ratings. #60 Hz. only √New item.

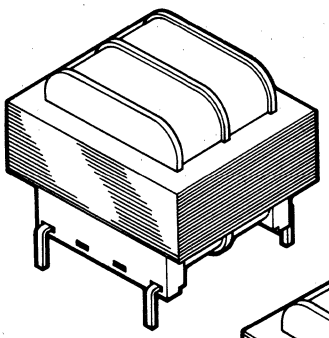
STANCOR

RECTIFIER, CONTROL AND FILAMENT TRANSFORMERS (Continued)

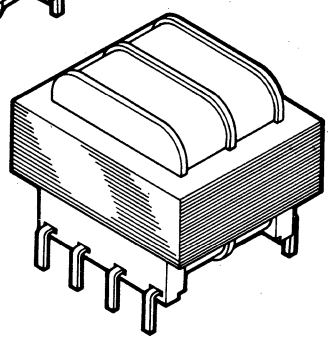
WITH MULTIPLE SECONDARIES: ALL PRIMARIES 50/60 Hz.§

SECT	STANCOR Part No.	Style	Secondary▲ Volts	Secondary▲ Amps.	Primary Volts	Insulation Test RMS Volts*	Termination Pri.	Termination Sec.	Dimensions-Inches Case H	Case W	Case D	Mounting MW	Mounting MD	Wt. Lbs.
A	P-6469	A	25.2	1.0	117	1500	Leads	Leads	2	3 1/4	2 1/8	2 13/16	—	1.4
	P-8707	A	25.2	1.0	230	1500	Leads	Leads	2	3 1/4	2 1/8	2 13/16	—	1.4
	P-8180	A	25.2C.T.	1.0	117	1500	Leads	Leads	2	3 1/4	2 1/4	2 13/16	—	1.4
	P-8357	A	25.2C.T.	2.0	117	1500	Leads	Leads	2 5/8	4	2 1/4	3 9/16	—	2.2
	✓P-8574	A	25.2C.T.	2.0	115/230	1500	Leads	Leads	2 19/32	4	2 1/4	3 9/16	—	2.2
	P-8388	A	25.2C.T.	2.8	117	1500	Leads	Leads	2 5/8	4	2 1/4	3 9/16	—	2.2
	P-8645	C	25.2C.T.	5.0	117	1500	Leads	Leads	4 1/4	3 7/16	3 7/8	2 3/4	2 11/16	6.0
	P-8646	C	25.2C.T.	7.5	117	1500	Leads	Leads	4 1/4	3 1/2	4 1/4	2 3/4	3 1/8	7.3
	P-8647	C	25.2C.T.	10.0	117	1500	Leads	Leads	4 11/16	3 3/4	5	3	3 7/8	12.3
B	P-8606	A	26.0C.T. Nominal ⁜Primary tapped to provide secondary voltages of 24.5C.T. or 27.5C.T. or 29C.T.	.040	117⁜	2500	Leads	Leads	1 1/4	2 1/8	1 3/8	1 3/4	—	.25
	P-8607	A	26.0C.T. Nominal ⁜Primary tapped to provide secondary voltages of 24.5C.T. or 27.5C.T. or 29C.T.	.25	117⁜	2500	Leads	Leads	1 5/8	2 7/8	1 3/4	2 3/8	—	.70
	P-8608	A	26.5C.T.	.6	117	2500	Leads	Leads	2	3 1/4	2 1/8	2 13/16	—	1.3
	P-8609	A	26.8C.T.	1.0	117	1500	Leads	Leads	2	3 1/4	2 1/8	2 13/16	—	1.3
C	P-8600	A	28.0C.T.	.085	117	1500	Leads	Leads	1 1/4	2 1/8	1 1/4	1 3/4	—	.25
	P-8601	A	28.0C.T.	.175	117	1500	Leads	Leads	1 3/8	2 3/8	1 3/8	2	—	.35
	P-8602	A	28.0C.T.	.300	117	1500	Leads	Leads	1 5/8	2 7/8	1 5/8	2 3/8	—	.60
	P-8603	A	28.0C.T.	.800	117	1500	Leads	Leads	2	3 1/4	2 1/8	2 13/16	—	1.0
	P-8667	A	28.0C.T.	1.0	117	1500	Leads	Leads	2	3 1/4	2 1/8	2 13/16	—	1.4
	P-8668	NV	28.0C.T.	2.0	117	1500	Leads	Leads	3 1/8	2 1/2	2 1/2	2	2 3/16	2.9
	P-8669	NV	28.0C.T.	4.0	117	1500	Leads	Leads	3 13/16	3 1/8	3 1/4	2 1/2	2 1/2	5.3
	P-8670	NV	28.0C.T.	6.0	117	1500	Leads	Leads	4 3/16	3 7/16	3 1/2	2 3/4	2 5/8	7.0
D	✓P-8561	A	30.0C.T.	1.0	115	1500	Leads	Leads	2 1/4	3 11/16	1 15/16	3 1/8	—	1.5
	✓P-8554	A	30.0C.T.	1.7	115	1500	Leads	Leads	2 19/32	4	2 1/4	3 9/16	—	1.5
	✓P-8562	NV	30.0C.T.	2.0	115	1500	Leads	Leads	3	2 1/2	2 9/16	2	2 3/8	3.2
	✓P-8563	NV	30.0C.T.	4.0	115	1500	Leads	Leads	3 3/4	3 1/8	3 1/8	2 1/2	2 5/8	5.7
	✓P-8576	A	35.0C.T.	1.5	115/230	1500	Leads	Leads	2 19/32	4	2 1/4	3 9/16	—	2.2
E	P-8610	A	36.0C.T.	.065	117	1500	Leads	Leads	1 1/4	2 1/8	1 1/4	1 3/4	—	.25
	P-8728	A	36.0C.T.	.065	230	1500	Leads	Leads	1 1/4	2 1/8	1 1/4	1 3/4	—	.25
	P-8611	A	36.0C.T.	.135	117	1500	Leads	Leads	1 3/8	2 3/8	1 3/8	2	—	.35
	P-8612	A	36.0C.T.	.300	117	1500	Leads	Leads	1 5/8	2 7/8	1 5/8	2 3/8	—	.60
	P-8613	A	36.0C.T.	.550	117	1500	Leads	Leads	2	3 1/4	1 7/8	2 13/16	—	1.0
	P-8671	A	36.0C.T.	1.0	117	1500	Leads	Leads	2 3/8	3 3/4	2 1/4	3 1/8	—	2.0
	P-8672	NV	36.0C.T.	2.0	117	1500	Leads	Leads	3 7/16	2 13/16	2 3/4	2 1/4	2 1/8	3.5
	P-8673	NV	36.0C.T.	4.0	117	1500	Leads	Leads	4 3/16	3 1/16	2 7/8	2 3/4	2 3/8	6.0
	P-8674	NV	36.0C.T.	6.0	117	1500	Leads	Leads	4 9/16	3 3/4	3 1/2	3	2 5/8	8.3
F	P-8540	A	40.0C.T.	.120	115/230	2500	Leads	Leads	1 3/8	2 3/8	1 3/8	2	—	.4
	P-8541	A	40.0C.T.	.200	115/230	2500	Leads	Leads	1 5/8	2 7/8	1 1/2	2 3/8	—	.6
	P-8542	A	40.0C.T.	.250	115/230	2500	Leads	Leads	1 5/8	2 7/8	1 1/2	2 3/8	—	.8
	✓P-8564	A	40.0C.T.	1.0	115	1500	Leads	Leads	2 9/16	4	2 1/4	3 9/16	—	2.6
	✓P-8565	NV	40.0C.T.	2.0	115	1500	Leads	Leads	3 3/8	2 13/16	2 7/8	2 1/4	2 3/8	4.0
	✓P-8566	NV	40.0C.T.	4.0	115	1500	Leads	Leads	3 3/4	3 1/8	3 1/2	2 1/2	2 7/8	6.4
G	P-8605	A	48.0C.T. Nominal ⁜Primary tapped to provide secondary voltages of 45C.T. or 51C.T. or 54 C.T.	1.0	117⁜	2500	Leads	Leads	2 5/8	4	2 3/8	3 9/16	—	2.3
H	✓P-8567	A	50.0C.T.	1.0	115	1500	Leads	Leads	2 9/16	4	2 1/4	3 9/16	—	2.4
	✓P-8568	NV	50.0C.T.	2.0	115	1500	Leads	Leads	3 3/4	3 1/8	2 7/8	2 1/2	2 3/8	4.7
	✓P-8569	NV	50.0C.T.	4.0	115	1500	Leads	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4	7.4
I	✓P-8552	A	60.0C.T.	.4	115	1500	Leads	Leads	1 15/16	3 5/16	2	2 13/16	—	1.3
	✓P-8570	NV	60.0C.T.	1.0	115	1500	Leads	Leads	3	2 1/2	2 5/8	2	2 3/8	3.4
	✓P-8571	NV	60.0C.T.	2.0	115	1500	Leads	Leads	3 3/4	3 1/8	3 1/8	2 1/2	2 5/8	5.6
J	✓P-8572	NV	70.0C.T.	1.0	115	1500	Leads	Leads	3 3/8	2 13/16	2 5/8	2 1/4	2 1/4	4.0
	✓P-8573	NV	70.0C.T.	2.0	115	1500	Leads	Leads	3 3/4	3 1/8	3 1/2	2 1/2	2 7/8	6.0

*Insulation Test voltage Twice allowable RMS working voltage plus 1000 volts. ▲R.M.S. values
§May be operated from a 400 Hz source with no change in output ranges. ✓New item



TYPE SW

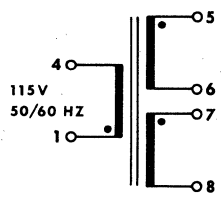


TYPE DSW

STANCOR TRANSFORMERS

"SIDE WINDER"

Split Bobbin— PC Mount Transformers



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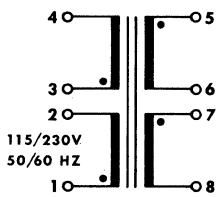

8 PIN
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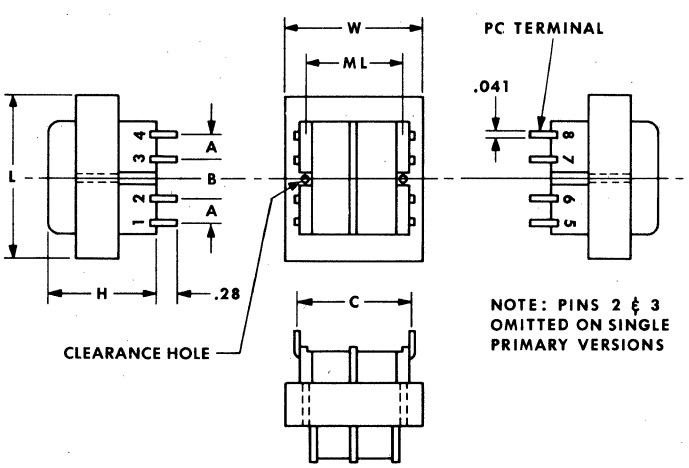


Stancor offers this compact transformer with primary and secondaries wound side by side. The "Side Winder" is non-concentrically wound, to reduce size and cost.

Split bobbin winding and low capacitive coupling design eliminates electrostatic shielding requirement and expense.

- High isolation...2,500 V RMS. Hi-Pot Testing
- PC Pins...Precision spaced insert directly into PC Boards
- Class B Insulation...130°C

"Side Winders" are available with Single 115V or Dual 115/230V Primaries, plus, secondaries are split to permit series or parallel connection.

SIDE WINDER APPLICATIONS:

Electronic Game Systems.
Computer Peripherals.
Switching Power Supplies.
Medical Electronics.
Instrumentation Equipment.
Communications Equipment.
Computer "On Board" Power.
Machine Control Logic Systems.
ROBOTICS.
Consumer Electronics.

Consult Factory For Special Design Requirements.

Size	Dimensions-Inches								Wt. Lbs.
	VA	H	W	L	ML	A	B	C	
2	1.1	15/16	1 1/8	1 3/8	—	.250	.250	1.200	.17
3	2.5	1 3/16	1 1/8	1 3/8	—	.250	.250	1.200	.25
4	6.0	1 5/16	1 5/16	1 5/8	1 1/16	.250	.350	1.280	.44
5	12.0	1 7/16	1 9/16	1 7/8	1 1/4	.300	.400	1.410	.70
6	20.0	1 7/16	1 7/8	2 1/4	1 1/2	.300	.400	1.600	.80

See size as first digit in Part Number.

STANCOR PRODUCTS • 131 GODFREY ST. • LOGANSPORT, IN 46947 • PHONE 219/722-2244 • TWX 810-295-0699

STANCOR

TRANSFORMERS

"SIDE WINDER" (Cont'd.)

SINGLE & DUAL PRIMARY—SPLIT BOBBIN–PC MOUNT TRANSFORMERS

SECT	STANCOR Part No.		Secondary RMS * Rating		
	Single 115V 6 Pin	Dual 115/230 V 8 Pin	Individual	Series	Parallel
A	√SW-210	√DSW-210	5V @ 0.11A	10V C.T. @ 0.11A	5 V @ 0.22A
	√SW-310	√DSW-310	5V @ 0.25A	10V C.T. @ 0.25A	5 V @ 0.5A
	√SW-410	√DSW-410	5V @ 0.6A	10V C.T. @ 0.6A	5 V @ 1.2A
	√SW-510	√DSW-510	5V @ 1.2A	10V C.T. @ 1.2A	5 V @ 2.4A
	√SW-610	√DSW-610	5V @ 2A	10V C.T. @ 2A	5 V @ 4A
B	√SW-212	√DSW-212	6.3V @ 0.09A	12.6V C.T. @ 0.09A	6.3V @ 0.18A
	√SW-312	√DSW-312	6.3V @ 0.2A	12.6V C.T. @ 0.2A	6.3V @ 0.4A
	√SW-412	√DSW-412	6.3V @ 0.5A	12.6V C.T. @ 0.5A	6.3V @ 1.0A
	√SW-512	√DSW-512	6.3V @ 1.0A	12.6V C.T. @ 1.0A	6.3V @ 2.0A
	√SW-612	√DSW-612	6.3V @ 1.6A	12.6V C.T. @ 1.6A	6.3V @ 3.2A
C	√SW-216	√DSW-216	8V @ 0.07A	16V C.T. @ 0.07A	8V @ 0.14A
	√SW-316	√DSW-316	8V @ .15A	16V C.T. @ .15A	8V @ 0.3A
	√SW-416	√DSW-416	8V @ .4A	16V C.T. @ .4A	8V @ 0.8A
	√SW-516	√DSW-516	8V @ .8A	16V C.T. @ .8A	8V @ 1.6A
	√SW-616	√DSW-616	8V @ 1.25A	16V C.T. @ 1.25A	8V @ 2.5A
D	√SW-220	√DSW-220	10V @ 0.055A	20V C.T. @ 0.055A	10V @ 0.11A
	√SW-320	√DSW-320	10V @ 0.12A	20V C.T. @ 0.12A	10V @ 0.24A
	√SW-420	√DSW-420	10V @ 0.3A	20V C.T. @ 0.3A	10V @ 0.6A
	√SW-520	√DSW-520	10V @ 0.6A	20V C.T. @ 0.6A	10V @ 1.2A
	√SW-620	√DSW-620	10V @ 1A	20V C.T. @ 1A	10V @ 2A
E	√SW-224	√DSW-224	12V @ 0.045A	24V C.T. @ 0.045A	12V @ 0.09A
	√SW-324	√DSW-324	12V @ 0.1A	24V C.T. @ 0.1A	12V @ 0.2A
	√SW-424	√DSW-424	12V @ 0.25A	24V C.T. @ 0.25A	12V @ 0.5A
	√SW-524	√DSW-524	12V @ 0.5A	24V C.T. @ 0.5A	12V @ 1.0A
	√SW-624	√DSW-624	12V @ 0.8A	24V C.T. @ 0.8A	12V @ 1.6A
F	√SW-228	√DSW-228	14V @ 0.04A	28V C.T. @ 0.04A	14V @ 0.08A
	√SW-328	√DSW-328	14V @ 0.085A	28V C.T. @ 0.085A	14V @ 0.17A
	√SW-428	√DSW-428	14V @ 0.2A	28V C.T. @ 0.2A	14V @ 0.4A
	√SW-528	√DSW-528	14V @ 0.42A	28V C.T. @ 0.42A	14V @ 0.84A
	√SW-628	√DSW-628	14V @ 0.7A	28V C.T. @ 0.7A	14V @ 1.4A
G	√SW-232	√DSW-232	16V @ 0.035A	32V C.T. @ 0.035A	16V C.T. @ 0.07A
	√SW-332	√DSW-332	16V @ 0.075A	32V C.T. @ 0.075A	16V C.T. @ 0.15A
	√SW-432	√DSW-432	16V @ 0.188A	32V C.T. @ 0.188A	16V C.T. @ 0.376A
	√SW-532	√DSW-532	16V @ 0.375A	32V C.T. @ 0.375A	16V C.T. @ 0.750A
	√SW-632	√DSW-632	16V @ 0.625A	32V C.T. @ 0.625A	16V C.T. @ 1.25A
H	√SW-236	√DSW-236	18V @ 0.03A	36V C.T. @ 0.03A	18V @ 0.06A
	√SW-336	√DSW-336	18V @ 0.065A	36V C.T. @ 0.065A	18V @ 0.13A
	√SW-436	√DSW-436	18V @ 0.17A	36V C.T. @ 0.17A	18V @ 0.34A
	√SW-536	√DSW-536	18V @ 0.35A	36V C.T. @ 0.35A	18V @ 0.7A
	√SW-636	√DSW-636	18V @ 0.55A	36V C.T. @ 0.55A	18V @ 1.1A
I	√SW-248	√DSW-248	24V @ 0.023A	48V C.T. @ 0.023A	24V @ 0.046A
	√SW-348	√DSW-348	24V @ 0.05A	48V C.T. @ 0.05A	24V @ 0.1A
	√SW-448	√DSW-448	24V @ 0.125A	48V C.T. @ 0.125A	24V @ 0.25A
	√SW-548	√DSW-548	24V @ 0.25A	48V C.T. @ 0.25A	24V @ 0.5A
	√SW-648	√DSW-648	24V @ 0.4A	48V C.T. @ 0.4A	24V @ 0.8A
J	√SW-256	√DSW-256	28V @ 0.02A	56V C.T. @ 0.02A	28V @ 0.04A
	√SW-356	√DSW-356	28V @ 0.045A	56V C.T. @ 0.045A	28V @ 0.09A
	√SW-456	√DSW-456	28V @ 0.11A	56V C.T. @ 0.11A	28V @ 0.22A
	√SW-556	√DSW-556	28V @ 0.22A	56V C.T. @ 0.22A	28V @ 0.44A
	√SW-656	√DSW-656	28V @ 0.35A	56V C.T. @ 0.35A	28V @ 0.7A
K	√SW-2120	√DSW-2120	60V @ 0.01A	120V C.T. @ 0.01A	60V @ 0.02A
	√SW-3120	√DSW-3120	60V @ 0.02A	120V C.T. @ 0.02A	60V @ 0.04A
	√SW-4120	√DSW-4120	60V @ 0.05A	120V C.T. @ 0.05A	60V @ 0.1A
	√SW-5120	√DSW-5120	60V @ 0.1A	120V C.T. @ 0.1A	60V @ 0.2A
	√SW-6120	√DSW-6120	60V @ 0.16A	120V C.T. @ 0.16A	60V @ 0.32A

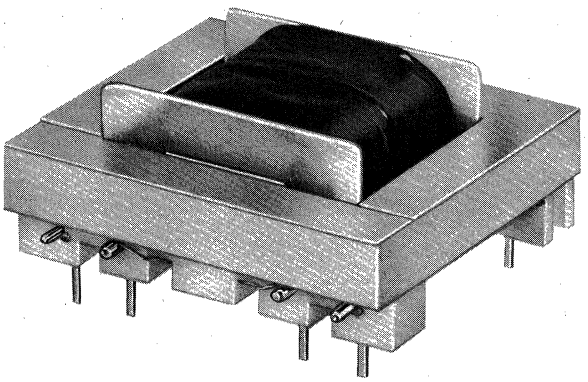
*RMS (Root Mean Square) = 70.7% of Peak Voltage

√ New Item

STANCOR

TRANSFORMERS

TELEPHONE COUPLING TRANSFORMERS



For Interconnecting Data/Voice Modem Terminals to Telephone Lines

Designed to Meet FCC Part 68

1500 Volt DIELECTRIC STRENGTH — Primary to Secondary — Primary to Core

Distortion: .5% Max. 300-3.5 kHz
Turns Ratio: ±2%
Frequency Response: ±.5 dB 300-3.5 kHz

Longitudinal Balance: 60 dB Min. @ 200-1kHz
40 dB Min. @ 4 kHz
Return Loss: 26 dB Minimum

APPLICATION DATA

Stancor's TTPC series transformers are designed to meet the high performance requirements of today's phone interconnect and instrumentation applications. Stancor has the broadest range of units for general use in impedance matching, circuit isolation, line balancing or bridging, and hybrid applications.

TTPC transformers are ideal for use in voice and data interconnect networks such as modem terminal connection to telephone lines. Stancor's units will handle 1500 volts dielectric breakdown and meet FCC Part 68 requirements.

REFERENCE CHART

SECT	STANCOR Part Number	Impedance Primary ±15%	Impedance Secondary ±10%	D.C. Curr. MA	Insertion Losses db Max. @ 1 Hz	Schematic No.	Style	Wt. Oz.
A	✓TTPC-1	600 C.T.	600 C.T.	0	1.4	2	A	.6
	✓TTPC-2	600	600	0	1.2	1	B	.5
	✓TTPC-3	600 C.T.	600 C.T.	0	1.2	2	C	.5
	✓TTPC-4	600	900	0	1.5	10	B	.5
	✓TTPC-5	4000	600	0	1.5	11	B	.5
B	✓TTPC-6	600	600 C.T.	90	1.8	3	E	1.0
	✓TTPC-7	600	600	0	1.2	1	A	.6
	✓TTPC-8	600 C.T.	600 C.T.	0	1.2	2	A	.6
	✓TTPC-9	600	600/600	0	1.2	4&12	D	1.0
	✓TTPC-10	600	900	0	1.2	10	A	.6
	✓TTPC-11	4000	600	0	1.2	11	A	.6
C	✓TTPC-12	Holding Coil (Inductance 1.3 Hy)			—	5	F	1.5
	✓TTPC-13	600	600 C.T. Split	90	1.8	6	G	.5
	✓TTPC-14	600	600 C.T. Split	75	1.1	13&14	H	2.5
	✓TTPC-15	600	600	80	1.1	16	H	2.5
	✓TTPC-16	900	600	80	1.1	15	H	2.5
D	✓TTPC-17	Holding Coil (Inductance 1.4 Hy)			—	9	H	2.5
	✓TTPC-18	600 C.T.	600 C.T. or 150 Split	80	1.7	7	J	2.5
	✓TTPC-19	600 C.T.	600 C.T.	80	1.7	8	L	2.5
E	*PCT-24	900 C.T.	600	3	2.0	3	K	.3
	*PCT-27	600	600 C.T./150 Split	3	2.0	13	K	.3
	*PCT-77	600 C.T.	600 C.T.	3	2.0	2	K	.3
	✓*PCT-78	600	600	3	2.0	1	K	.3

*1000 Volt Dielectric Strength

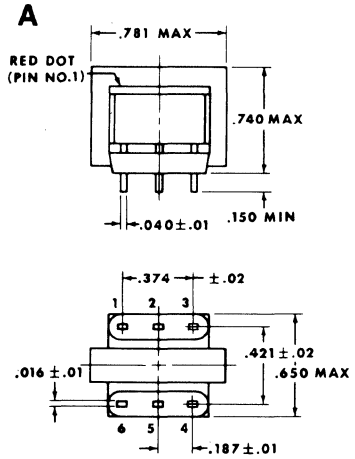
✓ New Item.

TELEPHONE COUPLING TRANSFORMERS

STANCOR TRANSFORMERS

STYLES

A



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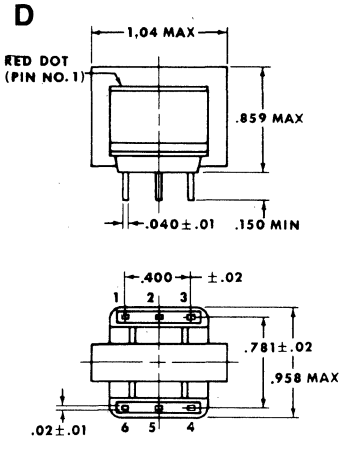

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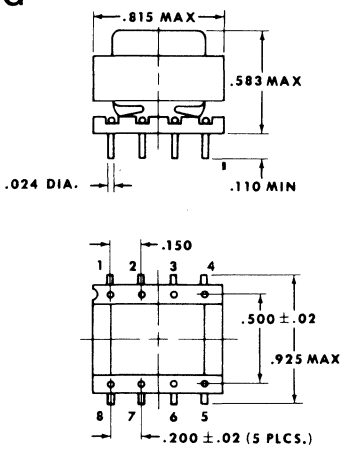

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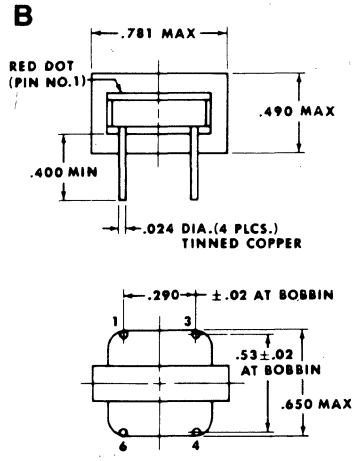

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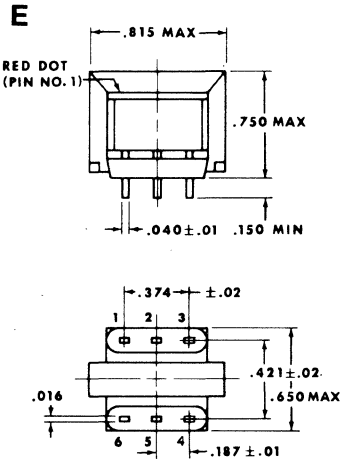

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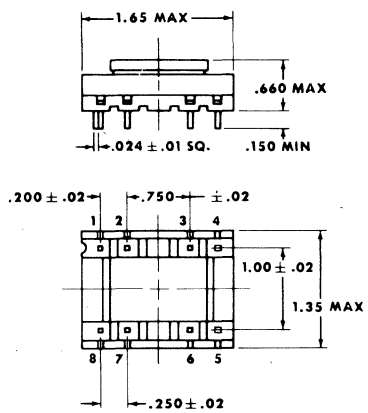

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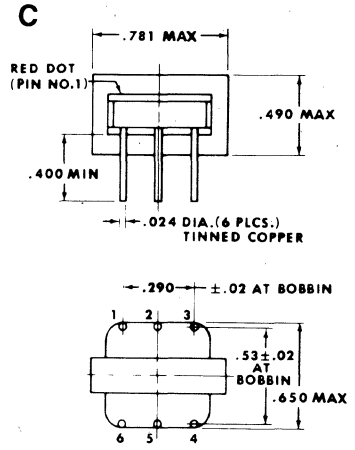

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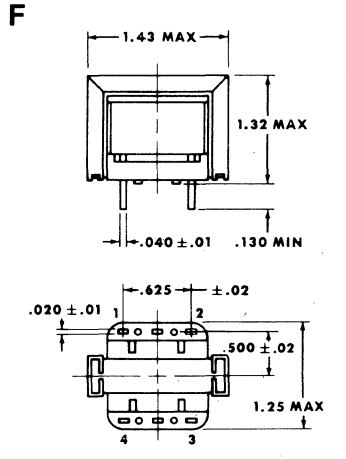

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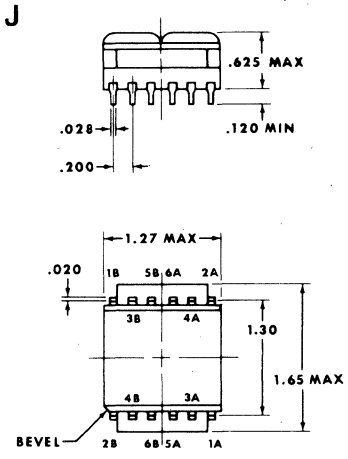

STANCOR TELEPHONE COUPLING TRANSFORMERS

TRANSFORMERS

STYLES

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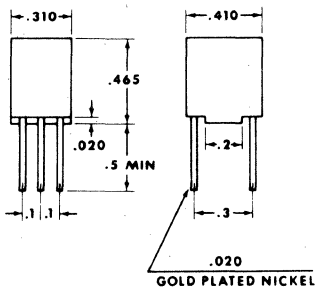

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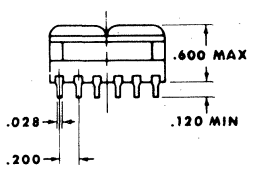

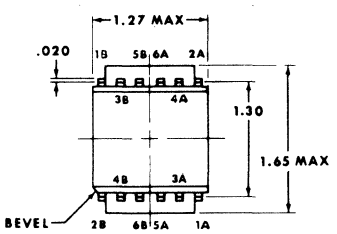

SCHEMATICS

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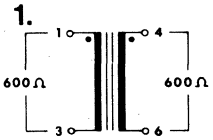

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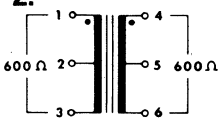

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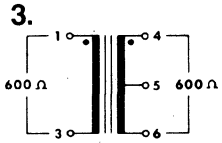

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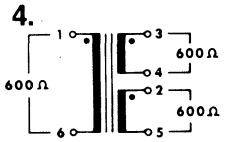

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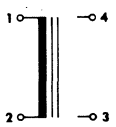

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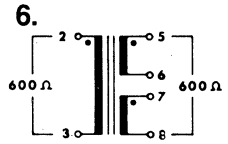

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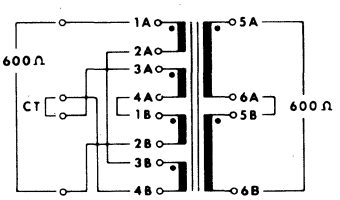

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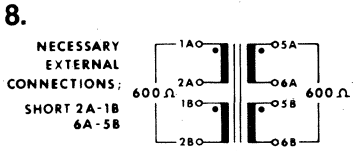

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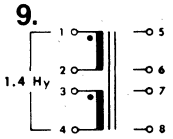

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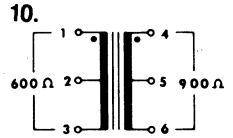

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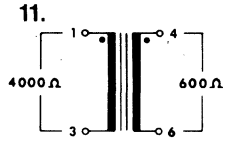

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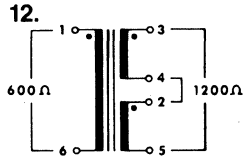

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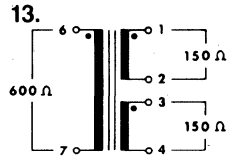

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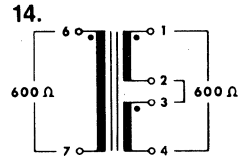

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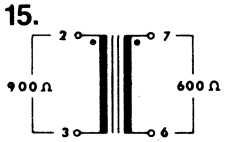

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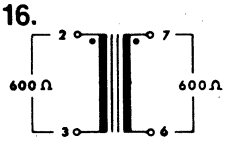


REFER TO TELEPHONE COUPLER REFERENCE CHART FOR IMPEDENCE SPECIFICATIONS

STANCOR

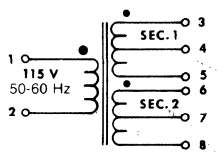
FOR SMALL D.C. POWER SUPPLIES PLUG-IN PRINTED CIRCUIT TYPE POWER TRANSFORMERS

SECT	STANCOR Part No.	Style	VA Cap.*	Output From Two Secondary Windings▲ Individually	Parallel	Series	Dimensions-Inches Case H	W	D	Mounting MW	A	E	Wt. Lbs.
F	√PPC-49	APC	7.5	7.5V. @ 500MA.	7.5V @ 1.0A	15V.C.T. @ 500MA.	1⅝	2 13/16	1 7/16	2⅜	1.31	.25	.75
	√PPC-50	APC	7.5	15V. @ 250MA.	15V. @ 500MA.	30V.C.T. @ 250MA.	1⅝	2 13/16	1 7/16	2⅜	1.31	.25	.75
	PPC-31	APC	8.0	20V. @ 200MA	20V. @ 400MA.	40V.C.T. @ 200MA.	1⅝	2⅞	1½	2⅜	1.30	.25	.75
G	√PPC-42	APC	10.0	6.3V. @ 800MA.	6.3V. @ 1.6A.	12.6V.C.T. @ 800MA.	1⅝	2 13/16	1 7/16	2⅜	1.31	.25	.75
	√PPC-43	APC	10.0	8V. @ 640MA.	8V. @ 1.28A.	16V.C.T. @ 640MA.	1⅝	2 13/16	1 7/16	2⅜	1.31	.25	.75
	√PPC-41	APC	10.0	10V. @ 500MA.	10V. @ 1.0A.	20V.C.T. @ 500MA.	1⅝	2 13/16	1 7/16	2⅜	1.31	.25	.75
	√PPC-40	APC	10.0	12V. @ 450MA.	12V. @ 900MA.	24V.C.T. @ 450MA.	1⅝	2 13/16	1 7/16	2⅜	1.31	.25	.75
	PPC-30	APC	10.0	20V. @ 250MA.	20V. @ 500MA.	40V.C.T. @ 250MA.	1⅝	2⅞	1½	2⅜	1.30	.25	.75
	√PPC-53	APC	10.0	115V. @ 44MA	115V. @ 88MA.	230V.C.T. @ 44MA.	1⅝	2 13/16	1 7/16	2⅜	1.31	.25	.75
H	√PPC-54	PC	24.0	5V. @ 2.4A.	5V. @ 4.8A.	10V.C.T. @ 2.4A.	1⅜	1⅝	2¼	—	2.11	.25	.90
	√PPC-55	PC	24.0	6.3V. @ 2.0A.	6.3V. @ 4.0A.	12.6V.C.T. @ 2.0A.	1⅜	1⅝	2¼	—	2.11	.25	.90
	√PPC-56	PC	24.0	8.V @ 1.5A	8V. @ 3.0A.	16.0V.C.T. @ 1.5A.	1⅜	1⅝	2¼	—	2.11	.25	.90
	√PPC-57	PC	24.0	10V. @ 1.2A	10V. @ 2.4A.	20V.C.T. @ 1.2A.	1⅜	1⅝	2¼	—	2.11	.25	.90
	√PPC-58	PC	24.0	12V. @ 1.0A	12V. @ 2.0A.	24V.C.T. @ 1.0A.	1⅜	1⅝	2¼	—	2.11	.25	.90
	√PPC-59	PC	24.0	14V. @ 800MA.	14V. @ 1.6A.	28V.C.T. @ 800MA.	1⅜	1⅝	2¼	—	2.11	.25	.90
I	√PPC-60	PC	24.0	17V. @ 700MA.	17V. @ 1.4A.	34V.C.T. @ 700MA.	1⅜	1⅝	2¼	—	2.11	.25	.90
	√PPC-61	PC	24.0	20V. @ 600MA.	20V. @ 1.2A	40V.C.T. @ 600MA.	1⅜	1⅝	2¼	—	2.11	.25	.90
	√PPC-62	PC	24.0	28V. @ 420MA.	28V. @ 840MA.	56V.C.T. @ 420MA.	1⅜	1⅝	2¼	—	2.11	.25	.90
	√PPC-63	PC	24.0	60V. @ 200MA.	60V. @ 400MA.	120V.C.T. @ 200MA.	1⅜	1⅝	2¼	—	2.11	.25	.90

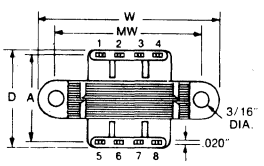
√—New item—U.L. Recognition not available at time of catalog printing. * All primaries for 115-230 V., 50-60 Hz. ▲ R.M.S. values.

NEW!! MICROPROCESSOR POWERS

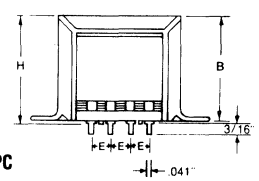
Developed especially for triple output regulated DC supplies that are used in microprocessor, logic and OP-amp circuit combinations. Outputs are listed in RMS values and will deliver popular ±12 and ±15 volts with 5V standby values included.



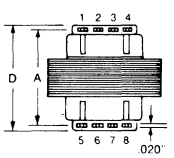
DUAL TAPPED SECONDARIES



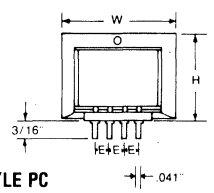
(Bottom View)



STYLE APC (Side View)



(Bottom View)



STYLE PC (Side View)

WITH SINGLE PRIMARY FOR 115 VOLTS, 50-60 HERTZ INPUT

SECT	STANCOR Part No.	Style	VA Cap.	Output From Two Secondary Windings▲ RMS Secondary No. 1	Secondary No. 2	Dimensions-Inches Case H	W	D	Mounting MW	A	E	Wt. Lbs.
A	√PPC-35	PC	1.5	9V. C.T. @ .100A.	24V.C.T. @ .025A.	1⅛	1 25/64	1 5/32	—	1.00	.20	.22
	√PPC-37	PC	1.5	15V.C.T. @ .060A.	32V.C.T. @ .020A.	1⅛	1 25/64	1 5/32	—	1.00	.20	.22
	√PPC-38	APC	4.5	15V.C.T. @ .195A.	32V.C.T. @ .050A.	1 25/64	2⅜	1¼	2⅜	1.31	.25	.47
	√PPC-36	APC	7.5	9V.C.T. @ .500A.	24V.C.T. @ .125A.	1 41/64	2 13/16	1 15/32	2⅜	1.31	.25	.75
	√PPC-39	APC	7.5	15V.C.T. @ .287A.	32V.C.T. @ .100A	1 41/64	2 13/16	1 15/32	2⅜	1.31	.25	.75
B	√PPC-X-12	PC	6.0	10V.C.T. @ .390A.	20V.C.T. @ .107A.	1⅝	1⅞	1 7/16	—	1.31	.25	.56
	√PPC-X-15	PC	6.0	10V.C.T. @ .390A	24V.C.T. @ .090A	1⅝	1⅞	1 7/16	—	1.31	.25	.56
	√PPC-Y-12	PC	15.0	10V.C.T. @ .900A.	20V.C.T. @ .270A	1⅜	1⅝	2¼	—	2.1	.25	.75
	√PPC-Y-15	PC	15.0	10V.C.T. @ .900A	24V.C.T. @ .240A	1⅜	1⅝	2¼	—	2.1	.25	.75

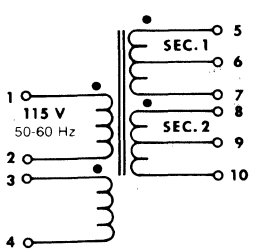
WITH DUAL PRIMARIES FOR 115/230 VOLTS,— 50-60 HERTZ INPUT. (SEE SCHEMATIC BELOW)

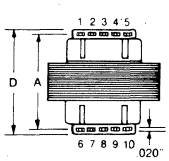
C	√DPC-X-12	PC	6.0	10V.C.T. @ .390A	20V.C.T. @ .107A	1⅝	1⅞	1 7/16	—	1.31	.20	.56
	√DPC-X-15	PC	6.0	10V.C.T. @ .390A.	24V.C.T. @ .090A	1⅝	1⅞	1 7/16	—	1.31	.20	.56
	√DPC-Y-12	PC	15.0	10V.C.T. @ .900A	20V.C.T. @ .270A.	1⅜	1⅝	2¼	—	2.1	.20	.56
	√DPC-Y-15	PC	15.0	10V.C.T. @ .900A	24V.C.T. @ .240A	1⅜	1⅝	2¼	—	2.1	.20	.56

√ New Item.

DUAL TAPPED SECONDARIES

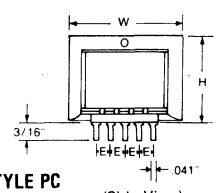
DPC





(Bottom View)

STYLE PC 10 PIN STYLE



(Side View)

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K
kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L
LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microforad
MHz megahertz
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOSIGT metal-oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM nuclear instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLL phased lock loop
PPI plan position indicator
PROM programmable read only memory
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

STERLING TRANSFORMER

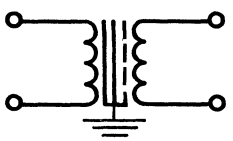
step-up/step-down ISOLATION – AUTO *transformers*

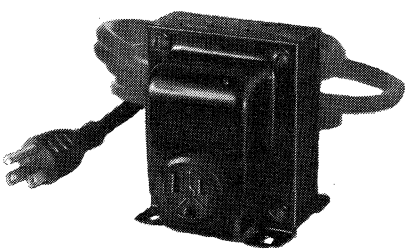
STEP-DOWN ISOLATION TRANSFORMERS

PRIMARY: 240 Volts • 50/60 HZ • Line Cord and Plug*
SECONDARY: 120 Volts • Standard Female Receptacle • Electrostatic Shield • UL Approved Cord and Plug.

Cat No.	VA Watts	Style	DIMENSIONS L	W	H	Mounting Centers M1	M2	Appr. Wt.
S2-50	50	A	2 29/32	3 7/16	3 1/2	2 1/4	1 13/16	3
S2-100	100	A	3 7/32	3 7/8	3 7/8	2 1/2	2 3/16	5
S2-150	150	A	3 17/32	4 3/8	4 1/4	2 3/4	2 13/16	7
S2-220	220	A	3 27/32	4 5/8	4 5/8	3	3 1/16	9.5
S2-330	330	A	4 17/32	5 1/4	5 7/16	3 1/2	3 1/4	14.5
S2-500	500	A	4 17/32	6 1/4	5 7/16	3 1/2	4 1/4	21
S2-700	700	A	5 1/2	5 15/16	6 9/16	4 1/4	3 1/2	25
S2-1000	1000	A	5 1/2	6 15/16	6 9/16	4 1/4	4 1/2	35
S2-1500	1500	B	9	7 3/4	6 5/16	8 1/4	4 3/8	42
S2-2200	2200	B	9	9 3/8	6 5/16	8 1/4	6	65
S2-3300	3300	B	9	11 5/8	6 5/16	8 1/4	8 1/4	95

Style A Only; Style B — Knockouts for Conduit Connectors.





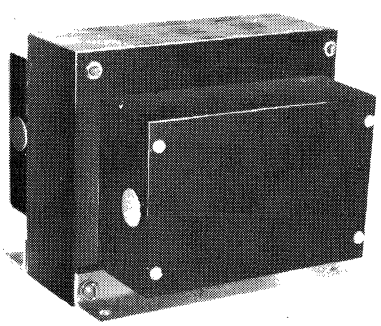
Style A

ISOLATION TRANSFORMERS

PRIMARY: 120 Volts • 50/60 HZ • Line Cord and Plug*
SECONDARY: 120 Volts • Standard Female Receptacle • Electrostatic Shield • UL Approved Cord and Plug.

Cat No.	VA Watts	Style	DIMENSIONS L	W	H	Mounting Centers M1	M2	Appr. Wt.
S1-50	50	A	2 29/32	3 7/16	3 1/2	2 1/4	1 13/16	3
S1-100	100	A	3 7/32	3 7/8	3 7/8	2 1/2	2 3/16	5
S1-150	150	A	3 17/32	4 3/8	4 1/4	2 3/4	2 13/16	7
S1-220	220	A	3 27/32	4 5/8	4 5/8	3	3 1/16	9.5
S1-330	330	A	4 17/32	5 1/4	5 7/16	3 1/2	3 1/4	14.5
S1-500	500	A	4 17/32	6 1/4	5 7/16	3 1/2	4 1/4	21
S1-700	700	A	5 1/2	5 15/16	6 9/16	4 1/4	3 1/2	25
S1-1000	1000	A	5 1/2	6 15/16	6 9/16	4 1/4	4 1/2	35
S1-1500	1500	B	9	7 3/4	6 5/16	6 3/4	4 3/8	42
S1-2200	2200	B	9	9 3/8	6 5/16	6 3/4	6	65
S1-3300	3300	B	9	11 5/8	6 5/16	6 3/4	8 1/4	95

Style A Only; Style B — Knockouts for Conduit Connectors.



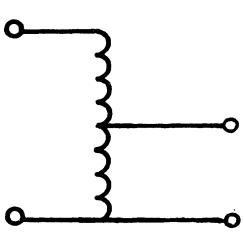
Style B

STEP-DOWN AUTO TRANSFORMERS

PRIMARY: 240 Volts • 50/60 HZ • Line Cord and Plug*
SECONDARY: 120 Volts • Standard Female Receptacle • UL Approved Cord and Plug.

Cat No.	VA Watts	Style	DIMENSIONS L	W	H	Mounting Centers M1	M2	Appr. Wt.
SA-100	100	A	2 29/32	3 7/16	3 1/2	2 1/4	1 13/16	3
SA-150	150	A	2 29/32	3 3/4	3 1/2	2 1/4	2 1/8	4
SA-200	200	A	3 7/32	3 7/8	3 7/8	2 1/4	2 3/16	5
SA-300	300	A	3 17/32	4 3/8	4 1/4	2 3/4	2 13/16	7
SA-450	450	A	3 27/32	4 5/8	4 5/8	3	3 1/8	9 1/2
SA-650	650	A	4 17/32	5 1/4	5 7/16	3 1/2	3 1/4	14 1/2
SA-1000	1000	A	4 17/32	6 1/4	5 7/16	3 1/2	4 1/4	21
SA-1500	1500	A	5 1/2	5 15/16	6 9/16	4 1/4	3 1/2	25
SA-2000	2000	A	5 1/2	6 15/16	6 9/16	4 1/4	4 1/2	35
SA-3000	3000	B	9	7 3/4	6 5/16	6 3/4	4 3/8	42
SA-4500	4500	B	9	9 3/8	6 5/16	6 3/4	6	65
SA-6500	6500	B	9	11 5/8	6 5/16	6 3/4	8 1/4	95
SA-8000**	8000	B	10 5/8	9 5/8	8 1/4	7 1/2	6 1/8	90
SAB-5300†	5300	A	5 3/4	8 5/16	4	3 3/4	6 1/2	17.5

*Style A Only **60 HZ Only Style B — Knockouts for Conduit Connector
†Step-up/down Auto Transformer. Connections for 208/230 V or 230/208 V, 23 Amp 50/60 HZ



STERLING TRANSFORMER CORPORATION
DEPT. EM, 510 DRIGGS AVENUE • BROOKLYN, NEW YORK 11211 • TELEPHONE: (718) 782-4200

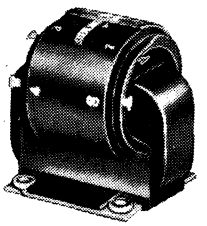
STERLING TRANSFORMER

ENCAPSULATED 400 cps transformers

CLIPPER SERIES

Fig.	Cat. No.	Sec. Volts	Sec. Amp	Insul. Volts (RMS)	Pri. Volts	Mold Size
19	4C1	6.3 CT	0.8	1500	115	SM3
19	4C2	6.3 CT	1.2	1500	115	SM2
19	4C3	6.3 CT	6.8	1500	110/115/120	2
20	4C4	6.3 6.3	4.9 2.7	1500	115	3
19	4C5	6.3 CT	7.2	1500	115	35
21	4C6	6.3 6.3 6.3	7 7 1.5	1500 1500 1500	120	35
22	4C7	6.3 CT 6.3 CT	7 7	1500 1500	120	4
21	4C8	6.3 6.3 6.3	13.7 2.9 0.3	1500 1500 1500	115	4
19	4C9	6.3 CT	12.3	1500	115	5
21	4C11	6.3 6.3 6.3	2.4 2.5 2.7	1500	115	3
19	4C26	6.3 CT	2	1500	115	SM1
19	4C27	6.3 CT	3	1500	115	1A
19	4C28	6.3 CT	5	1500	115	2
19	4C29	5 CT	3	2500	115	SM1
19	4C30	5 CT	6	2500	115	2
19	4C31	8.5 CT	12	1500	115	5
19	4C32	8.5 CT	23	1500	115	7
19	4C33	8.5 CT	35	1500	115	8
19	4C34	8.5 CT	45	1500	115	9
18	4C12	14.1	3	1500	115	3
19	4C35	21 CT	4.5	1500	115	5
19	4C13	21 CT	9	1500	115	7
19	4C36	21 CT	18	1500	115	9
19	4C10	20 CT	0.6	1500	115	SM1

FREQUENCY
380-1000 cps



FOR MINIMUM SIZE & MINIMUM WEIGHT
- CONTOUR MOLDED
- HIPERSIL CORES

MIL-T27C Specifications

MIL Type TF5S03ZZ
85°C Max. Ambient
130°C Max. Oper. Temp.

HIGH SHOCK EXTREME ENVIRONMENT CONDITIONS
LIGHTWEIGHT FOR AIRBORNE USE
10,000 HOUR PLUS-LIFE SERVO APPLICATIONS
ISOLATIONS
POWER SUPPLIES
AIRBORNE CONTROL CIRCUITS
MISSILE CIRCUITS

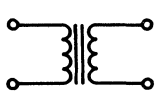


FIG. 18

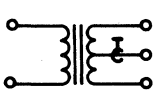


FIG. 19

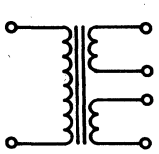


FIG. 20

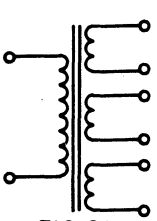


FIG. 21

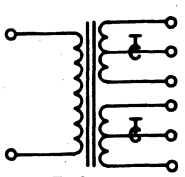


FIG. 22

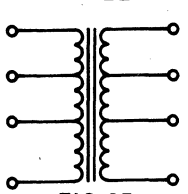


FIG. 23

STERLING TRANSFORMER CORPORATION
DEPT. EM, 510 DRIGGS AVENUE • BROOKLYN, NEW YORK 11211 • TELEPHONE: (718) 782-4200

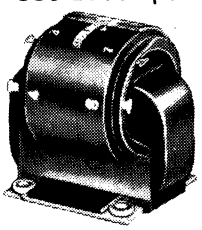
STERLING TRANSFORMER

ENCAPSULATED 400 cps transformers

CLIPPER SERIES

Fig.	Cat. No.	Sec. Volts	Sec. Amp.	Insul. Volts (RMS)	Pri. Volts	Mold Size
19	4C37	21 CT	24	1500	115	10
19	4C38	24 CT	4	1500	115	5
19	4C39	24 CT	8	1500	115	7
19	4C40	24 CT	16	1500	115	9
19	4C41	24 CT	21	1500	115	10
18	4C14	26	0.5	1500	115	SM1
19	4C15	26 CT	1.5	1500	115	3
19	4C23	26 CT	3	1500	115	4
19	4C24	26 CT	5	1500	115	6
22	4C16	28 CT 6.3 CT	0.8 7	1500	115	3
19	4C42	41 CT	2.3	1500	115	5
19	4C43	41 CT	4.5	1500	115	7
19	4C44	41 CT	9	1500	115	9
19	4C45	41 CT	12	1500	115	10
19	4C46	48 CT	2	1500	115	5
19	4C47	48 CT	4	1500	115	7
19	4C48	48 CT	8	1500	115	9
19	4C49	48 CT	10	1500	115	10
19	4C25	52 CT	2	1500	115	5
19	4C17	52 CT	0.2	1500	115	SM1
19	4C18	90 CT	4.5	1500	115	9
18	4C19	115	.05	1500	115	SM2
18	4C21	115	2.8	1500	115	8
23	4C20	105/115/125	0.4	1500	105/115/125	2
23	4C50	105/115/125	1	1500	105/115/125	6
23	4C51	105/115/125	2.4	1500	105/115/125	8
23	4C52	105/115/125	3.2	1500	105/115/125	9
23	4C53	105/115/125	4	1500	105/115/125	10
18	4C22	334	025	1500	115	SM1

FREQUENCY
380-1000 cps



FOR MINIMUM SIZE & MINIMUM WEIGHT
- CONTOUR MOLDED
- HIPERSIL CORES

MIL-T27C Specifications

MIL Type TF5S03ZZ
85°C Max. Ambient
130°C Max. Oper. Temp.

HIGH SHOCK EXTREME ENVIRONMENT CONDITIONS
LIGHTWEIGHT FOR AIRBORNE USE
10,000 HOUR PLUS-LIFE
SERVO APPLICATIONS
ISOLATIONS
POWER SUPPLIES
AIRBORNE CONTROL CIRCUITS
MISSILE CIRCUITS

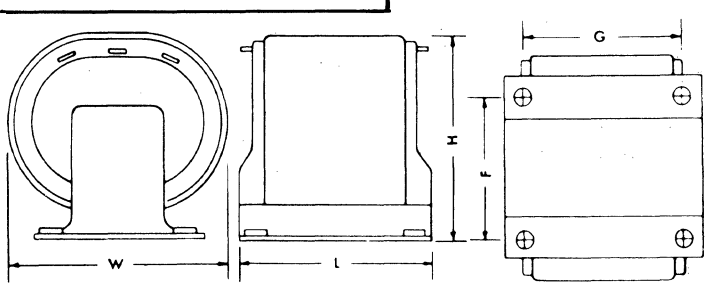
Mold No.	Overall Dimen. L	W	H	Mtg. Dimen. F	G	App. Wt. (Lbs.)	Mtg. Meth.
SM3	1 1/32	1 5/16	1 1/4	1	Note 1	0.06	Note 1
SM2	1 1/2	1 1/4	1 11/16	1	Note 1	0.10	Note 1
SM1	1 1/2	1 1/2	1 11/16	1 1/8	Note 1	0.16	Note 1
1	1 13/16	1 7/8	1 13/16	1 1/4	1 7/16	0.25	Note 2
1A	1 11/16	1 17/32	1 13/16	1 5/32	1 1/8	0.25	Note 2
2	2	1 13/16	2 1/8	1 5/32	1 1/4	0.40	Note 2
3	2 5/16	1 13/16	2 1/8	1 5/32	1 7/16	0.45	Note 2
35	2 1/16	2 3/8	2 3/16	1 17/32	1 11/16	0.70	Note 2
4	2 5/16	2 3/8	2 5/16	1 17/32	1 11/16	0.90	Note 2
5	2 3/4	2 3/8	2 7/8	1 17/32	2 3/16	1.20	Note 2
6	2 3/4	2 5/8	3 1/8	1 17/32	2 3/16	1.50	Note 2
7	3	2 7/8	3 3/8	1 25/32	2 1/2	2.00	Note 2
8	3 3/8	2 7/8	3 3/8	1 25/32	2 1/2	2.50	Note 2
83	3 3/4	3 1/4	3 3/8	2 1/4	3	3.25	Note 3
86	3 3/4	3 3/4	3 3/8	2 3/4	3 1/8	4.25	Note 3
9	4 1/16	3 3/8	3 7/8	2 3/16	3 1/2	5.00	Note 3
10	4 1/2	3 15/16	3 15/16	2 3/4	3 1/8	6.00	Note 3

Note 1 —
SM Series are two hole mounting with holes on center line. #4-40 Pem nuts are fastened to the bracket.

Note 2 —
#6-32 Pem nuts on bracket are standard.

Note 3 —
#8-32 Pem nuts on bracket are standard.

- All primaries 380-1000 cps
- Dielectric test voltages:
  PRIMARIES 1500 Volts RMS
  SECONDARIES 1500 Volts RMS
- Epoxy resin used as encapsulant
- Prices subject to change without notice



STERLING TRANSFORMER CORPORATION
DEPT. EM, 510 DRIGGS AVENUE • BROOKLYN, NEW YORK 11211 • TELEPHONE: (718) 782-4200

transistor transformers

STERLING TRANSFORMER

MINISPEC TRANSISTOR TRANSFORMERS—300 SERIES

Part No.	Application	Primary Impedance	Secondary Impedance	Pri. D.C. Unbal. Ma.	Oper. Lev. DBM	Freq. Response ±2 db.
300	Line to Base	600	600	10	23	200–15,000
301	Coll. to P.P. Base	100	10 C.T./40 C.T.	100	27	200–20,000
302	Coll. to Base or line	50,000	600	3	20	300–15,000
303	Collector to speaker	50,000	6	3	20	300–15,000
304	Coll. to P.P. Base	100,000	1,200 C.T.	1.4	17	200–15,000
305	Coll. to P.P. Base	25,000	1,200 C.T.	3	22	200–15,000
306	P.P. Coll. to P.P. Base	50,000 C.T.	1,200 C.T.	3	20	300–15,000
307	Line to P.P. Base	600 C.T.	1,200 C.T.	4	23	200–15,000
308	Collector to Base	25,000	600	3	22	200–15,000
309	P.P. Coll. to P.P. Base	4,000 C.T.	600 C.T.	3	32	200–15,000
310	Output Coll. to speaker	2,000	3.4	10	32	200–15,000
311	P.P. Coll. to speaker	4,000 C.T.	3.4	3	32	200–15,000
312	Coll. to Speaker	400	10	50	25	200–20,000
313	P.P. Servo Output	500 C.T.	210	30	27	300–20,000
314	P.P. Coll. to P.P. Base	25,000 C.T.	1,200 C.T.	6	22	200–15,000
315	P.P. Coll. to P.P. Base	50,000 C.T.	1200/300 Split	3	20	300–15,000
316	P.P. Coll. to P.P. Base	4,000 C.T.	600/150 Split	3	32	200–15,000
317	Line to P.P. Base	600/150 Split	1,200 C.T.	4	23	200–15,000
318	P.P. Coll. to Servo	250 C.T.	1,000	10	30	200–15,000
319	Coll. to P.P. Base	2,500	600 C.T.	10	32	200–15,000
320	P.P. Coll. to P.P. Base	7,500 C.T.	600 C.T.	8	32	200–15,000
321	Line to P.P. Base	600 C.T.	600 C.T.	20	23	200–15,000
322	P.P. Coll. to Servo	1,600 C.T.	450	15	30	200–15,000
323	P.P. Coll. to Servo	250 C.T.	500	10	30	200–15,000

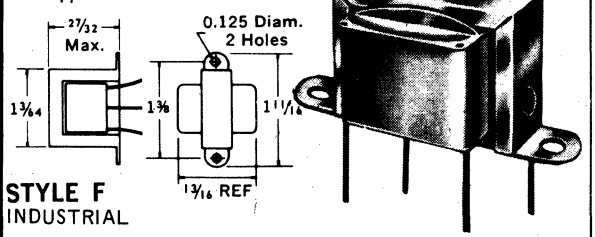
MINISPEC AUDIO TRANSFORMERS—300 SERIES

Part No.	Application	Primary Impedance	Secondary Impedance	Pri. D.C. Unbal. Ma.	Oper. Lev. DBM	Freq. Response ±2 db.
375	Mike or line to 1 grid	50/250/600 C.T.	50,000	0	5	20–20,000
376	Mike or line to 2 grids	50/250/600 C.T.	50,000 C.T.	0	5	20–20,000
377	Dynamic mike to 1 grid	7.5/30	50,000	0	5	20–20,000
378	Single plate to 1 grid	15,000	60,000	0	6	20–15,000
379	Single plate to 1 grid	15,000	60,000	4	14	200–20,000
380	Single plate to 2 grids	15,000	95,000 C.T.	0	5	20–15,000
381	Single plate to 2 grids	15,000	95,000 C.T.	4	11	200–20,000
382	Single plate to line	15,000	50/250/600 C.T.	0	8	20–20,000
383	Single plate to line	15,000	50/250/600 C.T.	4	21	150–20,000
384	Push pull plates to line	30,000 C.T.	50/250/600 C.T.	0	8	30–50,000
385	Crystal mike to line	50,000	50/250/600 C.T.	0	5	20–20,000
386	Mixing and matching	50/250 C.T.	50/250/600 C.T.	0	8	20–20,000
387	Reactor	300 hy.0 d.c.	50 hy. @ 3 ma.			DCR 6,000
388	50:1 mike to grid	200	½ Megohm	0	9	80–3,000
389	10:1 plate to grid	10,000	1 Megohm	0	11	100–2,500

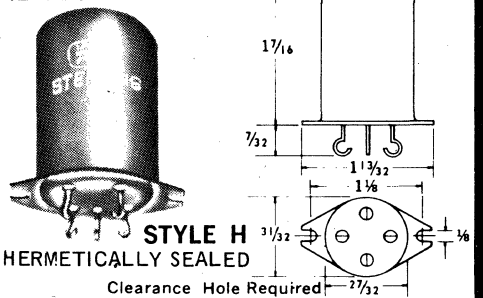
MINISPEC 300 SERIES

Highest efficiency miniature transformer for transistor and audio circuit applications.

MILITARY STYLE ENCAPSULATED VERSIONS ARE AVAILABLE



STYLE F
INDUSTRIAL



STYLE H
HERMETICALLY SEALED

STERLING TRANSFORMER CORPORATION
DEPT. EM, 510 DRIGGS AVENUE • BROOKLYN, NEW YORK 11211 • TELEPHONE: (718) 782-4200

STERLING TRANSFORMER

transistor transformers

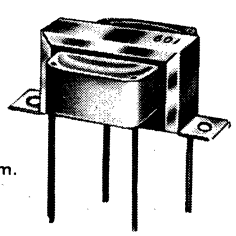
MICROSPEC TRANSISTOR TRANSFORMERS — 600 SERIES

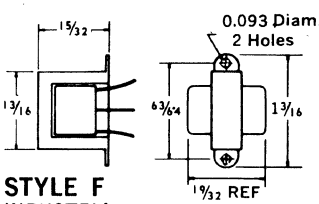
Part No.	Application	Primary Impedance	Secondary Impedance	Pri. D.C. Unbal. Ma.	Oper. Lev. DBM	Freq. Response ±2 db.
601	Line to Base	600	600	8	22	200–15,000
602	Coll. to Base or line	50,000	600	0.7	20	200–15,000
603	P.P. coll. to P.P. Base	50,000 C.T.	600 C.T.	1.4	20	200–15,000
604	Collector to speaker	50,000	6	1	20	200–15,000
605	Coll. to P.P. Base	25,000	1,200 C.T.	1	20	200–15,000
606	P.P. coll. to P.P. Base	50,000 C.T.	1,200 C.T.	1.4	20	200–15,000
607	Line to P.P. Base	600 C.T.	1,200 C.T.	16	22	200–15,000
608	Collector to Base	25,000	600	1	20	200–15,000
609	P.P. coll. to P.P. Base or line	4,000 C.T.	600 C.T.	5	28	200–15,000
610	Coll. to Spkr.	2,000	3.4	5	28	200–15,000
611	Output P.P. coll. to spkr.	4,000 C.T.	3.4	5	28	200–15,000
612	Coll. to P.P. Base	10,000	1,500 C.T.	1	20	200–15,000
613	P.P. Coll. to P.P. Base	10,000 C.T.	200 C.T.	6	20	200–15,000
614	P.P. Coll. to P.P. Base	25,000 C.T.	1,200 C.T.	2	20	200–15,000
615	Coll. to P.P. Base	2,500	2,500 C.T.	2	23	200–15,000
616	P.P. Coll. to P.P. Base	4,000 C.T.	600/150 split	5	28	200–15,000
617	P.P. Coll. to P.P. Base	7,500 C.T.	600 C.T.	4	22,	200–15,000
618	Line to Base	600 C.T.	600 C.T.	16	22	200–15,000
619	P.P. Coll. to P.P. Base	25,000 C.T.	600 C.T.	2	20	200–15,000
620	P.P. Coll. to P.P. Base	10,000 C.T.	1,500 C.T.	2	20	200–15,000
621	Driver/Isolation	10,000 C.T.	10,000 C.T.	2	20	200–15,000
622	P.P. Coll. to P.P. Base	7,500 C.T.	1,200 C.T.	4	22	200–15,000
623	P.P. Coll. to P.P. Base	2,000 C.T.	500 C.T.	10	28	200–15,000
624	Line to P.P. Base	600 C.T.	1200/300 split	16	22	200–15,000

MICROSPEC AUDIO TRANSFORMERS — 600 SERIES

Part No.	Application	Primary Impedance	Secondary Impedance	Pri. D.C. Unbal. Ma.	Oper. Lev. DBM	Freq. Response ±2 db.
675	Input	200/50	250,000/62,500	0	4	200–10,000
676	Interstage 3:1	10,000	90,000	0	4	150–10,000
677	Plate to line	10,000	200	3	20	150–10,000
678	Output	30,000	50	1	20	150–10,000
679	Reactor 50 HY at 1 madc				4700	ohms DCR
680	Output	100,000	60	0.5	20	250–10,000
681	Output	30,000	1,200	0.5	20	200–10,000

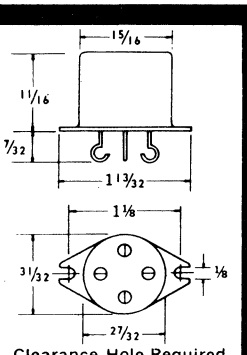
MICROSPEC 600 SERIES
Subminiature transformers for high efficiency circuits.





STYLE F
INDUSTRIAL

MILITARY STYLE ENCAPSULATED VERSIONS ARE AVAILABLE



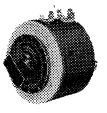
STYLE H
HERMETICALLY SEALED

STERLING TRANSFORMER CORPORATION
DEPT. EM, 510 DRIGGS AVENUE • BROOKLYN, NEW YORK 11211 • TELEPHONE: (718) 782-4200

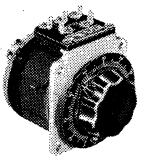
POWERSTAT® *Variable Transformers now*

New epoxy-coated POWERKOTE Coils make the POWERSTAT line the most outstanding value in variable transformers today. *Without increase in price, size or weight,* only POWERSTAT Variable Transformers give an average of 20% higher current ratings, 10:1 greater overload capability, longer life, greater resistance to fungus, salt spray and other contaminating atmospheres. POWERKOTE Coil commutator bars are embedded in place preventing steady-state operating temperature and severe overloads from distorting the commutator.

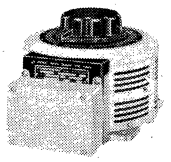
POWERSTAT Variable Transformers are designed to deliver continuously adjustable voltage from a-c power lines. They introduce no waveform distortion and feature rugged construction, precious metal plated commutators, excellent regulation, high efficiency and conservative ratings. All manually operated types listed in the charts except the 10B-12, EN116B-EN216B and EN117B-EN217B Series are available with motor drives if desired. Motor-driven speeds are 5, 15, 30 or 60 seconds for full range travel on all except types having -4, -5, or -6 suffixes which do not offer the 5-second speed. Single types in the 116B-216B, 117B-217B, 126-226 and 136B-236B Series are also offered with 2- or 3-wire cord-plug sets. 1156D-1256D Series types are available in ratings to 244 kva.



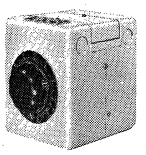
TYPE 10B



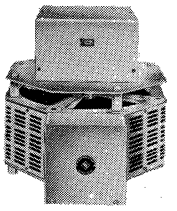
TYPE 21



TYPE 136BT



TYPE EN216B



TYPE 5MB1156DT

RATINGS AND SPECIFICATIONS

INPUT		OUTPUT						
			Const. Current Load		Const. Impedance Load			
Volts	Hertz	Volts	Max. Amp.	Max. KVA	Max. Amp.	Max. KVA	TYPE	Ship. Wt. Lbs.
10B-12 SERIES								
Single Phase								
120	50/60	0-120	2.25*	0.27	3‡	0.36	✓ 10B	2½
120	60	0-132	2.25*	0.30	—	—		
240	50/60	0-240	0.7*	0.17	0.9‡	0.22	✓ 12	2½
240	50/60	0-264	0.5**	0.13	—	—		
240	50/60	0-240	2.25*	0.54	3‡	0.72	10B-2	6
240	60	0-264	2.25*	0.59	—	—		
480	50/60	0-480	0.7*	0.34	0.9‡	0.43	12-2	6
480	50/60	0-528	0.5**	0.26	—	—		
Three Phase								
120	50/60	0-120	2.25*	0.47	3‡	0.62	10B-2	6
120	60	0-132	2.25*	0.51	—	—		
240	50/60	0-240	0.7*	0.29	0.9‡	0.37	12-2	6
240	50/60	0-264	0.5**	0.23	—	—		
240	60	0-240	2.25*	0.94	3‡	1.2	10B-3	8½
480	50/60	0-480	0.7*	0.58	0.9‡	0.75	12-3	8½
480	60	0-528	0.5**	0.46	—	—		
21-22 SERIES								
Single Phase								
120	50/60	0-120	4.5	0.54	6.5	0.78	✓ 21	6
120	50/60	0-140	4.5	0.63	—	—		
240	50/60	0-240	2.25	0.54	3.25	0.78	✓ 22	6
240	50/60	0-280	2.25	0.63	—	—		
240	50/60	0-240	4.5	1.1	6.5	1.6	✓ 21-2	13½
240	50/60	0-280	4.5	1.3	—	—		
480	50/60	0-480	2.25	1.1	3.25	1.6	22-2	13½
480	50/60	0-560	2.25	1.3	—	—		
Three Phase								
120	50/60	0-120	4.5	0.94	6.5	1.4	21-2	13½
120	50/60	0-140	4.5	1.1	—	—		
240	50/60	0-240	2.25	0.94	3.25	1.4	22-2	13½
240	50/60	0-280	2.25	1.1	—	—		
240	50/60	0-240	4.5	1.9	6.5	2.7	21-3	19
240	60	0-280	4.5	2.2	—	—		
480	50/60	0-480	2.25	1.9	3.25	2.7	✓ 22-3	19
480	60	0-560	2.25	2.2	—	—		

INPUT		OUTPUT						
			Const. Current Load		Const. Impedance Load			
Volts	Hertz	Volts	Max. Amp.	Max. KVA	Max. Amp.	Max. KVA	TYPE	Ship. Wt. Lbs.
116B-216B and 117B-217B SERIES†								
Single Phase								
120	50/60	0-120	10	1.2	13	1.6	✓116B	12
120	50/60	0-140	10	1.4	—	—		
120	60	0-120	12	1.4	15	1.8	✓117BT	12
240	50/60	0-240	3.5	0.84	5	1.2	✓216B	12
240	50/60	0-280	3.5	0.98	—	—		
240	60	0-240	5	1.2	7	1.7	✓217BT	12
240	50/60	0-240	10	2.4	13	3.1	✓116BT-2	24
240	50/60	0-280	10	2.8	—	—		
240	60	0-240	12	2.9	15	3.6	117BT-2	24
480	50/60	0-480	3.5	1.7	5	2.4	216BT-2	24
480	50/60	0-560	3.5	2.0	—	—		
480	60	0-480	5	2.4	7	3.4	217BT-2	24
Three Phase								
120	50/60	0-120	10	2.1	13	2.7	✓116BT-2	24
120	50/60	0-140	10	2.4	—	—		
120	60	0-120	12	2.5	15	3.1	117BT-2	24
240	50/60	0-240	3.5	1.5	5	2.1	216BT-2	24
240	50/60	0-280	3.5	1.7	—	—		
240	60	0-240	5	2.1	7	2.9	217BT-2	24
240	50/60	0-240	10	4.2	13	5.4	✓116BT-3	36
240	60	0-280	10	4.8	—	—		
240	60	0-240	12	5.0	15	6.2	117BT-3	36
480	50/60	0-480	3.5	2.9	5	4.2	✓216BU-3	36
480	60	0-560	3.5	3.4	—	—		
480	60	0-480	5	4.2	7	5.8	✓217BU-3	36
EN116B-EN216B and EN117B-EN217B SERIES								
Single Phase								
120	50/60	0-120	8	0.96	13	1.6	✓EN116B	15
120	50/60	0-140	8	1.1	—	—		
120	60	0-120	10	1.2	14.5	1.7	✓EN117B	15
Three Phase								
480	50/60	0-480	3	2.5	4.5	3.7	✓EN216B-3	39
480	60	0-560	3	2.9	—	—		
40-VOLT SERIES								
Single Phase								
40	60	0-40	7	0.28	9	0.36	✓ 10B-40	3½
			18	0.72	22	0.88	✓ 21-40	5

LW136B SERIES

INPUT		OUTPUT‡‡				
Volts	Hertz	Volts	Max. Amps.	Max. KVA	TYPE	Ship. Wt. Lbs.
Single Phase						
120-240	50-60	15-0-15	35	0.52	✓ LW136B	25
120-240	50-60	0-30	25	0.75		

‡LW136B Series ratings are for use as low voltage isolated output transformer.

*Rating when mounted on metal panel. On bracket or nonmetallic panel, derate 10B Series to 1.75 amp., 12 Series to 0.5 amp.

‡Rating when mounted on metal panel. On bracket or nonmetallic panel, derate 10B Series to 2.5 amp., 12 Series to 0.75 amp.

**0.7 amp. maximum in range from 0 to line voltage when mounted on metal panel.

†Also available with open construction. Suffix U when ordering.

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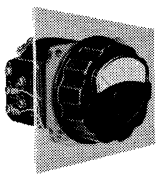
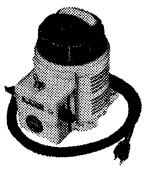
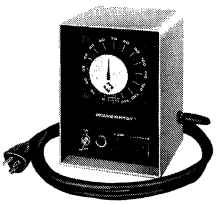
STATIONARY METERED KNOB TYPES

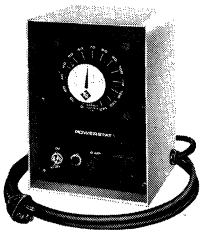




ENCLOSED TYPES



TYPE L10B



TYPE L116B

Single units (those listed in charts without -2 or -3 suffixes) in the 116B-216B, 117B-217B, 126-226, 136B-236B and 146-246 series are also available with metered knobs. Stationary voltmeter does not turn with knob. Voltmeter accurate within ±3% of full scale and insensitive to stray magnetic fields. When ordering, add VS prefix to type number. *Back-of-panel* mounted types in the 21-22 through 146-246 series can be combined with Metered Knob Assemblies. Existing models can be retrofitted also. Assembly type VS150 has a 0-150 volt scale and type VS300 has 0-300. Types VS116B, VS3PN116B and VS3PN136B are available off-the-shelf from distributor stock.

Designed to meet OSHA requirements. Portable 120 volt, single-phase units have grounded NEMA cord-plug assembly, on-off switch, grounded output receptacle, pilot light and fuse. Panel controls are recessed for protection from accidental bumping. Slots at rear for wall hanger brackets. Type L10B rated 0-132 volts, 1.75 amp; type L21 rated 0-140 volts, 4.5 amp; type L116B rated 0-140 volts, 10 amp. All available off-the-shelf from distributor stock.

INPUT		OUTPUT						
			Const. Current Load		Const. Impedance Load			
Volts	Hertz	Volts	Max. Amp.	Max. KVA	Max. Amp.	Max. KVA	TYPE	Ship. Wt. Lbs.
126-226 SERIES†								
Single Phase								
120	50/60	0-120	15	1.8	20	2.4	✓ 126	17
120	50/60	0-140	15	2.1	—	—		
240	50/60	0-240	7.5	1.8	10	2.4	✓ 226	17
240	50/60	0-280	7.5	2.1	—	—		
240	50/60	0-240	15	3.6	20	4.8	126-2	32
240	50/60	0-280	15	4.2	—	—		
480	50/60	0-480	7.5	3.6	10	4.8	✓ 226U-2	32
480	50/60	0-560	7.5	4.2	—	—		
Three Phase								
120	50/60	0-120	15	3.1	20	4.2	126-2	32
120	50/60	0-140	15	3.6	—	—		
240	50/60	0-240	7.5	3.1	10	4.2	✓ 226U-2	32
240	50/60	0-280	7.5	3.6	—	—		
240	50/60	0-240	15	6.2	20	8.3	126-3	49
240	60	0-280	15	7.3	—	—		
480	50/60	0-480	7.5	6.2	10	8.3	✓ 226T-3	49
480	60	0-560	7.5	7.3	—	—		
136B-236B SERIES†								
Single Phase								
120	50/60	0-120	22	2.6	28	3.4	✓ 136B	25
120	50/60	0-140	22	3.1	—	—		
120	50/60	0-120	44	5.3	56	6.7	136B-2 §	52
120	50/60	0-140	44	6.2	—	—		
240	50/60	0-240	10	2.4	13	3.1	✓ 236B	25
240	50/60	0-280	10	2.8	—	—		
240	50/60	0-240	22	5.3	28	6.7	✓ 136B-2	52
240	50/60	0-280	22	6.2	—	—		
480	50/60	0-480	20	4.8	26	6.2	✓ 236B-2	52
480	50/60	0-560	20	5.6	—	—		
Three Phase								
120	50/60	0-120	22	4.6	28	5.8	✓ 136B-2	52
120	50/60	0-140	22	5.3	—	—		
240	50/60	0-240	10	4.2	13	5.4	✓ 236B-2	52
240	50/60	0-280	10	4.8	—	—		
240	50/60	0-240	22	9.1	28	11.6	✓ 136B-3	76
240	60	0-280	22	10.7	—	—		
480	50/60	0-480	10	8.3	13	10.8	✓ 236B-3	76
480	60	0-560	10	9.7	—	—		
146-246 SERIES†								
Single Phase								
120	50/60	0-120	30	3.6	35	4.2	✓ 146	38
120	50/60	0-140	30	4.2	—	—		
120	50/60	0-120	60	7.2	70	8.4	146-2 §§	83
120	50/60	0-140	60	8.4	—	—		
240	50/60	0-240	15	3.6	19	4.6	✓ 246	38
240	50/60	0-280	15	4.2	—	—		
240	50/60	0-240	30	7.2	35	8.4	146-2	83
240	50/60	0-280	30	8.4	—	—		
480	50/60	0-480	15	7.2	19	9.1	246-2	83
480	50/60	0-560	15	8.4	—	—		

INPUT		OUTPUT						
			Const. Current Load		Const. Impedance Load			
Volts	Hertz	Volts	Max. Amps.	Max. KVA	Max. Amps.	Max. KVA	TYPE	Ship. Wt. Lbs.
146-246 SERIES† (contd.)								
Three Phase								
120	50/60	0-120	30	6.2	35	7.3	146-2	83
120	50/60	0-140	30	7.3	—	—		
240	50/60	0-240	15	6.2	19	7.9	246-2	83
240	50/60	0-280	15	7.3	—	—		
240	50/60	0-240	30	12.5	35	14.5	146-3	125
240	60	0-280	30	14.5	—	—		
480	50/60	0-480	15	12.5	19	15.8	246-3	125
480	60	0-560	15	14.5	—	—		
1156D-1256D SERIES†								
Single Phase								
120	50/60	0-120	50	6.0	55	6.6	✓ 1156D	82
120	50/60	0-140	50	7.0	—	—		
120	50/60	0-120	100	12.0	110	13.2	1156D-2P	169
120	50/60	0-140	100	14.0	—	—		
120	50/60	0-120	150	18.0	165	19.8	1156D-3P	272
120	50/60	0-140	150	21.0	—	—		
240	50/60	0-240	28	6.7	28	6.7	✓ 1256D	82
240	50/60	0-280	28	7.8	—	—		
240	50/60	0-240	50	12.0	55	13.2	1156D-2S	156
240	50/60	0-280	50	14.0	—	—		
240	50/60	0-240	56	13.4	56	13.4	✓ 1256D-2P	169
240	50/60	0-280	56	15.7	—	—		
240	50/60	0-240	84	20.2	84	20.2	1256D-3P	272
240	50/60	0-280	84	23.5	—	—		
240	50/60	0-240	100	24.0	110	26.4	1156D-4PS	361
240	50/60	0-280	100	28.0	—	—		
480	50/60	0-480	28	13.4	28	13.4	✓ 1256D-2S	156
480	50/60	0-560	28	15.7	—	—		
480	50/60	0-480	56	26.9	56	26.9	1256D-4PS	361
480	50/60	0-560	56	31.4	—	—		
Three Phase								
120	50/60	0-120	50	10.4	55	11.4	1156D-2D	155
120	50/60	0-140	50	12.1	—	—		
240	50/60	0-240	28	11.6	28	11.6	✓ 1256D-2D	155
240	50/60	0-280	28	13.6	—	—		
240	50/60	0-240	50	20.8	55	22.9	✓ 1156D-3Y	230
240	60	0-280	50	24.2	—	—		
240	50/60	0-240	100	41.6	110	45.7	1156D-6Y	507
240	50/60	0-280	100	48.5	—	—		
480	50/60	0-480	28	23.3	28	23.3	✓ 1256D-3Y	235
480	60	0-560	28	27.2	—	—		
480	50/60	0-480	56	46.6	56	46.6	1256D-6Y	507
480	60	0-560	56	54.3	—	—		

†Also available with open construction. Suffix U when ordering.
§Requires also one paralleling choke type T5000.
§§Requires also one paralleling choke type T6053.

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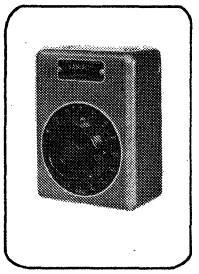

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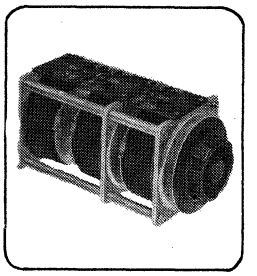
Control 3-phase power requiring 208, 240 or 480 V inputs. These Variacs come in 208, 240 and 50/60 Hz ratings and in 7.1, 8.5 and 10 Amps. 29 other units permit overvoltage use on an open Delta connection. 14 other models are Y connected. Ball bearings are also included.



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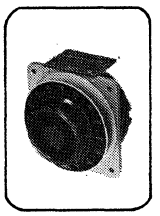

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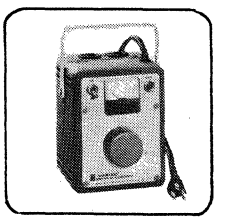
Metered, encased and available in 20 models featuring an autotransformer and overload protection. Some have Voltmeters, Ammeters, and Wattmeters. 120 V and 240 V models to 18.0A; 2 and 3 wire versions also offered.



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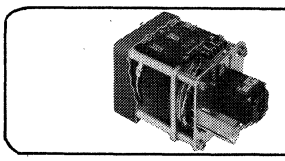

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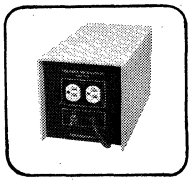

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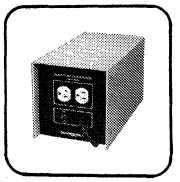

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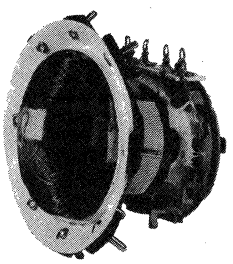
- Specific Custom Applications



20mm 90°

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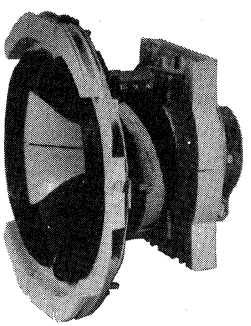
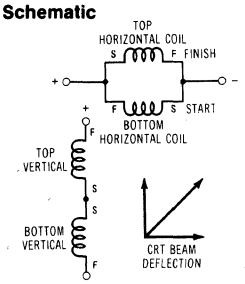
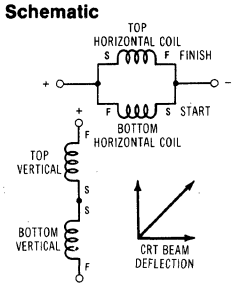


29mm 110°

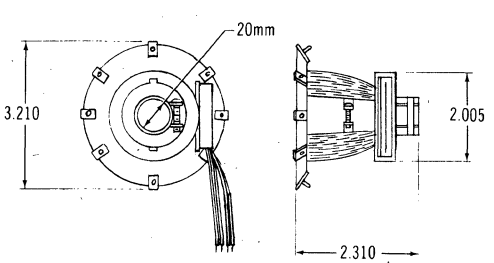
20mm 90° Yoke Schematic



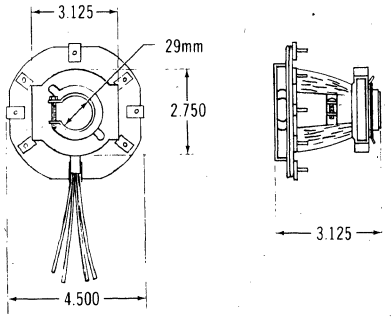
29mm 110° Yoke Schematic



Dimensional Diagram



Dimensional Diagram



THORDARSON MEISSNER INC.
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DEFLECTION YOKES AND HIGH VOLTAGE TRANSFORMERS (FLYBACK)

THORDARSON

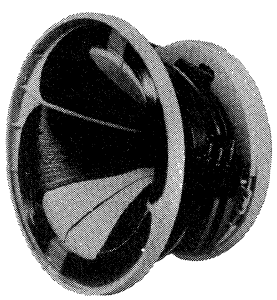
37mm 90° Color Yokes

Applications:
- CAD/CAM Display Terminals
- Data Display Terminals
- Military Defense Terminals
- Video Monitors
- Instruments With CRT Displays
- Special Custom Applications

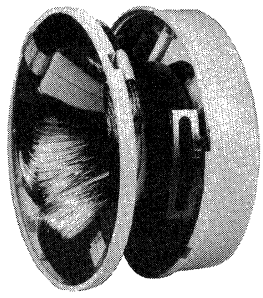
Features:
- Adapts to Any Size CRT
- Good Convergence and Color Purity
- Built To Customer Specifications
- Excellent Performance and Reliability
- Produced and Serviced in U.S.A.

Fully Integrated Sweep, Horizontal Output Transformers

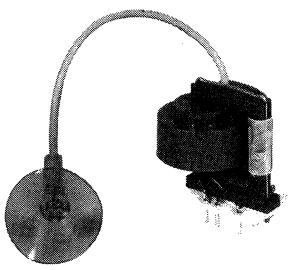
Features:
- Epoxy or Silicon Encapsulated
- Frequency Up To 32 kHz
- Retrace Time As Low As 5.5μ secs.
- Footprint Styles – Delta, Rectangular, Custom, "T" Print see pg. 20.
- Built to Customer Specification
- Excellent Performance and Reliability
- Produced and Serviced in U.S.A.



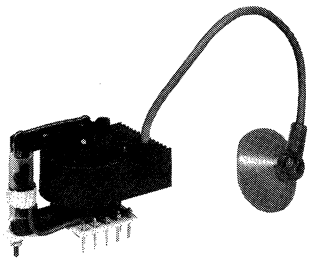
Standard Color 37mm 90°



Compact Color 37mm 90°

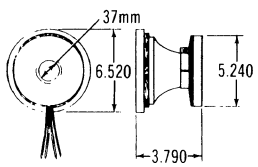


Fully Integrated With Doubler

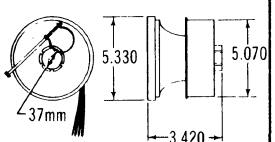


Diodes and Bleeder Resistor

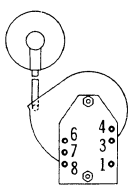
37mm 90° Standard Color Dimensions



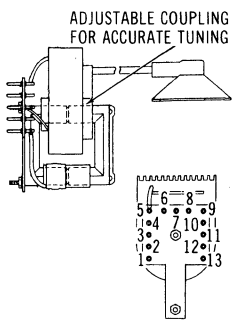
37mm 90° Compact Color Dimensions



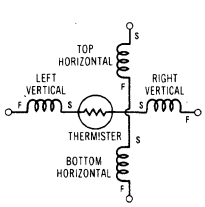
Fully Integrated With Doubler Encapsulated in Epoxy



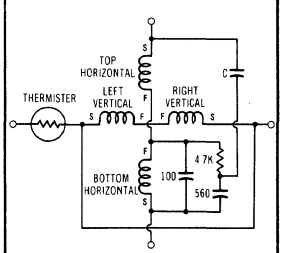
Diodes and Bleeder Resistor Fully Encapsulated



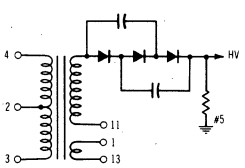
Typical Circuit



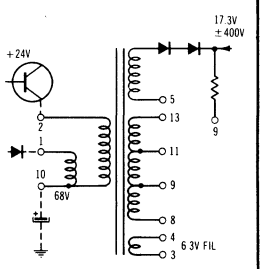
Typical Circuit



Schematic



Schematic



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HIGH VOLTAGE TRANSFORMERS (FLYBACK)

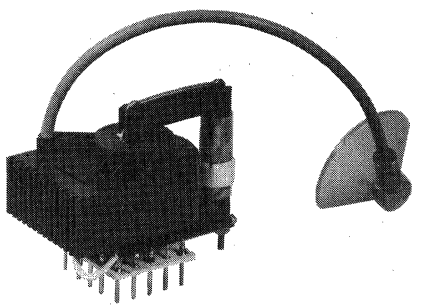
THORDARSON

Standard Sweep, Horizontal Output Transformers

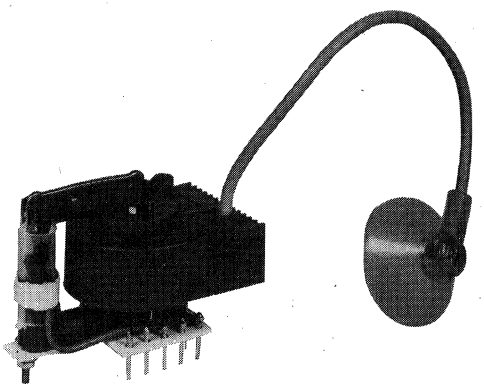
Features:
- Epoxy or Silicon Encapsulated
- Frequency Up to 32 kHz
- Retrace Time down to 5.5μ sec.
- Footprint Styles – Delta, Rectangular, Custom, "T" Print
- Built to Customer Specification
- Excellent Performance and Reliability
- Produced and Serviced in U.S.A.

If your footprint requirements do not match our standards, contact us with your specific specifications. We custom design to fit your project.

We invite you to send us your specifications for high voltage transformers (flybacks) and/or deflection yokes. We will send you a professionally designed prototype. Our engineering staff wants to work with you to design transformers for your special projects.

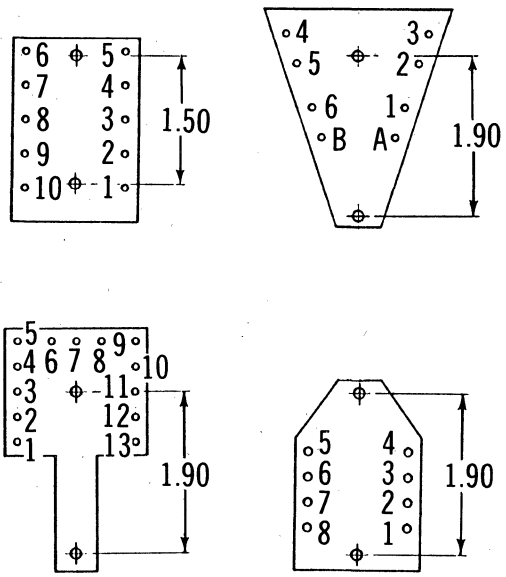


Silicon Encapsulated

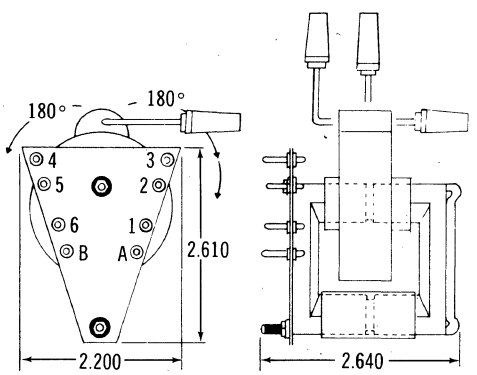


Epoxy Encapsulated

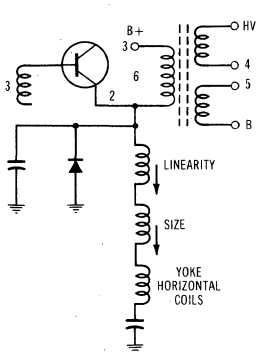
Terminal Board Standards (Footprints)



Flyback Outline Dimensions



Typical Circuit



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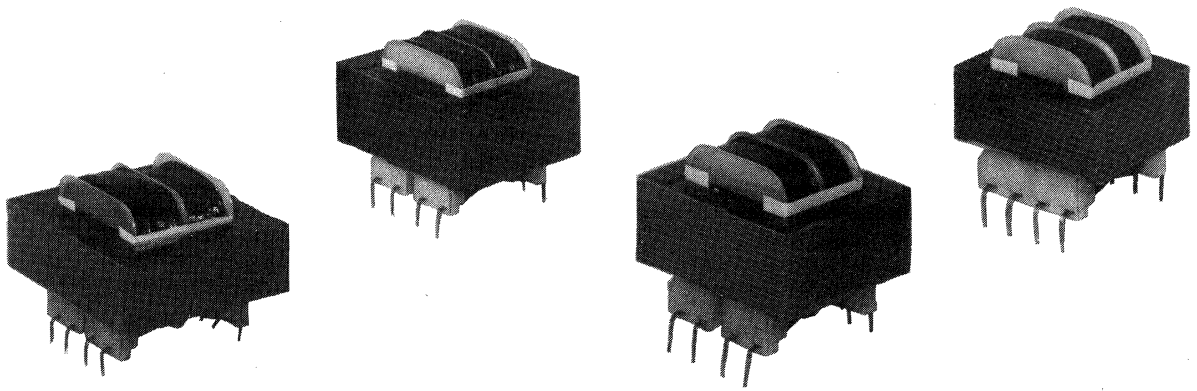
MINI-ISO-MITES

THORDARSON

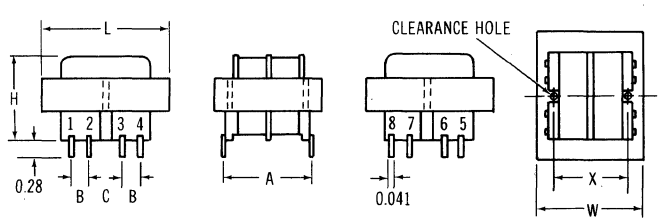
Low-Voltage Printed Circuit Plug-In Power Transformers



The MINI-ISO-MITES are low voltage, plug-in, power transformers added to THORDARSON'S printed circuit line. The Mini-Iso-Mite series are designed for ANY low voltage power supply application where tight space restrictions are a consideration. The single 115V or the dual 115/230V primaries and secondaries are wound non-concentrically meaning, side by side. This construction results in smaller units and eliminates the need for costly electro-static shielding.

The Mini-Iso-Mites are highly isolated units with 2500 HIPOT standard and are built to MIL-T-27 specifications.

The power ratings are: 2.4VA, 6VA, 12VA, 20VA, and 36VA. The tallest of the series is $1^{9}/_{16}$ inches and the smallest is $1^{3}/_{16}$ inches.



VA Size	H	L	W	X	A	B	C	Wt.
2.4	1.1875	1.375	1.1250	—	1.200	0.250	0.250	0.25
6	1.3125	1.625	1.3125	1.0625	1.280	0.250	0.350	0.44
12	1.4375	1.875	1.5626	1.2500	1.410	0.300	0.400	0.70
20	1.4375	2.250	1.8750	1.5000	1.600	0.300	0.400	0.80
36	1.5625	2.625	2.1875	—	1.850	0.400	0.400	1.10

Part Number			Secondary RMS Ratings	
Single 115V 6 Pin	Dual 115/230V 8 Pin	VA	Series	Parallel
MIM 421	MIM 420	2.4	10V CT @ 0.25A	5V @ 0.5A
MIM 423	MIM 422	2.4	12.6V CT @ 0.2A	6.3V @ 0.4A
MIM 425	MIM 424	2.4	16V CT @ 0.15A	8V @ 0.3A
MIM 427	MIM 426	2.4	20V CT @ 0.12A	10V @ 0.24A
MIM 429	MIM 428	2.4	24V CT @ 0.1A	12V @ 0.2A
MIM 431	MIM 430	2.4	28V CT @ 0.085A	14V @ 0.17A
MIM 433	MIM 432	2.4	26V CT @ 0.065A	18V @ 0.13A
MIM 435	MIM 434	2.4	48V CT @ 0.05A	24V @ 0.1A
MIM 437	MIM 436	2.4	56V CT @ 0.045A	28V @ 0.09A
MIM 439	MIM 438	2.4	120V CT @ 0.02A	60V @ 0.04A
MIM 521	MIM 520	6	10V CT @ 0.6A	5V @ 1.2A
MIM 523	MIM 522	6	12.6V CT @ 0.5A	6.3V @ 1A
MIM 525	MIM 524	6	16V CT @ 0.4A	8V @ 0.8A
MIM 527	MIM 526	6	20V CT @ 0.3A	10V @ 0.6A
MIM 529	MIM 528	6	24V CT @ 0.25A	12V @ 0.5A
MIM 531	MIM 530	6	28V CT @ 0.2A	14V @ 0.4A
MIM 533	MIM 532	6	36V CT @ 0.17A	18V @ 0.34A
MIM 535	MIM 534	6	48V CT @ 0.125A	24V @ 0.25A
MIM 537	MIM 536	6	56V CT @ 0.11A	28V @ 0.22A
MIM 539	MIM 538	6	120V CT @ 0.05A	60V @ 0.1A
MIM 621	MIM 620	12	10V CT @ 12A	5V @ 2.4A
MIM 623	MIM 622	12	12.6V CT @ 1A	6.3V @ 2A
MIM 625	MIM 624	12	16V CT @ 0.8A	8V @ 1.6A
MIM 627	MIM 626	12	20V CT @ 0.6A	10V @ 1.2A
MIM 629	MIM 628	12	24V CT @ 0.5A	12V @ 1A

Part Number			Secondary RMS Ratings	
Single 115V 6 Pin	Dual 115/230V 8 Pin	VA	Series	Parallel
MIM 631	MIM 630	12	28V CT @ 0.42A	14V @ 0.84A
MIM 633	MIM 632	12	36V CT @ 0.35A	18V @ 0.7A
MIM 635	MIM 634	12	48V CT @ 0.25A	24V @ 0.5A
MIM 637	MIM 636	12	56V CT @ 0.22A	28V @ 0.44A
MIM 639	MIM 638	12	120V CT @ 0.1A	60V @ 0.2A
MIM 720	MIM 721	20	10V CT @ 2000 mA	5V @ 4A
MIM 722	MIM 723	20	12.6V CT @ 1600 mA	6.3V @ 3.2A
MIM 724	MIM 725	20	16V CT @ 1250 mA	8V @ 2.5A
MIM 726	MIM 727	20	20V CT @ 1000 mA	10V @ 2A
MIM 728	MIM 729	20	24V CT @ 800 mA	12V @ 1.6A
MIM 730	MIM 731	20	28V CT @ 700 mA	14V @ 1.4A
MIM 732	MIM 733	20	36V CT @ 550 mA	18V @ 1.1A
MIM 734	MIM 735	20	48V CT @ 400 mA	24V @ 0.8A
MIM 736	MIM 737	20	56V CT @ 350 mA	28V @ 0.7A
MIM 738	MIM 739	20	120V CT @ 160 mA	60V @ 0.32A
MIM 820	MIM 821	36	10V CT @ 3600 mA	5V @ 7.2A
MIM 822	MIM 823	36	12.6V CT @ 2850 mA	6.3V @ 5.7A
MIM 824	MIM 825	36	16V CT @ 2250 mA	8V @ 4.5A
MIM 826	MIM 827	36	20V CT @ 1800 mA	10V @ 3.6A
MIM 828	MIM 829	36	24V CT @ 1500 mA	12V @ 3.0A
MIM 830	MIM 831	36	28V CT @ 1300 mA	14V @ 2.6A
MIM 832	MIM 833	36	36V CT @ 1000 mA	18V @ 2A
MIM 834	MIM 835	36	48V CT @ 750 mA	24V @ 1.5A
MIM 836	MIM 837	36	56V @ 650 mA	28V @ 1.3A
MIM 838	MIM 839	36	120V CT @ 300 mA	60V @ 0.6A

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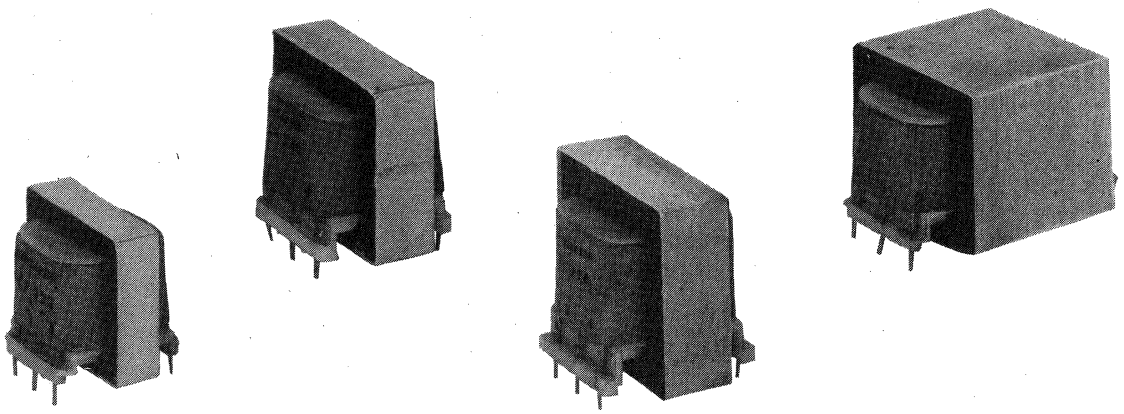
MINIATURE TRANSFORMERS

THORDARSON

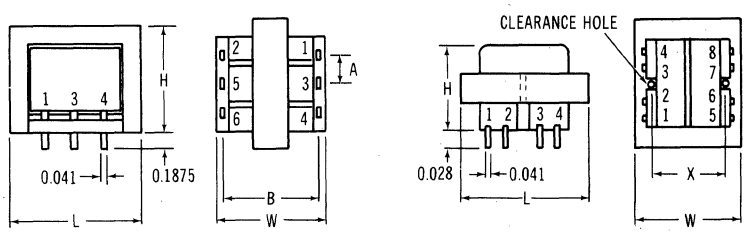
Printed Circuit Plug-In Power Miniature Transformers



Thordarson's new step down PCP transformer series is utilized in miniaturized equipment. 1.2, 4.4, 10, and 24 VA sizes are available.

All THORDARSON transformers are thoroughly impregnated and built to MIL-T-27 specifications to insure quality products.

The six and eight plug-in terminal pins are precisely placed with consistency for ease in mounting. The smallest of the PCP series is 3 oz., with a height of $1^{3}/_{16}$ inches. The largest unit weighs.12 oz., and is $1^{3}/_{8}$ inches in height. Additional statistical information is contained in the charts.



VA Size	W	L	H	A	B	Oz.
1.2	1.125	1.375	1.125	0.312	1.000	3
4.4	1.226	1.625	1.312	0.400	1.100	5
10	1.426	1.875	1.562	0.400	1.300	9
24	2.226	1.625	1.312	0.400	2.100	12

Part Number			Secondary RMS Ratings	
Single 115V	Dual 115/230V	VA	Series S*	Parallel P*
PCP 150	PCP 151	1.2	10V CT @ 120 mA	5V @ 0.240A
PCP 152	PCP 153	1.2	12.6V CT @ 100 mA	6.3V @ 0.200A
PCP 162	PCP 163	1.2	16V CT @ 75 mA	8V @ 0.150A
PCP 182	PCP 183	1.2	24V CT @ 50 mA	12V @ 0.100A
PCP 192	PCP 193	1.2	28V CT @ 40 mA	14V @ 0.080A
PCP 202	PCP 203	1.2	34V CT @ 35 mA	17V @ 0.070A
PCP 212	PCP 213	1.2	40V CT @ 30 mA	20V @ 0.060A
PCP 222	PCP 223	1.2	56V CT @ 20 mA	28V @ 0.040A
PCP 232	PCP 233	1.2	120V CT @ 10 mA	60V @ 0.020A
PCP 160	PCP 161	4.4	10V CT @ 440 mA	5V @ 0.880A
PCP 154	PCP 155	4.4	12.6V CT @ 350 mA	6.3V @ 0.700A
PCP 164	PCP 165	4.4	16V CT @ 260 mA	8V @ 0.520A
PCP 184	PCP 185	4.4	24V CT @ 180 mA	12V @ 0.360A
PCP 194	PCP 195	4.4	28V CT @ 180 mA	14V @ 0.320A
PCP 204	PCP 205	4.4	34V CT @ 125 mA	17V @ 0.250A
PCP 214	PCP 215	4.4	40V CT @ 110 mA	20V @ 0.220A
PCP 224	PCP 225	4.4	56V CT @ 80 mA	28V @ 0.160A
PCP 234	PCP 235	4.4	120V CT @ 35 mA	60V @ 0.070A

Part Number			Secondary RMS Ratings	
Single 115V	Dual 115/230V	VA	Series S*	Parallel P*
PCP 170	PCP 171	10	10V CT @ 1000 mA	5V @ 2A
PCP 156	PCP 157	10	12.6V CT @ 800 mA	6.3V @ 1.60A
PCP 166	PCP 167	10	16V CT @ 640 mA	8V @ 1.28A
PCP 186	PCP 187	10	24V CT @ 450 mA	12V @ 0.900A
PCP 196	PCP 197	10	28V CT @ 360 mA	14V @ 0.720A
PCP 206	PCP 207	10	34V CT @ 300 mA	17V @ 0.600A
PCP 216	PCP 217	10	40V CT @ 250 mA	20V @ 0.500A
PCP 226	PCP 227	10	56V CT @ 180 mA	28V @ 0.360A
PCP 236	PCP 237	10	120V CT @ 85 mA	60V @ 0.170A
PCP 180	PCP 181	24	10V CT @ 2400 mA	5V @ 4.8A
PCP 158	PCP 159	24	12.6V CT @ 2A	6.3V @ 4A
PCP 168	PCP 169	24	16V CT @ 1.5A	8V @ 3A
PCP 188	PCP 189	24	24V CT @ 1A	12V @ 2A
PCP 198	PCP 199	24	28V CT @ 800 mA	14V @ 1.6A
PCP 208	PCP 209	24	34V CT @ 700 mA	17V @ 1.4A
PCP 218	PCP 219	24	40V CT @ 600 mA	20V @ 1.2A
PCP 228	PCP 229	24	56V CT @ 420 mA	28V @ 0.840A
PCP 238	PCP 239	24	120V CT @ 200 mA	60V @ 0.400A

* Note: V_S is a series hookup; V_P is a parallel hookup.

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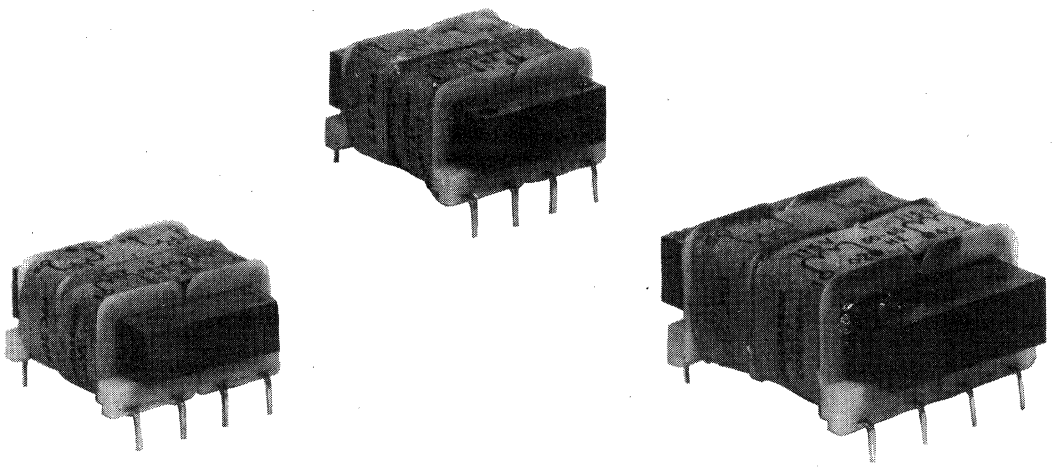
FLAT COMPACT TRANSFORMERS

THORDARSON

FLAT COMPACT Printed Circuit Power Transformers



Sleek design: The 6VA FLAT COMPACT permits 1 inch card spacing and is 0.850 inches high. The 12VA model permits $1^1/_4$ inch card spacing and is 1.065 inches high.

The electro-static shield has been removed. Why? It incorporates non-concentric windings which means the secondary is located next to the primary instead of being wound directly over it. The high isolation has diminished the capacitance between windings.

1500 V RMS HIPOT: High isolation is a standard feature.

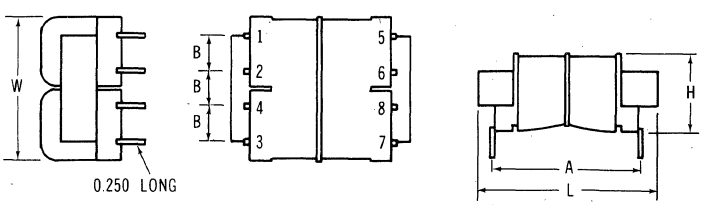
The FLAT COMPACT Transformer was created for use in ANY low voltage application where space is critical. For single or dual output DC supplies and isolated control circuits and reference supplies, use the FLAT COMPACT.

Part Number	VA Size	Secondary*	
		Series	Parallel
PFC 202	6	10V CT @ 600 mA	5V @ 1.2A
PFC 212	6	12.6V CT @ 450 mA	6.3V @ 0.9A
PFC 222	6	16V CT @ 350 mA	8V @ 0.7A
PFC 232	6	20V CT @ 300 mA	10V @ 0.6A
PFC 242	6	24V CT @ 250 mA	12V @ 0.5A
PFC 192	6	30V CT @ 200 mA	15V @ 0.4A
PFC 252	6	34V CT @ 170 mA	17V @ 0.34A
PFC 262	6	40V CT @ 150 mA	20V @ 0.3A
PFC 272	6	56V CT @ 100 mA	28V @ 0.2A
PFC 282	6	88V CT @ 65 mA	44V @ 0.13A
PFC 292	6	120V CT @ 50 mA	60V @ 0.1A
PFC 302	6	230V CT @ 25 mA	115V @ 0.05A

Part Number	VA Size	Secondary*	
		Series	Parallel
PFC 204	12	10V CT @ 1200 mA	5V @ 2.4A
PFC 214	12	12.6V CT @ 900 mA	6.3V @ 1.8A
PFC 224	12	16V CT @ 700 mA	8V @ 1.4A
PFC 234	12	20V CT @ 600 mA	10V @ 1.2A
PFC 244	12	24V CT @ 500 mA	12V @ 1.0A
PFC 294	12	30V CT @ 400 mA	15V @ 0.8A
PFC 254	12	34V CT @ 340 mA	17V @ 0.68A
PFC 264	12	40V CT @ 300 mA	20V @ 0.6A
PFC 274	12	56V CT @ 200 mA	28V @ 0.4A
PFC 284	12	88V CT @ 130 mA	44V @ 0.26A
PFC 324	12	120V CT @ 100 mA	60V @ 0.2A
PFC 334	12	230V CT @ 50 mA	115V @ 0.1A

* Regulation of size 6 units is 30%, i.e., no load secondary voltage is 30% higher than full load. Regulation of size 12 units is 20%.

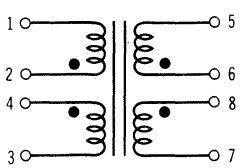
DIMENSIONAL DIAGRAM



VA Size	L	W	H	A	B	Oz.
6	1.875	1.5625	0.850	1.600	0.375	7
12	2.500	2.0000	1.065	2.000	0.500	11

DUAL PRIMARIES

115/230V, 50/60Hz



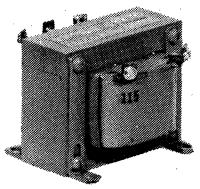
THORDARSON MEISSNER INC.
628 Belmont St. • Mt. Carmel, IL 62863 • (618) 262-5121 TWX 510-525-2254

TODD ENGINEERED

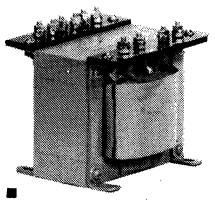
• NAME PLATES • WIRING DIAGRAMS

HIGH CURRENT TRANSFORMERS

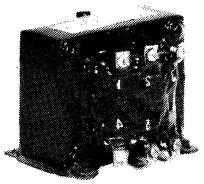
• 45° TEMP. RISE • MINIMUM REGULATION



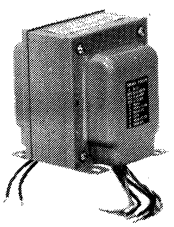
STYLE B



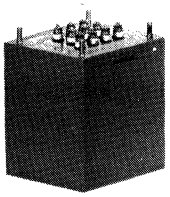
■ STYLE B (OVER 700 VA)



STYLE BE



STYLE V



STYLE CM

FOUR STYLES STOCKED IN DEPTH

SECONDARY VOLTS TAP VOLTS	PART NO.	RATING VA	PRIMARY VOLTS 50-500 Hz.	OPTIONAL SECONDARY HOOKUP SERIES VOLTS	SERIES AMPS (RMS)	PARALLEL VOLTS	PARALLEL AMPS (RMS)
10 VOLTS Parallel: 2.5, 5V Series: 7.5, 10V	10 02	20	115	10V CT	2	5V CT	4
	10 05	50	115	OR	5	OR	10
	10 10	100	115	7.5V	10	2.5V	20
	10 20	200	115		20		40
12.6 VOLTS Parallel: 3.1, 6.3V Series: 9.4, 12.6V	12 02	24	115	12.6V CT	2	6.3V CT	4
	12 05	60	115	OR	5	OR	10
	12 10	120	115	9.4V	10	3.1V	20
	12 20	240	115		20		40
16 VOLTS Parallel: 4, 8V Series: 12, 16V	16 01	16	115	16V CT	1	8V CT	2
	16 02	32	115		2		4
	16 05	80	115	OR	5	OR	10
	16 10	160	115	12V	10	4V	20
	16 20	320	115		20		40
24 VOLTS Parallel: 6, 12V Series: 18, 24V INTERMEDIATE RATINGS AVAILABLE	24 01	24	115		1		2
	24 02	48	115		2		4
	24 04	96	115	24V CT	4	12V CT	8
	24 06	144	115		6		12
	24 08	192	115	OR	8	OR	16
	24 12	288	115		12		24
	24 20	480	105, 115, 125	18V	20	6V	40
	24 25	600	105, 115, 125		25		50
	24 50	1200	105, 115, 125		50		100
	24 100	2400	115, 230		100		200
36 VOLTS Parallel: 9, 18V Series: 27, 36V	36 00	18	115		0.5		1
	36 01	36	115		1		2
	36 02	72	115		2		4
	36 04	144	115	36V CT	4	18V CT	8
	36 06	216	115		6		12
	36 08	288	115	OR	8	OR	16
	36 12	432	105, 115, 125		12		24
	36 20	720	105, 115, 125	27V	20	9V	40
	36 30	1080	105, 115, 125		30		60
	36 50	1800	115, 230		50		100
	36 100	3600	115, 230		100		200
56 VOLTS Parallel: 14, 28V Series: 42, 56V	56 01	56	115		1		2
	56 02	112	115	56V CT	2	28V CT	4
	56 05	280	115		5		10
	56 08	448	105, 115, 125	OR	8	OR	16
	56 12	672	105, 115, 125		12		24
	56 25	1400	105, 115, 125	42V	25	14V	50
	56 50	2800	115, 230		50		100
	56 100	5600	115, 230		100		200
64 VOLTS Parallel: 16, 32V Series: 48, 64V	64 00	32	115		0.5		1
	64 01	64	115	64V CT	1	32V CT	2
	64 02	128	115		2		4
	64 04	256	115	OR	4	OR	8
	64 08	512	105, 115, 125		8		16
	64 12	780	105, 115, 125	48V	12	16V	24
	64 25	1600	105, 115, 125		25		50
	64 50	3200	115, 230		50		100
68 VOLTS Parallel: 17, 34V Series: 51, 68V	68 01	68	115		1		2
	68 02	136	115	68V CT	2	34V CT	4
	68 04	272	115	OR	4	OR	8
	68 08	544	105, 115, 125	51V	8	17V	16
	68 12	816	105, 115, 125		12		24
80 VOLTS Parallel: 20, 40V Series: 60, 80V	80 01	80	115		1		2
	80 02	160	115	80V CT	2	40V CT	4
	80 05	400	115	OR	5	OR	10
	80 10	800	105, 115, 125	60V	10	20V	20
	80 25	2000	115, 230		25		50
	80 50	4000	115, 230		50		100
120 VOLTS Parallel: 30, 60V Series: 90, 120V	120 01	120	115		1		2
	120 02	240	115	120V CT	2	60V CT	4
	120 04	480	115	OR	4	OR	8
	120 08	960	105, 115, 125	90V	8	30V	16
	120 12	1440	105, 115, 125		12		24
180 VOLTS Parallel: 45, 90V Series: 135, 180V	180 00	90	115	180V CT	0.5	90V CT	1
	180 01	180	115	OR	1	OR	2
	180 04	720	105, 115, 125	135V	4	45V	8
	180 08	1440	105, 115, 125		8		16
230 VOLTS Parallel: 57.5, 115V Series: 172.5, 230V	230 00	115	115		0.5		1
	230 01	230	115	230V CT	1	115V CT	2
	230 02	460	115	OR	2	OR	4
	230 05	1150	105, 115, 125	172.5V	5	57.5V	10
	230 08	1840	115, 230		8		16
300 VOLTS Parallel: 75, 150V Series: 225, 300V	300 00	150	115	300V CT	0.5	150V CT	1
	300 01	300	115	OR	1	OR	2
	300 02	600	115	225V	2	75V	4
	300 05	1500	105, 115, 125		5		10

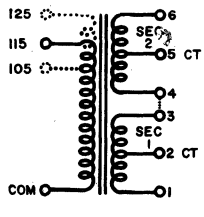
DC TO RMS CONVERSION CHART

SECONDARY RMS CURRENT = DC CURRENT × FACTOR BELOW

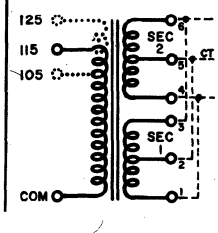
	Choke Input Filter or Inductive Load	Resistive Load	Capacitor Input Filter or Capacitive Load
FULL WAVE BRIDGE	1.0	1.0	1.8
FULL WAVE C.T.	.7	1.0	1.15

CUSTOM VARIATIONS QUOTED PROMPTLY

SERIES HOOKUP



PARALLEL HOOKUP



TODD SYSTEMS "HIGH CURRENT TRANSFORMERS & CHOKES" are designed for use in high power rectifier circuits, and high current A.C. applications. "TODD ENGINEERED" designs feature a nominal temperature rise of 45°C., at full load, thus providing outstanding overload capacity. All designs utilize extremely low regulation, varying from 10% in the smallest to 1% in the larger units.

Four styles . . . select the type best suited for your lab, test rigs, OEM or production equipment

DATA SUBJECT TO CHANGE WITHOUT NOTICE

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QUALITY ENGINEERED

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PRECISION BUILT

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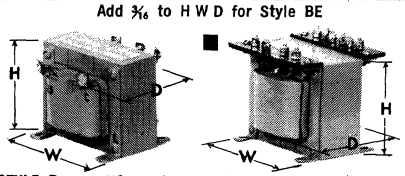
TODD ENGINEERED

HIGH CURRENT TRANSFORMERS

MECHANICAL SPECIFICATIONS · · · · · · · · · · · · · · SPECIFY STYLE REQUIRED

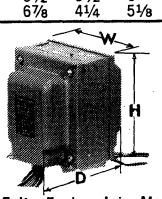
PART NO.	• BRACKET MTD. (STYLE B) • ENCAPSULATED (STYLE BE) H	W	D	MW	MD	WGT.	• FULLY MTD. SHELLS (STYLE V) H	W	D	MW	MD	WGT.	• HERMETIC SEALED MIL-T (STYLE CM) H	W	D	MW	MD	WGT.	PART NO.
10 02	2¼	2⅝	2 1/16	2 3/16	1 11/16	1¼	2⅝	2 3/16	2	1¾	1¼	1¼	3⅛	3	2 1/16	2 3/32	1 27/32	2	10 02
10 05	2½	3	2⅝	2½	2⅛	2⅜	3 1/16	2½	2¾	2	1 13/16	2½	3 3/16	3½	3	2⅝	2⅛	4	10 05
10 10	3⅛	3¾	3	3⅛	2⅛	4⅜	3⅞	3¼	3⅝	2½	2⅜	5	4¼	3⅞	3 5/16	3	2 1/16	7¾	10 10
10 20	3¾	4½	3⅝	3¾	2⅜	7½	4⅝	3⅞	3⅞	3	2 13/16	8	5 1/16	5	4¼	4 1/16	3 5/16	12½	10 20
12 02	2½	3	2⅛	2½	1⅝	1½	3 1/16	2½	2¼	2	1 5/16	1⅝	3 3/16	3½	3	2⅝	2⅛	2½	12 02
12 05	2½	3	2⅞	2½	2⅜	2¾	3 1/16	2½	3	2	2 1/16	2⅞	3 3/16	3½	3	2⅝	2⅛	4	12 05
12 10	3⅛	3¾	3 11/16	3⅛	2½	5¼	3⅞	3¼	3¾	2½	2½	5½	4 1/16	4¼	3⅝	3⅝	2 11/16	8	12 10
12 20	3¾	4½	4	3¾	2¾	9	4⅝	3⅞	4 5/16	3	3⅛	9¼	5 1/16	5	4¼	4 1/16	3 5/16	13	12 20
16 01	2¼	2⅝	2	2 3/16	1⅝	1¼	2⅝	2 3/16	1 15/16	1¾	1 13/16	1⅜	3⅛	3	2 1/16	2 3/32	1 27/32	2⅛	16 01
16 02	2½	3	2	2½	1¾	1⅞	3 1/16	2½	2½	2	1 13/16	1⅞	3 3/16	3½	3	2⅝	2⅛	3⅛	16 02
16 05	2 13/16	3⅜	2¾	2 13/16	2¼	3½	3⅜	2 13/16	3⅝	2¼	2 3/16	3¾	4¼	3⅞	3 5/16	3	2 1/16	5¼	16 05
16 10	3 1/16	4⅛	3¾	3 1/16	2⅝	7	4⅛	3 1/16	4	2¾	3	7⅛	4⅞	4⅝	3 5/16	3 1/16	3	11	16 10
16 20	3¾	4½	5	3¾	3¾	12¾	4⅝	3⅞	5⅜	3	3¼	13	5 1/16	5	4¼	4 1/16	3 5/16	16¼	16 20
24 01	2½	3	2⅛	2½	1¾	1¾	3 1/16	2½	2½	2	1 5/16	1¾	3 13/16	3½	3	2⅝	2⅛	3¼	24 01
24 02	2½	3	2½	2½	2	2¼	3 1/16	2½	2⅝	2	1¾	2¼	3 13/16	3½	3	2⅝	2⅛	4¼	24 02
24 04	3⅛	3¾	3⅛	3⅛	2⅛	4¼	3⅞	3¼	3¼	2½	2 1/16	4⅜	4 1/16	4¼	3⅝	3 5/16	2 11/16	7½	24 04
24 06	3 1/16	4⅛	3½	3 1/16	2⅜	6	4⅛	3 1/16	3¾	2¾	2 11/16	6¼	4⅞	4⅝	3 13/16	3 11/16	3	10	24 06
24 08	3 1/16	4⅛	4	3 1/16	2⅞	7½	4⅛	3 1/16	4¼	2¾	3 1/16	7¾	4⅞	4⅝	3 13/16	3 11/16	3	13	24 08
24 12	3¾	4½	4⅝	3¾	3⅜	11	4⅝	3⅞	4⅞	3	3¾	11⅜	5 1/16	5	4¼	4 1/16	3 5/16	15	24 12
24 20	4⅜	5¼	5¼	4⅜	3 1/16	16¼	5⅜	4½	5⅜	3½	3⅞	16⅞	6¼	5¾	4⅞	4⅜	3½	23	24 20
24 25	4⅜	5¼	5¼	4⅜	3⅞	18½	5⅜	4½	5¾	3½	4¼	19½	6¼	5¾	4⅞	4⅜	3½	26	24 25
24 50	■5½	6⅜	7⅛	5 5/16	5¼	42	6⅜	5 5/16	7¼	4¼	5½	43	7½	6⅞	5 13/16	5 5/16	4¼	53	24 50
24 100	■6 1/32	7 1/16	7⅜	5 13/16	5¼	51							8¼	7 9/16	6 17/32	5 13/16	4 25/32	65	24 100
36 00	2¼	2⅝	1⅞	2 3/16	1⅝	1¼	2⅝	2 3/16	2 1/16	1¾	1⅜	1½	3 13/16	3½	3	2⅝	2⅛	3⅜	36 00
36 01	2½	3	2⅛	2½	1⅞	2	3 1/16	2½	2⅝	2	1 1/16	2	3 13/16	3½	3	2⅝	2⅛	3¼	36 01
36 02	2 13/16	3⅜	2¾	2 13/16	2¼	3½	3⅜	2 13/16	3 5/16	2¼	2⅛	3½	4¼	3⅞	3⅜	3	2 1/16	5¼	36 02
36 04	3 1/16	4⅛	3⅝	3 1/16	2½	6¼	4⅛	3 1/16	4	2¾	2⅞	6½	4⅞	4⅝	3 13/16	3 11/16	3	10	36 04
36 06	3¾	4½	3¾	3¾	2⅝	8¼	4⅝	3⅞	4 1/16	3	2⅞	8½	5 1/16	5	4¼	4 1/16	3 5/16	11	36 06
36 08	3¾	4½	4¾	3¾	3½	11¾	4⅝	3⅞	5 1/16	3	3⅞	12½	5 1/16	5	4¼	4 1/16	3 5/16	15½	36 08
36 12	4⅜	5¼	5⅜	4⅜	3¾	17⅛	5⅜	4½	5¾	3½	4⅛	17⅞	6¼	5¾	4⅞	4⅜	3½	22½	36 12
36 20	4⅜	5¼	6⅜	4⅜	4⅞	23¾	5⅜	4½	6¾	3½	5¼	25	7⅜	5¾	4⅞	4⅜	3½	29	36 20
36 30	■5½	6⅜	6¾	5 5/16	4⅞	34½	6⅜	5 5/16	6¾	4¼	4 1/16	36	7½	6⅞	5 13/16	5 5/16	4¼	42	36 30
36 50	■6 1/32	7 1/16	6¾	5 13/16	5¼	48							8¼	7 9/16	6 17/32	5 13/16	4 25/32	55	36 50
36 100	■7½	9	9¼	7½	7⅛	85													36 100
56 01	2½	3	2¾	2½	2¼	2½	3 1/16	2½	3	2	2	2¾	3 13/16	3½	3	2⅝	2⅛	4	56 01
56 02	3⅛	3¾	3 1/16	3⅛	2⅜	4½	3⅞	3¼	3 1/16	2½	2⅜	4¾	4 1/16	4¼	3⅝	3 5/16	2 11/16	6¾	56 02
56 05	3¾	4½	4¾	3¾	3½	11½	4⅝	3⅞	5⅛	3	4	12	5 1/16	5	4¼	4 1/16	3 5/16	18	56 05
56 08	4⅜	5¼	5	4⅜	3 11/16	16¾	5⅜	4½	5⅝	3½	4	17	6¼	5¾	4⅞	4⅜	3½	24	56 08
56 12	■5½	6⅜	5½	5 5/16	3 1/16	24	6⅜	5 5/16	5½	4¼	3½	25	7½	6⅞	5 13/16	5 5/16	4¼	30	56 12
56 25	■5½	6⅜	7	5 5/16	5⅛	33	6⅜	5 5/16	7	4¼	5 1/16	34½	7½	6⅞	5 13/16	5 5/16	4¼	45	56 25
56 50	■6 1/32	7 1/16	8	5 13/16	6	60							8¼	7 9/16	6 17/32	5 13/16	4 25/32	68	56 50
56 100	■7⅝	9	11½	7½	9⅝	146													56 100
64 00	2¼	2⅝	2 1/16	2 3/16	2	1¾	2⅝	2 3/16	2 1/16	1¾	1½	1¾	3⅛	3	2 1/16	2 3/32	1 27/32	2½	64 00
64 01	2½	3	2 13/16	2½	2⅜	3	3 1/16	2½	3	2	2⅛	2¾	3 3/16	3½	3	2⅝	2⅛	4½	64 01
64 02	3⅛	3¾	3 1/16	3⅛	2⅜	4¾	3⅞	3¼	3⅛	2½	2	4⅛	4 1/16	4¼	3⅝	3 5/16	2 11/16	8	64 02
64 04	3¾	4½	4¼	3¾	3 1/16	10	4⅝	3⅞	4⅝	3	3½	10½	5 1/16	5	4¼	4 1/16	3 5/16	14½	64 04
64 08	4⅜	5¼	5⅝	4⅜	3 15/16	18¾	5⅜	4½	6	3½	4⅜	18½	6¼	5¾	4⅞	4⅜	3½	24	64 08
64 12	■5½	6⅜	5¾	5 5/16	3⅞	26	6⅜	5 5/16	5⅞	4¼	3⅞	28	7½	6⅞	5 13/16	5 5/16	4¼	34	64 12
64 25	■6 1/32	7 1/16	7½	5 13/16	5 7/16	52							8¼	7 9/16	6 17/32	5 13/16	4 25/32	66	64 25
64 50	■7⅝	9	7⅝	7½	5¾	75							10⅜	8	6¾	6¾	5½	105	64 50
68 01	2½	3	2 13/16	2½	2⅜	3¼	3 1/16	2½	3	2	2 1/16	2⅞	3 13/16	3½	3	2⅝	2⅛	4½	68 01
68 02	3⅛	3¾	3⅛	3⅛	2½	5	3⅞	3¼	3¾	2½	2½	5½	4 7/16	4¼	3⅝	3 5/16	2 11/16	8	68 02
68 04	3¾	4½	4⅜	3¾	3⅛	10½	4⅝	3⅞	5⅛	3	3⅞	12½	5 1/16	5	4¼	4 1/16	3 5/16	15	68 04
68 08	4⅜	5¼	5¾	4⅜	4	19½	5⅜	4½	6	3½	4⅜	19	6¼	5¾	4⅞	4⅜	3½	23	68 08
68 12	■5½	6⅜	5⅞	5 5/16	4	26	6⅜	5 5/16	6	4¼	4	30	7½	6⅞	5 13/16	5 5/16	4¼	35	68 12
80 01	2 13/16	3⅜	2¾	2 13/16	2¼	3½	3⅜	2 13/16	3 5/16	2¼	2 3/16	3¾	4¼	3⅞	3 5/16	3	2 1/16	5½	80 01
80 02	3 1/16	4⅛	3⅝	3 1/16	2½	6½	4⅛	3 1/16	4 3/16	2¾	2⅝	7	4⅞	4⅝	3 13/16	3 11/16	3	11	80 02
80 05	4⅜	5¼	5⅛	4⅜	3½	15¼	5⅜	4½	5½	3½	3⅞	16½	6¼	5¾	4⅞	4⅜	3½	27	80 05
80 10	■5½	6⅜	5½	5 5/16	4	28	6⅜	5 5/16	5¾	4¼	4	29	7½	6⅞	5 13/16	5 5/16	4¼	35	80 10
80 25	■6 1/32	7 1/16	6⅜	5 13/16	4¼	39							8¼	7 9/16	6 17/32	5 13/16	4 25/32	53	80 25
80 50	■7⅝	9	8½	7½	6⅝	89													80 50
120 01	3⅛	3¾	3⅜	3⅛	2½	5⅜	3⅞	3¼	3¾	2½	2½	5½	4 7/16	4¼	3⅝	3 5/16	2 11/16	8	120 01
120 02	3¾	4½	4	3¾	3⅛	9¾	4⅝	3⅞	4⅜	3	3⅛	9	5 1/16	5	4¼	4 1/16	3 5/16	12	120 02
120 04	4⅜	5¼	4⅞	4⅜	3⅝	16⅜	5⅜	4½	5½	3½	3⅞	15	6¼	5¾	4⅞	4⅜	3½	25	120 04
120 08	■5½	6⅜	5¾	5 5/16	4⅝	33	6⅜	5 5/16	6	4¼	4¼	34	7½	6⅞	5 13/16	5 5/16	4¼	34	120 08
120 12	■5½	6⅜	7½	5 5/16	5¾	43	6⅜	5 5/16	7¾	4¼	6	44	7½	6⅞	5 13/16	5 5/16	4¼	47	120 12
180 00	3⅛	3¾	3	3⅛	2⅛	4¼	3⅞	3¼	3⅛	2½	2	4¼	4 7/16	4¼	3⅝	3 5/16	2 11/16	7⅛	180 00
180 01	3 1/16	4⅛	3⅞	3 1/16	2⅝	7	4⅛	3 1/16	4⅛	2¾	3	7¼	4⅞	4⅝	3 13/16	3 11/16	3	12	180 01
180 04	■4⅜	5¼	6⅜	4⅜	4⅞	24	5⅜	4½	6¾	3½	5¼	25	7⅜	5¾	4⅞	4⅜	3½	29	180 04
180 08	■5½	6⅜	7½	5 5/16	5¾	43	6⅜	5 5/16	7¾	4¼	6	44	7½	6⅞	5 13/16	5 5/16	4¼	47	180 08
230 00	3⅛	3¾	3¼	3⅛	2⅜	5	3⅞	3¼	3 13/16	2½	2⅜	5⅛	4 7/16	4¼	3⅝	3 5/16	2 11/16	7¾	230 00
230 01	3 1/16	4⅛	4⅜	3 1/16	3⅛	8¼	4⅛	3 1/16	4⅝	2¾	3½	8¾	4⅞	4⅝	3 13/16	3 11/16	3	12¾	230 01
230 02	4⅜	5¼	5¼	4⅜	3¾	17	5⅜	4½	5 11/16	3½	4	17	6¼	5¾	4⅞	4⅜	3½	27	230 02
230 05	■5½	6⅜	5⅞	5 5/16	4	29	6⅜	5 5/16	6⅛	4¼	4⅜	30	7½	6⅞	5 13/16	5 5/16	4¼	35	230 05
230 08	■6 1/32	7 1/16	7⅝	5 13/16	5½	50							8¼	7 9/16	6 17/32	5 13/16	4 25/32	68	230 08
300 00	3 1/16	4⅛	3⅜	3 1/16	2 5/16	6	4⅛	3 1/16	3⅞	2¾	2¾	6¼	4⅞	4⅝	3 13/16	3 11/16	3	10½	300 00
300 01	3¾	4½	4⅝	3¾	3 1/16	11¼	4⅝	3⅞	4 13/16	3	3¾	11¼	5 1/16	5'	4¼	4 1/16	3 5/16	14½	300 01
300 02	4⅜	5¼	6	4⅜	4⅝	20	5⅜	4½	6½	3½	5	21	7⅜	5¾	4⅞	4⅜	3½	28	300 02
300 05	■5½	6⅜	6⅝	5 5/16	5	38	6⅜	5 5/16	6⅞	4¼	5⅛	40	8¾	6⅞	5 13/16	5 5/16	4¼	53	300 05

Add 3/16 to H W D for Style BE



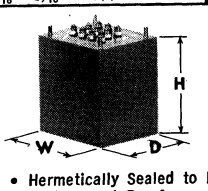
STYLE B: • "Open Frame" Bracket Mounted
• Double Vacuum Varnish Impregnated

STYLE BE: • Conforms to MIL-T-27B
• Epoxy Encapsulation added to Style B



STYLE V: • Fully Enclosed in Metal Shells
• Ease of "Wiring with Leads"
• Attractive Appearance
• Dbl Vacuum Varnish Impregnated

OUTLINE DRAWINGS AVAILABLE



STYLE CM: • Hermetically Sealed to MIL-T-27B
• Environment Proof
• Attractive Gray Finish
• Permanent Name Plate

CONTACT FACTORY FOR PRICES

QUALITY ENGINEERED
50 ASH STREET, DEPT. EM
TODD SYSTEMS INC.
YONKERS, NY, U.S.A. 10701
PRECISION BUILT
(914) 963-3400

TODD ENGINEERED

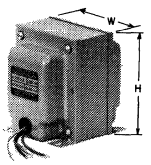
LINE ISOLATION ..... HIGH CURRENT CHOKES

LINE ISOLATION — OUTPUT 115 VOLTS — 50/60 HERTZ UL COMPONENTS

STRAIGHT ISOLATION — ELECTROSTATIC SHIELD CONNECTED TO CORE — TWO STYLES

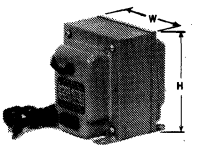
CATALOG NUMBER	WATTS (VA)	INPUT VOLTS	HIPOT TEST VOLTS	DIMENSIONS H	W	D	MW	MD	WGT.
LI-25	25	115	1500	3 1/8	2 5/8	2 1/2	2	1 1/2	1 5/8
LI-50	50	115	1500	3 1/2	2 7/8	3	2 1/4	1 7/8	3
LI-100	100	115	1500	3 1/2	2 7/8	3 1/2	2 1/4	2 1/4	4
LI-175	175	115	1500	4 5/8	3 7/8	3 7/8	3	2 3/4	7
LI-250	250	115	1500	4 5/8	3 7/8	4 3/8	3	3 1/4	10
LI-350	350	115	1500	4 5/8	3 7/8	5 1/4	3	4 1/8	14
LI-500	500	115	1500	6	4 3/8	5 1/8	3 7/16	3 3/8	17 1/2
LI-750	750	115	1500	6	4 3/8	6 3/8	3 7/16	4 1/2	24
LI-1000	1000	115	1500	6	4 3/8	7 1/4	3 7/16	5 1/2	30
LI-1500	1500	115	1500	6 1/2	5 1/2	7 1/2	4 1/4	5 3/8	42
LI-2000	2000	115	1500	6 1/2	5 1/2	9	4 1/4	6 7/8	58
LI-100-1	100	230	2000	3 1/2	2 7/8	3 1/2	2 1/4	2 1/4	4
LI-250-1	250	230	2000	4 5/8	3 7/8	4 3/8	3	3 1/4	10
LI-500-1	500	230	2000	6	4 3/8	5 1/8	3 7/16	3 3/8	17 1/2
LI-1000-1	1000	230	2000	6	4 3/8	7 1/4	3 7/16	5 1/2	30
LI-1500-1	1500	230	2000	6 1/2	5 1/2	7 1/2	4 1/4	5 3/8	42
LI-2000-1	2000	230	2000	6 1/2	5 1/2	9	4 1/4	6 7/8	58

STYLE LO



LEAD WIRE TERMINALS

STYLE LRG

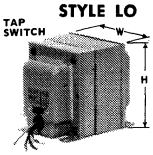


LINE CORD RECEPTACLE (W/GROUND)

ADJUSTABLE ISOLATION — ELECTROSTATIC SHIELD CONNECTED TO CORE — • PRIMARY TAPPED • TWO STYLES

CATALOG NUMBER	WATTS (VA)	INPUT VOLTS	HIPOT TEST VOLTS	DIMENSIONS H	W	D	MW	MD	WGT.
LI-50-2	50	105/115/125	1500	3 1/2	2 7/8	3 7/8	2 1/4	2 1/2	3
LI-100-2	100	105/115/125	1500	3 1/2	2 7/8	4 3/8	2 1/4	3	4 1/2
LI-250-2	250	105/115/125	1500	4 5/8	3 7/8	5 1/8	3	4	11 1/2
LI-500-2	500	105/115/125	1500	6	4 3/8	5 7/8	3 7/16	4 1/8	19
LI-1000-2	1000	105/115/125	1500	6	4 3/8	8 1/8	3 7/16	6 3/8	34
LI-50-3	50	210/230/250	2000	3 1/2	2 7/8	3 7/8	2 1/4	2 1/2	3
LI-100-3	100	210/230/250	2000	3 1/2	2 7/8	4 3/8	2 1/4	3	4 1/2
LI-250-3	250	210/230/250	2000	4 5/8	3 7/8	5 1/8	3	4	11 1/2
LI-500-3	500	210/230/250	2000	6	4 3/8	5 7/8	3 7/16	4 1/8	19
LI-1000-3	1000	210/230/250	2000	6	4 3/8	8 1/8	3 7/16	6 3/8	34

STYLE LO



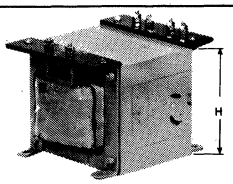
LEAD WIRE TERMINALS

STYLE LRG

LINE CORD RECEPTACLE (W/GROUND)

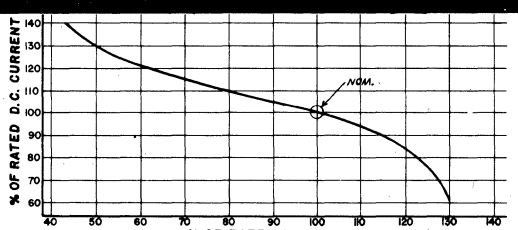
HI-POWER ISOLATION — ELECTROSTATIC SHIELD CONNECTED TO CORE — BRACKET MOUNTED

CATALOG NUMBER	WATTS (VA)	INPUT VOLTS	HIPOT TEST VOLTS	DIMENSIONS H	W	D	MW	MD	WGT.
LI-2500-4	2500	115/230	2000	6 1/8	7 1/8	8 3/4	5 7/8	7	60
LI-3000-4	3000	115/230	2000	7 1/2	9	7 7/8	7 1/2	6 1/2	95
LI-4000-4	4000	115/230	2000	7 1/2	9	9	7 1/2	7 5/8	113
LI-5000-4	5000	115/230	2000	7 1/2	9	10 1/4	7 1/2	8 7/8	135
LI-6000-4	6000	115/230	2000	7 1/2	9	11 3/4	7 1/2	10 1/4	168
LI-2500-5	2500	230/460	2500	6 1/8	7 1/8	8 3/4	5 7/8	7	60
LI-3000-5	3000	230/460	2500	7 1/2	9	7 7/8	7 1/2	6 1/2	95
LI-4000-5	4000	230/460	2500	7 1/2	9	9	7 1/2	7 5/8	113
LI-5000-5	5000	230/460	2500	7 1/2	9	10 1/4	7 1/2	8 7/8	135
LI-6000-5	6000	230/460	2500	7 1/2	9	11 3/4	7 1/2	10 1/4	168



SCREW TERMINALS

HIGH CURRENT CHOKES — 50/500 HERTZ — DIMENSIONS REFER TO HIGH CURRENT XFMR SKETCHES



- **Matching styles complement high current transformers**
- **Wide variety of compatible current ratings**

INDUCTANCE VARIATION

Graph indicates typical variation of inductance (%) when used at D.C. currents (%) other than the rated values.

Chokes operated at D. C. currents higher than rated value must be run on an intermittent basis to avoid overheating.

CATALOG NUMBER	INDUCTANCE (mh)	D.C. CURRENT (AMPS)	RESISTANCE (OHMS)	• BRACKET MTD. (STYLE B) • ENCAPSULATED (STYLE BE) H	W	D	MW	MD	WGT.	• FULLY MTD. SHELLS (STYLE V) H	W	D	MW	MD	WGT.	• HERMETICALLY SEALED MIL-T (STYLE CM) H	W	D	MW	MD	WGT.
CH-00	200	.5	3.00	2 1/4	2 5/8	2	2	1 3/4	1 1/2	2 5/8	2 1/4	2 1/4	1 3/4	1 5/8	1 3/4	3 1/8	3	2 5/16	2 5/16	1 7/8	2 1/8
CH-01	100	1	1.50	2 1/2	2	2 1/8	2 1/2	2	2 1/4	3 1/8	2 1/2	2 5/8	2	1 3/4	2 1/4	3 13/16	3 1/2	3	2 5/8	2 1/8	3 1/4
CH-02	80	2	1.30	2 1/2	3	2 1/2	2 1/2	2	2 1/2	3 1/8	2 1/2	2 1/2	2	1 3/4	2 1/2	3 13/16	3 1/2	3	2 5/8	2 1/8	3 1/2
CH-04	60	4	.60	3 1/8	3 3/4	3 1/4	3 1/8	2 1/2	5 1/4	3 7/8	3 5/16	3 3/4	2 1/2	2 1/4	6	4 5/16	4 1/4	3 5/8	3 5/16	2 11/16	7 1/4
CH-05	50	5	.50	3 1/8	3 3/4	3 3/8	3 1/8	2 3/4	5 3/4	3 7/8	3 5/16	4	2 1/2	3	6 1/2	4 5/16	4 1/4	3 5/8	3 5/16	2 11/16	8
CH-06	40	6	.35	3 1/8	3 3/4	3 3/8	3 1/8	2 3/4	6	3 7/8	3 5/16	4	2 1/2	3	6 1/2	4 5/16	4 1/4	3 5/8	3 5/16	2 11/16	8 5/8
CH-08	30	8	.25	3 1/2	4 1/8	3 7/8	3 3/8	3	8	4 1/8	3 1/2	4 3/8	2 3/4	3 3/8	8 1/2	4 7/8	4 5/8	4	3 11/16	3	11 1/8
CH-12	20	12	.12	3 3/4	4 1/2	4 7/8	3 3/8	3 1/2	15 1/2	4 5/8	3 7/8	4 7/8	3	3 3/4	14	5 7/16	5	4 1/4	4 1/16	3 5/16	20
CH-16	15	16	.08	4 7/16	5 1/4	4 5/8	4 3/8	3 3/8	14 1/4	5 7/16	4 1/2	5 1/4	3 1/2	3 3/4	15	6 1/4	5 3/4	4 7/8	4 3/8	3 1/2	22 1/2
CH-20	10	20	.05	4 7/16	5 1/4	4 1/2	4 3/8	3 1/2	15 1/2	5 7/16	4 1/2	5 3/8	3 1/2	3 7/8	16	6 1/4	5 3/4	4 7/8	4 3/8	3 1/2	24
CH-25	6.5	25	.028	4 7/16	5 1/4	5	4 3/8	4	18 1/2	5 7/16	4 1/2	5 7/8	3 1/2	4 3/8	19 1/2	6 1/4	5 3/4	4 7/8	4 3/8	3 1/2	26 1/2
CH-30	5.5	30	.022	5 3/8	6 3/8	4 1/2	5 1/4	3 1/4	21	6 1/2	5 7/16	5 1/2	4 1/4	3 1/4	24	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	29 1/2
CH-40	4.0	40	.014	5 3/8	6 3/8	4 5/8	5 1/4	3 1/2	23	6 1/2	5 7/16	5 3/4	4 1/4	3 1/2	25	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	32 1/2
CH-50	3.0	50	.010	5 3/8	6 3/8	5 1/2	5 1/4	4 1/8	29	6 1/2	5 7/16	6 3/8	4 1/2	4 1/8	30	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	37
CH-100	.8	100	.003	5 3/8	6 3/8	5 3/4	5 1/4	4 5/8	35	6 1/2	5 7/16	6 7/8	4 1/4	4 5/8	36	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	45
CH-200	.35	200	.001	6 1/8	7 1/8	6 3/4	5 7/8	5 1/2	43												

CONTACT FACTORY FOR PRICES

QUALITY ENGINEERED — PRECISION BUILT

TODD SYSTEMS INC.

50 ASH STREET, DEPT. EM — YONKERS, NY, U.S.A. 10701 — (914) 963-3400

TODD ENGINEERED

STEPDOWN AUTOTRANSFORMERS

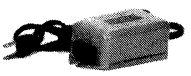
CONVERT DOMESTIC APPLIANCES FOR USE ON FOREIGN VOLTAGES

COND. CAT.-SD-81

50/60 HERTZ—*UL* COMPONENTS • ALSO AVAILABLE WIRED FOR STEPUP

PORTABLE MODEL — 220/240 INPUT 110/120 OUTPUT

CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D
SD-35	20	7/8	1½	2	2⅝
SD-36	40	1¼	1 1/16	2⅛	3½
SD-37	60	1 5/16	1 1/16	2⅛	3½
SD-41	80	1 1/16	1 1/16	2⅛	3½



LINE CORD • RECEPTACLE

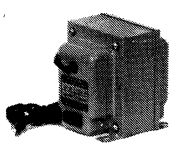
NORMAL DUTY MODEL — 220/240 INPUT 110/120 OUTPUT

CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D
SD-24	50	1⅝	2¼	2¾	2¼
SD-21	65	1⅝	2¼	2¾	2¼
SD-25	80	1¾	2¼	2¾	2⅜
SD-23	100	1¾	2¼	2¾	2⅜
SD-26	125	2⅜	2⅝	3 1/16	2½
SD-27	150	2⅜	2⅝	3 1/16	2½

LINE CORD • PIGTAIL

HEAVY DUTY MODEL — 220/240 INPUT 110/120 OUTPUT

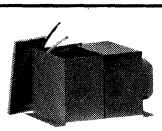
CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D
SD-16	100	2¼	3⅛	2⅝	3¼
SD-17	150	3½	3⅛	2⅝	3⅞
SD-38	200	3¾	3⅛	2⅝	4
SD-12	250	5½	4⅝	3⅞	3⅜
SD-18	350	6½	4⅜	3⅞	3⅝
SD-11	500	9¾	4⅝	3⅞	4¼
SD-19	750	12	4⅝	3⅞	5
SD-13	1000	13¾	4⅝	3⅞	5¼
SD-14	1500	19	4⅝	3⅞	6⅝
SD-20	2000	24½	6	4⅜	6⅜
SD-39	2500	35½	6½	5½	6⅝



LINE CORD • RECEPTACLE

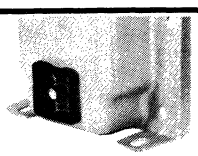
INDUSTRIAL MODEL — 220/240 INPUT 110/120 OUTPUT

CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D
SD-28	3000	47	6⅛	7 1/16	10¼
SD-29	4000	54	6⅛	7 1/16	12
SD-22	5000	59	6⅛	7 1/16	11¼
SD-30	6000	70	6⅛	7 1/16	12¼

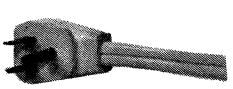


JUNCTION BOX
LEAD TERMINALS

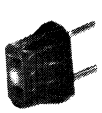
ACCESSORIES — AVAILABLE FOR USE WHERE APPLICABLE



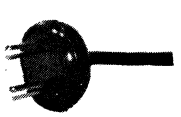
3 WIRE RECEPTACLE



3 WIRE LINE CORD



PLUG ADAPTERS



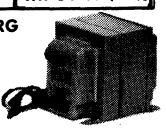
FOREIGN PLUGS

3 TAP REFRIGERATION — 188/210 210/236 236/260 → 105V-50Hz (115V - 60Hz. INPUT V. +10%)

CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D
SD-31LRG	350	6½	4⅝	3⅞	4⅜
SD-32LRG	550	9¼	4⅝	3⅞	5
SD-33LRG	750	12	4⅝	3⅞	5¾
SD-42LRG	850	14½	4⅝	3⅞	6⅝
SD-34LRG	1000	16¼	4⅝	3⅞	7
SD-40LRG	1500	23	4⅝	3⅞	8½

CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D
SD-31LO	350	6¼	4⅝	3⅞	4½
SD-32LO	550	9	4⅝	3⅞	5⅛
SD-33LO	750	12	4⅝	3⅞	5½
SD-42LO	850	14	4⅝	3⅞	6
SD-34LO	1000	16	4⅝	3⅞	6½
SD-40LO	1500	22	4⅝	3⅞	8

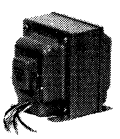
STYLE LRG



TAP SWITCH

3 WIRE LINE CORD & RECEPTACLE (WITH GROUND)

STYLE LO



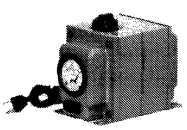
JUNCTION BOX

LEAD WIRE TERMINALS

MULTI-TAPPED VOLTAGE REGULATOR — METER • SWITCH

TYPE	PRIMARY VOLTS (SELECTOR SWITCH TAPS)	OUTPUT VOLTS
11	84 92 100 108 115 122 130 138	115
12	84 92 100 108 115 122 130 138	208, 230
21	170 185 200 215 230 245 260 275	115
22	170 185 200 215 230 245 260 275	208, 230

CATALOG NUMBER	TYPE	RATING WATTS	WGT. LBS.	DIMENSIONS H	W	D
MVR-17	11 or 22	150	4⅝	4⅝	3⅞	5
MVR-18	11 or 22	350	6½	4⅝	3⅞	5½
MVR-11	11 or 22	500	8	4⅝	3⅞	5¾
MVR-19	11 or 22	750	11	4⅝	3⅞	6⅝
MVR-13	11 or 22	1000	13¼	4⅝	3⅞	7⅛
MVR-14	11 or 22	1500	17	6	4⅜	7⅜
MVR-20	11 or 22	2000	22	6	4⅜	8¼
MVR-17	12 or 21	150	6	4⅝	3⅞	5⅛
MVR-18	12 or 21	350	9	4⅝	3⅞	5⅞
MVR-11	12 or 21	500	12½	4⅝	3⅞	6¾
MVR-19	12 or 21	750	15	4⅝	3⅞	7¼
MVR-13	12 or 21	1000	18¾	6	4⅜	7½
MVR-14	12 or 21	1500	24	6	4⅜	8½
MVR-20	12 or 21	2000	30½	6	4⅜	9¼

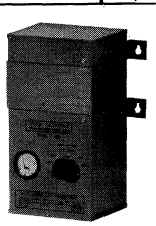


3 WIRE LINE CORD & RECEPTACLE (WITH GROUND)

PANEL MOUNTED VOLTAGE REGULATOR — METER • SWITCH JUNCTION BOX

TYPE	PRIMARY VOLTS (SELECTOR SWITCH TAPS)	OUTPUT VOLTS
11	84 92 100 108 115 122 130 138	115
12	84 92 100 108 115 122 130 138	208, 230
21	170 185 200 215 230 245 260 275	115
22	170 185 200 215 230 245 260 275	208, 230

CATALOG NUMBER	TYPE	RATING WATTS	WGT. LBS.	DIMENSIONS H	W	D
PVR-20	11 or 22	2000	29	5⅜	6⅜	11¼
PVR-28	11 or 22	3000	40	5⅜	6⅜	12¼
PVR-29	11 or 22	4000	49	5⅜	6⅜	13⅜
PVR-22	11 or 22	5000	57	5⅜	6⅜	14⅝
PVR-30	11 or 22	6000	63	6⅛	7⅛	13¾
PVR-20	12 or 21	2000	44	6⅛	7⅛	13
PVR-28	12 or 21	3000	58	6⅛	7⅛	14
PVR-29	12 or 21	4000	78	6⅛	7⅛	15½
PVR-22	12 or 21	5000	91	6⅛	7⅛	16½
PVR-30	12 or 21	6000	105	6⅛	7⅛	18



- JUNCTION BOX
- LEAD TERMINALS

CONTACT FACTORY FOR PRICES

QUALITY ENGINEERED PRECISION BUILT

TODD SYSTEMS INC.

50 ASH STREET. YONKERS, NY, U.S.A. 10701 (914) 963-3400

POWER TRANSFORMERS OF TOROIDAL DESIGN

Advantages of toroidal design.	**Your Product advantages.**
LOW WEIGHT	Light end product. Low chassis weight and cost. Low packing and shipping cost.
SMALL, FLEXIBLE DIMENSIONS	Small, slim end product.
SINGLE BOLT MOUNTING	Low assembly cost.
LOW HUM	Quiet end products. No cost for hum insulation.
LOW STRAYFIELD	No shielding cost. Compact design with straightforward component layout.
HIGH EFFICIENCY	Equipment runs cool, reliability is improved. Low operating cost.
Advantages offered by TOROID MARYLAND.	
CUSTOM ENGINEERING USING PROPRIETARY SOFTWARE	Reduced losses in your power supplies and regulators. Fast turnaround. Prototypes that work the first time.
COMPUTER DESIGN FROM DC DATA	No need to determine transformer specs, just give us the required DC data for your equipment.
UL RECOGNITION	Fast and easy UL approval of your end product.
MEETS FOREIGN SAFETY STANDARDS	No redesign for export.

CUSTOM MADE TRANSFORMERS ON STANDARD CORE SIZES

60Hz operation		50/60Hz operation		Size & Weight unmounted transformer		Core #
Max rated power	No-load loss	Max rated power	No-load loss	OD × H	Weight (lbs)	
26VA	.26W	20VA	.20W	2.4″ × 1.2″	.7	532
45VA	.32W	35VA	.24W	2.8″ × 1.3″	1.1	642
65VA	*.48W*	*50VA*	*.36W*	*2.9″ × 1.8″*	*1.4*	*643*
70VA	.54W	57VA	.40W	3.2″ × 1.4″	1.5	742
100VA	*.79W*	*85VA*	*.59W*	*3.3″ × 1.9″*	*2.0*	*743*
105VA	.63W	87VA	.47W	3.7″ × 1.4″	2.2	852
120VA	.77W	100VA	.57W	3.9″ × 1.5″	2.2	952
150VA	.94W	120VA	.70W	3.7″ × 1.8″	2.9	853
180VA	1.14W	150VA	.85W	3.9″ × 1.9″	3.0	953
185VA	1.21W	150VA	.90W	4.5″ × 1.6″	3.3	1052
200VA	*1.26W*	*165VA*	*.94W*	*3.8″ × 2.3″*	*3.3*	*854*
240VA	*1.52W*	*190VA*	*1.13W*	*3.9″ × 2.3″*	*3.8*	*954*
265VA	1.81W	225VA	1.35W	4.5″ × 1.9″	4.4	1053
360VA	2.41W	300VA	1.80W	4.5″ × 2.3″	5.3	1064
440VA	2.60W	360VA	1.94W	5.5″ × 2.0″	5.7	1063
600VA	3.06W	500VA	2.28W	5.5″ × 2.4″	8.2	1274
720VA	3.82W	600VA	2.85W	5.5″ × 2.8″	9.7	1275
1,000VA	4.70W	800VA	3.51W	6.3″ × 2.4″	12.1	1584
1,200VA	5.90W	1,000VA	4.40W	6.3″ × 2.9″	15.0	1585
1,450VA	7.10W	1,200VA	5.30W	6.3″ × 3.3″	17.4	1586
1,700VA	7.20W	1,400VA	5.40W	7.9″ × 2.6″	20.0	18104
2,000VA	9.00W	1,700VA	6.70W	7.9″ × 3.0″	24.0	18105
2,400VA	10.80W	2,000VA	8.10W	7.9″ × 3.3″	27.8	18106
2,750VA	10.30W	2,300VA	7.70W	8.7″ × 3.2″	29.7	20125
3,250VA	12.40W	2,700VA	9.30W	8.7″ × 3.5″	35.2	20126

Data in italics are for secondary standard, which may require longer delivery times.

GENERAL INFORMATION

TOROID CORPORATION OF MARYLAND is a U.S. Manufacturer specializing in medium size to large toroids. In our plant in Bowie, Maryland, we make tape-wound toroidal cores of super grain oriented steel strip. We also have specially designed toroidal winding machines for a wide range of wire sizes and for insulation. Our Application Engineers use proprietary computer programs to optimize your Custom Designed Transformer for rectifier use as well as for AC applications. *This means we can offer the smallest, most economical transformer for your application and minimum losses in your power supply. And the prototypes we supply will meet your specifications, so trial and error is avoided.*

MOUNTING METHODS

Disk Mounting is the preferred method for transformers and chokes up to about 6.3 inches in diameter and 12-15 lbs. weight.

For larger units, and for applications where severe shock and vibration must be tolerated, we offer potted centers with hole for a mounting bolt.

We also offer hardware for mounting the toroid on edge, as well as hardware for mounting of terminal strips.

LEADS AND CONNECTORS

Standard is 8″ long flying self-leads. Other lead lengths, multistranded leads, and mounted connectors are options.

SHIELDING

Static shields can be included between primary and secondary windings in custom made transformers.

Magnetic shielding is rarely needed in a toroidal transformer. If shielding is required, we offer a low-cost alternative to the mumetal shield boxes required on stacked core transformers: A Shield Ring which can be fitted around the rim of both standard and custom made toroids.

TOROID CORPORATION OF MARYLAND • 6000 Laurel-Bowie Road • Bowie, MD 20715-4037 • 301-464-2100

POWER TRANSFORMERS OF TOROIDAL DESIGN

PRODUCT PROGRAM

CUSTOM MADE TRANSFORMERS in sizes listed in the Table on the opposite page, and in other sizes if required, are our speciality. They are economical alternatives to standard transformers even in small quantities.

STANDARD TRANSFORMERS for 117V-60Hz as listed in the Table below are off-the-shelf. A similar program is available for 50/60Hz with dual primaries (2 × 115V). We also have combination transformers for regulated 5V DC and ± 15V DC, and Kits for making your own breadboarding transformer.

3-PHASE TRANSFORMERS using three single phase units.

AUTOTRANSFORMERS.

INVERTER TRANSFORMERS for 50, 60 and 400 Hz.

CURRENT TRANSFORMERS for indication and control applications, such as overcurrent protection and peak load limiting.

FILTER REACTORS for rectifiers, including *Swinging Chokes.*

Toroidal Power Transformers

UL-RECOGNIZED
OFF-THE-SHELF STANDARD TRANSFORMERS FOR 117V - 60 Hz SUPPLY.

Rated Power	Size OD × H Weight	Secondary Data		Stock Number	Price each, FOB Factory (includes mounting washer and rubber pads) US$			Typical DC data when transformer supplies bridge rectifier with large filter capacitor			
								Secondaries in series		Secondaries in parallel	
		Volts/Amps	No-load Voltage		1	2-4	5-24	DC Voltage	DC Current	DC Voltage	DC Current
26VA	2.4"X1.2" .7 lbs	2×8.5V/1.47A	2×10.7V	602.082	24.30	20.40	17.90	19.2V or 2×9.6V	.94A	8.6V	1.88A
		2×12V/1.08A	2×14.9V	602.122	24.30	20.40	17.90	28.6V or 2×14.3V	.68A	13.3V	1.36A
		2×15V/0.87A	2×18.6V	602.152	24.30	20.40	17.90	36.0V or 2×18.0V	.55A	17.0V	1.10A
		2×18V/0.71A	2×22.5V	602.182	24.30	20.40	17.90	44.0V or 2×22.0V	.45A	21.0V	.90A
		2×24V/0.54A	2×29.8V	602.242	24.30	20.40	17.90	59.0V or 2×29.5V	.34A	28.5V	.68A
45VA	2.8" × 1.3" 1.1 lbs	2×8.5V/2.59A	2×10.2V	604.082	26.10	22.00	19.60	19.8V or 2×9.9V	1.58A	8.9V	3.16A
		2×12V/1.77A	2×14.5V	604.122	26.10	22.00	19.60	29.0V or 2×14.5V	1.08A	13.5V	2.16A
		2×15V/1.40A	2×18.1V	604.152	26.10	22.00	19.60	36.6V or 2×18.3V	.86A	17.3V	1.72A
		2×18V/1.24A	2×21.6V	604.182	26.10	22.00	19.60	44.0V or 2×22.0V	.76A	21.0V	1.52A
		2×24V/0.88A	2×29.0V	604.242	26.10	22.00	19.60	60.0V or 2×30.0V	.54A	29.0V	1.08A
70VA	3.2" × 1.4" 1.5 lbs	2×8.5V/3.94A	2×9.80V	607.082	27.90	24.20	21.20	20.0V or 2×10.0V	2.30A	9.0V	4.60A
		2×12V/2.92A	2×13.8V	607.122	27.90	24.20	21.20	29.4V or 2×14.7V	1.70A	13.7V	3.40A
		2×15V/2.30A	2×17.3V	607.152	27.90	24.20	21.20	37.0V or 2×18.5V	1.34A	17.5V	2.68A
		2×18V/1.90A	2×20.8V	607.182	27.90	24.20	21.20	44.8V or 2×22.4V	1.10A	21.4V	2.20A
		2×24V/1.44A	2×27.6V	607.242	27.90	24.20	21.20	60.0V or 2×30.0V	.84A	29.0V	1.68A
120VA	3.9" × 1.5" 2.2 lbs	2×8.5V/7.06A	2×9.50V	612.082	32.20	27.50	24.45	20.0V or 2×10.0V	3.90A	9.0V	7.80A
		2×12V/5.00A	2×13.3V	612.122	32.20	27.50	24.45	29.4V or 2×14.7V	2.70A	13.7V	5.40A
		2×15V/4.00A	2×16.6V	612.152	32.20	27.50	24.45	37.6V or 2×18.8V	2.20A	17.8V	4.40A
		2×18V/3.33A	2×20.2V	612.182	32.20	27.50	24.45	45.2V or 2×22.6V	1.85A	21.6V	3.70A
		2×24V/2.50A	2×26.7V	612.242	32.20	27.50	24.45	61.4V or 2×30.7V	1.37A	29.7V	2.74A
		220V/0.55A	247V	612.220	32.20	27.50	24.45	N/A			
180VA	3.9" × 1.9" 3.0 lbs	2×12V/7.50A	2×13.0V	617.122	36.60	31.20	27.80	29.6V or 2×14.8V	3.90A	13.8V	7.80A
		2×15V/5.90A	2×16.4V	617.152	36.60	31.20	27.80	38.0V or 2×19.0V	3.10A	18.0V	6.20A
		2×18V/5.00A	2×19.5V	617.182	36.60	31.20	27.80	45.8V or 2×22.9V	2.60A	21.9V	5.20A
		2×24V/3.58A	2×26.3V	617.242	36.60	31.20	27.80	61.8V or 2×30.9V	1.90A	29.9V	3.80A
360VA	4.5" × 2.3" 5.3 lbs	2×24V/7.45A	2×25.4V	636.242	49.10	41.90	37.10	62.0V or 2×31.0V	3.63A	30.0V	7.26A
		2×30V/6.00A	2×31.7V	636.302	49.10	41.90	37.10	78.8V or 2×39.4V	2.90A	38.4V	5.80A
		2×33V/5.45A	2×34.9V	636.332	49.10	41.90	37.10	87.0V or 2×43.5V	2.60A	42.5V	5.20A
		2×38V/4.74A	2×40.3V	636.382	49.10	41.90	37.10	100.0 or 2×50.0V	2.30A	49.0V	4.60A
		2×50V/3.60A	2×52.9V	636.502	49.10	41.90	37.10	132.0 or 2×66.0V	1.75A	65.0V	3.50A
		220V/1.64A	233V	636.220	49.10	41.90	37.10	N/A			
600VA	5.5" × 2.4" 8.2 lbs	2×24V/12.50A	2×25.2V	660.242	65.90	56.00	50.00	65.0V or 2×32.5V	5.85A	31.5V	11.70A
		2×30/10.00A	2×31.5V	660.302	65.90	56.00	50.00	79.0V or 2×39.5V	4.70A	38.5V	9.40A
		2×33V/8.64A	2×34.7V	660.332	65.90	56.00	50.00	87.0V or 2×43.5V	4.10A	42.5V	8.20A
		2×38V/7.76A	2×39.9V	660.382	65.90	56.00	50.00	100V or 2×50.0V	3.65A	49.0V	7.30A
		2×50V/6.00A	2×52.5V	660.502	65.90	56.00	50.00	133V or 2×66.5V	2.80A	65.5V	5.60A
		220V/2.59A	231V	660.220	65.90	56.00	50.00	N/A			
1000VA	6.3" × 2.4" 12.1 lbs	2×50V/10.00A	2×51.8V	699.502	91.70	78.40	69.00	134V or 2×67.0V	4.40A	66.0V	8.80A
		2×65V/7.69A	2×67.4V	699.652	91.70	78.40	69.00	175V or 2×87.5V	3.40A	86.5V	6.80A

We reserve the right to change data and prices at any time.

TOROID CORPORATION OF MARYLAND • 6000 Laurel-Bowie Road • Bowie, MD 20715-4037 • 301-464-2100

TOROTEL PRODUCTS INC. 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

TRANSFORMERS

SUBMINIATURE AUDIO TRANSFORMERS

LT & LS SERIES
LU SERIES

The LS Series is electrically and mechanically the same as the LT Series except for phase relationships between terminals.

LS, LT, and LU Series transformers have successfully passed the rigid requirements of MIL-T-27, Class S, Grade 5.

Subminiature in size, weighing less than 0.1 ounce, these transformers have tenth inch grid spacing between terminals and are ideally suited for transistor circuit applications which utilize printed circuit board design. All three series have risers on mountng surfaces to facilitate inspection and board cleaning and also to prevent moisture traps.

A wide range of standard designs are available which meet the requirements of most common applications and allow for rapid delivery of prototype quantities. Special designs are also available in all three types.

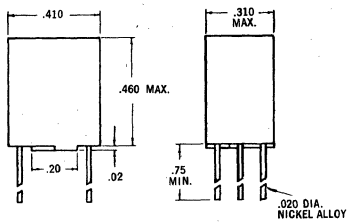
The new LU Series exhibits the same electrical characteristics as the LS and LT Series but has been packaged in a "thin line" configuration to allow for closer board spacing for "card cage" applications or where height dimensions are critical.

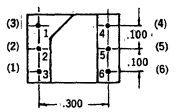
MAGNETIC SHIELDING

LS, LT and LU Series transformers are available with magnetic shields.

To order transformers with shields installed, add 500 to dash numbers shown in the table below. For example: to order an LS-22 with shield, specify LS-522.

LS/LT SERIES

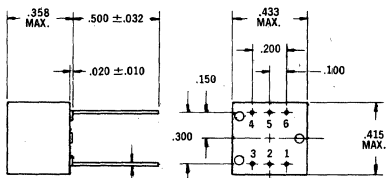




WT. 0.1oz

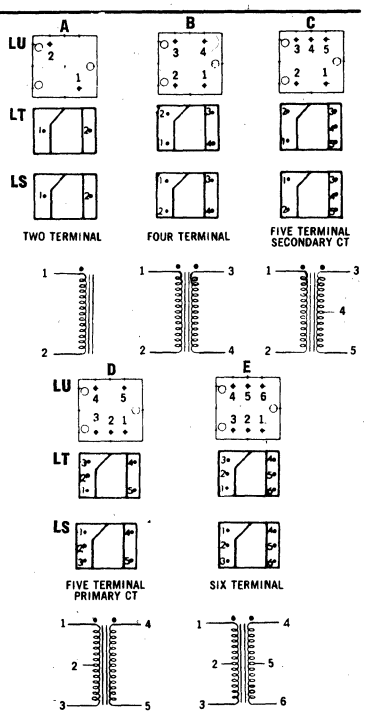
With Mag. Shield Dimensions are .365 Max. x .465 Max. x .531 Max.

LU SERIES



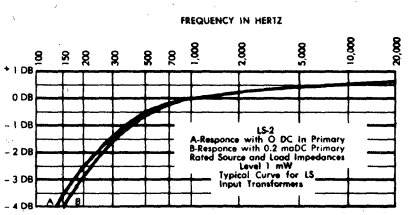
With Mag. Shield Dim.are .448 x Max. x .494 Max. x .400 Max.

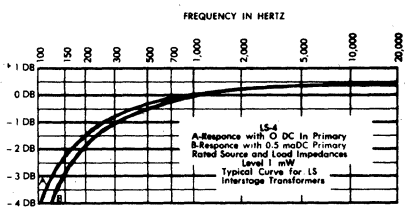
Mech. Tol. = ±.010 unless indicated.

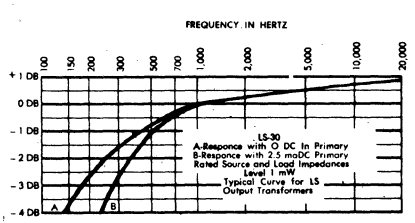


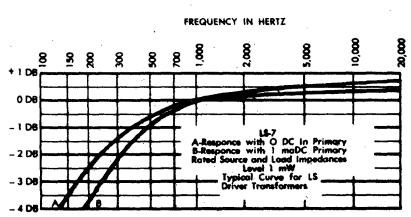
LS, LT or LU No.	Type	MIL-T-27 Designation	Primary Impedance	DCR Pri. Ohms	DC ma Pri.	Secondary Impedance	Max. Power mW	Terminal Layout
2	Input	TF5S21ZZ	50000 CT	3800	0.2	1000CT	25	E
4	Interstage	TF5S21ZZ	20,000/30,000	1700	0.5	800/1200	40	B
5	Interstage	TF5S21ZZ	20,000/30,000CT	1700	0.5	800/1200CT	40	E
6	Interstage	TF5S21ZZ	10,000/12,000CT	1050	1	1500/1800CT	50	E
7	Driver	TF5S21ZZ	10,000/12,000CT	1050	1	1200/1500CT	50	E
8	Driver	TF5S21ZZ	10,000/12,000CT	1050	1	2000/2500CT	50	E
9	Driver	TF5S21ZZ	10,000/12,000CT	1050	1	500/600CT	50	E
10	Output	TF5S21ZZ	500/600	60	3	50/60	50	B
11	Output	TF5S21ZZ	1000/1200	145	3	50/60	50	B
12	Output	TF5S21ZZ	600	70	3	3.2	50	B
13	Output	TF5S21ZZ	1200	120	2	3.2	50	B
14	Output	TF5S21ZZ	10,000	1160	1	3.2	50	B
15	Output	TF5S21ZZ	150/200CT	18	10	12/16	50	D
16	Output	TF5S21ZZ	300/400CT	38	7	12/16	50	D
17	Output	TF5S21ZZ	600/800CT	75	4.5	12/16	50	D
18	Output	TF5S21ZZ	1000/1330CT	120	3.5	12/16	50	D
19	Output	TF5S21ZZ	1500/2000CT	180	3	12/16	50	D
20	Output	TF5S21ZZ	7500/10,000CT	820	1	12/16	50	D
21	Output	TF5S21ZZ	300CT	37	7	600	50	D
22	Output	TF5S21ZZ	500CT	60	3	600	50	D
23	Output	TF5S21ZZ	900CT	100	4	600	50	D
24	Output	TF5S21ZZ	1500CT	170	3	600	50	D
25	Output	TF5S21ZZ	120/150CT	15	10	3.2/4	50	D
26	Output	TF5S21ZZ	320/400CT	40	6	3.2/4	50	D
27	Output	TF5S21ZZ	600/750CT	70	4.5	3.2/4	50	D
28	Output	TF5S21ZZ	800/1000CT	100	4	3.2/4	50	D
29	Output	TF5S21ZZ	1200/1500CT	125	3	3.2/4	50	D
30	Output	TF5S21ZZ	1600/2000CT	190	2.5	3.2/4	50	D
31	Output	TF5S21ZZ	8000/10,000CT	820	1	3.2/4	50	D
32	Output	TF5S21ZZ	10,000CT	1000	1	10,000CT	50	E
33	Driver	TF5S21ZZ	10,000/12,000	1050	1	500/600CT	50	C
34	Driver	TF5S21ZZ	20000	1700	0.3	1000	50	B
35	Output	TF5S21ZZ	1000	135	3	50	50	B
36	Output	TF5S21ZZ	400CT	40	3	11	50	D
37	Driver	TF5S21ZZ	10,000/12,000	1050	1	2000/2500CT	50	C
38	Output	TF5S21ZZ	600CT	72	3	600CT	50	E
39	Output	TF5S21ZZ	10,000	1000	1	10,000 split	50	*
40	Output	TF5S21ZZ	600	72	3	600 split	50	*
41	Input	TF5S21ZZ	25,000CT	4300	0.6	1000CT	30	E
42	Isolation	TF5S21ZZ	600CT	90	4	600CT	30	E
101	Choke	TF5S20ZZ	6 H @ 2 ma DC	1700				A
102	Choke	TF5S20ZZ	1.25 H @ 2 ma DC	180				A
103	Choke	TF5S20ZZ	3.5 M @ 2 ma DC	1100				A
104	Choke	TF5S20ZZ	.3 H @ 4 ma DC	42				A

* Primary terminals 1-2, secondary 3-4 & 5-6.









The above are typical response curves up to 20 kHz however many items in this series have useful frequency ranges up to 100 kHz and beyond.

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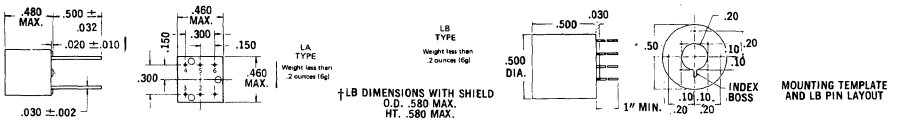
TRANSFORMERS

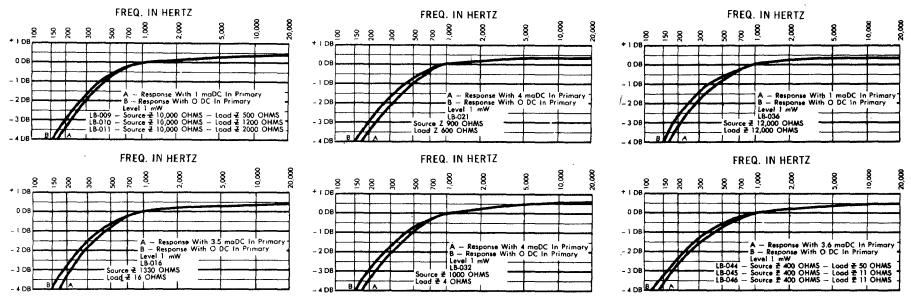
SUBMINIATURE AUDIO TRANSFORMERS

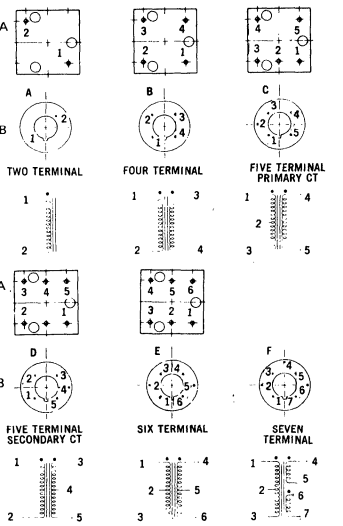
Torotel LA and LB series transformers are manufacturered to MIL-T-27, Grade 5, Class S specification. These series have 0.1 grid spaced terminals for printed circuit application. Both types have risers on mounting surfaces to prevent the formation of moisture traps and to facilitate cleaning of board assemblies.

The LA Series is electrically the same as the LB Series, but is packaged in a .460 inch cube with smaller outline dimensions for application where this configuration is more suitable.

Leads are made of 20 AWG tinned copper. Units utilizing Dumet wire are available on special request.







LA or LB No.	MIL Type	Application	Pri. Imp.	DC ma in Pri.	Sec. Imp.	Nom. Pri. DCR	mW Level @ 1 KHz	Term. Layout
001	TF5S21ZZ	Interstage	20,000 30,000	.5 .5	800 1200	850	50	B
002	TF5S21ZZ	Output	500 600	3 3	50 60	60	100	B
003	TF5S21ZZ	Output	1000 1200	3 3	50 60	115	100	B
004	TF5S21ZZ	Output	600	3	3.2	60	100	B
005	TF5S21ZZ	Output	1200	2	3.2	115	100	B
006	TF5S21ZZ	Output	10,000	1	3.2	790	100	B
007	TF5S21ZZ	Input Other Application	200,000 500	0 0	1000 100,000	8500	25	B
008	TF5S20ZZ	Reactor 3.5 H @ 2 maDC, 1 H @ 5 maDC				630		A
009	TF5S21ZZ	Output or Driver	10,000 12,000	1 1	500CT 600CT	800	100	D
010	TF5S21ZZ	Driver	10,000 12,000	1 1	1200CT 1500CT	800	100	D
011	TF5S21ZZ	Driver	10,000 12,000	1 1	2000CT 2500CT	800	100	D
012	TF5S21ZZ	Single or PP Output	150CT 200CT	10 10	12 16	11	500	C
013	TF5S21ZZ	Single or PP Output	300CT 400CT	7 7	12 16	20	500	C
014	TF5S21ZZ	Single or PP Output	600CT 800CT	5 5	12 16	43	500	C
015	TF5S21ZZ	Single or PP Output	800CT 1070CT	4 4	12 16	51	500	C
016	TF5S21ZZ	Single or PP Output	1000CT 1330CT	3.5 3.5	12 16	71	500	C
017	TF5S21ZZ	Single or PP Output	1500CT 2000CT	3 3	12 16	108	500	C
018	TF5S21ZZ	Single or PP Output	7500CT 10,000CT	1 1	12 16	505	500	C
019	TF5S21ZZ	Output to Line	300CT	7	600	19	500	C
020	TF5S21ZZ	Output or Line to Line or Mixing	500CT	5.5	600	31	500	C
021	TF5S21ZZ	Output to Line	900CT	4	600	53	500	C
022	TF5S21ZZ	Output to Line	1500CT	3	600	86	500	C
023	TF5S21ZZ	Interstage	20,000CT 30,000CT	0.5 0.5	800CT 1200CT	850	100	E
024	TF5S21ZZ	Input Other Application	200,000CT 500CT	0 0	1000CT 100,000CT	8500	25	E
025	TF5S21ZZ	Interstage	10,000CT 12,000CT	1 1	1500CT 1800CT	800	100	E
026	TF5S20ZZ	Reactor 6 H @ 2 maDC, 1.5 H @ 5 maDC				2100		A
027	TF5S20ZZ	Reactor 1.2 H @ 2 maDC, 0.5 H @ 1 maDC				100		A
028	TF5S20ZZ	Reactor 0.3 H @ 4 maDC, 0.15 H @ 20 maDC				31		A
029	TF5S21ZZ	Single or PP Output	120CT 150CT	10 10	3.2 4	10	500	C
030	TF5S21ZZ	Single or PP Output	320CT 400CT	7 7	3.2 4	20	500	C

* These LA types have no primary center tap

LA or LB No.	MIL Type	Application	Pri. Imp.	DC ma in Pri.	Sec. Imp.	Nom. Pri. DCR	mW Level @ 1 KHz	Term. Layout
031	TF5S21ZZ	Single or PP Output	640CT 800CT	5 5	3.2 4	43	500	C
032	TF5S21ZZ	Single or PP Output	800CT 1000CT	4 4	3.2 4	51	500	C
033	TF5S21ZZ	Single or PP Output	1060CT 1330CT	3.5 3.5	3.2 4	71	500	C
034	TF5S21ZZ	Single or PP Output	1600CT 2000CT	3 3	3.2 4	109	500	C
035	TF5S21ZZ	Single or PP Output	8000CT 10,000CT	1 1	3.2 4	505	100	C
036	TF5S21ZZ	Isolation or Interstage	10,000CT 12,000CT	1 1	10,000CT 12,000CT	950	100	E
037	TF5S21ZZ	Driver	10,000CT 12,000CT	1 1	1200CT 1500CT	800	100	E
038	TF5S21ZZ	Driver	10,000CT 12,000CT	1 1	2000CT 2500CT	800	100	E
039	TF5S21ZZ	Driver	10,000CT 12,000CT	1 1	500CT 600CT	800	100	E
040	TF5S21ZZ	Input	100,000	0	1000	1700	70	B
041	TF5S21ZZ	Driver	20,000	0.5	1000	1000	100	B
042	TF5S21ZZ	Driver	20,000	0.5	1200CT	1000	100	D
043	TF5S21ZZ	Output	1000	3	50	60	100	B
044	TF5S21ZZ	Output	400	3	50	30	100	B
045	TF5S21ZZ	Output	400	3	11	30	100	B
046	TF5S21ZZ	Single or PP Output	400CT	3	11	30	500	C
047	TF5S20ZZ	Reactor 10 H @ 0 maDC, 8 H @ 5 maDC				650		A
*048	TF5S21ZZ	Isolation or Interstage Ratio 1:1:1	2000CT 2500CT	3 3	8000 split 10,000 split	195	100	F
*049	TF5S21ZZ	Interstage	10,000CT 12,000CT	1 1	2000 split 2400 split	560	100	F
*050	TF5S21ZZ	Interstage	20,000CT 30,000CT	0.5 0.5	1000 split 1500 split	800	100	F
*051	TF5S21ZZ	Interstage	40,000CT 50,000CT	0.25 0.25	400 split 500 split	1700	50	F
*052	TF5S21ZZ	Interstage or Output	400CT 500CT	8 6	400 split 500 split	46	500	F
*053	TF5S21ZZ	Interstage	400CT 500CT	8 6	120 split 150 split	46	500	F
*054	TF5S21ZZ	Interstage	400CT 500CT	8 6	40 split 50 split	46	500	F
*055	TF5S21ZZ	Interstage	80CT 100CT	12 10	32 split 40 split	9.8	500	F
056	TF5S21ZZ	Input	50,000CT	0.3	1000CT	1900	50	E
057	TF5S21ZZ	Output	600CT 750CT	4.5	3.2 4	40	500	C
058	TF5S21ZZ	Output	1200CT 1500CT	3	3.2 4	100	500	C
059	TF5S21ZZ	Input	100,000CT	0	1000CT	3300	50	E
060	TF5S21ZZ	Driver	10,000CT	1	600CT	1100	100	E
061	TF5S21ZZ	Driver	4000CT	1.5	10,000CT	440	100	E
062	TF5S21ZZ	Output	1000CT	3	600CT	110	100	E
063	TF5S21ZZ	Output	600CT	4	25,000CT	65	100	E
064	TF5S21ZZ	Output	600CT	4	600CT	67	100	E
065	TF5S21ZZ	Output	600CT	4	60CT	65	100	E
066	TF5S21ZZ	Output	600CT	4	4	65	100	C
† 500		Magnetic Shielding Case						

† The LB-Mag. Shield may be supplied for all LB Types.
Add 500 to dash no. (I.E. LB-001 with Shield, order LB-501)

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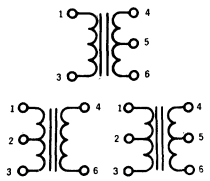
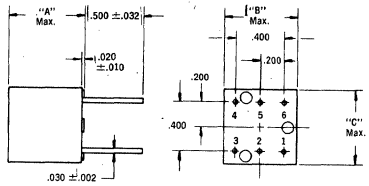
TRANSFORMERS

AUDIO TRANSFORMERS

LL & LR SERIES





Series	A	B	C
LL	.600	.590	.590
LR	.925	.800	.710

These tiny, versatile "LL" transformers are provided with .020 risers and 0.1 grid spacing for printed circuit board applications and are manufactured to MIL-T-27, Grade 5, Class S specifications.

Response: ±1 db 200 to 50,000 Hz

Distortion: 10% max. at rated power, 200 to 50,000 Hz

Weight: 0.4 oz.

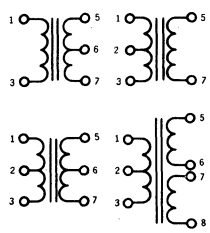
These miniaturized "LR" transformers are manufactured to MIL-T-27, Grade 5, Class S specifications and are ideally suited for a wide range of printed circuit applications.

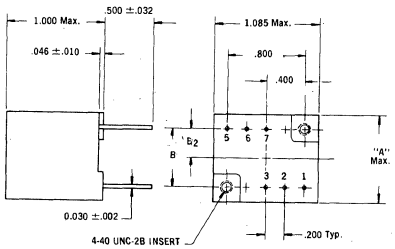
Response: ±1 db 200 to 20,000 Hz

Distortion: 10% max. at rated power, 200 to 20,000 Hz

Weight: 1.0 oz.

LW & LY SERIES





Series	A	B	B_2
LW	.900	.600	.300
LY	1.125	.800	.400

"LW" Series transformers are manufactured to MIL-T-27, Grade 5, Class S specifications. Riser areas and 0.1 grid spacing make these units ideal for printed circuit board applications.

Response: ±1 db 100 to 10,000 Hz

Distortion: 1.5% max. at 60 mW, 200 to 10,000 Hz

Weight: 2.0 oz.

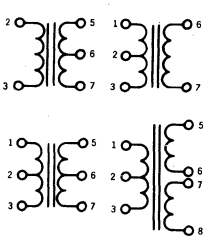
"LY" Series transformers are highly compact, efficient units with power output ratings to 7.5 watts. These transformers are manufactured to MIL-T-27, Grade 5, Class S specifications.

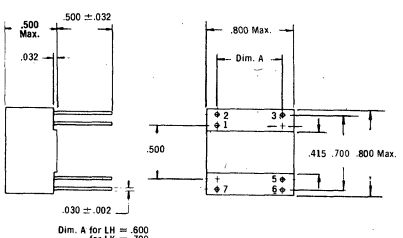
Response: ±1 db 60 to 10,000 Hz

Distortion: 1% max. at 250 mW, 200 to 10,000 Hz — 10% max. at rated power, 200 to 10,000 Hz

Weight: 2.5 oz.

LH & LK SERIES





Series	A
LK	.700
LH	.600

"LH & LK" Series transformers are the ultimate in compactness. Designed to meet MIL-T-27, Grade 5, Class S.

Response: ±1 db 200 to 10,000 Hz

Distortion: 10% max. at rated power, 200 to 10,000 Hz

Weight: .75 oz.

LL Series

No.	MIL-T-27 Desig-nation	Application	Impedance Ohms Pri.	Impedance Ohms Sec.	DC Resistance Ohms Pri.	DC Resistance Ohms Sec.	Max. Pri. DC (ma)	Max. 200 Hz Power† (mW)
001	TF5S21ZZ	Input	100,000CT	1000CT	6000	60	0	150
002	TF5S21ZZ	Interstage	25,000CT	1000CT	2800	120	0	150
003	TF5S21ZZ	Interstage	10,000CT	10,000CT	1100	1200	1	150
004	TF5S21ZZ	Driver	10,000CT	1500CT	1100	200	1	150
005	TF5S21ZZ	Output to Line	10,000CT	600CT	1100	75	1	150
006	TF5S21ZZ	Interstage	4000CT	10,000CT	440	1200	1.5	150
007	TF5S21ZZ	Output to Line	1000CT	600CT	100	60	3	150
008	TF5S21ZZ	Output	1000CT	4	100	0.4	3	150
009	TF5S21ZZ	Input	600CT	25,000CT	65	3500	4	150
010	TF5S21ZZ	Isolation	600CT	600CT	65	75	4	150
011	TF5S21ZZ	Output	600CT	60	65	7	4	150
012	TF5S21ZZ	Output	600CT	4	65	0.5	4	150
013	TF5S21ZZ	Driver	10,000CT	2000CT	1100	240	1	150
014	TF5S21ZZ	Driver	10,000CT	500CT	1100	65	1	150
015	TF5S21ZZ	Line to Line	500CT	600CT	55	75	4.5	150
016	TF5S21ZZ	Output to Line	300CT	600CT	33	75	5.5	150

LR Series

No.	MIL-T-27 Desig-nation	Application	Impedance Ohms Pri.	Impedance Ohms Sec.	DC Resistance Ohms Pri.	DC Resistance Ohms Sec.	Max. Pri. DC (ma)	Max. 200 Hz Power† (mW)
001	TF5S21ZZ	Interstage	25,000CT	1000CT	2600	110	0.5	750
002	TF5S21ZZ	Interstage	10,000CT	10,000CT	1000	1100	1	750
003	TF5S21ZZ	Driver	10,000CT	1500CT	1000	165	1	750
004	TF5S21ZZ	Output to Line	10,000CT	600CT	1000	70	1	750
005	TF5S21ZZ	Output	10,000CT	4	1000	0.5	1	750
006	TF5S21ZZ	Interstage	4000CT	10,000CT	400	1100	1.5	750
007	TF5S21ZZ	Output	1500CT	15	150	2	2.5	750
008	TF5S21ZZ	Output to Line	1000CT	600CT	100	70	3	750
009	TF5S21ZZ	Output	1000CT	4	100	0.5	3	750
010	TF5S21ZZ	Input	600CT	25,000CT	60	2900	4	750
011	TF5S21ZZ	Isolation	600CT	600CT	60	70	4	750
012	TF5S21ZZ	Output	600CT	60	60	6.5	4	750
013	TF5S21ZZ	Output	600CT	15	60	2	4	750
014	TF5S21ZZ	Output	600CT	4	60	0.5	4	750
015	TF5S21ZZ	Output to Line	250	600CT	25	70	7	750
016	TF5S21ZZ	Driver	10,000CT	2000CT	1000	110	1	750
017	TF5S21ZZ	Driver	10,000CT	500CT	1000	110	1	750
018	TF5S21ZZ	Line to Line	500CT	600CT	50	70	4.5	750
019	TF5S21ZZ	Output to Line	300CT	600CT	30	70	5.5	750

LW Series

No.	MIL-T-27 Desig-nation	Application	Impedance Ohms Pri.	Impedance Ohms Sec.	DC Resistance Ohms Pri.	DC Resistance Ohms Sec.	Max. Pri. DC (ma)	Max. 200 Hz Power† (watts)
001	TF5S21ZZ	Interstage	10,000CT	10,000CT	800	1050	1	3.5
002	TF5S21ZZ	Output to Line	10,000CT	600CT	800	60	1	3.5
003	TF5S21ZZ	Output	10,000CT	4	800	0.5	1	3.5
004	TF5S21ZZ	Output	1500CT	15	110	1.5	2.5	3.5
005	TF5S21ZZ	Output to Line	1000CT	600CT	75	60	3	3.5
006	TF5S21ZZ	Output	1000CT	4	75	0.5	3	3.5
007	TF5S21ZZ	Input	600CT	25,000CT	45	2700	4	2.5
008	TF5S21ZZ	Isolation	600CT	600CT	45	60	4	3.5
009	TF5S21ZZ	Output	600CT	60	45	6.5	4	3.5
010	TF5S21ZZ	Output	600CT	15	45	1.5	4	3.5
011	TF5S21ZZ	Output	600CT	4	45	0.5	4	3.5
012	TF5S21ZZ	Output to Line	250	600CT	20	60	7	3.5
013	TF5S21ZZ	Interstage	25,000CT	1000CT	2500	85	0.5	2.5
014	TF5S21ZZ	Driver	10,000CT	2000CT	800	170	1	3.5
015	TF5S21ZZ	Driver	10,000CT	500CT	800	50	1	3.5
016	TF5S21ZZ	Line to Line	500CT	600CT	50	60	4.5	3.5
017	TF5S21ZZ	Output to Line	300CT	600CT	30	60	5.5	3.5
018	TF5S21ZZ	Interstage	2500CT	10K split	200	900	1.5	3.5

LY Series

No.	MIL-T-27 Desig-nation	Application	Impedance Ohms Pri.	Impedance Ohms Sec.	DC Resistance Ohms Pri.	DC Resistance Ohms Sec.	Max. Pri. DC (ma)	Max. 200 Hz Power† (watts)
001	TF5S21ZZ	Interstage	10,000CT	10,000CT	700	900	1	6
002	TF5S21ZZ	Output to Line	10,000CT	600CT	700	55	1	6
003	TF5S21ZZ	Output	10,000CT	4	700	0.4	1	6
004	TF5S21ZZ	Output	1500CT	15	100	1.5	2.5	7.5
005	TF5S21ZZ	Output to Line	1000CT	600CT	65	55	3	7.5
006	TF5S21ZZ	Output	1000CT	4	65	0.4	3	7.5
007	TF5S21ZZ	Isolation	600CT	600CT	40	55	4	7.5
008	TF5S21ZZ	Output	600CT	60	40	6	4	7.5
009	TF5S21ZZ	Output	600CT	15	40	1.5	4	7.5
010	TF5S21ZZ	Output	600CT	4	40	0.4	4	7.5
011	TF5S21ZZ	Output to Line	250	600CT	16	55	7	7.5
012	TF5S21ZZ	Driver	10,000CT	2000CT	700	150	1	6
013	TF5S21ZZ	Driver	10,000CT	500CT	700	45	1	6
014	TF5S21ZZ	Line to Line	500CT	600CT	45	55	4.5	7.5
015	TF5S21ZZ	Output to Line	300CT	600CT	27	55	5.5	7.5
016	TF5S21ZZ	Interstage	2500CT	10K split	170	800	1.5	7.5

LH & LK No.	Application	Impedance Ohms Pri.	Impedance Ohms Sec.	DC Resistance Ohms Pri.	DC Resistance Ohms Sec.	Max. Pri. DC (ma)	Max. 200 Hz Power† (mW)
001	Interstage	25,000CT	1000CT	1325	53	0.5	300
002	Interstage	10,000CT	10,000CT	510	525	1	325
003	Driver	10,000CT	1500CT	510	80	1	325
004	Output to Line	10,000CT	600CT	510	31	1	325
005	Output	10,000CT	4	510	0.3	1	325
006	Interstage	4000CT	10,000CT	200	525	1.5	325
007	Output	1500CT	15	75	1	2.5	325
008	Output to Line	1000CT	600CT	50	31	3	325
009	Output	1000CT	4	50	0.3	3	325
010	Input	600CT	25,000CT	30	1500	4	300
011	Isolation	600CT	600CT	30	31	4	325
012	Output	600CT	60	30	3	4	325
013	Output	600CT	15	30	1	4	325
014	Output	600CT	4	30	0.3	4	325
015	Output to Line	250	600CT	13	31	7	325
016	Driver	10,000CT	2000CT	510	106	1	325
017	Driver	10,000CT	500CT	510	26	1	325
018	Line to Line	500CT	600CT	25	31	4.5	325
019	Output to Line	300CT	600CT	15	31	5.5	325
020	Isolation-Ratio 1:1:1	2000CT	8K split	100	425	2	300
021	Isolation	10,000CT	2K split	510	106	1	300

† These power ratings are based upon lowest frequency operation. Much higher ratings are possible at higher operating frequencies.

TOROTEL PRODUCTS INC. 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

TRANSFORMERS

PC MOUNT POWER TRANSFORMERS

Torotel standard PC mount transformers are designed for 115 Vrms 60 Hz input and are generally usable to above 400 Hz. Voltages listed in table are standard values but transformers can be furnished with other voltage and current ratings. Transformers are available with Channel Frame mounting, either tab style, (Type C) twist prong (Type B) or without Frame (Style A).

Also custom designed power transformers and audio transformers are available in these and other types and sizes upon special request.

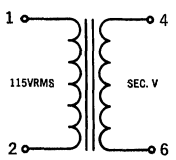
PART NUMBER EXAMPLE

T1 — 230 — A — B

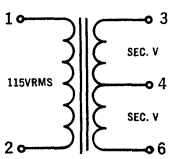
- T1 — VA Size
- 230 — Secondary Voltage
- A — Schematic
- B — Frame Style

Prefix	VA Size
T1	.50
T2	1.50
T3	4.50
T4	7.50

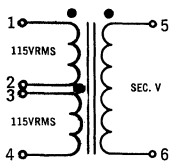
SCHEMATIC "A"



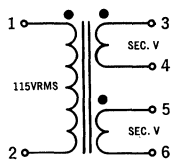
SCHEMATIC "B"



SCHEMATIC "C"

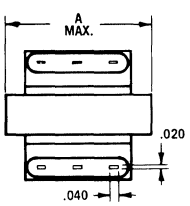


SCHEMATIC "D"

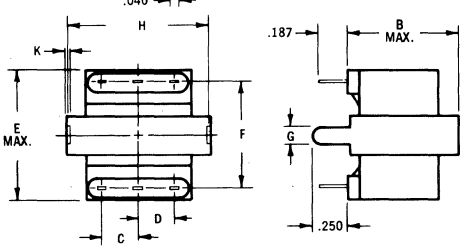


Standard Secondary Voltages Available With 115V Primary	
4	30
5	34
6.3	40
7.5	44
8	54
10	56
12	60
12.6	76
15	88
16	90
17	115
20	120
24	180
27	230
28	

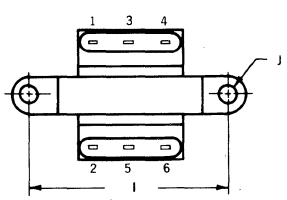
FRAME STYLE "A" NO FRAME



FRAME STYLE "B" P.C. MOUNT



FRAME STYLE "C" TAB MOUNT



DIMENSION TABLE

Size	A	B	C	D	E	F	G	H	I	J	K
T1	1.125	.870	.250	.250	.930	.720	.125	1.040	1.375	.125	.018
T2	1.500	1.250	.310	.310	1.156	1.000	.125	1.420	1.750	.187	.032
T3	1.750	1.450	.400	.400	1.275	1.100	.125	1.680	2.000	.187	.032
T4	1.970	1.690	.400	.400	1.468	1.300	.187	1.940	2.375	.187	.032

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TRANSFORMERS

400 Hz MINIATURE POWER TRANSFORMERS

Reference for all Industrial and Military Standard 400 Hz Miniature Power Transformers

These 400 Hz Miniature Power Transformers are selected for use in all Military and Industrial applications requiring high performance in the smallest possible package size. They conform to all of the requirements of MIL-T-27, Class S (−55°C to +130°C). The minimum continuous operating life expectancy is 10,000 hours. This series is available having power ratings of 0.5 VA through 25 VA. The primaries are 115 Vrms with secondary voltages ranging from 5 Vrms through 300 Vrms.

It is recommended that these transformers be specified for all applications where space, weight, and cost effectiveness are prime considerations.

PART NUMBER EXAMPLE

0.5 S T 26

0.5 — V.A. Rating (See Table I)
S — Package Style
T — Schematic (See Table I)
26 — Secondary Voltage (See Table II)

TABLE I

VA Rating	Package Style	Schematic	Size	Max. Height (Inches)	Regulation (%)		Available Secondary Voltages (VRMS)		Exciting Current (ma)	Efficiency (%)		Temperature Rise (°C) — MIL-T-27 No Heat Sink		Weight (Oz.)	
					Nom.	Max.	Min.	Max.	Max.	Min.	Nom.	Nom.	Max.	Nom.	Max.
0.5	S	T, X	—	—	15	18	5	300	1.5	65	70	10	15	0.38	0.4
0.5	S	S, Y	—	—	17	21	5	300	1.5	65	70	12	17	0.38	0.4
1.5	E, P	T, X	A	0.47	20	23	5	300	1.5	70	76	13	17	0.76	0.85
1.5	E, P	S, Y	A	0.59	15	18	5	300	3	70	76	13	17	0.97	1.1
2	E, P	T, X	A	0.78	3	3.7	5	300	6	72	87	10	15	1.5	1.65
2.4	E, P	S, Y	A	1.03	3	3.8	5	300	9	73	88	11	16	1.9	2.2
3	E, P	T, X	A	0.59	15	18	5	300	3	75	84	15	20	0.97	1.1
3	E, P	S, Y	A	0.78	10	12	5	300	6	75	84	15	20	1.5	1.65
3.6	E, P	T, X	A	1.03	3	3.8	5	300	9	76	87	10	15	1.9	2.2
6	E, P	T, X	A	0.78	10	12	5	300	6	81	88	18	25	1.5	1.65
6	E, P	S, Y	A	1.03	8	10	5	300	9	80	88	18	25	1.9	2.2
7.3	E, P	S, T, X, Y	B	0.97	3	3.5	5	300	16	84	92	15	23	3.2	3.4
9	E, P	T, X	A	1.03	8	10	5	300	9	83	89	23	30	1.9	2.2
13	E, P	S, T, X, Y	B	1.20	3	3.6	5	300	25	87	93	21	28	4.2	4.4
16	E, P	S, T, X, Y	B	0.97	7	8	5	300	16	87	92	25	32	3.2	3.4
25	E, P	S, T, X, Y	B	1.20	6	7	5	300	25	88	93	36	45	4.2	4.4

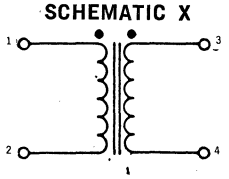
TABLE II INDUSTRY STANDARD SECONDARY VOLTAGES

Secondary Voltage	5	5.5	6	6.3	7	7.5	8	9	10	11	12	12.6	13	15	16	18	20	22	24	26	28	30	33
Maximum Working Voltage	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325

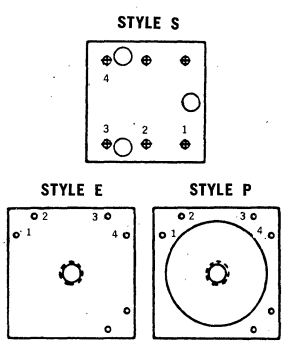
Secondary Voltage	36	39	43	47	51	56	62	68	75	82	91	100	110	115	120	130	150	180	200	220	240	270	300
Maximum Working Voltage	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	440	440	440	580	580

SCHEMATIC AND TERMINAL CONFIGURATIONS

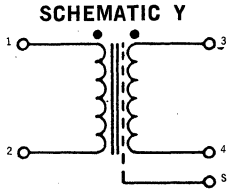
SCHEMATIC X



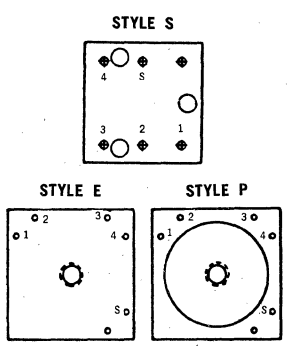
TERMINAL LAYOUTS



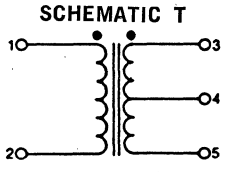
SCHEMATIC Y



TERMINAL LAYOUTS



SCHEMATIC T



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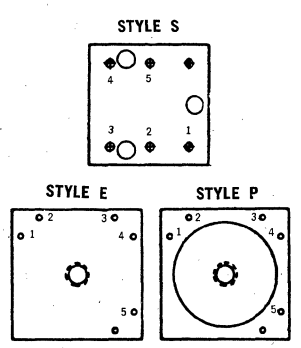
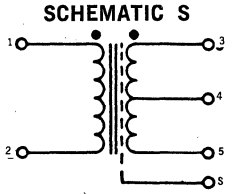
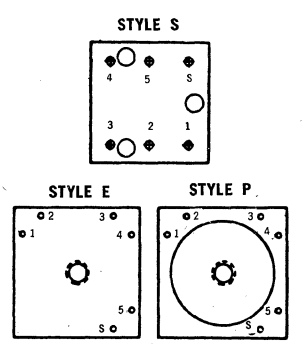


SCHEMATIC S



TERMINAL LAYOUTS



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TRANSFORMERS

400 Hz MINIATURE POWER TRANSFORMERS

Reference for all Industrial and Military Standard 400 Hz Miniature Power Transformers

PHYSICAL SPECIFICATIONS

Size: Sizes for Standard VA Types are given in Table I, and Outline Drawings.

Construction: MIL-T-27, Grade 5; Black Epoxy Encapsulated.

Terminals: Printed circuit pins — tinned brass.

Terminal Strength (Method 211 of MIL-STD-202, Test Condition A): 2.0 pounds.

Marking: Includes MIL-T-27 Type Designation, winding ratings, maximum working voltage, schematc, Torotel name, and part number.

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature Range: −55°C to +130°C (ambient plus temperature rise).

Altitude: 70,000 feet, maximum.

Vibration: MIL-STD-202, Method 204, Test Condition D.

Life Expectancy: 10,000 hours minimum.

Other Environmental Specifications: In accordance with MIL-T-27, Grade 5 Class S, Family 03.

ELECTRICAL SPECIFICATIONS

Primary Voltage: 115 volts rms ±10%.

Frequency: 400 Hz ±5%.

Secondary Voltage: See Table II.

Secondary Voltage Tolerance: ±3% at full load and 115 volts, 400 Hz applied to primary.

Electrostatic Shielding (Schematics S and Y): 5 to 1 minimum voltage ratio at 20 KHz.

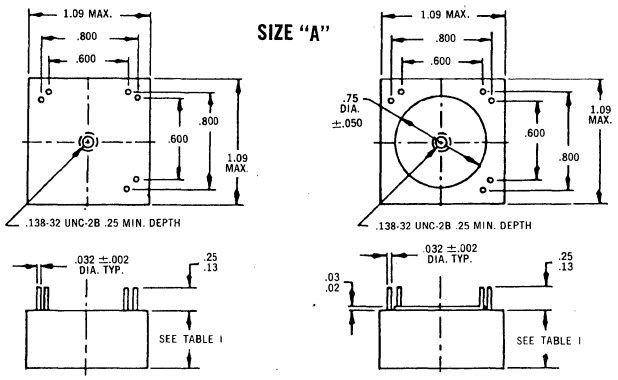
Phase Shift: 1.0 electrical degree between primary and secondary voltage at rated load, maximum.

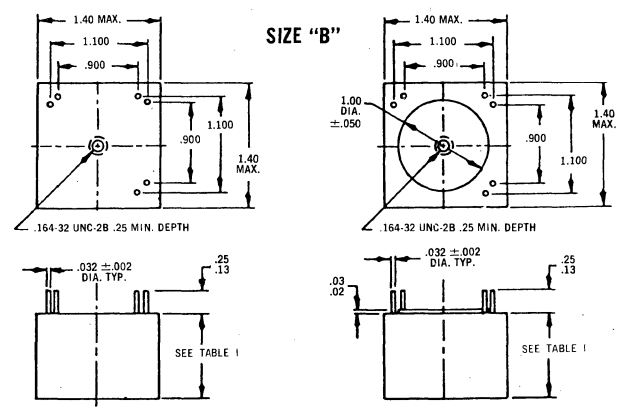
Insulation Resistance: 10,000 megohms minimum at 500 VDC.

Dielectric Strength: At sea level—2.8 times the maximum working voltage. At reduced barometric pressure—1.25 times the maximum working voltage.

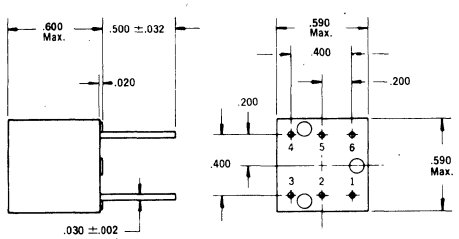
Mech. Tol. = ±.005 unless indicated.

PACKAGE STYLE E **PACKAGE STYLE P**





PACKAGE STYLE S



MECH. TOL. FOR STYLE "S" = ±.010 UNLESS INDICATED.

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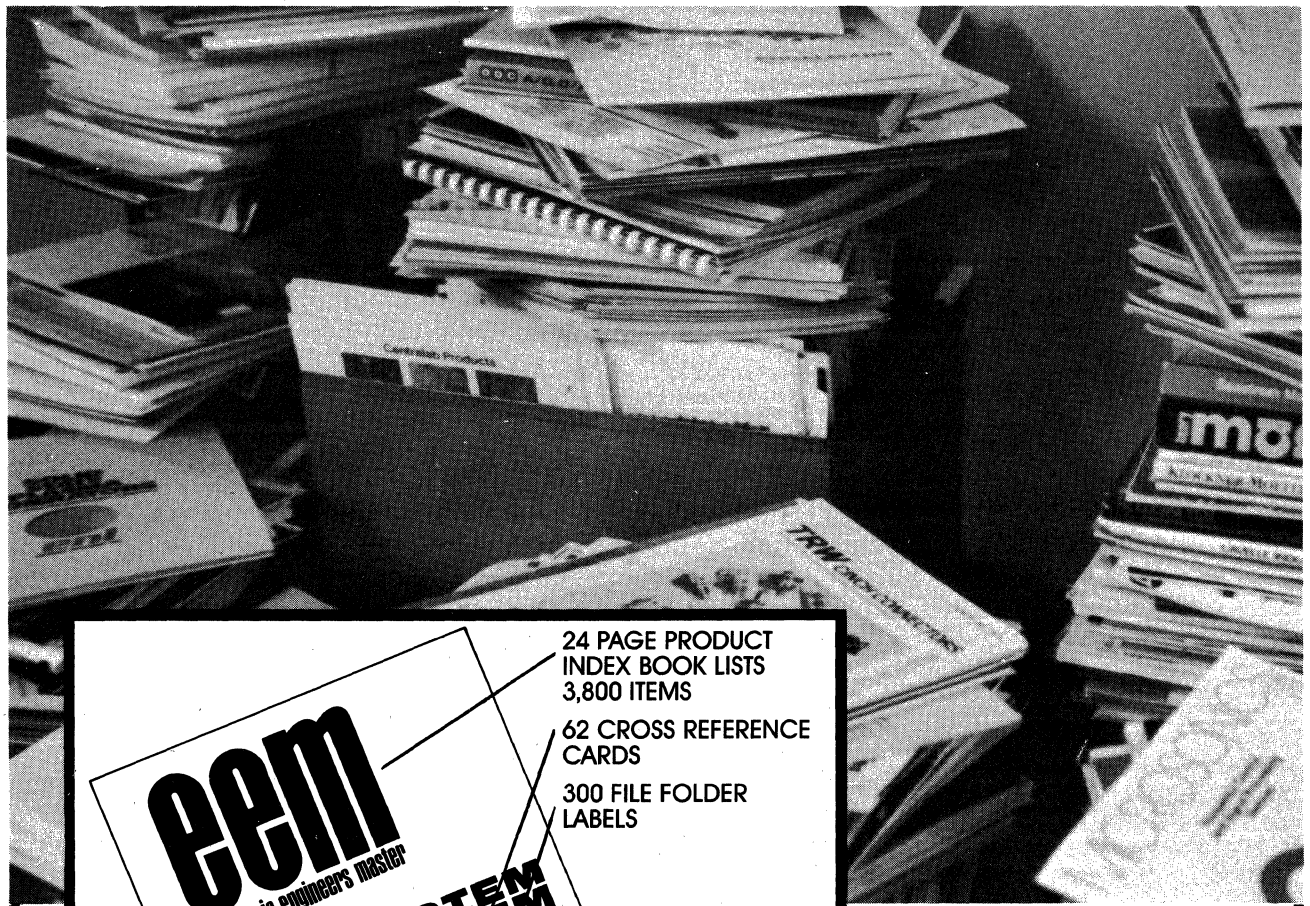

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Batteries & Fuel Cells, Characteristics ..... **D**•1430
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide ..... **A**•1003
Circuit Boards (Printed) Product Selection Guide ..... **C**•1099
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1205
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1863
Connectors, Miniglossary ..... **C**•1129
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Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Gude ..... **A**•1309
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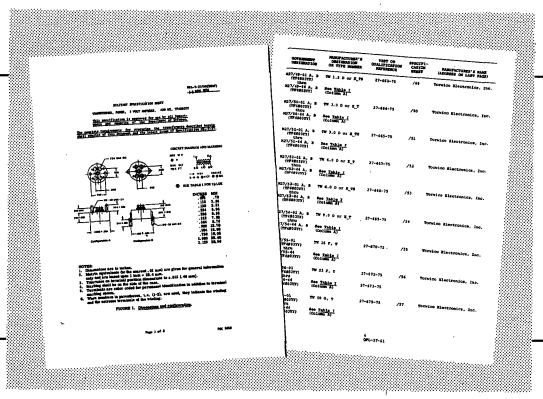
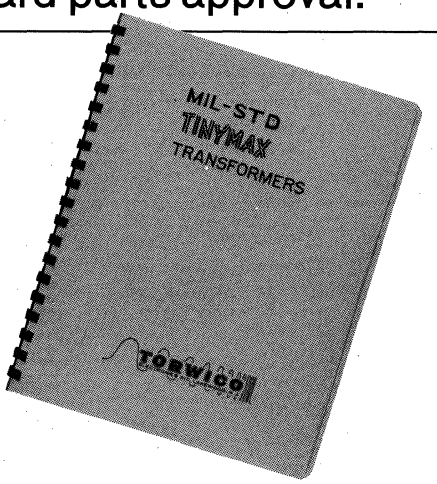


Now you can specify Military Standard Transformers without the need for Qualification Testing or requests for non-standard parts approval.



These miniature transformers are of toroidal construction and offer a size and weight reduction when compared to conventional laminated and "C" core designs. Yet, the prices on these custom engineered transformers are competitive with off-the-shelf stock items.

So, when you need a 115V, 400 Hz transformer having a specific secondary voltage don't settle for an off-the-shelf item that may only approximate your requirement. Torwico has over 2,000 MIL/STD units and an almost infinite selection of STD TINYMAX.

What's more, Torwico offers fast delivery and competitive pricing. Selection, delivery and price--Torwico has it all.

STD TINYMAX -- MIL-T-27, Grade 4 and Grade 5, Class S, 115 volt, 400 Hz transformers available in power ratings ranging from 1.5 VA through 250 VA, with an almost infinite combination of secondary voltages of 6V through 300V.

MIL-STD TINYMAX -- Grade 4 and Grade 5, Class S, 115 Volt, 400 Hz transformers. Reference M27/37 through M27/66. Over 2,000 choices of secondary voltages.

EXTENSION OF APPROVAL -- Any design selected directly from, or based, on our MIL/STD TINYMAX transformer may be qualified to MIL-T-27 by similarity.

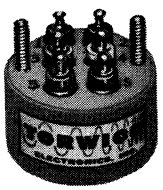
PROCUREMENT NOTE -- Catalog information and cross referenced sheets may be obtained from the factory or for MIL-STD units, refer directly to specification sheets M27/37 through M27/66.

PROTOTYPE DELIVERIES -- A large assortment of TINYMAX transformers is always maintained in stock for immediate delivery. Others can be shipped within 10 days.

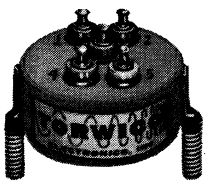
For a copy of Torwico's MIL-STD TINYMAX catalog, contact your local Torwico representative. He'll show you why Torwico is the easy way to deal with military standards.

TORWICO ELECTRONICS INC — LEADER IN MAGNETIC COMPONENTS

TINYMAX® 400 HZ Power Transformers



This Case style available in 1.5 through 250 VA



This Case style available in 1.5 through 9 VA

TINYMAX®

CONDENSED PERFORMANCE DATA FOR "STANDARD" GRADE 4 TINYMAX 400 HZ TRANSFORMERS MIL-T-27 DESIGNATION TF4S03YY

VA RATING	SELECTED FULL LOAD SEC. V (RMS) ± 3% (from range shown) with 115V PRI.	O.D ± .031"	HT. ± .031"	WEIGHT MAX.	REGULATION MAX.	TEMP. RISE MAX.
1.5	6.0 to 300	1.000	.469	1.00 oz.	23%	17°C
1.5 (With Electrostatic Shield)	6.0 to 300	1.000	.594	1.25 oz.	18%	17°C
3	6.0 to 300	1.000	.594	1.25 oz.	18%	20°C
3 (With Electrostatic Shield)	6.0 to 300	1.000	.812	1.70 oz.	12%	20°C
6	6.0 to 300	1.000	.812	1.70 oz.	12%	25°C
6 (With Electrostatic Shield)	6.0 to 300	1.000	1.062	2.30 oz.	10%	25°C
9	6.0 to 300	1.000	1.062	2.30 oz.	10%	30°C
9 (With Electrostatic Shield)	6.0 to 300	1.375	1.125	3.80 oz.	8%	32°C
16	6.0 to 300	1.375	1.125	3.80 oz.	8%	32°C
25	6.0 to 300	1.375	1.375	4.95 oz.	7%	45°C
50	6.0 to 300	2.000	1.500	11.00 oz.	3%	35°C
75	10 to 300	2.000	1.750	13.50 oz.	3%	40°C
100	12 to 300	2.250	2.000	18.70 oz.	2.5%	43°C
250	26 to 300	2.875	2.000	30.00 oz.	2%	55°C

WITH OR WITHOUT ELECTROSTATIC SHIELD

TINYMAX®

CONDENSED PERFORMANCE DATA FOR "STANDARD" GRADE 5 TINYMAX 400 HZ TRANSFORMERS MIL-T-27 DESIGNATION TF5S03ZZ

VA RATING	SELECTED FULL LOAD SEC. V (RMS) ± 3% (from range shown) with 115V PRI.	SIZE MAX- INCHES	WEIGHT MAX.	REGULATION MAX.	TEMP. RISE MAX.
1.5	6.0 to 300	1.09 Sq. X .47 ht.	.85 oz.	23%	17°C
1.5 (With Electrostatic Shield)	6.0 to 300	1.09 Sq. X .59 ht.	1.10 oz.	18%	17°C
3	6.0 to 300	1.09 Sq. X .59 ht.	1.10 oz.	18%	20°C
3 (With Electrostatic Shield)	6.0 to 300	1.09 Sq. X .78 ht.	1.65 oz.	12%	20°C
6	6.0 to 300	1.09 Sq. X .78 ht.	1.65 oz.	12%	25°C
6 (With Electrostatic Shield)	6.0 to 300	1.09 Sq. X 1.03 ht.	2.20 oz.	10%	25°C
9	6.0 to 300	1.09 Sq. X 1.03 ht.	2.20 oz.	10%	30°C
9 (With Electrostatic Shield)	6.0 to 300	1.40 Sq. X .97 ht.	3.40 oz.	8%	32°C
16 WITH OR WITHOUT	6.0 to 300	1.40 Sq. X .97 ht.	3.40 oz.	8%	32°C
25 ELECTROSTATIC SHIELD	6.0 to 300	1.40 Sq. X 1.20 ht.	4.40 oz.	7%	45°C

TORWICO ELECTRONICS INC.

410 OBERLIN AVE. SOUTH, LAKEWOOD, NJ 08701 • (201) 364-1800

TRIAD®-UTRAD
A Division of MagneTek, Inc.

POWER TRANSFORMERS

Dept. EM, 1124 East Franklin Street, Huntington, IN 46750 • Phone: (219) 356-6500 • TWX: 810-333-1532

FOR POWER SUPPLY, CONTROL AND FILAMENT CIRCUITS

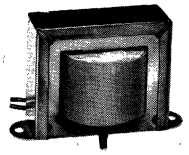
115V PRIMARY—SINGLE SECONDARY/50-60 Hz UNLESS NOTED (‡)

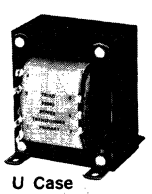
LISTED IN ORDER OF INCREASING SECONDARY VOLTAGES

Triad Part No.	Secondary Volts	Secondary Amps	RMS Test Voltage	Case Type	Connections or Lead Holes Used	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD	Mounting Hole Size	Max. Unit Wt. Lbs.
F-1X‡+	2.5 CT	3	1500	X	Leads	1 5/8	2 13/16	1 5/8	2 3/8	—	3/16	.68
F-72Z‡	2.5 CT	5	Sec. 7500	Z	Sec.-Lugs	2 23/32	3 1/8	2 1/8	2 13/16	—	3/16	1.7
F-6X‡+	2.5 CT	6	Sec. 2500	X	Leads	1 15/16	3 5/16	1 3/4	2 13/16	—	3/16	1
F-3X‡	2.5 CT	10	Sec. 3000	X	Leads	2 9/32	3 3/4	2 1/8	3 1/8	—	3/16	1.7
F-5U	2.5 CT	10	Sec. 7500	U	Leads	3 1/16	2 1/2	2 7/16	2	1 7/8	5/16 x 3/16	2.2
F-7X	5.0 CT	3	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.3
F-8X	5.0 CT	6	1500	X	Leads	2 9/32	3 3/4	2 1/8	3 1/8	—	3/16	1.7
F-12X	5.0 CT	8	2500	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	2.5
F-10U‡	5.0 CT	14	Sec.10,000	U	Leads	3 13/16	3 5/16	3 1/4	2 1/2	2 9/16	5/16 x 3/16	4.75
F-15U‡	5.0 CT	15	Sec. 3000	U	Lugs	3 1/2	2 7/8	2 11/16	2 1/4	2 3/16	5/16 x 3/16	3.25
F-9U	5.2 CT	13	1500	U	Leads	3 7/16	2 13/16	3 1/4	2 1/4	2 3/8	5/16 x 3/16	4
F-11U	5.2 CT	24	1500	U	Leads	3 13/16	3 5/16	3 7/8	2 1/2	3 1/16	5/16 x 3/16	6.75
F-13X+	6.3	.6	1500	X	Leads	1 3/8	2 3/8	1 3/8	2	—	3/16	.37
R-84K	6.3§	.6	Sec. 3500	K	2-Leads	2 3/4	2 1/4	2 11/16	1 1/2	2 3/8	3/16	1.5
F-14X‡+	6.3 CT	1.2	Sec. 2500	X	Leads	1 5/8	2 13/16	1 5/8	2 3/8	—	3/16	.7
F-14Z‡	6.3 CT	1.2	Sec. 2500	Z	Leads	1 15/16	2 3/8	1 5/8	2	—	3/16	.7
F-52X	6.3§	1.2	Sec. 5000	X	Leads	1 15/16	3 5/16	1 3/4	2 13/16	—	3/16	1
F-51X‡	6.3§	2	Sec. 5000	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.25
F-16X+	6.3 CT	3	Sec. 2500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.3
F-53X	6.3	4	Sec. 5000	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	2.1
F-43X‡	6.3	4	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.25
F-18A	6.3 CT	6	1500	A	1-Leads	3 3/16	2 21/32	2 5/8	2	1 11/16	3/8 x 3/16	2.5
F-18X+	6.3 CT	6	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	2.3
F-69X	6.3 CT	8	1500	X	Leads	2 1/16	4	2 1/4	3 9/16	—	3/16	2.3
F-21A	6.3 CT	10	1500	A	1-Leads	3 19/32	2 31/32	3 1/8	2 1/4	2	3/8 x 3/16	3.8
F-20U†	6.3 CT-6 CT	11	Sec. 3000	U	Leads	3 1/2	2 7/8	3	2 1/4	2 7/16	5/16 x 3/16	4
F-17U‡	6.3 CT	15	Sec.10,000	U	Pri. Leads	4 1/4	3 1/2	3 3/4	2 3/4	2 13/16	5/16 x 3/16	7.5
F-22A	6.3 CT	20	2000	A	2-Leads	3 7/8	3 9/32	4 1/8	2 1/2	3	3/8 x 3/16	7
F-24U†	7.5 CT-6.3 CT	8	Sec. 3000	U	2-Leads	3 1/2	2 7/8	2 13/16	2 1/4	2 5/16	5/16 x 3/16	3.65
F-28U†	7.5 CT-6.3 CT	25	Sec. 3000	U	Leads/Lugs	4 5/8	3 13/16	3 5/8	3	3 1/16	5/16 x 3/16	7.5
F-180X	10.0 CT	1	1500	X	Leads	1 15/16	3 5/16	1 3/4	2 13/16	—	3/16	.9
F-31X	10.0 CT	3	2000	X	Leads	2 9/32	3 3/4	2 1/8	3 1/8	—	3/16	1.7
F-95X	10.0 CT	4	1500	X	Leads	2 5/8	4	2 1/8	3 9/16	—	3/16	2.1
F-33U	10.0 CT	5	2000	U	Leads	3	2 1/2	2 5/8	2	2 1/16	3/16 x 3/8	2.5
F-96U	10.0 CT	6	1500	U	Leads	3	2 1/2	2 3/4	2	2 5/16	3/8 x 3/16	2.1
F-23U	10.0 CT	7	1500	U	Leads	3 1/2	2 7/8	2 15/16	2 1/4	2 7/16	5/16 x 3/16	3.9
F-97U	10.0 CT	8	1500	U	Leads	3 7/16	2 13/16	3	2 1/4	2 1/2	3/8 x 3/16	4.0
F-35U	10.0 CT	10	2000	U	Leads	4 1/8	4 1/2	3 1/4	2 3/4	2 7/16	3/16 x 3/8	9.1
F-113X	12.0	0.15	1500	X	Leads	1 3/8	2 3/8	1 3/8	—	2	3/16	.4
F-216X‡	12.0	.35	1500	X	Leads	1 3/8	2 3/8	1 3/8	2	—	3/16	.37
F-114X	12.0	0.7	1500	X	Leads	1 5/8	2 13/16	1 5/8	—	2 3/8	3/16	.8
F-217X‡	12.0	1.2	1500	X	Leads	2	3 1/4	1 3/4	2 13/16	—	3/16	1.0
F-218X‡	12.0	2	1500	X	Leads	2	3 1/4	1 7/8	2 7/8	—	3/16	1.13
F-219X‡	12.0	4	1500	X	Leads	2 9/16	4	2 1/4	3 9/16	—	3/16	2.3
F-220U‡	12.0	6	1500	U	Leads	3 7/16	2 13/16	2 1/2	2 1/4	2 1/8	3/8 x 3/16	3.5
F-221U‡	12.0	8	1500	U	Leads	3 13/16	3 1/8	2 3/8	2 1/2	2 1/8	3/8 x 3/16	4.0
F-29U†	12 CT-11 CT 10.0 CT	11	Sec. 3000	U	Leads	4 3/8	3 1/2	3 3/8	2 3/4	2 9/16	5/16 x 3/16	6.5
F-70X	12.6 CT	1.0	1500	X	Leads	1 15/16	3 5/16	1 3/4	2 13/16	—	3/16	1.3
F-25X +	12.6 CT	1.5	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.3
F-44X‡+	12.6 CT	2	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.25
F-26X‡+	12.6 CT	2.5	1500	X	Leads	2 9/32	3 1/16	2	3 1/8	—	3/16	1.55
F-224X‡	12.6	3	1500	X	Leads	2 1/4	3 3/4	2 1/8	3 1/8	—	3/16	1.6
F-225X‡	12.6	4	1500	X	Leads	2 5/8	4	2 1/16	3 9/16	—	3/16	2.3
F-181U+	12.6 CT	4	1500	U	Leads	3 1/16	2 9/16	2 3/16	2	2	3/16	2.3
F-182U	12.6 CT	6	1500	U	Leads	3 3/8	2 13/16	2 7/16	2 1/4	2 3/8	5/16 x 3/16	3.8

§ Static shield. † Tapped primary to produce lower voltages. ‡ 60 cycle operation. + Available 115/230 PRI.

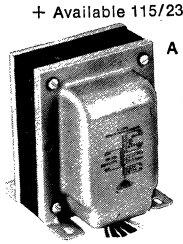
X Case



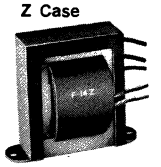


U Case

A Case



Z Case



POWER TRANSFORMERS

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115V PRIMARY—SINGLE SECONDARY/50-60 Hz UNLESS NOTED (‡) CONTINUED

Triad Part No.	Secondary Volts	Secondary Amps	RMS Test Voltage	Case Type	Connections or Lead Holes Used	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD	Mounting Hole Size	Max. Unit Wt. Lbs.
F-183U	12.6 CT	8	1500	U	Leads	3 13/16	3 3/16	2 15/16	2 1/2	2 1/4	5/16 x 3/16	5
F-112X+	14.0 CT	0.25	1500	X	Leads	1 3/8	2 3/8	1 3/8	2	—	3/16	.4
F-250X	14.0 CT	1	1500	X	Leads	1 15/16	3 1/4	1 3/4	2 13/16	—	3/16	1.2
F-251X	14.0 CT	2	1500	X	Leads	2 1/4	3 11/16	1 15/16	3 1/8	3/16	—	1.5
F-252U	14.0 CT	4	1500	U	Leads	3	2 1/2	2 7/16	2	2 1/4	5/16 x 3/16	3
F-253U	14.0 CT	6	1500	U	Leads	3 3/8	2 13/16	2 7/8	2 1/4	2 3/8	5/16 x 3/16	4
F-410X	18.0 CT	.75	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.3
F-411X	18.0 CT	1	1500	X	Leads	1 15/16	3 5/16	2 1/8	2 13/16	—	3/16	1.45
F-412X	18.0 CT	1.5	1500	X	Leads	2 9/32	3 3/4	2 1/8	3 1/8	—	3/16	1.7
F-413X	18.0 CT	2	1500	X	Leads	2 9/32	3 3/4	2 1/4	3 1/8	—	3/16	1.95
F-254X	20.0 CT	1	1500	X	Leads	2 1/4	3 11/16	1 15/16	3 1/8	—	3/16	1.5
F-255X	20.0 CT	2	1500	X	Leads	2 9/16	4	2 1/4	3 9/16	—	3/16	2.5
F-256U	20.0 CT	4	1500	U	Leads	3 3/8	2 13/16	2 7/8	2 1/4	2 3/8	5/16 x 3/16	4
F-257U	20.0 CT	6	1500	U	Leads	3 3/4	3 1/8	3 1/8	2 1/2	2 5/8	5/16 x 3/16	5.7
F-258U	20.0 CT	8	1500	U	Leads	3 3/4	3 1/8	3 1/2	2 1/2	2 7/8	5/16 x 3/16	6.4
F-259U	20.0 CT	10	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4	5/16 x 3/16	7.4
F-115X+	24.0 CT	0.085	1500	X	Leads	1 3/16	2 1/16	1 1/4	1 3/4	—	3/16	3
F-116X+	24.0 CT	0.2	1500	X	Leads	1 3/8	2 3/8	1 1/2	2	—	3/16	.45
F-117X+	24.0 CT	0.4	1500	X	Leads	1 5/8	2 13/16	1 5/8	2 3/8	—	3/16	.8
F-118X+	24.0 CT	0.7	1500	X	Leads	1 15/16	3 1/4	2	2 13/16	—	3/16	1.3
F-45X‡+	24.0 CT	1	1500	X	Leads	1 15/16	3 5/16	2	3 1/8	—	3/16	1.3
F-46X‡+	24.0	1	1500	X	Leads	1 15/16	3 11/16	2 1/8	3 1/8	—	3/16	1.4
F-192X	24.0 CT	2	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	2.3
F-229X‡	24.0	2	1500	X	Leads	2 9/16	4	1 7/8	3 9/16	—	3/16	2.3
F-193U	24.0 CT	4	1500	U	Leads	3 13/16	3 1/8	2 13/16	2 1/2	2 1/8	5/16 x 3/16	4
F-260U	24.0 CT	6	1500	U	Leads	3 3/4	3 1/8	3 1/2	2 1/2	2 7/8	5/16 x 3/16	6.4
F-261U	24.0 CT	8	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4	5/16 x 3/16	7.4
F-401U	24.0 CT	10	1500	U	Leads	4 1/8	3 7/16	3 3/4	2 3/4	3	3/8 x 3/16	8.0
F-226U	24.0 CT	12	1500	U	Leads	4 5/16	3 3/4	4 1/8	3	3 1/4	3/8 x 3/16	10.4
F-57X†	25.2 CT	1	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.5
F-41X‡+	25.2 CT	2	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	2.2
F-56X	25.2 CT	2.8	1500	X	Leads	2 21/32	4	2 1/4	3 9/16	—	3/16	2.5
F-119X	26.8 CT	0.15	1500	X	Leads	1 3/8	2 3/8	1 1/2	2	—	3/16	.45
F-120X	26.8 CT	0.5	1500	X	Leads	1 15/16	3 1/4	2	2 13/16	—	3/16	1.3
F-40X‡+	26.8 CT	1	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.3
F-55X+	26.8 CT	1.7	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	2.3
F-121X	28.0 CT	.085	1500	X	Leads	1 3/16	2 1/16	1 3/8	1 3/4	—	3/16	.25
F-122X	28.0 CT	.175	1500	X	Leads	1 3/8	2 3/8	1 1/2	2	—	3/16	.35
F-123X	28.0 CT	.300	1500	X	Leads	1 5/8	2 13/16	1 5/8	2 3/8	—	3/16	.6
F-124X	28.0 CT	.800	1500	X	Leads	1 15/16	3 1/4	2	2 13/16	—	3/16	1
F-184X	28.0 CT	1	1500	X	Leads	2 9/32	3 3/4	2 1/8	2 13/16	—	3/16	1.4
F-185U+	28.0 CT	2	1500	U	Leads	3 1/16	2 1/2	2 7/16	2	2 1/4	3/16 x 3/8	2.9
F-187U	28.0 CT	4	1500	U	Leads	3 1/2	2 7/8	3 1/16	2 1/4	2 3/4	5/16 x 3/16	5.3
F-262X	30.0 CT	1	1500	X	Leads	2 1/4	3 11/16	1 15/16	3 1/8	—	3/16	1.5
F-210X	30.0 CT	1.7	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	1.55
F-263U	30.0 CT	2	1500	U	Leads	3	2 1/2	2 9/16	2	2 3/8	5/16 x 3/16	3.2
F-264U	30.0 CT	4	1500	U	Leads	3 3/4	3 1/8	3 1/8	2 1/2	2 5/8	5/16 x 3/16	5.7
F-265U	30.0 CT	6	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4	5/16 x 3/16	7.4
F-266U‡	30.0 CT	8	1500	U	Leads	4 1/2	3 3/4	4	3	3	5/16 x 3/16	10
F-227X‡	35.0 CT	.065	1500	X	Leads	1 3/16	2 1/16	1 5/16	1 3/4	—	3/16	.3
F-188X	35.0 CT	.1	1500	X	Leads	1 5/8	2 13/16	1 7/16	2 3/8	—	3/16	.35
F-228X‡	35.0 CT	.3	1500	X	Leads	1 5/8	2 13/16	1 5/8	2 3/8	—	3/16	.6
F-189X	35.0 CT	.5	1500	X	Leads	2 5/16	3 11/16	1 15/16	3 1/8	—	3/16	1
F-54X+	35.0 CT	1.5	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	2.2
F-190U	35.0 CT	2	1500	U	Leads	3 3/8	2 13/16	2 3/4	2 1/4	2 3/8	5/16 x 3/16	3.5
F-191U	35.0 CT	4	1500	U	Leads	3 13/16	3 3/16	3 3/16	2 3/4	2 1/2	5/16 x 3/16	6
F-267U	35.0 CT	6	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4	5/16 x 3/16	7.4
F-268U	35.0 CT	8	1500	U	Leads	4 1/2	3 3/4	4 1/4	3	3 1/4	5/16 x 3/16	11
F-269U	35.0 CT	10	1500	U	Leads	5 1/4	4 3/8	4 1/8	3 1/2	2 3/4	5/16 x 3/16	12
F-270X	40.0 CT	1	1500	X	Leads	2 9/16	4	2 1/4	3 9/16	—	3/16	2.6
F-271U	40.0 CT	2	1500	U	Leads	3 3/8	2 13/16	2 7/8	2 1/4	2 3/8	5/16 x 3/16	4
F-272U	40.0 CT	4	1500	U	Leads	3 3/4	3 1/8	3 1/2	2 1/2	2 7/8	5/16 x 3/16	6.4
F-273U	40.0 CT	6	1500	U	Leads	4 1/2	3 3/4	4	3	3	5/16 x 3/16	10
F-274U	40.0 CT	8	1500	U	Leads	4 1/2	3 3/4	4 1/4	3	3 5/8	5/16 x 3/16	10.5
F-275U	40.0 CT	10	1500	U	Leads	5 1/4	4 3/8	4 1/2	3 1/2	3 1/4	5/16 x 3/16	14.5
F-276X	50.0 CT	1	1500	X	Leads	2 9/16	4	2 1/4	3 9/16	—	3/16	2.4
F-277U	50.0 CT	2	1500	U	Leads	3 3/4	3 1/8	2 7/8	2 1/2	2 3/8	5/16 x 3/16	4.7
F-278U	50.0 CT	4	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4	5/16 x 3/16	7.4
F-58A	50.0 CT	5	1500	A	Leads	4 5/8	3 15/16	4 1/2	3	3 3/8	3/8 x 3/16	10
F-59X	60.0 CT	.4	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.3
F-279U	60.0 CT	1	1500	U	Leads	3	2 1/2	2 5/8	2	2 3/8	5/16 x 3/16	3.4
F-280U	60.0 CT	2	1500	U	Leads	3 3/4	3 1/8	3 1/8	2 1/2	2 5/8	5/16 x 3/16	5.6
F-281U	60.0 CT	4	1500	U	Leads	4 1/2	3 3/4	4	3	3	5/16 x 3/16	10
F-282U	60.0 CT	6	1500	U	Leads	5 1/4	4 3/8	4 1/8	3 1/2	2 7/8	5/16 x 3/16	12.5
F-283U	70.0 CT	1	1500	U	Leads	3 3/8	2 13/16	2 5/8	2 1/4	2 1/4	5/16 x 3/16	4
F-284U	70.0 CT	2	1500	U	Leads	3 3/4	3 1/8	3 1/2	2 1/2	2 7/8	5/16 x 3/16	6

§ Static shield. † Tapped primary to produce lower voltages. ‡ 60 cycle operation. + Available 115/230 PRI.

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MICROPROCESSOR POWER TRANSFORMERS

DUAL C.T. SECONDARIES, 115V PRIMARY/50/60 Hz

F234Z-F245U HAVE 2 ISOLATED WINDINGS

Triad Part No.	Secondary Volts	Secondary Amps	RMS Test Voltage	Case Type	Connections or Lead Holes Used	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD	Mounting Hole Size	Max. Unit Wt. Lbs.
F-234Z‡	12.0 CT	.1	1500	Z	Lugs	1 3/8	2	1 5/16	1 3/4	—	3/16	.3
F-235Z‡	12.0 CT	.25	1500	Z	Lugs	2	2 3/8	1 7/16	2	—	3/16	.6
F-236Z‡	12.0 CT	.5	1500	Z	Lugs	2 5/16	2 7/8	1 5/8	2 3/8	—	3/16	.9
F-237Z‡	12.0 CT	1	1500	Z	Lugs	2 3/8	2 13/16	2 1/16	2 3/8	—	3/16	1.1
F-238U‡	12.0 CT	2	1500	U	Lugs	2 1/2	3	2 3/16	2 1/2	2	3/8 x 3/16	2.2
F-239U‡	12.0 CT	4	1500	U	Lugs	3 1/8	3 3/4	2 3/4	3 1/8	2 1/4	3/8 x 3/16	4.3
F-240U‡	12.0 CT	6	1500	U	Lugs	3 1/2	4 1/8	3 1/16	2 1/2	2 1/4	3/8 x 3/16	5.4
F-241U‡	18.0 CT	1	1500	U	Lugs	2 1/2	3	2 1/2	2 1/8	2	3/8 x 3/16	2.2
F-242U‡	18.0 CT	2	1500	U	Lugs	3 1/8	3 3/4	3 1/8	3 7/16	2	3/8 x 3/16	4.0
F-243U‡	18.0 CT	4	1500	U	Lugs	3 1/2	4 1/8	3 1/4	3 3/4	2 1/4	3/8 x 3/16	5.2
F-244U‡	18.0 CT	8	1500	U	Lugs	3 3/4	4 1/2	4	3 3/4	2 3/4	3/8 x 3/16	8.3
F-245U‡	18.0 CT	12	1500	U	Lugs	4 3/8	5 3/16	4 1/4	4 1/2	2 3/4	3/8 x 3/16	11.9
F-194X	32.0 CT 15.5 CT	.050 .200	1500	X	Leads	1 5/8	2 7/8	1 3/8	2 3/8	—	3/16	.45
F-195X	32.0 CT 15.5 CT	.250 .750	1500	X	Leads	2 1/4	3 3/4	1 7/8	3 1/8	—	3/16	1.3
F-196U	32.0 CT 15.0 CT	1 2	1500	U	Leads	3 3/8	2 13/16	2 5/8	2 1/4	2 1/4	5/16 x 3/16	4
F-197U	32.0 CT 15.0 CT	1 4	1500	U	Leads	3 3/4	3 1/8	2 15/16	2 1/2	2 1/4	5/16 x 3/16	4.7
F-198U	32.0 CT 15.0 CT	1 6	1500	U	Leads	3 3/4	3 1/8	3 3/16	2 1/2	2 3/4	5/16 x 3/16	6.2
F-199U	32.0 CT 15.0 CT	1 10	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4	5/16 x 3/16	7.4

* Windings may be connected in series to obtain their combined voltage when properly phased. Current will be equal to the current of the lowest winding. Example: Two 6.3V windings @ 2A in series would be 12.6V @ 2A. Windings may also be connected in parallel to obtain combined current. Example: Two 6.3V windings @ 2A in parallel would be 6.3V @ 4A. ¶ Tapped primary 105-115-125. ‡ 60 cycle operation.

DUAL C.T. SECONDARIES/PRIMARY 230V, 50/60 Hz

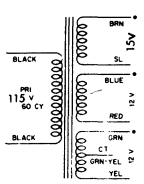
Triad Part No.	Secondary Volts	Secondary Amps	RMS Test Voltage	Case Type	Connections or Lead Holes Used	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD	Mounting Hole Size	Max. Unit Wt. Lbs.
F-395X	32.0 CT 15.0 CT	.250 .750	1500	X	Leads	2 1/4	3 3/4	1 7/8	3 1/8	—	3/16	1.3
F-396U	32.0 CT 15.0 CT	1 2	1500	U	Leads	3 3/8	2 13/16	2 5/8	2 1/4	2 1/4	5/16 x 3/16	4
F-397U	32.0 CT 15.0 CT	1 4	1500	U	Leads	3 3/4	3 1/8	2 15/16	2 1/2	2 1/4	5/16 x 3/16	4.7

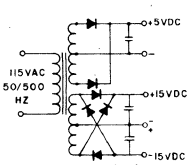
TRIPLE SECONDARIES, 115V PRIMARY, 60 Hz ONLY (3 ISOLATED WINDINGS)

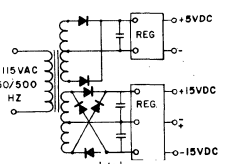
Type No.	Secondary Volts	Secondary Amps	RMS Test Voltage	Case Type	Connections	Case Dimensions H	Case Dimensions W	Case Dimensions D	Case Dimensions MW	Mtg. Hole Size	Max. Unit Wt. Lbs.
F-295Z	12VCT-12V 15V	.1	1500	Z	Leads	1 3/4	2	1 1/2	1 3/4	3/16	.4
F-296Z		.15	1500	Z	Leads	1 15/16	2 3/8	1 1/2	2	3/16	.6
F-297Z		.25	1500	Z	Leads	1 15/16	2 7/16	1 5/8	2	3/16	.7
F-298Z		.5	1500	Z	Leads	2 1/4	3 3/4	1 7/8	3	3/16	1.3
F-299X		1.5	1500	X	Leads	2 5/16	4	2 1/4	3 5/16	3/16	2.3

TRIPLE SECONDARIES, 115-230V PRIMARY, 50-60 Hz (3 ISOLATED WINDINGS)

F-3295Z	12VCT-12V 15V	.1	1500	Z	Leads	1 3/4	2	1 1/2	1 3/4	3/16	.41
F-3297Z		.25	1500	Z	Leads	2 3/8	2 7/8	1 5/8	2 3/8	3/16	.8
F-3298Z		.5	1500	Z	Leads	2 3/8	2 13/16	2	2 3/8	3/16	1.25







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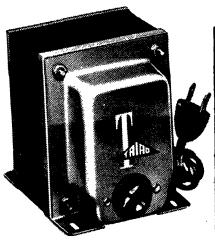
STEPDOWN AUTOFORMERS/50-60 Hz


M Case

Triad Part No.	Output Watts (VA)	Primary Volts	Secondary Volts ±5%	Secondary RMS Amps	RMS Test Voltage	Case Type	Connections	Mounting Dimension MW	Mounting Dimension MD
N-1X	50	230	115	.435	1500	X	Leads	3⅛	—
N-3M	85	230	115	.74	1500	M	6′ Cord & Plug & Socket	2¼	1⅝
N-2X	100	230	115	.87	1500	X	Leads	3⅝	—
N-4M	150	230	115	1.3	1500	M	6′ Cord & Plug & Socket	2¼	2⅜
N-6U	200	230	115	1.7	1500	U	Leads	2¼	2¼
N-5M	250	230	115	2.17	1500	M	6′ Cord & Plug & Socket	2½	3
N-7M	600	230	115	5.22	1500	M	6′ Cord & Plug & Socket	3	3⅞
N-39X	50	0-100-115-127-135	115	.43	1500	X	Lugs	2 13/16	—
N-40X	100	0-100-115-127-135	115	.87	1500	X	Lugs	2 13/16	—
N-100MG	100	115	230	.65	1500	MG	6′ 3 Wire, Cord Plug & Socket	2¼	2 31/32
N-250MG	250	115	230	1.1	1500	MG	6′ 3 Wire, Cord Plug & Socket	2½	3¼
N-500MG	500	115	230	2.2	1500	MG	6′ 3 Wire, Cord Plug & Socket	3	3⅝
N-1000MG	1000	115	230	4.35	1500	MG	6′ 3 Wire, Cord Plug & Socket	3½	4⅛

LOW VOLTAGE RECTIFIER/TRANSISTOR DRIVE VOLTAGE, 50-60 Hz

Triad Part No.	Primary Volts	Secondary AC Volts	Secondary AC Amps	DC Volts Half Wave	DC Volts Bridge	RMS Test Voltage	Case Type	Connections	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD
F-94X	115†	10-20 CT — 40 CT	.035	15	30	1500	X	Leads	1⅜	2⅜	1⅜	2	—
F-90X	115†	10-20 CT — 40 CT	.1	15	30	1500	X	Leads	1⅝	2 13/16	1⅝	2⅜	—
F-91X	115†	10-20 CT — 40 CT	.3	15	30	1500	X	Leads	2 9/32	3 11/16	2	3⅛	—
F-93X	115†	10-20 CT — 40 CT	.75	15	30	1500	X	Leads	2 19/32	4	2¼	3 9/16	—
F-92A	115†	10-20 CT — 40 CT	1.0	15	30	1500	A	Leads (2 Holes)	3 3/16	2 21/32	3	2	2 1/16
F-394X	230	10-20 CT — 40 CT	.035	15	30	1500	X	Leads	1⅜	2⅜	1⅜	2	—
F-390X	230	10-20 CT — 40 CT	.1	15	30	1500	X	Leads	1⅝	2 13/16	1⅝	2⅜	—
F-391X	230	10-20 CT — 40 CT	.3	15	30	1500	X	Leads	2¼	3 11/16	2	3⅛	—
F-393X	230	10-20 CT — 40 CT	.75	15	30	1500	X	Leads	2 19/32	4	2¼	3 9/16	—
F-392A	230	10-20 CT — 40 CT	1.0	15	30	1500	A	Leads	3 3/16	2 21/32	3	2	2 1/16

UNIVERSAL RECTIFIER POWER/PRIMARY 117V, 50-60 Hz

Triad Part No.	Secondary No. 1 AC Volts	Secondary DC Amps Full Wave CT	Secondary DC Amps Bridge	Secondary No. 2 AC Volts	Secondary No. 2 DC Amps	RMS Test Volts	Case Type	Connections	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD
F-202U	11.0 to 29.5	2.0	1.25	—	—	1000	U	Lugs	3	2½	3	2	2⅛
F-203U	12.0 to 30.0	4.0	2.0	—	—	1000	U	Lugs	3⅜	2 13/16	3¼	2¼	2⅜
F-204U	11.5 to 29.0	8.0	4.0	—	—	1000	U	Lugs	3¾	3⅛	4⅛	2½	2⅞
F-205U	12.0 to 29.5	12.0	6.0	—	—	1000	U	Lugs	4⅛	3 7/16	5⅛	2¾	3¼

Triad Part No.	Primary Volts	Secondary AC Volts	Secondary AC Amps	DC Volts Half Wave	DC Volts Bridge	RMS Test Voltage	Case Type	Connections	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD
F-47U **F-347U**	115 115/230	0-17-18	3	6-7	13-14	1500	U	Leads	3	2½	2¾	1⅝	2⅜
F-48U	115	0-17-18	6	6-7	13-14	1500	U	Leads	3 13/16	3 3/16	3 3/16	2½	2 11/16
F-49U	115	36* 36*	3 3	13 13	26 26	1500	U	Leads	4⅝	3 13/16	3¾	3	3 1/16
F-60U	115	0-6.5-13-19.5-26	3	9	18	1500	U	Leads	3⅜	2 13/16	2⅝	2¼	2 3/16
F-360U	115/230	—	—	—	—	—	—	—	—	—	—	—	—
F-61U	115	0-24-27-30-33-36	3	13	26	1500	U	Leads	3¾	3⅛	3¼	2½	2⅝
F-361U	115/230	—	—	—	—	—	—	—	—	—	—	—	—
F-67U‡	110-120	0-24-27-30-33-36	8	13	26	1500	U	Leads	4⅝	3 13/16	4⅜	3	3 5/16
F-64U	115	0-7-8-9	7	—	5-6-7	1500	U	Leads	3⅜	2 13/16	2¾	2¼	2 3/16

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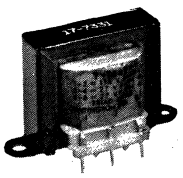
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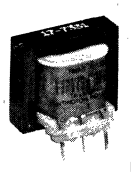
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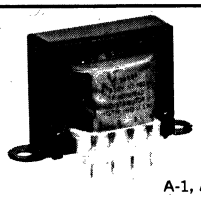
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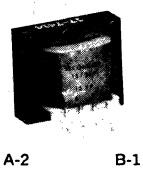

B-1

LOW-VOLTAGE, LOW-CURRENT PLUG-IN PRINTED CIRCUIT POWER

115V, 50-60 Hz PRIMARY/DUAL SECONDARIES*

Cat. No.	Fig.	Output Watts	Secondary		Dimensions						Mtg. Dim.	Wt. Oz.
			Series Connection	Parallel Connection	H	W	D	L	A	B		
F-131P	B	1½	8V CT @ .188A	4V @ .376A	1⅛	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-139P	B	1½	12.6V CT @ .12A	6.3V @ .24A	1⅛	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-132P	B	1½	15V CT @ .100A	7.5V @ .200A	1⅛	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-150P	B	1½	17V CT @ .085A	8.5V @ .170A	1⅛	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-138P	B	1½	25.2V CT @ .06A	12.6V @ .12A	1⅛	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-133P	B	1½	30V CT @ .050A	15V @ .100A	1⅛	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-160P	B	1½	34V CT @ .045A	17V @ .090A	1⅛	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-135P	B	1½	76V CT @ .020A	38V @ .040A	1⅛	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-149XP	A	4½	12.6V CT @ .35A	6.3V @ .70A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-142XP	A	4½	15V CT @ .300A	7.5V @ .600A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-161XP	A	4½	17V CT @ .264A	8.5V @ .528A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-148XP	A	4½	25.2V CT @ .178A	12.6V @ .356A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-143XP	A	4½	30V CT @ .150A	15V @ .300A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-162XP	A	4½	34V CT @ .132A	17V @ .264A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-147XP	A	4½	40V CT @ .112A	20V @ .224A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-144XP	A	4½	54V CT @ .084A	27V @ .168A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-159XP	A	7½	12.6V CT @ .60A	6.3V @ 1.2A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-152XP	A	7½	15V CT @ .500A	7.5V @ 1.000A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-163XP	A	7½	17V CT @ .441A	8.5V @ .882A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-158XP	A	7½	25.2V CT @ .30A	12.6V @ .60A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-153XP	A	7½	30V CT @ .250A	15V @ .500A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-164XP	A	7½	34V CT @ .220A	17V @ .440A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-154XP	A	7½	54V CT @ .140A	27V @ .280A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5

115-230V, 50-60 Hz DUAL PRIMARY*/DUAL SECONDARIES*

F-3132P	B-1	1½	15V CT @ .1A	7.5V @ .200A	1⅛	1 3/8	1 1/8	1 3/8	13/64	1	1 3/8	4.0
F-3142XP	A-1	4½	15V CT @ .3A	7.5V @ .600A	1 3/8	2 3/8	1 1/4	1 5/8	1/4	1 7/64	2	6.5
F-3152XP	A-1	7½	15V CT @ .5A	7.5V @ .100A	1 5/8	2 13/16	1 61/64	1 7/16	1/4	1 15/16	2 3/8	11.0
F-3143XP	A-1	4½	30V CT @ .150A	15V @ .300A	1 3/8	2 3/8	1 1/4	1 5/8	1/4	1 7/64	2	6.5
F-3153XP	A-1	7½	30V CT @ .250A	15V @ .500A	1 5/8	2 13/16	1 61/64	1 7/16	1/4	1 15/16	2 3/8	11.0
F-333P	B-1	1½	30V CT @ .050A	15V @ .100A	1⅛	—	1 1/8	1 3/8	13/64	1	—	4.0
F-349XP	A-1	4½	16V CT @ .280A	8V @ .560A	1 3/8	2 3/8	1 1/4	1 5/8	1/4	1 7/64	2	6.5
F-359XP	A-2	10	24V CT @ .450A	12V @ .900A	1 5/8	2 13/16	1 7/16	1 7/8	1/4	1 5/16	2 3/8	11.0
F-362XP	A-2	10	20V CT @ .500A	10V @ 1.0A	1 5/8	2 13/16	1 7/16	1 7/8	1/4	1 5/16	2 3/8	11.0

PLUG-IN PRINTED CIRCUIT POWER TRANSFORMERS/

115V, 50-60 Hz PRIMARY/TRIPLE OUTPUT SECONDARIES FOR ±15V AND ±5V DC

Cat. No.	Fig.	Output Watts	Secondary		Dimensions						Mtg. Dim.	Wt. Oz.
			Series Connection	Parallel Connection	H	W	D	L	A	B		
F-165P	B	1½	24V CT @ .025A	9V CT @ .100A	1⅛	1 25/64	1 5/32	1 25/64	13/64	1	—	3.5
F-167P	B	1½	32V CT @ .020A	15V CT @ .060A	1⅛	1 25/64	1 5/32	1 25/64	13/64	1	—	3.5
F-168XP	A	4½	32V CT @ .050A	15V CT @ .195A	1 25/64	2 3/8	1 1/4	1 45/64	1/4	1 3/32	2	7.5
F-166XP	A	7½	24V CT @ .125A	9V CT @ .500A	1 41/64	2 13/16	1 15/32	1 61/64	1/4	1 5/16	2 3/8	10.5
F-169XP	A	7½	32V CT @ .100A	15V CT @ .287A	1 41/64	2 13/16	1 15/32	1 61/64	1/4	1 5/16	2 3/8	10.5

PLUG-IN PRINTED CIRCUIT AUDIO TRANSFORMERS

Cat. No.	Fig.	Output M.W.	Primary Impedance	Secondary Impedance	Primary D.C. Unbalance	Dimensions			Pin Dimension		Wt. Oz.
						H	W	D			
TY-141P	B	100	10,000 CT	10,000 CT	4 ma.	5/8	13/16	19/32	3/16	.042	1
TY-142P	B	100	10,000 CT	2,000 CT	4 ma.	5/8	13/16	19/32	3/16	.042	1
TY-147P	B	100	150 CT	600 CT	15 ma.	5/8	13/16	19/32	3/16	.042	5

* Two isolated windings.

TRANSFORMERS

TRIAD®-UTRAD
A Division of MagneTek, Inc.

Dept. EM, 1124 East Franklin Street, Huntington, IN 46750
Phone: (219) 356-6500 • TWX: 810-333-1532

ISOLATION/50-60 Hz ALL ISOLATION UNITS HAVE STATIC SHIELDS

Type No.	Output Watts (VA)	Primary Volts	Secondary AC Volts ±5%	Secondary AC Amps	RMS Test Voltage	Case Type	Connections	Lead Holes Used	Case Dimensions H	W	D	Mounting Dimensions MW	MD
N-48X	15	115	115	.13	1500	X	Leads	—	1 15/16	3 5/16	2	2 13/16	—
N-51X‡	35	115	115	.3	1500	X	Leads	—	2 9/32	3 11/16	2 1/8	3 1/8	—
N-68X	50	115-230§	115	.435	1500	X	Leads	—	2 9/32	3 11/16	2 1/8	3 1/8	—
N-53M	85	115	115	.74	1500	M	6' Cord, Plug & Socket	—	3 19/32	2 31/32	3 5/8	2 1/4	2 3/8
N-54M	150	115	115	1.3	1500	M	6' Cord, Plug & Socket	—	3 7/8	3 9/32	4 1/4	2 1/2	3
N-73A	150	115	115-230§	.65	1500	A	Leads	1	3 7/8	3 9/32	3 7/8	2 1/2	2 3/4
N-67A	150	115-230§	115	1.3	1500	A	Leads	2	3 7/8	3 9/32	4 1/8	2 1/2	3
N-55M	250	115	115	2.17	1500	M	6' Cord, Plug & Socket	—	4 5/8	3 15/16	5	3	3 7/8
N-55MG†	—	115	—	—	—	—	—	—	—	—	—	—	—
N-66A	250	115-230§	115	2.17	1500	A	Leads	2	4 5/8	3 15/16	4 5/8	3	3 5/8
N-469A‡	50	220-440§	115	.435	1500	A	Leads	1	3 3/16	2 21/32	2 1/2	2	1 9/16
N-471A‡	300	220-440§	115	2.6	2000	A	Leads	1	4 5/8	3 15/16	4 3/8	3	3 3/8

CONTROL TRANSFORMERS/6V, 12V, 24V SECONDARIES

Triad Part No.	Primary	Secondary Parallel	Secondary Series	VA Rating	Case Type	Connections	Height Overall	Base Area	Mounting Dimension	Shpg. Wt. in lbs.
F-105Z		6V @ 2A	12V @ 1A	12	Z	Lugs	3 3/8	2 7/8 x 1 3/4	2 3/8	1
F-106Z		6V @ 4A	12V @ 2A	24	Z	Lugs	2 3/4	3 1/8 x 2	2 13/16	1 1/2
F-107Z		12V @ 4A	24V @ 2A	48	Z	Lugs	3 1/8	3 5/8 x 2 3/8	3 1/8	2 1/2
F-398U		12V @ 6A	24V @ 3A	72	U	Lugs	3 1/2	2 13/16 x 2 13/16	2 1/4 x 2 1/4	4 1/4
F-108U		12V @ 8A	24V @ 4A	96	U	Lugs	3 1/2	2 7/8 x 3	2 1/4 x 2 1/4	4 1/4
F-399U	115V/230V	12V @ 12A	24V @ 6A	144	U	Lugs	3 3/4	3 1/8 x 3 1/2	2 1/2 x 2 7/8	5.9
F-109U	50/60 CPS	12V @ 16A	24V @ 8A	192	U	Lugs	4 1/8	3 3/4 x 3 1/2	3 x 2 3/4	8
F-211Z	on all	24V @ .5A	48V @ .25A	12	Z	Lugs	2 5/16	2 13/16 x 1 1/2	2 3/8	.678
F-212Z		24V @ 1A	48V @ .50A	24	Z	Lugs	2 3/4	3 1/8 x 2 1/4	2 13/16	1.05
F-213Z		24V @ 2A	48V @ 1A	48	Z	Lugs	3 1/16	3 5/8 x 2 3/8	3 1/8	1.55
F-214U		24V @ 4A	48V @ 2A	96	U	Lugs	3 31/32	3 3/16 x 2 3/16	2 1/4 x 2 5/8	3.24
F-400U		24V @ 6A	48V @ 3A	144	U	Lugs	3 3/4	3 1/8 x 3 1/2	2 1/2 x 2 7/8	5.9
F-215U		24V @ 8A	48V @ 4A	192	U	Lugs	4 5/32	3 3/4 x 3 7/16	2 3/4 x 3	6.06

MINIATURE AUDIO TRANSFORMERS

Type No.	Power Output	Application	Matching Impedance Primary	Matching Impedance Secondary	DC Resistance Primary	DC Resistance Secondary	Overall Turns Ratio	Frequency Response ±3DB	RMS Test Volts	Case Type	Case Dimension H	W	D	Mtg. Dimen. MW
T-1X‡	1MW	Line or Mike to Grid	600/250/50	50,000	80	3200	1:9.16	60-15,000	500	X	5/8	1 7/32	3/4	1
T-31X‡	10MW	Line to Line	600/250/50	600/250/50	55	80	1:1	50-15,000	500	X	5/8	1 7/32	3/4	1
T-34X	20MW	Transistor or Line to Transistor or Line	500 CT 2 MA. D.C.	500 CT/ 125§	45	55	1:1.03	50-20,000	500	X	5/8	1 9/32	11/16	1 1/16
T-35X	10MW	Transistor or Line to Transistor	600 CT 1 MA. D.C.	2000 CT/ 500§	68	200	1:1.7	50-20,000	500	X	5/8	1 7/32	3/4	1

TELEPHONE COUPLING TRANSFORMERS

Cat. No.	Fig. No.	Application	Primary Impedance	Secondary Impedance	Dimensions A	B	C	D	E	F	G	H	I	J	Wt. Oz.
TY-300P	B	Hybrid*	600	600/600†	.63	.75	.55	.421	.187	.375	.25	.203	.020	.041	3.2
TY-301P	B	Coupling	600	900	.63	.75	.55	.421		.375	.25	.203	.020	.041	3.2
TY-302P	B	Hybrid*	600	600/600	.75	1.00	.94	.781	.200	.400	.26	.203	.020	.041	3.2
TY-303P	B	Bridging	4000	600	.63	.75	.55	.421		.375	.25	.203	.020	.041	3.2
TY-304P	B	Coupling	600 CT	600 CT	.63	.75	.55	.421	.187	.375	.25	.188	.018	.041	4.8
TY-350P	B	Holding Coil	2.0 hy @ 60 ma. 1.3 hy @ 100 maDC, 180 ohms DCR		1.19	1.44	.98	1.00		.63	.25		.020	.040	4.8

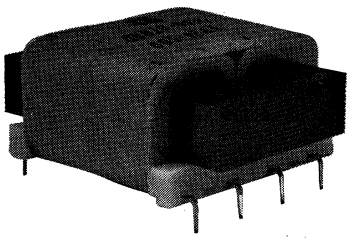
* Two required for hybrid operation. † Split winding; one wide band, one narrow band.

New Product

Flat Pack Power

TRIAD-UTRAD
A Division of MagneTek, Inc.
Dept. EM, 1124 East Franklin Street, Huntington, IN 46750 • Phone: (219) 356-6500 • TWX: 810-333-1532

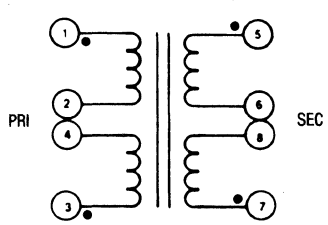
Triad-Utrad's new Flat Pack power transformer is designed to meet the needs of low clearance printed circuit board and solid state power designs. These new units can also be used for control and instrumentation applications. Voltages and currents were chosen for widely used power applications and could be used in single or dual output supplies. The Triad-Utrad Flat Pack has a unique construction feature allowing them to pass a 2000V HiPot test.



UL RECOGNIZED

TYPE NO.	OUTPUT WATTS	INDIVIDUAL	SECONDARY SERIES	PARALLEL
☞ FP10-250	2.5	5V @ .25A	10V CT @ .25A	5V @ .5A
FP10-600	6	5V @ .6A	10V CT @ .6A	5V @ 1.2A
FP101200	12	5V @ 1.2A	10V CT @ 1.2A	5V @ 2.4A
☞ FP12-200	2.5	6.3V @ .2A	12.6V CT @ .2A	6.3V @ .4A
FP12-475	6	6.3V @ .475A	12.6V CT @ .475A	6.3V @ .95A
FP12-950	12	6.3V @ .95A	12.6V CT @ .95A	6.3V @ 1.9A
☞ FP16-150	2.5	8V @ .15A	16V CT @ .15A	8V @ .3A
FP16-375	6	8V @ .375A	16V CT @ .375A	8V @ .75A
FP16-750	12	8V @ .75A	16V CT @ .75A	8V @ 1.5A
☞ FP20-125	2.5	10V @ .125A	20V CT @ .125A	10V @ .25A
FP20-300	6	10V @ .3A	20V CT @ .3A	10V @ .6A
FP20-600	12	10V @ .6A	20V CT @ .6A	10V @ 1.2A
☞ FP24-100	2.5	12V @ .1A	24V CT @ .1A	12V @ .2A
FP24-250	6	12V @ .25A	24V CT @ .25A	12V @ .5A
FP24-500	12	12V @ .5A	24V CT @ .5A	12V @ 1.0A
☞ FP30-80	2.5	15V @ .08A	30V CT @ .08A	15V @ .16A
FP30-200	6	15V @ .2A	30V CT @ .2A	15V @ .4A
FP30-400	12	15V @ .4A	30V CT @ .4A	15V @ .8A
☞ FP34-75	2.5	17V @ .075A	34V CT @ .075A	17V @ .15A
FP34-170	6	17V @ .17A	34V CT @ .17A	17V @ .34A
FP34-340	12	17V @ .34A	34V CT @ .34A	17V @ .68A
☞ FP40-60	2.5	20V @ .06A	40V CT @ .06A	20V @ .12A
FP40-150	6	20V @ .15A	40V CT @ .15A	20V @ .3A
FP40-300	12	20V @ .3A	40V CT @ .3A	20V @ .6A
☞ FP56-45	2.5	28V @ .045A	56V CT @ .045A	28V @ .09A
FP56-100	6	28V @ .1A	56V CT @ .1A	28V @ .2A
FP56-200	12	28V @ .2A	56V CT @ .2A	28V @ .4A
☞ FP88-28	2.5	44V @ .028A	88V CT @ .028A	44V @ .056A
FP88-65	6	44V @ .065A	88V CT @ .065A	44V @ .13A
FP88-130	12	44V @ .13A	88V CT @ .13A	44V @ .26A
☞ FP120-20	2.5	60V @ .02A	120V CT @ .02A	60V @ .04A
FP120-50	6	60V @ .05A	120V CT @ .05A	60V @ .1A
FP120100	12	60V @ .1A	120V CT @ .1A	60V @ .2A
☞ FP230-10	2.5	115V @ .01A	230V CT @ .01A	115V @ .02A
FP230-25	6	115V @ .025A	230V CT @ .025A	115V @ .05A
FP230-50	12	115V @ .05A	230V CT @ .05A	115V @ .1A

☞ new product/UL recognition pending



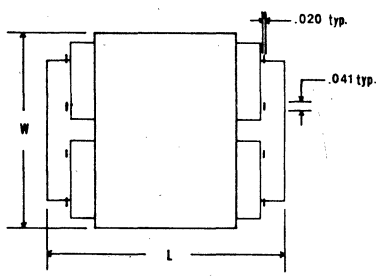
Specifications:

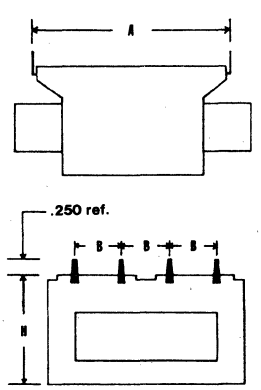
Flat Pack = allows ¾" card spacing for 2.5VA units, 1" card spacing for 6VA units or 1¼" for 12VA units

Split Bobbin = side by side windings reduce interwinding capacitance and eliminates the need for a static shield

Semi-Toroidal Construction reduces radiated magnetic fields and results in balanced windings

Terminals are precision spaced





OUTPUT WATTS	H	W	L	A	B	WT OZ
2.5	.650	1.562	1.875	1.600	.375	5
6	.875	1.562	1.875	1.600	.375	7
12	1.062	2.000	2.500	2.000	.500	11

Split Pack™

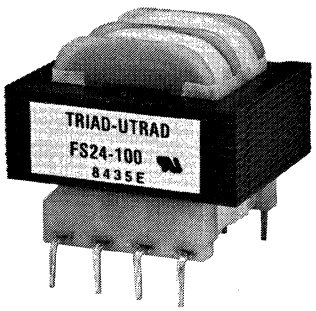
New Product

TRIAD-UTRAD
A Division of MagneTek, Inc.

Dept. EM, 1124 East Franklin Street, Huntington, IN 46750 • Phone: (219) 356-6500 • TWX: 810-333-1532

Split Bobbin Tansformer

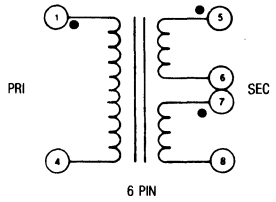
Triad-Utrad's new Split Pack split bobbin transformer increases the depth and versatility of Triad's already extensive line of PC board mounted transformers. Like Triad's recent Flat Pack™ series, the Split Pack transformers are nonconcentrically wound—with primary and secondaries wound side by side, unlike the secondary-on-top-of-primary windings of stancard PC board transformers. Split bobbin winding and low capacitive coupling eliminate costly electrostatic shielding. The Split Pack's unique construction make possible higher HiPot testing—2,500V rather than 1,500V. Dual primaries-115/230V, 50/400 Hz, plus precision spaced terminals.

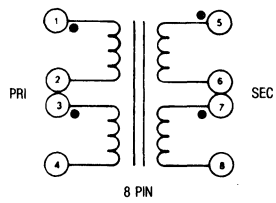


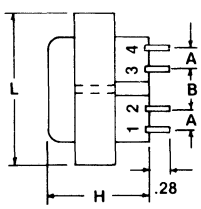
UL RECOGNIZED

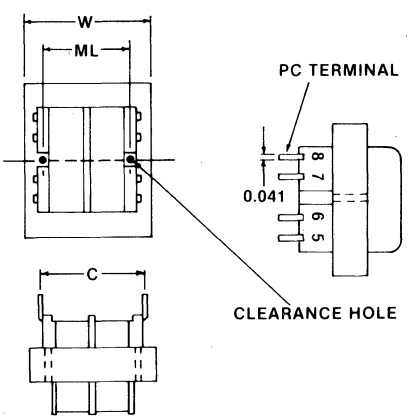
PRIMARY			SECONDARY RATINGS (RMS)		
115V 6 PIN	115–230V 8 PIN	VA	INDIVIDUAL	SERIES	PARALLEL
F10-110	FS10-110	1.1	5V @ .11A	10V CT @ .11A	5V @ .22A
F10-250	FS10-250	2.5	5V @ .25A	10V CT @ .25A	5V @ .5A
F10-600	FS10-600	6	5V @ .6A	10V CT @ .6A	5V @ 1.2A
F10-1200	FS101200	12	5V @ 1.2A	10V CT @ 1.2A	5V @ 2.4A
F10-2000	FS102000	20	5V @ 2A	10V CT @ 2A	5V @ 4A
F10-3600	FS103600	36	5V @ 3.6A	10V CT @ 3.6A	5V @ 7.2A
F12-090	FS12-090	1.1	6.3V @ .09A	12.6V CT @ .09A	6.3V @ .18A
F12-200	FS12-200	2.5	6.3V @ .2A	12.6V CT @ .2A	6.3V @ .4A
F12-500	FS12-500	6	6.3V @ .5A	12.6V CT @ .5A	6.3V @ 1.0A
F12-1000	FS121000	12	6.3V @ 1.0A	12.6V CT @ 1.0A	6.3V @ 2.0A
F12-1600	FS121600	20	6.3V @ 1.6A	12.6V CT @ 1.6A	6.3V @ 3.2A
F12-2850	FS122850	36	6.3V @ 2.85A	12.6V CT @ 2.85A	6.3V @ 5.7A
F16-070	FS16-070	1.1	8V @ .07A	16V CT @ .07A	8V @ .14A
F16-150	FS16-150	2.5	8V @ .15A	16V CT @ .15A	8V @ .3A
F16-400	FS16-400	6	8V @ .4A	16V CT @ .4A	8V @ .8A
F16-800	FS16-800	12	8V @ .8A	16V CT @ .8A	8V @ 1.6A
F16-1250	FS161250	20	8V @ 1.25A	16V CT @ 1.25A	8V @ 2.5A
F16-2250	FS162250	36	8V @ 2.25A	16V CT @ 2.25A	8V @ 4.5A
F20-055	FS20-055	1.1	10V @ .055A	20V CT @ .055A	10V @ .11A
F20-120	FS20-120	2.5	10V @ .12A	20V CT @ .12A	10V @ .24A
F20-300	FS20-300	6	10V @ .3A	20V CT @ .3A	10V @ .6A
F20-600	FS20-600	12	10V @ .6A	20V CT @ .6A	10V @ 1.2A
F20-1000	FS201000	20	10V @ 1.0A	20V CT @ 1.0A	10V @ 2A
F20-1800	FS201800	36	10V @ 1.8A	20V CT @ 1.8A	10V @ 3.6A
F24-045	FS24-045	1.1	12V @ .045A	24V CT @ .045A	12V @ .09A
F24-100	FS24-100	2.5	12V @ .1A	24V CT @ .1A	12V @ .2A
F24-250	FS24-250	6	12V @ .25A	24V CT @ .25A	12V @ .5A
F24-500	FS24-500	12	12V @ .5A	24V CT @ .5A	12V @ 1.0A
F24-800	FS24-800	20	12V @ .8A	24V CT @ .8A	12V @ 1.6A
F24-1500	FS241500	36	12V @ 1.5A	24V CT @ 1.5A	12V @ 3A
F28-040	FS28-040	1.1	14V @ .04A	28V CT @ .04A	14V @ .08A
F28-85	FS28-85	2.5	14V @ .085A	28V CT @ .085A	14V @ .17A
F28-200	FS28-200	6	14V @ .2A	28V CT @ .2A	14V @ .4A
F28-420	FS28-420	12	14V @ .42A	28V CT @ .42A	14V @ .84A
F28-700	FS28-700	20	14V @ .7A	28V CT @ .7A	14V @ 1.4A
F28-1300	FS281300	36	14V @ 1.3A	28V CT @ 1.3A	14V @ 2.6A
F36-030	FS36-030	1.1	18V @ .03A	36V CT @ .03A	18V @ .06A
F36-65	FS36-65	2.5	18V @ .065A	36V CT @ .065A	18V @ .13A
F36-170	FS36-170	6	18V @ .17A	36V CT @ .17A	18V @ .34A
F36-350	FS36-350	12	18V @ .35A	36V CT @ .35A	18V @ .7A
F36-550	FS36-550	20	18V @ .55A	36V CT @ .55A	18V @ 1.1A
F36-1000	FS361000	36	18V @ 1A	36V CT @ 1A	18V @ 2A
F48-023	FS48-023	1.1	24V @ .023A	48V CT @ .023A	24V @ .046A
F48-050	FS48-050	2.5	24V @ .05A	48V CT @ .05A	24V @ .1A
F48-125	FS48-125	6	24V @ .125A	48V CT @ .125A	24V @ .25A
F48-250	FS48-250	12	24V @ .25A	48V CT @ .25A	24V @ .5A
F48-400	FS48-400	20	24V @ .4A	48V CT @ .4A	24V @ .8A
F48-750	FS48-750	36	24V @ .75A	48V CT @ .75A	24V @ 1.5A
F56-020	FS56-020	1.1	28V @ .02A	56V CT @ .02A	28V @ .04A
F56-045	FS56-045	2.5	28V @ .045A	56V CT @ .045A	28V @ .09A
F56-110	FS56-110	6	28V @ .11A	56V CT @ .11A	28V @ .22A
F56-220	FS56-220	12	28V @ .22A	56V CT @ .22A	28V @ .44A
F56-350	FS56-350	20	28V @ .35A	56V CT @ .35A	28V @ .7A
F56-650	FS56-650	36	28V @ .65A	56V CT @ .65A	28V @ 1.3A
F120-010	FS120-01	1.1	60V @ .01A	120V CT @ .01A	60V @ .02A
F120-020	FS120-02	2.5	60V @ .02A	120V CT @ .02A	60V @ .04A
F120-050	FS120-05	6	60V @ .05A	120V CT @ .05A	60V @ .1A
F120-100	FS120100	12	60V @ .1A	120V CT @ .1A	60V @ .2A
F120-160	FS120160	20	60V @ .16A	120V CT @ .16A	60V @ .32A
F120-300	FS120300	36	60V @ .3A	120V CT @ .3A	60V @ .6A

new product/UL recognition pending







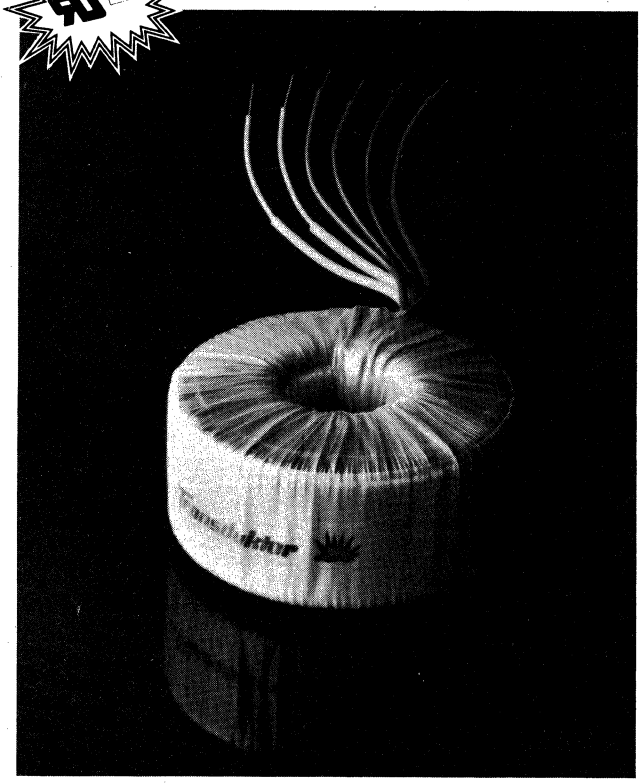


VA	H	W	L	ML	A	B	C	WT
1.1	15/16	1-1/8	1-3/8	—	.250	.250	1.200	.17
2.5	1-3/16	1-1/8	1-3/8	—	.250	.250	1.20	.25
6	1-5/16	1-5/16	1-5/8	1-1/16	.250	.350	1.280	.44
12	1-7/16	1-9/16	1-7/8	1-1/4	.300	.400	1.410	.70
20	1-7/16	1-7/8	2-1/4	1-1/2	.300	.400	1.600	.80
36	1-9/16	2-3/16	2-5/8	!	.400	.400	1.850	1.1

! 36VA size has 4 mtg. holes on 2-3/16 × 1-3/4 centers

Ulveco

Toroidal Power Transformers



LOW WEIGHT
Typically 50% lighter than traditional stacked lamination transformers.

SMALL DIMENSIONS
Low height profile allows slim, compact design of electronic equipment.

FLEXIBLE DIMENSIONS
The Ulveco Toroidal Power Transformer can be "modeled" to fit very limited spaces and still conform to your electrical requirements.

EASY TO MOUNT
Just one center screw easily and quickly mounts the Ulveco Toroidal Power Transformer to the chassis.

LOW MAGNETIC STRAYFIELD
No air gap and the primary and secondary windings evenly spread around the core, resulting in a very low radiated magnetic field.

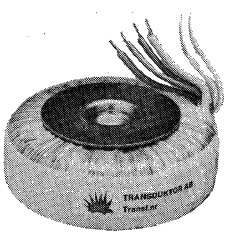
LOW MECHANICAL HUM
A single continuous strip of steel tightly wound into a roll results in a very solid and stable unit. No loose parts to buzz.

SMALL NO LOAD LOSSES
Ulveco Toroidal Power Transformers can reduce open circuit power by 90% compared to traditional stacked lamination transformers.

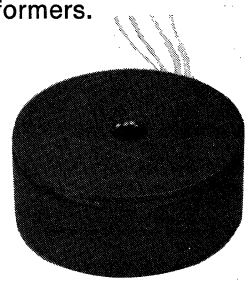
STANDARD OFF-THE-SHELF TRANSFORMERS SERIES 5000

Primary voltage: 120V, 60 Hz

Primary to secondary insulation: 4000V RMS



DISK MOUNTED



ENCAPSULATED TYPE TD

Nominal Power VA	Secondary Voltage VAC	Secondary Current A AC	Size OD × H Weight	Type No.
20	2 × 9 2 × 12 2 × 15 2 × 18	1.11 .83 .67 .56	2.4 × 1.3 .7 lbs	5020-2009 5020-2012 5020-2015 5020-2018
40	2 × 9 2 × 12 2 × 15 2 × 18	2.22 1.67 1.33 1.11	2.8 × 1.3 1.2 lbs	5040-2009 5040-2012 5040-2015 5040-2018
60	2 × 9 2 × 12 2 × 15 2 × 18	3.33 2.50 2.00 1.67	3.2 × 1.5 1.5 lbs	5060-2009 5060-2012 5060-2015 5060-2018
100	2 × 12 2 × 15 2 × 18 2 × 22	4.20 3.3 2.8 2.3	3.9 × 1.5 2.2 lbs	5100-2012 5100-2015 5100-2018 5100-2022
150	2 × 12 2 × 15 2 × 18 2 × 22	6.3 5.0 4.2 3.4	3.9 × 1.9 3.2 lbs	5150-2012 5150-2015 5150-2018 5150-2022

Nominal Power VA	Secondary Voltage VAC	Secondary Current A AC	Size OD × H Weight	Type No.
200	220 2 × 18 2 × 22 2 × 24	.9 5.5 4.5 4.1	4.5 × 1.9 4.0 lbs	5200-1220 5200-2018 5200-2022 5200-2024
250	220 2 × 22 2 × 24 2 × 30	1.1 5.6 5.2 4.1	4.5 × 2.0 4.6 lbs	5250-1220 5250-2022 5250-2024 5250-2030
350	220 2 × 24 2 × 30 2 × 33 2 × 38	1.6 7.3 5.8 5.3 4.6	4.5 × 2.4 5.8 lbs	5350-1220 5350-2024 5350-2030 5350-2033 5350-2038
425	220 2 × 30 2 × 33 2 × 38	1.9 7.1 6.4 5.6	5.5 × 2.0 6.9 lbs	5425-1220 5425-2030 5425-2033 5425-2038
550	220 2 × 30 2 × 33 2 × 38	2.5 9.1 8.3 7.2	5.5 × 2.4 8.5 lbs	5550-1220 5550-2030 5550-2033 5550-2038

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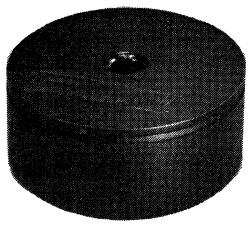
- Rectifier transformers
- Autotransformers
- 1-phase and 3-phase transformers
- 400 Hz transformers
- Current transformers
- DC and low frequency chokes
- Filter chokes for SMPS

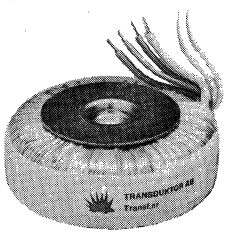
CUSTOM DESIGNED TOROIDAL POWER TRANSFORMERS 50/60 Hz

Power Range		No Load Loss W	Max Copper Loss W	Size and Weight (unmounted transformer)	
60 Hz VA	50 Hz VA			OD × H inches	Weight lbs.
20	15	.20	3.2	2.4 × 1.3	0.7
40	30	.25	6.3	2.8 × 1.3	1.2
60	50	.45	9.2	3.2 × 1.5	1.5
100	80	.60	13.0	3.9 × 1.5	2.2
150	120	.90	17.0	3.9 × 1.9	3.2
200	160	1.20	21.0	4.4 × 1.7	4.0
300	250	1.70	18.0	4.5 × 2.4	5.5
360	300	2.00	24.0	4.5 × 2.7	6.6
480	400	2.40	29.0	5.4 × 2.3	7.9
600	500	3.10	33.0	5.4 × 2.8	9.5
750	630	3.80	39.0	6.5 × 2.6	12.0
960	800	4.70	49.0	6.5 × 3.0	14.0
1200	990	6.50	49.0	6.5 × 3.4	17.0
1600	1300	5.70	64.0	7.9 × 2.6	20.0
1900	1600	7.10	67.0	7.9 × 3.0	23.0
2300	1900	8.50	70.0	7.9 × 3.3	26.0
2650	2200	8.10	79.0	8.9 × 3.3	29.0
3000	2500	9.70	85.0	8.9 × 3.5	33.0
3400	2800	11.00	96.0	9.6 × 3.1	35.0
3900	3200	13.00	98.0	9.6 × 3.5	42.0
4500	3700	15.00	100.0	9.6 × 3.9	46.0
5300	4400	17.00	120.0	11.2 × 4.3	53.0
6000	5000	20.00	120.0	11.2 × 4.7	62.0
7600	6300	27.00	140.0	12.4 × 4.7	84.0
9600	8000	28.00	150.0	13.4 × 4.7	88.0
12000	10000	39.00	150.00	13.4 × 5.9	120.0

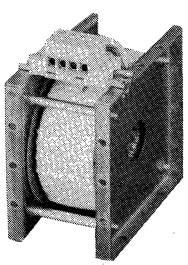
Data above are typical and may be changed without prior notice.



ENCAPSULATED TYPE TD
(20 VA — 360 VA)

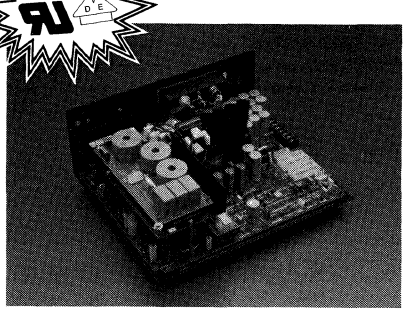


DISK MOUNTED
(20 VA — 1200 VA)



FLANGE MOUNTED
(150 VA — 12,000 VA)

Switched Mode Power Supplies— VDE & Custom



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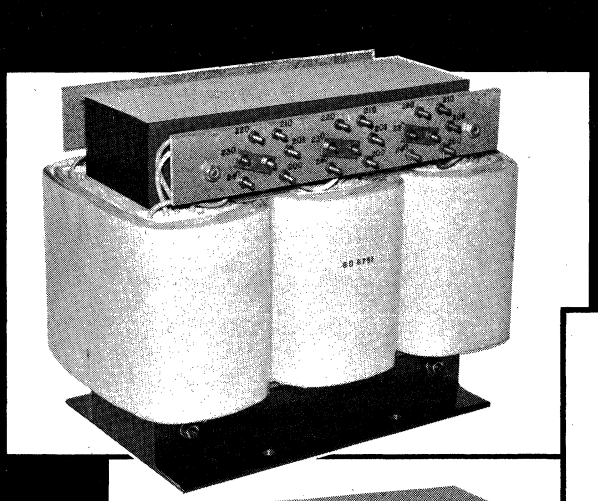

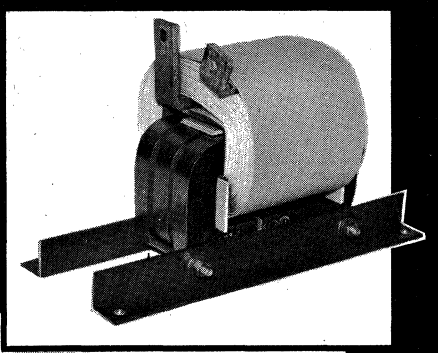

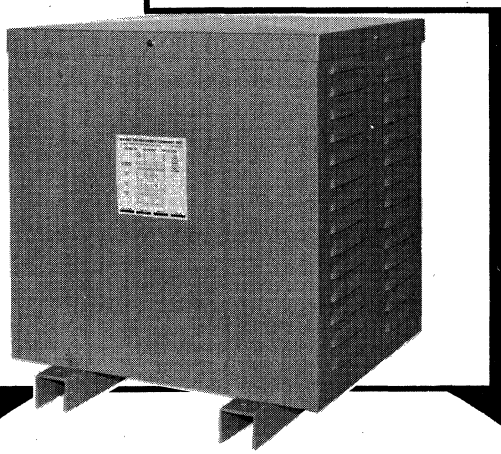

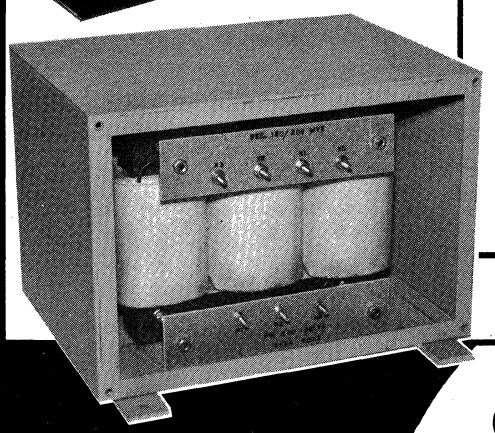

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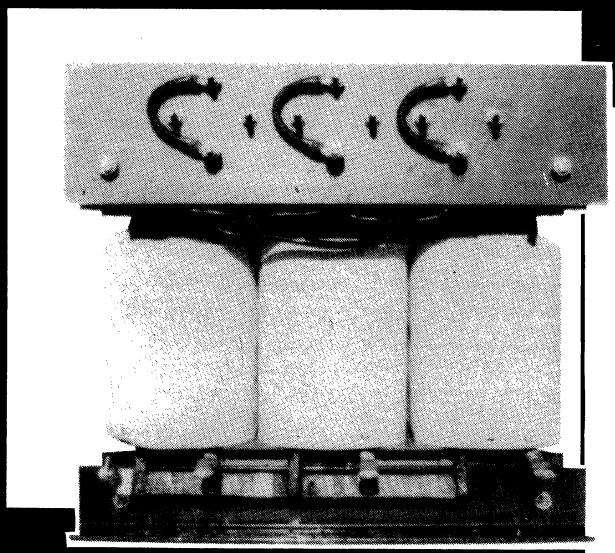

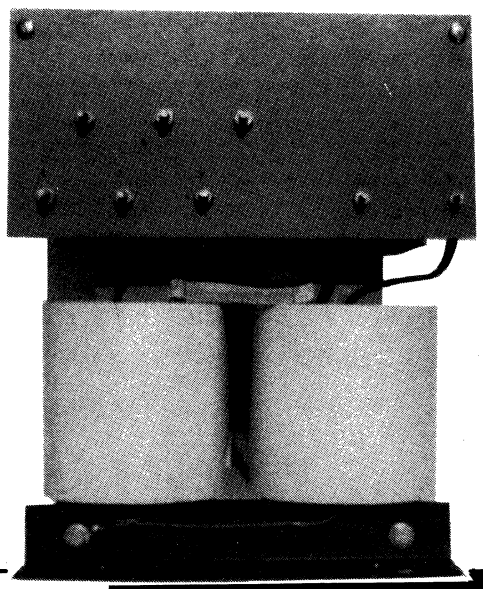

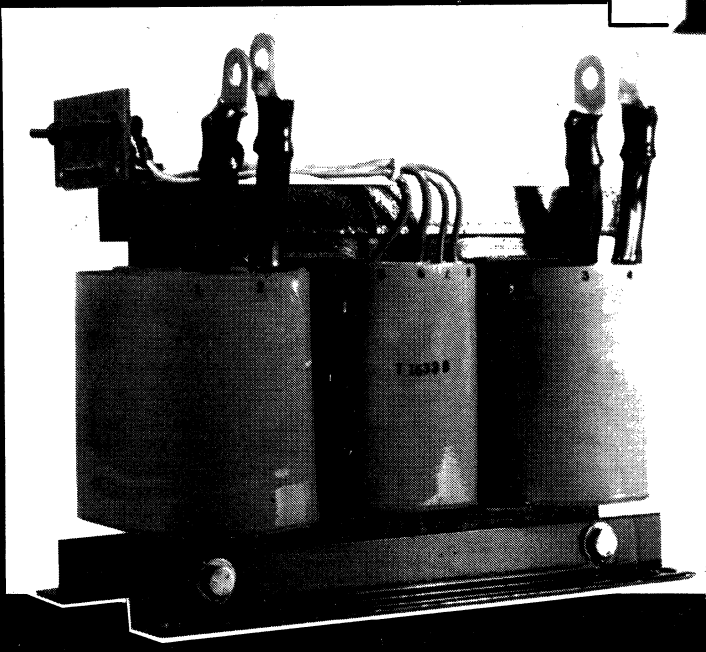

High Frequency Pulse,
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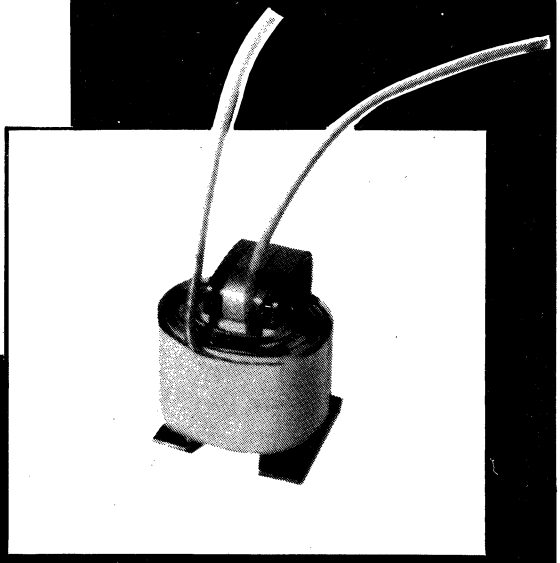

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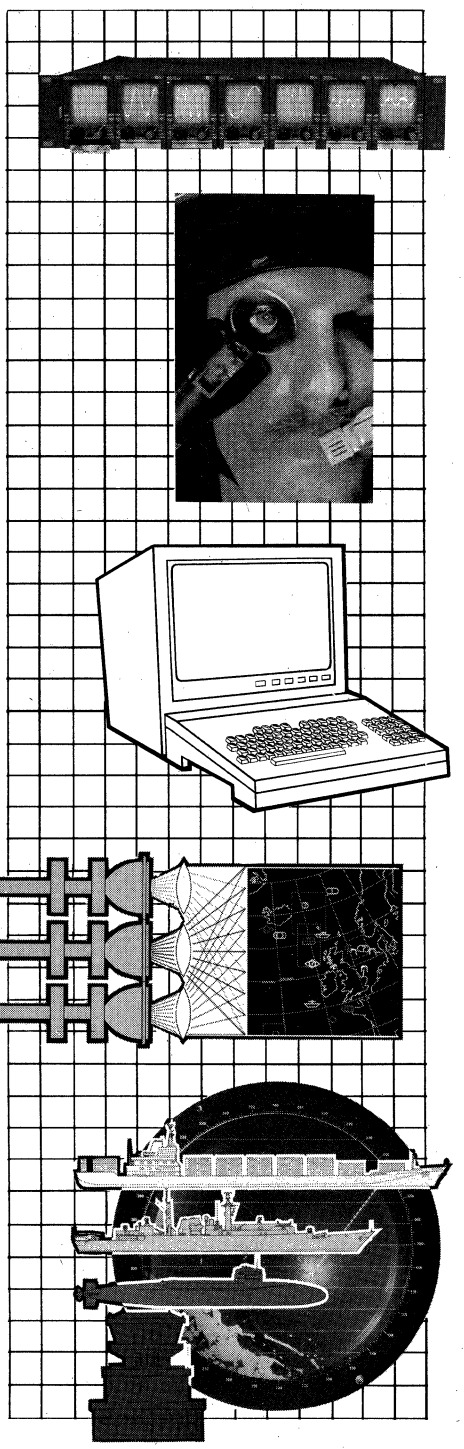

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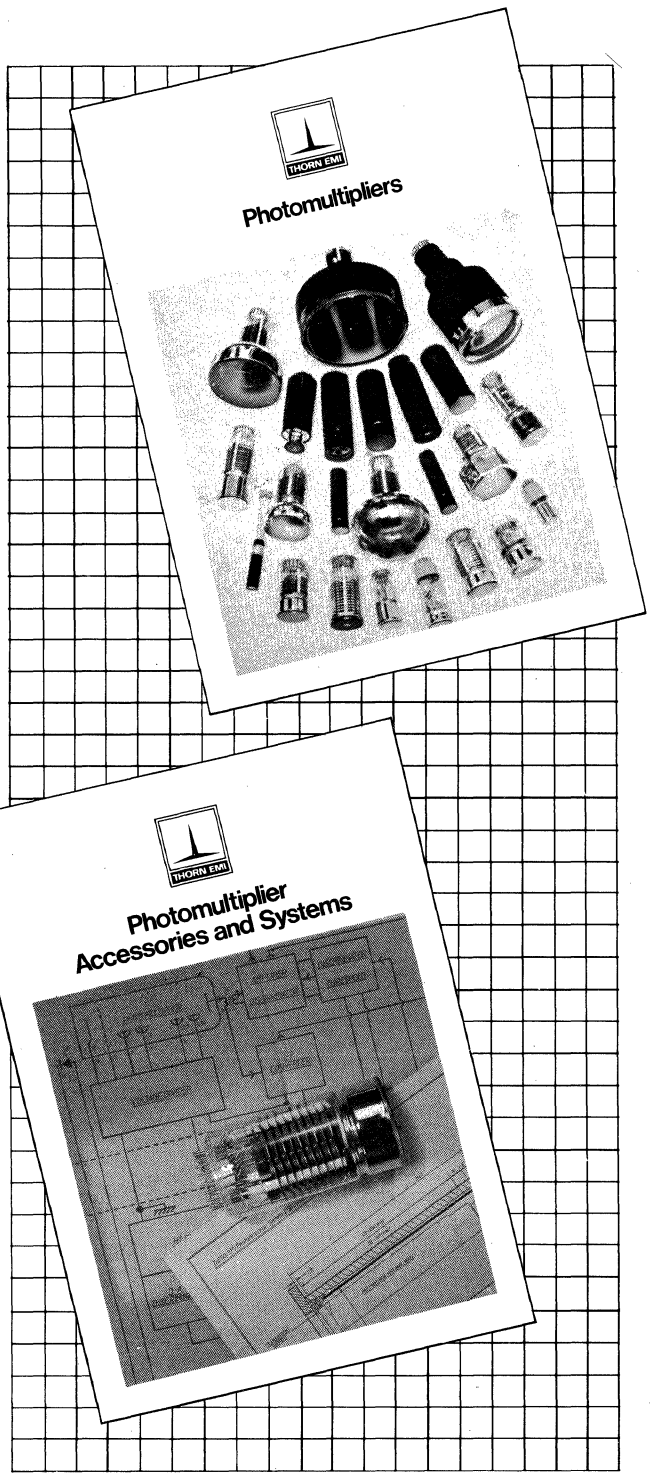

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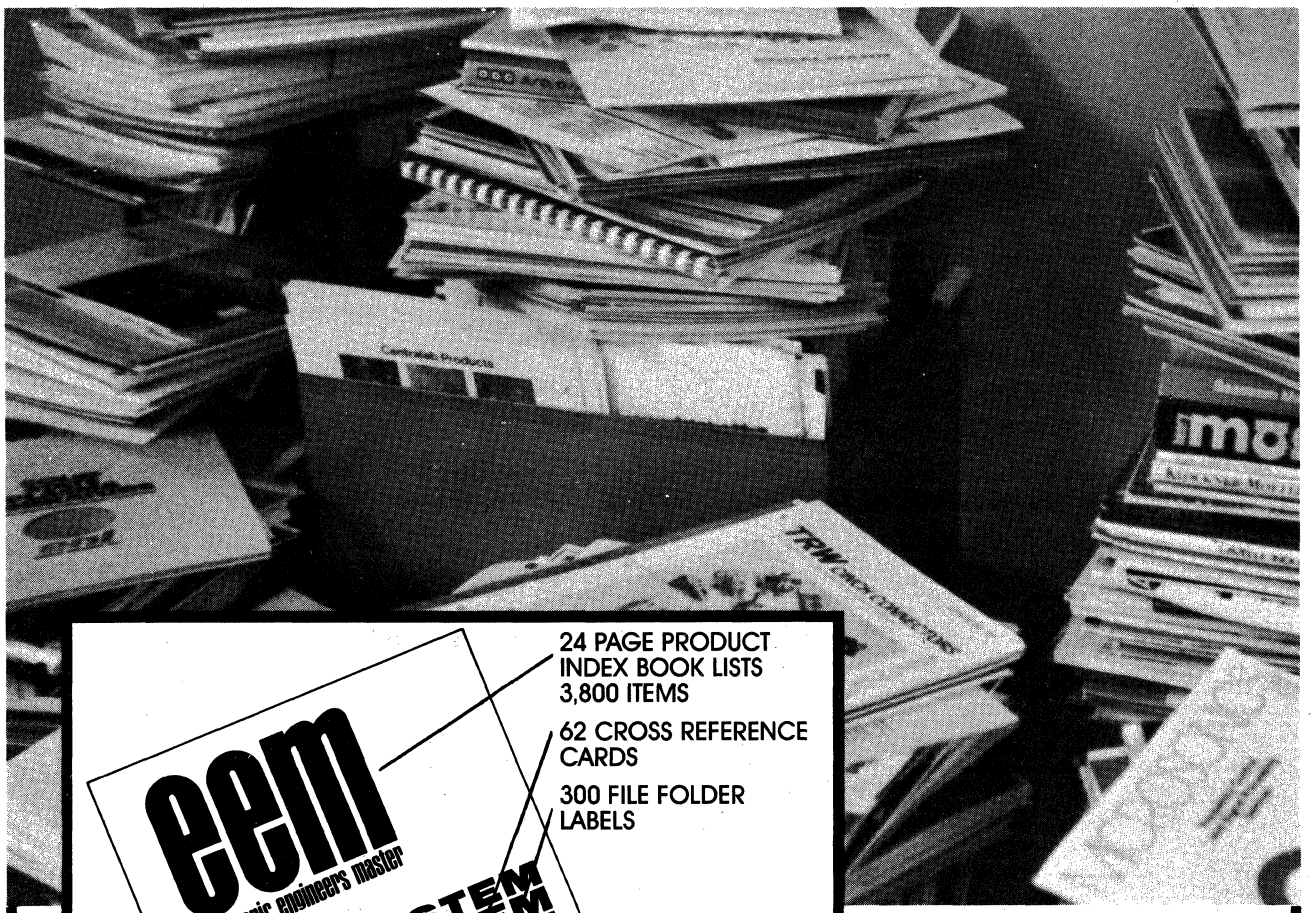

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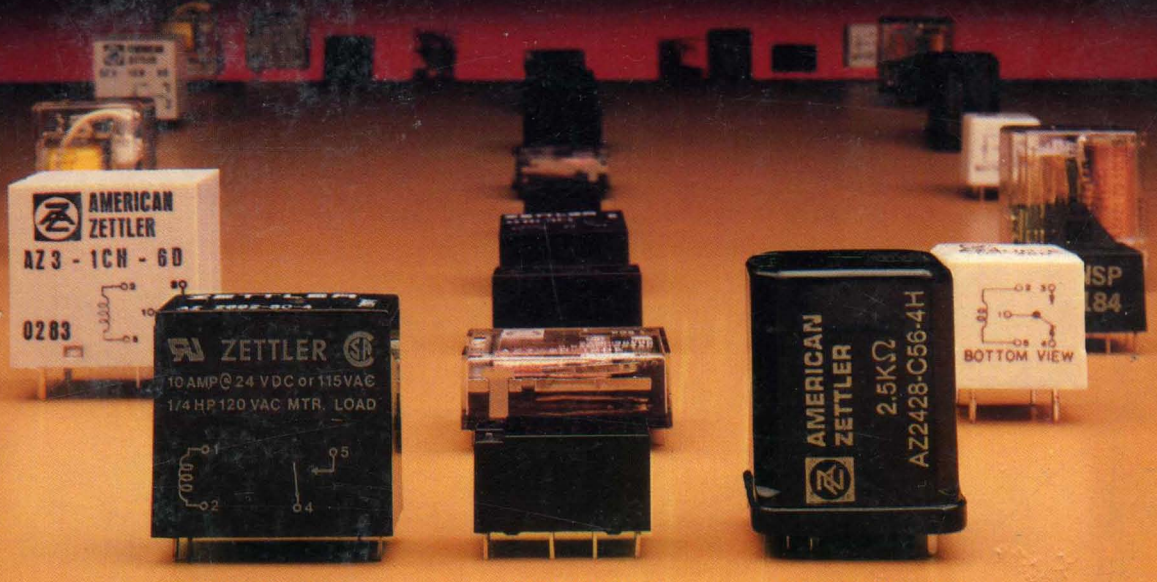

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